Recent advances in whalewatching research: 2008-2009

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ABSTRACT

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 2008.

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KEYWORDS: WHALEWATCHING; CODE-OF CONDUCT; REGULATIONS; MANAGEMENT; WHALE-WATCHERS; PROTECTED AREAS

Introduction

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 paper 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. As this was deemed to be a useful digest of recently published articles, and as such assisted the work of the Sub-committee, similar digests in following years were requested (see Parsons, Lewandowski & Lück, 2006; Parsons, Lück, & Lewandowski, 2006; Scarpaci,

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Parsons & Lück, 2008; Scarpaci, Parsons & Lück, 2009). This is the fifth in this series of review papers, detailing a summary of whalewatching research published over the past year (June 2008-May 2009), since the 60th Annual Meeting of the IWC.

Impacts of Whalewatching Activities on Cetaceans

Bejder and Lusseau (2008) compared two cases of tourism impacts on bottlenose dolphins in order to illustrate that there are indeed significant impacts on animals that are being watched repeatedly and for extended times, as stated by the International Whaling Commission's Scientific Committee in 2006: "[t]*here is new compelling evidence that the fitness of individual odontocetes repeatedly exposed to whale-watching vessel traffic can be compromised and that this can lead to population-level effects*." Bejder and Lusseau (2008) interpreted the results of two well-researched bottlenose dolphin (*Tursiops* spp.) populations: one in Shark Bay, Western Australia (*T. aduncus*), and one in Fiordland, New Zealand (*T. trucatus*). In Shark Bay, data from tourism and control sites over many years have been evaluated, and it was evident that after an increase from one to two tour operators there was a significant average decline in the dolphin population exposed to the tour boats (Bejder & Lusseau, 2008). In addition, the reproductive process of the females in the area was reduced as well. In Doubtful Sound and Milford Sound in New Zealand, tour boats were found to have a significant impact on the behaviour of the dolphins, in particular, they were found to spend increasing time for travelling, and reduced time for resting (Bejder & Lusseau, 2008). The duration of travelling outs increased as well, and it was found that females have different avoidance strategies than males: they use vertical avoidance only, when tour boats were around, potentially injuring the dolphins (Bejder & Lusseau, 2008). Results at both sites show clear evidence that the long-term effects of tour boats are significant, leading to a decrease in the dolphin populations, especially in smaller populations (Bejder & Lusseau, 2008).

Several studies have highlighted the problems associated with human activities, including dolphin-watching, on Hawaiian spinner dolphins (*Stenella longirostris*) that rest in bays during the day, before heading offshore to feed at night (Courbis, 2007; Delfour, 2007). Timmel *et al.* (2008) add to this data, with a study

that investigated dolphin movements and responses, ascertained using a surveyor's theodolite, to human swimmers and boat traffic. During the 178 hours of dolphins being tracked in this study, human swimmers or vessels were within 100m of the focal dolphin group 100% of the time, with swimmers being within 50 m 85% of the time, and up to 34 vessels or swimmers were within 300m of the dolphin groups during the study (Timmel *et al.*, 2008). On average 10 vessels were present during the study, but vessel numbers were significantly higher when there were dolphins.

Timmel *et al*. (2008) found that swimmers and vessels increased the rate at which dolphins changed direction. However, as boat speeds increase, direction changes lessened Timmel *et al.* (2008). The effects of increasing vessels and swimmers and reorientation rates were significant whether vessels were within, 50m, 100m or 300m (Timmel *et al.*, 2008). It was suggested that as human swimmers are slow moving and many of the vessels encountered by the dolphins are likewise slow moving kayaks, changing direction frequently may be an effective way to avoid these disturbances.

The study also found significant relationships between swimming speed and distance away from the closest vessel – "dolphins tended to swim faster when further away from vessels" (p. 406). Number of vessels or swimmers did not affect swimming speeds, but it was suggested that dolphins swim faster in the presence of faster vessels (Timmel *et al.* 2008). The authors noted that their study was complicated by the fact that there was no period throughout the study when dolphins were present without vessels or human swimmers, so there was no baseline data for undisturbed animals. The authors concluded "*Although it may be possible that spinner dolphins have partially habituated to increasing levels of human activity within Kealakekua Bay, care should be taken not to interpret the results of this study to mean these activities have only a limited effect on these dolphins*" (p. 409), further noting that cumulative disturbance could have an impact on these animals.

Although this was not discussed by the authors, bearing in mind that behavioural changes have been observed in relation to increasing numbers of swimmers and vessels, and the constant disturbance faced by these animals during their resting period, we suggest that the situation warrants urgent attention and the

introduction of an appropriate management regime. At the very least minimum approach distances, and limits on swimmer and vessel numbers should be implemented, monitored and enforced, likewise temporal and spatial restrictions, to allow periods and locations in the bay where spinner dolphins can rest undisturbed.

An additional study on interaction of spinner dolphins with swimmers and vessels was conducted by Courbia and Timmel (2009) at three Hawaiian Bays. The study was in response to the proposal of new regulations by NOAA Fisheries to mitigate dolphin disturbance to both swimmers and vessels. Observations from either elevated clifftops (Kealake'akua Bay and Kauhako Bay) central sea level site (Honaunau Bay). Behavioural data was collected during a four month period (February to May) in 2002. Researchers recorded aerial behaviours, group size, movement of dolphins into and out of the bays, vessel numbers and swimmers. Findings were compared to previous research conducted by Norris *et al.* (1994) and Forest (2001) to determine trends over time. Results indicated that mean occurrence of aerial behaviours was not significantly related to mean frequency of vessels and swimmers in the three Bays (Courbia & Timmel, 2009). Findings also indicated that group size was not significantly different across the three study bays (Courbia & Timmel, 2009). The authors suggest that the lack of significance detected between vessels/swimmers to aerial behaviours of spinner dolphins could be attributed to a) a lack of relationship b) non-linear relationship or c) incentive for aerial behaviour aside from swimmers and vessels (Courbia & Timmel, 2009). However, the authors stress that further research may be required due to the small sample size presented in the paper.

In contrast, to previous research results indicate that midday (rest period) aerial behaviour has increased and aerial behaviour in the morning and afternoon has decreased. The authors indicate that across their study, dolphins were always observed in the presence of vessels or swimmers therefore, changes in aerial behaviour pattern may indicate that vessel and swimmer traffic has reached a level that affects daily behavioural patterns of these dolphins. In addition, changes in aerial behaviour patterns were detected at Kealake'akua since previous research and the authors suggest that spinner dolphins have reduced aerial displays during exit and

entry however, these findings cannot be directly linked to vessel and swimmer activity.

Degrati, Dans, Pedraza, Crespo and Garaffo (2008) documented the diurnal activity budgets of dusky dolphins (*Lagenorhynchus obscurus*) in Argentina (Golfo Nuevo). Data was collected from a research vessel exclusively during summer and autumn in the years from 2001 to 2005. A total of 168 groups were encountered (success rate of 71.3%; Degrati *et al*., 2008). Group size was significantly associated with group composition: the largest groups were typically mixed groups (Degrati *et al*., 2008). Group composition varied significantly between seasons but not with time of day: mother-calf groups were observed exclusively during the summer study period (Degrati *et al*., 2008). The most common activity observed was travel (40%) followed by milling (18%) feeding and social (16%) and resting (10%) (Degrati *et al*., 2008). No significant variations in behaviour were documented across the two seasons. When data on both seasons were pooled results indicated that mother and calves spent most of their time milling and resting and mixed groups spent most of their time travelling and feeding and adults and juveniles spent most of their time socializing more than other groups (Degrati *et al*., 2008). This paper provides a baseline for the detection of behavioural differences associated with tourism in the study area as described in the following paper.

Interactions between dolphin watch vessels and dusky dolphins were documented by Dans, Crespo, Pedraza, Degrati and Garaffo (2008) in Argentina (Golfo Nuevo). The objective of the study was to document the behaviour of dolphins to approaching vessels (commercial and research vessels). At total of 156 groups of dolphins were observed (Dans *et al.*, 2008). Of these, 93 were approached by commercial vessels and 63 by a research vessel (Dans *et al.*, 2008). Commercial vessels were most likely to encounter feeding dolphins whereas, in contrast, the research vessel encountered the same proportion of feeding and travelling dolphin groups (Dans *et al.*, 2008). These results indicate the possibility of a potential bias of commercial vessels to specific behaviours. Dolphin response to vessel presence also varied dependent on their behavioural state and vessel type: feeding and milling groups were most likely to change behavioural states (approximately 50% of the

time) when approached by commercial vessels (Dans *et al.*, 2008) whereas travelling dolphins did not respond to an approaching commercial vessel. In contrast, the approaching research vessel did not significantly alter any of the behavioural states studied (Dans *et al.*, 2008). Of the 156 dusky dolphin groups followed, 29 of these were followed simultaneously by a research vessel in the presence of a commercial vessel (Dans *et al.*, 2008). Results indicated that the feeding and social time budget decreased when commercial vessels were present. In contrast, the dolphin's time budget for milling increased significantly in the presence of commercial vessels (Dans *et al.*, 2008). The study also demonstrated that the time of return to feeding and social behavior state was longer, while the return to resting behaviour and milling took less time (Dans *et al.*, 2008). Dans *et al.*'s (2008) discussion focused on the possible long-term implications that could result from the documentation of these short-term responses. The consequence of a reduction in feeding behavior during the presence of whalewatching vessels could be significant in terms of impacting dolphins' energy intake and therefore health and fitness, i.e. a long-term cost. In addition a reduction in social interactions may affect reproductive output and thus the fitness of the population. The findings presented by Dans *et al.* (2008) are of importance as previous research on dusky dolphins in New Zealand posited that that tour vessel presence did not significantly affect the behaviour of this species (i.e. Markowitz, 2004). The difference in findings, could be attributed to different diurnal patterns (dusky dolphins forage at night in New Zealand and dusky dolphins in Argentina forage during the day) exhibited by the two populations. Therefore, the affect that commercial vessels may pose on dolphin behaviour could be different dependent on locality and diurnal patterns. To minimize the impacts of this industry, Dans *et al.* (2008) recommend the development of guidelines with a focus on boat approaches and prescribed distances between vessels and dolphins. Furthermore, the study reflected the findings of Bejder *et al.* (2006) that short term responses should not be discounted as long term data may yield chronic implications.

Weir, Duprey and Wursig (2008) documented relative distribution of dusky dolphins in Kaikoura, New Zealand. Data was collected between January and April 2005, and between December 2005 and April 2006, on group composition, presence

of predators (e.g. *Orcinus orca*), vessel traffic and water depth. To meet research objectives, 12 survey lines were conducted that were 1.5 km apart and a total of 77 days were spent in the field observing 99 nursery groups and 66 adult groups (Weir *et al*., 2008). Results indicated that nursery groups were significantly more likely to be observed in shallow water than deeper water (Weir *et al*., 2008). This trend was not documented for large groups. Results also indicated that the number of private recreational vessels encountered per search per hour was higher in deeper water and the opposite trend was documented for commercial fishing boats (Weir *et al*., 2008). Pooling of data (all boat types) together indicated that significantly more boats were found in shallow areas than deeper areas. In addition, orcas and sharks were almost seen exclusively in deeper water (Weir *et al*., 2008). The authors suggest that mother-calf pairs may utilise shallow waters as a refuge and therefore, in light of the research findings, wildlife managers should focus on protecting mother calf groups of dusky dolphins by protecting their shallow habitat (Weir *et al*., 2008).

Wahlberg, Schack, Wilson, Bejder, and Madsen (2008) investigated the particle acceleration noise generated by various boat types, using a case study in Bunbury, Western Australia. They found that "*the largest difference between free-field acoustic and total acceleration was* at *a 5-m range from a smaller motor boat*", and that "*at distances beyond this range, the acoustic and total accelerations were comparable in magnitude for all types of boats*" (Wahlberg *et al*., 2008, p. 149). While this study was not directly related to tourism, the findings of this preliminary study, and potential future research in other geographic locations (with varying bathymetry), might be significant for recreational and tour boats around cetaceans. This is supported by the study of Jensen, Wahlberg, Bejder and Madsen (2008), which investigated the noise impacts of smaller vessels, such as tour and research boats, in Koombana Bay, Western Australia (shallow-water habitat) and Tenerife, Canary Islands, Spain (deep-water habitat). The results show that dolphins are likely to have their communication range significantly reduced, for example, in a shallow-water habitat of Koombana Bay by a factor between 1.4-6 and 24-150 (at a 30 meter distance; depending on the engine type and vessel behaviour) for cruise speeds at five and ten knots, respectively (Jensen *et al*., 2008). Dolphin communication would not

be masked by boats travelling at 2.5 knots or below (Jensen *et al*., 2008). In the deep-water habitat of Tenerife, the communication range of pilot whales was found to be reduced by a factor of between 4-8 and 26-65 (Jensen *et al*., 2008), again at a 30 meter distance and for cruise speeds at five and ten knots, respectively. Jensen *et al.* (2008) cautiously estimate the masking impact at a speed of 2.5 knots at between 1.3 and 2, despite some difficulties in measuring the impacts at the slower speed levels. They conclude that if tour vessels adhere to the guidelines for whale and dolphin-watching that are in place at most locations, i.e. keep at a distance of at least 50 to 100 meters, the vessel noise is unlikely to mask communication, at least for the two odontocete species investigated in Koombana Bay and in Tenerife.

Songs produced by humpback whales are thought to be related to both a social and reproductive context (Parsons *et al*., 2008). Vessel traffic has the potential to mask or disturb these signals i.e. the signal does not reach the intended receiver. This would be of particular importance at breeding grounds with the potential to reduce mating success. The Abrolhos National Marine Park (Brazil) is identified as a crucial breeding ground for the southwestern Atlantic population of humpback whales. Both commercial whale watch vessels and recreational vessels utilize the Abrolhos National Marine Park. Sousa-Lima and Clark (2008) documented natural acoustic variation in these humpback whales continuously across a 26 day study period; the objective was to determine how noise generated by marine vessels could impact the variation in singing activity within the breeding grounds. Sousa-Lima and Clark (2008) also correlated variation in singing with number of acoustic events, tide height, lunar phase, hour of day, day of season and light presence. Approximately 7% of the park was continuously acoustically monitored via the use of an array of pop ups (each array consisted of 4 pop ups) across 26 days (Sousa-Lima & Clark, 2008). Individual whales were counted (singers) and located and variation in male singing behaviour in relation to boat traffic was analysed. The results of the study demonstrated that boat traffic had a significant negative response on singer activity (Sousa-Lima & Clark, 2008). The authors suggest that an increase in acoustic events generated by marine vessels could displace the whales from the feeding grounds or males would cease to vocalize or combination of the two. Sousa-Lima and Clark

(2008) also documented a greater degree of singing activity at night in the absence of light. This observation could be explained by the engagement of different diurnal behaviours (i.e. males engage in fight bouts during the day when visibility may be required and sing solo at night; Sousa-Lima & Clark, 2008). The authors highlighted that sustainability of whalewatching is dependent upon maintaining visitor numbers close to carrying capacity, economic fluctuations and the presence of the resource (whales). Therefore, acoustic disturbance has the potential to displace whales and thus negatively impact the whalewatching industry within this region (Sousa-Lima & Clark, 2008). Management strategies suggested by Sousa-Lima and Clark (2008) included acoustic isolation of boat engines (i.e. reduction in non-biological acoustic events), a vessel approach protocol and re-enforcement of regulations.

Whalewatching Regulations and Codes of Conduct

Duprey, Weir & Würsig (2008) investigated the effectiveness of a voluntary "rest period" introduced in 1999 to mitigate the impacts of whalewatching on a population of dusky dolphins in the waters off of Kaikoura, New Zealand. The rest period was designated as between the hours of 11:30 am and 1:30 pm between 1st December and 31 March i.e. in the southern Hemisphere summer.

During the study, 292 vessels were observed approaching dolphin groups, 253 during non-rest periods and 39 during rest periods (Duprey *et al*., 2008). It was found that the one licensed company in Kaikoura that actively engages in dusky dolphin swim-with trips obeyed the rest period 100% of the time (Duprey *et al*., 2008). A second company, which specializes in sperm whale trips, interacted with dolphins during the rest period – in fact there was no significant difference in the latter company's rate of interactions inside or outside of the rest period (Duprey *et al*., 2008).

There was a significant decrease in the number of vessels around the dolphins during the resting period (1.46 interactions/ hour versus 2.63 interactions/ hour), but this was entirely due to the compliance of the single swim-with-dolphin company with the rest period – when interactions from this company was excluded from the

analysis, there was no significant effect of the rest period on reducing interactions (Duprey et al., 2008). During the rest period, there were one to three vessels around the dolphin groups for a quarter of the observation period (Duprey *et al*., 2008). Throughout the study, the number of interactions involving private recreational vessels was high. Duprey *et al*. (2008) also noted that the number of visits by vessels was significantly higher at the weekends (3.66 visits/hour verses 2.07 visits/hour during weekdays), and there were fewer periods during the weekends when dolphins were not attended by boats.

The researchers considered that in some respects the voluntary rest period was effective in reducing the amount of disturbance being experienced by dolphins, but this was entirely due to the voluntary compliance of one company.

In conclusion they stated:

> "*we suspect that a voluntary code of conduct, such as the ''rest period'' established in Kaikoura, is not likely to change the business practices of a company not heavily dependent on the regulated population for the success of their business. Without increased pressure from either the community or controlling government departments, in the form of public reprimands, media attention, more community support for complying businesses, or the threat of more mandatory regulations, these companies will, most likely, not comply with voluntary codes of conduct as there is little encouragement for compliance.*" (Duprey *et al*., 2008, p. 635)

Moreover, they advocated that private boat owners needed to be targeted with respect to educating about whalewatching guidelines, and efforts should be increased to ensure compliance by all whalewatching operators. It was considered that the voluntary rest period had some success, but it was warned that "voluntary measures require constant observations, education and encouragement so that they continue to be effective year after year" (Duprey *et al*., 2008, p. 636)

Tosi and Ferreira (2009) investigated the behaviour of the estuarine dolphin, or costero, *Sotalia guianensis* within a newly established marine reserve (Rio Grande do Norte, Brazil). Prior to the current study, and before the establishment of a marine reserve in the area, Carrera (2004) indicated that these dolphins significantly reduced

their feeding behaviour in the presence of vessels. Tosi and Ferreira (2009) evaluated estuarine dolphin proximity and breathing synchrony during the first year after the deliniation of the marine reserve. The study was also used as a gauge to evaluate the efficiency of the marine reserve. Restrictions implemented in the marine reserve included a limit on the number of tour boats (maximum of 2) that could operate in the marine reserve, a prescribed approach distance of 50 m or greater, and a 2 knot speed limit (Tosi & Ferreira, 2009). A total of 70 (414.9 hours) effective data collection days were completed during the study with 197.12 hours of encounter time with dolphins (Tosi & Ferreira, 2009). Data was collected in two periods before (Period 1: Feb-May) and after the rainy season (Period 2: September-December). The study's results indicated that in period 1 travel and social behaviour increased and resting and feeding behaviour decreased in the presence of vessels (Tosi & Ferreira, 2009). However, these results were not statistically significant. A behavioural analysis for period 2 also indicated that behavioural budgets did not significantly alter in the presence of vessels (Tosi & Ferreira, 2009). The results also indicated that dolphins increased breathing synchrony in the presence of vessels during travelling behaviour in period 1 (Tosi & Ferreira, 2009). The authors suggest that the differences documented in the earlier (i.e. Carrera, 2004) and the current study, may be attributed to: i) different methods applied across the two research studies or, ii) effective management, i.e. the creation of the marine reserve and appropriate restrictions. These findings are of importance, as many studies provide suggestions for the management of cetacean tourism, however there is a dearth of information available on the effectiveness of these proposed management strategies. It would appear that the establishment of a reserve, with extended conditions (e.g. limits on vessel number, vessel proximity and speed) may be effective management measures and aid the development of sustainable tourism.

It is now well established that cetacean tourism is not necessarily benign (Bejder *et al*., 2006a, Lusseau, 2006). Higham and Bejder (2008) review a series of developments that evolved whilst stakeholders worked together to manage tourist interactions at Shark Bay, Western Australia. Major contributions to the development of new management were a series of research publications (Bejder *et al*., 2006a

Bejder *et al*., 2006b) and the attendance of key individuals at the National Wildlife Tourism Conference (2006). The conference created a forum to report on the available long-term research conducted in Shark Bay, with particular emphasis on impacts of commercial tourism and the biological significance of recent research. The research also provoked a ministerial decision that was supported by delegates at the aforementioned conference. Delegates of the conference concluded that managers must be responsive to rigorous scientific research in order to understand the complex relationship that exists between tourism and the targeted species (Higham & Bejder, 2008). Furthermore, the Shark Bay study exemplified the importance of baseline data and the usefulness of powerful methodologies (behaviour of dolphins before and during vessel-based tourism, control sites, -long-term data sets) towards understanding the complexity surrounding tourism impacts and dolphins. As the result of research indicating that dolphin abundance declined in the tourism effected area, the relevant minister reduced tour vessels licenses by 50% (from two to one dolphinwatching tour vessel) and introduced a moratorium on any increases in research vessel activity. Higham & Bejder (2008) highlights the positive outcomes achieved by designing a rigorous research methodology and publishing their results, and how this can trigger the development of new management strategies that will help promote sustainability of the resource (dolphins) and the industry (whalewatching).

Nature of Whalewatchers

In 2007, Ballantyne, Packer & Hughes (2008) conducted a series of questionnaire surveys on visitors to marine and nature tourism sites in Queensland, Australia, which included surveys of visitors taking whalewatching trips, as well as those visiting Mon Repos Conservation Park (a nesting turtle site), a marine theme park, a botanical garden and an aquarium. To gauge tourists attitudes to conservation they were asked whether they agreed with a series of statements: 40% of whalewatchers agreed with the statement “I often think about whether my actions harm the environment”; 42% agreed that “I am Interested in learning more about the environment”; and 15% agreed with the statement “I actively search for information about conservation”

(Ballantyne *et al*., 2008). There was no significant difference between the responses of whalewatchers and those visitors to the other sites surveyed (Ballantyne *et al*., 2008).

To investigate the respondents willingness to accept conservation information and education, participants were asked about the level to which they agreed with a further series of statements: 98% of whalewatchers agreed with the statement that their tours should "Give people information about marine life and marine life behavior"; 91% agreed that their tour should "Give people information about conservation issues"; 94% agreed that that whalewatching tours should "Give people practical information about what they can do to help protect marine life"; whereas conversely 26% said that they should "Let people view marine life without giving them anything but the basic facts" (Ballantyne *et al*., 2008). Again, there was no significant difference between the responses of whalewatchers and those visitors to the other sites surveyed. One interesting difference between whalewatching (and nesting site) visitors and the other (captive display) sites was that they were more likely to agree that people should be given information than at the captive display sites i.e. the aquarium and marine theme park (Ballantyne *et al*., 2008). Also it was noted that there was a statistically significant preference amongst all sites for visitors to be provided with practical information about what they could do to aid conservation, rather than simply information on conservation issues (Ballantyne *et al*., 2008).

Although the data was not separated by activity, Ballantyne *et al*. (2008) reported that most respondents in the study stated that they were frequently involved in a variety of conservation activities (low commitment activities, i.e. "recycling, conserving water, conserving energy": 80%; moderate commitment activities, i.e. "purchasing environmentally friendly products " or "picking up other people's litter": 37%; high commitment activities, i.e. "participating in a public land/water clean-up; doing volunteer work for a group that helps the environment; donating money to a nature or conservation organisation": 6%. There was no significant difference between the responses of whalewatchers and visitors to other sites (Ballantyne *et al*., 2008).

Reduction of Whalewatching Impacts (Whalewatching Management)

Numerous studies have indicated that many current management regimes for whalewatching are insufficient. Higham, Bejder and Lusseau (2008) suggest that the sustainable management of whalewatching has been compromised due to:

- social and economic development;
- lack of rigorous scientific information on economic costs of the management of the industry – there is an assumption that management will involve significant costs;
- non-flexible management approaches (i.e. policy makers cannot respond to short or medium term changes), and
- visitor numbers being maintained close to carrying capacity.

Higham *et al*. (2008) emphasise the need for adaptive management regimes. Furthermore, the authors proposed that management frameworks must address the interactions that exist between "macro", "meso" and "micro" management. The management framework proposed in this study is founded upon the delineation and monitoring limits of acceptable change that were initially proposed by Duffus and Dearden (1990). Higham *et al.* (2008) propose that the model will address current short comings in the management of whale watch activities. The management model emphasises the importance to utilize multiple stakeholders (commercial tour operations, social science research, natural scientists and planning agencies). The management model requires that it be research informed, via quality science (e.g. peer-reviewed documentation) and the management framework must adapt in the face of research findings. The authors indicate that this framework moves towards an enforceable legislative context for cetacean tourismWith the end product being a regulated licensing system. Furthermore, legislation may also address marine protected areas, and managers need to ensure that whale watch operations comply with stipulations within the legislation. The licensing system provides the policy agencies with the ability to revoke licenses if deemed necessary - as was implemented in Western Australia as the result of the scientific findings of Bejder *et al*. (2006a, 2006b). However, the Bejder *et al*. (2006a, 2006b) findings were significant due to the establishment of prior baseline studies before the initiation of boat-based tourism.

Therefore, the authors emphasise, that when possible, baseline studies, need to be conducted as a perquisite action before the establishment of tourism.

Wild Dolphin Feeding Programs

The feeding, or provisioning, of wild dolphins occurs in several locations around the world, but the most famous, and most studied, location is Monkey Mia, Shark Bay, Western Australia. Although not whalewatching *per se*, this cetacean tourism activity is of interest due to the potential impacts on the cetacean involved (see Orams, 2002; Mann et al., 2000; Mann & Kemps, 2003; Neil & Holmes, 2008). However, there have also concerns about the the aggressive behavior in dolphins in this feeding program and the potential impacts on humans (e.g. Orams, Hill, & Baglioni, 1996).

Smith, Samuels & Bradley (2008) investigated 'risky' behavior in three female dolphins at the Monkey Mia feeding program, that is to say behavior that is aggressive and/or likely to cause injury. They also documented attempts by humans to physically interact with the dolphins, which were deemed inappropriate. The researchers noted that when dolphins were interacting with humans, this was under the supervision of a ranger slightly less than two-thirds of the time (64.4%; Smith et al., 2008).

Smith *et al.* (2008) found that there were differences in the behavior of the individual dolphins: one of the dolphins spent significantly more time at Monkey Mia and interacting with humans. Overall rates of risky interactions were 2.61 - 0.73 interactions per hour depending on the dolphin (Smith *et al.*, 2008). The authors noted that "The probability that a risky interaction would occur increased with increasing waiting time to the feed, with the greatest probability at an elapsed time of 60 min" (Smith *et al*., 2008, p. 998).

Moreover, the researchers found that the rate of risky behavior exhibited by humans to dolphins was much higher than that exhibited by dolphins to humans: 6.48 inappropriate or "risky" interactions per hour versus 1.71 per hour (Smith *et al*., 2008). These risky behaviors were typically the result of tourist actions.

To minimise risky behavior, Smith *et al.* (2008) suggested reducing the dolphins waiting time to be fed to 30 minutes. They also stated that closer supervision is required, and in lieu of increasing the number of rangers, this would mean a reduction in the numbers of tourists accessing the site would aid oversight, and also improve the tourist experience. Finally, bearing in mind the individual differences in dolphins, having experienced rangers who are able to distinguish between dolphins, and who understand their behavioral traits, would also be important (Smith *et al*., 2008).

While not a "feeding program" *per se*, Finn, Donaldson and Calver (2008) report on a human-dolphin interaction involving the illegal feeding of wild Bottlenose Dolphins (*Tursiops* sp.) in Cockburn Sound, Western Australia from 1993-2003. In 1993 only one dolphin was considered conditioned to human interaction through food reinforcement. By 2001, 16% (n = 12) of the resident community of 74 adult dolphins were conditioned, and at least 14 dolphins were conditioned by 2003. While they found only recreational fishing boats as feeding sources during their research, they also contends that anecdotal evidence showed that there are additional sources. Finn *et al.* (2008) used belt transects to determine the densities of recreational boats and encounter rates for conditioned dolphins across habitats within Cockburn Sound. Encounter rates and boat densities were positively correlated, suggesting an association between recreational boat density and the ranging patterns of conditioned dolphins. Their longitudinal study demonstrates that illegal feeding can grow over time to affect a potentially biologically significant proportion of a local dolphin population. The results underline the call for early and pro-active intervention and demonstrate the value of longitudinal, individual-specific wildlife studies. (Finn *et al*., 2008).

Economic Value of Whalewatching

In a regional update of the worldwide estimate of the economic impact of whalewatching conducted by Hoyt (2001), Hoyt & Iñíguez (2008) produced an estimate of the extent and value of whalewatching in Latin America. The study estimated that between 1998 and 2006, the growth of whalewatching in Latin

American countries averaged 11.3% per annum (Hoyt & Iñíguez, 2008). This extremely high growth rate was considered to be three times that of tourism in general. In total for the region, a sum of expenditures from 91 different communities in 18 countries, the direct expenditure per annum on ticket sales alone was estimated to be spending US$ $79.4 million (Hoyt & Iñíguez, 2008). Indirect expenditure (calculated using a multiplying factor to the direct expenditure) was estimated at over a quarter of a billion dollars (US$278 million; Hoyt and Iñíguez, 2008). The potential for increase is high however, as it was stated that studies have indicated that whalewatching tourists in some areas might be will to spend more than double the current ticket value for whalewatching trips. At least 1,189 whalewatching vessels are involved in the industry and 786 companies (Hoyt & Iñíguez, 2008).

Hoyt & Iñíguez (2008) highlighted the fastest growing industries in specific countries were in Costa Rica (74.5% growth), Chile (19.5% growth), Ecuador (17.8%), Colombia (17.6%) and Argentina (14.3%). They expressed concerns that the rapid growth rate in Costa Rica might be such that it may not be sustainable in terms of impacts on whales

However, it was emphasised that in contrast to many other areas of the world, there is potentially a high level of whalewatching management in Latin America with whalewatching in several locations occurring within marine protected areas, with relevant oversight (Hoyt & Iñíguez, 2008). Many whalewatching operators, or areas, are the subject of research programs monitoring the status of cetacean stocks and cetacean behavior. In 2006 and 2007 alone, there were 29 whalewatching-related workshops held in 10 Latin American countries – the majority of these workshops were related to developing sustainable and high quality whalewatching operations. Moreover, thirteen Latin American countries are members of the International Whaling Commission and several have delegates who contribute to deliberations on whale watching at the IWC (notably Argentina, Brazil, Chile, and Venezuela). Finally, seven countries have established specific whalewatching regulations (Hoyt & Iñíguez, 2008).

In addition to whalewatching, other whale tourism activities include whale festivals. There are currently 12 annual festivals in Argentina, Brazil, Ecuador,

Mexico and Uruguay, which involved an estimated 46,000 participants and bringing in an estimated had an economic value of nearly US$2 million (Hoyt & Iñíguez, 2008).

Education on Whalewatching Tours

Over the past decades, theory and models for nature interpretation concentrated on the 'cognitive' domains of learning (e.g., Forestell & Kaufmann, 1990; Orams, 1995; Lück, 2003), and did not attribute a high value to, or recognise the importance of the 'affective' domain or the role of intensity of experiences in wildlife tourism contexts as a major part of education/interpretive processes. Mayes (2008) and Mayes & Richins (2009) investigated the role of experience intensity on the effects of education/interpretation commentaries on participants of wild dolphin feeding programs, whalewatching and swim-with wild dolphin-based activities at various locations throughout Australia.

An underpinning goal of Mayes' (2008) study was to assess the success and effectiveness of the same education/interpretation commentaries in increasing participants' satisfaction and knowledge about dolphins and moving participants from a passive to a more conservation-active role. The results of the study showed that *intensity of experiences* did have a moderating role, on the impacts of high quality *education/interpretation* commentaries, on participants of dolphin-based tourism encounters. The moderator role moves between having positive, neutral and negative effects, which, in turn impacts on participants' satisfaction with the overall experience; changes in knowledge about dolphins and aspects of pro-environmental attitudes, beliefs, intended behaviours and intended actions (Mayes, 2008).

Marine wildlife tourism can provide a range of education and conservation benefits for visitors. Zeppel and Muloin (2009) reviewed the education and conservation benefits of marine wildlife experiences in Australia using Orams's (1999) framework of indicators to manage marine tourism. The key indicator for tourists assessed in their paper is behaviour/lifestyle change that benefits marine species, along with three indicators of conservation outcomes for marine environments (minimising disturbance, improving habitat protection, and contributing

to the long-term health and viability of ecosystems). Information was drawn from selected case studies of research on guided tourist encounters with whales, dolphins and marine turtles from 1996 to 2007, mainly in Australia. Zeppel and Muloin's (2009) analysis found tourist learning during mediated encounters with marine wildlife contributed to pro-environmental attitudes and improved on-site behaviour changes, with the public being instilled with long-term intentions to engage in conservation actions that benefit marine species. Marine wildlife interpretation programs that highlight species biology and human impacts can also influence visitor attitudes, beliefs and conservation outcomes. Guided interactions on marine wildlife tours can motivate visitors to respect marine life; foster environmentally responsible attitudes and behaviours; and thus benefit marine conservation.

Conclusion

The research papers presented in this report have further highlighted that cetacean tourism is not benign and that the management of these industries has been insufficient to manufacture sustainable cetacean tourism. The management strategies proposed by a range of authors within this report were:

- the introduction of appropriate management regime (Dans *et al*., 2008; Timmel *et al*., 2008) that is adaptive to change (Higham *et al*., 2008; Sousa-Lima & Clark, 2008). Moreover, the management regime should address approach distances (Dans *et al*., 2008; Timmel *et al*., 2008) limit number of swimmers and/or vessels (Timmel *et al*., 2008) and introduce boat approach protocols (Dans *et al*., 2008, Sousa-Lima & Clarke, 2008).
- Consultation by management agencies with multiple stakeholders (tour operators, researchers) in the establishment of regulations that are constructed based on solid science and can be adapted pertaining to research findings (Higham *et al*., 2008).
- Formation of protected zones around areas that may have ecological importance or act as nursery areas for cetaceans (Weir *et al*., 2008) with

extended conditions that restrict vessel traffic, vessel speed and proximity of vessels to cetaceans (Tosi & Terreira, 2009).

- Reinforcement of regulations (Sousa-Lima & Clark, 2008).
- Acoustic isolation of vessels in critical habitats (Sousa-Lima & Clark, 2008)
- Increase education and interpretation, on tour vessels by guides. Research has indicated that tour guides have the potential to act as a vector to promote biocentric values to tourists, increasing pro-cetacean conservation activities (Peake, 2008; Zeppel &Muloin, 2008).

Furthermore, short-term data (e.g. reduction if foraging behaviour) should not be discounted as being insignificant, or not biologically importants, as long-term data may yield chronic implications that are significant at a population level. Therefore, implementation of effective management (e.g. via an adaptive management framework) is crucial.

References

Ballantyne, R., Packer, J. & Hughes, K. (2009). Tourists' support for conservation messages and sustainable management practices in wildlife tourism experiences. *Tourism Management*, in press.

Bejder, L., Samuels, A., Whitehead, H., Gales, N., Mann, J., Connor, R., Heithaus, M., Watson-Capps, J., Flaherty, C. & Kürtzen, M. (2006a). Decline in relative abundance of bottlenose dolphins exposed to long-term disturbance. *Conservation Biology*, *20*(6), 1791–1798.

Bejder, L., Samuels, A., Whitehead, H. & Gales N. (2006b). Interpreting short-term behavioural responses to disturbance within a longitudinal perspective. *Animal Behaviour*, *72*(5), 1149-1158.

Bejder, L. & Lusseau, D. (2008). Valuable lessons from studies evaluating impacts of cetacean watch tourism. *Bioacoustics* (Special Issue) 17: 158-161.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.Carrera, M. L. R. (2004). Impact of boat tourism on *Sotalia fluviatilis* , Brazil. PhD Thesis, University Federal de Pernambuco, Brazil.

Courbis, S. & Timmel, G. (2008). Effects of vessels and swimmers on behaviour of Hawaiian spinner dolphins (*Stenella longirostris*) in Kealake'akua, Honaunau, and Kauhako bays, Hawaii. *Marine Mammal Science*, *25*(2),430-440.

Dans, S. L. Crespo, E. A., Pedraza, S. N., Degrati, M. & Garaffo, G. V. (2008). Dusky dolphins and tourist interaction effect on diurnal feeding behavour. *Marine Ecology Progress Series*, *369*, 287-297.

Degrati, M, Dans, S. L., Pedraza, S. N., Crespo, E. A. & Garaffo, G. V. (2008) Diurnal behaviour of dusky dolphins (*Lagenorhynchus obscurus*) in Golfo Nuevo, Argentina. *Journal of Mammalogy*, *89*(5), 1241-1247.

Delfour, F. (2007). Hawaiian spinner dolphins and the growing dolphin watching activity in Oahu. *Journal of the Marine Biological Association of the United Kingdom*, *87*(1), 109-112.

Duprey, N.M.T., Weir, J.S. & Würsig, B. (2008). Effectiveness of a voluntary code of conduct in reducing vessel traffic around dolphins. *Ocean & Coastal Management*, 51 (8-9), 632–637.

Finn, H., Donaldson, R. & Calver, M. (2008). Feeding Flipper: a case study of a dolphin-human interaction. *Pacific Conservation Biology*, *14*(3), 215-225.

Forestell, P. H., & Kaufman, G. D. (1990). *The History of Whale Watching in Hawaii and its Role in Enhancing Visitor Appreciation for Endangered Species.* Paper presented at the 1990 Congress on Coastal and Marine Tourism: A Symposium and Workshop on Balancing Conservation and Economic Development, Newport, Oregon.

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

Higham, J. E S. & Bejder, L. (2008). Commentary managing wildlife based tourism: edging towards sustainability. *Current Issues in Tourism*, *11*(1), 75-83.Higham, J.E.S., Bejder, L. & Lusseau, D. (2008). An integrated and adaptive management model to address the long-term sustainability of tourist interactions with cetaceans. *Environmental Conservation*, *35*(4), 294-302.Hoyt, E. & Iñíguez, M. (2008). *The State of Whale Watching in Latin America.* Yarmouth Port, USA: International Fund for Animal Welfare and Chippenham, UK: Whale and Dolphin Conservation Society.

Forest, A. (2001). The Hawaiian spinner dolphin (*Stenella longirostris*): Effects of tourism. M.Sc. Thesis, Texas A & M University, Galveston, TX. 91pp.

International Whaling Commission (2006). Report of the Scientific Committee. *Journal of Cetecean Research and Management*, *8* (Suppl.), 1-68.

Jensen, F.H., Wahlberg, M., Bejder, L. & Madsen, P. (2008). Noise levels and masking potential of small whale watching and research vessel around two delphinid species. *Bioacoustics*, *17* (Sp. Iss.),166-168.

Lück, M. (2003). Environmental education on marine mammal tours as agent for conservation - but do tourists want to be educated? *Ocean & Coastal Management*, *46*(9 & 10), 943 - 956.

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.

Lusseau, D. (2006). Short term behavioral reactions of bottlenose dolphins to interactions with boats in Doubtful Sound, New Zealand. *Marine Mammal Science*, *22*(4), 802-815.

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.

Mayes, G. (2008). The interactive effect between the intensity of wild dolphin tourism experiences and high quality education/ interpretation commentaries and the impacts on participants. Ph.D. Thesis, University of the Sunshine Coast Maroochydore, Queensland..

Mayes, G. & H. Richins (2009). Dolphin watch tourism: two different examples of sustainable practices and pro-environmental outcomes. *Tourism in Marine Environments*, *5*(2&3), 201-214.

Markowitz, T. M. (2004). Social organization of New Zealand dusky dolphins. Ph.D. Thesis, Texas A&M University.

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

Norris, K., Wursig, B., Wells, R., Wursig, M., Brownless, S., Johnson, C. &Solow, J. (1994). *The Hawaiian Spinner Dolphin*. University of Californian Press, Berkeley, CA.

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

Orams, M. (1999). *Marine Tourism: Development, Impacts and Management.* London: Routledge.

Orams, M.B. (1995). Development and management of a feeding program for wild bottlenose dolphins at Tangalooma, Australia. *Aquatic Mammals, 21*(2), 137 - 147.

Orams, M.B, Hill, G.J.E. & Baglioni, A.J. Jnr. (1996). “Pushy” behaviour in a wild dolphin feeding program at Tangalooma, Australia. *Marine Mammal Science, 12*(1), 107-117.

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., Wright, A.J. & Gore, M. (2008). The nature of humpback whale (*Megaptera novaeangliae*) song. *Journal of Marine Animals and Their Ecology, 1*(1), 22-31.

Scarpaci, C., Parsons, E.C.M., & Lück, M. (2009). Recent advances in whalewatching research: 2007-2008. *Tourism in Marine Environments, 5*(4), in press.

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

Smith, H., Samuels, A. & Bradley, S. (2008). Reducing risky interactions between tourists and free-ranging dolphins (*Tursiops* sp.) in an artificial feeding program at Monkey Mia, Western Australia. *Tourism Management, 29*(5), 994–1001.

Sousa-Lima, R.S. & Clark, C.W. (2008). Modelling the effect of boat traffic on the fluctuation of humpback whales singing out in the Abrolhos National Marine Park, Brazil. *Canadian Acoustics, 36*(1), 174-181.

Tilden, F. (1957). *Interpreting our heritage*. Chapel Hill: The University of North Carolina Press.

Timmel, G., Courbis, S., Sargeant-Green, H. & Markowitz, H. (2008). Effects of human traffic on the movement patterns o Hawaiian spinner dolphins (*Stenella longirostris*) in Kealakekua Bay, Hawaii. *Aquatic Mammals*, *34*(4), 402-411.

Tosi, C. H. & Ferreira, R. G. (2009). Behaviour of estuarine dolphin, *Sotalia guianensis* (Cetacean, Delphinidae) in controlled boat traffic situation at southern coast of Rio Grande do Norte, Brazil. *Biodiversity and Conservation*, *18*(1),67-78.

Wahlberg, M., Schack, H.B., Wilson, M., Bejder, L. &Madsen, P.T. (2008). Particle acceleration noise generated by boats. *Bioacoustics*, *17* (Sp. Iss.), 148-150.

Weir, J. S., Duprey, N. M. T. & Wursig, B. (2008). Dusky dolphins (*Lagenorhynchus obscurus*) subgroup distribution: are shallow waters a refuge for nursery groups? *Canadian Journal of Zoology*, 86(11), 1225-1234.