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Review

Biological effects, conservation potential, and research priorities of shark diving tourism

Austin J. Gallagher [a,b,c,*], Gabriel M.S. Vianna [d,e], Yannis P. Papastamatiou [f], Catherine Macdonald [a], Tristan L. Guttridge [g,h], Neil Hammerschlag [a,c]

[a] Leonard and Jayne Abess Center for Ecosystem Science and Policy, University of Miami, Coral Gables, FL, USA
[b] Beneath the Waves Incorporated, Syracuse, NY, USA
[c] Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL, USA
[d] School of Animal Biology and Oceans Institute, The University of Western Australia, 35 Stirling Hwy, Crawley, WA 6009, Australia
[e] Australian Institute of Marine Science, The UWA Oceans Institute (MO96), 35 Stirling Hwy, Crawley, WA 6009, Australia
[f] School of Biology, University of St Andrews, St Andrews, Fife KY16 8LB, Scotland, UK
[g] Earth and Ocean Sciences, Cardiff University, Cardiff CF10 3XQ, Wales, UK
[h] Bimini Biological Field Station, 15 Elizabeth Drive, South Bimini, Bahamas

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ABSTRACT

Shark diving tourism is a burgeoning, global industry. The growing perception that sharks can be worth more alive for tourism than dead in a fish market has become one of the leading contemporary arguments for shark conservation. However, there still exists concern that many aspects of shark-related tourism (e.g., provisioning) may alter natural behaviors and foraging areas, as well as pose a threat to humans by associating people with food. These concerns are largely driven by the previously limited scientific knowledge regarding the effects of shark diving tourism on shark biology, the marine environment and human interactions. Here we review and summarize previous research in these areas and evaluate the potential effects of dive tourism on shark behavior, ecology and subsequent human dimensions. To assist the development of future research, we provide a set of research questions. Taken together, we conclude that under the right conditions and if done in a precautionary, responsible manner, shark diving can provide a net conservation benefit (i.e., garnering of protective measures, raising awareness, instilling a conservation ethic) for a handful of species.

Contents

* Corresponding author at: Leonard and Jayne Abess Center for Ecosystem Science and Policy, University of Miami, Coral Gables, FL, USA. Tel.: +1 (305) 421 4356; fax: +1 (305) 421 4675.
E-mail address: gallagher.austin@gmail.com (A.J. Gallagher).

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1. Introduction

As humans continue to exploit natural resources, driving species population declines and biodiversity loss, the non-consumptive values of nature associated with tourism have become increasingly important (Davies, 1990; Duffus and Dearden, 1990). This type of ecological or natural tourism, often termed 'ecotourism,' is one of the fastest growing sectors of the tourism industry worldwide (Wearing and Neil, 1999). According to the World Tourism Organization (UNWTO), "ecotourism" is broadly defined as activities in which tourists observe and appreciate nature that minimize impacts on the natural and cultural environment and support the maintenance of natural areas and host communities (UNWTO, 2002). Additionally, these activities should contain educational features and be generally organized by small, locally-owned businesses. Species in their natural settings hold significant aesthetic and economic values, and wildlife viewing is one of the most profitable and popular forms of ecotourism worldwide (Kruger, 2005).

Charismatic animals tend to be the major attractions in the wildlife viewing sectors, and are commonly used as flagships for global conservation efforts (Zacharias and Roff, 2001). Shark diving tourism is a growing, worldwide industry focused on viewing sharks underwater by either snorkeling or scuba diving (e.g., Gallagher and Hammerschlag, 2011). Shark diving tourism is highly diverse in terms of species, cultures, and regulations. The industry is estimated to cater to more than half of a million participants annually, distributed in approximately 85 countries (Cisneros-Montemayor et al., 2013). Shark diving operations can generate significant revenues, benefiting select members of local communities and even national economies (e.g., Bahamas; Gallagher and Hammerschlag, 2011). Given that certain shark populations are experiencing significant population declines globally due to overfishing (e.g., Ferretti et al., 2010), the monetary benefits of shark diving have become a flag for shark conservation activism. In addition, the debate on this type of valuation has been rightfully discussed (see Catlin et al., 2013).

The majority of shark diving operations use an attractant (i.e., minced fish) to lure sharks in close proximity to tourists, where the animals are frequently offered food rewards to maintain their interest. Such practices have generated public and scientific concern as to the potential negative consequences for shark behavior or health, as well as for human safety. Accordingly, some coastal states or nations have banned shark diving activities involving food rewards (e.g., Florida and Hawaii, USA). Despite these concerns, scientific information regarding the industry and its effects is restricted to a few locations. In the last five years, there have been many studies covering a wide range of topics related to shark diving tourism, such as behavioral modifications or other effects on sharks, socio-economics, as well as legal and social issues (Table 1). However, this field of research has only begun to answer the many questions remaining regarding the biological, ecosystem, socio-economic, safety and conservation implications of this growing industry.

Despite the global nature and popularity of this industry, as well as the recent surge of research interest into assessing it, there are currently no conceptual frameworks for guiding empirical research, nor is there a set of science-based recommendations on how practices can be designed to promote conservation and sustainability while minimizing impacts. Instead, there seems to be a high degree of mistrust, doubt, misinformation in the media, and questioning of validity of data and results between studies and researchers, and an even greater amount of controversy surrounding certain practices and specific operators among the public and through social media (Authors, direct observation). Thus, a conceptual overview of the literature and issues surrounding shark diving tourism may be of great value to the scientific, policy, and public communities.

Here we provide a comprehensive and quantitative review of the research surrounding the shark diving tourism industry by analyzing trends and patterns in the literature, summarizing what is known from previous work, identifying critical knowledge gaps, and providing recommendations for future research. We also compare findings from the shark literature to other forms of wildlife viewing and tourism (where appropriate). We focus on five broad categories and their associated research priorities: behavior (learning, habitat use and movement), ecology and trophic interactions, animal welfare, human dimensions (safety, socio-economics, conservation and research, management), and practice (regulation, codes of conduct). To identify areas where future research can be directed to maximize benefit, we also provide a comprehensive set of questions that may serve as a road map for future studies.

While the terms "shark diving ecotourism" and "shark-diving tourism" are often used interchangeably in the literature, use of the word "ecotourism" implies ecologically sustainable practices which directly contribute to the maintenance of species, habitats, and local cultures (Valentine, 1993; UNWTO, 2002). Due to the wide range of operations and variation in practices and ethics, we refrain from using the word "ecotourism" in the remainder of our paper. Instead, we use the term "shark dive/diving tourism" throughout to describe the practice of tourists paying for in-water experiences with sharks in their natural habitat. Since the majority of shark diving operations worldwide use bait and attractant (Gallagher and Hammerschlag, 2011; see also references in Table 1), a large proportion of our discussion indeed focuses on diving operations in which sharks are "provisioned." We define "provisioning" as those activities where some type of attractant, bait, or food reward is offered for the tourism purposes of aggregating or positively reinforcing sharks to neutralize their aversion to humans (Orams, 2002; Knight, 2009; Fig. 1), although other activities which do not use provisioning are also mentioned (i.e., basking shark and whale shark tourism). We also impart that this paper does not argue or advocate for or against any activities related to shark diving tourism.