Tourism Management 75 (2019) 626–629

Contents lists available at ScienceDirect

Tourism Management

journal homepage: www.elsevier.com/locate/tourman

# Does provisioning for tourism harm whale sharks at Oslob? A review of the evidence and reply to Ziegler et al. (2018)

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A B S T R A C T

Provisioning of whale sharks (*Rhincodon typus*) for tourism at Oslob in the Philippines is a controversial issue. Recent studies that claim negative impacts of this industry on the ecology of whale sharks are characterised by a lack of baselines, limited methodological approaches and poor interpretation of results. They do not provide robust evidence for management or for advocacy that seeks to prevent provisioning. Furthermore, these studies cannot be used to draw conclusions about the ethics of tourists visiting Oslob or the motivations of the local people running the tourism operation.

## 1. Background

The provisioning of wild animals to enhance interactions with tourists is a controversial issue (Orams, 2002). In marine systems, the ecological costs of provisioning of sharks and rays for tourism has become a focus of this debate, due to the rapid global growth of this industry. In some instances, detrimental effects on target species of provisioning for tourism have been clearly identifiable, whereas in many others, impacts are far less obvious or remain to be determined (Gallagher & Huveneers, 2018).

Tourism based on interactions with whale sharks at Oslob in the Philippines has been a focal point of some recent research into the ecological impacts and ethics of provisioning. At this locality, whale sharks are provisioned within a small area of shallow coral reef (10 m water depth), 50 m from the shore. Tourists are transported to the feeding location by outrigger canoes and can remain in the canoe or enter the water to observe the sharks. In the water, many tourists hang on to the canoe sides or outrigger and some snorkel near the sharks. Snorkelers wear life jackets and no fins, which aims to prevent them from diving to touch sharks. SCUBA divers enter from the shore or visiting dive boats, moored outside the interaction area. Tourist boats form a line and feeders in small canoes lead whale sharks past the line of tourists. This activity occurs between 6.00 a.m. and 1.00 p.m. each day, with feeders distributing between 50 and 150 kg of food (mostly small shrimp) each session (Araujo et al., 2014).

Although whale sharks are a core element of shark tourism, with a third of the global industry featuring the species, Oslob is one of the few sites where provisioning occurs. This form of dive tourism at Oslob is now extremely popular and has been growing in attendance and income. From 2012 to 2016 approximately 751,047 tourists visited the site and of these, 62% were Filipino. Income from ticket sales was estimated to be $US 18.4 million for this period (Lowe & Tejada, 2019). The somewhat unusual nature of the industry and the fact that it involves a species that is both iconic and categorised as Endangered by the International Union for the Conservation of Nature Red List, provides strong incentives to examine the ecological effects of provisioning at Oslob.

To date, the outcomes of such studies have largely been negative. Three studies by similar groups of researchers (Araujo et al., 2014; Schleimer et al., 2015; Thomson et al., 2017) have concluded that provisioning alters the behavioural response of whale sharks to disturbance by humans and affects patterns of residency at the Oslob site. In turn, it is claimed that these behaviours are likely to (negatively) "*influence foraging success, alter distributions and lead to dependency as sharks get older*" (Thomson et al., 2017). A recent study by Ziegler et al. (2018) that also involved the some of the same group of researchers used the industry at Oslob as a case study to examine tourist attitudes to the ethics of provisioning. Involvement by tourists in the Oslob industry was characterised as a "guilty pleasure", because tourists obtained considerable enjoyment from the interaction involving provisioning, despite knowledge of the potential negative ecological effects on whale sharks. Ziegler et al. (2018) also examined the ethics of the local people involved in the industry and concluded that "*Their motivation is therefore to make as much money as possible from this endeavour before it gets shut down and not on ensuring an ethical and sustainable tourism experience.*"

These negative ecological impacts and ethical issues are key factors that underlie lobbying of the National Government of the Philippines by local conservation groups to stop the practise of provisioning, an action

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https://doi.org/10.1016/j.tourman.2019.02.003
Received 6 September 2018; Received in revised form 31 January 2019; Accepted 1 February 2019
Available online 03 March 2019
0261-5177/ 

that might close the shark tourist industry in Oslob. This is likely to have severe economic effects on local communities. The industry at Oslob is community-based, does not involve ownership by expatriate or local elites and has offered fulltime, alternative employment for 177 fishermen (Lowe & Tejada, 2019), who prior to its creation earned around a dollar per day (Ziegler et al., 2018). The benefits of well-remunerated employment in shark tourism have flowed to immediate and extended families, the fishing village and the broader municipality through the ability to pay for more food, health care, schooling, transport and better housing (Ziegler et al., 2018). Neighbouring communities also benefit through increased tourist patronage of surrounding areas and attractions (Lowe & Tejada, 2019). Furthermore, there are additional ecological benefits for local coral reefs with the reduction in fishing pressure through the removal of effort, protection of whale sharks from fishing and shark tourism providing finance for the management of five marine reserves (Lowe and Tejada 2019).

Given the implications of the closure of the industry to local communities, it is imperative that any management decisions be based on scientific evidence that is both robust and unequivocal. Here, we show that recent studies that have asserted that provisioning impacts the ecology of whale sharks at Oslob (Araujo et al., 2014; Schleimer et al., 2015; Thomson et al., 2017) are fundamentally flawed. We argue that there is no conclusive evidence that provisioning influences the behaviour or residency of whale sharks at Oslob and thus any suggestions about negative biological impacts are unfounded. For this reason, the conclusions of Ziegler et al. (2018) about the ethics of tourist participation in provisioning, or the motivations of local people in providing this experience lack any empirical basis.

## 2. Impacts of provisioning on whale sharks – what is the evidence?

All of the studies that have claimed evidence of impacts of provisioning on the ecology of whale sharks at Oslob are derived from the analysis of photo-identification data. Briefly, this technique photographs the spot and stripe patterns of whale sharks in a standard area of the body, just behind the last gill slit and forward of the dorsal fin (see Holmberg, Norman, & Arzoumanian, 2009; Meekan et al., 2006). These markings on each whale shark are unique and do not change over time, thus providing a means of identifying individuals. By matching photographs taken at different times, usually through a semi-automated software program, researchers can build a record of re-sightings of individual sharks, creating a data base that can be used for analyses of movement patterns, residency and demography (Meekan et al., 2006). Around the world, large photographic databases have now been built by collaborations among researchers and through citizen science, with tourists and operators contributing photos after encountering sharks (Andrzejaczek et al., 2016; Mckinney et al., 2017).

At Oslob, monitoring of 208 whale sharks by Thomson et al. (2017) over three years revealed variation in residency among individuals. Nine sharks were present frequently for extended periods of time, whereas others were present seasonally, sporadically or appeared only once at the site. The high residency of these nine sharks was a behaviour that these researchers argued was evidence that they had been captured by provisioning and were reliant on it as a food source. In reality, these observations provide no evidence of the causal relationship the authors claim. This would require baseline data showing the residency of the same animals changing over time in response to the commencement of provisioning. A more parsimonious explanation is that sharks differ in movement patterns (as is the case in other aggregations; see below) and individuals that are more resident at Oslob are simply more likely to take advantage of provisioning for feeding. The departure of all of the nine "resident" sharks from the aggregation for periods lasting from weeks to several months is good evidence that they are not entirely dependent on provisioning (Thomson et al., 2017). Similarly, using photo-id data, Araujo et al. (2014) claimed that differences in residency time between provisioned (mean 44.9 d) and non-provisioned (22.4 d) sharks at Oslob was evidence of "*behavioural modification induced by feeding opportunities*". Again, these differences in residency time are not evidence of a causal relationship with provisioning. Given that the resident sharks were smaller that non-resident sharks, it is very likely that differences in residency could result from variation in movement patterns among size classes. Further evidence that this is the case is shown by Thomson et al. (2017), who found that residency was negatively and significantly correlated with the mean size of sharks at Oslob; the smallest sharks (mean size 4.3 m) were the most resident, slightly larger sharks (mean 5.0 m) were present seasonally, sharks of 5.3 m mean length were recorded sporadically, whereas the largest sharks (mean 5.8 m) tended to be sighted only once. Evidence from tagging studies at aggregation sites where provisioning does not occur, such as Ningaloo Reef, Western Australia, show similar variation in residency patterns among individuals, with some sharks occurring at the aggregation site year-round, whereas the presence of others is seasonal or very infrequent. Such tagging studies increasingly show that not all individuals in an aggregation of whale sharks can be characterised as "highly migratory". For this reason, a lack of movement is not reason to infer that the behaviour of sharks has been modified by human intervention either through provisioning or by any other means.

The issue of what constitutes a "natural" pattern of residency was examined by Thomson et al. (2017), who noted that the 44.9 d residency of provisioned whale sharks at Oslob (Araujo et al., 2014) was considerably longer than whale sharks at non-provisioned sites at Panannon Island, Leyte (27 d), Ningaloo Reef (33 d) or Utila Honduras, in the Caribbean (12 d). They argued that this greater average residency was a "clear behavioural response to provisioning". However, a new study at a non-provisioned aggregation site at Donsol Bay, just 370 km to the north of Oslob, shows that sharks had an average residency of 50 d, (Mccoy et al., 2018), a result that contradicts any assumed relationship between mean residency times and provisioning.

Thomson et al. (2017) also argued that because "*seasonality is a well-known feature of whale shark aggregations globally*", individuals that do not seasonally migrate from an aggregation site at Oslob provide evidence of provisioning affecting their behaviour. Although it is certainly true that sharks appear seasonally at many aggregation sites, as noted above, tagging studies show that it is not at all unusual that some portion of the population is more resident than others. At Oslob, the highly resident sharks consisted of only nine of the 208 individuals that were monitored by (Thomson et al., 2017). Moreover, many of the other sharks monitored at Oslob did display patterns of seasonal movement, showing that the behaviour of the nine resident sharks was not representative of the entire population. In any event, it can be very difficult to determine seasonal patterns of movement of whale sharks using a photo-id approach. For example, whale sharks were thought to occur seasonally at Mafia Island off the coast of Tanzania, based on photo-id studies. More recent work using acoustic telemetry shows that sharks did not depart seasonally from this locality but only moved into deeper areas offshore where they could not be photographed (Cagua et al., 2015). Thus, any assessment of residency among individuals within or between populations at different aggregation sites is likely to require an approach that uses multiple techniques.

Arguments about seasonality by these studies also involve an underlying assumption that is never explicitly tested. Thomson et al. (2017) contended that "*This year-round food source* (provisioning) *represents a major deviation from natural patterns of prey availability for a highly mobile planktivore*". Although this statement assumes that prey availability for whale sharks at Oslob varies through time, there is no published data to confirm that this is the case. As the identity of "natural prey" or patterns in their abundance is unknown, this cannot provide a basis for any argument about provisioning affecting seasonality. It is certainly true that at some aggregation sites the appearance of whale sharks coincides with sporadic but predictable opportunities for

foraging, such as the spawning of red crabs at Christmas Island (Meekan, Jarman, Mclean, & Schultz, 2009), tuna spawning off the coast of the Yucatan and Qatar (De La Parra Venegas et al., 2011; Robinson et al., 2013) and spawning of reef fish at reefs off Belize (Heyman, Graham, Kjerfve, & Johannes, 2001). However, as noted above, in many locations it is not at all unusual that some component (or even all) of the population can be present year-round (Prebble et al., 2018) and there is a growing realisation among researchers that populations of whale sharks are likely to be regionally-based, rather than wide ranging (Andrzejaczek et al., 2016).

In addition to impacts on residency, Schleimer et al. (2015) also suggested that provisioning also affects the behaviour of whale sharks at Oslob. These researchers found that sharks with a longer resighting history were present only five minutes after feeding boats arrived and had a higher tolerance to touches from tourists or contact with boats than sharks with smaller numbers of resights. Sharks that were highly resident were also more likely to display vertical feeding behaviours. Similar to residency, such patterns do not demonstrate any causal relationship between provisioning and behaviour. Sharks that are more resident and move over smaller distances will be more likely to be present when feeder boats arrive and will encounter tourists and boats more frequently, thus becoming habituated to their presence. This type of encounter habituation occurs at the non-provisioned aggregation at Ningaloo Reef, where sharks that encounter tourists frequently in one year are more likely to be resighted in the following year (Sanzogni, Meekan, & Meeuwig, 2015). Similarly, the observation that sharks that are resident are more likely to display vertical feeding behaviours cannot be linked explicitly to provisioning. A vertical mode of feeding is characteristic of whale sharks worldwide (Nelson & Eckert, 2007) and has evolved as a cost-effective means of foraging when prey occurs in dense patches. It is most likely that the propensity to feed vertically is size-specific, with smaller, resident sharks more easily able to adopt this mode than larger sharks in the shallow water where provisioning occurs. There is no evidence that whale sharks that have a greater likelihood to feed in this way suffer any negative ecological impacts; indeed if this were true, the behaviour would not have evolved in the first place.

Overall, the lack of evidence of causal relationships between provisioning, behaviour and residency make it entirely inappropriate to conclude that provisioning could negatively "*influence foraging success, alter distributions and lead to dependency*" of whale sharks (Thomson et al., 2017). All studies of the impact of provisioning at Oslob lack the appropriate baselines of data on patterns of food availability and residency and behaviours of sharks prior to the commencement of the tourist industry. For this reason, researchers must rely on comparisons among sites or individuals that have any number of potential (and more parsimonious) explanations. Furthermore, even if provisioning were the cause of the behavioural and residency patterns that these authors claim, any ecological effects apply to only a tiny portion (seven to nine resident sharks) of the hundreds of animals that visit the aggregation.

## 3. Implications for Ziegler et al. (2018)

As there is no evidence that provisioning negatively affects the ecology of whale sharks at Oslob, the central claim of the work by Ziegler et al. (2018) that tourists visiting the site should feel guilty about enjoying their experience is not grounded in reality. Furthermore, the argument that local communities are only motivated by money and are acting unethically by pursuing this industry is entirely unfounded and an unjustified slur on their reputations.

The generation of livelihoods from shark tourism provides a significant incentive to the Oslob community to conserve whale sharks and the coral reef resources of the local area (Lowe and Tejada 2019). As noted by Ziegler et al. (2018), some forms of tourism may not include the most resource dependent community members who are more likely to participate in behaviours that negatively affect the environment, thereby missing an opportunity to improve conservation outcomes. This is certainly not the case in Oslob, where the tourism business is owned and operated by a cooperative of 177 fishers, in partnership with their village and municipality. Prior to commencement of this industry, these fishers had some of the lowest incomes in the country; today they are among the highest (Ziegler et al., 2018).

It is remarkable that in categorising the behaviours of the local villagers who participate in the whale shark industry, Ziegler et al. (2018) relied only on tourist participant surveys and TripAdviser reviews. It is not clear how the motivations of the fishers, villagers and local government officials who own and operate shark tourism can be assessed without communicating with them. Contrary to Ziegler et al.'s (2018) assertions that fishers act in their own interests to the detriment of the whale sharks, Lowe and Tejada (2019) found that shark tourism at Oslob provides income to four beneficiary groups; fishers, their families, other village residents and other residents of the broader municipality. Livelihoods from shark tourism create payoffs for fishers and their community that change behaviour, leading to collective engagement in sustainable integrated coastal management, a goal that many donor funded and community based livelihood projects strive for but few achieve (Cinner, 2014; Roe et al., 2015). Income from whale shark tourism is also used by local government to support the management of five marine reserves in the municipality and to pay for enhanced law enforcement by the Bantay Dagat to protect whale sharks and coral reef resources (Lowe and Tejada 2019).

Other evidence that refutes the conclusion that the community at Oslob is motivated only by self-interest is their continued positive response to the challenges raised by growth of the industry. The villagers have consistently upgraded management of tourism and infrastructure through time, applying interaction guidelines for tourists with whale sharks to reduce incidences of touching of animals and to attempt to increase distances of encounters. Pre-swim briefings of tourists are now held to improve compliance with these codes. Beach-side facilities have been renovated to reduce run-off from showers and septic systems and staff are employed to clean the beach and assembly area of litter left by tourists (Lowe and Tejada 2019).

## 4. Conclusion

Although the studies examining the effects of provisioning on whale sharks at Oslob note some of the uncertainties surrounding outcomes of their work, the authors invoke a "*precautionary principal*" whereby management should apply "*preventive actions even if data on cause and effect are still inconclusive*" (Schleimer et al., 2015). We argue that there is little point in applying this principal if it simply means yet more research that lacks baselines, has a limited methodological approach and is poorly interpreted. Such studies offer no robust evidence for the impacts that are claimed or most importantly, that the abolition of provisioning would have any positive effects on the ecology of whale sharks at Oslob. They do not provide a reasonable basis for advocacy that seeks to prevent provisioning, or allow researchers to draw conclusions about the ethics of tourists visiting Oslob and the motivations of the local people running the tourism operation.

It is indisputable, however, that closure of whale shark tourism at Oslob would have a devastating impact on the livelihoods of local communities. We agree that a precautionary principal is a good approach to management, but argue that it should not just be applied to whale sharks – it should also take into account the welfare of the human communities that this tourism industry has successfully lifted from poverty.

## Declarations of interest

None.

## Author contributions

Mark Meekan and Judi Lowe conceived the idea, wrote and edited the work.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tourman.2019.02.003.

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