



The role of recreational fishermen in the removal of target reef fishes

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ABSTRACT

Captures by recreational anglers and spearfishermen at preserved (PR) and overexploited (OR) Brazilian reefs were studied. The selection exercised by fishermen was established by comparison between catch composition and the fish community structure determined through underwater visual census. Fishing activities were more regular at PR, with more participants, lower duration and larger-sized captures than at OR. Activities at PR showed a strong selection towards top predator fishes. Activities at OR showed lower selectivity for predators with accompanying high rates of capture for conspicuous herbivore and invertivore fishes. Our findings support that 1) CPUE is not necessarily different among preserved and overfished sites, and 2) that even in an overfished environment, recreational fishing activities keep targeting large predatory species of diminishing size. This scenario is consistent with those of commercial fishing where the catch composition is continuously evolving toward species with shorter and faster life cycles in accordance to the gradual simplification of the community structure.

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1. Introduction

Recreational fisheries are an important social and economic use of marine living resources (Cooke and Schramm, 2007) and they are, in many places of the world, responsible for a considerable part of the catch (Lappalainen and Pönni, 2007). However, the continuous increase in utilization of marine resources puts in question the effects of human activities on natural environments (Plathong et al., 2000). The intense fishing pressure on commercial and vulnerable reef species has tested the sustainability of stocks and activities (Friedlander and DeMartini, 2002; Pinheiro et al., 2010) and some studies have shown that recreational fisheries alone are sufficient to alter the population structure of target species (Frisch et al., 2012; Westera et al., 2003). This occurs because fishing is the activity that most directly influences and changes community structure (Floeter et al., 2006; Friedlander and DeMartini, 2002; Pinnegar et al., 2000). Fisheries also are responsible for species evolutionary changes, driving the decline in length, weight and age of sexual maturity observed in a large number of species (Hawkins and Roberts, 2003; Jørgensen et al., 2007).

In developing nations (Costa et al., 2003; Stallings, 2009), there

is a strong deficiency of reef fisheries statistics and little is known about the conservation status of reef fishes. The relationships between the environment and fishing activities, in especial recreational fisheries, therefore are poorly understood. Two common denominators in such nations are the disordered form of use of coastal renewable resources (Isaac et al., 2006) and the considerable extent to which coastal areas and oceanic islands are open to fisheries, often without law enforcement or species management.

Aiming to evaluate the importance of recreational fisheries in the catch of reef species, the present work investigates activities and captures of recreational anglers and spearfishermen made in overexploited and preserved reefs. There are important ecological differences between the studied localities. Therefore, the focus of this paper is a comparison between the fish community in the environment and what fishermen are catching to evidence the role of fishermen in exploiting available species. The following questions were addressed: 1) Are CPUEs (number and weight) and average length of species higher at the more preserved reef? 2) Do fishermen play distinct roles in preserved and overexploited reefs, targeting species of higher trophic level in the former instead of conspicuous species in the latter? To answer these questions, the selection fishermen exert in respect to species availability and specimen size in overexploited and preserved community was determined. This study exploits an unique opportunity to study unmanaged recreational activities in preserved and overexploited areas, revealing fishermen's possibilities to choose their target and to sustain their catches in such different settings.

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2. Materials and methods

2.1. Study area

The study was conducted at Franceses and Trindade Islands, both situated off the central coast of Brazil, Western Atlantic (Fig. 1). Franceses Island is located 4 km off the coast, close to artisanal fishing communities, and is locally attractive to tourists and recreational fishermen alike (Pinheiro et al., 2009). A recent analysis showed that Franceses Island mainly shelters small-sized invertivore and herbivore fish species (Pinheiro et al., 2013) that indicate an overexploited reef status (OR) (see Pinheiro et al., 2010). The island also is under the influence of terrigenous sedimentation (eroded minerals carried by nearby rivers) and coastal pollution.

Trindade Island is located 1160 km off the coast, at the eastern end of the Vitória-Trindade submarine chain (Gasparini and Floeter, 2001). It is occupied by the Brazilian Navy and public visitation of the terrestrial area (~5 km²) is restricted. Recreational activities at and around Trindade Island consist of occasional fishing or spearfishing excursions from the continent and regular leisure activities by military personnel (Pinheiro and Gasparini, 2009). A recent study shows that the reef fish community of Trindade Island still shelters large predators and a very high fish biomass, indicating a more preserved reef (PR) (Pinheiro et al., 2011). On the other hand, although less attractive to professional fishers due to the distance from the continent, some commercial fishing occurs in Trindade, and may already be promoting changes in the fish community structure (Pinheiro et al., 2010, 2011).

2.2. Sampling and data analyses

Data sampling at the overexploited reef was spread over 51 field days, between March 2005 and February 2006 (23 March to 01

April 2005; 16–22 April 2005; 25–26 June 2005; 19–22 August 2005; 20–30 September 2005; 26–27 October 2005; 26–28 December 2005; 7–12 January 2006; 25–28 January 2006; 8–9 February 2006). Data sampling at the preserved reef was done during a scientific expedition of 58 field days (28 February 2007 to 26 April 2007).

The same catch and fish community assessment protocols were applied in both locations. Fishing activities were monitored during the entire day, occurred in similar habitats and used similar fishing gear in both studied sites. Angling activities occurred from the rocky shores and spearfishing in the shallow zones (up to 20 m deep) at both sites. No SCUBA nor surface-supplied air apparatus was used. The number of fishermen was recorded daily by direct observation of the main fishing spots of each site. The time spent in each fishing activity, the number of fish caught and the total length of captures were recorded through interviews of forty-six fishing groups (130 fishermen) and the identification and measurement of 336 fishes. The species were identified following Figueiredo (1977), Fischer (1978), Figueiredo and Menezes (1978, 1980, 2000), Menezes and Figueiredo (1980, 1985) and Humann and Deloach (2002). The trophic category of each species was established according to Ferreira et al. (2004).

Reef fish communities were assessed using SCUBA through visual census on 20 × 2 m transects (40 m²), following a procedure that is largely utilized along the Brazilian coast (e.g., Ferreira et al., 2004; Floeter et al., 2006; Pinheiro et al., 2010, 2011, 2013). Most of OR and PR underwater habitats are similar in structure, composed mainly of rocky reefs and interface zones. Two hundred and eight censuses were conducted at the overexploited island and 92 at the preserved island. Fish were counted by species and length classes (0–5, 6–10, 11–20, 21–30 cm, and so on). Before descriptive and statistical analysis, abundance data (individuals 10 m⁻²) were transformed to biomass data (g m⁻²) using length–weight

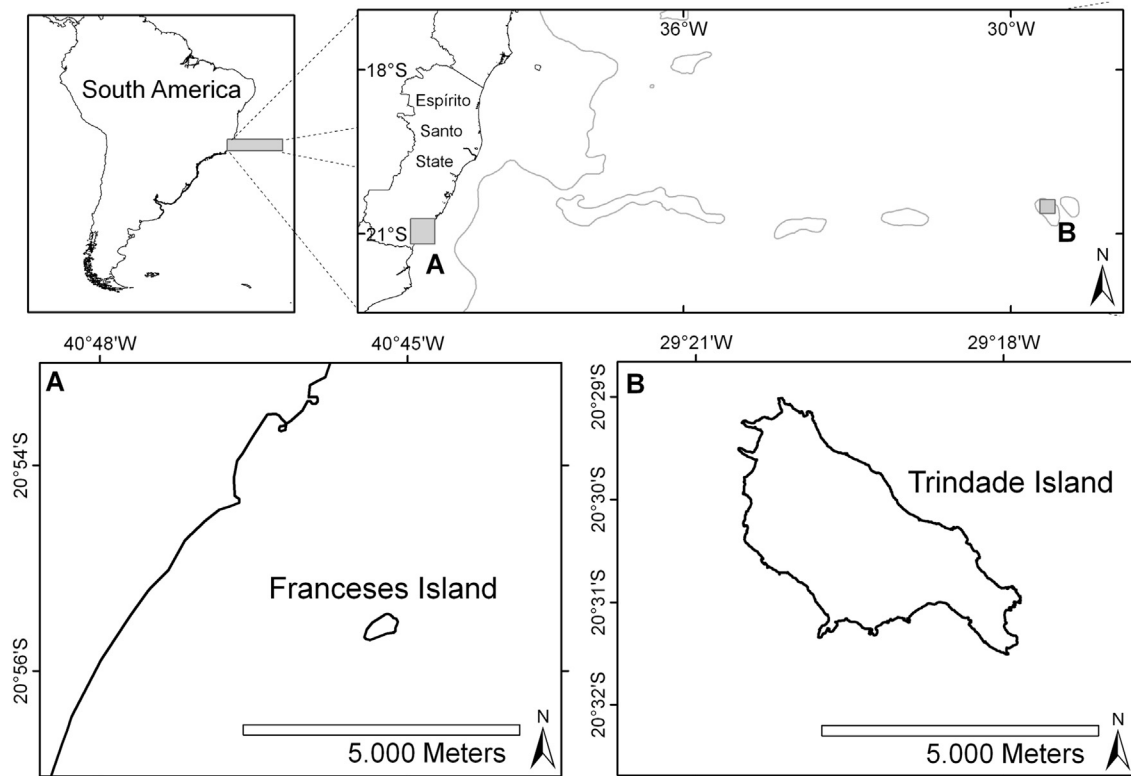


Fig. 1. Geographic localization of Franceses (over-exploited – OR) and Trindade (preserved – PR) islands, off the central coast of Brazil. The 500 m isobath is shown in the box of the right upper side.

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