

Examining the Impacts of Antarctic Tourism on Whales

by

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Abstract

Since the formation of the International Association of Antarctica Tour Operators (IAATO) in 1991, the number of tourists visiting Antarctica has increased from 6,400 to over 35,000 annually. If vessel-based Antarctic tourism (known as “expedition cruising”) continues to expand, the opportunities for interactions between tourism vessels and whales will likewise increase. Potential impacts to whales from tourism range from negative impacts, such as collisions, ship noise, and behavioral modification, to positive impacts, such as tourist participation in whale research projects. My review of the available literature found that the interactions between Antarctic tourism and whales have received limited attention from the scientific community. In order to gain insight into this situation, I designed and beta-tested online surveys for Antarctic scientists, tourists, and tour operators. These surveys examine the perspectives of these groups towards the interactions between whales and Antarctic tourism. Preliminary results indicate these groups believe that Antarctic tourism currently offers more benefits to whales than risks. In the future, the distribution of similar surveys to larger groups, particularly to IAATO members and tourists on IAATO vessels, would help confirm these findings. Understanding the perceptions of each group will be useful during the development of future Antarctic guidelines and policy, and can be used to guide future Antarctic research.

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Introduction

The first explorers who set foot on Antarctica in the nineteenth century found a pristine wilderness containing endless stretches of ice. Some regions were teeming with life. Today, many people still view Antarctica as remote and unspoiled, but there has been a rapid increase in visitation and tens of thousands of scientists, tourists, government workers, and tour operators now travel to Antarctica every year for study and to drink in its sights.

These human visitors are not Antarctica's only inhabitants. Despite being the coldest, driest continent on earth, Antarctica is home to charismatic creatures that number in the millions (Australian Antarctic Division, 2012). Bird species include albatross, terns, gulls, petrels, and penguins; many of these species form dense nesting colonies on land. Six types of seals, including Weddell, leopard, and crabeaters pup on land, lounge on ice floes, and feed on fish. Additionally, at least eight species of whales spend part of their lives in Antarctic or sub-Antarctic waters (Table 1). Orca, minke, and humpback whales are the most common species, while blue, fin, sei, sperm, and southern right whales are seen more rarely (IAATO, 2014a). Due to the seasonal migrations of many cetaceans, whale sightings increase in Antarctica throughout December and January, and peak during the austral summer in February and March.

The increasing human presence in Antarctica poses several threats to the Antarctic environment and its wildlife, although the impacts of most of these threats have not been quantified. In particular, the potential impact of Antarctic tourism on whales has received little attention. For example, while the Committee for Environmental Protection's 2012 report on Antarctic tourism discusses penguins, seals, seabirds, and vegetation, no mention was made of whales (CEP, 2012). It is possible that the human activities affecting Antarctic species on land may also impact whales that spend their whole lives at sea. Importantly, many whale species are still recovering from past overexploitation.

Starting in 1904, many of the whale species found in Antarctica were exploited heavily by the commercial whaling industry (Clapham & Baker, 2002). More than two million whales were killed in the Southern Hemisphere, including 400,000 sperm whales and 750,000 fin whales. Hunting pressure has decreased since 1986, when a commercial whaling moratorium was

Whale Species Occurring in Antarctica	
<i>Common Name</i>	<i>Scientific Name</i>
Blue	<i>Balaenoptera musculus</i>
Fin	<i>Balaenoptera physalus</i>
Humpback	<i>Megaptera novaeangliae</i>
Minke	<i>Balaenoptera bonaerensis</i>
Orca	<i>Orcinus orca</i>
Sei	<i>Balaenoptera borealis</i>
Southern right	<i>Eubalaena australis</i>
Sperm	<i>Physeter macrocephalus</i>

Table 1. Common and scientific names of the whale species that occur in Antarctica.

adopted by the International Whaling Commission, known as the IWC (IWC, 2014c). Additionally, in 1994 the IWC established the Southern Ocean Whale Sanctuary, which prohibits any commercial whaling in the waters surrounding Antarctica (IWC, 2014d). Japan continued issuing permits for the scientific whaling of minke and fin whales in the Southern Ocean despite this sanctuary, but was ordered to cease such operations in March 2014 by the International Court of Justice (Adler, 2014). Some whale populations are showing signs of recovery as a result of these protections: humpback numbers, for example, are increasing at an annual rate of 10% near Australia and South America, and the IWC estimates that the Southern Ocean population now contains at least 42,000 individuals (IWC, 2014c). The most recent estimate for blue whales in 1998 estimated that only 2,300 individuals remained, although their rate of population increase averaged 8.2% from 1979-2004 (IWC, 2014c). And estimates for Antarctic minke whales, which were not targeted by whalers until the 1970s, range from 460,000 to 690,000 (IWC, 2014c). However, the IWC has no current population estimates for sperm, sei, or fin whales in Antarctic waters. Blue, sei, and fin whales are currently listed as ‘endangered’ and sperm whales are listed as ‘vulnerable’ on the IUCN Red List (IUCN, 2013).

This report examines the interactions between Antarctic tourism and whales, and consists of two parts. First, I will consider the potential impacts, both positive and negative, of the growing Antarctic tourism industry on the Antarctic environment and discuss how these impacts may

specifically affect whales. This discussion will consider past and present trends in Antarctic tourism, the international body of law governing Antarctica, and the interests of various stakeholders. In the second part of this report, I developed and beta-tested three surveys to evaluate scientist, tourist, and tour operator perspectives towards interactions between Antarctic tourism and whales.

Part I: An Overview of Antarctica, Tourism, and Whales

Past and Present Trends in Antarctic Tourism

Antarctic tourism began in the late 1950s, when the first visitors traveled on Argentine and Chilean ships that were traveling to the South Shetland Islands. The purpose of these voyages was to restock research stations, but approximately 500 tourists joined the crossings each season annually during the 1960s (IAATO, 2014b). The first vessel designed specifically to bring tourists to Antarctica, the M/S *Lindblad Explorer*, was built in 1969 (Liggett et al., 2011). It conducted three trips to the Antarctic continent during its first season (CEP, 2012). From that point in time, commercial Antarctic tourism gradually began to expand.

Scenic flights (known as “overflights”) to Antarctica also began in the 1950s, but peaked in popularity during the 1970s. During such trips, passengers view the Antarctic landscape from the air, but do not land. Over 10,000 tourists had experienced such flights by the 1979-80 season (CEP, 2012). The operation of overflights ceased in 1979 when Air New Zealand Flight TE901 crashed into Mount Erebus, killing all 257 passengers (Liggett et al., 2011). Qantas began offering overflights again during the 1994-95 season, and today there is one additional overflight operator from Chile (CEP, 2012). Overflights account for only a small fraction of modern Antarctic tourism.

Land-based tourism is another means by which visitors experience Antarctica and has been offered since the 1980s. Tourists typically fly in and out of Antarctica and reside in camps or semi-permanent/permanent structures on land. Three commercial tour operators currently offer such land-based activities (CEP, 2012). In addition, private expeditions sometimes organize

land-based trips, such as races to the South Pole. Several hundred people participate in land-based tourism each season.

Historically, however, the most popular way to experience Antarctica has been by ship, often known as “expedition cruising.” In recent years, such vessel-based tourism has accounted for 80-90% of tourism activity (CEP, 2012). Until the 1990s, Antarctic tourism grew at a relatively slow pace. In 1991, six tour companies were offering cruises to Antarctica on ten different ships. Along with one land-based operator, these companies brought 6,400 tourists to Antarctica during the 1991-92 season (IAATO, 2014b). However, over the last two decades, the number of tourists visiting Antarctica has increased rapidly (Figure 1). More than 10,000 tourists visited Antarctica during the 1997-98 season (CEP, 2012). Numbers peaked in 2007-08 at 46,265 visitors (IAATO, 2013). Two developments contributed to this growth: first, the Soviet Union collapsed in the early 1990s and many Soviet icebreakers and ice-strengthened ships became available for charter (Liggett et al., 2011). Second, in 1991, seven tour operators formed the

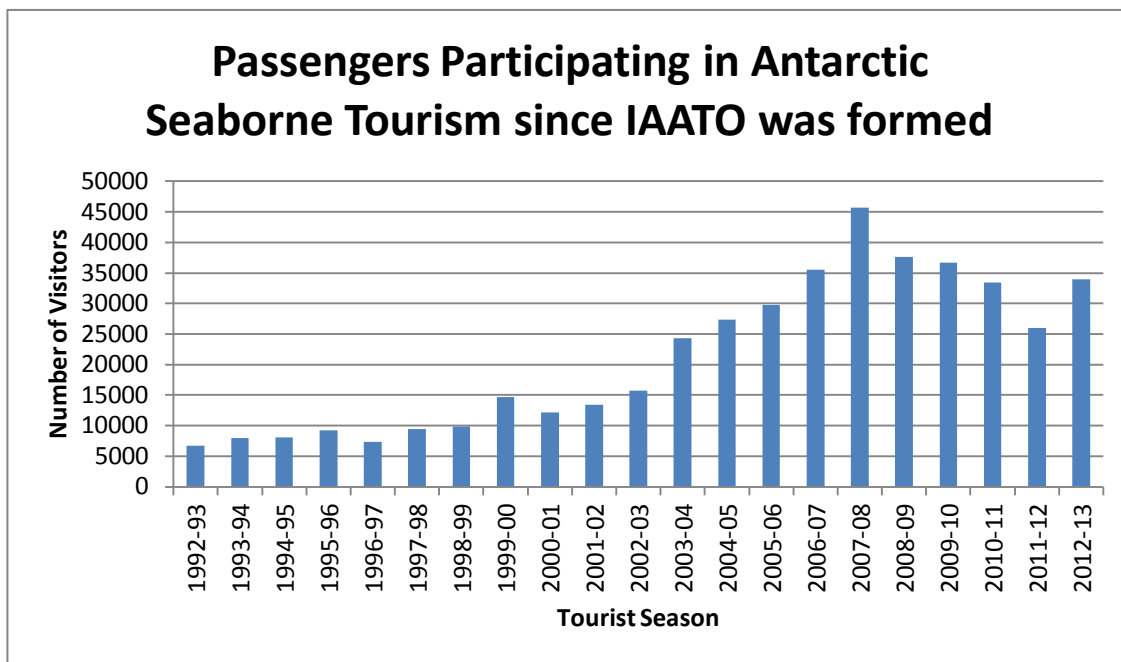


Figure 1. Number of seaborne tourists visiting Antarctica over the last 21 seasons. Data gathered from IAATO overview of Antarctic tourism: 2012-13 season and preliminary estimates for 2013-14 season (IAATO 2007).

International Association of Antarctica Tour Operators, known as IAATO (IAATO, 2014a). The purpose of IAATO is to “advocate, promote and practice safe and environmentally responsible travel to Antarctica.” Through IAATO, member operators have developed environmental and safety guidelines, coordinated their itineraries, advertised their trips to tourists, and lobbied their respective governments for stricter tourism regulations. Today, IAATO has over 100 members, which make up the overwhelming majority of Antarctica tour operators (IAATO, 2014a).

The number of tourists peaked in the 2007-08 season; since that time, however, tourist numbers have fluctuated and remained below this level. Visitor counts dropped in 2008-09 due to the downturn in the global economy (CEP, 2012). Numbers dropped again during 2011-12 due to an IMO ban on heavy fuel oil in the Antarctic Treaty Area, which became effective in August 2011. This ban caused several large cruise ships to remove Antarctica from their itineraries. For the 2013-14 season, IAATO anticipated bringing 35,354 tourists to Antarctica (IAATO, 2013).

Thus, over the past few decades, Antarctic tourism has expanded overall and become significantly more complex. The types of vessels available for trips, as well as the adventure opportunities available to tourists, have diversified. Vessel-based tourism takes one of three forms: yachting (up to 12 passengers), expedition cruising (13-500 passengers), or cruise-only tourism (500+ passengers; IAATO, 2014c). IAATO members participate in all three types: the ships in IAATO’s current 55-vessel fleet range from 6-person sailing yachts to luxury cruise liners, capable of carrying thousands of travelers (Table 2). The most popular trip format, expedition cruising, typically involves 10-14 day voyages that include shore landings, which last an average of 1-3 hours (CEP, 2012). Upon disembarking from the vessel, visitors can participate in a wide range of activities such as wildlife viewing, overnight camping, kayaking, scuba diving, a “polar plunge,” mountain climbing, skiing, and skydiving.

Unsurprisingly, the rise in visitor numbers has coincided with an increase in the number of voyages and sites visited (Figure 2). During the 2012-13 season, 45 IAATO vessels undertook 258 voyages to Antarctica (IAATO, 2013). Tourism vessels visit the Antarctica Peninsula, the Ross Sea, and occasionally other sites. Most trips depart from Argentina, cross the Drake Passage, and visit the Peninsula, which receives 95% of the tourists annually (Figure 3). Several

IAATO MEMBER VESSELS 2013-2014			
SHIP	CATEGORY	SHIP	CATEGORY
M/Y Asteria	YA	Hanseatic	EC
MY Arctic P	YA	Island Sky	EC
MY Hans Hansson	YA	National Geographic Explorer	EC
MY Hanse Explorer	YA	Ocean Nova	EC
S/V Ann-Margaretha	YA	Oosterschelde	EC
S/V Australis	YA	Orion	EC
S/V Endurance of Antarctica	YA	Ortelius	EC
S/V Golden Fleece	YA	Plancius	EC
S/V Icebird	YA	Polar Pioneer	EC
S/V Kotick	YA	S/V Lord Nelson	EC
S/V Le Sourire	YA	Sea Adventurer	EC
S/V Louise	YA	Sea Explorer	EC
S/V Paradise	YA	Sea Spirit	EC
S/V Pelagic	YA	Silver Explorer	EC
S/V Pelagic Australis	YA	Spirit of Enderby	EC
S/V Podorange	YA	Ushuaia	EC
S/V Santa Maria Australis	YA	Delphin	EC
S/V Selma Expeditions	YA	Fram	EC
S/V Spirit of Sydney	YA	L'Austral	EC
S/V Vaihere	YA	Le Boreal	EC
S/V Xplore	YA	Ocean Diamond	EC
Akademik Ioffe	EC	Seabourn Quest	EC
Akademik Sergey Vavilov	EC	Azamara Journey	CR
Akademik Shokalskiy	EC	Celebrity Infinity	CR
Bark Europa	EC	Crystal Symphony	CR
Bremen	EC	Prinsendam	CR
Corinthian	EC	Zaandam	CR
Expedition	EC		

Table 2. IAATO's 2013-2014 member fleet contains 55 vessels.

YA = Yachts (up to 12 passengers)

EC = Expedition Cruising (13-500 passengers)

CR = Cruise only (500+ passengers)

Data gathered from <http://apps.iaato.org/iaato/vessel/listVessels.jsp> (IAATO, 2014c).

factors make the Peninsula an appealing destination: it is close to South America, has a relatively mild climate and little sea ice, hosts multiple scientific stations, and contains diverse wildlife and scenery (Farreny et al., 2011). From 2003-2009, the CEP’s tourism study noted that the top 20 most visited Antarctic landing sites were all in the Antarctic Peninsula (2012). Activity is highly concentrated: among these top 20 sites, 54% of visitor landings occurred at just seven of them. The top five visited sites—Whalers Bay, Port Lockroy, Half Moon Island, Neko Harbor, and Cuverville Island—each averaged more than 10,000 visitors per season during 2003-2009 (CEP, 2012). In contrast, the most heavily visited site in the Ross Sea, Cape Royds, averaged 320 tourists per season from 2005-2011.

In addition to being spatially concentrated, visitor activity is seasonally concentrated. This is because Antarctic tourism is limited to the austral summer (late October to early April), when ice cover is minimal, the climate is at its mildest, and passage is safest for ships (IAATO, 2014a).

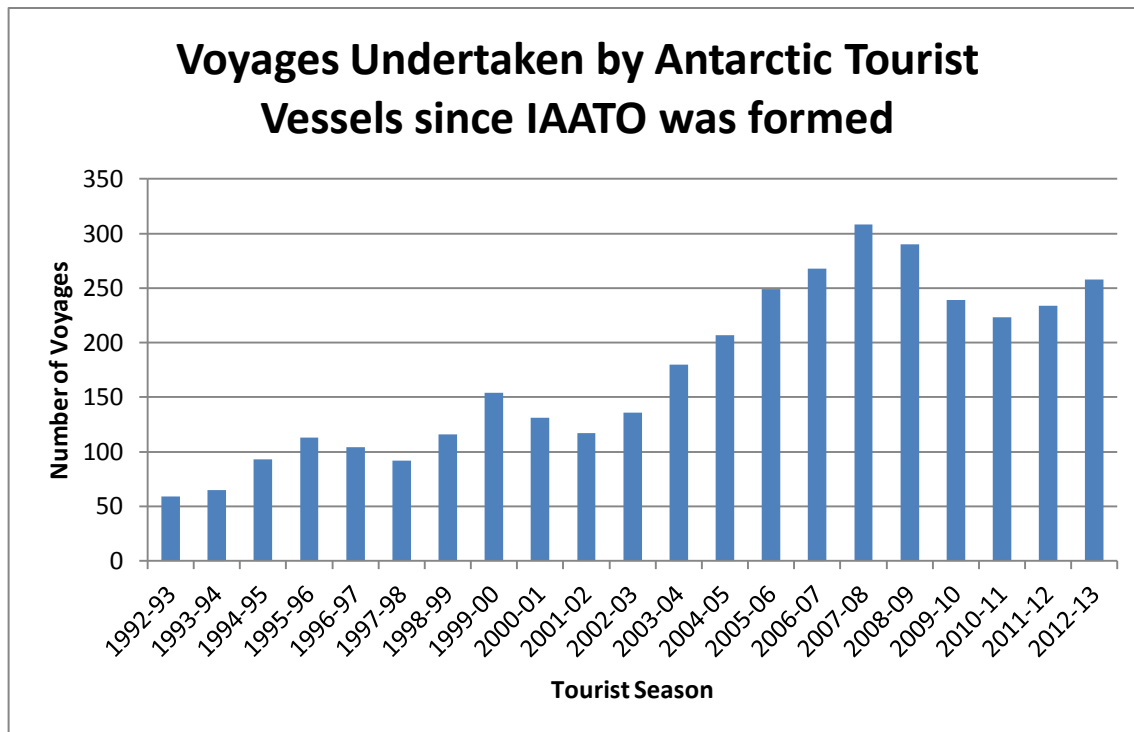


Figure 2. Number of vessel-based tourist voyages to Antarctica over the last 21 seasons. Data gathered from IAATO overview of Antarctic tourism: 2012-13 season and preliminary estimates for 2013-14 season (IAATO 2007).



Figure 3. A typical tour vessel itinerary to the Western Antarctic Peninsula.
 Source: <http://www.oneoceanexpeditions.com/antarctic/itineraries.php#A> (One Ocean Expeditions, 2014).

This is also the period when the largest numbers of whales occur in Antarctic waters. The growth of the tourism industry therefore provides multiple opportunities for tour boats to interact with Antarctic whales.

The International Legal Framework

The Antarctic Treaty

No nation exerts sovereignty over Antarctica, but many are interested in its resources and research opportunities. For the first half of the twentieth century, no formal policy existed to govern the use of Antarctica. As countries began to make territorial claims to the continent, disputes arose over their legality and overlapping nature (Kimball, 1999). Then, during 1957-58,

twelve nations (including seven with territorial claims) established 40 research bases on Antarctica. This was the International Geophysical Year, and the participating nations decided to preserve this period of peaceful cooperation (Kimball, 1999). Thus, in 1959, these twelve nations came together to sign the Antarctic Treaty in Washington, D.C (Table 3). The purposes of the treaty were to ensure that Antarctica would continue to be used “for peaceful purposes only,” that “freedom of scientific investigation” would not be compromised, and that the results of any such research would be freely exchanged (ATS, 2011d). The treaty also preserved the status quo by stating that no activities performed under the treaty would “constitute a basis for asserting, supporting or denying a claim to territorial sovereignty in Antarctica.” To promote transparency, any signatory nation was free to inspect the Antarctic research bases of other countries without advance notice (ATS, 2011d). The treaty entered into force in 1961. It is now the central document that addresses international affairs in Antarctica, including environmental protection and tourism.

The original signatories enjoy status as “Consultative Parties,” meaning that they conduct significant research in Antarctica. The Antarctic Treaty Consultative Parties (ATCPs) meet annually at Antarctic Treaty Consultative Meetings (ATCMs) to discuss issues facing Antarctica. The ATCPs are permitted to make decisions at these meetings pursuant to the treaty. The ATCPs can pass *measures*, which are legally binding, *resolutions*, which are non-binding, and *recommendations*, which provide advice to governments on how to implement the Treaty (Kimball, 1999). For example, the Agreed Measures for the Conservation of Antarctic Fauna and Flora was adopted by the ATCPs in 1964 under Recommendation III-VIII (Kimball, 1999). These measures instruct the parties to prohibit the capture, wounding, or killing of any native Antarctic mammal, and to minimize “harmful interference” with wildlife.

Since 1959, an additional 38 countries have become parties to the treaty, bringing the total to 50 (ATS, 2011b). Of the newer parties, 17 have demonstrated that they conduct significant Antarctic research and have been granted Consultative Party status, bringing the total number of ATCPs to 29. The remaining 21 nations are considered Non-Consultative; they do not contribute during Consultative Meetings, but are welcome to attend (ATS, 2011b).

PARTIES TO THE ANTARCTIC TREATY	
Consultative	Non-Consultative
Argentina*	Austria
Australia*	Belarus
Belgium	Canada
Brazil	Colombia
Bulgaria	Cuba
Chile*	Denmark
China	Estonia
Czech Republic	Greece
Ecuador	Guatemala
Finland	Hungary
France*	Korea (DPRK)
Germany	Malaysia
India	Monaco
Italy	Pakistan
Japan	Papua New Guinea
Korea (ROK)	Portugal
Netherlands	Romania
New Zealand*	Slovak Republic
Norway*	Switzerland
Peru	Turkey
Poland	Venezuela
Russian Federation	
South Africa	
Spain	
Sweden	
Ukraine	
United Kingdom*	
United States	
Uruguay	

Table 3. The Parties to the Antarctic Treaty as of 2014. Nations in bold are the 12 original Parties to the Treaty. Nations with an asterisk (*) symbol have asserted a territorial claim in Antarctica. Data gathered from http://www.ats.aq/devAS/ats_parties.aspx?lang=e (ATS, 2011b).

In addition to the measures, resolutions, and recommendations attached to the Antarctic Treaty itself, there are three other agreements that are closely tied to the Treaty. The Convention for the Conservation of Antarctic Seals was signed in 1972 (ATS, 2011c). The Convention on the Conservation of Antarctic Marine Living Resources (1980) deals with the rational use, harvesting, and conservation of resources, such as fish and krill. The Protocol on Environmental Protection to the Antarctic Treaty (the Protocol) designated Antarctica as a “natural reserve, dedicated to peace and science” (ATS, 2011e). Collectively, these three documents and the Antarctic Treaty make up the Antarctic Treaty System.

The Protocol was signed in 1991 and entered into force in 1998 (ATS, 2011e). The body of the Protocol lays out environmental principles to be applied to all Antarctic activities (including tourism) and established a Committee for Environmental Protection, abbreviated CEP (ATCPs, 1991). The Protocol has six annexes: the first requires an Environmental Impact Assessment to be conducted prior to any Antarctic activity. Annexes II through VI cover conservation of fauna and flora, waste disposal, marine pollution, protected areas, and liability, respectively (ATS, 2011e). Articles 5 and 6 of Annex II call for the exchange of detailed information on marine mammal population statuses between the parties. To facilitate this, it calls for a universal form, which each party uses to report on species killed, as well as the status of Antarctic mammal populations. Parties to the Protocol ultimately “commit themselves to the comprehensive protection of the Antarctic environment” (ATCPs, 1991).

One aspect of tourism covered by the original Antarctic Treaty is information sharing. Under Article VII of the Antarctic Treaty, each Party is required to submit pre-season information on the activities it plans to carry out during the upcoming season (ATS, 2011a). This includes data on its governmental expeditions, environmental management plans, the population sizes and activities of its national research stations, and tourism expeditions. Each tourism vessel is expected to submit the following details for each trip: the number of passengers, dates of departure and return to port, the sites it will visit (with coordinates), the date it will be at each site, and the activities that tourists will participate in at each site. This information is made publicly available on the Antarctic Treaty’s website (ATS, 2011a). These proposed itineraries must often be adjusted due to inclement weather or ice cover. Thus, each party submits updated

information at the conclusion of the tourist season. However, the CEP noted that this information is often incomplete and inconsistently reported by Parties, and thus could not use it in its 2012 tourism report (CEP, 2012).

There are no provisions under the Antarctic Treaty that focus exclusively on whales. However, from 1959-2011, the ATCPs made 30 decisions (consisting of recommendations, resolutions, and measures) regarding tourism (CEP, 2012). Multiple resolutions have issued site guidelines regulating landing activity at the most visited Antarctic sites; currently, guidelines for 35 sites are available on the Antarctic Treaty's website. Most recently, the ATCPs released "General Guidelines for Visitors to the Antarctic" in 2011 under Resolution III (ATS, 2011f). These guidelines cover the protection of wildlife, respect for protected areas and research, and safety precautions. All tourists are expected to be familiar with the guidelines prior to reaching Antarctica.

The influence of the Antarctic Treaty has strengthened gradually since it was signed. Each nation is responsible for passing and enforcing its own laws to meet the Treaty's terms. Throughout the 1960s and 1970s there was little effort to regulate or enforce compliance (Kimball, 1999). With the end of the Cold War, the parties have grown more comfortable monitoring one another. There are numerous examples of compliance that have not required external monitoring: for example, the United States has passed a plethora of laws in accordance with the treaty, including the Antarctic Conservation Act of 1978, the 1984 Antarctic Marine Living Resources Convention Act, and the Antarctic Science, Tourism, and Conservation Act of 1996 (Kimball, 1999). In February 2014, France became the first nation to prosecute one of its citizens for conducting unauthorized tourist voyages to Antarctica (Ponnet, 2014). The offender was convicted of violating the Protocol, fined €10,000, and banned from Antarctica until 2015.

International Association of Antarctica Tour Operators

For the first few decades of Antarctic tourism, there was no formal organization of tour operators, and tourism statistics were not monitored. This changed in 1991 with the formation of the International Association of Antarctica Tour Operators (IAATO). As noted above, IAATO was founded by the seven tour operators who then offered trips to Antarctica. Today, there are

over 100 IAATO members, including tour operators, travel agents, conservation organizations, government tourism bureaus, and more (IAATO, 2014b).

The formation of IAATO allowed member operators to lobby their governments for stricter tourism regulations, and provided a means to advertise their safe, environmentally-friendly practices to customers. IAATO's prominence resulted in an invitation to attend the ATCMs as an invited Expert, where it presents annual reports on tourism trends to the ATCPs (IAATO, 2013). IAATO gathers and maintains the most complete record of Antarctic tourism data available (CEP, 2012).

IAATO has also successfully crafted many guidelines and recommendations for its members to follow. For example, IAATO's "Marine Wildlife Watching Guidelines for Vessel & Zodiac Operations" provide instructions on how to conduct encounters with whales, dolphins, seals, and seabirds from a vessel (IAATO, 2007). Compliance with these measures is self-regulated and enforced through "peer pressure" (Liggett et al., 2011). Member operators who violate IAATO guidelines risk expulsion from the organization if they are caught (IAATO, 2014a). This may damage the offending operator's reputation, but will not prevent it from voyaging to Antarctica, provided it complies with its host nation's laws.

The CEP's 2012 tourism report acknowledged that the ATCPs do not have an adequate record of tourism data and, therefore, rely on IAATO for this information (CEP, 2012). The ATCPs also use IAATO guidelines to make decisions about Antarctic tourism—for example, Measure 15, which was adopted by the ATCPs in 2009, prohibits ships carrying more than 500 passengers from making tourist landings. This measure also requires a 1:20 guide to passenger ratio, and prohibits more than 100 passengers from being onshore at a given site at one time. All of these rules were already standard industry practice for IAATO members. Measure 15 has not yet entered into force, but when it does each Party's national government will be required to enforce it (IAATO, 2014a). IAATO continues to implement guidelines that are stricter than those under the Antarctic Treaty, demonstrating its commitment to the protection of the Antarctic environment.

Other international agreements

Multiple international agreements govern the behavior of ships on the high seas, and therefore apply to ships traveling to Antarctica. One example is the International Convention for the Prevention of Pollution from Ships (MARPOL), which was adopted by the International Maritime Organization in 1973 and entered into force in 1983 (IMO, 2014a). MARPOL's six annexes contain regulations on the pollution of the oceans by oil, noxious liquid substances, harmful packaged substances, sewage, garbage, and air pollution, respectively. Antarctica is considered a "special area" under Annexes I (oil), II (noxious liquid substances), and V (garbage), which means it receives extra protection with regards to these pollutants (IMO, 2014b). Tourist vessels are required to abide by the provisions of these annexes if their home country is a party to MARPOL.

Potential Threats to Whales from Antarctic Tourism

International law protects the Antarctic environment and wildlife as a whole, but little specific protection is afforded to whales. However, the growing number of voyages to the Antarctic Peninsula increases the opportunity for tour vessels and whales to interact. Several threats to whales may arise from these encounters. The following potential threats to whales from Antarctic tourism are discussed in this report: behavioral modification, anthropogenic noise, collisions between ships and whales, oil spills, greenhouse gas emissions, and other forms of pollution.

Behavioral Modification in the Presence of Whale-Watching Vessels

Due to the timing of their migrations, whale sightings increase gradually throughout the tourist season, peaking in February and March. Whale-watching has thus become a popular tourist activity in Antarctica; sometimes, it is one of the main factors in trip planning. In March 2014, the vessel *Akademik Sergey Vavilov* offered a "Marine Mammals tour," which claimed that "sightings are regular and in fact whales are seen almost everywhere we look" (One Ocean Expeditions, 2014).

Scientific studies outside the Antarctic have shown that the presence of whale-watching boats can alter whale behavior. Williams, Trites & Bain (2002) observed orcas in British Columbia,

and found that the presence of one boat can produce visible changes in whale behavior—even if the boat is complying with whale-watching guidelines. These whales exhibited horizontal avoidance (increased their swimming speed and made unpredictable direction changes) and vertical avoidance (made longer, steeper dives) of the boats. The conclusion that a single boat can modify whale behavior is significant because Antarctic tour operators coordinate their itineraries to avoid each other, thereby preserving the impression of Antarctica's remoteness. There may only be only one tour boat in an area at a time, but there is still a potential for each vessel to affect whale behavior.

Christiansen, Rasmussen & Lusseau (2013) found that minke whales in Iceland also changed their behavior in the presence of whale-watching boats. Without boats in the nearby vicinity, the whales typically foraged by performing a series of shallow dives followed by a longer dive. However, when boats were present, the inter-breath intervals and dive intervals of the whales decreased. This behavior increased the erratic movements and metabolic rates of the whales, which disrupted their ability to feed successfully.

However, other studies have concluded that whales habituate to boats and come to ignore their presence, or that they will approach the boat voluntarily. In a study on humpback whales in Australia, 46% of the pods observed did not change their behavior in the presence of whale-watching boats, while 23% of pods approached the boats (Stamation, Croft, Shaughnessy, Waples & Briggs, 2010). The 17% of humpback pods that avoided the whale-watching boats behaved similarly to the orcas in the British Columbia study: they increased their speed, changed direction frequently, and stayed submerged longer. However, Stamation et al. found that whales behaved differently based on the proximity of the vessel. The humpbacks were more likely to avoid the vessel if it violated whale-watching guidelines (approached closer than 100 meters) and were more likely to approach the vessel if it complied with the guidelines (kept a distance of at least 100 meters). This implies that the distances set in whale-watching guidelines are well-founded. While approaching the boats appears to be a positive response, this may actually be another form of disturbance to the whales, as it prevents them from engaging in other behaviors like feeding or socializing.

IAATO has endeavored to address these issues through its 2007 “Marine Wildlife Watching Guidelines for Vessel & Zodiac Operations.” The guidelines suggest that operators let the “animals...dictate all encounters” (IAATO, 2007). Vessels should also post a lookout in areas where marine mammals are known to occur so that collisions are avoided. In the section on whales, the guidelines state that vessels should not stay near whales for more than an hour, and should not circle, separate, scatter, or pursue them. The guidelines further note how vessels should approach a whale (parallel to the whale and slightly to its rear), and list appropriate distances that each type of vessel may approach: not closer than 100 feet for small boats, or 500 feet for ships over 20,000 tons.

While short-term whale behavior was affected in each of these studies, none of them found evidence indicating that changes in long-term behavior had occurred (Williams, Trites & Bain, 2002). However, the long-term consequences of short-term behavioral changes are not known (Stamation et al., 2010). Several observations indicate that frequent changes in short-term behavior may be detrimental to whales. Baleen whales such as minke and humpbacks are capital breeders, which means that they do not eat during the breeding season—they obtain all of their caloric intake during their time in the Southern Ocean. Any time they spend avoiding or approaching vessels prevents them from feeding, which may impact their fitness (Christiansen, Rasmussen & Lusseau, 2013). Orcas may also be vulnerable. In 2006, the IWC stated that the “fitness of individual odontocetes [toothed whales] repeatedly exposed to whale-watching vessel traffic can be compromised...[this] can lead to population-level effects” (Higham & Shelton, 2011).

Anthropogenic Noise

Light and scent do not easily permeate the marine environment, but sound moves effectively through saltwater—sometimes traveling for hundreds of miles across ocean basins. Cetaceans therefore use auditory signals to communicate, navigate, avoid predators, and forage (Erbe, 2002). Noise generated by ship engines and propellers has been shown to interfere with this communication, and evokes varied responses from whales to compensate for this interference.

Nowacek, Thorne, Johnston & Tyack noted that “[cetacean] responses to noise fall into three main categories: behavioral, acoustic, and physiological” (2007). For example, a study on sperm whales in the Gulf of Mexico indicated that sperm whales change their behavior in response to vessel noise. These whales typically emit a near-constant stream of clicks to communicate, forage, and navigate, but buoys detected a 32% decrease in the number of clicks when a ship approached (Azzara & von Zahren, 2013). The low levels of clicking persisted for a half hour after the ship had passed. Tests were performed to ensure that the ship noise was not masking researchers’ abilities to hear clicks on the buoy. The reduction in clicks suggests that whales were leaving the area to avoid a ship, orienting themselves away from the buoy when a ship approached, surfacing as part of an avoidance strategy, or a combination of these. It is possible that many behavioral modifications in the presence of vessels, such as those discussed in the previous section, are caused by vessel noise.

Boat noise can mask low-frequency whale calls, especially when a boat is directly in front of a whale (Williams, Trites & Bain, 2002). Whales sometimes alter their vocalizations in response to masking by changing the type and/or timing of their calls. A study of killer whales in Puget Sound, Washington, found that whales increased the amplitude of their calls by one decibel for every one-decibel increase in background noise (Holt, Noren, Veirs, Emmons & Veirs, 2008). The whales also produced longer calls in the presence of whale-watching boats. Increasing the amplitude or length of calls to communicate may have energetic costs or cause stress to the whales (Holt et al., 2008). Furthermore, noise exposure can produce temporary threshold shifts and even permanent hearing loss in whales at very high received levels (Erbe, 2002).

Ship noise may produce physiological reactions (stress) in whales. One study focused on right whales in the Bay of Fundy, which receives heavy shipping traffic. In the days following September 11, 2001, background noise levels decreased by six decibels due to restricted shipping activity (Rolland et al., 2012). During the same period, researchers recorded a significant decrease in the right whales’ secretions of adrenal glucocorticoids (GCs), which are released in response to stressors. Chronic elevated levels of GCs suppress growth, reproduction, and immune system function. Thus, persistent stress caused by noise can negatively impact a whale’s health.

Currently, scientists note that “marine noise pollution is not thought to pose a major threat” to Antarctic wildlife (Chown et al., 2012a). However, noise produced by tour vessels in Antarctica may produce reactions similar to those recorded in whales elsewhere, particularly if ship density and ship size in the region increases. A model developed by Erbe (2002) indicated that a two-engine zodiac boat traveling at 10 km/hr, similar to those that ferry Antarctic tourists to and from landings, could potentially mask cetacean calls at a distance of one kilometer. The same boat could elicit a behavioral response at a distance of 50 meters. Thus, even low levels of ship noise in the Antarctic may impact whales.

Collisions

Increased boat traffic in Antarctica raises the probability of collisions with whales. Since 1998 there have been one or two collisions each season between tour boats and whales in Antarctica, although none are known to have resulted in deaths (Williams & Crosbie, 2007).

Whales become more susceptible to collisions when they approach vessels. Whales sometimes approach whale-watching vessels voluntarily (Stamation et al., 2010). Conversely, there is evidence indicating that whales cannot always detect a ship or determine its position. Mysticetes (baleen whales) have been known to turn into the paths of slow-moving ships as a result (Allen, Peterson, Sharrard, Wright & Todd, 2012). This is because noise radiates asymmetrically from ships and varies with depth. The acoustic signature of a vessel is louder from its side and stern than from its front, producing a “bow-null effect acoustic shadow zone” (Allen et al., 2012). Whales that are near the front of a ship and close to the surface are the most vulnerable to collision. To address this, IAATO notes in its 2007 wildlife-watching guidelines that “cetaceans should never be approached head-on.”

Oil Spills

Oil spills in other areas have had severe, deleterious effects on cetaceans. Significant impacts were seen following the *Exxon Valdez* spill in March 1989, which spilled 42 million liters of crude oil into Prince William Sound (Matkin, Saulitis, Ellis, Olesiuk & Rice, 2008). Within 24 hours of the incident, orca whales had been photographed covered in oil. Matkin et al. tracked two orca pods in the area: the resident AB pod and the transient AT1 pod. AB lost 33% (12) of

its members within a year of the spill, while AT1 lost 41% (9) of its members. At the conclusion of the study 16 years later, neither population had recovered to pre-spill levels.

The orcas in Prince William Sound appeared to neither detect nor attempt to avoid the oil (Matkin et al., 2008). Cetaceans do not have a well-developed olfactory system, which may contribute to these difficulties. Furthermore, whales swim underwater for hundreds of meters at a time, and may surface into a slick they are not aware of. Most whales begin to exhale before reaching the surface, and thus may be committed to inhaling before realizing they are in an oil slick. Direct inhalation of oil or its aromatics is toxic and can cause whales to lose consciousness. Matkin et al. (2008) believed that seven of the lost AB whales lost consciousness and drowned from such inhalation.

Over a longer period of time, whales may ingest oil through the consumption of oiled prey. Oiled seals are lethargic and easier to catch than healthy animals, but will have detrimental effects on a killer whale's health (Matkin et al., 2008). Chronic exposure to oil can also lead to disease in cetaceans. One year after the *Deepwater Horizon* oil spill in the Gulf of Mexico, scientists found hormonal abnormalities and lung disease in bottlenose dolphins within a heavily oiled area. Dolphins in Sarasota Bay, which was not oiled, did not display similar symptoms (Goldenberg, 2013).

Even when precautions are taken, Antarctica is a dangerous environment for vessels. The most common type of incident in Antarctica is vessel grounding, which may occur due to collisions with uncharted rocks or the sudden appearance of a strong wind or current (CEP, 2012). The January 1989 grounding of the *Bahia Paraiso* resulted in an oil spill of 600,000 liters, which remains the largest Antarctic oil spill to date. The *Bahia Paraiso* was not a tourist vessel, but it did have tourists onboard and ran aground while trying to drop them off for a visit at Palmer Station (CEP, 2012). The spill contaminated all aspects of the marine environment within two miles of Arthur Harbor, including fish, clams, limpets, birds, and macroalgae (Kennicutt, Sweet, Fraser, Stockton & Culver, 1991). Intertidal limpets populations fell by 50% directly after the spill, and clams and fish ingested contaminated sediments (Kennicutt & Sweet, 1992). However, the oil dispersed relatively quickly due to the high-energy nature of the surrounding waters. The

spilled mixture was a combination of diesel and jet fuel, which was highly volatile and evaporated easily. Some beaches continued to show signs of contamination or re-oiling, but most of the affected areas appeared clean within two years of the spill.

Recent incidents with tourist vessels serve as reminders that Antarctic travel is inherently dangerous. The *M/S Explorer* became the first tourist vessel to sink in the Antarctic after reportedly striking ice in November 2007 (Bowermaster, 2007). All passengers were rescued successfully, but the sinking raised concerns over future incidents.

On Christmas Eve 2013, the *M/V Akademik Shokalskiy* became trapped in pack-ice around 100 nautical miles from Antarctica, with 52 scientists and tourists on board (McGuirk, 2014). Rescue operations required the cooperation of multiple countries and were not completed until January 2 due to snow, winds, and ice in the area (Jamieson, 2014). The *Akademik Shokalskiy*, a Russian icebreaker and IAATO member vessel, eventually broke free from the ice and returned to port. The incident highlighted the fact that poor weather conditions can delay rescue operations in Antarctica, including moving equipment and personnel to any incidents involving oil spills.

A recent study by Ruoppolo, Woehler, Morgan & Clumpner (2013) conducted a survey of national governments and IAATO to determine the ability of these groups to respond to an Antarctic oil spill. They identified five factors preventing these groups from responding to an oiled wildlife event: poor weather, high cost, the remoteness of the area, limited capacity to accommodate personnel on land, and lack of facilities necessary to rehabilitate wildlife. Ruoppolo et al. concluded that none of the groups surveyed were adequately prepared to respond to such an event. The threat to wildlife is emphasized because Antarctic tour operators target areas with dense animal populations. Furthermore, most of the large cruise ships, which carry the most fuel and the most passengers requiring rescue, are not ice-strengthened (Bowermaster, 2007). “An oil spill in the Antarctic affecting wildlife is a matter of when, not if,” and it remains to be seen how such a spill will impact whales (Ruoppolo et al., 2013).

Greenhouse Gas Emissions

The Antarctic tourism industry releases large amounts of greenhouse gas emissions into an area that is already vulnerable to climate change. In a 2011 study, Farreny et al. used IAATO data to calculate emissions for Antarctic cruises departing from Ushuaia, Argentina. Results found that these cruises released nearly 200,000 tons of CO₂ during the 2008-09 season. This equates on average to 5.44 tons of CO₂ per passenger, or 0.49 tons per passenger per day. 70% of these emissions were produced during the cruising part of the trip, while the other 30% were attributable to the flights tourists used to get to and from Argentina.

Overall, Antarctic tourism is a minor contributor to climate change: it accounts for only 0.02% of the CO₂ emissions from all tourism globally (Farreny et al., 2011). Furthermore, tourism as a whole was estimated to produce only 5% of the total worldwide CO₂ emissions in 2005. However, Antarctic tourism is a larger polluter than other tourism destinations when the emissions from individual trips are compared. Antarctic cruises release up to eight times more greenhouse gasses per capita and per day than the average international tourist trip (Farreny et al., 2011). Furthermore, the average emissions per passenger from one Antarctic trip (5.44 tons) is higher than the global emissions for the average world citizen over one year (4.38 tons). The high level of emissions released by Antarctic tourism does not line up with the industry's message of environmental protection and ambassadorship. Tourists are largely unaware of and unconcerned with the emissions produced by their trips (Eijgelaar, Thaper & Peeters, 2010).

The carbon emissions from Antarctic tourism are problematic because the Antarctic Peninsula—where over 95% of tourists travel—is feeling the effects of global climate change more intensely than the rest of the continent (Figure 4). A report released in 2009 by the Scientific Committee on Antarctic Research (SCAR) found that 90% of the Peninsula's glaciers have retreated in the last few decades and several have collapsed, such as the Larsen B Ice Shelf in 2002 (SCAR, 2009). This is relevant to whales because this loss of sea ice has led to a decline in krill abundance, which is the primary prey of baleen whales. SCAR reported that “some whale species might not get the chance to continue to recover further from whaling if the krill population remains at a low level.”

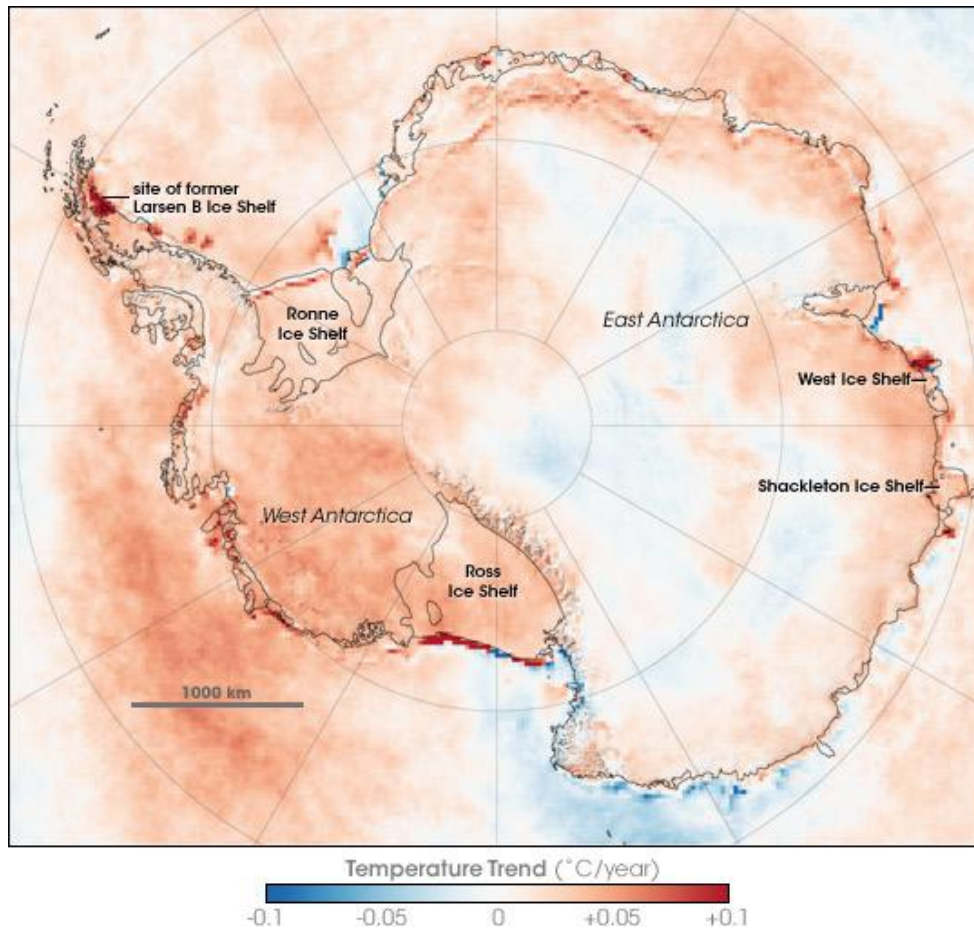


Figure 4. Temperature trends in Antarctica from 1981-2007.
 Source: <http://earthobservatory.nasa.gov/IOTD/view.php?id=8239> (NASA, 2007).

Other forms of pollution

Some researchers have noted that the increasing human presence in Antarctica is producing high amounts of pollution from ship fuel and trash (eTurboNews, 2009). One German scientist noted that there is a “genuine waste problem in the Antarctic,” referencing garbage piles, empty oil cans, toxic chemicals, and dead car batteries on King George Island (Kumar, 2013). However, such problems typically occur around research stations and other permanent settlements, indicating that scientists and station staff are the main contributors to pollution. Approximately 7,000 scientists visit Antarctic annually (Chown et al., 2012b). This number is much lower than the 35,000 visiting tourists, but scientists spend longer periods of time on the continent, and are present during all times of the year. Furthermore, under IAATO guidelines, tourists must pack

out their trash (Kumar, 2013). Garbage that runs off land and enters the ocean can be harmful to whales if they become caught in or swallow it.

Potential Benefits to Whales from Antarctic Tourism

The presence of tourist vessels in Antarctica may indirectly benefit whales by bringing groups of people into direct contact with these animals in their natural habitat. The following potential benefits to whales from Antarctic tourism are discussed in this report: the development of “ambassadors” for Antarctic conservation, and the facilitation of whale research.

Antarctic tourists become “ambassadors” for conservation

Proponents of wildlife tourism (including IAATO) claim that when tourists experience exotic locations and wildlife firsthand, they become more likely to engage in conservation-minded behaviors upon returning home. These behaviors may involve donating to or volunteering with conservation organizations, discussing conservation with friends and family, writing to government officials, or avoiding harmful products. Tourists also leave their trips with an increased knowledge of the area and more “supportive attitudes” towards environmental management (Powell & Ham, 2008). Thus, while tourism itself may have some impact on wild areas, the benefits of creating “ambassadors” for threatened areas and species outweigh any negative outcomes.

A study of tourists on a cruise to the Galapagos supported this hypothesis. Tourists were surveyed at the beginning and the conclusion of their cruise. During the trip, tourists had the opportunity to attend multiple talks about Galapagos wildlife and conservation. During the second survey, tourists indicated a high level of satisfaction with their trip, and performed better on knowledge questions about the Galapagos than on the first survey (Powell & Ham, 2008). A higher percentage also noted their intention to join environmental organizations and donate to conservation. Tourist support for management techniques, such as invasive species eradication and strict visitor regulations, increased. This survey only tested travelers’ intentions, and not their actual behavior, but 78% of passengers donated to the Galapagos Conservation Fund before disembarking from the ship. The authors concluded that tourists are more likely to act if a

conservation opportunity presents itself soon after their trip, which may be why soliciting donations was successful in this case (Powell & Ham, 2008).

There is evidence that forming a connection to a specific species can also increase conservation-minded behavior. Tourists are interested in seeing charismatic megafauna in the wild and in zoos, which is why conservation organizations use species such as polar bears, tigers, and gorillas to attract revenue. Tourists report feelings of “wonder” and “euphoria” after encountering these species (Skibins, Powell & Hallo, 2013). Tourists who were surveyed after visits to zoos, aquariums, or a Tanzanian safari were asked to select the species they felt the deepest connection with (possible options included elephants, hippos, pandas, whales, and dolphins). Results indicated that tourists had a stronger desire to protect such species, and biodiversity in general, after seeing them in person (Skibins, Powell & Hallo, 2013). Like the Galapagos study, however, these surveys measured the tourists’ intentions and not actual behavior.

The results of these studies suggest that Antarctic tourists who see whales (a charismatic species) and form an emotional connection to them may support whale conservation after returning home. Even tourists who connect more strongly with another species, such as penguins or seals, may become “ambassadors” for Antarctic conservation as a whole and support whales indirectly. This is an overarching goal of Antarctic tourism; one of IAATO’s objectives is to “to create a corps of ambassadors for the continued protection of Antarctica by offering the opportunity to experience the continent first hand” (IAATO, 2014d). Several studies have evaluated the opinions of tourists on their Antarctic experiences.

An examination of Antarctic tourist blogs revealed that wildlife was an important attraction for travelers, with over 30% of the blogs’ pictures containing wildlife (Roura, 2012). Penguins were the most popular subject, followed by seals. Few bloggers mentioned the impacts their own presence might have, but many described their impression of Antarctica as a pristine and undisturbed continent. Other studies have surveyed Antarctic tourists about their trips. When tourists were asked “how did this experience affect you?”, 22.3% expressed feelings of awe, which suggests that visiting Antarctica was a profound experience (Powell & Brownlee, 2012).

In a 2003 survey of tourists aboard the *Akademik Ioffe*, 76% of tourists reported that they had become more aware of Antarctic conservation issues during their trip, and 96% reported that seeing wildlife was an important part of their cruise (Tisdell, 2010). Additionally, all those surveyed indicated that they were pro-conservation after their trip, whereas some tourists had expressed a “neutral” attitude towards conservation beforehand.

Powell, Kellert & Ham (2008) surveyed Antarctic tourists on ten cruises during 2002-2004 and found that tourists had greater intentions to engage in pro-conservation behaviors immediately after their trips. However, a follow-up survey three months later showed that despite these intentions, tourists had not significantly altered their behavior. Like tourists in the Galapagos study, Antarctic tourists seemed more likely to donate to conservation when an operator provided opportunities to do so onboard (Powell, Kellert & Ham, 2008). These Antarctic studies displayed similar results to those of tourism from other parts of the world, and indicate that the pro-conservation intentions of tourists may increase after their trips. Pro-conservation behavior of tourists may also increase, particularly if such opportunities are provided during trips or immediately afterwards. There is therefore potential for IAATO to succeed at creating “ambassadors” for Antarctica, who raise awareness and funds for whale conservation.

Antarctic tourism facilitates whale research

Antarctic tour vessels have assisted scientists with Antarctic whale research in multiple ways. Tour operators provide transportation for scientists to and from Antarctica, and often allow them to conduct their research from the vessel (Williams & Crosbie, 2007). This is helpful because funding for a research-based vessel is expensive, particularly in the Antarctic, and can inhibit scientists from conducting research there. These arrangements provide an opportunity for scientists to share their research with tourists, which increases the tourists’ knowledge and awareness of whales. One scientist found that “the passengers were quite enthusiastic and even supportive of [my] biopsy sampling” (Williams & Crosbie, 2007).

Tourists can also participate in research directly by taking pictures of whales for the Antarctic Humpback Whale Catalogue. After pictures have been submitted, scientists match pictures of the same whale using unique markings on their flukes (College of the Atlantic, 2014). Individual

whales have been matched between Antarctica and breeding grounds in South America and elsewhere, improving our understanding of humpback migration patterns. There are currently images of over 5,300 whales in the catalogue; of those, more than 1,000 pictures of 568 whales were gathered through tourism. Williams & Crosbie (2007) reported that the value of cooperation between Antarctic scientists and tour operators is worth \$1 million per year.

Stakeholder Interest in Antarctic Whales

Diverse groups of people have a stake in Antarctic tourism, and/or Antarctic whale populations. Knowing the threats and benefits to whales from tourism is only useful if stakeholders desire the protection of these species. Thus, understanding the perspectives, desires, and needs of each of these groups is essential to both the success of Antarctic tourism and the protection of whales.

The parties to the Antarctic Treaty are one stakeholder group, as many of these parties have a vested economic interest in the success of Antarctic tourism. However, there are varying stances amongst the parties about whale conservation, as reflected by their political stances within the International Whaling Commission (IWC).

The United States places a high value on the conservation of marine mammals, as evidenced by passage of the 1972 Marine Mammal Protection Act. The U.S. therefore supports the IWC's moratorium on commercial whaling, which was passed in 1982 and took effect in 1986. Many other ATCPs also belong to the IWC and share the United States' stance on whaling. A few exceptions, including Norway, Russia, and Japan, value whales as an economic resource. Canada, a non-consultative party to the Antarctic Treaty, left the IWC in 1982 after the moratorium passed (IWC, 2014a). Norway and Russia, both consultative parties, filed an objection to the moratorium, and Norway continues to participate in commercial whaling. Japan and Peru, also both consultative parties, initially filed objections to the moratorium. However, they withdrew their objections before the moratorium went into effect, and consequently are bound by it (Bowman, Davies & Redgwell, 2011). Since commercial whaling is no longer an option for Japan, it issues permits to its citizens to take whales for the purpose of scientific research. Under this provision, Japan licenses its nationals to take 850 minke whales, 50 humpback whales, and 50 fin whales annually (IWC, 2014b). A March 2014 ruling by the UN's

International Court of Justice ordered Japan to cease these scientific research whaling operations in the Antarctic (Adler, 2014). Japan has agreed to abide by this ruling, but its convictions on whaling remain. These differences of opinion may make it difficult to enact regulations related to Antarctic whale conservation through the Antarctic Treaty system. The same nations are often heavily involved in Antarctic tourism, the Antarctic Treaty, and the IWC, so it is necessary to consider each nation's overall attitude toward whales before addressing the issues surrounding whales and tourism.

Since the 1970s, non-governmental organizations have been a key player in the conservation of Antarctica and its wildlife. The first groups to become interested were the Sierra Club, the International Institute for Environment and Development, and the Center for Law and Social Policy in Washington, D.C. (Kimball, 1999). When these groups began critiquing the Antarctic Treaty, the United States invited them to join their delegation to Consultative Meetings. Then, in 1978, a member of the Center for Law and Social Policy (in conjunction with Australian NGOs) formed the Antarctic and Southern Ocean Coalition, or ASOC (Kimball, 1999). Today, ASOC has over 30 dues-paying members, including Greenpeace, WWF, and Friends of the Earth (ASOC, 2013c). It is "the only non-governmental organization working full time to preserve the Antarctic continent and its surrounding Southern Ocean." ASOC was granted observer status to Antarctic Treaty Consultative Meetings in 1991, and has sat in on ATCMs ever since along with the IUCN and IAATO (ASOC, 2013b). At these meetings, ASOC has argued that operator self-regulation through IAATO is not sufficient. It believes that the Antarctic Treaty must take responsibility for regulating the Antarctic tourism industry (ASOC, 2013a).

Scientists, tourists, and tour operators have a clear stake in these issues, as they personally have spent time in Antarctica. Some Antarctic scientists who study cetaceans have expressed concern over the blossoming tourism industry, but many others utilize tourist vessels to conduct their research. Tourists are also invested in both whale conservation and the tourist industry, as evidenced by the overall upward trend in tourist numbers. In a 2003 survey of tourists aboard the *Akademik Ioffe*, 94.2% of respondents were interested in Antarctic wildlife, and 86.5% said that seeing wildlife was an important factor in choosing to come on the trip (Tisdell, 2010). When asked what type of wildlife they were most interested in seeing, whales and dolphins placed

second behind penguins. Finally, tour operators care strongly about Antarctica. Most are highly educated and skilled, with hundreds of Antarctic voyages under their belts. They depend on Antarctica for their livelihoods and take pride in sharing the continent with others. Since these groups have firsthand experience with Antarctica and whales, their perspectives on the interactions between tourism and whales are particularly valuable. It is for this reason that the surveys discussed in Part II are targeted at these three groups.

Part II: Beta-Tests of Questionnaires for Antarctic Tourists, Scientists and Tour Operators

Introduction

A large body of literature has examined the impacts of human presence on Antarctica. The number of articles covering the impacts of Antarctic tourism, however, is much smaller. Of the 220 human impacts articles that the Committee for Environmental Protection reviewed for its Antarctic tourism study, only 24 of them focused specifically on tourism activities (CEP, 2012). Of these, 14 articles evaluated the effects of tourism on wildlife—but none of the articles mentioned in CEP’s report were about whales. I found one article that discussed the potential impacts of Antarctic tourism on whales (Williams & Crosbie, 2007), but to my knowledge no studies have attempted to quantify these impacts, with the exception of the monetary value of tourism-supported whale research.

Given the complete lack of quantitative data, perhaps qualitative data from individuals who have firsthand interactions with whales and Antarctic tourism can shed light on the current situation. If scientists, tour operators, and tourists display high levels of agreement on certain threats to whales, future research could quantify these impacts. Agreement on certain threats can also influence future policy decisions or guidelines designed to protect whales. Conversely, if there is little perceived threat to Antarctic whales, or little agreement amongst these stakeholder groups, then future research may wish to focus on accentuating the benefits of tourism, and increasing tourism’s ability to help whales.

To explore these possibilities, I developed three different questionnaires: one for Antarctic tourists, one for Antarctic tour operators, and one for Antarctic whale researchers. Due to the

limitation of time, I was constrained to running a beta-test of these questionnaires. Beta-tests are essential to determining how questions will be received and interpreted by participants, which questions should be included in future versions of the questionnaires, and whether or not additional questions are needed.

Methods

Questionnaires ranged in length from 19 to 22 questions. All questionnaires were prepared and distributed online using the website www.kwiksurveys.com. A copy of each questionnaire is included as an Appendix to this report.

Some questions were unique to a single questionnaire, while other questions were identical or similar between two of the questionnaires. Five questions, which asked participants for their opinions on the interactions between Antarctic tourism and whales, were identical in all questionnaires.

All questionnaires contained a section titled “Survey Evaluation.” Questions in this section asked how long it had taken participants to complete the survey, and whether they had found any of the questions confusing. If a participant indicated that they had found a question(s) confusing, they were then asked to identify the question(s) and explain why. Finally, participants were asked if they had any further thoughts on the survey experience.

The sample population of Antarctic tourists was comprised of travelers who participated in a Duke Alumni Association (DAA) trip to Antarctica in February 2014. After the completion of this voyage, I obtained contact information for 19 travelers from Dr. Andrew Read, who accompanied the travelers to Antarctica as a Duke lecturer. Four emails were sent out to this group in March 2014: an introductory email describing the project, an email containing the survey link, a reminder email sent one week after link distribution, and a reminder email sent two weeks after link distribution.

Contact information for Antarctic whale researchers was obtained from Dr. Andrew Read, Dr. Douglas Nowacek, and Dr. David Johnston. The resulting sample size comprised 12 Antarctic

scientists. Three emails were sent to this group in March and April 2014, following the same format described above (timing allowed for only one reminder email to scientists).

Contact information for Antarctic tour operators was obtained through IAATO's website; the IAATO vessel directory contains contact names and website links for IAATO member vessels. This gave me a sample size of 13 Antarctic tour operators. Since I had no liaison to connect me with these tour operators, I used a different approach for the introductory email (sent March 2014). This email explained the project and contained a link to a two-question survey. Tour operators were asked whether they would be willing to participate in the full survey; and for their email addresses. Tour operators could indicate their willingness to participate in the project by completing this brief survey or by emailing me directly. If a tour operator responded negatively or did not respond, they received no future emails. If a tour operator responded positively, they were sent an email with a link to the survey.

Survey results were analyzed using Microsoft Excel.

Results

Nine tourists, four scientists, and one tour operator completed the beta-surveys. The respondents ranged in age from 31-70. All respondents possessed a bachelor or graduate degree. Half of the respondents were male and half were female, although all female respondents were tourists.

Due to the small number of respondents, no results could be considered statistically significant or applicable to a broader population of scientists, tourists, or tour operators. To protect the identities of respondents, only the responses containing participants' opinions will be discussed.

Participants were asked to select up to three threats to whales from tourism that they considered to be most detrimental (Figure 5). Scientists and the tour operator selected similar responses, choosing collisions and stress to whales most frequently. One scientist noted, "Different boat operators behave differently around whales—some are very conscientious, others merely want to get their passengers as close to whales as they can...the main impact I see down there is ship

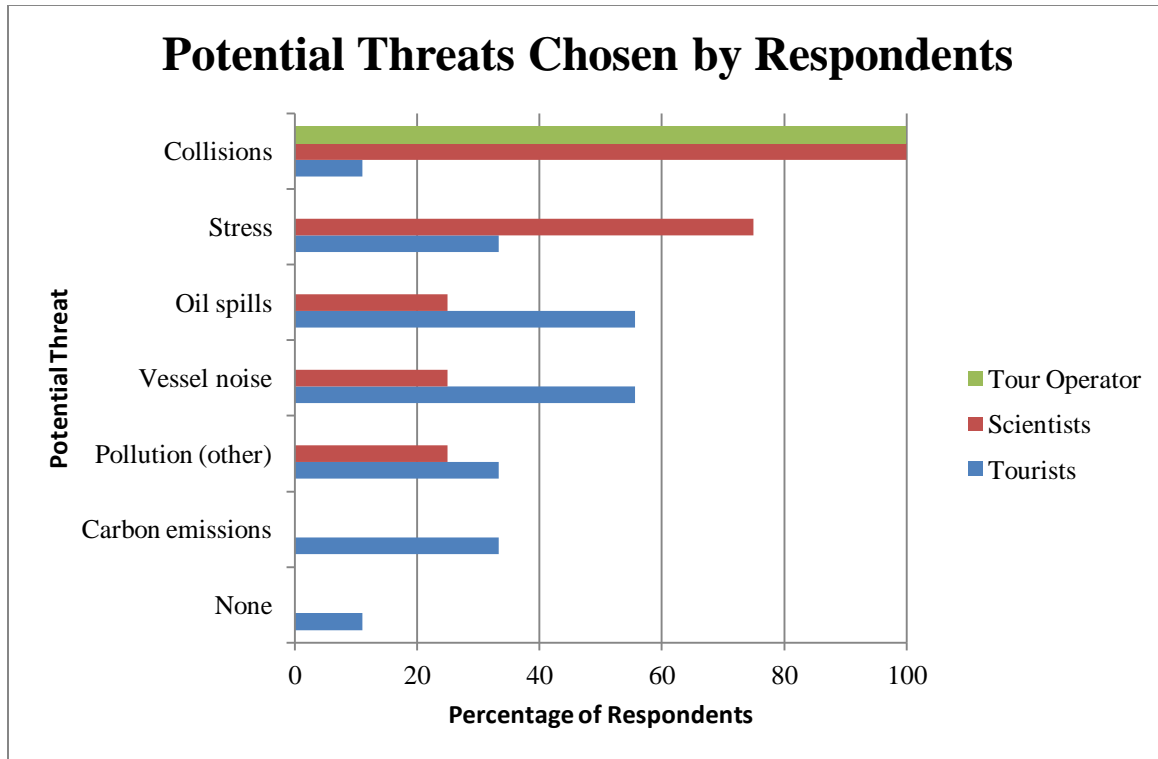


Figure 5. Participants were asked, “The following list contains aspects of Antarctic tourism that potentially **threaten** Antarctic whales. Please choose **up to 3** threats that you feel are most detrimental.”

traffic (inadvertent approaches) and deliberately approaching too closely.” Tourist responses were more variable across the seven options.

Participants were asked to select up to three benefits to whales from tourism that they considered to be the most beneficial (Figure 6). Tourists most often chose the ability of tourism to create conservation “ambassadors,” while the tour operator selected the facilitation of whale research. Scientists indicated that both categories provide benefits to whales.

Each group was asked to consider the impacts of tourism on whales as a whole (Table 4). While 71% of respondents agreed that certain aspects of tourism threaten whales, 78% agreed or strongly agreed that certain aspects of Antarctic tourism benefit whales.

No respondents said that the overall impact of tourism on whales is negative. However, 78% agreed or strongly agreed that the overall impact of tourism on whales is positive.

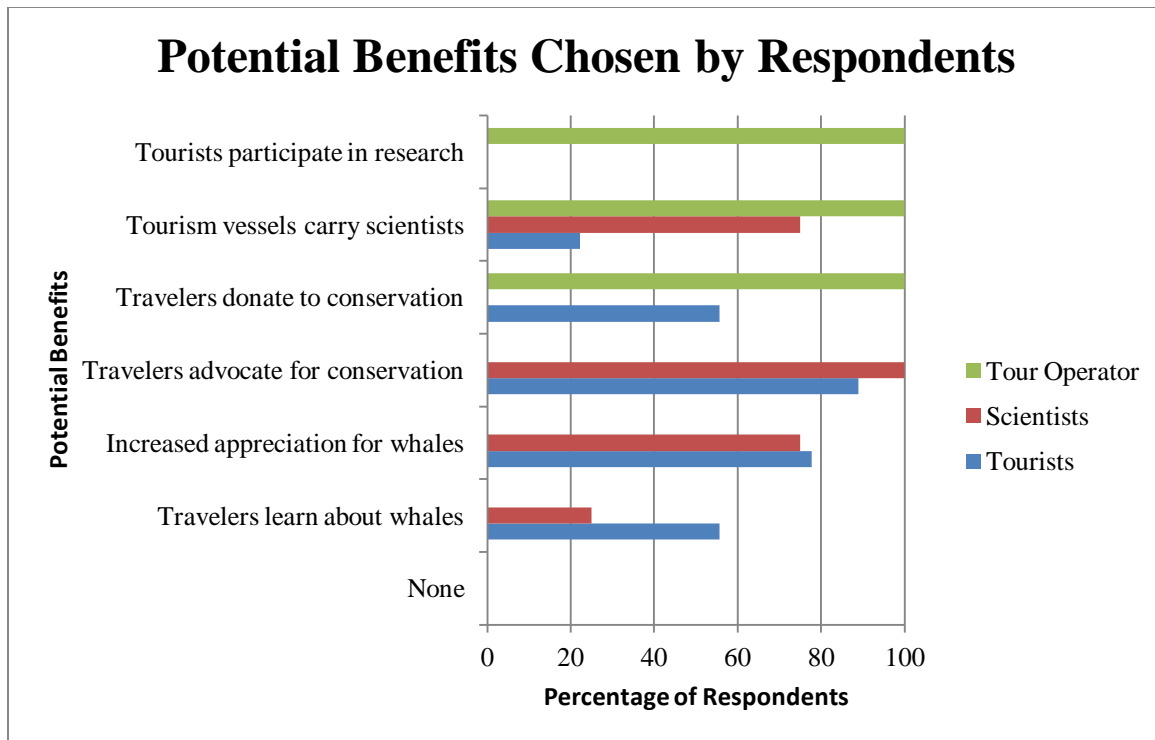


Figure 6. Participants were asked, “The following list contains aspects of Antarctic tourism that potentially **benefit** Antarctic whales. Please choose **up to 3** benefits that you feel are most valuable.”

Respondents' Overall Impressions of Antarctic Tourism's Impacts on Whales					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Certain aspects of Antarctic tourism pose a threat to whales.		14.3	14.3	71.4	
Certain aspects of Antarctic tourism are beneficial to whales.			21.4	57.1	21.4
Overall, the impact of Antarctic tourism on whales is negative.	28.6	50	21.4		
Overall, the impact of Antarctic tourism on whales is positive.			21.4	50	28.6

Table 4. Participants were asked to rate the impacts of the Antarctic tourism industry on whales. Numbers reflect the percentage of respondents who selected each answer across all three groups.

One scientist suggested that in future versions of the survey, additional questions should be included that ask “if whales were approached during your (last) trip, which species, did you have concern for the health or well-being of the whales during the approach, was it too close.”

Another participant indicated that the questions covered in Table 4 were too broad and very similar to each other.

Discussion and Recommendations

Despite the small number of participants in the beta-tests, trends emerged in the responses of individual groups, and when all participants were combined into a single group. Scientists and a tour operator, who have spent the most time in the Antarctic, regard collisions and stress as the most significant negative impacts to whales. This is in line with one scientist’s comment about inadvertent approaches. Tourists gave approximately equal weight to many of the potential threats; if tourists did not witness a near-collision with a whale, they may not have regarded it as a threat. In the case of benefits to whales, tourists most often selected options related to tourists becoming “ambassadors” for conservation. Once again, this may be related to the tourists’ personal experiences, providing there were not scientists conducting research onboard during their voyage. Scientists and the tour operator acknowledged the benefits of ambassadorship and these two groups also valued tourism’s facilitation of research. Several scientists indicated they had conducted research from a tour vessel, and the tour operator had had scientists on his vessel during Antarctic voyages. Notably, the results contained in Table 4 indicate that this small sample of tourists, tour operators, and scientists believe Antarctic tourism is overall more beneficial to whales than detrimental.

Due to the small samples used in the beta-tests, these results cannot be extended to the actual populations of Antarctic tourists, tour operators, or scientists. To achieve accurate results, surveys should be administered to a random, representative sample of tourists across all vessels that travel to Antarctica in a season. For example, if 35,000—40,000 tourists visit Antarctica annually, the sample size required to represent that population would be approximately 380 people (Krejcie & Morgan, 1970). Assuming the survey will achieve a conservative 10-15% response rate, the survey should be distributed to 3,800 tourists. This is a large task that will

require cooperation and assistance from IAATO. Representative samples of Antarctic tour operators and researchers should also be surveyed to determine their opinions.

The feedback and data I received from participants in my surveys indicated that several new topics should be explored in future versions of the surveys. Based on the suggestions of a scientist, and the collective responses of scientists and a tour operator, questions should be added to all three surveys that address close encounters with whales. These questions could ask respondents whether whales were approached during their last trip, which species were approached, how the whales responded, and how respondents perceived the situation with regards to the safety and well-being of the whales. These questions would provide additional data on a perceived threat to whales from tourism.

Additionally, more questions should be added to the tourist questionnaire to adequately assess tourists' experiences and opinions. Respondents from all three groups indicated that Antarctic travel instills pro-conservation sentiments in tourists, effectively creating ambassadors for Antarctic protection. Therefore, tourists should be surveyed on what they learned about whales during their trips, whether their feelings towards conservation have changed, and if (and how) they intend to contribute to Antarctic/whale conservation. Ideally, tourists would be surveyed at the beginning and end of their trips, in order to assess any changes. Tourists might then complete a third survey some months later, to evaluate whether they actually engaged in pro-conservation behaviors after visiting Antarctica. Powell, Kellert & Ham (2008) used such methods and achieved response rates above 70% for all three surveys.

Finally, the responses to my surveys represent perceived interactions between whales and tourism at current levels of visitation—but do not assess how continued growth of the tourism industry might affect whales. Thus, all three surveys could ask participants whether they anticipate continued expansion of the industry, and at what point this growth might shift the overall impact of Antarctic tourism on whales from beneficial to detrimental.

Conclusions

As Antarctic tourism has grown and diversified since the late 1950s, the institutions governing Antarctica have taken many steps to protect the Antarctic environment. The Antarctic Treaty of 1959, which governs all human uses of Antarctica, has proved successful at keeping peace in the region and promoting scientific research amongst Parties. The ATCPs have frequently voiced concerns over the growing tourism industry, and have adopted 30 decisions regarding tourism as a result (CEP, 2012). IAATO has led the way in Antarctic tourism regulation by implementing strict environmental and safety guidelines for its members. However, despite IAATO's commitment to conservation, there have been several criticisms that the ATCPs are too reliant on IAATO for data and self-regulation (ASOC 2013a, CEP 2012).

Studies of Antarctic tourism have evaluated impacts on penguins, seals, and birds, but almost no research has been conducted on the effects of tourism on whales (CEP, 2012). Such impacts will be difficult to measure and, unlike those on terrestrial wildlife, depend largely on the actions of tour operators rather than the tourists themselves. Research in other parts of the world has demonstrated a variety of threats to whales from tourism, including behavioral modification, collisions, oil spills, and vessel noise. On the other hand, wildlife tourism allows tourists to connect with species they would not normally encounter, creating support for conservation actions that may be critical to their future survival.

Beta-tests of the surveys presented in this report represent a first step towards assessing the many-layered interactions between Antarctic tourism and whales. These results and suggestions from participants provide direction for a tool that will allow evaluation of the perspectives of Antarctic tourists, tour operators, and scientists on this topic. The admittedly limited results of my beta-tests indicate that Antarctic tourism may not currently pose a severe threat to whales, and may actually support Antarctic conservation. However, through personal correspondence with survey participants, I discovered that several participants feel tourism's impacts on whales should be explored further. A wider distribution of similar surveys, along with natural science research of human impacts on Antarctic whales, would contribute valuable data on this topic that is currently lacking. Hopefully, this report opens a dialogue amongst Antarctic stakeholders that leads to mutual gains for all Antarctic travelers—humans and whales alike.

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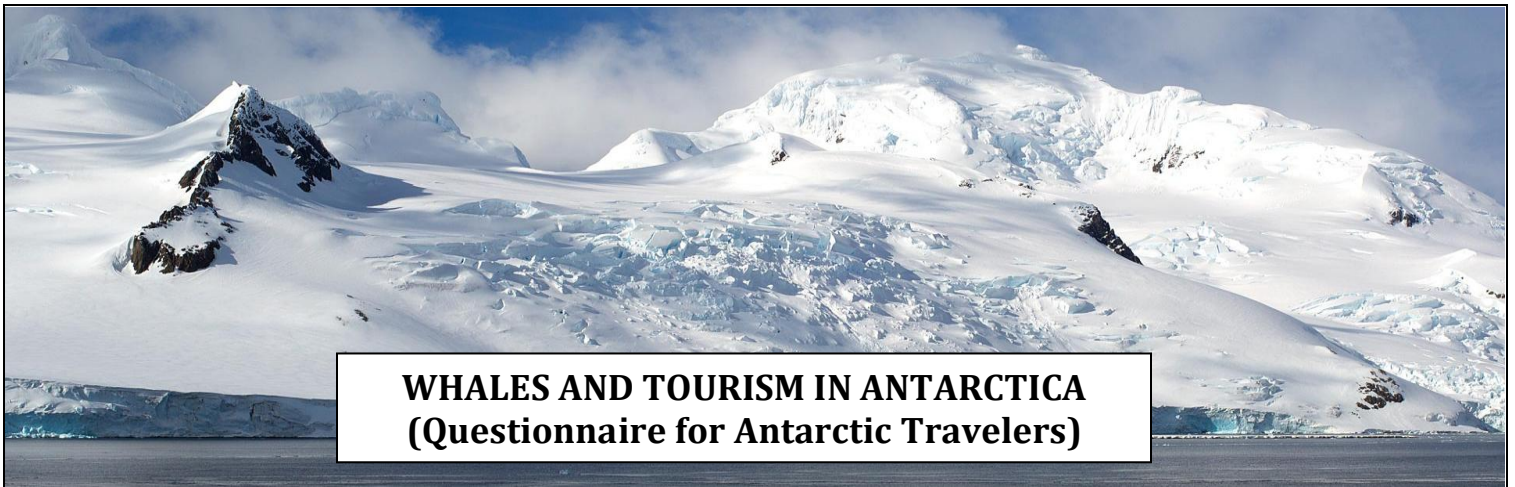
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WHALES AND TOURISM IN ANTARCTICA (Questionnaire for Antarctic Travelers)

This study is being conducted as part of the Master's Project of a student from Duke University's Nicholas School of the Environment. We would greatly appreciate your help in gathering information about whales and tourism in Antarctica. Surveys will be distributed to people who travel, work, and perform research in Antarctica. We wish to see how these groups perceive interactions between Antarctic tourism and whales. Summarized results will be written into the student's Master's Project, and presented at two Duke research symposiums in April and May 2014. The completed questionnaires will be kept only through May 2014, when the Master's Project has been completed. Only the researcher listed below will have access to your completed questionnaire.

Your participation in this survey is completely voluntary. We anticipate that the survey will take 15-20 minutes to complete. You may choose not to complete or submit the survey at any time. Your answers will be aggregated with others and will only be used for scientific purposes. It is not necessary to divulge your name, address, or other identifiable information for this study. Should you have any questions, please feel free to contact us. Thank you in advance for your time and effort.

Contact information:

Allison Fox— Master's student, Duke University, Nicholas School of the Environment. Email: allison.fox@duke.edu

Preliminary Information

1. How many trips have you taken to Antarctica/the sub-Antarctic region?
 - a. 1
 - b. 2
 - c. 3
 - d. Other (Please specify) _____

2. Have you ever participated in a whale-watching cruise **outside of Antarctica**?
 - a. Yes
 - b. No

3. If you answered **yes** to **Question 2**, where was the whale-watching cruise located? _____

Antarctica and Whales

4. Which of the following whale species did you see on your most recent trip to Antarctica? Select all that apply.
 - a. Orca
 - b. Minke
 - c. Humpback
 - d. Other (Please specify) _____
 - e. I saw whale(s), but do not know the species
 - f. No whales seen on my most recent trip

5. Where were you when you saw whales on your most recent trip? Select all that apply.
 - a. On the main ship
 - b. On a zodiac boat
 - c. On land
 - d. Other (Please specify) _____
 - e. No whales seen on my most recent trip

6. How would you rate your current knowledge of Antarctic whales?
- a. Excellent
 - b. Above average
 - c. Average
 - d. Below average
 - e. Poor
7. Over the course of your most recent trip, do you feel that your knowledge of Antarctic whales:
- a. Increased dramatically
 - b. Increased slightly
 - c. Stayed the same
 - d. Decreased slightly

The following two questions are **True/False** questions.

8. The ship I traveled on most recently to Antarctica is a member of the **International Association of Antarctica Tour Operators (IAATO)**.
- a. True
 - b. False
 - c. Don't know
9. The ship I traveled on most recently to Antarctica follows a set of wildlife-watching guidelines.
- a. True
 - b. False
 - c. Don't know

10. Please circle the number that most closely matches your opinion on the following statements.
1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

Certain aspects of Antarctic tourism pose a threat to whales. 1 2 3 4 5

Certain aspects of Antarctic tourism are beneficial to whales. 1 2 3 4 5

Background Information

15. What is your gender?

- a. Female
- b. Male

16. Which of the following age classes contains your age?

- | | |
|----------|----------|
| a. 18-25 | e. 51-60 |
| b. 26-30 | f. 61-70 |
| c. 31-40 | g. 71-80 |
| d. 41-50 | h. 81+ |

17. What is the highest level of education you have attained?

- | | |
|------------------------|-------------------------|
| a. Some High School | d. Bachelor Degree |
| b. High School diploma | e. Some Graduate School |
| c. Some College | f. Graduate Degree |

Survey Evaluation

In order to improve this questionnaire for future users, we would like to ask you a few questions about your experience while completing this survey.

18. Approximately how long did it take you to complete this survey? _____

19. Did you find any of the questions confusing or difficult to understand?

- a. Yes
- b. No

20. If you answered **yes** to **Question 19**, which questions did you find confusing? _____

Please elaborate on why these questions were confusing:

21. Please share any additional thoughts or concerns about the survey:

Thank you for completing this survey.



WHALES AND TOURISM IN ANTARCTICA (Questionnaire for Antarctic Researchers)

This study is being conducted as part of the Master's Project of a student from Duke University's Nicholas School of the Environment. We would greatly appreciate your help in gathering information about whales and tourism in Antarctica. Surveys will be distributed to people who travel, work, and perform research in Antarctica. We wish to see how these groups perceive interactions between Antarctic tourism and whales. Summarized results will be written into the student's Master's Project, and presented at two Duke research symposiums in April and May 2014. The completed questionnaires will be kept only through May 2014, when the Master's Project has been completed. Only the researcher listed below will have access to your completed questionnaire.

Your participation in this survey is completely voluntary. We anticipate that the survey will take 15-20 minutes to complete. You may choose not to complete or submit the survey at any time. Your answers will be aggregated with others and will only be used for scientific purposes. It is not necessary to divulge your name, address, or other identifiable information for this study. Should you have any questions, please feel free to contact us. Thank you in advance for your time and effort.

Contact information:

Allison Fox— Master's student, Duke University, Nicholas School of the Environment. Email: allison.fox@duke.edu

1. Which whale species is the focus of your Antarctic research? Select all that apply.

- a. Orca
- b. Humpback
- c. Fin
- d. Sperm
- e. Other (Please specify) _____
- f. Minke
- g. Blue
- h. Sei
- i. Southern right

2. How many research trips have you made to Antarctica?

- a. 1
- b. 2
- c. 3
- d. 4
- e. 5
- f. Other (Please specify) _____

3. Which whale species did you see on your **most recent research trip** to Antarctica? Select all that apply.

- a. Orca
- b. Humpback
- c. Fin
- d. Sperm
- e. Other (Please specify) _____
- f. Minke
- g. Blue
- h. Sei
- i. Southern right

4. On your research trips to Antarctica, how often do you see vessel(s) that are carrying tourists **other than the one you are on**? Note: you may select option (e) in addition to one other answer.

- a. Never
- b. On less than 50% of trips
- c. More than, or equal to, 50% of trips
- d. Every trip
- e. When I see a vessel, I can not always identify whether it is carrying tourists

5. How many of your Antarctic research trips have been conducted from a vessel that had Antarctic tourists onboard **at the same time**?

- a. 0
- b. 1
- c. 2
- d. 3
- e. 4
- f. 5
- g. Other (Please specify) _____

Note: If you selected answer (a) for Question 5, please proceed to Question 9. Otherwise, continue to Question 6.

6. On research trips **where Antarctic tourists were onboard the vessel with you**, in which of the following ways did you interact with the tourists that involved whales? Select all that apply.
- a. Gave lectures to tourists about whales
 - b. Identified whale species for tourists that were seen during the trip
 - c. Had informal conversations with tourists about whales
 - d. I did not discuss whales with tourists in any way

 - e. Other (Please specify) _____

The following two questions are True/False questions. These questions apply to the vessel you traveled on most recently to Antarctica that **also had tourists onboard**.

7. The ship I traveled on most recently to Antarctica is a member of the **International Association of Antarctica Tour Operators (IAATO)**.
- a. True
 - b. False
 - c. Don't know
8. The ship I traveled on most recently to Antarctica follows a set of wildlife-watching guidelines.
- a. True
 - b. False
 - c. Don't know

9. Please circle the number that most closely matches your opinion on the following statements.
1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

Certain aspects of Antarctic tourism pose a threat to whales. 1 2 3 4 5

Certain aspects of Antarctic tourism are beneficial to whales. 1 2 3 4 5

Background Information

14. What is your gender?

- a. Female
- b. Male

15. Which of the following age classes contains your age?

- | | |
|----------|----------|
| a. 18-25 | e. 51-60 |
| b. 26-30 | f. 61-70 |
| c. 31-40 | g. 71-80 |
| d. 41-50 | h. 81+ |

Survey Evaluation

In order to improve this questionnaire for future users, we would like to ask you a few questions about your experience while completing this survey.

16. Approximately how long did it take you to complete this survey? _____

17. Did you find any of the questions confusing or difficult to understand?

- a. Yes
- b. No

18. If you answered **yes** to **Question 17**, which questions did you find confusing? _____

Please elaborate on why these questions were confusing:

19. Please share any additional thoughts or concerns about the survey:

Thank you for completing this survey.



WHALES AND TOURISM IN ANTARCTICA (Questionnaire for Antarctic Tour Operators)

This study is being conducted as part of the Master's Project of a student from Duke University's Nicholas School of the Environment. We would greatly appreciate your help in gathering information about whales and tourism in Antarctica. Surveys will be distributed to people who travel, work, and perform research in Antarctica. We wish to see how these groups perceive interactions between Antarctic tourism and whales. Summarized results will be written into the student's Master's Project, and presented at two Duke research symposiums in April and May 2014. The completed questionnaires will be kept only through May 2014, when the Master's Project has been completed. Only the researcher listed below will have access to your completed questionnaire.

Your participation in this survey is completely voluntary. We anticipate that the survey will take 15-20 minutes to complete. You may choose not to complete or submit the survey at any time. Your answers will be aggregated with others and will only be used for scientific purposes. It is not necessary to divulge your name, address, or other identifiable information for this study. Should you have any questions, please feel free to contact us. Thank you in advance for your time and effort.

Contact information:

Allison Fox— Master's student, Duke University, Nicholas School of the Environment. Email: allison.fox@duke.edu

1. What is your role in the Antarctic tourism industry? Select all that apply.
- a. Vessel owner
 - b. Tour company owner
 - c. Captain/skipper
 - d. Expedition leader
 - e. Other (Please specify) _____

2. How many trips have you made to Antarctica/ the sub-Antarctic region? _____

3. How often do you see whales on your trips to Antarctica?
- a. Never
 - b. On less than 50% of trips
 - c. More than, or equal to, 50% of trips
 - d. Every trip

4. Which whale species did you see on your most recent trip to Antarctica? Select all that apply.
- | | |
|--|--|
| a. Orca | g. Minke |
| b. Humpback | h. Blue |
| c. Fin | i. Sei |
| d. Sperm | j. Southern right |
| e. I saw whales, but do not know the species | k. No whales seen on my most recent trip |
- f. Other (Please specify) _____

5. Where were you when you saw whales on your most recent trip? Select all that apply.
- a. On the main ship
 - b. On a zodiac boat
 - c. On land
 - d. Other (Please specify) _____
 - e. No whales seen on my most recent trip

6. In which of the following ways have you interacted with tourists that involved whales? Select all that apply.
- a. Given lectures to tourists about whales
 - b. Identified whale species for tourists that were seen during the trip
 - c. Had informal conversations with tourists about whales
 - d. I have not discussed whales with tourists in any way
 - e. Other (Please specify) _____
7. On your trips to Antarctica, how often do you see vessel(s) that are carrying tourists **other than the one you are on**? Note: you may select option (e) in addition to one other answer.
- a. Never
 - b. On less than 50% of trips
 - c. More than, or equal to, 50% of trips
 - d. Every trip
 - e. When I see a vessel, I can not always identify whether it is carrying tourists
8. Have you ever had a scientist as a passenger that **conducted research from your vessel** during a trip to Antarctica?
- a. Yes
 - b. No
 - c. Not sure
9. If you answered **yes** to **Question 8**, have any of these scientists' research projects focused on Antarctic whales?
- a. Yes
 - b. No
 - c. Not sure
10. How would you rate your current knowledge of Antarctic whales?
- a. Excellent
 - b. Above average
 - c. Average
 - d. Below average
 - e. Poor

11. Please circle the number that most closely matches your opinion on the following statements.
1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

Certain aspects of Antarctic tourism pose a threat to whales. 1 2 3 4 5

Certain aspects of Antarctic tourism are beneficial to whales. 1 2 3 4 5

12. The following list contains aspects of Antarctic tourism that potentially **threaten** Antarctic whales. Please choose **up to 3** threats that you feel are most detrimental.

- a. Carbon emissions from travel to, and in, the Antarctic
- b. Pollution (other than carbon emissions) from tourism vessels
- c. Collisions between whales and tourism vessels
- d. Impacts of noise from tourism vessels on whales
- e. Oil spills from tourism vessels
- f. Stress to whales from interactions with humans and/or man-made technology
- g. None of these
- h. Other (Please specify) _____

13. The following list contains aspects of Antarctic tourism that potentially **benefit** Antarctic whales. Please choose **up to 3** benefits that you feel are most valuable.

- a. Travelers learn more about Antarctic whales
- b. Seeing whales firsthand increases traveler appreciation of these animals
- c. Travelers advocate for the protection of whales after returning home
- d. Travelers donate to Antarctic conservation after returning home
- e. Tourism vessels carry Antarctic scientists who conduct research onboard
- f. Travelers participate in whale research by taking pictures for whale registries
- g. None of these
- h. Other (Please specify) _____

14. Please circle the number that most closely matches your opinion on the following statements.

1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

Overall, the impact of Antarctic tourism on whales is negative. 1 2 3 4 5

Overall, the impact of Antarctic tourism on whales is positive. 1 2 3 4 5

15. Please share any additional thoughts you have on Antarctic whales and tourism:

Background Information

16. What is your gender?

- a. Female
- b. Male

17. Which of the following age classes contains your age?

- | | |
|----------|----------|
| a. 18-25 | e. 51-60 |
| b. 26-30 | f. 61-70 |
| c. 31-40 | g. 71-80 |
| d. 41-50 | h. 81+ |

18. What is the highest level of education you have attained?

- | | |
|------------------------|-------------------------|
| a. Some High School | d. Bachelor Degree |
| b. High School diploma | e. Some Graduate School |
| c. Some College | f. Graduate Degree |

Survey Evaluation

In order to improve this questionnaire for future users, we would like to ask you a few questions about your experience while completing this survey.

19. Approximately how long did it take you to complete this survey? _____

20. Did you find any of the questions confusing or difficult to understand?

a. Yes

b. No

21. If you answered **yes** to **Question 20**, which questions did you find confusing? _____

Please elaborate on why these questions were confusing:

22. Please share any additional thoughts or concerns about the survey:

Thank you for completing this survey.