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How shark conservation in the Maldives affects demand for dive tourism

Johanna S. Zimmerhackel[a,b,c,*], Abbie A. Rogers[a,c], Mark G. Meekan[b,c], Khadeeja Ali[d], David J. Pannell[a], Marit E. Kragt[a]

[a] Centre for Environmental Economics and Policy, UWA School of Agriculture and Environment, The University of Western Australia, M087/35 Stirling Hwy, Crawley, WA 6009, Australia
[b] Australian Institute of Marine Science, M096/35 Stirling Hwy, Crawley, WA 6009, Australia
[c] Oceans Institute, The University of Western Australia, M470/35 Stirling Hwy, Crawley, WA 6009, Australia
[d] Marine Research Centre, H. White Waves Moonlight Higun, Malé 20025, Maldives

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ABSTRACT

Shark-diving tourism provides important economic benefits to the Maldives. We examine the link between shark conservation actions and economic returns from diving tourism. A combined travel cost and contingent behaviour approach is used to estimate the dive trip demand under different management scenarios. Our results show that increasing shark populations could increase dive-trip demand by 15%, raising dive tourists' welfare by US $58 million annually. This could result in annual economic benefits for the dive-tourism industry of > US$6 million. Conversely, in scenarios where shark populations decline, where dive tourists observe illegal fishing, or if dive operators lack engagement in shark conservation, dive trip demand could decrease by up to 56%. This decline causes economic losses of more than US$24 million annually to the dive tourism industry. These results highlight the dependence of the shark-diving industry on the creation and enforcement of appropriate management regimes for shark conservation.

1. Introduction

Ecotourism to watch wildlife is a fast-growing industry worldwide and offers a variety of benefits for those involved. For tourists, these include recreational and educational values such as a sense of well-being and improved environmental awareness (Ballantyne, Packer, & Falk, 2011; Curtin, 2009). For local communities, wildlife tourism supports the economy by providing jobs and income (Tisdell & Wilson, 2003). Within the wildlife tourism sector, shark diving has increasingly gained popularity and is now attracting over 500,000 tourists to shark dive sites in approximately 45 countries around the world (Cisneros-Montemayor, Barnes-Mauthe, Al-Abdulrazzak, Navarro-Holm, & Rashid Sumaila, 2013). The benefits for local economies from this industry are substantial (Gallagher & Hammerschlag, 2011). For example, in Palau, shark-diving generates US$18 million in annual business revenue for the national economy (Vianna, Meekan, Pannell, Marsh, & Meeuwig, 2012), while in Australia it generates up to US$25.5 million per year (Huveneers et al., 2017). Typically, the economic returns of these diving tourism industries are many times greater than fisheries that target the same species (Anderson & Ahmed, 1993, p. 51; Gallagher et al., 2015; Topelko & Dearden, 2005).

The economic returns of shark-diving to a country will depend, in part, on the degree of satisfaction that the experience provides to tourists. In welfare economics, this satisfaction (or 'welfare') is expressed as the 'consumer surplus' (Ward & Loomis, 1986). In the case of shark-diving tourism, visitors' satisfaction will depend on the quality of the shark-diving operation and the condition of shark populations. For example, in the Maldives, decreasing numbers of sharks at dive sites as a result of fishing caused dive operators to abandon or reduce visits to popular shark-diving sites due to lowered tourist demand. This caused considerable economic losses to the dive-tourism industry (Anderson & Waheed, 1999).

As this example shows, changes in the quality of the shark-diving experience and thus recreational benefits for tourists have implications for the number of trips that dive tourists will plan to make to a particular site. To date, no study has attempted to quantify the type of changes (positive or negative) in the environment or management strategies that might cause tourist demand to alter or the impact that this might have on the economics of the shark-diving industry. Such studies, which typically involve a combined travel cost and contingent

* Corresponding author. Centre for Environmental Economics and Policy, UWA School of Agriculture and Environment, The University of Western Australia, M087/35 Stirling Hwy, Crawley, WA 6009, Australia.
E-mail addresses: johanna.zimmerhackel@research.uwa.edu.au (J.S. Zimmerhackel), abbie.rogers@uwa.edu.au (A.A. Rogers), m.meekan@aims.gov.au (M.G. Meekan), kali@mrc.gov.mv (K. Ali), david.pannell@uwa.edu.au (D.J. Pannell), marit.kragt@uwa.edu.au (M.E. Kragt).

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behaviour approach, are commonplace in other contexts, for example in recreation in forest (Simões, Barata, & Cruz, 2013; Starbuck, Berrens, & McKee, 2006) and lake environments (Jeon & Herriges, 2010; Richardson & Loomis, 2004) and in the recreational fishing industry (Layman, Boyce, & Criddle, 1996; Prayaga, Rolfe, & Stoeckl, 2010). Some combined travel cost and contingent behaviour studies have also examined broader aspects of tourism in coral reef environments. Bhat (2003) showed that improvement of coral reef quality in the Florida Keys could increase the trip demand of tourists that visit the area (including dive tourists) by 43–80%. Conversely, Kragt, Roebeling, and Ruijs (2009) found that a decline in coral reef and fish diversity in the Great Barrier Reef could cause a decrease in dive and snorkel trip demand by 80% resulting in major economic losses to the tourism industry.

Given that shark diving is a fast-growing tourism industry that is recognised as providing important economic and social benefits, a change in trip demand due to management strategies that fail or succeed to achieve conservation goals (thereby influencing tourist satisfaction) could have important implications for local communities. Here, we quantify the impacts of both negative and positive scenarios on the economic contribution of the shark-diving industry. We hypothesize that improving the quality of the shark-dive experience through increased shark populations, an absence of illegal fishing activities, and engagement in shark conservation actions by dive operators will enhance the demand for trips by dive tourists, and will thereby generate economic benefits. Conversely, we predict that a decline in shark abundance, the presence of illegal fishing during dive trips, and a lack of engagement by dive operators in actions to improve fishers' compliance will reduce trip demand by dive tourists, with negative effects on tourism numbers and economic losses for the dive tourism sector and local tourism generally.

2. Methods

2.1. Study site

The Republic of the Maldives is a small island nation in the central Indian Ocean (Fig. 1). The country is composed of about 1200 islands of which 200 are inhabited, around 122 are assigned as resort islands, and the remainder are uninhabited.

The Maldives provide an excellent case study because tourism dominates the nation's economy and accounted for 27% of the gross domestic product in 2014. Diving and snorkelling are the most popular activities of tourists in the Maldives (Statistics and Research Section, Ministry of Tourism Republic of Maldives 2017) with 184 dive schools registered in the country (Dive Schools - Ministry of Tourism n.d.). Watching marine mega fauna such as rays and sharks is an essential element of the diving tourism industry (Anderson, Shiham Adam, Kitchen-Wheeler, & Stevens, 2011; Cagua, Collins, Hancock, & Rees, 2014). In 1991, shark diving in the Maldives generated about US$2.3 million in direct annual business revenue, compared to a revenue of US $0.5 million per year from the reef shark fishery (Anderson & Ahmed, 1993, p. 51). Anderson and Ahmed (1993, p. 51) estimated that the value of a living grey reef shark may be one hundred times higher than when it's dead as a fisheries resource. These numbers are likely to be much higher today, as in 2013 an estimated 78,000 tourists accounted for $9.4 million direct expenditures solely for tourism focused on whale sharks in the South Ari Atoll (Cagua et al., 2014).

In 2010, a shark sanctuary was implemented in the Maldives when the declining status of shark fisheries and concerns over decreased shark sightings from divers encouraged the government to announce a total ban on shark fisheries in its waters (Ali & Sinan, 2015). Today, shark populations are recovering in most, but not all, atolls (Sattar, Wood, Ushan, & Ali, 2013). An overall increased shark abundance indicates that the implementation of the shark sanctuary is achieving its intended objectives to some extent. Nevertheless, the Maldives are facing a number of challenges that could disturb the effectiveness of the ban. Occasionally, scuba divers have complained about observing illegal shark fishing activities during their dive trips (Ali & Sinan, 2014). These claims are further strengthened by the sale of shark jaws and teeth in most souvenir shops (first author's observation). The lack of an import ban allows shop sellers to claim that souvenir articles were imported, whereas there are indications that jaws and teeth have been extracted from local shark populations in at least some cases (fourth author's observation). Reef fishermen, in turn, complain about growing shark populations that depredate on their catch (Ali & Sinan, 2014). This drives some fishermen to kill sharks (fourth author's observation).

Many dive operators in the Maldives engage in some sort of shark conservation action. Some resorts host marine biologists who create awareness and teach best practices during dive operations (Cagua et al., 2014). The long-term citizen science programme "Shark Watch" is conducted by dive guides who monitor their shark sightings and help to assess population trends in the area (Sattar et al., 2013). Some resorts report illegal fishing activities to authorities and refuse to buy fish from fishermen that have landed sharks (first author's observation).

2.2. Survey

We designed a tourist survey to estimate how the quality of the shark-diving experience influences the trip demand of dive tourists in the Maldives and subsequent economic returns to the local economy. Prior to data collection, surveys were tested in a pilot study with 12 experienced divers in Western Australia. For data collection in the Maldives, all 184 registered dive operators in the study area were contacted by phone and email and asked for permission to conduct surveys with their clients. For logistic reasons, a subsample of 19 different dive operators (seven on resort islands, 11 on local islands, and one on a dive cruise boat) who agreed to collaborate were included in the study. From September to November 2016, surveys were conducted with dive tourists on 13 different islands and six different administrative atolls in the Maldives (North Male, South Male, North Ari, South Ari, Lhaviyani, and Baa—Fig. 1). We considered this sample to be representative of dive operators in the Maldives, given that these central atolls receive approximately 95% of tourist arrivals. Once on site, dive tourists were personally approached in the dive centres and provided with a brief overview of the project. They were asked if they were willing to participate and were given a digital survey on an electronic tablet or an equivalent paper-based survey.

Each survey consisted of five sections that first asked about the dive tourist's purpose for visiting the Maldives and the importance that sharks played in their decision to visit, and second, their satisfaction with the shark-diving experience. The third section asked about respondents' future plans to visit the Maldives in the next ten years under the status quo scenario and seven alternative scenarios (Table 1).

These alternative scenarios were of a qualitative nature and were as follows: (i) fishing absent: respondents would not observe illegal fishing activities or trade in shark products, (ii) fishing present: respondents would observe illegal fishing activities or trade in shark products, (iii) abundance increase: the number of sharks would increase, (iv) abundance decrease: the number of sharks would decrease, (v) sharks absent: there would be no sharks, (vi) conservation present: a dive operator would take actions against illegal fishing activities, and (vii) conservation absent: a dive operator would not take actions against illegal fishing activities. Participants were provided with examples of different actions that dive operators could engage in to reduce illegal fishing. Those actions were: patrol dive sites during dive operations, help fishermen financially through employment or compensation schemes, support fishermen socially through educational programs or infrastructure, and integrate fishermen in the management of sanctuaries by mediating between fishermen and other stakeholders. For each scenario, participants were asked how many times they expected to visit the Maldives, and whether or not they would recommend the