Recent advances in whalewatching research: 2006-2007

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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. Many of these research activities are of interest to the Whalewatching Sub-Committee of the International Whaling Commission, in particular research on the impacts of whalewatching, and whalewatching as a source of scientific data that could be used in management decisions. This paper is the latest of a series of annual digests that describes the variety and findings of whalewatching studies published since the 58th Annual meeting of the IWC, in 2006.

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, and considering the increasingly small amount of time available to discuss whalewatching matters during the International Whaling Commission (IWC) Scientific Committee meetings, a summary paper of the breadth and variety of whalewatching research, published during the previous year, was presented to the IWC Whalewatching Sub-Committee (Parsons *et al*., 2004) during the 56th 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 *et al*., 2006a, 2006b). This is the fourth of these review papers detailing a summary of whalewatching research published over the past year, since the 58th meeting of the IWC.

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IMPACTS OF WHALEWATCHING ACTIVITIES ON CETACEANS

Two of the most significant papers published on whalewatching impacts over the past year detailed a long-term study on on Indo-Pacific bottlenose dolphins (*Tusiops aduncus*) in Shark Bay, Australia. These studies provided longditudinal data that allowed a comparsion between sub-populations that were disturbed, and undisturbed by whale-watching traffic over a long (more than 10 years) period and showed substantial, but subtle, effects of such traffic.

The first Shark Bay paper (Bejder *et al.*, 2006a) is of particular significant as it demonstrates the importance of documenting both short-term behavioural response data to disturbances (e.g. presence of vessels to dolphins) with long-term population data. This is of fundamental importance to ensure that the results are correctly interpreted and wildlife mangers are provided with data that is not misleading. In the study of Bejder *et al.* (2006a) short-term behavioural responses of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) to experimental vessel approaches were documented in regions of high (impact site) and low (control) vessel traffic (Bejder *et al*., 2006a). Geographically the sites were 17 km apart (in Shark Bay, Australia) and all individual dolphins identified at one site were not encountered at the alternative site (Bejder *et al*., 2006b). The behaviour of dolphins was documented for each site 15min before (B), during (D) and after (A) experimental approaches were made. Observations were conducted simultaneously at two field stations (shore-based and boat-based). Shore based observers were responsible for selecting the focal dolphin group and documenting the behaviour of dolphins from an elevated shore-based site. Shore-based researchers documented movement and social patterns of focal groups by the use of a digital theodolite (x30 telescope). Boat-based researchers took photographs of dorsal fins of focal groups during experimental approaches. Absence of vessels was defined as no vessels present within 300m of the focal group. The results of the study demonstrated the following (Bejder *et al*., 2006a):

- experimental approaches caused significant changes in the behaviour of the targeted dolphins when compared with their behaviour both before and after;
- the short-term behavioural responses documented before (B) and after (A) experimental boat approaches yielded different results according to site (impact and control);
- behaviour documented before a boat approach was not resumed to pre-approach levels after the experimental vessel departed in the control site. Alternatively, pre-approach levels were achieved in the impact site.

Moreover, the following changes in social and movement patterns were documented at both study sites during experimental boat approaches (Bejder *et al*., 2006a):

- dolphin groups become more compact;
- higher rates of change in membership occurred;
- directions of travel and erratic changes in swimming increased;
- "[d]*olphins at the control site had stronger and longer-lasting responses than those at the impact site*".

The authors discuss that the initial interpretation of these results would indicate habituation of dolphins to vessels at the impact-site. Such an interpretation would

indicate to wildlife managers that tourism has posed no adverse impact on this population.

However, when this study is complimented to a long-term study in the (Bejder *et al*., 2006b) the interpretation of results requires re-evaluation. Bejder *et al.* (2006b) documented a decrease in dolphin abundance at the impact site. In the disturbed region, over the course of the study, one dolphinwatching company began operations in the disturbed area, which in itself did not result in any change in dolphin abundance or distribution (Bejder *et al*., 2006b). However, when a second company began operations, there was a significant decrease in dolphin abundance (a 14.9% decline; Bejder *et al*., 2006b). In the undisturbed (i.e. control) site there was a slight, but not statistically significant, increase in dolphin abundance (8.5%; Bejder *et al*., 2006b). This study shows a significant effect on a dolphin population despite only a relatively low density of whale-watching vessels (i.e. 2).

Collectively the moderate dolphin response documented at the impact site is not a result of habituation to vessel activity but a response of sensitive individuals becoming displaced from this region prior to the onset of this study. Therefore, caution needs to be exercised when evaluating short-term behavioural data (in the absence of long-term data) to ensure that wildlife mangers are not misinformed. This is of great importance as it can seriously weaken management plans and conservation efforts if wildlife managers are mislead.

Because of this research, Western Australia's Minister for the Environment, set a precedence with a precautionary, logical, and arguably brave, decision: "*After careful consideration and consultation with CALM* [the Department of Conservation], *and MPRA* [the Marine Parks and Reserves Authority], *the existing licence holders, other dolphin researchers and stakeholders, Mark McGowan, the Minister of the Environment decided, among other things, upon the following:*

a) reduce the number of commercial dolphin-watch licences from two to one;
b) introduce a moratorium on any increase in research vessel activity in the effected area"
(Ministry Media Statement, 2006)

Lusseau (2006) presents a study in Doubtful Sound, New Zealand, which quantifies changes in specific bottlenose dolphin (*Tursiops truncatus*) behaviours in response to different types of boat traffic. The study collected data between 2000 and 2002 from a small boat, which was considered not to be having an impact on the dolphin's behaviours itself. The study noted statistically significant changes in behaviour in response to boat traffic (Lusseau, 2006). Moreover, type of boat present and whether boats were, or were not, violating the New Zealand Marine Mammal Protection Regulations (1992) was a factor in the behavioural changes (Lusseau, 2006). For example, a behaviour referred to as a "side flop" (a leap where the dolphin lands on its side) was more likely to occur if powerboats were present, or in groups of socializing and diving dolphins, if a boat was violating regulations (Lusseau, 2006). These "side flops" occurred more frequently when boats were traveling at fast speed, at close range (within 50m) or when circling a group (Lusseau, 2006). Due to their incidence during regulation violations and period of greatest disturbance, it is possible

that "side flops" could be used as an indication for disturbance in these dolphins, although this possibility was not explored by the author.

It was also noted that dolphins were less likely to "snaggle" (a behavior described as floating still at the surface, flexing horizontally, holding its breath and contracting its melon; Lusseau, 2006) in the presence of powerboats. Lusseau (2006) suggests that this type of behaviour occurs when a dolphins is attempting to gather acoustic information, which may explain the decrease in its exhibition in presence of noisy powerboats.

So called, "tail out" dives (the dolphin arches when it dives, bringing its tail flukes out of the water, with the flukes reentering soundlessly, i.e. probably a prelude to a deep dive) were more frequent when dolphins were resting, and boats were present that were violating regulations; Lusseau (2006) interpreted these deep dives as dolphins vertically avoiding boats, i.e. diving deeper in the water column to avoid disturbance. Finally, when dolphins were traveling (directed movement from one area to another) they reverse direction when in the presence of kayaks and also if a boat was present violating regulations (Lusseau, 2006), which appears to be a clear example of horizontal avoidance. As noted above, these behaviours could be used to develop an ethogram of disturbance reactions, that might be a possible in field gauge of the impacts of whalewatching.

The diurnal behaviour of Hawaiian spinner dolphins (*Stenella longirostris*) generally consists of night offshore feeding on mesopelagic prey and daytime rest in protected sheltered bays (Benoit-Bird & Au, 2003; Norris *et al*., 1994). Due to the predictable movement of spinner dolphins into typical resting sites, they can be easily found by dolphin-tourist operations (e.g. swim-with-dolphin tour-operators). Delfour (2007) evaluated the impact of human activities (boat activity, kayak and dolphin-swim activity) during three successive summers (2001-2003) at one dolphin resting location. Observers recorded (Delfour, 2007):

- dolphin group size and group composition (adults, sub adults, juveniles and newborns);
- swim direction, activity level and social behaviour; and
- number of boats present, boat activity within 40m of dolphins.

All anthropogenic factors (number of boats, kayaks, swimmers) were pooled together in the analysis of impacts. The results of the study indicated the following (Delfour, 2007):

- abundance of dolphins was significantly less in the last year of study (2003);
- human activity significantly increased in 2003 when compared to 2001/02;
- the number of boats/kayaks that frequented the area was also significantly more in 2003; and
- number of swimmers to the study area was not significantly different across the consecutive years.

Furthermore, when the data was pooled across the three study years, results demonstrated that the numbers of dolphins and swimmers were positively correlated (Delfour, 2007). The authors state that these "*results indicated a stable dolphin habitat frequency over the three summers, which put emphasizes on the critical value of this rest area for the spinner dolphins*" (p. 109). However, for proper evaluation

frequency of dolphins at this site would require further long-term research in order to detect changes in the occupancy pattern.

The behavioural activities of northern resident killer whales (*Orcinus orca*) in Johnstone Strait, British Columbia (Canada) were documented in the presence and absence of boat traffic (a component of which are whalewatching vessels) by Williams *et al.* (2006). The results of this study indicated that whales significantly switched their activity from one behavioural state to another in the presence of vessels (Williams *et al.*, 2006). Moreover, the period of time whales engaged in particular activities was found to be different in the presence and absence of vessels, i.e. the proportion of time whales spent resting, travel/forage and in social state was significantly greater when boats were present (Williams *et al*., 2006). In addition, the proportion of time whales spent with feeding and smooth pebble beach rubs was significantly reduced in the presence of vessels (Williams *et al*., 2006). It is possible vessels may also compromise feeding opportunities in good feeding sites. This decrease of feeding opportunities could have resulted in a considerable decrease in energy intake, which might have a biologically significant impact on the population.

Williams *et al*. (2006) also indicated that although there is concern about the impacts of whalewatching boats on this population of killer whales, the majority of vessels encountered by these animals are not whalewatching boats but commercial fishing vessels. Williams *et al.* (2006) postulate that the production of adverse levels of noise is probably the likely reason that boat traffic is disrupting whale behaviour.

Many studies on whalewatching impacts have been conducted in locations such as Australia, Canada, New Zealand and the USA, however this year sees studies from new regions, namely Zanzibar in eastern Africa and northern Brazil.

The study in Zanzibar (Tanzania), investigated the responses of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) to whalewatching traffic. The study found that small numbers (n =1 to 2) of whalewatching boats did not result in changes in dolphin swimming patterns (Stensland & Berggren, 2007). As the number of whalewatching vessels increased so did the amount of non-directional ("erratic") movements (Stensland & Berggren, 2007). These non-directional movements also increased when swimmers were placed in the water (i.e. swim-with-dolphin tourism). Moreover, certain behaviours increased in proportion to tourism activity (such as "tail-out" dives) and the degree to which female dolphins engaged in "traveling" behaviour (persistent movement at a speed greater than 2 knots; Stensland & Berggren, 2007). Female dolphins were subject to whalewatching activity approximately 45% of the time (Stensland & Berggren, 2007); whereas males were less exposed (38%) which was attributed to the greater dispersal and larger territory size of male dolphins (i.e. outside the main dolphin-watching area). The researchers conclude that "[t]*he apparent changes in dolphin behaviour in response to increased tourism may reduce the time available for important behaviours such as foraging and nursing, and this ultimately may reduce fitness at both individual and population levels*" (Stensland & Berggren, 2007, p. 233).

The two studies from Pipa, Brazil, similarly described changes in the estuarine dolphin (*Sotalia guianensis*), or tucuxi, behaviour as the result of exposure to boat traffic, including whalewatching vessels (do Valle & Cunha Melo, 2006; Santos *et al*., 2006). Dolphins demonstrated behavioural changes which are common signs of

whalewatching vessel disturbance, namely increasing dive times and increased group cohesion when boats were deemed to be closer than 100m (do Valle & Cunha Melo, 2006). The second study investigated speed and direction at which boats approached dolphins (rather than distance) and discovered significant effects, particularly in groups of dolphins containing calves (Santos *et al*., 2006). These studies echo the results of previous studies (for reviews of such research, see Parsons *et al.*, 2006a, 2006b), but for a novel species (*i.e.* the estuarine dolphin) and emphasizes that regulations that restrict ways in which vessels approach dolphins, the distance to which vessels can approach and the prohibitions on vessels avoiding groups with calves, would presumably reduce disturbance and impacts to cetacean populations that are subject to whalewatching pressure.

WHALEWATCHING REGULATIONS AND CODES OF CONDUCT

Florida is a major area for dolphin-watching activities in the US, but there have been concerns about the impacts of tourism and human activities on dolphins in this region (e.g. Samuels & Bejder, 1999; 2004). To investigate this issue, Whitt and Read (2006) studied the level of compliance with dolphin-watching regulations in Clearwater, Florida. Regional guidelines for whale-watching activities in southwest Florida request that (NOAA, 2005):

- boats should remain 50 yards (~46m) from dolphins;
- time spent observing dolphins should be limited to half an hour;
- if animals show signs of "disturbance" dolphin-watchers should leave;
- dolphins should not be encircled, approached from behind, or trapped by vessels;
- approaching dolphins should be avoided if other vessels are present; and
- if a dolphin approaches a vessel, engines should be put into neutral gear until the animals has passed.

It should be emphasized that these are purely voluntary guidelines.

Whit and Read (2006) monitored compliance of five dolphin-watching companies with these regulations, via an on-board researcher, of whom the operators were aware. A total of 26 dolphinwatching trips were observed incorporating 45 encounters with dolphins – every monitored trip encountered at least one group of dolphins (Whitt & Read, 2006).

Other boats within 100 yards of the dolphins were quantified and from one to 11 boats were within 100 yards of dolphins when animals were encountered, 15% of which were other dolphin-watching vessels (Whitt & Read, 2006). A third of the watercraft present concurrently were jet skis, up to four per encounter and several approached closer than 50 yards to dolphins; one jet ski "*circled and moved directly over a group of dolphins with a calf*" (Whitt & Read, 2006, p. 124).

Dolphin-watching companies obeyed guidelines about approach distances on average 57% of the time, with varying degrees of adherence for different companies (with one company approaching closer than 50 yards on 61% of encounters, to one company approaching closer than 50 yards only 22% of the time; Whitt & Read, 2006). More than half of the instances when guidelines were flaunted involved close approaches and maneuvers intended to entice the dolphins to bowride or jump over

the wake of the boat (Whitt & Read, 2006). Conversely, none of the operators stayed with dolphins for more than 30 minutes, with most encounters with dolphins being less than 15 minutes (Whitt & Read, 2006).

During approximately a quarter of the dolphin encounters, animals displayed behaviours associated with "disturbance", with the majority of these behaviours being "chuffing" exhalations or slapping of the tail flukes on the water surface (Whitt & Read, 2006). Half of the "disturbance behaviours" were exhibited when boats were within 50 yards of dolphins and tail slaps tended to be exhibited when calves were present (80% of the time), and chuffing likewise was more prevalent when calves were present (60%; Whitt & Read, 2006).

Inappropriate approach methods were also recorded in 22% of encounters, including head-on approaches, or reversing towards animals (Whitt & Read, 2006). Again there was variability between operators with one displaying inappropriate approaches more than others. Maneuvering within 50 yards of dolphins was only in compliance with guidelines during 60% of such occasions, with one company only maneuvering appropriately on 25% of close encounters, ranging up to appropriate maneuvering in 79% encounters, with another company (Whitt & Read, 2006).

Whitt & Read (2006) describe that overall compliance with guidelines ranged from a low of compliance during only 38% of encounters to a high of 73% compliance. None of the companies showed total compliance or obeisance to the guidelines and on average there was compliance only 60% of the time. Of the regulations, only the "duration with dolphins-guideline" was completely adhered to and the guideline least adhered to was the one "that requires knowledge of dolphin behavior" (Whitt & Read, 2006, p. 125). The authors suggested that to remedy lack of compliance training should be given with information, for example, on how to recognize "disturbance behaviors" and such receive *"on-the-water training in which operators practice appropriate maneuver methods*" (p. 126). Jet ski operators were considered to be particularly in need of training considering the observed numbers and behaviour of jet skiers in close proximity to dolphins (Whitt & Read, 2006).

It was suggested that part of the problem with compliance was a difficulty in estimating distances on the water, *i.e.* where is the 50 yard limit (Whitt & Read, 2006). The difficulty of estimating distances on the water has been noted by other researchers studying dolphin-watching regulation compliance rates (e.g. Scarpaci *et al*., 2003). It was also postulated that operators may break guidelines in order to satisfy customer expectations. One way of combating this would be to outline whalewatching guidelines, and the need to follow them, at the beginning of a trip, and thus tourists would not have an expectation of close approaches to dolphins in the field (Whitt & Read, 2006).

To conclude the authors also suggested that, in lieu of a whalewatching permitting system and compulsory training in the US, a voluntary certification program, incorporating training as part of the certification procedure (Whitt & Read, 2006). It was suggested that this certification scheme should be annual with independent assessments and inspections by government officers.

Previous studies (e.g. Allen & Read, 2000) have found decreases in dolphin foraging behaviour in response to high levels of boat traffic in the Clearwater area and such a disruption could have biologically significant effects on the dolphin

population; the lack of compliance of guidelines is therefore a problem that needs to be addressed.

Corbelli (2006) investigated whalewatching operators in Newfoundland after new codes of conduct have been introduced in 2001. Fewer than 40% of the operators actually signed onto the code. Out of these, Corbelli (2006) found that most skippers accepted the new codes, and that the operators had no difficulty in implementing them in their daily operations. However, they also indicated that depending on the situation (e.g., in poor weather) it would be difficult to adhere to the codes. At the end of the first season after implementation of the code of conduct, 14 out of 17 interviewed operators stated that their regularly informed passengers about the code (Corbelli, 2006). Eight operators indicated that the code was valuable to their business, seven said it "didn't hurt", and one each stated that it harmed their business, and that they "don't know". Corbelli (2006) also compared the tour boat operator compliance in two studies in 2002 and in 2004. It was found that, although the operators claimed that it was easy to follow the codes, compliance with the codes was generally low, and that the code was respected by only 31% of the operators in 2002, and 23% in 2004 (Corbelli, 2006). Most of these infractions were related to manoeuvres to get within 100m of the whales, or to remain within 100m once they had entered the exclusion zone (Corbelli, 2006).

Feeding of wild cetaceans by members of the public has also been an issue in Florida, with concerns being expressed about the impacts of the activity on these cetaceans and also potential risks to humans (e.g. Samuels, & Bejder, 2004). In particular, one dolphin which has been named "Beggar" has high incidence interactions with humans (86% of sightings of Beggar involved the animal interacting with humans). Cunningham-Smith *et al*. (2006) conducted a study in Sarasota, Florida, to evaluate the level of human/wild dolphin interaction in a three phase study. The first phase involved observations of dolphin boat interactions from a land-based platform. The second or "docent program" phase occurred during a period when efforts were being made to highlight illegal harassment of wild dolphins, while a well marked vessel monitored behaviour of boaters near dolphins (and approached illegal actors). The final phase echoed the initial phase, i.e. land-based surveys, and sought to determine whether there was any impact of the docent program.

During the first phase, 1,786 interaction between humans and dolphins were observed over a period of 87.5 hours (*i.e.*, 20 interactions on average per hour; Cunningham-Smith *et al*., 2006). Of these interactions 26% involved touching dolphins or trying to attract their attention (e.g., splashing the water surface or the side of a boat) and 10.9% involved feeding dolphins (Cunningham-Smith *et al*., 2006). During the second phase, over 8,000 boats passed through the study area, and 1.3% engaged in illegal interactions with dolphins (n=108) (Cunningham-Smith *et al*., 2006): 0.9% of boats had passengers that tried to touch dolphins and 0.8% of boats tried to feed dolphins (*n.b.* the percentages noted in the original paper are incorrect by two orders of magnitude). These illegal interactions occurred despite the presence of the clearly marked docent program vessel. Boats performing illegal interactions and those "who expressed curiosity as to why they should not interact with the dolphin" (Cunningham-Smith *et al*., 2006, p. 349) were approached and presented with information about dolphin harassment. Interestingly, 61% of those

approached were actually aware of restrictions on human interactions and contact with dolphins, which suggests that despite regulations in place, these are often disregarded, perhaps *"because the risk of law enforcement action is small"* (Cunningham-Smith *et al*., 2006, p. 355).

During the third phase the dolphin "Beggar" was followed for a total of 11 hours, during which 813 boats passed by, with 3.7% of vessels attempting to feed the dolphin and 2.6% attempting to touch the dolphin; three people were bitten by Beggar during the observation period (Cunningham-Smith *et al*., 2006).

Cunningham-Smith *et al*. (2006) noted that the number of illegal interactions, although still occurring, decreased significantly during the docent program phase, presumably due to the presence of a clearly marked vessel and enforcement personnel. But after this period infractions increased again. This clearly indicates the efficacy of having a continual, and very visual, monitoring and enforcement program to reduce illegal activities and harassment. They also noted that feeding attempts declined over the period of the study, although touching of dolphins, and trying to attract their attention increased, and it was suggested that maybe there was a shift to less intrusive interactions, perhaps an effect of the docent program.

In terms of feeding Beggar, it was noted that the dolphin was observed eating 84% of the items that it was offered (and was observed to refuse only 6%; for the remainder of feeding interactions the result was not clear), and approximately half were "natural" items such as fish, shrimp and squid, mostly purchased from a nearby bait shop; but nearly half of the items offered to the dolphin were non-natural human foodstuffs such as fruit, potato chips and nuts (Cunningham-Smith *et al*., 2006). This feeding of foreign foodstuffs is clearly a risk to the dolphins in the region, and even feeding "natural" food items is a risk, as these items may be contaminated with bacteria or other pathogens that could impact the health of animals. Other negative effects of feeding interactions such as these in Florida may be reliance of dolphins on provisioning, even to the extent that calves may be taught to beg and thus loose natural hunting skills (Cunningham-Smith *et al*., 2006).

Like other areas where dolphins are fed by humans (e.g., Orams *et al.*, 1996) there was frequent aggression by dolphins towards humans. The study also noted 18 instances of dolphins biting people (Cunningham-Smith *et al*., 2006). Considering the relatively short duration of the study, this is a relatively high rate of negative interactions between dolphins and humans. It was noted that the biting only occurred when humans attempted to touch or tease dolphins (Cunningham-Smith *et al*., 2006). In addition to the obvious risks to human health, such biting could have detrimental impacts on dolphins, if humans were to retaliate or injure dolphins as the result of their aggression.

The researchers express concerns about the increasing amount of boat traffic in the region which presumably will be accompanied by increases in negative and illegal dolphin interactions. They particularly note that "[t]*he proliferation of programs where people can feed and/or swim with captive dolphins may lead to more public interest in engaging in these activities with wild dolphins*" (Cunningham-Smith *et al*., 2006, p. 351-2), and Florida is an area where there are many such programs. However, the study does have positive results as *"these findings suggest that the well-marked docent boat also had a deterrent effect"* (Cunningham-Smith *et al*., 2006, p.

355), and the regular use of such a vessel could markedly decrease negative interactions and protect the dolphin population. Further more, the researchers suggested that there should be "*well publicized punitive sanctions*" (Cunningham-Smith *et al*., 2006, p. 355) brought against infractors, which might persuade boaters that there will be enforcement of regulations, that the likelihood of being caught and punished is high, and thus, perhaps, reducing illegal activities.

REDUCTION OF WHALEWATCHING IMPACTS (WHALEWATCHING MANAGEMENT)

As an evaluation of a means to reduce whalewatching impacts, Lusseau *et al.* (2006a) is a recent study of particular importance as it demonstrates the importance of adopting precautionary principles to protect species and resources that are targeted either directly or indirectly by tourism. The paper indicates the initial research that was conducted in Fiordland, New Zealand (one of the most sought after tourist destinations in New Zealand) and the potential threat that tourism posed to bottlenose dolphins in this region at that given time.

Past research indicated that bottlenose dolphins (*Tursiops truncatus*) have limited social and genetic interactions (Lusseau *et al*., 2003; Williams *et al.*, 1993) and that there is direct evidence of negative boat interactions, e.g. in Milford Sound a large percentage (8-10% of the population) of dolphins were observed bearing marks of physical injuries representative of boat strikes and one calf was killed by a tour-operator in 2002 (Lusseau *et al*., 2002). Moreover, concerns have been expressed about energetic costs on dolphins resulting for behaviour altered as the result of boat-based disturbance (Lusseau 2003a, 2003b, 2004 – see also summaries in previous whalewatching research reviews *i.e.*, Parsons *et al*., 2006a, 2006b). Dolphins have even been displaced from the fiord when boat intensity was high (Lusseau, 2005).

Researchers provided authorities with a management plan (e.g. development of a multilevel sanctuary zone) in 1999-2002, that allowed for tourism and dolphins to co-exist (Lusseau & Higham, 2004). However, to this date these recommendations were discounted and tourism in this region continued to grow, e.g. the number of vessels that operated in the fiord in 2000-2006 doubled in contrast to 1994-1999 period (Lusseau *et al*., 2006a).

The researchers continued to monitor these dolphins and results indicated that these dolphins have become further susceptible to tourism, e.g. reduction in population abundance (the population abundance decreased from 67 individuals in 1997 to 56 in 2005), displacement and an increase in the number of stillbirths (Lusseau *et al*., 2006a). Currently, if the trend of tourism continues in this region the population is expected to become extinct within 50 years (Lusseau, *et al*., 2006b).

Lusseau *et al*. (2006a) importantly demonstrate that adopting precautionary principles in the management of boat-based tourism in Fiordland is not practiced. The authors urge government to implement actions as proposed earlier (e.g. multilevel sanctuary zone) to protect this small isolated population of bottlenose dolphins in New Zealand.

INTERPRETATION AND EDUCATION

In addition to monitoring compliance with dolphinwatching regulations, as noted above, Whitt and Read (2006) also investigated the provision of education and interpretation on dolphinwatching vessels in Clearwater, Florida. They rated interpretation with a score of one to eight, with a rating of one being minimal information and an eight being comprehensive interpretation. The operator rates ranged from 1 to 1.75, indicating a poor rating (Whitt and Read, 2006). Although basic information was provided about dolphin biology and questions about dolphins were answered, there was no provision of information about guidelines, protective legislation or ways to help conserve dolphins (Whitt and Read, 2006). Literature and educational materials for tourists to view was also very limited (Whitt and Read, 2006). It was also noted that none of the companies had trained naturalists or interpreters on board. As such, this is a rather poor display of the level of education and interpretation present in a major whalewatching area. There clearly needs to be an increase in the level of interpretation provision, and it is suggested that this might help to reduce non-compliance with whalewatching regulations in Clearwater, Florida (see "whalewatching regulations and codes of conduct" section above).

WHALEWATCHING AND WHALING

In a paper produced by Corkeron (2006) the rationale for the development of whalewatching is discussed. The development of cetacean tourism is motivated and supported by many, such as environmental groups, on the basis that:

i) whaling and whalewatching are incompatible; and
ii) this industry promotes environmental awareness (e.g. via education) that may provoke individuals to adopt more environmentally friendly practices (Corkeron, 2006).

However, the validity of these statements may not currently be justified. Corkeron (2006) notes that at present, Iceland, Japan and Norway all engage in active whaling and whalewatching activities. Therefore, Corkeron (2006) postulates that the statement that whaling and whalewatching are incompatible (Hoyt and Hvenegaard, 2002) can be challenged. Japan and Norway have strong economies or wealthy resources, and Corkeron (2006) therefore suggests injections of income by wildlife tourism may be insignificant to in their economy structure.

However, this stance is somewhat challenged by Higham and Lusseau (2007). Their paper addresses the urgent need to evaluate the cultural and environmental values of whale watchers. As noted above, previous literature (Hoyt & Hvenegaard, 2002) has stated that whalewatching is incompatible to whaling. Other researchers have reported that tourist participating in cetacean tourism hold strong environmental values (Lück, 2003; Rawles & Parsons, 2005). Higham and Lusseau (2007) suggest that these results would indicate that tourists who participate in cetacean tourism would be discouraged to participate in tourism in whaling countries. However, Iceland, Norway and Japan are all whaling nations that have an active whalewatching

industry. But, Higham and Lusseau (2007) suggest that whalewatching in these countries could be much more lucrative if whaling were to cease, with more tourists (who are presumably currently boycotting the country) coming to these areas, stating that it is possible that *"whaling in Norway has undermined the capacity for whalewatching in Norway to achieve its full potential"*, pointing out that the economic growth in whalewatching in Norway was much lower than in Iceland (when the latter no longer engaged in whaling) and commercial whaling may have rendered the whalewatching industry in Norway *"economically unsustainable"* (p. 557).

In 2003, Iceland resumed hunting and consumptive exploitation of whales via a lethal scientific research program, in which the products of killed whales were sold in domestic meat markets. Higham and Lusseau (2007) note anecdotal evidence suggested that whale-watching tourists to Iceland declined (WorldWide Fund For Nature, 2003) after whaling was re-introduced. In compliment, they note that Parsons and Rawles (2003) indicated that 91.4% of whale watchers would not engage in whale watching in countries that hunt whales for commercial rewards.

Higham and Lusseau (2007) also demonstrate the importance to distinguish nations that hunt whales for commercial, aboriginal and scientific whaling in relation to the way tourists respond to whaling activities. Furthermore, exactly which species is targeted (e.g., endangered or threatened species versus abundant species), corresponding visitor attractions that may be of interest to a tourist in the area, and the cost of travel to an area may influence tourist demand for whalewatching at a particular location (Higham & Lusseau, 2007) and should be quantified. In conclusion, Higham and Lusseau (2007) emphasise that it is important to evaluate and understand what 'attracts' and 'repels' whale-watchers. This information will provide insight into the management of cetacean tourism by understanding the potential growth of tourism at a particular destination and towards the understanding of carrying capacity of cetacean tourism.

Finally, Endo & Yamao (2007) provide information on whalewatching in Japan. They note three types of whalewatching activity:

(i) marine tourism – where operations were originally started by tourism companies such a pleasure boat operators, scuba divers or hotel owners, but some operations have now turned to full-time whalewatching (e.g. in Ogasawara, Tokyo and Zamami, Okinowa);

(ii) fisherman's sideline – where local fishermen have turned to whalewatching to supplement their incomes when not engaged in fishing activity (e.g. in Ogata, Kochi and Nomaike, Kagoshima); and

(iii) coastal whaler's sideline – coastal whaling or small cetacean hunting communities where whalewatching was initiated as another means of maximizing the economic exploitation of cetaceans as a resource (e.g. Taiji, Wakayama and Wada, Chiba).

Endo and Yamao (2007) describe that of these three types of whalewatching, "*marine tourism*" is most successful, with operations being described as "*well-organised*", attracting foreign and local tourists and having *"a large positive economic influence on local communities"* (p. 179). Whalewatching as a supplement to fishing incomes was seen as being less successful partly due to lake of

organization, lack of competition between operators (and thus less incentive to develop a competitive product) and also due to a lack of openness to tourists, i.e. "*local fishing communities are often perceived as a closed society by tourists*" (Endo & Yamao, 2007, p. 179). Whalewatching in coastal whaling/ small cetacean hunting communities were considered to be least successful, with Endo and Yamao (2007) noting that "[whalewatching] *businesses often failed because of economic and social factors*" (p. 179). In Taiji-cho, difficulties in getting whalewatching businesses to be successful include an inability to purchase boats, a long-term decline in tourists, and "*discord between drive and hand-harpoon fishermen, and tourists, resulting from different opinions over animal welfare*" (p. 180). As tourism makes up approximately 12% of all income for the town, loss of tourism-based revenues will have a major negative impact on the town's economy. In Wada, another coastal whaling town, the target species was the Baird's beaked whale (*Berardius bairdii*), but attempts at whalewatching failed, partially due to the cryptic nature and long dives taken by beaked whales making them less suitable for whalewatching, and "*as in Taiji-cho* [whalewatching] *was found to be incompatible with whaling because of contrasting opinions between tourists and fishermen*" (Endo & Yamao, 2007, p. 180).

WHALEWATCHING VESSELS AS A SCIENTIFIC RESEARCH PLATFORM

Although the ability and potential for whalewatching vessels to collect scientific data that could be important for the management and conservation of cetaceans has often been stated (e.g., International Whaling Commission, 2006), and biological research papers based on data collected from whalewatching vessels have been published in peer-reviewed scientific journals (e.g. Stockin *et al.*, 2001; MacLeod *et al.*, 2004), there has been little study specifically into the veracity of data collected from whalewatching vessels as a 'platform of opportunity'. An innovative study by Hauser *et al.* (2006) investigated data gathered by whalewatching operators in British Columbia (Canada) and Washington State (USA) targeting the resident killer whale populations. Data on sighting location and killer whale pod composition collected from a shore based survey was contrasted with data gathered from whalewatching boats. It was discovered that sighting location (i.e. distributional) information was very accurate (91.7% correct; Hauser *et al.*, 2006). However, ability to identify which specific groups were present was not equally accurate (74.1%; Hauser *et al.*, 2006). But this accuracy increased to 92.6% and 96.3% when errors due to "sub-pod misidentification" and "early morning (before 10:30) unknown pod sightings" were removed from the data set (Hauser *et al.*, 2006). Errors in the former were due to mistakes being made when a sub-pod (but not the whole pod) was present, or most of the main pod was present, but a sub-pod was absent.

The type of data on group distribution gathered in this current study is relatively unusual: there are few cetacean species that have such stable groups, or are as easily recognisable to the naked eye as killer whales. However, there are many species where sightings and distribution data is valuable and the accuracy with which this data was collected by whalewatching operators is encouraging. The researchers note specifically that "*…in developing nations with expanding ecotourism*

endeavours, whalewatch platforms may present a cost-effective method to accumulate basic information" (Hauser *et al.*, 2006, p. 280) and that on a wide scale "*it is proposed that data provided by commercial whale watch operations can be applied to spatial analyses*" (Hauser *et al.*, 2006, p. 280), albeit with appropriate consideration of some of the limitations of the data collected.

CONCLUSIONS

There have been considerable advances in whalewatching research this year with more studies showing that whalewatching can have behavioural impacts which translate into biologically significant effects for populations. However, some of the most significant research has come from long-term, wide-scoping studies, whereas many studies on whalewatching impacts tend to be short, and of a narrow focus, primarily due to a lack of funding for more long-term and in-depth studies.

Research again, as in previous years (see Parsons *et al.*, 2006a, 2006b) has seen a lack of compliance with whalewatching regulations, and it seems that better public and operator education and enforcement of regulation are themes that keep occurring, as do the nature and relevance of the regulations themselves (e.g. Scarpaci *et al.*, 2003). The controversy over whether whalewatching was compatible with whaling has continued, and has attracted attention with several papers this year, and perhaps will be an area of greater research in future. Finally, a new area of whalewatching research, which is particularly relevant to the work of the International Whaling Commission, is an evaluation of scientific data collected on whalewatching vessels and its applicability to cetacean management – the study so far seems to indicate that data gathered from whalewatching vessels can be both very accurate and useful for distribution and spatial analysis studies at the very least.

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