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An ecosystem approach to small-scale co-managed fisheries: The yellow clam fishery in Uruguay

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ABSTRACT

The Ecosystem Approach to Fisheries (EAF) has been proposed as a holistic approach for managing fisheries. Although EAF is a widely accepted concept, many challenges remain in its practical implementation, particularly in small-scale fisheries (SSFs) in developing countries. Long-term evaluations of EAF performance in SSFs are scarce and even fewer when considering co-management (Co-M) as the institutionalized governance mode implemented under an EAF scheme (EAF/Co-M). This paper addresses the implementation, development process and performance of an EAF/Co-M in the yellow clam SSF of Uruguay through multiple fishery indicators for the period 2007–2015. EAF/Co-M showed a highly positive response in abundance and biomass of the harvestable stock through time, stabilization in individual sizes above the minimum landing size limit, and a fairly constant exploitation rate at low levels that did not exceed 25%, accompanied by relatively constant CPUE values through time. Temporal variations in unit price and revenues per unit of effort showed higher values after EAF/Co-M implementation. These indicators, taken together, suggest that the enhanced production capacity of the fishery during the EAF/Co-M implementation did not have a negative impact on the stock. The number of fishers involved in the activity has not changed markedly through time, but two remarkable positive changes occurred in the composition of the group: (i) an increasing number of licenses allocated twice in a row through time, which suggests the consolidation of a stable group of fishers; and (ii) a significant increase in the number of women directly involved in the fishing activity. This study provides solid empirical evidences to the idea that EAF, coupled with Co-M as a formal governance mode, could be helpful to address management tasks and to improve social–ecological conditions of SSFs.

1. Introduction

The Ecosystem Approach to Fisheries (EAF) has been proposed as a holistic approach for managing fisheries in order to redress the critical situation of many fisheries worldwide [1–3]. The broad purpose of this approach is to address the multiple needs of societies, but at the same time to guarantee both ecosystem and human well-being in the long-term. Although EAF is a widely accepted concept, many challenges remain in its practical implementation [4–6], particularly in developing countries. Some of the changes necessary to incorporate a broader perspective include [1,7]: (i) effective mechanisms for involving stakeholders in decision-making and management from the beginning of the EAF process; (ii) coordination, cooperation and communication within and among institutions and stakeholders; and (iii) sharing authority and responsibilities between government and stakeholders, allowing decentralized fisheries governance. The implementation of EAF requires an improvement in the institutional infrastructure governing fisheries management, by integrating cross-scale linkages at different levels (e.g. local, regional and national) [5].

Co-management (Co-M) emerges naturally as a promising governance mode to accomplish EAF principles and goals. Co-M is defined as an institutional arrangement in which several degrees of responsibility and authority are shared between the government and stakeholders for managing common pool resources [8,9]. The consistency and compatibility of both approaches (i.e. Co-M and EAF) make feasible to integrate Co-M in the broader context of EAF [10]. Co-M could strengthen EAF through a formal involvement of stakeholders from the very beginning of the management process [11]. There is a well grounded literature highlighting the potential advantages of Co-M, which include [9,12–14]: (i) a more accountable, autonomous and economic

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management system requiring less to be spent on administration and enforcement in the long term; (ii) an enhancement of fishers' ownership over the resource, encouraging responsible fishing practices; (iii) a higher degree of acceptability, legitimacy and compliance to plans and regulations, leading to a better monitoring, control and surveillance (MCS) by fishers themselves; (iv) a greater sensitivity to local specific realities, incorporating traditional knowledge, socioeconomic and ecological constraints; and (v) a continuous process of adaptive learning, leading to modifications and improvements in management.

Although the institutionalization of EAF into the national fisheries policy is not a necessary and sufficient condition for its implementation, long-term political support would facilitate a proper EAF inception and development [15]. Indeed, many successful small-scale fisheries (SSFs) have chased, analogously, the fundamental steps of EAF development and implementation, although its principles have not been included formally in their management plans. In Latin America there are many examples of co-managed SSFs [13,15,16], but examples of SSFs that have formally implemented an EAF coupled with a Co-M scheme (hereafter EAF/Co-M) are scarcely documented [10].

Since 2005, Uruguay began an institutional strategy aiming to generate a long-term policy with regard to the management of fishery resources. At that time, the Uruguayan Fisheries Agency (Dirección Nacional de Recursos Acuáticos: DINARA) drawn up a Fisheries Management Program with clear long-term policy goals that included the development and potential institutionalization of an EAF approach for SSFs, notably incorporating Co-M as the formal governance mode to be implemented within an EAF context [10]. This has been a desired strategy by the national government, taking into account that this governance mode (i.e. Co-M) proved to be helpful to redress previous open access and centralized (top-down) management failures in SSFs of Uruguay [13,17,18]. The management unit chosen to implement EAF/Co-M included a zoning scheme with a core zone closed to fishing and was operationalized through a decentralized governance system (i.e. Co-M) and EAF principles. This operational unit conceptualized for EAF/Co-M development was named Functional Unit of Ecosystem-based Fisheries Management (*Unidad Funcional de Manejo Ecosistémico Pesquero: UFMEP*) and emerged from participatory inception workshops between relevant stakeholders and DINARA [10]. The selection of pilot sites to implement EAF/Co-M was made according to scientific, social and political criteria, including: (i) availability of long-term historical data and the feasibility of gathering information from primary and secondary sources for assessing the performance of a management plan; and (ii) history, fishery traditions and social cohesion of local communities, and relationships among institutions.

One of the pilot fisheries selected to implement EAF/Co-M was the yellow clam (*Mesodesma mactroides*) SSF at Rocha, Uruguay. This UFMEP is located at the easternmost edge of the Atlantic coast of Uruguay, along a 22 km sandy beach fringe between La Coronilla and Barra del Chuy, where the yellow clam is harvested (see Fig. 1 in Defeo 1998). After a closure established for more than a decade (1994–2008), the yellow clam fishery was reopened under an adaptive management approach that included an EAF coupled with Co-M as the formal mechanism for stakeholder participation. The process included initial planning, implementation and feedback loops with stakeholders as the core of the EAF management plan, where operational objectives were set, together with the identification of indicators and performance measures. The main goals of this EAF management plan in the yellow clam fishery were to: (i) look forward towards a sustainable exploitation by improving fishing practices following EAF principles; (ii) empower the local fishing communities through the institutionalization of Co-M; and (iii) improve the livelihood of fishers by securing employments and developing new market opportunities. However, after several years since its formal implementation, the performance of EAF/Co-M has not been assessed yet.

This paper addresses the implementation, development process and performance of EAF/Co-M in the yellow clam fishery of Uruguay. For this purpose, multiple fishery indicators were used to evaluate the effect of EAF/Co-M implementation in a before/after context for the periods 2007–2011 (pre-implementation and implementation) and 2012–2015 (post-implementation). Social and market changes related to EAF/Co-M implementation are also detailed and discussed.

2. Methods

2.1. The yellow clam fishery: features and historical background

M. mactroides is a sedentary infaunal bivalve artisanally exploited (shovels and handpicking) in sandy beaches of Brazil, Uruguay and Argentina. In Uruguay, the yellow clam is exploited along 22 km of sandy beach from Barra del Chuy (33°40′S, 53°20′W) to La Coronilla (33°50′S, 53°27′W), representing the only place in the country where the species is commercially exploited.

The fishing activity started in the 1960s and evolved under an open access regime through an initial development phase (1960–1980), followed by a second phase of expansive extraction (1980–1985). A third phase of overexploitation was observed during 1986–1987, when catch and catch per unit effort (CPUE) decreased rapidly [15]. A full fishery closure for 32 months (April 1987 to November 1989) was set in response of the declining trends [13]. Two years after the closure, adult clam density increased by more than 400%, and thus the fishery was reopened from December 1989 onwards, with the implementation of several management strategies, including an active fisher participation in enforcing regulations [15]. This situation provided the basis for a *de facto* Co-M regime which in turn resulted in positive mid-term trends that included an increase in unit price, CPUE, economic incomes and stabilization of catches (ca. 50 t) [15]. However, this Co-M experience lasted until late 1994, when mass mortalities decimated populations of *M. mactroides* throughout its entire distribution range [19]. Several putative factors have been invoked to explain the causes underlying mass mortalities, including a long-term increase in sea surface temperature, harmful algal blooms, environmental stress and parasitism [19]. The scale and magnitude of the mass mortalities determined that the system was not resilient to their detrimental impacts and therefore a full fishery closure between 1994 and 2008 was set. As no options were provided to fishers to mitigate the economic impact of this perturbation on their livelihoods, the fishery closure caused loss of incomes and unemployment. Fishers immediately responded by diversifying their livelihoods in other sectors of the economy (e.g., construction, agriculture).

2.2. Back into the ring: implementation and development of EAF/CO-M

In 2007 the yellow clam population showed the first signs of partial recovery of the harvestable stock. This event triggered a strong initiative among fishers and researchers to reopen the fishery. The government decided to develop an adaptive management strategy and opened the fishery following a precautionary approach, actively involving fishers in the management process, particularly in MCS activities. This strategy allowed fishers to perceive this window of opportunity as a long-term asset rather than a short-term prospect.

Within the fisheries national policy context, DINARA, together with the local community, set the basis to carry forward an EAF by