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Marine life preferences and perceptions among recreational divers in Brazilian coral reefs

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HIGHLIGHTS

- We examine divers' changes in marine life preferences and perceptions.
- Novice divers preferred megafauna and experienced divers, cryptic animals.
- Perceptions of decreasing in the quality of fish attributes were accompanied by the worst expectations.
- Experience and perceptions can be used as a predictor to maximizing diver's enjoyment.
- We provide managerial implication for sustainable dive tourism.

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ABSTRACT

Understanding diver preferences and perceptions of environmental attributes can help inform dive tourism management. We interviewed 190 recreational divers and examined their preferences for marine life in the Abrolhos National Marine Park, eastern Brazil. We also assessed divers' perceptions of changes in fish abundance when they revisit the dive site. Marine life preferences changed according with the divers' experience level. Novice divers preferred encounters with megafauna, whereas experienced divers preferred to see cryptic species. Individual perceptions of decline in fish abundance were influenced by longer time interval between visits. Visitors elicited the end of fish feeding, and illegal fishing, as the main causes of decline. Strategies to limit decline in the quality of marine life attributes, such as zoning and visitation limits based on carrying capacity estimates should be also based in divers' preferences and perceptions. Therefore, understanding divers' motivations and preferences will help maximize visitors' enjoyment and guide the dive industry into a more sustainable mode in the future.
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1. Introduction

1.1. Coral reefs and dive tourism

Coral reefs provide humans with a variety of benefits, including cultural, social, biological, and economic services and values such as fisheries, coastal protection, and tourism (Brander, Van Beukering, & Cesar, 2007). Coral reefs are popular travel destinations, especially among scuba divers, underpinning one of the world's fastest growing recreational sports and rapidly developing to be a multi-billion dollar industry (Cope, 2003; Ong & Musa, 2012). Scuba diving is considered a low-impact activity and provides an economic alternative to fishing through non-extractive use of marine wildlife (Davis & Tisdell, 1996; Tapsuwan & Asafu-Adjaye, 2008). Preferred destinations worldwide are renowned for its high coral reef biodiversity, attaining high visitation rates, such as dive sites in the Caribbean (Tratalos & Austin, 2001), the Red Sea (Wilhelmsson, Ohman, Stahl, & Shlesinger, 1998) and Australia (Wilks & Davis, 2000).

The uniqueness and abundance of marine life are among the most important motivations for diving tourism (Mundet & Ribera,

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2001; Musa, Kadir, & Lee, 2006; Uyarra, Watkinson, & Côté, 2009). Because most of the marine protected areas (MPAs) possess relatively better quality of marine life, these areas have been experiencing an increase in the number of visitors (Green & Donnelly, 2003). MPAs generally protect marine life and conserve ecosystems healthy, thus making it attractive to dive tourism. However, diving can inflict direct and indirect negative impacts on reef ecosystems. For instance they could cause damage like trampling, feeding, and unintentional contact with corals through body parts, mainly fins (Barker & Roberts, 2004; Chung, Au, & Qiu, 2013; Hawkins & Roberts, 1993; Milazzo, Badalamenti, Vega-Fernandéz, & Chemello, 2005; Worachananant, Carter, Hockings, & Reopanichkul, 2008). These impacts may become intensified when destinations lack proper management and receives high rates of visitation, which may render diving tourism unsustainable.

1.2. Measuring specialization among recreational divers

Surveys have verified variability in environmental attitudes, behaviors, and preferences between experienced and novice recreationists within a variety of activities (Bricker & Kerstetter, 2000; McFarlane, 1994). This experience-related theory was named "recreation specialization", which refers to a continuum of behavior from the general (broad interests and minimal resource dependence), to specific (skilled interests and high resource dependence). Recreation specialization is a multidirectional approach, influenced by experience, skill and activity setting preferences (Bryan, 1977). People approach their preferences differently, according with their level of experience in the activity. One indicator of experience level often used in studies of recreational scuba is number of dives performed in a lifetime (Camp & Fraser, 2012; Lucrezi, Saayman, & Merwe, 2013; Thapa, Graefe, & Meyer, 2006). This indicator is generally correlated with divers' certification (Miller, 2005), knowledge, skill and responsible behavior (Fitzsimmons, 2009; Musa, Seng, Thirumoorthi, & Abessi, 2011; Thapa et al., 2006). However, other indices of recreational specialization have been used to empirically examine scuba divers. For instance, Miller (2005) used a Multidimensional Recreational Specialization Index based on diver's level of participation (experience), training and associated skills, and coral reef setting history to examine divers' recreational specialization.

1.3. Understanding divers' marine life preferences, perceptions and implications for tourism management

Dive tourism managers must promote user satisfaction while preventing reef degradation. It is therefore important to understand divers' motivations, perceptions, and preferences. Observe and interact with marine life is the major reason for diving enjoyment (Ditton, Loomis, & Choi, 1992). Specific interests in marine life may predict typical behaviors and attitudes among recreational scuba divers (Lucrezi et al., 2013), such as the preference for swimming near the substrate by divers who want to observe seahorses (Uyarra & Côté, 2007). However, scuba divers are not a homogeneous group. Knowledge, motivations, preferences and expectations can vary among individuals. Preferences also greatly depend upon aspects such as gender (Priskin, 2003) and experience (Dimmock, 2009; Fakeye & Crompton, 1991). Understanding diver preferences can help to manage the activity according to the diver's desires. Studies on divers' motivations, preferences and perceptions have been conducted in several diving destinations around the world, including Bonaire (Uyarra et al., 2009), Australia (Inglis, Johnson, & Ponte, 1999), Malaysia (Musa, 2002), South Africa (Dicken, 2014; Lucrezi et al., 2013), Thailand (Dearden, Bennett, & Rollins, 2007); Mauritius (Gössling, Lindén, Helmersson, Liljenberg, & Quarm, 2008), Belize, Jamaica and Cuba (Williams & Polunin, 2000). Increasing in experience and specialization has been observed to influence marine life preferences among divers (Cater, 2008a, b; Ince & Bowen, 2011). However, there is no information regarding how preferences change according experience level in Southwest Atlantic coral reefs. This theme needs to be encouraged to improve the management of diving industry and its potential impacts upon the marine environment.

Recreational users revisiting the same locality over the years seemed to be able to perceive differences in the environment, especially regarding certain preferred biological attributes like fish abundance, coral cover, and species richness (Uyarra et al., 2009). These divers also have a greater perception of impacts at the sites (Miller, 2005). As these perceptions appear to directly affect divers' perceptions regarding biodiversity of the site, it becomes essential to maintain reef biodiversity at satisfactory levels. Large and charismatic marine animals, such as groupers (Giglio et al., 2014), rays (Luiz, Balboni, Kodja, Andrade, & Marum, 2009), sharks (Gallagher & Hammerschlag, 2011), mammals (Curtin & Garrod, 2008), and turtles (Bell et al., 2009) are important attractions for diving tourism. Other smaller species can also provide a special appeal because of their rarity, colorful and/or cryptic nature; such as seahorses, frogfishes and nudibranchs (Goffredo, Piccinetti, & Zaccanti, 2004; Uyarra & Côté, 2007). Cater (2008a, b) observed that an initial desire to observe charismatic megafauna by novice divers is gradually supplanted by a fascination with smaller underwater inhabitants. Experienced divers were more often excited by colorful nudibranchs and cryptic fishes than sharks or turtles (Cater, 2008a, b).

Management strategies for recreational diving destinations (e.g. zoning and carrying capacity estimates; Davis & Tisdell, 1995; Ríos-Jara, Galván-Villa, Rodríguez, López-Uriarte, & Muñoz-Fernández, 2013) should be supplied not only with biological information of dive sites, but also with information about diver profile, behavior and motivations. Dives aiming to see species of megafauna may need specific management strategies to increase the chance of observing without disturbing animals. For instance, reductions in group size to reduce the noise levels and increase their chances of observing groupers (Rudd & Tupper, 2002), reduce behavioral changes in gray nurse sharks (Smith, Scarpaci, Scarr, & Otway, 2014) and establishment of a minimum approach distance between divers and whale sharks (Davis, Banks, Birtles, Valentine, & Cuthill, 1997; Quiros, 2007). The presence of cryptic species can also alter the behavior of recreational divers who may approach too close to the substratum, and thus increase the chances of collisions and damage to corals, both accidentally and intentionally (Uyarra & Côté, 2007).

1.4. Survey site and aims

Marine life preferences and perceptions regarding fish abundance between recreational divers were investigated in Abrolhos National Marine Park – ANMP, a no take MPA in eastern Brazil. The ANMP bears the highest marine biodiversity in the South Atlantic (Leão, Kikuchi, & Testa, 2003) and high levels of endemic fish and corals (Francini-Filho & Moura, 2008). It is a popular diving destination, considered as one of the best dive sites in Brazil. Marine fauna of the ANMP include components of megafauna, such as turtles, dolphins, rays, sharks, groupers, snappers, parrotfishes, triggerfishes, surgeonfishes, as well as cryptic species like the Brazilian basslet, *Gramma brasiliensis*, the cleaner goby, *Elacatinus figaro*, nudibranchs and cleaner shrimps (Francini-Filho & Moura, 2008; MMA, 2011; Rossi-Santos, Wedekin, & Sousa-Lima, 2006). The presence of such a wide variety of marine life attributes makes

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