REVIEW

RECENT ADVANCES IN WHALEWATCHING RESEARCH: 2007-2008

C. SCARPACI,* E.C.M. PARSONS,†‡ AND M. LÜCK§

*School of Biomedical and Clinical Sciences, Ecology and Sustainability Group, Victoria University, 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.
§ School of Hospitality and Tourism and new Zealand Tourism Research Institute, AUT University, Auckland, New Zealand.

Whalewatching research encompasses a wide variety of disciplines and fields of study, including monitoring the biological impacts of whalewatching activities on cetaceans and assessments of the effectiveness of whalewatching 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 whalewatching studies published over the past year, since June 2007.

Key words: Whalewatching; Code of conduct; Regulations; Management; Whale-watchers; Protected areas

Introduction

Whalewatching research encompasses a wide variety of disciplines and fields of study, including monitoring the biological impacts of whalewatching activities on cetaceans and assessments of the effectiveness of whalewatching management and regulations, to the sociological and economic aspects of whalewatching on communities hosting such activities. Recognising the difficulties of keeping up to date on the wealth of research on whalewatching activities, in particular the impacts of these activities on cetaceans, a digest summarizing the breadth and variety of whalewatching research, published during the previous year, was presented to the International Whaling Commission (IWC) Scientific Committee's Whalewatching Sub-committee (Parsons, Classen, & Bauer, 2004) during the 56th Annual Meeting of the IWC and every year subsequently (see Parsons, Lewandowski & Lück, 2006;

Parsons, Lück, & Lewandowski, 2006; Scarpaci, Parsons & Lück, 2008). This is the fifth in this series of review papers, detailing a summary of whalewatching research published over the past year (June 2007-May 2008), since the 59th Annual Meeting of the IWC.

Impacts of Whalewatching Activities on Cetaceans

Coastal species of marine mammals found in waters that are utilised by boaters may be vulnerable to boat strikes. Research has clearly demonstrated that boat strikes can cause direct physical injury or death to the struck animal. Evidence of boat strikes include: scars and large parallel cuts along the dorsal surface of the animal made by propeller blades. Camargo & Bellini (2007) report on a collision between a vessel and a spinner dolphin (*Stenella longirostris*) in the Fernando de Noronha Archipelago, Western Equatorial Atlantic, Brazil. The majority of this archipelago is part of the National Marine Park of Fernando de Noronha, an area which is regulated, but within which there is a high volume of tourism traffic. Photographs taken by researchers within the National Marine Park indicated that the struck *S. longirostris* acquired two broken jaws and parallel cuts along the dorsal side of its body as a result of the boat collision (Camargo & Bellini, 2007). The degree of injury was deemed as progressively fatal as the body of the dolphin was "extremely emaciated" and movement was "arduous" (Camargo & Bellini, 2007). Location of the injury (within or outside the marine park) could not be determined, as researchers did not observe the collision (Camargo & Bellini, 2007). Nonetheless, the authors suggested two precautionary preventive measures to protect coastal dolphins in the region from tourism-related boat traffic: i) education (of both locals and tourists); and ii) propeller guards on boats that regularly encounter cetaceans. The latter was strongly recommended by the authors to avoid a similar accident again (Camargo & Bellini, 2007).

The above paper describes a very direct impact of boat traffic on cetaceans. However, typically the effects of boat traffic, especially whalewatching vessels on cetaceans is often more subtle. Another paper published described a study on

Northern Resident killer whales on the Pacific coast of Canada, an area where whalewatching activity is intense. Williams & Ashe (2007) noted that killer whales (*Orcinus orca*) in this region displayed behavioural changes, i.e., a change of swimming pattern to a more direct route, when exposed to as many as three whalewatching vessels within a 1km radius. However, contrary to the expected, when more than three vessels were present, behavioural responses diminished (Williams & Ashe, 2007). The researchers emphasised, that had these data been analysed without taking the number of vessels present into account, i.e., just noting presence or absence of boats, the conclusions would, erroneously, have been that there was no significant behavioural change (Williams & Ashe, 2007). The researchers state that "experimental design, coupled with analytical techniques incorporating statistical power and appropriateness of treatments and response variables, must be considered when interpreting the biological significance of null findings from impact assessments" (Williams & Ashe, 2007, p. 390). In terms of management of impacts, the researchers suggest that the issue of crowding by vessels should be addressed and the behavioural data suggests that there should be a maximum of three boats within 1km of a killer whale pod (Williams & Ashe, 2007). Currently in the Pacific Northwest, killer whale groups can be surrounded by tens to over one hundred vessels (Williams & Ashe, 2007).

A second recent paper on behavioral changes as the result of boat activity was conducted in New Zealand. Common dolphins (*Delphinus* sp.) are the most common cetacean sighted in the Hauraki Gulf, a shallow semi-enclosed coastal sea on the east coast of the North Island of New Zealand. These dolphins display a high level of residency and are the target of year round whalewatching interest (Stockin et al. 2008). Bryde's whales (*Balaenoptera edeni*) are also targeted by whalewatching tours, but their occurrence is seasonal (Stockin et al. 2008). Boat traffic in the Hauraki Gulf is diverse, ranging from commercial vessels and ferries to kayaks and jet skis, as well as two licensed whalewatching tour boats (although there was only one licensed vessel at the time of the described study). Stockin et al. (2008) followed focal groups of common dolphins 86 hours in total, over 46 days and monitored their observed behavior. Using Markov chain analysis, Stockin et al. (2008) investigated

whether behavioral changes in the proximity to tour vessels were significant. They discovered that the likelihood that dolphins would continue foraging was significantly reduced (by 6.9%) when tour boats were present (Stockin et al., 2008). Moreover, there was also a significant transition from "milling" to "social" behavior and vice versa, when tour boats were present (Stockin et al., 2008). The time it took for dolphins to return to their normal (i.e. pre-disturbance) behavior was higher for foraging and resting dolphins in the presence of the tour boats (extending by 54% to nearly 14 minutes). Moreover, the length of feeding bouts and socializing bouts significantly decreased by four minutes and 1.5 minutes, respectively, in the presence of the tour boats (Stockin et al., 2008). In summary, the common dolphins spent more time "traveling", "milling" and "socializing" in the presence of tour boats and less time "foraging" and "resting". Altogether, foraging time was reduced by nearly 12% as the result of tour boat presence (Stockin et al., 2008).

As a result of this decreased foraging, there could ultimately be population-level impacts on the dolphin population, even with only one licensed whalewatching vessel, and the researchers "concluded from the present study that even low-level tourism based on common dolphins in the Hauraki Gulf is not benign and that continued operation of dolphin tourism in this area needs to be carefully monitored" (Stockin et al., 2008, p. 293). To mitigate these impacts they suggested that tour boats could be banned from approaching feeding dolphins, but practically this would be difficult as the tour operators would have to be able to distinguish feeding behavior from a distance (Stockin et al., 2008). Another suggestion by Stockin et al. (2008) was to restrict tour boat access to dolphins during periods when they are more likely to be foraging (which in turn would require research to determine these periods). The researchers thought that the potential for significant population-level impacts was so strong that they advocated "a moratorium on further permits targeting common dolphins in New Zealand waters, at least until this population has been reassessed and any potential effects of the second permit have been determined." (Stockin et al., 2008, p. 293).

Another study to document changes in feeding behavior was published by Stamation et al. (2007a). This study monitored migrating humpback whales

(*Megaptera novaeangliae*), from whalewatching vessels (in 2002, 2003 and 2005), and from two land-based whale-watching sites on Montague Island (2002-2005) off the coast of New South Wales, Australia. Feeding groups of humpback whales were observed on a quarter of the whalewatching trips and during 14% of the land-based observations – these whales were consuming coastal krill species (*Nyctiphanes australis*) and small fish (Stamation et al., 2007a). The researchers found that although feeding behaviour did not cease or change (in terms of the rate of feeding lunges, or interval between lunges) when whalewatching vessels were present, the interval between feeding lunges did significantly increase when the behavior of whalewatching vessels was not compliant with local regulations, or when more than one vessel were present. The researchers emphasized that "the presence of one whale-watching vessel did not significantly change feeding behaviour relative to what it was in the absence of a vessel as long as the vessel was sitting idle or traveling at a no-wake speed at 100 m or greater separation away and parallel to the pod" (Stamation et al., 2007a, p. 172). Bearing in mind possible impacts of whalewatching traffic on feeding whales, Stamation et al. (2007a) suggested consideration of vessel maneuvers and their potential to disturb schooling fish (and hence humpback prey species); they also asked for consideration of the impacts of fishing on potential prey species. In addition, modifications of existing regulations were suggested, bearing in mind the whale foraging activity, namely that tour operators should initially watch the whales from a distance of 300m or greater, before approaching closer (to the 100m limit) as the surfacing behaviour of feeding whales makes it hard to predict the movement of the whales (Stamation et al., 2007a). They also suggested that no more than one vessel should approach within 300m to reduce the effect of boat proximity on feeding behaviour (Stamation et al., 2007a).

A year ago the whalewatching review (Scarpaci et al., 2007) noted two published studies that documented behavioral changes, as the result of tourism traffic, in *Sotalia guianensis* - the marine tucuxi, estuarine dolphin or costero (do Valle & Cunha Melo, 2006; Santos et al., 2006). A third study published this year also documents impacts of boat traffic on this species (Carrera et al., 2008). The dolphins were observed in Baía dos Golfinhos (Dolphin Bay) in Northeast Brazil, before,

during and after boats entered the Bay. Before boats entered the Bay the average number of dolphins observed was significantly higher than when boats were present, and numbers increased slightly, although not significantly, after the boats left. Behavioural displays associated with foraging were also significantly reduced when boats entered the Bay, and again there was a slight increase after boats left, although foraging behaviour was not significantly higher (Carrera et al., 2008). Carrera et al. (2008) suggest that "as a preliminarily step towards improved welfare and conservation, we recommend the prevention of motorised boats from entering the Baía dos Golfinhos for any commercial or recreational pursuits" (p. 120). If foraging behaviour is reduced this could have a population level effect on this dolphin population, particularly as this species of dolphin can display a high degree of residency and site fidelity (e.g. Flores, 1999) and may thus be exposed to chronic disturbance and harassment. The costero or marine tucuxi is a species which has only recently been recognized as a distinct and separate species from the riverine tucuxi, *Sotalia fluvialis* (Caballero et al., 2007), yet it is already known from three studies that tourist boats are causing behavioural changes in these animals that could reduce their ability to perform biologically important activities, i.e. feeding. It would seem that precautionary management to reduce the impact of whalewatching on these animals is warranted.

Whalewatching Regulations and Codes of Conduct

The International Whaling Commission has agreed "that there is new compelling evidence that the fitness of individual odontocetes repeatedly exposed to whalewatching vessel traffic can be compromised and that this can lead to population level effects" (International Whaling Commission, 2006). To manage pressures of tourism on cetaceans and other wildlife, managers typically require tour operators to abide to regulations (legal requirement) or code of conducts (non-legal requirement) (Garrod & Fennell, 2004). However, management regimes are variable geographical (e.g. no guidelines or regulation to highly regulated, government licensed industries) and this variability has been documented as inconsistent and highly fragmented

(Garrod & Fennell, 2004). Allen et al. (2007) described the cetacean tourism management regime in New South Wales, Australia. In Australia, management of whalewatching is on a state by state basis and variable, for example, Victoria has regulations whereas New South Wales has a voluntary code of conduct. Cetacean tourism in New South Wales has increased by 37% across a five-year period (1998-2003; International Fund for Animal Welfare, 2004), the majority of which is based on dolphin-watch operations from Port Stephens. A total of 17 dedicated dolphin watch boats (approximately 50% of these offer multiple trips per day) operate in Port Stephens (Allen et al., 2007). Furthermore, 3,000 recreational boats are registered in this 140km² estuary. The Port Stephens Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) population size is estimated to be 160, of which 90 are considered to be resident (Möller et al. 2002). Due to concerns over the industry's impacts on dolphins, the absence of government regulation in this state and increasing competitiveness and hostility between operators, the operators formed the Port Stephens Commercial Dolphin Watch Association (PSCDWA) in 1995 and a code of conduct was developed. In 2000, the code was amended to incorporate the Australian National Guidelines for Cetacean Observation. The code of conduct addresses interaction time between vessels and dolphins, approach types, number of whale watch trips per day and interaction of vessels with calves. Allen et al. (2007) assessed tour-operator compliance with the code of conduct and whether the code of conduct was appropriate for the protection of targeted dolphin schools from tourism.

Observations of dolphins and boat activity were conducted from an elevated man-made platform on a daily basis during a 7-week period, which coincided with peak tourism activity (Allen et al., 2007). A total of 716 dolphin watch trips and 947 dolphin-boat interactions were recorded during 238.25 hours of observational work. The study found that boats approached from one to four dolphin schools during each trip, with the likelihood of a tour boat approaching more than one dolphin school per trip being 30% (Allen et al., 2007). The mean number of boats in proximity to a dolphin school was 1.7 (range 1-4; SD=0.7) and the mean number of tour and recreational boats (pooled data) interacting with dolphins was three (range = 1-10; S.D. =1.6; Allen et al. 2007). The code of conduct recommends a maximum of two

interacting boats per dolphin school. Vessels (irrespective of vessel type) were compliant to this code of conduct during 65% of interactions (Allen et al., 2007). When restricted to tour boats alone, compliance during dolphin interactions ranged from 71-97%. However, individual tour operator compliance decreased between 6-25%, when both recreational and tour boats were interacting with dolphin schools (Allen et al., 2007). The researchers suggested this is possibly because recreational boats are unaware of the code of conduct and the Australian guidelines for whales (i.e. no more than three boats should interact with cetaceans within 150m).

The code of conduct for New South Wales recommends that a tour boat should not interact with bottlenose dolphins for longer than 30 minutes. The median time tour boats interacted with dolphins was 8-24min and compliance ranged between 74-98% . The results also indicated that a dolphin school was exposed to at least one dolphin boat for a median interaction time of 43 minutes during continued interactions due to boats encountering dolphins sequentially (Allen et al. 2007). The percentage of time dolphins were exposed to tour boats for more than 30 min was 76% during such continued interactions. Allen et al. (2007) state that dolphin schools were subjected to vessels for several hours in some instances; therefore, whilst compliance was acceptable in terms of the specific requirements of the code of conduct, it was not sufficient to protect dolphins from prolonged exposure to vessels. Code of conduct compliance with respect to the way that boats approached dolphins was evaluated to be 84%. Vessels were observed interacting with calves during 21% of encounters (Allen et al., 2007), something which is not specifically prohibited by the code of conduct, but is not recommended under the Australian National Guidelines for Cetacean Observation.

In summary, the results of Allen et al. (2007) indicate a high level of compliance of dolphin-watch operators in Port Stephens to the code of conduct. Acceptable levels of compliance were deemed to be 80% or above, and this figure was the result of discussions between wildlife managers and researchers. However, the important finding in this study is that satisfactory compliance does not necessarily imply that the targeted species are resilient to tourism pressures. Results indicated that certain conditions in the code of conduct were not effective in ensuring dolphins

were alleviated from exposure to boat traffic. As in previous studies, documented in this review paper, the importance of testing the effectiveness of management strategies to protect targeted cetacean populations is fundamental to the management of cetacean tourism. Allen et al. (2007) also believed that the development of regulations for dolphin watching may be necessary to better manage this industry, i.e. create regulations that are effective in protecting targeted species, alongside enforcement presence.

A second study to investigate the efficacy of voluntary whalewatching guidelines was described by Wiley et al. (2008). The guidelines in question were part of a voluntary agreement by whalewatching operators targeting whales in the Stellwagen Bank National Marine Sanctuary, New England, USA. The voluntary agreement was negotiated by a variety of stakeholders and contained guidelines that could be quantified (e.g. speed limit). Wiley et al. (2008) placed researchers on whalewatching vessels as disguised whalewatching customers, in order to monitor levels of operator compliance, specifically vessel speeds when in close proximity to whales. At present, the recommended speed for vessels varies according to distance from whales (zone 1 [30.5-927m] = <13km/h; zone 2 [927.1 1853m] = <18.5 km/h and zone 3 [1853.1-3706m] = < 24km/h). The onboard observers tracked both the location of whales and the track and speed of the whalewatching vessels, then used GIS software to analyze speeds in the various zones around the whales, and thus compliance with guidelines. A total of twelve whalewatching vessels were monitored during a total of 46 trips (35 in 2003 and 11 in 2004; Wiley et al., 2008). The results showed that the level of compliance varied significantly both according to the speed zone, and also by whalewatching company, i.e. some companies were more compliant than others (Wiley et al., 2008). In the outer zones (2 & 3) levels of non-compliance with speed guidelines was significantly higher that within zone 1 (Wiley et al., 2008). Pooling the data for all three zones, the total level of non-compliance was high (78% non-compliance on average, ranging from 74% to 88% non-compliance between companies; Wiley et al., 2008). This study shows a lack of effectiveness of voluntary whalewatching guidelines in the field, with operators typically exceeding speed limits. The fact that this non-compliance occurred in a high

profile marine sanctuary area, a location where considerable time and effort was invested by government agencies to manage whalewatching activities. Despite apparent support by the industry of these voluntary guidelines this development is not encouraging. Wiley et al. (2008) highlight in their conclusions that "the goal of any program, whether voluntary or regulatory, should be high levels of compliance. The challenge to scientists and managers is to bring participant behavior up to the standards needed for conservation, rather than dropping standards to a point where high levels of compliance can be achieved" (p. 456).

Antarctic Tourism

The issue of marine tourism in Antarctica, and its management, is an area attracting much interest and attention. Tourism in Antarctica began in 1969 and despite its remote location and the logistical difficulties in accessing this area, the numbers of tourists visiting have been steadily increasing with an estimated 35,000 visitors in the austral summer of 2005-2006 (Landau & Splettstoesser, 2007; Williams & Crosbie, 2007). Marine mammals and penguins are a major draw for these tourists, in particular sightings of humpback whales (*Megaptera novaeangliae*), Antarctic minke whales (*Balaenoptera bonaerensis*), fin whales (*B. physalus*) and killer whales (*Orcinus orca*) are common, and blue whales (*B. musculus*), southern right whales (*Eubalaena australis*) and Arnoux's beaked whales (*Berardius arnuxii*) also sighted relatively frequently (Williams & Crosbie, 2007).

At present, tourism in Antarctica is largely managed voluntarily via the International Association of Antarctic Tour Operators (IAATO), a stakeholder-run organization. The IATTO began in 1991 with six companies, and as of 2005 – 2006 consisted of 80 full and associate members, the latter category encompassing travel agencies that promote Antarctic tourism (Landau & Splettstoesser, 2007). In the austral summer of 2005-2006, an estimated 35,000 tourists visited Antarctica, with 90% of this tourism being boat-based, via 40-45 vessels operated by IATTO members (Landau & Splettstoesser, 2007; Williams & Crosbie, 2007).

The organization has made efforts to minimize its environmental impacts, for example prohibiting members from discharging ballast waters, requiring they carry

clean up equipment for oil spills, and in 2001, the IATTO introduced a code of conduct for whalewatching to minimize their members' impacts on cetaceans (Landau & Splettstoesser, 2007; Williams & Crosbie, 2007). The association also collects and allocates charitable donations; which in the austral summer of 2005-2006 amounted to US$ 350,000 (Landau & Splettstoesser, 2007). The beneficiaries of these donations included the Antarctic Heritage Trust and wildlife research/conservation NGOs working in Antarctica. Tour operators also assist scientists in the region, helping to transport scientific personnel and equipment and offering vessels as platforms of opportunity (see the relevant section later in this review). As such, many Antarctic companies focused on cetacean-watching could be said to be practicing "whale ecotourism" (see definitions of whalewatching activities in Parsons et al., 2006).

Haase et al. (2007) conducted stakeholder interviews to assess impressions and opinions of the effectiveness of the IATTO. The general opinion was that the association was being effective at present, and played an important role in managing the environmental impacts of tourism, but a major increase in tourism activities could exceed their management capabilities. From opinions posited during the interviews, Haase et al. (2007) suggested that more site-specific guidelines, and the introduction of other regulatory mechanisms, may aid the management of Antarctic tourism activity. They also empahsised the need for stakeholder involvement in tourism management in this region and the need to monitor the effectiveness of Antarctic tourism management schemes (Haase et al., 2007).

Interpretation, Education and Outreach

Gray Whales (*Eschrichtius robustus*) can be spotted seasonally from vantage points along the Oregon coastline, which attracts whale watch tourists to this region. These whale watchers are provided with the opportunity to participate in a free of charge outreach program (entitled "whale watching spoken here"). This education program encompasses correct use of field equipment (binoculars), species familiarity and general information on cetaceans and the marine environment was provided. The

outreach program was offered at an extensive 28 vantage sites along the Oregon coastline and timing of programs coincided with summer school holidays and the gray whales' migration pattern. The outreach program was facilitated by trained volunteers and 25% of whale watchers participated in the program. To determine if the outreach program could raise participant awareness and that individual behaviour had consequences (for other people, environment and wildlife), Christensen, Rowe & Needham (2007) studied whale watchers that did and did not participate in the outreach program. The main objective was to determine if their value orientation (human centric, biocentric) was influenced as the result of program participation.

Seven whale watching sites were selected across three study periods and a total of 229 whale watchers completed the survey, a 75% response rate (Christensen, Rowe & Needham, 2007). Survey completion success was higher for respondents that completed the outreach program (66%) than did not (34%). The results indicated that respondents that participated in the outreach program were significantly more likely to: i) be aware that their daily actions affect cetaceans and the marine environment; ii) value whales as important for Oregon; and iii) believe financial input is necessary to protect whales (Christensen, Rowe & Needham, 2007). Respondents that participated in the outreach program were also more likely to agree ($p = 0.20$) that the marine environment requires protection and a healthy environment is required for whale survival. Further analysis, revealed that two clusters of respondents were apparent: (i) a strong biocentric orientation and awareness of consequences cluster; and (ii) a weaker biocentric and awareness of consequences cluster. Individuals that spoke to an outreach volunteer were more likely to be from the first cluster (66%) and individuals that did not were more likely to be from the latter. Differences among groups were found to be statistically different ($p=0.02$; Christensen, Rowe & Needham, 2007). In summary, the results indicated that respondents that had discussion with the outreach volunteers were more likely to believe that whales and the marine environment requires protection, were more biocentric[1] in their values and were aware of consequences that their actions placed on the environment (Christensen, Rowe & Needham, 2007). However, it may also be likely that the

[1] i.e. respondents that believed that all forms of life are valuable, as opposed to anthropocentrism in which humans and their society are most important.

individuals that participated in the program already possessed biocentric values, and that their greater interest in wildlife motivated them to participate in the program, to further learn about gray whales and their environment. Therefore, the authors could not determine if the differences in the group (participants and non-participants) was a results of the outreach material or prior biocentric values and attitudes to wildlife. To better understand the effectiveness of outreach programs in encouraging individuals to shift their values and attitudes, future studies are required. Studies should include longitudinal or panel data (pre and post program) with different experiment designs to determine if more "environmentally friendly" attitudes result from participation in outreach programs (Christensen, Rowe & Needham, 2007).

A second study investigating education related to whalewatching was conducted in New South Wales, Australia a region with an active whalewatching industry (International Fund for Animal Welfare 2004; and see Allen et al. 2007 above). The study by Stamation et al. (2007b) involved a three part questionnaire survey: the first part tested participants baseline knowledge, the second part taken after a whalewatching boat trip tested information learnt on the trip, and the third part questioned participants six to eight months later to investigate whether any knowledge was retained and to test whether participants had conducted any conservation related activities. Boat-based whalewatching was conducted via six vessels (ranging from 12 to 75 passengers), which primarily targeted migrating humpback whales (*Megaptera novaeangliae*). These vessels hosted on-board talks by crew covering whale biology, migration, population trends, but provided little information on whale conservation (Stamation et al., 2007b). Most crew members had no formal science or education training and there was little in the way of onboard educational materials (posters, books, videos etc).

Surveys (including a follow up survey 6-8 months later) were also conducted on land-based whalewatchers observing migrating humpbacks past a headland. During the first year of the study there were no formal interpretative panels at this land-based observation site, although occasionally a humpback whale fact sheet was handed out at the location (Stamation et al., 2007b). In the second year of the study, a small observation platform was set up with interpretative panels on whale behaviour,

their migration route, the latest whale count data and information on whaling. Moreover, a public talk program began with 15 minute talks every half hour given by rangers. There was also some information on whales in the Botany Bay National Park Discovery Center, which land-based whalewatchers could access (Stamation et al., 2007b).

The researchers discovered that most (55%) boat-based whalewatchers increased their knowledge of whales between the first and second part of the survey, i.e. as the result of taking the whalewatching trip, whilst 41% of whalewatchers maintained the same level of knowledge (Stamation et al., 2007b). The results of the follow up survey, 6-8 months later, showed that 41% knew less about whales than they did directly after trip (65% of which had had increased their knowledge on the whalewatching trip), while 45% the same and 14% had actually improved in their knowledge on whales. This suggests the educational value of whalewatching trips in this area, at present, is short term. For land-based whale watchers, there was no significant difference between initial knowledge and levels of knowledge 6-8 months later (Stamation et al., 2007b).

Interestingly, six months later, none of the boat-based watchers had taken another whalewatching boat trip, but 33% had been whalewatching from land (Stamation et al., 2007b). However, 15% of land-based whalewatchers had taken a boat-based whalewatching trip, and 45% had whale-watched from land. Fifty-percent of the land-based whalewatchers had been on a whalewatching boat trip prior to being surveyed. Six months after the initial survey, 89% of the land-based whalewatchers had recommended their category of whalewatching to someone, as did 91% of boat-based whalewatchers (Stamation et al., 2007b).

Whalewatchers of both categories were given an environmental rating based on the degree to which they conducted certain environmental activities. There was no significant difference in the environmental rating between land and boat-based whalewatchers, nor did the participants' environmental ratings change six months after their whalewatching experience. Boat-based whalewatchers were found to be more likely to say that they would donate money or actively be involved in an environmental group than land-based whale-watchers, and the willingness to donate

money increased with the participants' environmental rating (Stamation et al., 2007b).

For another component of the survey, whalewatchers were requested to consider five activities, that could "help" whales. Boat-based whalewatchers were more likely than land-based whale watchers to state that they would tell people to pick up litter that could harm wildlife, would tell people about whales, or inform people about whale conservation (Stamation et al., 2007b). The other two activities offered were for participants to find out more about whales, or find out more about wildlife in general. During the follow-up survey 6-8 months later, participants reported that they had done the stated activities, or more. Of the activities conducted, picking up litter or telling people about whales were the most highly performed (Stamation et al., 2007b).

In addition to the above surveys, a brochure on whale biology, behaviour, migration and conservation, was distributed to the boat-based whale watchers. However, by the time the trip had been completed only 12% had read it, 46% stated that they had read parts of it and would read it later, and the rest did not read it, but again said that they would read it later - 60% did in fact read it later and a further 38% read parts of the brochure later (Stamation et al., 2007b). In terms of the information on the brochure which the participants thought increased their knowledge, two-thirds stated that the information on whale migration was most useful and 52% highlighted the section on threats to whales, and 35% noted the section on actions that participants could take to help conserve whales (Stamation et al., 2007b).

Of these latter suggested actions on the brochure, 31% had stated that they would attempt to do some of these actions, and 25% stated that they would do all of them. Six months later, 53% of responding participants had done some of the suggested actions but only 7% had done them all. It was also found that 44% of respondents had shown the brochure to other people and 54% had shown the brochure to children, thus increasing the educational effectiveness of the brochure (Stamation et al., 2007b).

In conclusion, Stamation et al. (2007b) found that whalewatching boat trips resulted in some short-term increase in knowledge about whales. Participating in

whalewatching activities also seemed to result in members of the public taking some actions to aid whale conservation. The brochure that was distributed also appeared to aid in raising cetacean awareness and promoting conservation-oriented behavior. At present, the amount of interpretation provided during whalewatching activities in New South Wales could be improved, but nonetheless it was found that whalewatching had the potential to be a tool for increasing environmental awareness and conservation oriented behaviour in the public.

Although not a cetacean, the Florida manatee (*Trichechus manatus latirostris*) is an threatened species stock that faces anthropogenic pressures similar to those faced by cetaceans, in particular the threat of boat strikes. As such, lessons learnt from manatee management could be directly applicable to the management of cetacean impacts. As in several cetacean populations, regulations have been developed to protect manatees from watercraft injuries. Regulations include speed zones, speed limits and no-entry zones in manatee habitat. Due to the large intensity of boat traffic within areas frequented by manatees a number of non-profit organizations have developed education material to promote manatee conservation (prevent water-craft related mortality and protect manatee habitat) and supplement regulatory interventions to conserve manatees. Boaters receive kits (waterproof maps, sunglasses, fish measuring sticks, floating key chain) from the Manatee Watch volunteer and the volunteer provides the boat with a brief information talk (approximately 1min) on manatees with particular emphasis on their presence and speed limits. The talks are designed to be non-confrontational. Morris, Jacobson, & Flamm (2007) tested the efficacy of these outreach programs, which is an important but often neglected task as resources (time, energy) are invested into these outreach programs and efficacy is often assumed, but not evaluated. Morris, Jacobson, & Flamm (2007) surveyed boaters that both had received the outreach material, and a control group boaters that had not, to test whether i) the outreach material improved boater knowledge of manatees and their conservation; ii) the outreach material changed attitudes towards support for manatee protection; and iii) pro-conservation behavioural intentions were elevated among Tampa Bay boaters. A total of 499 surveys gathering demographic data, consisting of questions to test knowledge,

attitude, and behaviour towere completed (202 (40.5%) from treatment group and 297 (59.5%) from control group; Morris, Jacobson, & Flamm, 2007). Results showed no significant different in the socio-demographic backgrounds between the outreach group and the control group (e.g., boater experience, membership to conservation organisation, utilisation of Tampa Bay), nor any significant differences in boating behaviour (carrying nautical charts while boating, maintaining lower speed while boating in shallow areas and watching for manatees in shallow areas), participant's levels of knowledge about manatees, or boaters' attitudes to manatees and conservation. Moreover, several open-ended questions asking about boating behaviour (e.g. what would boaters do if they observed an injured manatee) were not different between the groups. However, the control group felt significantly more strongly that speed zone signs were appropriate than the group receiving outreach materials (Morris, Jacobson, & Flamm, 2007). In summary, results indicate that the manatee outreach program had minimal effects. It was suggested that more interaction with boaters might be a more effective means of changing behaviours, i.e. going beyond simply handing out educational materials (Morris, Jacobson, & Flamm, 2007), and possibly longer and more frequent interactions to emphasise the need for responsible boater behaviour, as information in newspapers, magazines and interpretative materials at marinas.

A second study by Sorice, Flamm & McDonald (2007) from a prior study indicated that personal water craft were more likely to be less compliant to speed restrictions set up to protect manatees, and that vessel length was positively correlated with compliance. Moreover, previous data has indicated that compliance improves in the presence of enforcement officers. However, due to the widespread dispersed localities of manatees it is not feasible for an enforcement officer to be continuously present within all the prescribed manatee zones. The objective of the study by Sorice, et al. (2007) was to document the effectiveness of an alternative management strategy that increased compliance but did not strain resources (enforcement officers). Secondly, the study also examined the covariants that allow law enforcement officers to understand and predict non-compliance behaviour. The researchers, along with appropriate government bodies, developed a sign that had three essential elements:

the sign read “Watch your speed” which is a persuasive gesture to encourage vessels to comply to speed limit; the sign also included the wording “Max Fine $500”, a persuasive message designed to make the reader feel a personal threat (loss of finances) and therefore, encourage compliance behaviour; and finally, the signs also included a picture of a manatee to promote awareness of consequences of non compliance. Vessel compliance with speed restrictions was divided into three categories (Sorice, Flamm & McDonald, 2007): “compliant” (vessel operates at slow speed, no wake), “technically noncompliant” (vessel’s bow was elevated with significant wake from stern and bow) and “blatantly noncompliant” (vessel was travelling fast enough to raise boat of the water) - all measures of speed were qualitative. To document the effectiveness of the installed signs, the researchers documented vessel speed and, thus, compliance before and after signs were posted. A total of 1170 vessels were observed before signs and signage and 636 vessels post signage. The compliance rate decreased from 61% to 58% (3% decrease) after signs were posted (Sorice, Flamm & McDonald, 2007). “Technical non-compliance” decreased from 30% to 28%, whilst “blatant non-compliance” increased from 8% to 14% (Sorice, Flamm & McDonald, 2007). It is possible that “blantant non-compliance” increased post signage due to a contrarian attitude in individuals, i.e. individuals perceiving the signs to be reducing their personal freedom and thus to act in a non-compliant manner. Or simply boaters did not observe the sign, or were not influenced by the message (Sorice, Flamm & McDonald, 2007). The researchers found that compliance varied according to vessel type: “Jon boats” (the smallest vessels) were least compliant and “roundabouts” and sailboats were most compliant (Sorice, Flamm & McDonald, 2007). Logistic regression models also demonstrated that boat type and time of day were significantly related to compliance, for all types of vessel compliance was less likely in the mornings, as opposed to the afternoon (Sorice, Flamm & McDonald, 2007). These results are indicative that passive methods of persuasion, such as signs, are not adequate in improving boater compliance to speed limits. Previous studies in the area reported that compliance improves with enforcement officers. It was suggested that allusions to the presence of an enforcement officer in the area (signage that indicates enforcement officer

presence) or '"dummy" police cars', may be useful strategies for improving compliance without burdening resources, i.e. requiring more enforcement officers (Sorice, Flamm & McDonald, 2007).

The lessons learnt in the two above studies, albeit related to protection of manatees, could be extrapolated to management measures for cetaceans. Boat-based cetacean tourism was identified as possibly harmful to cetaceans at an individual and population level (International Whaling Commission, 2006) and measures such as speed restrictions are commonly introduced to mitigate these impacts. However, compliance is with regulations is often lax (Scarpaci, Dayanthi, & Corkeron, 2003). Thus, studies that measure compliance and, especially factors that may increase or decrease compliance, are extremely important to ensure that cetacean tourism is sustainable.

On a more positive note, Whaley et al. (2007) documents a case study where adaptive and precautionary management arose as the result of new patterns in habitat use by humpback whales in the Dominican Republic. The waters to the north of the Dominican Republic, in particular Navidad and Silver Banks, and Samana Bay on the mainland coast are areas where there is a high density of humpback whale (*Megaptera novaeangliae*) watching activity (Hoyt, 2001). To manage this activity the Dominican government declared the waters of Silver Bank a marine mammal sanctuary in 1986, which entailed prohibitions on the killing, capture and harassment of cetaceans, prohibitions on certain types of fishing activity and the introduction of a code of for whalewatching activities (Whaley et al., 2007). In 1996, the sanctuary was extended to include Navidad Bank and Samana Bay, and the protective laws for humpback whales were extended to include all Dominican waters (Whaley et al., 2007). However, in 2004, this protection was then reduced to sanctuary areas in northern waters only, partly because this was believed to be the only area inhabited routinely by humpback whales. However, in March 2005, several humpback whales were sighted in the southeastern waters of the Dominican Republic, including a mother and calf pair. Moreover, several speedboats were reported approaching closely to the animals, and in turn behaviours suggesting "disturbance" were exhibited by the whales (Whaley et al., 2007).

When researchers informed the government of these encounters and the possibility for whale harassment a workshop was arranged in November 2005 with various tourism operators from the southeastern area, at which a 'Guide to Good Practices for the Conservation of Marine Mammals' was developed and introduced. This code of conduct was produced in consultation with many stakeholders including government officials, scientists, tour operators and members of the local community. This workshop was followed by the initiation of a long term training program to promote the use of codes of conduct and to highlight best practices for responsible whalewatching (Whaley et al., 2007). A second workshop was held in April 2006 to further promote the whalewatching guidelines, its rationale and the concept of ecotourism in general. Again multiple stakeholders were involved in the workshop including tour operators, scientists and representatives from the merchant navy, the environmental police and the Dominican Navy (Whaley et al., 2007). Although voluntary, the whalewatching guidelines have apparently been well received and widely implemented. The authors note that "the authorities of the Dominican Republic acknowledged the harassment caused by the vessels in southern waters and promoted whalewatching guidelines throughout their waters as a precautionary measure in the face of uncertainty over the entire range of humpback whales" (Whaley et al., 2007, p. 3).

Precautionary and adaptive whalewatching management in the face of feedback from new scientific data is important, but such rapid intervention is rarely seen. The researchers also noted that "this case study also shows how important it is that those directly affected by voluntary guidelines are not only aware of them, but also fully understand the reasons behind them" (Whaley et al., 2007, p. 3). Again, in areas where code of conduct use is voluntary, or regulations may be in place but are unmonitored or not enforced, compliance with codes of conduct is reliant upon the acceptance and understanding of individual tour operators. Codes of conduct developed with multiple stakeholders, with input from scientists, seem to, at least on the surface, appear to gain acceptance and are more likely to be widely utilized.

Reduction of Whalewatching Impacts (Whalewatching Management)

Measures that researchers have recommended in studies over the past year, as ways and means to reduce the pressure of tourism on cetaceans and sirenians, are highlighted in this section of the report. The authors of this paper have also made additional comment by referring to past relevant literature and their own experiences in cetacean tourism. To reduce the impacts of tourism the authors of the papers reviewed have recommended the following strategies:

Passive Strategies

- Distribution of education material to locals and tourist (Camargo & Bellini, 2007). Even though this strategy is often used, research is beginning to demonstrate that this strategy may not be effective in either improving compliance of vessels to regulations (Camargo & Bellini, 2007) or shifting boater attitude towards conservation values (Camargo & Bellini, 2007). Therefore, in light of current findings it is recommended that wildlife managers test the efficiency of educational material (regardless of format) and not assume that passive strategies are effective in mitigating anthropogenic impact on marine mammals.
- Create the illusion of enforcement presence, e.g. dummy enforcement vehicles (Sorice *et al*., 2007).
- Collaborative research between researchers and government organisations (Anwa *et* al., 2007; Sorice *et al*., 2007). This is extremely beneficial as it allows wildlife managers and researchers to work together to mitigate human impacts by widening the doors of communication.

Non-passive Strategies

- Propeller Guards to prevent collisions between vessels and boats (Camargo & Bellini, 2007). This strategy would require financial expenditure to the individual boater unless subsidised by the government. However, this strategy would be extremely valuable in regions were boat traffic is congested and the

likelihood of boat strikes with marine mammals is high (Florida). Such a drastic measure, would also be warranted in instances were the vulnerable species is deemed as endangered.

- Test the effectiveness of new management techniques (e.g., signage) by monitoring compliance of vessels to regulations/code of conduct as demonstrated in Sorice et al. (2007). Research publications this year have clearly demonstrated the importance of this strategy and not to assume that passive strategies are effective. Furthermore, this strategy provides accountability to the funding sources, ensuring that monies are distributed towards an effective purpose.
- Test the efficacy of regulations or guiding principles to ensure that they are effective in the promotion of a sustainable industry, i.e. they protect targeted species, the environment, and tourist and industry participants.
- Continuously monitor compliance of vessels to regulations/code of practices. According the revised manatee plan, compliance studies are a requirement. Literature on compliance of cetacean tourism has indicated that compliance cannot be assumed (Scarpaci et al., 2003) and therefore, it may be appropriate that similar strategies are instituted cetacean tourist sites.

It is important that scientists and wildlife managers are not tempted to drop standards to a point where levels of compliance can be easily achieved (Wiley et al., 2008). This may be crucial in areas were unsatisfactory compliance has been documented and wildlife managers are sanctioned to improve compliance but do not have the necessary funds to facilitate an enforcement officer and therefore, drop industry standards. If wildlife managers opt for this strategy, they jeopardize the ability to protect targeted cetaceans from tourism pressure and create an industry that is further unsustainable.

Swim-With-Cetacean Tourism

Courbis (2007) monitored the intensity of boat and swimmer activity in three bays on the Big Island of Hawaii which spinner dolphins (*Stenella longirostris*) inhabit during the day: Kealake'akua, Honaunau and Kauhako Bays. The bays were observed over a total period of 39 days from land-based field stations and dolphin entry and exit times, to and from the bay, were recorded, as were the types of boats and number of swimmers that were present, as well as how swimmers entered the water (Courbis, 2007). In Kealake'akua and Honaunau Bays, the total number of swimmers peaked between 10 and 12am, but there was no distinct peak, and fewer boats and swimmers in Kauhako Bay. The mean number of swimmers and vessels per hour in Kealake'akua, Honaunau, and Kauhako Bays were 13.2 ± 9.7 (S.E.), 10.1 ± 8.9 and 4.1 ±2.4, respectively (Courbis, 2007). There were a significantly higher number of kayaks, motorboats and zodiacs in Kealake'akua Bay. Also in Kealake'akua Bay, there were more swimmers in the northern part of the Bay, the area that is most highly frequented by dolphins (Courbis, 2004, 2007). However, the numbers of swimmers in the water did not seem to be significantly higher when dolphins were present in the Bay – although the author notes that after 8am, the use of the Bay was so high that obtaining data was problematic (Courbis, 2007).

In Honaunau Bay, the number of vessels and swimmers was also not significantly higher when dolphins were present`. However, in Kauhako Bay, there was a significant relationship with the number of swimmers in the water being substantively higher when dolphins were present (Courbis, 2007). The level of tourism in the three bays has increased substantially in past few decades, and in Kauhako Bay at least, the number of swimmers was specifically related to the presence of spinner dolphins, and the situation thus warrants attention. Courbis (2007) suggests that due to the differing nature and intensity of tourism in the three bays that management measures should be implemented individually for each bay.

Captive Swim-With-Cetacean Tourism

Curtin and Wilkes (2007) describe interviews with participants of captive swim-with-dolphin programs Antigua, the Bahamas, Mexico, the Dominican Republic, Florida, Spain and Portugal, for their impressions of the activity. As the type of activity specifically described in the paper takes place in a captive setting, it is not "whalewatching" as such - whalewatching is defined as involving viewing of cetaceans in the wild (see Parsons et al. (2006) for definitions of types of whalewatching activity). Nonetheless, the results may have some implications for public attitudes, motivations and perceptions for swim-with-cetacean programs in the wild.

There is a large market for swim-with-dolphin activities, as illustrated in the study: "when UK television viewers were asked to vote on the 50 things they thought people should do in their lifetime: swimming with dolphins ranked first" (p. 131 in Curtin & Wilkes, 2007). There is a continuum for dolphin human–interactions during tourism activities, from "authentic", i.e. tourists interacting with wild, free living cetaceans, to "staged", i.e. trained dolphins in a captive setting, and the study deals with the latter. Members of the public who had swam with dolphins were interviewed via a university website-based survey (Curtin & Wilkes, 2007). All those interviewed had interacted with bottlenose dolphins (*Tursiops* spp.) and "in nearly all cases, swimming with dolphins represented a long-standing desire based upon the perception of dolphins as charismatic mega-fauna and popular representations of dolphins in the media (Curtin & Wilkes, 2007, p. 135). The participants considered that activities were very expensive, with little time for interaction with the dolphins. They also stated feeling that the interactions were very "staged" and unnatural (Curtin & Wilkes, 2007).

The participants also expressed concerns about the welfare of the animals and doubts about the ethics of keeping animals in captivity, but assumed that the animals were all bred in captivity, or had been somehow rescued, although several participants thought that animals would have been taken from the wild. The authors noted that "despite the investment by leading marine parks, tourists are not easily convinced as to the suitability of the setting or the management of the activity;

enclosures tended to leave a lasting negative impression" (Curtin & Wilkes, 2007, p.136). Several participants also recollected "erratic behaviour" by the dolphins that could have been potentially injurious and many stated that the size and power of the dolphins made them fearful. There was a general belief that "the dolphins genuinely enjoyed playing and performing and that this was a sign of well-being" (Curtin & Wilkes, 2007, p. 140), although some thought that the dolphins participated to "alleviate their boredom".

In terms of the education and interpretation provided by the facilities, one of the key elements that often justifies existence of such facilities, the respondents replied that they could not remember many of the details of the interpretation, that they did not consider it to be very factual, and that some viewed the material to be "fill in" while the animals were being prepared (Curtin & Wilkes, 2007). The researchers summarise that "Despite the strong desire and intensity of the experience at the time, all respondents had 'problems' with seeing such powerful intelligent creatures in captivity" (Curtin & Wilkes, 2007, p. 144). It's possible that the expense of, dissatisfaction with the "staged" nature, and ethical concerns with captive-swim-with dolphin programs could possibly lead to an increased demand for swim-with-cetacean tourism in the wild to gain "authentic" interactions with cetaceans, and the links between the two types of tourism could be investigated.

Dolphin Assisted Therapy

Dolphin assisted therapy (hereafter referred to as DAT) refers to the use of dolphins for the treatment of illness, disability and psychopathology. This lucrative business began in the 1970s and provides participants with the opportunity to interact or swim with dolphins, typically in captive environments and so, as noted above, is not considered to be whalewatching *per se* (see Parsons et al., 2006). However, DAT is sometimes used as a marketing lure from with swim-with-cetacean tourism in the wild, and thus recent publications on this type of activity merits discussion here.

Previous literature has indicated that the effectiveness of DAT cannot be supported by credible scientific data (Marino & Lilienfeld, 1998; Humphries, 2003). Two studies that proposed therapeutic benefits of DAT for disabled children were

found to have no controls, potentially biased raters and numerous methodological and analytical flaws (Marino & Lilienfeld, 1998). Five years later, a similar analysis (Humphries, 2003), was conducted on an additional four studies and again found a lack of experimental controls and analytical flaws.

Moreover, Brensing, Linke and Todt (2003) investigated the claim used by many DAT practitioners that therapeutic benefits arise in DAT as the result of ultrasound use by dolphins. Observations of dolphin behaviour in 2 DAT programs was conducted to determine if the behaviour of dolphins was consistent with the concept that dolphins will echolocate towards human participants. Results did not support this hypothesis and therefore, did not meet the minimal criteria required for common ultrasound therapies. Furthermore, there is no scientific evidence to suggest that dolphin echolocation can heal humans.

However, despite DAT's lack of scientific validity, the industry is growing. Further evaluating and investigating the claims for DAT as a therapeutic treatment, Marino & Lilienfeld (2007) added to their previous critiques by reviewing five published, peer-reviewed, DAT studies (Antonioli & Reveley, 2005; Iikura *et al*., 2001; Lukina, 1999; Servais, 1999; Webb & Drummond, 2001) which have appeared in journals since 1998. Four of the five publications posited that DAT participants improved. Again, Marino & Lilienfeld (2007) found the studies to be scientifically flawed and plagued by several threats to both internal and construct validity, a critique opinion that was also supported for one of the studies by Basil & Mathews (2005). Furthermore, Marino & Lilienfeld (2007) noted that positive results cited by proponents of DAT did not necessarily persist in patients. In fact, DAT at best appears no more effective than using domesticated animals such as dogs or cats, and is far more expensive and clearly carries higher risks to participants (for example contracting diseases from the dolphins, or sustaining injuries). Marino & Lilienfeld (2007) concluded that a decade after the authors' initial review, there is still no compelling evidence supports DAT as a legitimate therapy. Therefore, ethical questions need to be raised about DAT and its widespread use (e.g. Bahamas, China, Israel, Japan, Mexico, Russia, United States) and promotion. Marino & Lilienfeld (2007) recommend (at the very least) that DAT practitioners should inform

participants (and/or their parents or guardians) that this treatment lacks scientific validity as an effective treatment. Arguably, they should also be informed of the potential risks to the participant. Such information would allow consumers of DAT to make educated decisions regarding the costs and benefits of the practice.

Wild Dolphin Feeding Programs

The feeding, or provisioning, of wild dolphins occurs in several locations, most famously Monkey Mia, Shark Bay, Western Australia, but this tourism activity is somewhat controversial (Orams, 2002). In Shark Bay, a high mortality rate of bottlenose dolphin (*Tursiops sp.*) calves was associated with tourist feeding of lactating mothers until a management regime was implemented (Mann et al., 2000; Mann & Kemps, 2003). A paper by Neil and Holmes (2008) documented mortality rate of calves born to provisioned mothers at a wild provisioning program located at Tangalooma (Queensland, Australia). At present, the provisioned group comprises of ten dolphins (six adults, two subadults and two calves). The results of the study indicate a 0% calf mortality (including both orphaned and first born calves) during an extensive (15 years) period of time. It was suggested by Neil and Holmes (2008) that the low mortality is a result of:

i) consultation with the scientific literature (on dolphin provisioning) to develop effective management frameworks;
ii) the location of the provisioning area (i.e. an area of good water quality, distant from sources of pollution, with good tidal flushing);
iii) continual monitoring of water quality parameters (once per week);
iv) the nature of the management regime, i.e. limited feeding sessions (one per day) and an appropriate, scheduled interaction time (just before sunset to avoid interaction between dolphins and boat vessels and coincide diurnal foraging patterns);
v) the implementation and practice of disinfection (washing hands prior to handling fish) to prevent zoonotic transfer of pathogens; and
vii) fish being provided to dolphins having a high nutritional value.

The study by Neil and Holmes (2008) demonstrates that effective management practices can be developed when all components of the industry (existing literature, ecology and behaviour of the target species, and the threat of zoonosis) are considered and implemented into the management framework. These findings are important to the cetacean tourism industry as they indicate important criteria that wildlife managers need to consider in order to develop effective management strategies.

Whalewatching Vessels as Scientific Platforms of Opportunity

In their review of whalewatching activity in Antarctica, Williams & Crosbie (2007) emphasised that many member companies of the International Association of Antarctic Tour Operators (IAATO) allow scientists to conduct research using their vessels as scientific platforms of opportunity, i.e. scientists are able to gather research data from the decks of tourism vessels. Tourism operations in Antarctica also provide information to scientists which can be beneficial, for example information on ship strikes in the region are reported to the US Marine Mammal Commission, and photographs of cetaceans are provided to various photo-identification catalogues (Williams & Crosbie, 2007). In particular the Antarctic humpback whale and killer whale catalogues have benefited from photographs collected from Antarctic whalewatching vessels, for example 1197 photos were provided of 568 individual humpback whales (half of the identified individuals from the Antarctic Peninsula) to the Antarctic humpback whale catalogue from this source (Williams & Crosbie, 2007). Because these contributed photographs, important information on humpback whale migration routes has been discovered: Stevick et al. (2004) managed to match a whale from the Antarctic peninsular with a photograph taken from western South America, and similarly Stevick et al. (2006) matched a whale from South Georgia with its breeding ground off the coast of Brazil.

In addition to photographic information, genetic samples have been gathered from tourism vessels via non-lethal biopsies, and tour vessels have been used to test out new research techniques and methodologies (Williams & Crosbie, 2007). Altogether, the in kind contribution of boat access for scientists alone was estimated

to be equivalent to US$ 1 million, logistically (Williams & Crosbie, 2007), but the scientific data gathered could prove to be invaluable. Williams & Crosbie (2007) conclude that there is great potential for the use of Antarctic tour vessels in future research such as investigations on whale abundance, stock structure, migration routes and distribution (particularly when related to ice occurrence and changing environmental conditions).

Other Whalewatching Research

Predictive Modeling of Whalewatching Operator Behavior

One of the best regions in the world to observe whales is the Saguenay St. Lawrence Marine Park (SSLMP) and the adjacent proposed marine protected area (MPA) in Canada. This area is biodiversity rich, including twelve species of marine mammals, six of which considered endangered species (DFO, 2004). Anthropogenic activities (e.g. shipping, whalewatching and other tourism and recreation activities) create intense traffic in this area, which poses cumulative threats (collisions of vessels with marine mammals, disruption of feeding/social activities, exposure to pollutants, etc) to marine wildlife that utilize this region (DFO, 2004). The study presented by Anwar et al. (2007) is a collaborative research project with the Marine Park and MPA managers with the objective to create a multi-agent system (MAS) model to examine the interactions between traffic and marine mammals in the estuary. The paper describes a prototype MAS model used to investigate the different strategies that whalewatching operators use to search for whales, and how these strategies could affect the target whales. Whalewatching operators were divided into categories of “cooperative” (they shared information on whale location and expected the same courtesy to be shown by other whale watch operators) or “non-cooperative” (they did not share information about the location of whales). Anwar et al. (2007) then compared which strategy (cooperative versus non-cooperative) had the best result for the whalewatcher, measured as the length of time individual whalewatch boats interacted with whales, which they termed the "happy factor". The researchers assumed that longer interactions with whales led to greater satisfaction for the

tourists. However, the greater the level of interaction, the greater, one would assume, the level of impact on the target species, for example, disruption in feeding/social activities. The researchers compiled whalewatching effort data from 2000 to 2002 (from 27 vessels taking 341 trips), and the number individual whales encountered, and of which species (an important factor as whalewatching guidelines vary between species being observed for that location). Other data sources were also obtained (e.g., bathymetric and coastline maps, regional whalewatching literature) to derive the principle components of the multi-agent model and to determine the strategies that whalewatching operators employed (cooperative or non- cooperative).

The results of the model indicated that the "happy factor" values were marginally better for non-cooperative operators (5.65) than cooperative ones (5.25) (Anwar et al., 2007). Also, the happy factor increased noticeably from 5.59 to 8.60 when the number of whales increased from 20 to 40 - increases in whale numbers increased happy factor regardless of the operator strategy (Anwar et al., 2007). Moreover, non-cooperative operators had longer times with whales (when whales were encountered), although the lack of cooperative behaviour meant that rates of encounters with whales would be reduced. The highest happy values were obtained for operators that switched strategies (i.e. they get the benefits of both strategies). However, a higher happy value may also mean a higher negative impact on whales, with more time being spent in their proximity and thus a higher risk of collision, more exposure to underwater noise, etc.

According to local regulations, whalewatching operators are expected to share information on the location of whales. However, the data contained within Anwar et al. (2007) suggest that communicative behaviour between tour-operators may be increasing pressures on whales, presenting them with more exposure to boat traffic. This implies that the current regulations may need to be revised in the light of these results. Unfortunately, the authors did not address this problem in their paper.

Final Comments and Conclusion

Over the past year, many of the arising research publications are of particular importance to the management of whalewatching as they represent the need to test the effectiveness of management strategies (e.g., out reach material, code of conducts) in the field. Management strategies should be designed to protect wildlife (this instance marine mammals) from anthropogenic activities and encourage the sustainable use of resources. The trend presented in this review paper, is that passive measures to encourage compliance (educational volunteer, education kits) are not effective to date (e.g. an educational volunteer with education kits did not significantly change boater behaviour or motivated more compliant behaviour: reduction of speed in manatee zones). Past literature (e.g. Gorzelany, 2001) has indicated that the presence of enforcement officers is the most likely strategy to shift boater non-compliant behaviour to compliant behaviour. It may be worthwhile considering a reduction in financial expenditure towards other management strategies (e.g. outreach material) in order to support enforcement officers to police regions that are heavily congested with boat traffic and consist of vulnerable (manatee) species until alternative management strategies are developed and proven effective. Alternatively, cetacean tourist regions can impose an additional charge to whalewatchers to financially support the presence of enforcement officers in these regions. Considering that cetacean tourism is a billion dollar industry (Hoyt, 2001), resources may need to be allocated to ensure that both the targeted species and the industry remain viable.

Acknowledgements

This paper was presented to the Subcommittee on Whalewatching of the Scientific Committee of the International Whaling Commission during the 60th Annual Meeting of the International Whaling Commission in Santiago, Chile, in June 2008, as paper

SC/60/WW1. The authors wish to thank Kasey Stamation for providing papers for this review.

References

Allen, S., Smith, H., Waples, K. & Harcourt, R. (2007). The voluntary code of conduct for dolphin watching in Port Stephens, Australia: is self-regulation an effective management tool? *Journal of Cetacean Research and Management 9*(2), 159–166.

Antonioli, C. & Reveley, M.A.(2005). Randomized controlled trial of animal facilitated therapy with dolphins in the treatment of depression. *British Medical Journa*l *331*, 1231–1234.

Anwar, S.M., Jeanneret, C.A., Parrott, L. & Marceau, D.J. (2007) Conceptualization and implementation of a multi-agent model to simulate whale-watching tours in the St. Lawrence Estuary in Quebec, Canada. *Environmental Modelling & Software 22* (12), 1775-1787.

Basil, B. & Mathews M. (2005) Methodological concerns about animal facilitated therapy with dolphins. *British Medical Journal* 331, 1407.

Brensing, K., Linke, K. & Todt, D. (2003). Can dolphins heal by ultrasound. *Journal of Theoretical Biology 225*(1), 99–105.

Caballero, S., Trujillo, F., Vianna, J. A., Barrios-Garrido, H., Montiel, M.G., Beltrán- Pedreros, S., Marmontel, M., Santos, M.C., Rossi-Santos, M., Santos, F.R. & Baker, C.S. (2007). Taxonomic status of the genus *Sotalia*: species-level ranking for "tucuxi" (*Sotalia fluviatilis*) and "costero" (*Sotalia guianensis*) dolphins. *Marine Mammmal Science 23*(2), 358—386.

Camargo, F.C. & Bellini**,** C. (2007). Report on the collision between a spinner dolphin and a boat in the Fernando de Noronha Archipelago, Western Equatorial Atlantic, Brazil. *Biota Neotropica 7*(1), 209-211.

Carrera, M.L., Favaro, E.G.P. & Souto, A. (2008). The response of marine tucuxis (*Sotalia fluviatilis*) towards tourist boats involves avoidance behaviour and a reduction in foraging. *Animal Welfare 17*, 117-123.

Christensen, A., Rowe, S. & Needham, M.D. (2007). Value orientations, awareness of consequences, and participation in a whale watching education program in Oregon. *Human Dimensions of Wildlife 12* (4), 289–293.

Courbis, S. (2004). *Behavior of Hawai'ian spinner dolphins* (Stenella longirostris) *in response to vessels/swimmers*. Master's thesis. San Francisco State University, San Francisco, CA.

Courbis, S. (2007). Effect of spinner dolphin presence on level of swimmer and vessel activity in Hawai'ian Bays. *Tourism in Marine Environments 4*(1): 1-14.

Curtin, S. & K. Wilkes. (2007). Swimming with captive dolphins: current debates and post-experience dissonance. *International Journal of Tourism Research* 9: 131-146.

DFO (2004). St. Lawrence Estuary Marine Protected Area Project. Available from: <http://www.qc.dfo-mpo.gc.ca/ZPMEstuaire/en/proj.asp>.

Flores, P.A.C. (1999) Preliminary results of a photoidentification study of the marine tucuxi, Sotalia fluvialis, in southern Brazil. *Marine Mammal Science 15*(3), 840-847.

Garrod, B. & Fennell, D.A. (2004). An analysis of whalewatching Codes of Conduct. *Annals of Tourism Research 31*(2), 334-352

Haase, D., Storey, B., McIntosh, A., Carr, A. & Gilbert, N. (2007). Stakeholders perspectives on regulatory aspects of Antarctic tourism. *Tourism in Marine Environments 4*(2-3), 167-183.

Hoyt, E. (2001). *Whale watching 2001: worldwide tourism numbers, expenditures, and expanding socioeconomic benefits.* Crowborough: International Fund for Animal Welfare.

Humphries, T. L. (2003). Effectiveness of dolphin-assisted therapy as a behavioral intervention for young children with disabilities. *Bridges: Practice-Based Research Synthesis* 1, 1–9.

Iikura, Y, Sakamoto, Y., Imai, T., Akai, L., Matsuoka, T., Sugihara, K., Utumi, M. & Tomikawa, M. (2001). Dolphin assisted seawater therapy for severe atopic dermatitis: an immunological and psychological study. *Archives of Allergy and Immunology 124* (1-3), 389–390.

International Fund for Animal Welfare (2004) F*rom whalers to whale watchers – the growth of whale watching tourism in Australia.* IFAW Asia Pacific, Surrey Hills, New South Wales. 34pp.

International Whaling Commission (2006). Report of the Sub-committee on Whalewatching. *Journal of Cetacean Research and Management* 8(Suppl.), 241-251.

Gorzelany, J. F. 2001. Effects of increased police enforcement on boater compliance in speed restricted areas. Report 782. Sarasota, FL: Mote Marine Lanoratory.

Landau, D. & Splettstoesser, J. (2007) Management of tourism in the marine environment of Antarctica: the IAATO perspective. *Tourism in Marine Environments 4*(2-3), 185-193.

Lukina, L.N. (1999). Influence of dolphin-assisted therapy sessions on the functional state of children with psychoneurological symptoms of diseases. *Human Physiology 25*(6), 676–679.

Mann, J. & Kemps, C. (2003). The effects of provisioning on maternal care in wild bottlenose dolphins, Shark Bay, Australia. In N. Gales, M. Hindell & R. Kirkwood (Eds.), *Marine Mammals: Fisheries, Tourism and Management Issues* (pp. 304–317). Collingwood: CSIRO Publishing.

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.

Marino, L. & Lilienfeld, S.O. (1998). Dolphin-assisted therapy: flawed data, flawed conclusions. *Anthrozoos 11*(4), 194–200.

Marino, L. & Lilienfeld, S.O. (2007). Dolphin-assisted therapy: more flawed data and more flawed conclusions. *Anthrozoos 20*(3), 239-249.

Möller, L.M., Allen, S.J. & Harcourt, R.G. (2002). Group characteristics, site fidelity and seasonal abundance of bottlenose dolphins (*Tursiops aduncus*) in Jervis Bay and Port Stephens, southeastern Australia. *Australian Mammalogy 24*(1), 11-21.

Morris, J.K., Jacobson, S.K. & Flamm, R.O. (2007) Lessons from an evaluation of a boater outreach program for manatee protection. *Environmental Management 40*(4), 596–602.

Neil, D.T. & Holmes, B.J. (2008). Survival of bottlenose dolphin (*Tursiops sp.*) calves at a wild dolphin provisioning program, Tangalooma, Australia. *Anthrozoos 21*(1), 57-69.

Orams, M. B. (2002). Feeding wildlife as a tourism attraction: a review of issues and impacts. *Tourism Management 23*(3), 281–293.

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. SC/56/WW6.

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 whalewatching research: 2005-2006. *Tourism in Marine Environments 3*(2), 179-189.

Parsons, E.C.M., Fortuna, C.M. Fortuna, 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.

Santos, E., Pansard, K.C., Yamamoto, M.E. & Chellappa, S. (2006). Comportamento do boto-cinza, *Sotalia guianensis* (Van Bénédén) (Cetacea, Delphinidae) na presence de barcos de tourismo na Praia de Pipa, Rio Grande do Norte, Brasil. *Revista Brasiliera de Zoologia 23*(3), 661-666. [in Portugese].

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

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

Servais, V. (1999). Some comments on context embodiment in zootherapy: the case of the Autodolfijn project. *Anthrozoos 12*(1), 5–15.

Sorice, M.G., Flamm, R.O. & McDonald, S. (2007). Factors influencing behavior in a boating speed zone. *Coastal Management 35*(2/3), 357–374.

Stamation, K.A., Croft, D.B., Shaughnessy, P.D. & Waples, K.A. (2007a). Observations of humpback whales (*Megaptera novaeangliae*) feeding during their southward migration along the coast of southeastern New South Wales, Australia: identification of a possible supplemental feeding ground. *Aquatic Mammals 33*(2), 165-174.

Stamation, K.A., Croft, D.B., Shaughnessy, P.D., Waples, K.A. & Briggs, S.V. (2007b). Educational and conservation value of whale watching. *Tourism in Marine Environments 4*(1), 41-55.

Stevick, P.T., Aguayo, A., Allen, J., Avila, I.C., Capella, J.C., Castro, C., Chater, K., Della Rosa, L., Engel, M.H., Félix, F., Flórez-González, L., Freitas, A., Haase, B., Llano, M., Lodi, L., Munoz, E.,

Olavarría, C.Y., Secchi. E., Scheidat, M. & Siciliano, S. (2004) Migrations of individually identified humpback whales between the Antarctic Peninsula and South America. *Journal of Cetacean Research and Management 6*(2), 109-113.

Stevick, P.T., Paceco de Godoy, L., McOsker, M., Engel, M. & Allen, J. (2006). Movement of a humpback whale from Abrolhos Bank, Brazil to South Georgia. *Journal of Cetacean Research and Management 8*(3), 297-300.

Stockin, K.A., Lusseau, D., Binedell, V., Nicky Wiseman, N. & Orams, M.B. (2008). Tourism affects the behavioural budget of the common dolphin *Delphinus* sp. in the Hauraki Gulf, New Zealand. *Marine Ecology Progress Series 355*, 287–295.

do Valle, A.L. & Cunha Melo, F.C. (2006). Alterações comportamentais do golfinho *Sotalia guianensis* (Gervais, 1953) provicadas por embarcações. *Biotemas 19*(1), 75-80. [in Portugese].

Webb, N. L. & Drummond, P.D. (2001). The effect of swimming with dolphins on human well-being and anxiety. *Anthrozoos 14*(2), 81–85.

Wiley, D.N., Moller, J.C., Pace, R.M. & Carlson, C. (2008). Effectiveness of voluntary conservation agreements: case study of endangered whales and commercial whale watching. *Conservation Biology 22*(2), 450–457.

Williams R. & Ashe. E. (2007). Killer whale evasive tactics vary with boat number. *Journal of Zoology 272*(4), 390–397.

Williams, R. & Crosbie, K. (2007). Antarctic whales and Antarctic tourism. *Tourism in Marine Environments 4*(2-3), 195-202.Whaley, A.R. Wright, A.J., Bonnelly De Calventi, I., & Parsons, E.C.M. (2007). Humpback whale sightings in southern waters of the Dominican Republic lead to proactive conservation measures. *Journal of the Marine Biological Association 2: Biodiversity Records* 5751, 4pp.