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Towards sustainable fisheries: A multi-criteria participatory approach to assessing indicators of sustainable fishing communities: A case study from Cartagena (Spain)

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ABSTRACT

The fishery system involves a complex relationship between humans and natural resources that is a challenge to analyze. Moreover, government policies are generally not efficient in resolving this complexity and ensuring the sustainable development of fisheries. This paper develops an integrated multicriteria participatory assessment framework involving the evaluation of Ecological, Economic, Social, Technological, Ethical and Institutional dimensions of sustainability. It analyzes the relative importance of each dimension and its indicators, modifying the published 'Rapfish' technique. The analysis is employed as a decision-making tool to analyze and evaluate multiple relations and dimensions under a participatory group decision-making protocol. An allied soft methodology, cognitive mapping, can be used to assess the perceived linkage among indicators. The methodology is applied to a case study of the fishing community of Cartagena (Spain).

1. Introduction

Since 1980, the fisheries sector has been, and remains in, a state of crisis [1,2]. The different policy measures developed by governments, which often have a monopoly of biological knowledge in decision-making, are seldom sufficient for sustainable fisheries [3]. Despite excellent, detailed guidelines for fisheries policy in the form of the FAO (UN) Code of Conduct for Sustainable Fisheries (1995), compliance with the Code is weak at best [4]. The objective of the policies adopted by governments has been, for decades, to stimulate the sustainable development of fisheries, ensuring the viability of fishing communities and the sustainable exploitation of fish stocks. As with Code compliance, the reality is very different [5].

At present, fisheries management focuses on an optimal level of catches that ostensibly sustains the existence of the stocks. However, measures to address the social and economic problems of fishing communities are generally ineffective, hindering sustainable development [6]. Historically, fisheries have tended to be non-sustainable. From 1945 until the early 80s, world catches grew by 80%, because of technological development and exploitation of new fisheries ecosystems, a saga of serial depletion by region [7] and depth [8]. Although world catches have remained approximately constant from 1980 [1], this masks increasing depletions (Fig. 1) and moreover the stability may be more apparent than real when illegal and unreported catches are included as they may mask a decline in the world catch [9].

Most global fish stocks are exploited unsustainably: 30% of the target species are overfished and 24% collapsed, being at risk of extirpation [1]. Pitcher and Cheung [2] show that, without serious action, marine resources will likely continue depletion at the same rate as already warned of in 1970. Bycatch, discards, illegal fishing, intensification of industrial fishing and bad subsidies are the results of unsustainable fisheries management [2,10]. Over-exploitation of marine resources has also had negative effects on the economic viability in the fishing sector: according to the World Bank (2009), losses in world fisheries amounted to 50 billion dollars a year [11]. Increases in fuel prices, stagnation of real fish prices, overcapacity of the fishing fleet, unsustainable use of technology, pollution and increased catches of species with high commercial value, have caused a significant loss of productivity in fisheries [12]. These ecological, economic and social crises are the result of centralized national managements in the face of a rampant commoditization of fishery resources by an increasingly global seafood industry [13,14].

Fisheries management has been dominated by scientific research, while fishermen often have extensive knowledge of fishery resources – Local Ecological Knowledge (LEK) [15] – which has

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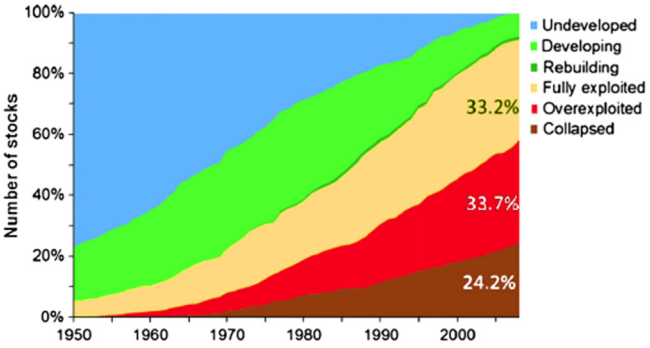

Fig. 1. History of the status of world fish stocks from the FAO catch database 1950–2008, using a catch-only algorithm revised to meet earlier objections [10].

generally not been taken into account by those responsible for the management of fisheries. Rather, it has often been considered a type of local knowledge limited in scope and lacking abstract thought [16]. However, the importance of indigenous knowledge was recognized at RIO+20 (2012) as important for the sustainable management and analysis of fisheries. Fisheries are complex and changing social-ecological systems with many different stakeholders and require a great deal of complex information [16,17] and this has led many to stress the need for the co-production of knowledge in contemporary fisheries policy allowing different actors to work and think together to generate new knowledge collaboratively [20]. Hence, LEK is crucial for sustainable development in fisheries, emphasizing social interactions among stakeholder groups [18–21] and the benefits of incorporating LEK in fisheries governance can be profound [22]. This process can provide a better framework to analyze the state of fisheries [23] and moreover, without a framework to organize findings, isolated knowledge is not cumulative [24].

According to Ostrom, understanding a complex whole requires knowledge about specific variables and how their component parts are related in complex social-ecological systems (SESs) [24]. Thus, it is helpful to dissect and harness complexity, rather than try to eliminate it from such systems. In this context, local management institutions could become the foundation for sustainable development [25] and fishing communities and regional government should work together to share data and local knowledge and thereby reach collectively a more complete understanding of the resource [26].

We present an historical review of the fishery sustainability concept, leading to an innovative integrated multidisciplinary methodological framework. The participatory technique entails a set of indicators that show the sustainability status, and involves local stakeholders and international experts in fisheries management (Government, Fishermen and Scientists). As a case study, this paper then analyzes the present state of the fishing community in Cartagena (Spain).

2. Sustainable development in fisheries systems

2.1. Sustainable fishing communities

The concept of sustainability has been at the center of economic, social and environmental debate for decades. According to FAO (1988), sustainable development is "The management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment of continued satisfaction of human needs for present and future generations. Such sustainable development, conserves land, water, plants and animal genetic resources, is environmentally non-degrading, technologically appropriate, economically viable and socially acceptable" [32]. The Brundtland Commission (1987) defined it more simply as "development that meets present needs without compromising the ability of future generations" [33]. Related definitions of sustainable development have been derived by the scientific community.

In classical fisheries science, sustainability in a fishery has been defined with reference to catch levels that can be maintained (e.g., Maximum Sustainable Yield) [38], termed the conservation paradigm of sustainable fisheries [29] which is focused on protecting the ecological system without considering human and social goals [39]. In contrast to the conservation paradigms, Charles (2002) said that the best means to achieve fishery sustainability is through a complex and systematic social-ecological analysis. This analysis is not only focused on the conservation of the fish and maximizing economic rent, but also on the human dimensions of preserving the way of life of fishers and ensuring the principle of justice in fishing communities [40]. Likewise, Norton (1992) defines sustainability as "a relationship between dynamic human economic systems and larger, dynamic, but normally slower changing ecological system" [34]. In the economic dimension, the neoclassical approach to environmental economics aims to turn the environment into a commodity that can be analyzed just like other commodities [35]. In line with this approach, neoclassical economists are of the opinion that the environment is frequently undervalued because it can often be used free of charge, it tends to be overused and, therefore, degraded [36]. Alternatively, ecological economists like Constanza and Daly (1992) argue that "a minimum necessary condition for sustainability is the maintenance of the total natural capital stock at or above the current level" [37] and so sustainability occurs only when there is no decline in natural capital.

All researchers accept three dimensions of sustainability: social, economic and ecological, but a deeper analysis requires consideration of ethics [44]. Justice relates to equity or the fair distribution of benefits and harm, classifying two broad types of justice: ecosystem and social justice [41–43]. Fisheries that realize the two forms of justice will be precautionary, viable, resilient, participatory, equitable and compensatory, and thereby, sustainable [42]. The sustainability of fisheries pivots on reconciling basic human rights, such as for food and livelihood, with the ecological impacts of fishing [44].

According to the principle of justice, we adopt the idea that sustainable development is achieved through the interplay of factors in six dimensions comprising economic, ecological, technological, institutional, social and ethical, aspects of the fishery system [27–29] (Fig. 2).

Ecological sustainability entails maintaining individual stocks and species at levels that do not foreclose future options and maintain or enhance the capacity and quality of the ecosystem and

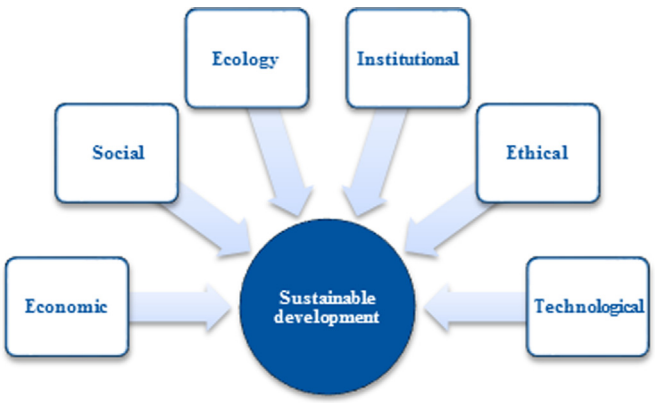

Fig. 2. Six dimensions for the sustainability of fishery systems.