REVIEW

RECENT ADVANCES IN WHALE-WATCHING RESEARCH: 2012–2013

CAROL SCARPACI* and E. C. M. PARSONS†‡

*College of Engineering and Science, Victoria University, Werribee Campus, Victoria, Australia
†Department of Environmental Science and Policy, George Mason University, Fairfax, Virginia, USA
‡University Marine Biological Station Millport (University of London), Isle of Cumbrae, Glasgow, UK

Whale-watching research encompasses a wide variety of disciplines and fields of study, including monitoring the biological impacts of whale-watching activities on cetaceans and assessments of the effectiveness of whale-watching management and regulations, to the sociological and economic aspects of whalewatching on communities hosting such activities. This article is the latest in a series of annual digests, which describes the variety and findings of whale-watching studies published over the past year, since June 2012.

Key words: Whalewatching; Code-of-conduct; Regulations; Management; Swim-with-dolphin/whale tourism; Whale watchers; Illegal feeding; Whale ecotourism

Address correspondence to E. C. M. Parsons, Department of Environmental Science and Policy, George Mason University, Fairfax, VA 22030-4444, USA. E-mail: ecm-parsons@earthlink.net

Introduction

Recognizing the difficulties of keeping up to date on the wealth of research on whale-watching activities, in particular the impacts of these activities on cetaceans, a paper summarizing the breadth and variety of whale-watching research, published during the previous year, was presented to the International Whaling Commission (IWC) Scientific Committee's Whalewatching Subcommittee (Parsons et al., 2004) during the 56th Annual Meeting of the IWC. As this was deemed to be a useful digest of recently published articles, and as such assisted the work of the Subcommittee, similar digests in following years were requested (see Parsons et al., 2006; Parsons et al., 2006; Scarpaci et al., 2008, 2009; Scarpaci et al., 2009; Parsons & Scarpaci, 2010, Scarpaci & Parsons, 2012, 2013). This is the ninth in this series of review articles, detailing a summary of whale-watching research published over the past year (June 2012–May 2013), since the 64th Annual Meeting of the IWC.

Impacts of Whale-Watching Activities on Cetaceans

Numerous studies have documented behavioural changes and other impacts of whale-watching activities (see a recent review in Parsons 2012) on a wide variety of species and many different locations. Bejder and Samuels (2003) highlighted that impacts of cetacean tourism can be species, population and/or location specific. Peters, Parra, Skuza & Moller (2012) documented the effects of swim-with-dolphin tourism on the behaviour of the little studied burrunan dolphin (*Tursiops australis;* Charlton-Robb et al., 2011) in South Australia. The study is the first empirical documentation on the potential effects of cetacean tourism in South Australia and provides guidance for the development of location specific guidelines/regulations. The study site was located in the Gulf of St. Vincent (100km^2 area- 25km across and 5 km offshore) and inhabited by *Tursiops australis*, a bottlenose dolphin species that is endemic to southern Australia (Moller et al., 2008). The objectives of the research were to document the behaviour of the dolphins (behavioural state and group cohesion) in relation to vessel approaches and presence of swimmers (Peters et al., 2012). Further variables tested included dolphin group size and age-class compositions. Data were collected on board the sole dolphin tour vessel (63.72 hours of surveys across 19 days) that markets one daily morning tour (dolphin watch or dolphin swim) of 3 hours duration. Observations were conducted from March-May (2010) in calm seas between the hours of 0730-1130. The positions of the dolphins were marked and the standard 50m chain rule (each animal in a group was within 50m of another) was utilized to define dolphin groups. From the onset of an encounter data were collected using 2 min focal group scans. The tour vessel involved in the study employed a consistent approach type (parallel to the animals) and speed throughout the study period. Responses of dolphins were recorded as either: dolphins approached swimmers; approached vessel; there was no

response; or there was avoidance (change in path). Dolphin approaches involved approaching to a distance of 5m to either the swimmers, or the 'mermaid' lines that swimmers were holding onto, or the vessel. Transitions in behaviour were analysed using first-order Markov chains. Of the 5 studied behaviours (social, feed, rest, travel and mill), resting behaviour was discounted as it was rarely observed (n= 10 transitions involved resting behaviour). The researchers compared activity budgets for the stages of a) before vessel/swimmer encounters; b) during encounters; and c) after encounters (Peters et al., 2012).

A total of 106 dolphin groups were sighted and approached by the tour vessel across the survey period (Peters et al., 2012). The operator selected not to interact with solitary dolphins or females with a small calf (n=16). A total of 79 swim attempts were observed that lasted from 1 to 41 minutes (mean = 8min) and 285 transitions were recorded (47= before encounter; 174=during encounter; 55=after encounter; Peters et al., 2012). Results indicated that irrespective of sampling stage the dolphins were most likely to maintain the same behaviour, with the exception of social behaviour (Peters et al., 2012). The dolphins' activity budget for travel, feed and mill varied across the three stages. Feeding activity significantly increased after encounters and milling activity increased from before encounters to during encounters (Peters et al., 2012). Group cohesion did not significantly fluctuate across stages, but large groups were more likely to approach swimmers than vessels and the reverse response was true for small groups (Peters et al., 2012). This may be attributed perhaps to large groups having a higher degree of mutual protection than smaller groups. Occurrence of a calf did not significantly influence the responses of the dolphins (Peters et al., 2012).

The behavioural budgets of dolphins failed to return to the same level before the vessel/swimmer interaction, indicating that the behaviour of the dolphins was impacted by this single swim-with-dolphin trip vessel (Peters et al., 2012). The increase in milling behaviour during the encounter stage might be compromising feeding, socializing and resting behaviour and in turn, pose longer term consequences in the fitness of the population (Peters et al., 2012). The researchers highlight that a lack of baseline data from before the swim-with-dolphin tourism initiated in 2002 prevents the opportunity to compare changes in dolphin activity budgets. Peters et al. (2012) noted that the responses of dolphins could change in the event that the frequency of trips or the number of vessels increased.

Three genetically isolated populations of common bottlenose dolphins (*Tursiops truncatus*) are found in New Zealand (Tezanos-Pinto et al., 2009), which prompted their listing as 'nationally endangered'. The Bay of Islands bottlenose population is ideal for observing changes in habitat usage due to: a) dolphins being present in the bay throughout the year; b) dolphin-trip vessels are a potential research platform of opportunity; and c) historical, long-term population data are available. Tezanos-Pinto et al. (2013) estimated the abundance of dolphins across time in the Bay of Islands, utilizing an existing photo-identification database collected in 1997-1999 (246 surveys) and 2003-2006 (205 surveys). Records were collected on board a commercial dolphin-watching vessel and an independent research vessel. Collected data included GPS position, group-size, age-class composition, behaviour of the group and photo-identification of individual dolphins (Tezanos-Pinto et al., 2013). A total of 3841 records were in the dataset, of 317 identified individual dolphins (Tezanos-Pinto et al., 2013).

When the data were modelled, a significant decline in the number of dolphins that occupied the Bay of Islands was discovered: an annual decline of 5.8% (Tezanos-Pinto et al., 2013). Abundances varied across sessions and seasons indicating shifts in habitat usage amongst individuals (Tezanos-Pinto et al., 2013). The estimated annual survival rate was 92.8% and/or 85% using two different models (Tezanos-Pinto et al., 2013). In comparison, the annual survival rate of other wild common bottlenose dolphin populations range from 93.7% (Doubtful Sound, New Zealand; Curry, Dawson, & Slooten, 2009) to 96.2% (Sarasota, Florida; Wells & Scott, 1990). Two hypotheses might explain the reduction in bottlenose dolphin abundance documented in this paper: a) population is reduced due to increased mortality, which in turn translates to a reduction in reproduction; or b) dolphins have altered their habitat use (Tezanos-Pinto et al., 2013). Dolphin mortality rates in the Bay of Islands might be high due to a variety of factors, such as predation and fisheries interactions, but Tezanos-Pinto et al. (2013) also discuss factors such as vessel traffic potentially displacing dolphins, as seen in other studies of population decline in bottlenose dolphins (e.g.,, Bejder et al., 2006).

Tourism in Kaikoura, New Zealand, has experienced rapid growth since its onset in the 1980s. One of the main focuses of tourism in this area is the local population of dusky dolphins (*Lagenorhynchus obscurus*) and tourists have of the opportunity to 'watch' or 'swim with' these dolphins. Lundquist et al. (2012) tried to estimate the potential impact that tourism may have on this dolphin population to ensure timely and effective management. Data were collected from 2008-2010 across 220 days from an elevated shore platform and focal groups of dolphins were tracked. Researchers collected data on location, time, season, number of vessels and other dolphin groups within

observation range. Behaviour was defined as resting, traveling, milling, socializing or feeding and the number of vessels that were within 300m of the dolphins was recorded, as well as the presence of aircraft (Lundquist et al., 2012). Markov chain models were used to determine whether dolphin behaviour changed due to the presence of tourism vessels. A total of 404 dolphin groups was tracked (728hrs) and 1203 vessels were observed within 300m of the dolphins (Lundquist et al., 2012). During summer, vessels were within 300m of dolphins 55% of the time. A total of 11,373 behavioural transitions was noted and Markov-chains demonstrated that the behaviour of the dolphins was affected by tourism vessels (Lundquist et al., 2012). In the presence of a vessel, milling increased in all seasons apart from autumn, whilst resting and traveling decreased (Lundquist et al., 2012). Responses of dolphins to vessels were also dependent on time of day, with resting behaviour decreasing, whilst traveling increased in the afternoon (Lundquist et al., 2012). As with previous studies noting behavioural changes, Lundquist et al. (2012) expressed concerns that behavioural changes may translate to reduced fitness due to the interruption of critical behaviours.

Dans, Degrati, Pedraza & Crespo (2012) also used Markov chain analysis to investigate changes in behavioural budget of dusky dolphins in Golfo Nuevo, at the Península Valdés World Heritage Site, Patagonia, Argentina. Over 100,000 people visit the area to watch southern right whales (*Eubalaena australis*), but in 1997 commercial dolphin watching also began in the area. Dans et al. (2012) reported that three small dolphin-watching boats were operating (8m & 10 m inflatables and an 11m Fiberglas boat). A previous study by several of the authors (Dans et al., 2008) had reported on dolphin-watching vessels causing a decrease in feeding behaviour; the current study developed a Markov chain model with those data. The behavioural data were collected via a 6m or 7.2m Fiberglas boat with 50hp and 102hp engines respectively, approaching dolphins to a distance of 100m. Through their Markov chain analysis, Dans et al. (2012) tried to determine which changes in dolphin behaviour would have the biggest effect on the dolphins' feeding budget and the time it would take before the dolphins would return to feeding after disturbance. They stated that "[o]*ur most important finding was that feeding time budget was modified when boats interfered with the transition from feeding to traveling and from traveling to feeding*" (p. 714, Dans et al., 2012), determining that it took on average 10 minutes for the dolphins to return to feeding. They noted that dolphin-watching operators frequently approached traveling dolphins more closely in order to encourage them to leap out of the water (Dans et al., 2012). Because of the effect of boat traffic on the dolphins' feeding time budget, the authors suggested that local whale-watching guidelines should have a maximum time for close (<50m) approaches.

Concerns that a reduction in critical behaviours, such as feeding, may translate to reduced fitness were also expressed by Christiansen, Rasmussen & Lusseau (2013). This study focused on northern minke whales (*Balaenoptera acutorostrata*) in Faxaflói Bay, Iceland. The bay is used by four whale-watching companies and Christiansen et al. (2013) attempted to ascertain their impacts. Data were collected from two locations using two methods: a whale-watching-free location abutting a headland at the edge of the bay, where a theodolite was used to detect surfacing patterns and movements from a lighthouse; and a whale-watching boat where surfacings were similarly recorded and positions noted with a digital compass and laser range finders. Errors with the two methods for measuring position data were estimated by viewing an object on the water. Christiansen et al. (2013) made the assumption that 'sinuous' movement by the whales meant that they were foraging for sandeels (*Ammodytes* sp.), which are a known prey species in the bay.

The position of 8793 surfacings (2757 from the land-based site, 6036 from the whale-watching boat) was recorded. The researchers found that longer dives were reported from the land site, but also a greater variability in dive times and less 'sinuous' movement. There was a lower probability of observing 'surface feeding events' from the whale-watching boat platform. Christiansen et al. (2013) stated that "*since minke whales are capital breeders, a decrease in feeding success on the feeding grounds due to whale-watching boats could lead to a decrease in energy available for foetus development and nursing on the breeding grounds*" (p. 239).

It should be noted that the methodology of this study was criticised in the IWC's Whalewatching Subcommittee when the paper was presented in an earlier draft. The main criticisms were that the differences in diving behaviour might be: (a) a reflection of differences in oceanographic features and prey distribution in two different locations and/or (b) differences in the ability to sight surfacing whales between the two methods used, rather than the effect of whale-watching boats (IWC, 2012). A recent study directly comparing boat-based behavioural observations versus land-based observations on the same humpback whales found that surfacing intervals were longer when observed from land-based platforms, as surfacings and behaviours were more frequently missed (Godwin, 2013). Therefore differences in minke whale behaviour between the two locations in Faxaflói Bay may have been an artefact of the two observation methods used, rather than an actual impact of whale-watching vessels, and it was suggested by the

IWC (2012) that comparing whale behaviour before, during and after an encounter with a whale-watching vessel in a single location might be a more accurate method of determining behavioural impacts of whalewatching.

Faxaflói Bay used to have one of the densest populations of minke whales on the Icelandic coast and Icelandic scientists attribute the decline to climate change-induced movements of fish species (IWC, 2012). It is also possible that whalewatching could be having an impact on this population. However, it should be noted that Faxaflói Bay is also the site of whaling activity. The Icelandic government recently increased the area of Faxaflói Bay in which whaling vessels are not allowed to hunt, making 80% of the bay a whaling exclusion zone. The Icelandic Tourist Industry Association is calling for whaling to be banned from the entire bay and from all areas within 30 nautical miles of where whale-watching companies operate (Kravec, 2013).

Due to a significant decline, the Southern Resident population of killer whales (*Orcinus orca*) (SRKW) on the west coast of the USA and Canada was listed as an endangered population in 2003 (Canada) and 2005 (USA) (see also the summary of Giles & Koski (2013) below). To effectively manage endangered species requires an evaluation of the population-level impacts of anthropogenic factors and the evaluation of these factors can pose a challenge for cetacean managers. Many studies investigating impacts are based purely on behavioural observations, so determining the precise population-level impacts can be difficult, but many new non-invasive physiological methods can provide useful data. For example, Ayers, Booth, Hempelmann, Koski, Emmons, Baird, Bartok, Hanson, Ford and Wasser (2013) collected data on thyroid (T3) and glucocorticoid (GC) hormone levels from the faeces of killer whales to assess the hypothesis that the SRKW population has declined due to inadequate prey availability and/or vessel presence (including whale-watching vessels). One hypothesis is that the SRKW population has declined due to shortage of Chinook salmon (*Oncorhynchus tshawytscha*), but the alternative hypothesis is that the decline is due to an increase in vessel traffic around the cetaceans, which reduces their ability to forage and increases psychological stress. Ayers et al. (2013) compared the GC and T3 hormones levels in faeces with temporal changes in Chinook salmon (the largest salmon in this habitat and the main prey item for killer whales in summer) and vessel traffic across a 3-year period. The pairing of the GC and T3 markers provides an insight into both the psychological and nutritional stress of the SRKW population health, i.e., GC level will increase with both nutritional and psychological stress, whereas T3 hormone drops in response to nutritional stress but does not alter with psychological stress.

A total of 154 floating faecal samples of killer whales were collected and in addition to hormone extraction, a DNA analysis was also performed on the samples to determine sex (138 were genotyped for sex) and individual identity (Ayers et al., 2013). The GC and T3 results supported the inadequate prey hypothesis, indicating that the recovery of the SRKW is heavily dependent on prey availability and the recovery of Chinook salmon (Ayers et al., 2013). The two biological markers utilised in the study provide wildlife managers with vital (and timely) data for the future management of the SRKW population and suggest that prey depletion may be the most immediate threat, as opposed to whale-watching traffic, for these endangered animals. The hormone analysis method could also be transferable to other cetacean populations to investigate and evaluate whale-watching impacts.

Swim-With-Whale Tourism

Swim-with-cetacean tourism is now expanding from resident coastal dolphin populations (Howes et al., 2012), to large species of migratory whales. These encounters occur in both developed and developing countries and pose additional management considerations. Swimming with large whales appears to be increasing around the world (from 29 operators in 2003 to 51 in 2005; see Rose et al., 2003; Rose et al., 2005) across a range of taxa. The next four papers document swim-with programs that target large whales (humpback whales, dwarf minke whales and southern right whales) across three regions (Argentina – simulated; Australia and Tonga – active swim-with-whale tourism locations).

Curnock, Birtles & Valentine (in press) explore the effort and spatial distribution of tourists swimming with dwarf minke whales (*Balaenoptera acutorostrata*, unnamed subspecies) across time on the Great Barrier Reef, Australia. In 2000, the IWC considered that tourists swimming with whales was 'highly invasive' (IWC, 2001), which in turn led to some countries banning swim-with-whale programs (Mexico and Spain) or imposing strong regulatory conditions (e.g., USA). In Australia, however, tourists can swim with dwarf minke whales. Curnock et al. (in press) highlight that as demand for swim-with-whale trips increase, there is potential for a cumulative impact that may pose long-term consequences. Moreover, crowding and multiple vessels can deteriorate the tourist experience. Dwarf minke whales on the Great Barrier Reef can be found during June to July and appear to be 'inquisitive', approaching swimmers/vessels and remaining in close proximity for lengthy periods (Arnold, 1997; Mangott et al., 2011). In 2003, authorities capped the number of tour licenses (9 tour operations permitted) in this area, and two

conditions are imposed on license holders: compliance with the code of conduct and completion of a whale sighting sheet. The authors report on six years of submitted whale sighting sheets (2003-2008) and investigate changes in encounters with the whales. An 'encounter' was recorded on the sheets as the time of first sighting of a whale until the last sighting, and an 'in water' encounter was defined as the period of time at least one swimmer was in the water with a whale. The encounters generally occur at frequently visited reef sites: snorkelers undertake a swim on mermaid lines or via a scuba dive. The survey sheets were completed by a vessel crew member and included data on encounter time, location, vessel status (i.e., whether the vessel was moored, anchored, drifted) and notable behaviour observed.

A total of 1,477 (98 of these completed by a researcher) whale sighting sheets was logged (Curnock et al., in press). A total of 64% of encounters resulted in tourists swimming with minke whales for a mean duration of 120min (Curnock et al., in press). The mean number of whales was higher in the presence of swimmers (3.66) than in their absence (2.92; Curnock et al., in press). The study ranked the five most frequented encounter sites and statistically analysed the mean encounter duration and mean number of whales per encounter per site – one site (Lighthouse Bommie) was found to have significantly longer encounter durations than the other sites (Curnock et al., in press). No significant differences in the encounter duration or number of whales present were detected across time; however, the number of encounters increased per season by 91% across the study period and the total contact time with whales increased from 237.4 hours with whales in 2003 to 451.6 contact hours in 2008, and the authors suggested that the increase in effort by tour operations may be a result of an increase in whale encounters.

Tourists can swim with humpback whales (*Megaptera novaeangliae*) in Tonga. This activity contributes substantially to Tonga's economy (15% of Tongan foreign revenue; O'Connor, 2008). The whale-swim industry has been managed via codes of conduct; conditions include minimum boat approach distance (10m) and swimmer numbers (maximum of 5 swimmers). However, concerns have been expressed regarding the impact that humpback whale tourism may have on mother/calf associations on the breeding grounds, prompting research that has resulted in two recent research papers.

Kessler & Harcourt (2013a) studied the human-whale value transition in Tonga across time and the current impact of humpback whale tourism, using re-sightings of whales during swim-with encounters. In reference to how Tongans value cetaceans, the shift has been from whale 'worship' in a pre-Christian mythology (involving whale products exclusively from stranded animals), followed by a loss of such values during the rise of Christianity on the island, leading to the onset of commercial whaling in the 1800s until it was prohibited by Royal Decree in 1978 (enacted by the Whaling Act 1979; Kessler & Harcourt, 2013a). Commercial whaling in the region by several countries led to the humpback whale population being reduced to 250 animals by 1963 and then to just 25 mature females in 1978 (Kessler & Harcourt, 2013a). Recent data indicated a population of approximately 2,311 individuals, with a slow recovery rate, possibly due to the lack of genetic interchange between the Oceania and South Pacific populations (Baker et al., 2006; Clapham et al., 2006). At present, humpback whales have economic value through tourism (Kessler & Harcourt, 2013a). The financial benefits of cetacean tourism to Tonga are substantial (worth an estimated US$ 1.89 million), but it is an industry threatened by: a) fisheries interactions; b) pressure for Tonga to return to whaling; c) global warming; and d) the tourism activities themselves (Kessler & Harcourt, 2013a). Moreover, humpback whales are not the only target species for cetacean tourism: swim-with-dolphin tourism is prominent in the Vava'u island group.

Kessler & Harcourt (2013a) monitored humpback whale sightings in reference to water depth and re-sightings of whales during swim-with encounters, using photo-identification. They identified 331 unique individuals during 2006-2010, of which there were 26 re-sightings of 22 individuals (Kessler & Harcourt, 2013a). Individuals were never re-sighted for more than two years after the first sighting (Kessler & Harcourt, 2013a). These results suggest that the whales display low site fidelity and travel regularly into other regions (Kessler & Harcourt, 2013a). This implies that management changes in one area could impact the entire population. Kessler & Harcourt (2013a) suggested management options such as limiting the number of whale-watching licenses; restriction of one boat per license; and zonation to protect mother-calf pairs.

Also in Tonga, Kessler, Harcourt & Heller (2013) documented humpback whale responses to swim-with encounters, to determine whether these posed greater risks than regular whale-watching activities. Data were collected on board a commercial tour vessel (2009) and research vessel (2010). Variables recorded included behaviour of whales, distance and direction of the whales per surfacing, swimmer numbers, swim length, distance of vessel to whales and encounter time. Three experimental tourist 'swim' approaches to whales were trialled to investigate the responses of whales to different 'swim' types, for example, a) a 'quiet' approach with swimmers at surface with minimal

splashing; b) a 'splash' approach with swimmers at the surface with vigorous splashing); and c) a 'dive' approach – a quiet approach but with swimmers diving whilst whales were in visual range (Kessler et al., 2013). Responses were scored as 'avoidance' (whales moved away from swimmers or vessel) and changes in surface behaviour were recorded.

The 'splash' swim approach resulted in significantly more whale departures (avoidance) than 'quiet' and 'dive' swims (Kessler et al., 2013). The presence of a calf or the distance that the vessel approached did not influence whale avoidance. Approach distance significantly influenced surface activity of the whales (close whale approaches equated to greater increase in whale activity; Kessler et al., 2013). The overall results of this study indicate that swim-with-whales encounters do not cause responses from whales any more than regular whale-watching encounters if swimmers enter and remain in the water quietly with minimal splashing (Kessler et al., 2013). However, close boat approaches cause changes in surface behaviour (a vessel at 30m from whales results in increased surface activity in 50% of the whale group; Kessler et al., 2013). Kessler et al. (2013) made the following recommendations: a) conduct further research to document the impact that tourism may pose to mother-calf associations and parental care; b) increase minimum approach distance from 10m to 90m (at 90m only 10% of the whale group showed an increase in surface activity) with a slow approach speed; c) have swimmers enter the water quietly with minimal to no splash; and d) improve levels of compliance by increasing positive partnerships between stakeholders (Kessler et al., 2013). The authors expressed reservations about their recommendations, as local whale-watching/swim-with-whale tour guides tend to disregard whale-watching guidelines; however, they argued that the proposed recommendations could increase customer satisfaction via longer interactions, and this in turn might encourage tour operators to comply with the proposed guidelines.

Responses by southern right whales (*Eubalaena australis*) in Argentina to simulated swim-with-whale tourism were documented by Lundquist, Sironi, Wursig, Rowntree, Martino & Lundquist (2013). The researchers used theodolite tracking before, during and after staged 'swims' from a vessel. Currently, swim-with-whale trips are illegal in the study region. Data were collected from 2005-2006; the variables scored included behaviour (resting, traveling, surface active or social), whale group composition and orientation. A total of 108 survey days yielded 36 suitable data days across two field seasons, with a total of 153 approaches with swimmer interactions, of which 93 were analysed (38 mother/calf associations, 25 juvenile groups and 30 mixed groups; Lundquist et al., 2013). The following behaviours decreased, by the factor expressed in brackets, during the simulated swim (compared with baseline data before the interaction): resting (11% decrease), social (12%) and surface activity (5%; Lundquist et al., 2013). Mother/calf pairs displayed less rest and social behaviours during a swim encounter whilst travel increased, and these groups were more likely to change direction during a swim encounter (Lundquist et al., 2013). Juvenile whales displayed significantly less social behaviour and higher rates of traveling. After the swim encounter, levels of resting increased and travel decreased (Lundquist et al., 2013). 'Other' groups spent significantly less time resting but no other behaviour altered (Lundquist et al., 2013). Responses of southern right whales varied depending upon group composition and the behavioural changes identified were comparable to case studies published from other locations. Lundquist et al. (2013) stated that the results of the study do not warrant endorsing swim-with-whale tourism in the region, at least until further research is completed.

Whale-Watching Activities in Developing Countries

Cetacean tourism occurs in many developing countries and provides economic benefits, but these regions generally lack management and research and the impact of these activities on target species is of particular concern (Scarpaci & Parsons, 2013). Bali is a global tourism hotspot. Cetacean tourism originated at Lovina (north Bali) in Indonesia in the 1980s. Anecdotal data indicate that tourists who take part in cetacean tourism activities in Lovina have complained that dolphins are approached too closely and chased by tour vessels (Mustika et al., 2013). The tours are conducted on *jukungs* (boats that are 98-10m long, 60-90 cm wide, with 5m outriggers; Mustik et al., 2013) with approximately 180 dedicated tour operations that are self-regulated and cater to western (the majority) and Asian tourists. Mustika et al. (2013) accompanied trips (on *jukungs*) during 2007-2010 (n= 108 days); eight species of cetaceans were sighted and identified, the predominant target species being the southeast Asian spinner dolphin (*Stenella longirostris*). Data were collected on maximum number of boats per day, the number of boats in proximity to dolphins, and the distance from dolphins. The majority of the trips embarked in the morning (6am) for 2hrs, with an average of 34.5 vessels maximum per day, 16 vessels per dolphin group, and a minimum distance of 24.4 m from the dolphins (Mustika et al., 2013).

Surveys were also conducted on beaches, to determine the general tourist composition (during high season) and it was found that the majority of tourists were westerners (72%), followed by Asians (27%), aged mainly 16 to 35

years, with more females than males (Mustika et al., 2013). In addition, surveys were developed to document tourist perception of and satisfaction with their dolphin trips. The authors conducted interviews (34 questions) during the low tourism season and distributed questionnaires during the peak season – the questionnaires were either in English or Indonesian and comprised 28 questions that could be ranked by level of satisfaction. The results of surveys completed after a dolphin-watching trip (high season = 123; low season = 264) demonstrated that levels of satisfaction were low to medium; the management of the dolphin encounter was the most important variable and nationality did not influence levels of satisfaction, although factors that promoted levels of satisfaction varied by nationality (Mustika et al., 2013). A stepwise regression revealed that western tourists "*who felt uncomfortable*" with encounter management displayed lower levels of satisfaction, even if many dolphins were sighted (Mustika et al., 2013). In contrast, good encounter management, with fewer dolphins observed, yielded greater satisfaction levels; in short, encounter management influenced levels of satisfaction for western tourists (Mustika et al., 2013). In contrast, levels of satisfaction in Asian tourists decreased with increased search effort (when it took longer to find dolphins), small dolphin group sizes and a lack of dolphin social displays (Mustika et al., 2013). Knowledge of tourist profiles (e.g., major tourist groups), coupled with factors that promote customer satisfaction, are important for the management of these tourism ventures (particularly in developing countries). It is possible that western tourists were more educated on animal welfare issues, more sensitive to crowding and, therefore, satisfaction levels were driven by encounter management. The data indicate that customer satisfaction in the dominant tourist group (westerners) requires better dolphin encounter management, which in turn would help to make the industry more sustainable (Mustika et al., 2013).

Given that tourism is often postulated to have the potential to alleviate poverty in developing countries, and minimal data are available on cash flow distribution into the community from cetacean tourism, Mustika, Birtles, Welters & Marsh (2012) examined the economic impact of dolphin-watching in Lovina. What dolphin-watching tourists spend (i.e., ticket price) was used as a proxy for direct and indirect expenditure value (Mustika et al., 2012). Auxiliary direct spending was defined as costs of accommodation, food, communication, souvenirs and travel. Data were collected through direct observations of the number of boats conducting dolphin trips daily on and via the distribution of surveys (Mustika et al., 2012). Data were collected in the years 2007-2009, with 57 boat survey days (6 months), and 533 surveys were distributed to tourists (in 2008 and 2009). During the survey period, the number of tourists visiting the area increased by a factor of 1.75 (Mustika et al., 2012). The questionnaires also assessed visitor satisfaction and the direct observations were used to calculate the net profit to boat operators.

The questionnaire revealed that 60% of dolphin tourists were likely to stay overnight in Lovina (Mustika et al., 2012). The average estimated daily auxiliary spending (2008-2009) ranged from US$5.50 for internet/telephone to US$14.7 for food per person, yielding a total daily expenditure of US$58 per person (Mustika et al., 2012). The average annual gross income per boat operator ranged between US$1490 and US$1600, which was an above average income for the region (Mustika et al., 2012). These trip fees comprised just 3% of the total expenditure on dolphin-watching activities (Mustika et al., 2012).The results indicate that the industry is profitable, that profits are distributed beyond the tour operations and that proper management is required to develop a sustainable industry (Mustika et al., 2012).

Management priorities should be to manage boat numbers (boats can impact dolphin behaviour and the majority of western tourists expressed concerns about the number of boats interacting with dolphins in close proximity). However, given that the economic gains are (fairly) equally distributed amongst individual boat operators and income generated is above average, incentive to cease this intensity of activity would be low (Mustika et al., 2012). The authors recommended a shared license system and implementation of daily tradable permits via an agreed rotation (i.e., the number of boat operators remains constant but the number of boats on the water per day is reduced). To compensate for the reduction of income loss, ticket price could be increased to yield a comparable annual income (Mustika et al., 2012).

Mustika et al. (2012) proposed a novel strategy that would promote a reduction in vessel traffic and would increase customer satisfaction, without causing financial disadvantage to boat operators. A similar management strategy may be beneficial in other developing countries. Given that the cost associated with these activities is relatively low for western tourists, this strategy has the potential to increase customer satisfaction through a reduction in crowding – identified in both Bali and Mexico (see Avila-Foucat et al., 2013 below) as undesirable – and to foster a more sustainable industry (reduction in vessels around dolphins) without financially hampering developing countries whose economy may be assisted by tourism.

Compliance with Whale-Watching Regulations

Humpback whalewatching off Sydney, Australia, has grown considerably over the past decade, but there are guidelines and regulations that cover whalewatching in this region – specifically the 2009 National Parks and Wildlife Regulation within 3 nautical miles of the coast and the 2005 Australian National Guidelines for Whale and Dolphin Watching beyond that. Kessler & Harcourt (2013b) studied the levels of compliance with these regulations by commercial and recreational whale-watching boats (recreational defined as members of the public that encounter cetaceans and view them from personal craft; Parsons et al., 2006). To illustrate the growth of whalewatching in the region, Kessler & Harcourt (2013b) noted that in 2007 there were nine commercial whale-watching operators using nine vessels; at the end of 2010 there were 15 commercial operators using 17 vessels. Moreover the seasonal period during which whalewatching occurred had lengthened: in 2007 the northward migration of humpback whales was the primary whale-watching target, but by 2010 the southward migration was receiving more whale-watching effort as well (Kessler & Harcourt, 2013b). The study focused on non-compliance with regulations, specifically approach distance (300m for whales with calves, 100m for other whale groups) and the number of boats around a whale group (3 or fewer within 300m of a whale group; Kessler & Harcourt, 2013b). The authors observed 74 encounters (58 northward migration, 16 southward) in 2007 and 74 in 2010 (51 northward, 23 southward).

The proportion of whale-watching vessels that were recreational increased between 2007 (northward migration: 13.7%; southward 6.2%) and 2010 (northward migration: 23.3%; southward 30.1%; Kessler & Harcourt, 2013b). The number of vessels within 300m of whale groups ranged from 2 to 12, with up to 24 vessels within 1km of a whale group (Kessler & Harcourt, 2013b). The average number of boats within 300m of a whale group generally increased between 2007 and 2010, during weekends (2007: northward migration weekdays 2.8; southward weekdays 1.7; northward migration weekend 4.5; southward weekend 1.5; 2010: northward migration weekdays 3.1; southward weekdays 3.5; northward migration weekend 5.0; southward weekend 3.6; Kessler & Harcourt, 2013b).

Only 37% of vessels abided with the regulation to keep more than 300m away from mothers with calves, but at least 92% stayed farther than 100m from whales, and 96% did not approach whales from directly in front or behind (Kessler & Harcourt, 2013b). The number of encounters where more than three vessels were within 300m of whales significantly increased between the 2007 and the 2010 northward migrations (Kessler & Harcourt, 2013b). There was also a significant increase in the number of times vessels got closer to groups containing calves during the southward migration (Kessler & Harcourt, 2013b). Non-compliance was significantly more frequent in general during the southward migration (Kessler & Harcourt, 2013b). Non-compliance by recreational vessels could be as high as 40%. It was suggested that recreational whale-watching vessels used commercial whale-watching vessels as a guide to finding whales, and also to guide their behaviour around whale groups, and this was partially responsible for the lack of compliance with the vessel number regulation, and the higher rate of non-compliance during the southward migration (Kessler & Harcourt, 2013b).

Kessler & Harcourt (2013b) stated that "[g]*iven the nature of boat based whalewatching, the only way to ensure compliance with regulations is for authorities to conduct on-water enforcement activities*" (p.18) and that perhaps there should be larger fines for non-compliance, especially for repeat offenders. They also suggested more publicizing of the regulations, on boat licenses and in boating magazines, especially the penalty for non-compliance (Kessler & Harcourt, 2013b).

Whale-Watching Management

Southern resident killers whales (SRKW) of the Salish Sea (USA/Canada) have been the focus of large-scale whale-watching tourism since 1984. However, this genetically isolated population is vulnerable due to the presence of persistent toxins in their environment, prey availability (salmon) and tourism pressures (see summary of Ayers et al. (2013) above). To combat the challenges, both NGOs and the whale-watching industry employed a bottom-up management process that implemented, evaluated and enforced whale-watching guidelines (Giles & Koski, 2012). Post management, however, population levels declined at a significant rate (in the 1990s) and SRKWs were listed as endangered in 2003 (Canada) and 2005 (USA). Management moved from guidelines (bottom-up management) to regulations (top-down management), which fostered political conflict amongst the stakeholders, primarily because of concerns about the potential economic impact. Giles and Koski (2013) documented the different models of adaptive management (voluntary guidelines to mandatory regulations) in the Salish Sea. The authors noted that there is a dearth of empirical information on management efficacy and utilised the Salish Sea as a case study for describing the impacts of different forms of management.

Killer whale management in the Salish Sea began in the 1970s when concerns were raised about marine theme parks taking killer whales for public display (1965-1977), which prompted population studies (Giles & Koski, 2013). The population trends for SRKWs were defined as 'variable': the lowest population was recorded in 1976 with 70 whales, the highest in 1995 with 98 whales, followed by a decline in 2001 to 81 whales (Giles & Koski, 2013). The initial decline was attributed to the removals by marine theme parks and the decline that followed (1996: 17% decrease) to anthropogenic impacts such as pollutants, a decline in prey availability, oil spills, disease, inbreeding and vessel presence and the associated underwater noise from boats (Giles & Koski, 2013).

Commercial whalewatching experienced exponential growth in the Salish Sea (in 1985 commercial whale-watching ticket sales were just $10,000 and expanded to $5.7 million by 1997), facilitated by a wide range of vessels with varying passenger capacities (12 to 250 passengers per vessel) with the potential for up to two trips per day per vessel (Giles & Koski, 2013). In addition, recreational vessels utilise the region and are often observed following whales (30% of whale-watching traffic; Giles & Koski, 2013). On average 15-20 boats are within half a mile of whales and a maximum of 120 boats were recorded near whales in 1999 (Giles & Koski, 2013). The rapid growth of the commercial whale-watching industry prompted NGOs to implement adaptive management via voluntary whale-watching guidelines, based on monitoring/research they conducted, with these guidelines reviewed annually in partnership with tour operators (Giles & Koski, 2013). This approach facilitated the whale museum in Friday Harbor (San Juan Islands, Washington state) to conduct on research on tourism trends in the region, provide outreach materials, launch undergraduate ecology field trips and drive the development of guidelines for boaters around whales. Giles and Koski (2013) note that the whale museum was the catalyst for the implemented adaptive management that led to a whale-watching code of conduct, in addition to training for vessel drivers at the onset of each season. However, research also demonstrated that even though outreach material was provided, levels of boater compliance (private boaters accounted for highest levels of non-compliance) were low (Giles & Koski, 2013).

Formalised management by government agencies amplified after the population decline of SRKWs in the late 1990s, with the consequence that the population was officially listed as 'endangered' in the USA and Canada (Giles & Koski, 2013). Government agencies of both countries expressed concern about vessel activity in the region, based on the population decline, growing scientific literature on the impacts of vessels on cetaceans, low levels of guideline compliance and public concern about reckless whale-watching activities (Giles & Koski, 2013). This resulted in simple (e.g., approach distance) but adaptable (since 2002 they have been amended four times) revisions to the Whale Wise Guidelines for Watching Marine Wildlife, which are used in both countries. This top-down management, however, created some political conflicts amongst stakeholders (Giles & Koski, 2013). The authors stipulated that for species that are migratory there is a need to adopt uniform guidelines that apply across both borders and that both countries (USA and Canada) should invest comparable resources for research and enforcement. Furthermore, Giles & Koski (2013) documented the valuable involvement of key stakeholders that provided a platform for government agencies to adapt a regulatory framework (i.e., bottom-up involvement in management).

Modelling the Impacts of Whale-Watching Management

Regulations are utilised to mitigate impacts that tourism may pose on targeted wildlife. However, unforeseen impacts may occur when regulations are enforced. Agent-based models (ABMs) have the potential to isolate unanticipated side effects. In the Saguenay-Saint Lawrence (SSL) marine park, Quebec, Canada, local managers have the sometimes conflicting remits of protecting the Saguenay River and St Lawrence Estuary, but simultaneously encouraging education, science and the recreational use of the area. Chion, Cantin, Dionne, Dubeau, Lamontagne, Landry, Marceau, Martins, Menard, Michaud, Parrott and Turgeon (2013) evaluated the rationales used to formulate new, proposed whale-watching regulations, in contrast with current regulations, using ABM as a tool to evaluate the merit of the new regulations.

The normally high predictability of observing whales in the marine park helped prompt the development of cetacean tourism in the SSL marine park. The five most commonly encountered species are belugas (*Delphinapterus leucas*; threatened), fin whale (*Balaenoptera physalus*; species of concern), northern minke whales, humpback whales and the blue whale (*B. musculus*; endangered). The marine park was established to mitigate impacts of cetacean tourism on the whales and further management actions included limited tour vessels and permit numbers (Chion et al., 2013). The marine park's management framework was achieved through a consultative process with a range of stakeholders, in accordance with scientific literature and was intended to be flexible, i.e.,, adaptive management (Chion et al., 2013). The purpose of the new, proposed regulations was to further protect beluga whales (and other species) and critical habitats utilised by vessels (by reducing boat speed and number of boats in vicinity to whales).

The authors used simulations to evaluate the justifications for the amendments in the whale-watching regulations. The authors used three aspects of sustainable management in their evaluation; impact on the whales, economic impact, and tourist satisfaction (Chion et al., 2013). During analysis, the regulations were divided into rules pertaining to speed, boat distance/density and observation time. The results of the simulation indicated that the proposed regulation (a limit of no more than 10 vessels within 926m of a whale) would be beneficial to whalewatching, with benefits to both the whales and tourists (Chion et al., 2013). The proxy variable, being 'alone with whales' (i.e., limiting boat numbers) was deemed 'beneficial' for all three aspects, but increased time with whales had a negative impact on the animals, while not affecting tourist satisfaction or economic impact (Chion et al., 2013). The overall results of the ABM exercise supported the movement to supersede the old regulations with the new regulations.

Whale Ecotourism

Whalewatching is often mistakenly referred to as ecotourism, doubly mistaken when referred to as unsustainable ecotourism, or ecotourism that has unregulated impacts, as by definition ecotourism is a type of tourism that has measures in place to reduce the impacts on target species and the environment, as well as providing benefits for local communities. The IWC's Whalewatching Subcommittee specifically notes that whale-watching operations should be considered ecotourism if they:

(i) actively assist with the conservation of their resource (cetaceans);

(ii) provide appropriate, accurate, and detailed interpretative/educational materials or activities for their passengers about the cetaceans viewed and their associated habitat;

(iii) minimize their environmental impact;

(iv) adhere to whale-watching regulations or an appropriate set of guidelines, if no specific regulations are available for the area; and

(v) provide some benefits to the local community within which the company operates (Parsons et al., 2006).

Few studies have investigated how many whale-watching operations are true ecotourism. Kur and Hvenegaard (2013) investigated whether whale-watching operators on Vancouver Island, Canada, promoted the principles of ecotourism by analysing their marketing materials. Sixty-two whale-watching brochures from 36 companies, from 1998 (n=27), 2005 (n=15), and 2010 (n=20) were examined (Kur & Hvenegaard, 2013).

The companies were assessed according to the three ecotourism principles of nature-based attractions, environmental education and sustainability. Based on brochure text, it was found that only 8% of attractions advertised were cultural/historical, whereas 92% were nature-related (37% whales; 25% other wildlife; 30% natural environment; Kur & Hvenegaard, 2013). A similar proportion of images in the brochures (92%) were nature-related (52% whales; 37% other wildlife; 4% natural environment). There was no significant change in these proportions over time.

Environmental education was graded based on the following aspects of materials: 1) provided interpretation; 2) guide quality; 3) offered a pre-tour orientation; 4) used hydrophones; 5) addressed whale conservation issues; 6) addressed other wildlife conservation and environment issues; 7) provided a video log; 8) provided free printed information; and 9) provided a map of the whale-watching area (Kur & Hvenegaard, 2013). The average number of environmental education activities offered by companies increased from 2.7 in 1998 to 3.7 in 2010, but this increase was not significant (Kur & Hvenegaard, 2013). Less frequently offered educational activities included pre-tour orientations, discussions on whale, wildlife conservation or environmental issues, video log, or free printed information (Kur & Hvenegaard, 2013).

Sustainability was assessed based on the following: 1) commitment to conservation; 2) facilitated donations for conservation; 3) donated to conservation or whale research; 4) was a member of a whale-watching/ecotourism association; 5) vessels were environmentally friendly; 6) whale-watching guidelines were followed; 7) waste was responsibly managed (Kur & Hvenegaard, 2013). The level of local employment and local ownership was also noted as an indication of 'economic sustainability'. The average number of sustainability activities increased from 0.5 in 1998 to 1.6 in 2010. One major (and statistically significant) area of increase was the number of environmentally friendly vessels reported: only 4% of companies in 1998 versus 55% in 2010 (Kur & Hvenegaard, 2013). Twenty-five percent of companies noted their membership in a whale-watching/ecotourism association in 2010; 25% stated a commitment to conservation; 10% provided opportunities for tourists to donate to conservation; whereas 40%

mentioned following whale-watching guidelines (Kur & Hvenegaard, 2013). In 2005, a third of companies mentioned donating to whale conservation or research, but this inexplicably dropped to just 5% in 2010 (Kur & Hvenegaard, 2013). No one mentioned recycling or environmentally friendly waste management. Local employment or ownership was not mentioned in 1998 or 2005, but 5% specifically did so in 2010 (Kur & Hvenegaard, 2013).

It should be noted that this study was based solely on advertised activities – in practice whale-watching companies may pursue many of these activities, and it is possible that educational and sustainability activities may be more forcibly promoted by guides and operators during whale-watching trips. Kur and Hvenegaard (2012) concluded that "[t]*here is* [the] *opportunity for whale-watching companies to more strongly promote ecotourism principles and the corresponding educational, environmental, economic, and social benefits of the industry*" (p. 150).

Social Research on Cetacean Tourism

Swim-with-dolphin programs and tourist expectations

The continuing allure whales hold for humans spans an extensive history shaped by cultural, social and scientific perspectives. This fascination has led to the development of cetacean tourism – the intent to provide novel experiences via interactions with cetaceans in a specific geographic location. In particular, swim-with-dolphin programs are in demand in both a captive and wild setting. Wiener (2013) reviewed and compared literature on swim-with-cetacean programs and provided an interpretation of the findings with relevance to social perceptions and values of this form of tourism. The literature review extended from 1995-2011 and research articles were divided into natural and social science research (Wiener, 2013). Across 32 regions, the USA, New Zealand and Australia had published the greatest number of studies (Wiener, 2013). The main themes studied were: a) forms of dolphin tourism; b) interactions (tourists toward dolphins); c) tourist perceptions and motivators; d) preferences of participants; and e) the sensory experience of dolphin-swim encounters (Wiener, 2013). No empirical data values were presented within each theme; however, a collection of attributes associated with each theme were presented (Wiener, 2013).

Two parameters were measured in swim-with programs to determine an encounter's 'success': interaction period (at least 15 sec) and proximity to dolphins (within 20m). Tourists expressed disappointment when a close interaction was not achieved, even when told that a close interaction could be harmful to the animals (Wiener, 2013). Further factors that promoted satisfaction included calm weather (a reduction in sea sickness), lower numbers of participants and a higher number of animals observed (Wiener, 2013). 'Sensual' experience satisfaction was associated with the anticipation of observing a dolphin, photographic opportunities and close interaction during a swim-with encounter (Wiener, 2013). In addition, the sensation of being in the water, usage of snorkel equipment and effectively utilising equipment (e.g., flippers) to maintain pace with dolphins during swims elicited satisfaction (Wiener, 2013). The outcomes of the swim-with-dolphin experience for the participants include heightened energy post interaction, being 'happier' and feeling 'peaceful' (Wiener, 2013). The study did not examine whether the dolphin-swim experience caused an increase in biocentric values in the participants or conservation motivation. This study indicated that tourists desire a sustained interaction with dolphins, in close proximity to the animals, in calm weather (Wiener, 2013). This desire is not diminished when tourists are made aware that close encounters could negatively impact the target animals (Wiener, 2013).

This study highlights distinct management problems: the practicality and feasibility of satisfying tourists' expectations (close interactions, effective usage of snorkel equipment, calm weather and photographic opportunities) in a free ranging setting are limited. Moreover, these tourist expectations could put pressure on operators and, in a bid to give the tourists the experiences they desire, may push them to be non-compliant with regulations and guidelines that minimise the tourists' proximity to, and encounter duration with, dolphins. This may explain the low levels of compliance with regulations/guidelines demonstrated in coastal dolphin-swim tourism (e.g., Scarpaci et al., 2003, 2004).

Whale-whaling vessel crowding and customer satisfaction

Development of cetacean tourism regulations has the potential to promote sustainable tourism and mitigate impacts of tourism on the target species. In the absence of regulations, the sustainability of tourism may be compromised but it may also lead to dissatisfaction in tour participants. Avila-Foucat, Vargas, Jordan and Flores (2013) examined whether vessel crowding affects whale-watching customer satisfaction and discourages repeat business (i.e., the same tourists returning) in Banderas Bay, Mexico, to evaluate these as effective markers for the need to improve management.

Cetacean tourism (primarily on humpback whales) generates 14% of Mexico's tourism income, with annual increases of 5.6% over the past decade (Avila-Foucat et al., 2013). A total of 410 whalewatchers was surveyed after a whale-watching tour (n=2 whale-watching companies) at Banderas Bay. The survey included questions on socio-economic variables, travel motivators and crowding. Crowding was assessed as the number of boats a tourist observed with whales and was related to their satisfaction with the tour (Avila-Foucat et al., 2013). 'Norm crowding' was categorised as the maximum number of boats that could be present whilst still maintaining tourist interest in revisiting (Avila-Foucat et al., 2013). Return visits were also scored against whale behaviours observed during a tour. Tourists were also asked to identify potential threats to whales and their knowledge of threats (e.g., vessel strike, behavioural disturbances), as this might be linked to levels of vessel crowding that were acceptable to tourists (Avila-Foucat et al., 2013).

Results indicated that the majority of whalewatchers would return if the number of vessels around whales was no more than two (Avila-Foucat et al., 2013). Vessel crowding clearly had the potential to reduce tourist satisfaction (Avila-Foucat et al., 2013). Whalewatchers' intention to return was also related to knowledge of conservation issues (Avila-Foucat et al., 2013). The likelihood of return was also positively correlated with income (tourists with higher incomes were more likely to return; Avila-Foucat et al., 2013). Current management allows four whale-watching vessels to be in the vicinity of a whale and therefore repeat business is discouraged (Avila-Foucat et al., 2013). At present, the main management issue at Banderas Bay is the number of non-permitted vessels that interact with whales (Avila-Foucat et al., 2013). The authors recommend maintaining the current permitting system, endorse best practice through labelling (e.g., accreditation), implement a code of conduct for all vessels and declare a marine sanctuary zone in an area in the northern part of the bay to protect mothers and calves.

The behaviour of whale-watching tourists on an excursion

Although there have been several studies on the knowledge levels of whale-watching tourists, their attitudes and their motivations, few studies have looked into how whale-watching tourists actually perceive their trips. Hrycik & Forestell (2013) documented questions raised by whale-watching tourists in Boston, Massachusetts, to evaluate whether tourists' focus (i.e., interest area) varied across three time frames on a whale-watching trip. The time frames were: a) pre-contact (search effort); b) contact (the encounter with a whale); and c) post contact (return to port). The length of each phase varied according to search effort, sea conditions and the number of participants (Hrycik & Forestell, 2013). The authors' assumption was that the spontaneous questions asked by tourists indicated their focus at that time, and knowing this (i.e., what the tourist desires to know, and when) could help develop more effective interpretation programs and in turn could lead to an increase in biocentric values and satisfaction in participants (Hrycik & Forestell, 2013). The tourists' individual questions were pooled across eight focus categories: biology, safety and comfort, tour itinerary, methodology, conservation, geographic and anthropogenic factors, retail and 'personal connection' (Hrycik & Forestell, 2013).Overall, the top three categories were biology (46%), tour itinerary (11.5%) and safety and comfort (10.7%; Hrycik & Forestell, 2013). The results indicated that questions did vary as a trip progressed. Pre-contact, the dominant categories were safety and comfort and itinerary (91.4%), possibly due to the tourists' excitement and apprehension at that time (Hrycik & Forestell, 2013). In the contact phase the most common questions were biology and methodology-related (82.8%) and the authors stated that these questions "*allow passengers to integrate the new information with their own observations*" (Hrycik & Forestell, 2013). In the post-contact phase, 51% of questions were related to biology, followed by conservation (12%) and methodology (12%; Hrycik & Forestell, 2013). It was thought that tourists validated their experiences and were more likely to broaden their perspectives and seek further information (e.g., conservation information) at this time. Hrycik & Forestell (2013) found that the focus of whale-watching tourists evolved across a tour and therefore whale-watching interpretative material intended to promote more pro-conservation attitudes and greater biological understanding amongst trip participants should be scheduled at different, and specific, times of the tour; e.g., discuss conservation issues and more detailed biological information after whale encounters, not during pre-contact.

Impacts of whalewatching on a community

Cetacean tourism is often supported by the argument that observing marine mammals in a wild setting may promote pro-conservation attitudes and behaviour in participants. It is also seen as an alternative to whaling and as an economic benefit. However, there is a dearth of research on the actual influence of cetacean tourism at the community level. Silva (2013) reviewed the whale-watching industry in the Azores through interviews with stakeholders to gain insight into the actual impact that whalewatching can have on a community that has shifted from whaling (consumptive use) to whalewatching (non-consumptive). Whalewatching in the Azores has moved from small scale to large scale (23 licences) over the years, with repeat clientele.

Silva (2013) noted that community-level shifts have occurred in the Azores with the move from whaling to whalewatching. The value of whales has been 'humanized' and whalers now carry a stigma (Silva, 2013). Locals view whalewatching positively (Silva, 2013). The value of cetacean tourism is considered to be more profitable than the consumptive use of whales; however, the financial benefit across the community is not as widespread as the profits of whaling (Silva, 2013). Furthermore, whalewatching provides only seasonal financial benefits, but these benefits are translated into indirect benefits to the community, such as increases in the number of tourists in cafes, museums and hotels in the region (Silva, 2013).

Unfortunately, whale-watching management actions to help promote sustainable tourism industry are being circumvented by tour operators, who are more motivated to satisfy paying tourists' expectations. For example, current legislation limits swimming with dolphins to just two individuals per trip, but an operator stated that "*I take 5 or 6 tourists on board to swim. I cannot put two of them in the waters and not the others, for they have all paid for the activity and they want to swim with dolphins*" (Silva, 2013). The study indicated that whalewatching was unsuccessful in encouraging sociocultural sustainability and instead created conflict amongst community groups on the management of marine resources (for the protection of whales), the distribution of community financial gain due to usage of whales, and issue of competition. Silva (2013) stated that tourism is not a "*magic formula*" for increasing a) conservation through cetacean tourism; b) financial gain for the host community; or c) sociocultural sustainability.

Dolphin food-provisioning tourism

Dolphin feeding is restricted or forbidden in many nations, based on concerns for the welfare of the dolphin and the interacting tourist. Donaldson, Finn, Bejder, Lusseau and Calver (2012) documented illegal feeding of bottlenose dolphins in Cockburn Sound, Western Australia, to determine whether these interactions can lead to the dolphins learning harmful behaviours. Records were examined across a decadal time scale (1993-2003) to identify dolphins interacting with illegal feeders, conditioned behaviours and the presence of these behaviours amongst other dolphins. A total of 11 dolphins were documented as conditioned to food handouts (Donaldson et al., 2012). It was found that dolphins that occupied areas of high boat density, and dolphins associated with dolphins that accepted fish handouts, were the most likely to become conditioned to food handouts (Donaldson et al., 2012). This study confirmed that dolphins have the potential to learn harmful behaviours from each other (such as accepting fish handouts). The authors highlighted the importance of long-term monitoring to assess the impacts of such anthropogenic activities; furthermore, the study showed that effects of illegal feeding of dolphins can extend beyond the specific dolphins that are receiving an illegal food handout (Donaldson et al., 2012).

A second study, also in Australia, investigated the impacts of legal provisioning of bottlenose dolphins (*Tursiops* sp.), in Monkey Mia, Western Australia. Here members of the public interact with wild, provisioned dolphins under the supervision of local authorities. Foroughirad & Mann (2013) were the first to implement a BACI (Before-After Control Impact) framework, and research the impacts that provisioning may have on early (calf and juvenile) development, by contrasting activity budgets of provisioned and non-provisioned groups.

The Shark Bay dolphin population is estimated at 3000 dolphins, with 600 of these inhabiting the Monkey Mia study site (Foroughirad & Mann, 2013). Feeding fish to free-ranging dolphins began in the 1960s and these activities were unregulated, random and consisted of fishermen throwing some of their catch to the dolphins or tourists purchasing buckets of fish to feed dolphins in knee-deep water. In 1989, these activities became regulated and were restricted to members of three dolphin matrilines (Foroughirad & Mann, 2013). The amount of fish handed out was restricted to 60kg per month, per dolphin. Mann et al. (2000) demonstrated an increase in calf mortality as a result of this activity, which led to stricter management in 1994 (e.g., 2kg of fish per day per dolphin, maximum of 3 feeds between 0730-1300, fish quality control, supervised programs, educational talk, tourists can stand in knee-deep water but cannot approach dolphins; Foroughirad & Mann, 2013).

Dolphin activity budgets were documented from 1988-2011 for non-provisioned adult females and their offspring and provisioned adult females with their offspring, via focal follows. Follows conducted on board a research vessel were defined as 'offshore follows' and observations conducted at the provisioned area defined as 'onshore follows' (Foroughirad & Mann, 2013). Focal observations were tallied and pooled into categories of resting, foraging, socializing, traveling and other. Researchers also documented calf activity (i.e., whether they were in the 'infant position', in close proximity to the mother) and the time sustained in infant position, which was considered to be representative of maternal care through protection, contact and nursing access (Foroughirad & Mann, 2013). The results demonstrated that the management changes implemented in 1994 led to provisioned adult females reducing average time spent per day in the provisioning area by approximately half (Foroughirad & Mann, 2013). Calf

survivorship improved post management (pre-1994 = 23.1% calf survivorship; post-1984 = 86.7%) and no significant difference was found between calves born to provisioned and non-provisioned mothers (Foroughirad & Mann, 2013). The authors stipulated in their discussion that the increase in calf survivorship could be attributed to the 1994 management changes.

The behaviour (resting, socializing, traveling and feeding) of adult females was not influenced by their provisioning status (Foroughirad & Mann, 2013). However, calf behaviour was influenced by their mothers' provisioning status (Foroughirad & Mann, 2013). Calves belonging to provisioned mothers spent less time in the infant position than non-provisioned calves (Foroughirad & Mann, 2013). Calves that belonged to provisioned mothers invested more time foraging with less time resting than calves born to non-provisioned mothers (Foroughirad & Mann, 2013). In addition, non-provisioned calves spent less time away from their mothers than calves belonging to provisioned mothers (Foroughirad & Mann, 2013). In summary, the provisioned calf community received less maternal care, foraged more and spent more time separated from their mothers and Foroughirad and Mann (2013) suggest the increased foraging effort exhibited by the calves was a result of lower milk uptake and increased energy usage due to travel to provisioning sites. The reduced resting rates in calves from provisioned mothers could be due to calves spending less time in the 'infant position', which provides an opportunity for the calf to rest (Foroughirad & Mann, 2013).

Foroughirad & Mann (2013) noted that even though the new management measures were effective at increasing calf survivorship, caution needs to be exercised on the current provisioning program, as it is an opportunity for dolphins to learn behaviours that could be detrimental (begging for fish and following boats; see Donaldson et al. (2012) above). Of further importance, looking into the effects of provisioning on long time survivorship, five offspring born to provisioned mothers (after 1994) failed to survive beyond their juvenile period (Foroughirad & Mann, 2013); thus provisioning is likely still having a population-level impact.

A provisioning program targets Amazon River dolphins, or boto (*Inia geoffrensis*), in Brazil. The dolphins that seek feeding in this location are all male, and Pinto de Sá Alves, Andriolo, Orams and de Freitas Acevedo (2013) recorded aggressive behaviour by these males in the presence and absence of food handouts, to establish whether provisioning can promote the formation of a dominance hierarchy. Data were collected during two time periods, in 2008 and 2009, across 134 study days (Pinto et al., 2013). Observations took place on a floating restaurant with a wooden platform that is near the surface of the river. Here, botos can be provided fish handouts by tourists at random times during the day. Two types of aggressive behaviour were noted: 'bite' behaviour, the deliberate attempt by a dolphin to bite another dolphin; and 'supplant' behaviour, when a boto positions its body to block, push or guide another away from a food resource (Pinto et al., 2013). The number of 'bite' and 'supplant' behaviours during feeding sessions was compared to the number in the absence of feeding sessions. Ten individual provisioned dolphins were sampled and observations taken of paired animals, to establish biter (actor) and bitten (recipient) (Pinto et al., 2013). The researchers tallied the number of times an individual dolphin was an actor or recipient to establish a dominance index. The mean number bite behaviours in botos increased during feeding sessions (non-feeding sessions = 1.9 bites per individual per 30 min; feeding sessions = 4.66 bites per individual per 30 min) at a statistically significant rate (Pinto et al., 2013). Moreover, the mean number of bites increased significantly with time during the non-feeding sessions (1.4 to 8.7 bites/individual/30min). A total of 824 bite events were observed, with the dominant individuals utilising 'bite' and 'supplant' behaviours to limit subordinates' access to fish handouts (Pinto et al., 2013). The authors suggested that the high levels of aggressive behaviour observed in this study could put both the botos and the tourists at risk (Pinto et al., 2013).

Summary

Several studies published over the past year have added to the large body of work that has shown that cetacean tourism can have an impact on cetaceans. Behavioural responses of cetaceans to vessels and swimmers occur across a range of taxa and are not simply limited to regions with large scale operations (a single tour vessel was documented to impact dolphin behaviour). Based on previous research, reductions in dolphin abundance and habitat usage could be a consequence of long-term tourism impacts in some regions, e.g., Bay of Islands, New Zealand. Many studies have demonstrated a reduction in feeding and resting behaviour, but few studies, if any, have equated this decrease into quantifiable impacts on cetacean health, life history parameters or mortality.

Swim-with-cetacean tourism is now expanding from resident coastal dolphin populations to large species of migratory whales, which poses additional management concerns. Furthermore, whalewatching on mother-calf pairs requires particular research (and management) consideration, as new studies summarised above add to evidence that

responses of whales to vessels was influenced by whale group composition and presence of calves, and that compliance with regulations protecting mother and calf groups can be especially poor.

Management strategies proposed include limits on number of licenses; a limit of one boat per license; tourism activity zones; increases in approach distances; limits on swim-with-cetacean interactions; monitoring with enforcement vessels; publicising guidelines/regulations and the consequences for non-compliance more broadly; more severe fines for non-compliance with regulations, especially for repeat offenders; compulsory submission of sighting sheets from tour operations; and more research on the social science aspects of whale-watching management, such as motivating factors amongst tourists and what creates customer satisfaction, and how these data can be used to aid conservation and minimise whale-watching impacts.

References

Arnold, P.W. (1997). Occurrence of dwarf minke whales (*Balaenoptera acutorostrata)* on the northern Great Barrier Reef, Australia. *Reports of the International Whaling Commission*, 47, 419-424.

Avila-Foucat, V.S., Vargas, A.S. Jordan, A. F., & Flores, O.M.R. (2013). The impact of vessel crowding on the probability of tourists returning to whalewatching in Banderas Bay, Mexico. *Ocean and Coastal Management*, 78(3), 12-17.

Ayers, K.L., Booth, R.K., Hempelmann, J.A., Koski, K.L., Emmons, C.K., Baird, R.W., Bartok, B.B., Hanson, M.D., Ford, M.J., & Wasser S.K. (2013). Distinguishing the impacts of inadequate prey and vessel traffic on an endangered killer whale (*Orcinus orca*) population. *PLoS ONE*, 7(6), e36842, 1-12.

Baker, C.S., Garrigue, C., Constantine, R. Madon, B., Poole, M., & Hauser, N. (2006). Abundance of humpback whales in Oceania (south Pacific), 1999-2004. Inter-sessional workshop for the comprehensive assessment of Southern hemisphere Humpback whales, 3-7 April, 2006.

Bejder, L., & Samuels, A. (2003). Evaluating the effects of nature based tourism on cetaceans. In N. Gales, M. Hindell E R. Kirkwood (Eds.), *Marine mammals: Fisheries, tourism and management issues* (pp. 229-256), Collingwood, Victoria, Australia: CSIRO Publishing.

Bejder, L., Dawson, S.M., & Harraway, J. A. (2006). Responses by Hector's dolphins to boats and swimmers in Porpoise Bay, New Zealand. *Marine Mammal Science,* 15**,** 738-750.

Charlton-Robb, K., Gershwin, L.-A., Thompson, R., Austin, J., Owen, K., & McKechnie, S. (2011). A new dolphin species, the burrunan dolphin *Tursiops australis* sp. nov., endemic to Southern Australian coastal waters. *PloS ONE*, 6(9), e24047.

Chion, C., Cantin , G., Dionne , S., Dubeau , B. Lamontagne , P., Landry , J. A., Marceau , D., Martins , C.C.A., Ménard , N., Michaud , R., Parrott , L., and Turgeon, S. (2013). Spatiotemporal modelling for policy analysis: application to sustainable management of whale-watching activities. *Marine Policy*, 38, 151-162.

Christiansen, F., Rasmussen, M., & Lusseau, D. (2013).Whalewatching disrupts feeding activities of minke whales on a feeding ground (2013). Marine *Ecology Progress Series*, 478, 239–251.

Clapham, P., Wade, P., & Zerbini, A. (2006). Plausible rates of population growth in humpback whales revisited. International Whaling Commission, 2006. Paper presented to the Scientific Committee at the 58th Meeting of the International Whaling Commission, 26 May–6 June 2006, St. Kitts. SC58/SH4.

Curnock, M.I., Birtles, R.A., & Valentine, P.S. (in press). Increased use levels, effort, and spatial distribution of tourists swimming with dwarf minke whales at the Great Barrier Reef. *Tourism in Marine Environments*, 9, in press.

Curry, R., Dawson, S.M., & Slooten E. (2009). Survival rates of declining bottlenose dolphins in Doubtful Sound, New Zealand: An information theoretic approach to assessing the role of human impacts. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 19(6), 658-670.

Dans, S.L., Crespo, E.A., Pedraza, S.N., Degrati, M. & Garaffo, G.V. (2008). Dusky dolphins and tourist interaction: effect on diurnal feeding behavior. *Marine Ecology Progress Series*, 369, 273–285.

Dans, S.L., Degrati, M., Pedraza, S.N. & Crespo, E.A. (2012). Effects of tour boats on dolphin activity examined with sensitivity analysis of Markov chains. *Conservation Biology*, 26(4), 708–716.

Donaldson, R., Finn, H., Bejder, L., Lusseau, D., & Calver, M. (2012). The social side of human-wildlife interaction: wildlife can learn harmful behaviours from each other. *Animal Conservation*, 15(5), 427-435.

Foroughirad, V. & Mann, J. (2013). Long-term impacts of fish provisioning on the behaviour and survival of wild bottlenose dolphins. *Biological Conservation*, 160, 242-249.

Giles, D.A., & Koski K.L. (2012). Managing vessel-based killer whalewatching: a critical assessment of the evolution from voluntary guidelines to regulations in the Salish Sea. *Journal of International Wildlife Law and Policy*, 15(2), 125-151.

Godwin, E. (2013) Comparing multiple methods for measuring the behavior of humpback whales (*Megaptera novaeangliae*). Presented at the 27th Conference of the European Cetacean Society, Setúbal, Portugal, 8-10 April 2013.

Howes, L., Parsons, E.C.M., & Scarpaci, C. (2012). Ineffectiveness of a marine sanctuary zone to protect dolphins from tourism activities in Port Phillip Bay, Australia. *Journal of Ecotourism*, 11(3), 188-201.

Hrycik, J.M. & Forestell, P.H. (2013). Change in focus of attention among whale-watch passengers occurs as a function of temporal phase of the tour. *Tourism in Marine Environments*, 8(4), 189-198.

International Whaling Commission (2012). Report of the sub-committee on whalewatching. *Journal of Cetacean Research and Management*, 13(Suppl.), 292-301.

International Whaling Commission (2001) Report of the sub-committee on whalewatching. *Journal of Cetacean Research and Management*, 3(Suppl.), 279–307

Kessler, M., & Harcourt, R. (2013a). Management implications for the changing interactions between people and whales in Ha'apai, Tonga. *Marine Policy*, 36, 440-445.

Kessler, M., & Harcourt, R. (2013b). Whalewatching regulation compliance trends and the implications for management off Sydney, Australia. *Marine Policy*, 42, 14–19.

Kessler, M., Harcourt, R., & Heller, G. (2013). Swimming with whales in Tonga: Sustainable use or threatening process? *Marine Policy*, 39, 314-316.

Kravec, A. 2013. Whaling area reduced. *The Reykjavik Grapevine*, 22 May 2013. http://grapevine.is/Home/ReadArticle/whaling-area-reduced (accessed 23 May 2013).

Kur, N.T. & Hvenegaard, G.T. (2012). Promotion of ecotourism principles by whale-watching companies' marketing efforts. *Tourism in Marine Environments***,** 8(3): 145–151.

Lundquist, D., Gemmell, N.J., & Wursig, B. (2012). Behavioural responses of dusky dolphin groups (*Lagenorhynchus obscurus*) to tour vessels of Kaikoura, New Zealand. *PLoS ONE*, 7(7), e41969.

Lundquist, D., Sironi, M., Wursig, B., Rowntree, V., Martino, J., & Lundquist L. (2013). Responses of southern right whales to simulated swim-with-whale tourism at Peninsula Valdes, Argentina. *Marine Mammal Science*, 29(2), 24-45.

Mangott, A.H., Birtles, R.A., & Marsh H. (2011). Attraction of dwarf minke whales *Balaenoptera acutorostrata* to vessels and swimmers in the Great Barrier Reef World Heritage Area- the management challenges of an inquisitive whale. *Journal of Ecotourism*, 10(1), 64-76.

Mann, J., Connor, R.C., Barre, L.M., & Heithaus, M.R. (2000). Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects. *Behavioral Ecology*, 11(2), 210–219

Moller, L. M., Bilgmann, K., Charlton-Robb, K., & Beheregaray L.B. (2008). Multi-gene evidence for a new bottlenose dolphin species in southern Australia. *Molecular Phylogenetics and Evolution*, 49, 674-681.

Mustika, P.L.K., Birtles, A., Everingham, Y., & Marsh, H. (2013). The human dimensions of wildlife tourism in a developing country: watching spinner dolphins at Lovina, Bali, Indonesia. *Journal of Sustainable Tourism*, 21(2), 229-251.

Mustika, P.L.K., Birtles, A., Welters, R. & Marsh, H. (2012). The economic influence of community based dolphin watching on a local economy in a developing country: Implications for conservation. *Ecological Economics*, 79, 11-20.

O'Connor, S. (2008). *Whale and Dolphin Watching in the Pacific Islands Region Phase 2: Country Case Study — Whalewatching Tourism in the Kingdom of Tonga* . Noble Park, Victoria, Australia: International Fund for Animal Welfare and Opérations Cétacés.

Parsons, E.C.M. **(**2012). The negative impacts of whale-watching. *Journal of Marine Biology*, 2012 (807294), 1-9.

Parsons, E.C.M., Classen, J.M, & Bauer, A. (2004). Recent advances in whale-watching research. Paper presented to the Scientific Committee at the 56th Meeting of the International Whaling Commission, 29 June–10 July 2004, Sorrento, Italy. SC56/WW6.

Parsons, E.C.M., Fortuna, C.M., Ritter, F., Rose, N.A., Simmonds, M.P., Weinrich, M., Williams, R., & Panigada S. (2006). Glossary of whalewatching terms. *Journal of Cetacean Research and Management*, 8(Suppl.), 249-251.

Parsons, E.C.M., Lewandowski, J., & Lück, M. (2006). Recent advances in whalewatching research: 2004–2005. *Tourism in Marine Environments*, 2(2), 119–132.

Parsons, E.C.M., Lück, M., & Lewandowski, J. (2006). Recent advances in whale-watching research: 2005–2006.*Tourism in Marine Environments*, 3(2), 179–189.

Parsons, E.C.M., & Scarpaci, C. (2010). Recent advances in whale-watching research: 2009-2010. *Tourism in Marine Environments*, 7(1), 43-53.

Peters, K.J., Parra, G.J., Skuza, P.P., & Möller, L.M. (2013). First insights into the effects of swim-with-dolphin tourism on the behavior, response, and group structure of southern Australian bottlenose dolphins. *Marine Mammal Science*, in press.

Pinto de Sá Alves, L.C., Andriolo, A. Orams, M.B., & de Freitas Acevedo, A. (2013). Resource defence and dominance hierarchy in the boto (*Inia geoffrensis*) during a provisioning program. *Acta Ethologica*, 16(1), 9-19.

Rose, N.A., Weinrich, M., & Finkle, M. (2003). Swim-with-whales tourism – a preliminary review of commercial operations. Paper presented to the Scientific Committee at the 55th Meeting of the International Whaling Commission, 26 May–6 June 2003, Berlin, Germany. SC/55/WW4.

Rose, N.A., Weinrich, M., Iníguez, M.A., & Finkle, M. (2005). Swim-with-whales tourism - an updated review of commercial operations. Paper presented to the Scientific Committee at the 57th Meeting of the International Whaling Commission, 30 May–10 June 2005, Ulsan, Korea. SC/57/WW6.

Scarpaci, C., Lück, M., & Parsons, E.C.M. (2009). Recent advances in whale-watching research: 2008–2009. *Tourism in Marine Environments*, 6(1), 39–50.

Scarpaci, C., Nugegoda, D., & Corkeron, P.J. (2003). Compliance with regulations by "swim-with-dolphins" operations in Port Philip Bay, Victoria, Australia. *Environmental Management*, 31(3), 342-347.

Scarpaci, C., Nugegoda, D., & Corkeron, P.J. (2004). No detectable improvement in compliance to regulations by "swim-with-dolphin" operators in Port Philip Bay, Victoria, Australia. *Tourism in Marine Environments*, 1(1), 41-48.

Scarpaci, C., & Parsons, E.C.M. (2013). Recent advances in whale-watching research: 2011-2012. *Tourism in Marine Environments*, 8(4), 207-217.

Scarpaci, C., & Parsons, E.C.M. (2012). Recent advances in whale-watching research: 2010-2011. *Tourism in Marine Environments*, 8(3), 161-171.

Scarpaci, C., Parsons, E.C.M., & Lück, M. (2009). Recent advances in whale-watching research: 2007–2008. *Tourism in Marine Environments*, 5(4), 319–336.

Scarpaci, C., Parsons, E.C.M., & Lück, M. (2008). Recent advances in whale-watching research: 2006–2007. *Tourism in Marine Environments*, 5(1), 55–66.

Silva, L. (2013). How eco-tourism at the community-level: the case of whalewatching in the Azores. *Current Issues in Tourism*, in press.

Tezanos-Pinto, G., Constantine, R., Brooks, L., Jackson, J.A., Mourão, F., Wells, S., & Baker, C.S. (2013). Decline in local abundance of bottlenose dolphins (*Tursiops truncatus*) in the bay of Islands, New Zealand. *Marine Mammal Science*, in press.

Tezanos-Pinto, G., Baker, C.S., Russell, K., Martien, K., Baird, R.W., Hutt, A., Stone, G., Mignucci-Giannoni, A.A., Caballero, S., Endo, T., Lavery, S., Oremus, M., Olavarría, C., & Garrique, C. (2009). A worldwide perspective on the population structure and genetic diversity of bottlenose dolphins (*Tursiops truncatus*) in New Zealand. *Journal of Heredity*, 100(1), 11-24.

Wells, R.S. & Scott, M.D. (1990). Estimating bottlenose dolphin population parameters from individual identification and capture-release techniques. *Reports of the International Whaling Commission*, Special Issue 12, 407-416.

Wiener, C. (2013). Friendly or dangerous waters? Understanding dolphin swim tourism encounters. *Annals of Leisure Research*, 16(1), 55-71.