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Harvesting costs and revenues: Implication of the performance of open-access industrial fishing fleets off Rio Grande, Brazil

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ABSTRACT

In order to assess the performance of major commercial fleets, key factors affecting fishing costs and revenues are provided along with a framework to standardize economic knowledge construction in data-poor fisheries, such as South Brazil's. Additionally, the effects of fuel subsidy policies on profitability were further evaluated among fleets. The unprecedented set of field survey data generated by this study revealed that fuel consumption, fish price, and catch volume were the main factors affecting profitability. Annual gross profit was positive for all fleets. Longliners showed the highest gross profit margin (29%), while single-bottom-trawlers, close to unviability, showed the lowest (0.9%). Overall, subsidies were ineffective in increasing Rio Grande fleet gross profits and may be masking poor economic performance, primarily for single-bottom-trawlers. Specific policy advice aiming to protect both economic performance and natural resources are discussed, including the importance of economic data collection and cost-benefit analysis.

1. Introduction

The contribution of economic analysis to the comparison of fishing fleet performance, together with environmental and social approaches, have been considered strategic to solving problems related to fishery mismanagement and unsustainable practices [1,2]. The burden of not having this perspective represented in both management and policy outcomes is widely recognized [3,4]. However, for several fishery systems, an economic performance analysis of the fleets has not been performed [5]. This lack of analysis is understandable because in practice, data and indicators of the socio-economic performance of commercial fleets have not been made publicly available, often not even to the scientific community [1,5]. Therefore, since the motivation for fishing is profit [6], knowledge of the economic dimension of fisheries can be particularly useful to address policy questions regarding fishery management.

In Brazil, economic data on fisheries are generally scarce. This is possibly because current fisheries' statistics systems do not include economic data (i.e., costs and profits) or evaluations of the economic performance and efficiency of fishing fleets in public reports. The systematic collection and updating of the information prioritizes data regarding the fishing effort and the landed production per species. Nevertheless, academic research papers have been reporting economic data on inland fisheries [7–9], marine small-scale fisheries, such as for lobster and shrimp [10–14], bioeconomic models and cost analysis for a few species [15–19]. According to [1], which was the first broad study describing comparative multi-fleet analysis of socio-economic performance indicators for fishing fleets in Brazil, there is a need to build on the suggested protocol for the standardized collection and analysis of economic data. Regarding the fishing industry in Brazil, data on the economic performance of fishing fleets, as explained by a detailed analysis of costs, benefits and profitability, have, in most cases, been difficult to access and measure and have been notably unavailable for multi-fleet comparison purposes [1].

In terms of subsidy policies for fisheries, there are at least 10 types in Brazil. Ranging from incentives for ports facilities, capacity enhancing, and closure compliance of small-scale fishers to marketing, credit access, social security, and operational ones (such as for fuel), it was estimated that approximately 25% of the subsidies show high risk potential for contributing to overcapacity or overfishing [20]. Nevertheless, a comprehensive subvention program to oil price [21] guarantees that the difference between national and international diesel prices be equalized for maintaining international trade. Thus, officially registered vessels (in Brazil's Fisheries Secretariat and port authority)

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have a fuel tax waiver at the state level, plus a federal pecuniary aid (cash transfer) for up to 25% of their fuel consumption per year [22] established as an individual quota in liters [23]. In practice, there are some vessels not eligible for receiving the subsidy.

According to [24], this policy contributes to an increase in catches without regard to knowledge on stock sizes, which tends to result in a decline in the fishery resources because catches are not regulated. Moreover, a central issue is that subsidizing fisheries without knowing their economic performance may underestimate the real benefits of the subvention. This issue becomes even more relevant, since the cost of fuel is significant in fisheries [5,19,25,26], and the appeal for its subsidy is constant in the fishing sector.

In addition, commercial fishing fleets in Brazil operate in an open-access regime, i.e., there are currently no constraints imposed by government besides fish and mesh size and closure seasons for a few resources (none in Rio Grande). For tuna fisheries, the country supports a quota established by the International Commission for the Conservation of Atlantic Tunas. However, it is well known that the eventual benefits of open-access regimes tend to weaken over time and can create economic inefficiencies as well as unsustainable yields [27].

From both the socio-economic and environmental perspectives, there are significant differences between the fishery fleets, emphasizing the need for specific studies to provide better knowledge, especially on financing and economics. Indeed, the lack of fleet studies limits the ability to understand and manage these fisheries. Another issue is the heterogeneity of the fleets in terms of vessel size and types of fishing gears, which leads to a variety of economic, social and environmental impacts that are rarely translated into financial terms or presented together in the form of a cost-benefit analysis [28]. Furthermore, before implementing costly management systems, it may be appropriate to investigate the economic efficiency of an open access fishery and how the cost-benefit relationship behaves [29].

Based on these assertions, the purpose of the present study was to evaluate the financial performance of the multi-fleet commercial fisheries of an open-access regime in South Brazil in terms of both budget (cost and revenues) and the impact of the government fuel subsidy policy on the profitability of these fleets.

Thus, the objectives of the present study are to (1) provide economic indicators on the Rio Grande fishing fleets, including their cost structures and profits and (2) to present a methodology that may contribute to the organization (and collection) of economic data from Brazilian fisheries, which are currently non-existent. This knowledge was applied to analyze and compare the economic performance of the different fishing fleets and to estimate, compare and discuss the cost of fuel and the effect of the fuel subsidies policies on profitability, which might be useful for future regional management plans.

2. Background

Commercial fishing in Rio Grande is economically relevant because it is the main fishing center in the Brazilian state of Rio Grande do Sul. In addition, it is a traditional activity that involves many stakeholders. Evidence, however, indicates the decline of the industry, the number of active vessels, and the condition of overexploitation of certain stocks in the region [30–32]. In the 1970's, the Rio Grande fishing involved 23 large fishing companies, and the catch reached a maximum of 105,000 t. Currently, 16 companies are operating in the town [33] and, the catch has fallen sharply in recent decades and currently stands at approximately 35,000 t [34].

The causes of the declines may be related to outdated technology, organizational structure and outdated management methods [35]. Other important factors were fishing beyond the reproductive capacity of the species, blocks on the reproduction of marine species, pollution levels, and external predation in the economic zone of Brazilian territorial waters [36]. Between the years 1991 and 2001, 290 vessels were active and landed at Rio Grande, and approximately 10 years later, reduced to 266, while not all vessels operate every year [37]. The commercial fishing in Rio Grande has been carried out by different fleets using several gears (e.g., trawls, longlines, gillnets) and target primarily the argentine croaker (*Umbrina canosai*), white mouth croaker (*Micropogonias furnieri*), weakfish (*Cynoscion* spp), shortfin mako (*Isurus* spp), tuna (*Thunnus* spp), and swordfish (*Xiphias gladius*). The two croakers are the most important commercial species in the region, caught by gillnetters, bottom-trawlers and purse-seiners [34]. There are also some vessels for Mugilidae and skipjack tuna.

Finally, the masters and fishers value their autonomy, resisting both the wage labor system and long-term agreements with the industry, which predominantly involves the payment of shares that are now calculated on the overall value of production per fishing trip [38]. Thus, fishers are 'co-partners' together with the vessel owners and have no fixed salary. The individual salary is calculated by subtracting the operational cost (fuel, ice, repairs, etc.) and the owner's portion (profit) from the gross revenue, while division between the crew is made in parts and depends on their on-board functions [1]. Furthermore, obtaining information related to fishing activities in general, but particularly to economic data, is extremely difficult. First, due to the dynamics of the vessels, which spend the majority of their time at sea without a fixed date for their return to harbor, they often unload their merchandise at private locations where access to data is restricted. Second, the official data is incomplete, not collected regularly, and very often not made publicly available. Lastly, it seems that there is a 'secrecy pact', principally among the vessel owners and fishing companies, and there is a great deal of reluctance in making information available and a widespread belief that it will be used against the sector.

3. Methods

3.1. Data collection

The Rio Grande commercial fleet operating around Southern Brazil was analyzed. A survey was conducted during 2013–2014 among the primary landing points in the Rio Grande zone (Fig. 1). Key-informant, semi-structured personal interviews with vessel captains and owners were used [1,25] to gather data related to the technical and fishing effort details, costs, production data and ex-vessel price by species of the most recent fishing trip (Table 1) by vessel and from four different fleets (bottom-gillnetters, surface-longliners, pair-bottom-trawlers and single-bottom-trawlers). The questionnaire that was used had relatively little complex structure and required no more than half an hour to be completed. This approach was applied because it allows the economic situation of a fleet to be estimated when the official data is not complete or not collected regularly, as is the case in Brazil. The interviews were performed at three principal industries due to the significant numbers of vessels that landed at these sites and that are currently considered representative of the regional fisheries. Interviews were conducted between June 2013 and May 2014, completing a total of 106 questionnaires covering the four fleet categories. However, as some vessels were sampled more than once during the period, the interviews represent 22% of the active bottom-gillnetter vessels, 100% of the active longliner vessels, 39% of active single-bottom-trawler vessels, and 34% of active pair-bottom-trawler vessels. The number of potentially active vessels in the area was obtained from the CEPERG [34] and is shown in Table 2, as well as the basic technical characteristics of the commercial vessels analyzed.

A fixed percentage of the gross revenue is taken from each fishing trip for vessels maintenance and repair. The results obtained on this from our surveys was considered for that estimate (varying by vessel and fleet, but about 20% for longliners, single-bottom-trawlers, and pair-bottom-trawlers and 16% for bottom-gillnetters). Despite the maintenance of the vessels varying between fixed and variable costs, this factor was only considered to be a variable cost within this study because, considering the fishing operation, the vessels repair costs can