



Sustainability of tropical small-scale fisheries: Integrated assessment in French Guiana



Abdoul Ahad Cissé^{a,b,*}, Fabian Blanchard^a, Olivier Guyader^c

^a IFREMER, Domaine de Suzini, BP 477, 97331 Cayenne, French Guiana, France

^b CEREGLIA, University of the French West Indies and French Guiana, BP 266, 97326 Cayenne, French Guiana, France

^c IFREMER, UMR AMURE, Département d'économie maritime, Centre de Brest, BP 70, 29280 Plouzané, France

ARTICLE INFO

Article history:

Received 16 April 2013

Received in revised form

8 October 2013

Accepted 12 October 2013

Available online 4 November 2013

Keywords:

French Guiana

Small scale fishery

Sustainability

Rapfish

Ecosystem approach

ABSTRACT

Like many tropical small-scale fisheries, the French Guiana coastal fishery is characterized by the high fish biodiversity of its ecosystem, the weak selectivity of the fleets exploiting the resources, and the heterogeneity of the vessels in terms of size and fishing techniques. The Rapfish method is used to assess sustainability within 11 fishery systems by means of 27 attributes relating to ecological, economic, social, and technological fields. Overall results indicate an average performance in the weak sustainability range. Comparisons made among the FSs show a gradient of sustainability performance from the western portion of the coast to the eastern portion. Several recommendations are formulated to raise the current “sustainability” status, such as the reduction of discards. This study is used as a complementary tool to the bioeconomic model in order to define a sustainable management plan for the French Guiana coastal fishery.

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1. Introduction

The traditional tools used to manage fisheries are more suitable for homogeneous fleets targeting one species [1,2]. Simple catch and effort data are no longer sufficient to satisfy the interests of the different stakeholders, and the need to improve knowledge about small-scale fisheries in order to secure their sustainable development is increasingly recognized [3–6]. The necessity of taking an integrated approach to tackling sustainability issues in a complex framework is now acknowledged [7,8]. However, there is a lack of operational methodology to assess and manage heterogeneous small-scale fisheries that exploit multiple species, despite their socio-economic importance, especially in developing countries, and that would also take into account an ecosystem approach.

Among the techniques that aim to achieve an integrated assessment of fisheries, the Rapfish method [9] is well ranked [8] and appears to be the most suitable, since it takes into account the multidisciplinary endeavor in fisheries in addition to ecological considerations. This method provides a rapid assessment of fishery status and does not require extensive data. It relies upon the ordination of scored attributes grouped in ecological, economic, social, and technological sustainability fields achieved by using multidimensional scaling (MDS) including uncertainties. The ability

of Rapfish to assess sustainability status has been largely tested on fisheries worldwide (see official Rapfish website for more details¹). More recently, this technique has been used in several tropical coastal fisheries in Brazil [10–14].

In the disciplinary field of economics, the substitutability between environmental assets and human-made capital is debated in the context of ecological and resource economics [15]. According to neoclassical economists, ecological decline can be compensated for by maintaining the overall welfare of society. This is the so-called weak sustainability approach. However, in the long term, “ecological decline” (depleted stocks, species loss, habitat alteration, etc.) drives the alteration of goods and services provided by ecosystems such as income from exploitation, which in turn no longer enable the welfare of society to be maintained. In the same way, but in the disciplinary field of fisheries science, defining the maximum biological sustainable yield (MSY) has been the basis of fisheries management. Since the effects of fishing on ecosystems were ignored, as well as the economic viability of the fisheries, this is also a weak sustainability approach. Actually, it has now been recognized that a systemic approach is necessary, because the exploited resources and the fisheries exploiting them depend on socio-ecological interactions. Thus there is nowadays widespread acceptance that a more integrated perspective is needed that would take both marine biodiversity preservation and economic and social objectives into account. In this context,

* Corresponding author. Tel.: +5940594 30 22 00; fax: +594 594 30 80 31.
E-mail address: abdoul.cisse@ifremer.fr (A.A. Cissé).

¹ <http://www.rapfish.org>

the Ecosystem Approach has emerged as a promising approach. The strong sustainability paradigm [16,17], which allows no substitutability between different types of “capital” (natural or human-made), therefore seems more consistent. The diagnosis provided here via an assessment carried out using the Rapfish method explicitly takes into account several dimensions such as natural and human-made capital.

The French Guiana coastal fishery has been neglected as it serves exclusively to supply local food demand. Moreover, this fishery is quite complex, with various landing sites and numerous species exploited, and is partially informal. With the decline of the shrimp fishery, the great potential of this fishery has been revealed [18]. In fact, the coastal fishery has yielded more than the shrimp and red snapper fisheries since 2008. The coastal fishery has been monitored for 6 years, but no stock assessment has been carried out so far. Nevertheless, the biodiversity associated with this resource does not seem to be threatened by fishing activities, as yields seem stable up to 2010. Still, fish yields are not the same in all the fishing areas. Recent socio-economic studies highlight the difficulties of some fleets to generate profits, mainly because of the low selling prices and high and fluctuating input costs such as fuel. The total population of French Guiana is around 250,000, and demographic projections show it will double over the next 20 years, thus raising the issue of fish demand fulfillment. More generally, the value of carrying out an integrated assessment, taking into account all dimensions, had never been examined before. In this paper, the sustainability of the French Guiana coastal fishery according to ecological, economic, social, and technological dimensions is diagnosed using the Rapfish method. Important sustainability-related factors requiring improvement are also identified.

The paper is structured as follows: Section 2 presents the French Guiana coastal fishery in more detail. Section 3 provides insights on the data used and the Rapfish methodology. Section 4 is devoted to depicting the results for each dimension. Findings are discussed in Section 5 and the last section draws a conclusion.

2. Case study

The continental shelf of French Guiana is a tropical ecosystem under the influence of the Amazon estuary, as is the entire North Brazil Shelf Large Marine Ecosystem (LME), which has a high level of biodiversity [19]. With a 350 km coastline, French Guiana benefits from a 130,000 km² Exclusive Economic Zone (EEZ) including 50,000 km² of continental shelf, bordered in the west by Suriname and in the east by Brazil. The coastal fishery operates in a 16 km offshore zone with depths from 0 to 20 m; fishing areas are close to the landing points. The eight main landing points are spread out along the coastline. The major landing point, Cayenne, receives one third of the total annual landings, which are estimated at around 3000 t per year and are increasing as reported in the Ifremer² data collection (<http://www.ifremer.fr/guyane/Chiffres-cles>).

This fishery currently involves approximately 200 wooden boats that are less than 12 m long. Traditionally, four kinds of vessel are identified [20]: *Pirogues* (P), *Canots créoles* (CC), *Canots créoles améliorés* (CCA) and *Tapouilles* (T). *Pirogues*, which are canoes equipped with an outboard engine, fish for a few hours essentially in estuaries using stored ice in an old refrigerator. Compared to *Pirogues*, *Canots créoles* are better suited to sea navigation. *Canots créoles améliorés* have cabins and ice tanks, which enable them to fish for several days. *Tapouilles* are wider

boats with a cabin and an inboard diesel engine. Catches are conserved on ice and trips last up to 10 days. Even if some fishermen use several types of gear including long lines and hooks, the main gears used are drift or fixed nets, with mesh sizes between 40 and 100 mm. The fleets have a limited range and operate in different fishing areas.

More than 30 coastal species are exploited and about 15 species, including weakfishes, catfishes, and sharks, represent more than 90% of the production. The dominant species landed is the Acoupa Weakfish (*Cynoscion acoupa*), representing around 40% of total landings, followed by the Green Weakfish (*Cynoscion virescens*) and the Crucifix Catfish (*Sciades proops*) with respectively 13% and 11%.

Since it operates in an overseas region of the EU, the French Guiana coastal fishery is governed by French and European regulations through technical measures (maximum net length, minimum mesh size, and marine protected area) and access regulation (European authorization and regional licenses). Despite this, an important part of this fishery remains informal, as one third of the active vessels do not have a permit. There are no quotas for catches, and no limitation concerning exploited species and their size. The French Guiana coastal fishing area is also illegally exploited by Brazilian and Surinamese fleets. Foreign illegal catches are estimated to be at least twice as large as those of French Guiana [21].

3. Materials and methods

3.1. Data collection

With the observation system implemented by Ifremer since 2006, production and fishing effort values are collected on a daily basis at the main landing points by observers from local communities. It is possible to carry out an exhaustive observation of the fishing effort thanks to the small number of active boats (approximately 200). The landings of seventy five percent (75%) of the fishing activity are observed on a daily basis from January to December. Each year, some 3600 landings are recorded. For each landing, the production by species is either estimated by the observers or reported by the fishermen. Other information is also collected, such as trip length, net length, fishing area, number of crew, quantity of ice, and fuel consumed. For this study, data from 2006 to 2009 were used.

Two socio-economic surveys were carried out in this fishery in 2009 and 2011. Only vessels with significant fishing effort were sampled. The objective was to obtain economic data from a sample of vessels representative of the different segments. The sampling strategy used for vessel sampling selection was similar to that developed for mainland France [22]. The questions were based on a monetary approach that also includes social indicators. The questionnaire consisted of nine main sections presented in a logical order; surveys were conducted with vessel owners on their fishing activities, related earnings and costs, and more specifically, on the characteristics of their fishing vessel. The latter include the type of hull, engine, fishing gear, electronic equipment, and related costs. The survey also included questions about family implication in fishing activities, fishermen educational level, conflicts, and discards. Technical documents (in French) describing the methodology, from sampling optimization to the questionnaire, and the software used to record the information collected are available on the Ifremer website (<http://www.ifremer.fr/sih/>). Around 40% of the active boat owners were questioned. The socio-economic surveys and the regular data collection concern both the legal and illegal coastal vessels of the fishery.

² French Research Institute for Exploitation of the Sea.

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