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Small-scale shrimp fisheries on the Brazilian coast: Stakeholders perceptions of the closed season and integrated management

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ABSTRACT

The aim of this study is to describe small-scale fishing for Atlantic seabob shrimp and to analyse the perceptions of traditional fishers regarding the temporary suspension of fishing accompanied by financial compensation -closed season-along the north-eastern and southeastern coasts of Brazil. Ethnographic interviews were conducted with 80 artisanal fishers of the Barra de Caravelas (n = 36) and Santa Cruz Cabrália (n = 12) communities in the state of Bahia in north-eastern Brazil, and Anchieta (n = 18) and Barra Nova (n = 14) in the state of Espírito Santo in the south-eastern Brazil. The fishers shrimp are predominantly male (100%) with a mean age of 47 years. The vessels length used are up to 10 m. According to the fishermen, the amount paid by the Brazilian government as a subsidy during the closed season is not sufficient to support their families. Fishermen are against the current closed season of Atlantic seabob fishing, claiming that this period does not actually correspond whit the breeding season or the recruitment of the species. Even during the Atlantic seabob closed season, some fishermen catch this resource and thus break the law, as seen in Anchieta (56%, n = 10) and Barra de Caravelas (9%, n = 03). The fact that the fishers disagree with the closed season and do not obey the law shows that the management measure enforced on the northeast and southeast coasts of the country is not as effective as originally proposed. This demonstrates the need to understand local perceptions of this issue and to include the fishers in decision-making related to management and public measures involving shrimp fishing.

1. Introduction

Fishing for penaeid shrimp is an ancient and important coastal fishery activity performed both artisanally and industrially in tropical and subtropical regions of the world (Gillett, 2008). Because this type of fishing has been practiced so intensively, some of the world's shrimp stocks have become over-exploited, for example: pink shrimp (*Farfantepenaeus brasiliensis*, *F. paulensis* and *Pandalus jordani*), brown shrimp (*F. aztecus* and *F. subtillis*) and white shrimp (*Litopenaeus setiferus*) (Ferreira and Soomai, 2001; Leite and Petrere, 2006; FAO, 2011; Kolling and Ávila-da-Silva, 2014; Rajakumaran and Vaseeharan, 2014). Currently, small-scale shrimp fishing is very important, and although the number of fishers involved in this practice is unknown, they likely far outnumber those working in industrial shrimp fishing (Gillett, 2008).

On the coast of Brazil, most Atlantic seabob shrimp (*Xiphopenaeus kroyeri* Heller, 1862) fishing is performed by small-scale fisheries, because it is a resource located along the sub-tropical shelves (Nakagaki and Negreiros-Fransozo, 1998; IBAMA, 2006; Viana et al., 2015). Despite being performed by traditional fishermen, Atlantic seabob fishing is nevertheless important to the

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dynamics of Brazilian fishers. In 2011, approximately 15,000 tons of Atlantic seabob shrimp were captured, making it the fifth leading resource of the Brazilian fishing (MPA, 2011). While clearly important from an economic perspective, seabob shrimp fishing also permeates historical, social and cultural relations among traditional fisher's (Branco, 2005). Currently, the Atlantic seabob shrimp, *Xiphopenaeus kroyeri*, is part of the National List of Species of Aquatic Invertebrates and Fish Overexploited or Threatened with Overexploitation, continuing without change from the new list in 2014, because species that are not on the new list follow the classification from 2004 (BRASIL, 2004; BRASIL, 2014). Thus, this scenario may negatively affect the dynamics of artisanal fisheries (Martins et al., 2013). To reverse this scenario, the ideal is for the economic, social and political aspects of fishing activities to be incorporated into the fisheries' management system using an ecosystem approach, and interested parties should be included in the drafting of fishery policy, but this is not happening (Beddington et al., 2007).

In Brazil, the fishery policy used to manage shrimp fishing involves limitations on fishing licenses, a closed season for fishing activities, the regulation of mesh size of fishing nets, the control of vessels (size), the use of Turtle Excluder Devices (TEDs) and oil subsidy (Medeiros et al., 2013). The closed season is the most popular management measure in the country, which was initially implemented in the southeast-southern region in 1984 to protect the stocks of pink shrimp (*Farfantepenaeus* sp.). It was subsequently extended to the northeast region in 1986 (SUDEPE, 1983). Around the world, other countries – such as Mexico, the Dominican Republic and French Guiana –also use the closed season as an important management measure for shrimp fishing (Lins Oliveira, 1991; Salas et al., 2011).

The closed season aims to reduce the fishing of shrimp species during breeding seasons or resource recruitment to ensure stock replacement or the weight gain of individuals (Vasques and Couto, 2011). Due to the length of the Brazilian coast, specific closed seasons are determined for each of four different regions: i) Northeast I (08°91′S - 12°41′S) (BRASIL, 2004), ii) Northeast II (12°41′S - 18°20′S) (BRASIL, 2004), iii) Espírito Santo state (18°20′S - 21°18′S) (IBAMA, 2008) and iv) Southeast- South (21°18′S - 33°40′S) (IBAMA, 2008).

During the closed season, fishers registered in the representative bodies of the fishing sector receive a financial compensation from the Brazilian government equivalent to US$ 274.79 (R$ 880.00; Brasil, lei nº 10.779 de 2003). However, the distribution of these benefits is plagued by fraud: financial resources are allocated for electoral purposes or for the personal use of sector representatives (Maia, 2009). Other factors, such as the discontent of artisanal fishers regarding the periods defined for closed seasons and the lack of dialogue with fishing communities, also hinder the management of this fishery resource (Pezzuto et al., 2008). Because they feel excluded and do not participate in decision-making regarding management, fishermen are dissatisfied and violate the law (Medeiros et al., 2013). As a result, excessive shrimp fishing occurs during the closed season, which may have unsustainable consequences for fish stocks because shrimp populations are most vulnerable precisely during this period (Viana et al., 2015).

Brazil, similar to other developing countries, lacks the scientific data required for the proper management of its fisheries (Silvano and Begossi, 2012). Due to this lack of information, local ecological knowledge (LEK) is used in developing management plans (Berkes and Turner, 2006; Oliveira et al., 2016). This may promote a sense of shared responsibility between management and fishing communities. Moreover, fishers are interested in management processes because traditional fishing communities are the first to be affected by the depletion of marine resources (Friesinger and Bernatchez, 2010; Azzurro et al., 2011).

In recent decades, a growing number of studies have examined artisanal fisher's LEK with regard to fishery resources (e.g.: Drew, 2005; Silvano and Begossi, 2012; Leite and Gasalla, 2013; Carvalho et al., 2016; Zappes et al., 2016). People acquire LEK through their interactions with nature and through the development of adaptive techniques for particular regions and time periods, which ensures the reproduction of the social and cultural system. In this sense, the objective of this study is to describe artisanal Atlantic seabob shrimp fishing and to analyse the perceptions of traditional fisher regarding closed seasons as the primary means of fisheries management. The study also analyses fisher's perceptions of financial compensation in Brazilian northeast and southeast fishing communities.

2. Materials and methods

2.1. Study areas

This study was conducted in four artisanal fishing communities in the northeastern and southeastern regions of Brazil: (1) Santa Cruz Cabrália (16°16′S; 39°1′W) and (2) Barra de Caravelas (17°43′S; 39°15″W), both located in the southern portion of the state of Bahia; (3) Barra Nova (18,9°S; 39,7°W) in São Mateus, located in the northern part of the state of Espírito Santo; and (4) Anchieta (20°48′S; 40°38′W), located in the south-central portion of that state (Fig. 1). Small-scale shrimp fisheries constitute them major fishing activity in the selected communities (Eutrópio et al., 2013; Soares and Hostim-Silva, 2011; Viana et al., 2015; Pesca, 2009).

2.2. Characteristics of small-scale fishing activities in the study areas

2.2.1. State of Bahia

The state of Bahia is Brazil's third largest fish producer and the largest producer in the Northeast region. Fishing along this coast is traditionally artisanal and is responsible for the direct and indirect employment of approximately 7000 people (Pesca, 2009). Atlantic seabob fishing accounts for 90% of the state's total production (Santos and Ivo, 2000; Santos et al., 2007; Viana et al., 2015). In southern Bahia, the closed season for shrimp fishing occurs twice annually (01 april - 15 may and 15 september - 31 october) the last data update was in 2004 (BRASIL, 2004). In Santa Cruz Cabrália, fishermen use in-line and longline techniques at depths greater than 20 m, and the shrimp fishing artisanal fleet operates at depths of up to 20 m (*personal observation*). These workers are associated with the Fishermen Colony Z - 51, in which 18 Atlantic seabob fishers are registered (president of Fishermen Colony Z - 51). The Barra de Caravelas community, located in the municipality of Caravelas, in the southern portion of Bahia, is located inside the Extractive Reserve of Cassurubá in the Abrolhos archipelago (Leão and Kikuchi, 2001; ICMBio, 2012). Artisanal fishing is this community's main economic activity, and Atlantic seabob fishing represents 95% of its penaeid production. Currently, in Barra de Caravelas, 58 fishers are registered and represented by the Fishing Colony Z - 25.

2.2.2. State of Espírito Santo

The state of Espírito Santo, in southeastern Brazil, has approximately 521 km of coastline. Fishing activity in this state is family-based and accounts for 14,000 direct jobs and 5000 indirect jobs (Netto and Di Beneditto, 2002). This state has the longest closed season in Brazil: a total of four months divided into two periods (01 april – 31 may and 01 november – 15 january) and the last data update was in 2008 (IBAMA, 2008). Barra Nova belongs to the