

Review Article

The Negative Impacts of Whale-Watching

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Received 16 February 2012; Accepted 23 May 2012

Academic Editor: Lori Marino

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Whale watching is an international industry worth more than US\$2 billion globally and is currently the greatest economic activity reliant upon cetaceans. However, there is concern that whale watching is detrimental to the target species. Numerous studies have shown that cetaceans exhibit behavioral changes in response to whale-watching boat traffic. Some of these behavioral changes involve inhibiting biologically important behaviors such as feeding and resting. There is convincing evidence for some species that these can translate into population-level effects such as reduced reproductive rates. Whale watching can also cause direct mortality through collisions between vessels and animals. The introduction of guidelines or regulations for whale watching has been the most common method of trying to mitigate the impacts of boat-based whale watching. However, there is great variety in the comprehensiveness of guidelines, and even if operators have guidelines, compliance with them can be poor. Compliance might be improved if guidelines have legal under-pinnings, with monitoring and enforcement or via pressure to comply by other operators and whale-watching tourists. Simple guidelines may be more easily complied with than ones requiring specialist knowledge. Likewise undertaking simple measures, such as establishing temporal or spatial “refuges” protecting biologically important areas (e.g., feeding grounds) where whale-watching activity is prohibited, could be an appropriate mitigation strategy.

1. Introduction

In 2009, it was estimated that 13 million tourists took trips to see whales, dolphins, and porpoises (cetaceans) in their natural habitat, as part of an industry that generated US\$2.1 billion dollars (1.7 billion Euros) and employed 13,000 people in 119 countries [1, 2]. As a class of tourism, it is particularly desirable as it can specifically draw tourists to a region, with many whale-watching tourists only visiting locations because of the presence of cetaceans [3–5]. It has been estimated that potentially the industry would be worth an additional US\$400 million and an additional 5,700 jobs, if maritime countries with cetacean populations, currently without whale-watching industries, were to develop them [2]. Whale watching is currently the greatest economic activity reliant upon cetaceans.

Many environmental and animal welfare groups have promoted whale watching as a tourism activity, as an alternative to the consumptive use of whales, that is, commercial whaling. Indeed, whale watching in countries that are still actively hunting whales is arguably more lucrative than whaling [5–7]. Statements from politicians in whaling

countries claim that whaling and whale-watching can coexist without impacting each other (e.g., [8–12]), but data suggest that whaling can inhibit whale-watching development or potentially reduce whale watching tourism revenues within a country [6, 7, 13–15]. Whaling may even reduce tourism revenues in general, because of ethical boycotts of whaling locations by tourists [16].

Some of the fastest growing whale-watching industries are in developing countries, such as China, Cambodia, Laos, Nicaragua and Panama [1], and there is potential for considerable growth in whale-watching operations in other developing nations [2]. Seeing cetaceans as an important economic resource in developing countries may aid their conservation, with losses from directed takes (such as hunts or culling) or indirect takes (such as fisheries entanglements or boat strikes) possibly seen as removing a valuable tourism resource. In addition, it has been argued that whale-watching can provide other intangible benefits, such as being educationally beneficial, or promoting a conservation ethic in whale-watching tourists [17–19]. At present some studies suggest that these benefits are minimal [20], whilst others are more positive about the educational and public

conservation-promoting benefits of whale watching [21–24]. It has been found that provision of education on-board whale-watching vessels increased customer satisfaction with trips [25] or was considered to be an important part of a whale-watching trip [21, 26, 27] in several locations and this does suggest that on-board education is providing some benefits to customers.

In contrast, there is also concern that promotion of whale watching could be detrimental to the target species [28, 29], and that adverse impacts of whale watching on target species could be not only detrimental to threatened species, but also potentially “killing the goose that laid the golden egg” as far as tourism is concerned.

2. Defining Whale Watching

The International Whaling Commission (the recognized intergovernmental authority on the management of whales as a resource) defined whale watching as “*any commercial enterprise which provides for the public to see cetaceans in their natural habitat*” (page. 33 in [30]). Although the term “whale” is used, the activity refers to all cetacean species, whether they are baleen whales, or dolphins or porpoises [31]. Whale watching does not, however, include tourism activities where animals are captive in pools or sea pens [31]. In 2005, the International Whaling Commission Whale Watching Sub-committee defined various types of whale-watching activity, noting that it might not necessarily be commercial, but could include members of the public taking their personal boats out to see whales, or research trips where there are paying customers on board (which they termed “whalewatching-aided research”).

It should be emphasized that although the majority of whale-watching activities are boat-based, whale watching could potentially include aerial activities (e.g., from a dirigible/airship or aircraft) or land-based whale-watching platforms. Whale-watching from land-based platforms or aerial craft such as hot air balloons is unlikely to have major impacts on cetaceans. However, powered aircraft and helicopters could produce substantial amounts of noise that could impact cetaceans, and although there has been little research into this area, it is a cause of concern (e.g., [32, 33]).

A subset of whale-watching activities involves trips where humans enter the water with wild cetaceans (i.e., “swim-with-cetacean tourism” [31]). Such activities can be “passive” where cetaceans are allowed to approach human swimmers of their own volition or “active” where the swimmers are placed in the path of oncoming cetaceans, or the cetaceans are pursued [31]. Both types of activity are more invasive than regular boat-based whale watching, especially the “active” form. Again, this is an area of particular concern of the International whaling Commission due to the potential risk to both humans and cetaceans involved in the activity [75]. Another type of tourism involving marine mammals is “provisioning” or feeding wild cetaceans—which most famously occurs in Monkey Mia in Australia. There are many concerns about the impact of this activity on the target species [76–80] as well as the risk to humans [81, 82]. However, for purposes of this paper, land-based and

aerial whale watching and the impacts of wild cetacean feeding programs and swim-with-cetacean tourism are not discussed.

3. Negative Impacts of Whale Watching

Several studies have recorded changes in cetacean behaviour in response to whale watching. These have included changes in surfacing, acoustic, and swimming behaviour and changes in direction, group size, and coordination (Table 1).

However, it is difficult to determine the long-term negative effects (if any) of these short-term behavioural changes. Possibly they can increase an animal’s energy expenditure or result in chronic levels of stress, which might have a negative effect on health [83], and it has been suggested in at least one study on bottlenose dolphins that long-term behavioural disruption may eventually lead to reduced reproductive rates [55]. Studies have shown an alteration or cessation of essential behaviours, such as feeding or resting (Table 1), and this would obviously be detrimental and could reduce fitness in the long-term, especially in situations where there is prolonged or repeated exposure. Research has also shown that boat-related sound can be drowned out or “mask” cetacean vocalizations [84]. This could result in animals either being unable to communicate (which could include prevention of biologically important communication related to mating or danger) or the animals having to increase the volume of their vocalizations, which may entail an additional energetic cost [52]. The effect of noise from whale-watching traffic and its population-level impacts are issues that require more quantification and attention [85, 86].

Disturbance has also been linked to cetaceans temporarily or permanently abandoning areas [68, 87, 88]. In addition to the energetic costs of moving to a new location and potentially establishing a new territory, animals may be displaced to less than optimal habitats—perhaps areas with higher predation, lower quality, or more difficulty in accessing prey species. All of these would have a cost.

However, absence of an observable reaction to whale-watching should not be interpreted as absence of an effect on cetaceans. In noncetaceans, researchers have noted that sometimes the most vulnerable animals do not react or move away from a disturbance, possibly because they lack the energy surplus to do so [89, 90]. There are a number of reasons why cetaceans may remain within an area or continue certain behaviours despite disturbance [91]. The location may be an important source of prey or outside the area may have a high rate of predation. Animals may also lack the foraging skills to feed on different species outside of the area. These are factors that might cause animals to “tolerate” disturbance, but as noted above, the lack of an obvious reaction does not mean that the animals is not being stressed or impacted [85].

The cumulative effect of changing behaviours, displacement, or the chronic stress induced by exposure to whale-watching activity may translate into declines in health and vital rates [85]. Bejder et al. [55, 88] linked the cumulative cost of short-term behavioural changes to a decline in female reproduction, and it was this and similar studies

TABLE 1: Examples of behavioral changes observed in cetacean species in response to whale-watching traffic.

Behaviour change	Species	Reference
Surfacing/diving	Common bottlenose dolphin, <i>Tursiops truncatus</i>	[34–38]
	Indo-Pacific bottlenose dolphin, <i>Tursiops aduncus</i>	[39, 40]
	Indo-Pacific humpback dolphin, <i>Sousa chinensis</i>	[41]
	Costero, <i>Sotalia guianensis</i>	[42]
	Killer whale, <i>Orcinus orca</i>	[43]
	Humpback whale, <i>Megaptera novaeangliae</i>	[44]
	Fin whale, <i>Balaenoptera physalus</i>	[45]
“Active” behavior (e.g., tail slapping and beaching)	Sperm whale, <i>Physeter macrocephalus</i>	[46]
	Common bottlenose dolphin, <i>Tursiops truncatus</i>	[37]
	Commerson’s dolphin, <i>Cephalorhynchus commersonii</i>	[47]
	Killer whale, <i>Orcinus orca</i>	[48]
Acoustic	Humpback whale, <i>Megaptera novaeangliae</i>	[49]
	Common bottlenose dolphin, <i>Tursiops truncatus</i>	[50, 51]
	Killer whale, <i>Orcinus orca</i>	[52]
	Humpback whale, <i>Megaptera novaeangliae</i>	[53]
Group size or cohesion	Sperm whale, <i>Physeter macrocephalus</i>	[54]
	Common bottlenose dolphin, <i>Tursiops truncatus</i>	[55, 56]
Swimming speed	Costero, <i>Sotalia guianensis</i>	[42]
	Indo-Pacific bottlenose dolphin, <i>Tursiops aduncus</i>	[40]
	Spinner dolphin, <i>Stenella longirostris</i>	[57]
	Killer whale	[43, 58]
Swimming direction	Humpback whale, <i>Megaptera novaeangliae</i>	[59]
	Common bottlenose dolphin, <i>Tursiops truncatus</i>	[55, 56]
	Indo-Pacific bottlenose dolphin, <i>Tursiops aduncus</i>	[39]
	Indo-Pacific humpback dolphin, <i>Sousa chinensis</i>	[41]
	Spinner dolphin, <i>Stenella longirostris</i>	[57]
	Costero, <i>Sotalia guianensis</i>	[60]
	Killer whale, <i>Orcinus orca</i>	[43, 58, 61]
Altered feeding or resting	Humpback whale, <i>Megaptera novaeangliae</i>	[49, 59]
	Common bottlenose dolphin, <i>Tursiops truncatus</i>	[62–65]
	Indo-Pacific bottlenose dolphin, <i>Tursiops aduncus</i>	[66]
	Short-beaked common dolphin, <i>Delphinus delphis</i>	[67]
	Costero, <i>Sotalia guianensis</i>	[68]
	Dusky dolphin, <i>Lagenorhynchus obscurus</i>	[47, 69]
	Commerson’s dolphin, <i>Cephalorhynchus comersonii</i>	[47]
	Risso’s dolphin, <i>Grampus griseus</i>	[70]
	Killer whale, <i>Orcinus orca</i>	[71, 72]
Humpback whale, <i>Megaptera novaeangliae</i>	[73]	

that persuaded the whalewatching subcommittee of the International Whaling Commission to state in 2006 that

“... there 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” (page. 54 in [92]).

In addition to altering behaviour, masking communication, or displacing animals, whale-watching tourism can also have more direct impacts. Whales have been injured or killed as a result of collisions with whale-watching vessels, especially in areas where there is a high intensity of whale-watching traffic, such as off the coast of Massachusetts or

Hawaii [92–94]. An increasing number of large, high-speed whale-watching vessels are of particular concern [75]: the speed of these vessels limits their ability, as well as that of the whales, to avoid collisions. In addition, a higher speed means greater force when collisions occur and a higher likelihood of a lethal outcome [93]. From an analysis of vessel-cetacean collisions, it was suggested that the likelihood of lethal collisions decreased when vessel speeds were below 11 knots [93]. Thus, speed restrictions may be an effective way to mitigate this problem. However, reducing speeds may impact whale-watching business profits, as a faster speed means accessing cetacean habitat more quickly, more trips being taken throughout a day, and thus more customers and revenue.

4. Mitigating Whale-Watching Impacts

The introduction of guidelines or regulations has been the most common method of trying to mitigate the impacts of boat-based whale-watching. In 2004, a review and comparison of international whale watching guidelines and codes of conduct from around the world found that one-third were regulatory, that is, legal requirements and non-voluntary, but two-thirds were entirely voluntary [95]. Most codes of conduct had regulations for minimum approach distances (e.g., 50–100 m or more), but most did not curtail especially invasive activities, for example, two-thirds had no proscriptions on feeding cetaceans and three-quarters did not prohibit touching cetaceans [95].

A study in Scotland conducted in 2000 found relatively high levels of acceptance of codes of conduct amongst operators, although it should be noted that this study found that there was a preference for operator organization or local NGO-produced guidelines, rather than guidelines produced by the national government [96]. Indeed there seemed to be resistance towards government intervention and a top-down approach in whale-watching management [96]. However, it should also be noted that a subsequent change in Scottish law led to the production of a new, government-mandated set of marine wildlife-watching guidelines. These governmental guidelines had greater acceptance because whale-watching operators and tourism organizations were consulted extensively during the drafting of the guidelines, that is, there was a top-down remit for the production of new guidelines, but there was bottom-up involvement in their construction [97].

The existence of guidelines, regulations, or laws in an area is no guarantee of compliance with these guidelines. In Doubtful Sound in New Zealand, two-thirds of tour boat encounters with common bottlenose dolphins violated the New Zealand Marine Mammal Protection Act, with one-third of encounters involving more than one violation [98]. In Victoria, Australia, swim-with-dolphin trip operators complied with only one out of the four regulations (i.e., the number of swimmers allowed in the water with dolphins), with regulations governing time spent with animals and boat approaches frequently disregarded [99]. After this research was presented to the government and a tour operator education/awareness program was introduced, the rates of noncompliance actually increased [100]. This may have been because operators realized that despite high levels of regulatory infractions, there was little enforcement or punishment. This is arguably the crux of the matter—guidelines are often poorly monitored and there is chronic lack of enforcement.

A study in New South Wales, Australia, found good levels of compliance with whale-watching guidelines [101]. Despite this, however, there were still probably impacts to cetaceans, as follows:

“The code’s aim in reducing exposure of dolphins to boats was not achieved as dolphin schools were subject to consecutive approaches by numerous boats and interactions also involved boats to which the code did not apply.” (page. 159 in [101]).

Therefore, although there was good compliance, a lack of broader management of whale-watching activities in the area, such as limiting vessel numbers and addressing the potential whale-watching “carrying capacity” for the region, ultimately led to a likely unsustainable situation. In several locations numbers of operators are limited by requiring licenses in order to operate, and the number of these licenses is restricted.

A factor in assessing whale-watching guideline effectiveness is that sometimes infractions are difficult to judge, especially by nonexperts. For example, it is frequently difficult to judge distances accurately at sea, especially during rough weather. If a regulation relies on an absolute approach distance, enforcement may be difficult. In addition, guidelines that mention specific behaviours (such as “feeding” or “distress” behaviours) may not be effective, as nonscientist operators could misinterpret, or simply miss, exhibited behaviours (e.g., [102]). Likewise, guidelines that have subjective values, such as “noisy activities,” could be misconstrued. Guidelines with approach distances can be problematic if cetaceans actively approach a vessel—should the operator undertake avoidance manoeuvres, which could possibly be noisy and stressful for the animals? Or should the operator continue current activities despite the approaching cetaceans, as this could cause less actual disturbance to the animals?

Scarpaci et al. [100] suggested that guidelines should be simple and easily understood, be realistic/feasible in the field (considering operator expertise and local conditions), and be easily enforceable. Whilst being practical, however, simple guidelines do not necessarily cover every eventuality and unexpected problem situations may arise. Thus an ability to change and alter guidelines quickly (i.e., adaptive management) may be crucial.

Very often authorities with the responsibility to monitor whale watching lack the will, resources, or logistical support to do so (e.g., the whale-watching location might be especially remote and difficult to access). Therefore monitoring of compliance may be very poor. In some regions, enforcement may effectively come down to operator peer-pressure; that is, responsible operators may report or otherwise criticize or pressure operators who are not adhering to codes of conduct or who are not behaving responsibly (pers. obs.). Moreover, whale watching tourists may be a possible enforcement tool. A study in Scotland found that many whale-watchers engaged in environmental activities, one-half were members of environmental groups, and an astonishing one-quarter stated that they conducted voluntary work for such organisations [103]. Few other studies have looked at environmental attitudes in this tourism sector, but the high level of involvement in environmental activities suggests that whale-watching tourists could be educated as to how a sustainable whale-watching operation should be run through articles in environmental organizations’ magazines and newsletters or via websites such as Planet Whale (<http://www.planetwhale.com/>). The environmental attitudes of the tourists could also be used to persuade operators that it is in their interest to be as environmentally-friendly and conservation-conscious as possible or they may risk alienating their customers.

TABLE 2: A checklist of questions to ascertain whether whale watching is sustainable in a region (after [74]).

Is the marine mammal population growing?
Are marine mammals moving out of an area?
Are the marine mammals exhibiting changes in behavior?
What are the levels of biological and chemical pollutants in coastal waters?
Are marine mammal tourism operators knowledgeable about marine mammals and local culture?
Are they good education providers?
Are marine mammal operators concerned about the safety and welfare of their customers?
Does the marine mammal tourism activity aid or benefit the local community?

After reviewing many studies on the effectiveness, or lack thereof, of whale-watching guidelines, the International Whaling Commission recommended

“... that, in general, codes of conduct should be supported by appropriate legal regulations and modified if necessary as new biological information emerges” (page. 59 [32]).

One simple method for reducing the impacts of whale watching is to establish “refuges” that is, “no-go” or “sanctuary” areas. Ideally such areas would allow animals to engage in biologically important behaviours (e.g., feeding, resting, or nursing) without being disturbed by whale-watching vessels. Refuges could be spatial (e.g., a marine protected area limiting whale-watching traffic), or they could be temporal (e.g., prohibitions on whale-watching activity in a location at certain times of day, days, or seasons [104]). A clearly defined (and less subjective) spatial or temporal refuge should allow monitoring or compliance and therefore make enforcement easier for managers.

5. Conclusions

Whale watching can provide many socioeconomic benefits, and it also could potentially aid conservation and/or allow the public to view cetaceans as being an economically important resource alive rather than dead. However, there are many direct and indirect impacts on the target species. To be sustainable environmentally and economically, these impacts need to be minimized. In an attempt to assess whether whale watching is sustainable in an area, Hoyt [74] suggested a check list of questions to gauge the sustainability of a whale-watching industry in an area (Table 2). Many regions have accreditation schemes, where operators receive training and have to abide by certain strictures (e.g., adhering to a code of conduct or whale-watching guidelines, providing certain levels of education, using environmentally-friendly practices), and such schemes can be beneficial if the standards for accreditation are high and the scheme is monitored, policed appropriately, and widely recognized. Along these lines, the International Whaling Commission developed a definition of “whale ecotourism,” which could potentially be used as benchmark criteria for an accreditation

scheme or standard for sustainable whale watching. A whale ecotourism operation is one that has taken major steps to

- (i) “actively assist with the conservation of cetaceans (for example, assisting local scientists or promoting conservation initiatives),
- (ii) provide accurate educational materials and/or activities about cetaceans and their associated habitats for tourists,
- (iii) ...minimize their environmental impact (whether by reducing their carbon footprint, reducing the amount of waste produced by their operation or introducing other environmentally beneficial practices),
- (iv) abide by a set of whale-watching regulations or an appropriate set of guidelines if no specific regulations are available for the area,
- (v) provide benefits to the local host community within which the company operates. Examples of such benefits might include a company policy of preferential employment of local people, selling local handicrafts, or supporting conservation, educational, or social and cultural projects or activities in the local community.” (page. 250-251 in [31]).

It is possible for whale-watching operations to minimize their impacts on cetaceans, perhaps enough so that there are no lasting or unduly negative effects. However, arguably the majority operations around the world are not doing so, to the detriment of cetacean populations internationally.

Acknowledgment

I wish to thank Naomi Rose for editorial comments on early drafts of this paper.

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