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PROFILE

Identifying Drivers of Collective Action for the Co-management of Coastal Marine Fisheries in the Gulf of Nicoya, Costa Rica

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Abstract Small-scale fisheries are important for preventing poverty, sustaining local economies, and rural livelihoods, but tend to be negatively impacted by traditional forms of management and overexploitation among other factors. Marine Areas for Responsible Fishing (Áreas Marinas de Pesca Responsable, AMPR) have emerged as a new model for the co-management of small-scale fisheries in Costa Rica, one that involves collaboration between fishers, government agencies, and NGOs. The primary objective of this paper is to elucidate some of the key variables that influence collective action among small-scale fishers in Tárcoles, a community in the Gulf of Nicoya. We examined collective action for the formation of a local marketing cooperative and participation in management through the AMPR. We apply the social-ecological framework as a diagnostic and organizational tool in the analysis of several types of qualitative data, including interviews with key informants, informal interviews, legal documents, and gray literature. Findings illustrate the importance of socio-economic community attributes (e.g., group size, homogeneity, previous cooperation), as well as that of social (e.g., equity) and ecological (e.g., improved stocks) outcomes perceived as favorable by actors. In addition, our work demonstrates the importance of certain kinds of external NGOs for facilitating and sustaining collective action.

Keywords Fisheries management · Collective action · Co-management · Small-scale fisheries · Marine protected areas · Common-pool resources · Social-ecological systems

Introduction

Small-scale fisheries (SSFs) support approximately 90 % of all fisheries jobs worldwide and produce more than half of all fisheries landings in developing nations, where the vast majority are destined for human consumption (FAO and World Fish Center 2008). Participation in SSFs plays a significant role in preventing poverty and ensuring food security, either through direct consumption or indirectly as a source of income (Béné et al. 2007). However, SSFs in developing nations are especially vulnerable to several factors that drive overexploitation and resource scarcity including poor management, weak property rights and governance regimes, the neoliberalization of global and regional markets, poverty, and external environmental factors such as climate variability and pollution (Allison and Ellis 2001; Kittinger et al. 2013; Defeo et al. 2013). Contributions of SSFs to food security and poverty alleviation in developing nations have been overlooked and sometimes undermined by dominant strategies for commercial fisheries management (Béné et al. 2007).

Costa Rica is a developing Central American nation with an extensive, bicoastal exclusive economic zone (EEZ, 613,683 km^2; FAO 2004) where fisheries have been subject to increasing exploitation since the 1950s. Fishing pressure intensified in the 1980s due to fishery development programs and technological innovation (Ovares 1989; Mack et al. 1992). Conflicts have arisen among different sectors and governmental agencies as a result of resource scarcity, especially in the productive and heavily exploited

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fisheries of the Pacific region (Mack et al. 1992; Alpízar 2006). Dominant management strategies in Costa Rica involve top-down regulation (e.g., fishing licenses and seasonal closures) by the Costa Rican Institute of Fisheries and Aquaculture (INCOPESCA) and restrictions within marine protected areas (MPAs) under the Ministry of the Environment (MINAE).

Centralized regulation of fishing inputs (e.g., gear and seasonal restrictions) has largely failed to address overcapacity and, in some cases, has intensified competition and uncertainty among fishers (Beddington et al. 2007). When underlying problems driving overcapacity are not addressed, MPAs may shift exploitation elsewhere. Because they reallocate property rights over natural resources, MPAs can also lead to displacement of vulnerable social groups such as small-scale fishers (Mascia and Claus 2008). Case studies from Central America, and Costa Rica specifically, suggest there are conflicts of interest in the management of MPAs that preferentially benefit profitable sectors (e.g., sport fishing) and a number of unaddressed social problems that hinder participatory management (Solís Rivera et al. 2012).

Marine Areas for Responsible Fishing (*Areas Marinas de Pesca Responsable*, AMPR), recognized in 2009 by Presidential Decree N° 35502-MAG, have emerged as a new model for participatory management of small-scale fisheries in Costa Rica. The AMPR model stems from the work of fishing communities and their respective fishing organizations, and prioritizes the protection of marine resources from non-selective fishing practices at both the commercial and artisanal scale. To establish an AMPR, fishing organizations propose a comprehensive management plan based on guidelines established in the enabling legislation and subject to approval by INCOPESCA. Per the legislation, fishing organizations may rely on government agencies for collecting information and drafting the management plan.

Fishing organizations initially proposed AMPR designations as a form of community-based resource management, in which communities are exclusively responsible for management and conservation. Costa Rican legislation does not recognize collective property rights over natural resources, except for a few remaining indigenous reserves (Madrigal and Solís Rivera 2012). Therefore, the AMPR model was legally recognized as a co-management approach that involves shared, collaborative governance (Borrini-Feyerabend et al. 2013) negotiated between small-scale and commercial fishers, government agencies, and other stakeholders. The creation of AMPRs acknowledges the contributions of artisanal fishers in decision-making and facilitates the devolution of rights and responsibilities to communities (e.g., developing rules for extraction and monitoring resources). Several AMPRs have been created since 2009 but implementation remains at varying stages throughout Costa Rica.

The primary objective of this paper is to identify some of the various factors that influence collective action among small-scale fishers in Costa Rica, particularly in the Gulf of Nicoya where the majority of AMPRs have been established. By collective action we refer to any cooperative action taken by a group of individuals in order to achieve a common goal. We employ the social-ecological systems (SES) framework to examine some of the variables and interactions that have facilitated collective action with respect to two different outcomes: (1) the formation and endurance of a fishing cooperative, and (2) the creation of an AMPR. We focus on one case study involving a community of fishers and an external non-governmental organization (NGO) in the Gulf of Nicoya and frame it within the broader regional context in order to identify some of the drivers of collective action and co-management, as well as key areas for future research. In the following sections, we establish the theoretical framework for analysis of several types of qualitative data and the methodology employed, followed by a discussion of findings and implications for management.

Methods

Theoretical Framework

Common-pool resources (CPR), such as fisheries and forests, are characterized by limited resource flow, subtractability (i.e., one user's extraction reduces the amount available to others), and high cost of excluding others from accessing the resource (Ostrom 1990). In pelagic marine fisheries, the fugitive nature of the resource exacerbates uncertainty of future access and exclusion that leads actors to discount future value (Ohashi 2010). The most influential explanations for poor management and economic failures in fisheries (e.g., Gordon 1954; the tragedy of the commons, Hardin 1968) presupposed that resource users are rational egoists who fail to act collectively without externally imposed institutions (Ostrom 2000). Views emphasizing individualistic rational choice have translated to the need for centralized government regulation and privatization (Ostrom 1990). However, findings from the study of long-standing CPR institutions have demonstrated that users are capable of devising rules to address resource overexploitation, circumventing economic failures, and overcoming the tragedy of the commons scenario under certain conditions (Basurto and Ostrom 2009).

In addition to factors not formerly acknowledged, such as communication among actors in commons dilemmas, Ostrom (1990) identified design principles that characterize

long-standing institutions for the management of CPRs, which have since received a great deal of support in the years of ensuing research (Ostrom 2000; Cox et al. 2010). Some of the key design principles include user participation in decision-making at the collective-choice level (i.e., determining rules that affect day-to-day operational rules), appropriate monitoring, graduated sanctions, access to conflict resolution, and government recognition of CPR institutions. In addition, other major studies have concluded that small group size is an important factor for sustainable resource management and collective action, albeit one that is likely to be mediated by other variables (Agrawal 2001).

CPR theory has evolved into the more comprehensive Institutional Analysis and Development (IAD) Framework, which facilitates the analysis of institutions and collective action in relation to various interactions and external factors. Under the IAD framework, institutions are defined as the "prescriptions that humans use to organize all forms of repetitive and structured interaction" (Ostrom 2005, p 3). The core analytical unit of the IAD framework is the *action situation*, which refers to the social setting "in which individuals (acting on their own or as agents of formal organizations) interact with each other and thereby jointly affect outcomes that are differentially valued by those actors," (McGinnis and Ostrom 2014, p 2).

More recent theoretical and empirical efforts have responded to the need to integrate social and ecological paradigms, and place the action situation within the context of SES (Ostrom 2009). Fisheries, like other CPRs, are part of complex and adaptive SES, wherein social institutions interact extensively and interdependently with the biophysical world (Berkes and Folke 1998). The SES paradigm reflects shifts in ecological theory to include humans in the understanding of dynamic and complex natural systems, which has valuable implications for studying participatory and decentralized management of natural resources and for effective interdisciplinary conservation work (Berkes 2004). Some focal research questions about SESs concern the resilience and adaptability of complex systems and their interrelated subsystems, as well as the influence of various non-linear effects and feedback mechanisms on their stability, particularly in the face of issues such as resource overexploitation and climate change (Berkes and Folke 1998; Berkes et al. 2003; Folke 2006; Defeo et al. 2013).

Ostrom (2009) proposed a framework, later refined by McGinnis and Ostrom (2014), to identify relevant variables for the analysis of SESs along four major axes or first-tier variables: resource systems (RS), resource units (RU), governance systems (GS), and actors (A). A number of variables can be derived from the first-tier variables (e.g., second- and third-tier) in order to refine analytical and diagnostic efforts (Table 1). Variables within these dimensions directly affect action situations and the accompanying set of interactions (I) and outcomes (O; Table 2) associated with management in SES, and are simultaneously influenced by feedbacks. In addition, SESs are shaped by the lager social, economic, and political context (S), as well as related ecosystems and other SESs (ECO). We adopted the SES framework because it was developed to address a variety of emerging questions and provide uniformity in theoretical language (McGinnis and Ostrom 2014). Basurto et al. (2013) modified it further for examining small-scale benthic fisheries. Following in these efforts and other insights from CPR research, we seek to identify key variables, as well as some of the interactions and outcomes, that have influenced collective action and co-management of pelagic marine fisheries in the Gulf of Nicoya region.

Study Site

The Gulf of Nicoya is a tropical estuary located in the central Pacific region of Costa Rica with the nation's most productive fisheries. Oceanic currents, upwellings, and discharge from several rivers contribute to high primary productivity in the gulf, which traditionally supported an abundance of fish and invertebrates (Vargas 1995). Coastal ecosystems include mangroves, rocky reefs, and estuaries (Salas et al. 2012). Reported landings from the Gulf accounted for approximately 65 % of total production in Costa Rica from 1994 to 2005 (Chacón et al. 2007) but peaked during that period and have declined since 2000. The majority of commercially valuable and well-known species (e.g., Penaeid prawns, snook, snappers) are exploited beyond sustainable levels (Wehrtmann and Nielsen-Muñoz 2009; Herrera-Ulloa et al. 2010). The livelihoods of thousands of artisanal fishers from at least 16 communities depend on seafood in the region (Turriago 2013).

Tárcoles is a village located in a district of approximately 4300 inhabitants located on the outer Gulf of Nicoya, immediately south of the Tárcoles River delta (Fig. 1). Approximately 50 % of the people of Tárcoles benefit directly or indirectly from fishing or harvesting other marine life (CoopeSoliDar 2010). Fishers in Tárcoles employ various gear types including gillnets, bottom-set longlines, and drifting longlines. They usually fish in small vessels made of fiberglass, ca. 3 m in length, with outboard motors and rudimentary iceboxes; some cast gillnets close to shore from small vessels without motors. Shrimp and finfish populations are high in Tárcoles due to estuarine conditions near the mouth of the river and the role of mangroves as nurseries. The semi-industrial shrimp sector concentrates its activities in this region using non-

Table 1 Second- to fifth-tier variables of the SES framework adapted from Basurto et al. (2014) with specific changes applicable to pelagic fisheries management in Costa Rica italicized

Social, Economic, and Political Setting (S)

S1—Economic development, S2—Demographic trends, S3—Political stability, S4—Other governance systems, S5—Markets, S6—Media organizations, S7—Technology, *S8—Discourse and ideology*

Resource Systems (RS)

RS1—Sector

RS1.1 Pelagic finfish

RS1.2 Penaeid shrimp

RS2—Clarity of system boundaries

RS3—Size of resource system

RS4—Productivity of system

RS4.1 Stock status

RS4.2 Biophysical factors

RS5—Equilibrium properties

RS6—Predictability of system dynamics

RS7—Storage capabilities

RS8—Connectivity

RS9—Location

Resource Units (RU)

RU1—Resource unit mobility

RU2—Growth or replacement rate

RU3—Interaction among resource units

RU3.1—Reproduction

RU4—Economic value

RU5—Number of units

RU6—Distinctive characteristics

RU6.1 Wild

RU7—Spatial and temporal distribution

RU7.1 Patchy

RU7.2 Random

Actors (A)

A1—Number of relevant actors

A2—Socioeconomic attributes

A3—History or past experiences

A3.1 Crisis

A3.2 Duration

A3.3 Previous experience of cooperation

A4—Location

A5—Leadership/entrepreneurship

A6—Social capital

A6.1 Trust and reciprocity

A7—Knowledge of SES/mental models

A7.1 Mechanisms for sharing knowledge

A8—Importance of resource

A8.1 Economic dependence

A8.2 Cultural dependence

A9—Technologies available

A9.1 Ownership by fishers

A9.2 Homogeneity

Governance Systems (GS)

GS1—Policy area

GS1.1 Environment

GS1.1.1 Benthic marine

GS1.1.2 Pelagic marine

GS2—Geographic range

GS3—Population

GS4—Regime type

GS4.1 Democratic

GS4.2 Autocratic

GS5—Organizations

GS5.1 Government organizations

GS5.1.1 Support enforcement

GS5.1.2 Support funding

GS5.1.3. Restoration efforts

GS5.2—Non-government organizations

GS5.2.1 Capacity building

GS5.2.2 Linking

GS5.2.3 Bridging

GS5.2.3.1 Unions

GS5.2.3.2 Cooperatives

GS6—Rules-in-use

GS6.1 Property rights

GS6.1.1 Open-access

GS6.1.2 Moratory

GS6.2 Operational rules

GS6.3 Collective-choice rules

GS6.4 Constitutional rules

GS7—Norms and strategies

GS8—Network structure

GS8.1 Horizontal

GS8.2 Vertical

GS9—Monitoring

GS9.1 Social

GS9.2 Biophysical

GS10—Sanctions

Related Ecosystems (ECO)

ECO1—Climate patterns, ECO2—Pollution patterns, ECO3—Flows into and out of focal SES

Table 2 Interactions and outcomes of a SES adapted from McGinnis and Ostrom (2014) with modifications for fisheries management in Costa Rica in italics

Interactions (I)	→	Outcomes (O)
I1—Harvesting		O1—Social performance measures (e.g., efficiency, equity, accountability, sustainability)
I2—Information sharing		O2—Ecological performance measures (e.g., overharvesting, resilience, biodiversity, sustainability)
I3—Deliberation processes		O3—Externalities to other SESs
I4—Conflict		
I4.1 Intra-sector conflict		
I4.2 Inter-sector conflict		
I4.3 Conflict between fishers and government organizations		
I5—Investment activities		
I6—Lobbying activities		
I7—Self-organizing activities		
I8—Networking activities		
I9—Monitoring activities		
I10—Evaluative activities		

selective bottom trawls, while artisanal fishers harvest shrimp using gillnets. The AMPR of Tárcoles was approved in 2011 after negotiations between artisanal fishers and representatives of the semi-industrial sector. The AMPR is about 108.8 km^2 (Salas et al. 2012) and contains six different zones with specific gear restrictions.

Data Collection and Analysis

We conducted semi-structured, open-ended interviews with 23 key informants, including fishers and community members ($n = 15$) in the community of Tárcoles, as well as representatives of fishing organizations, related NGOs and public institutions in the Gulf of Nicoya region ($n = 8$). Interviews with key informants can be useful for rapidly generating substantial amounts of qualitative and some quantitative data in social research (Tremblay 1957). Heinen (2010) illustrated the utility of key informant interviews and other social science instruments for exploring social dimensions of conservation. Key informant interviews have been used for similar studies, including assessing regulations and management of a nature reserve in Kyrgyzstan (Ter-Ghazaryan and Heinen 2006); evaluating non-timber forest product policy in Nepal (Heinen and Shrestha-Acharya 2011); and identifying gaps in the implementation of international regulations on the trade of endangered species (Dongol and Heinen 2012).

Sampling for informants was non-random and purposive (Bernard 2006), i.e., they were specifically chosen because of their roles in communities and organizations. In some cases, the selection of informants was participant-driven by referral. Interviews with fishers explored their experience in relation to fishing, perceptions of the current state of fishing as an economic activity, attitudes about belonging to local fishing organizations, and opinions on marine conservation in the AMPR. Representatives of public agencies were interviewed about their involvement with fishing communities, as well as their perceptions of strengths and weaknesses of management through AMPRs.

All key informant interviews were conducted in person in July and August 2013. Interviews were recorded, translated from Spanish into English, and coded using the qualitative data analysis software Atlas.ti (version 7.0). Coding allowed us to identify emergent themes in responses and variables that have influenced decision-making and collective action. Findings from interviews are supplemented with reviews of other case studies from the region, NGO documents, government reports, and other relevant literature. In particular, our work is informed by baseline socio-economic information that has been collected in Tárcoles (CoopeSoliDar 2009, 2010) and Isla Chira (Babeu et al. 2012). We also carried out 45 informal interviews with fishers and community members in Tárcoles, Isla Chira, Puntarenas, and Costa de Pájaros to supplement our knowledge of fisher communities and general perceptions of management. We obtained oral consent from all informants after informing them of the purpose of the research and assuring the voluntary and anonymous nature of participation.

Results

Findings from data analysis and review are reported here in relative chronological order to illustrate the dynamics that have resulted in the current state of management. In order to structure discussion, key variables of the SES framework

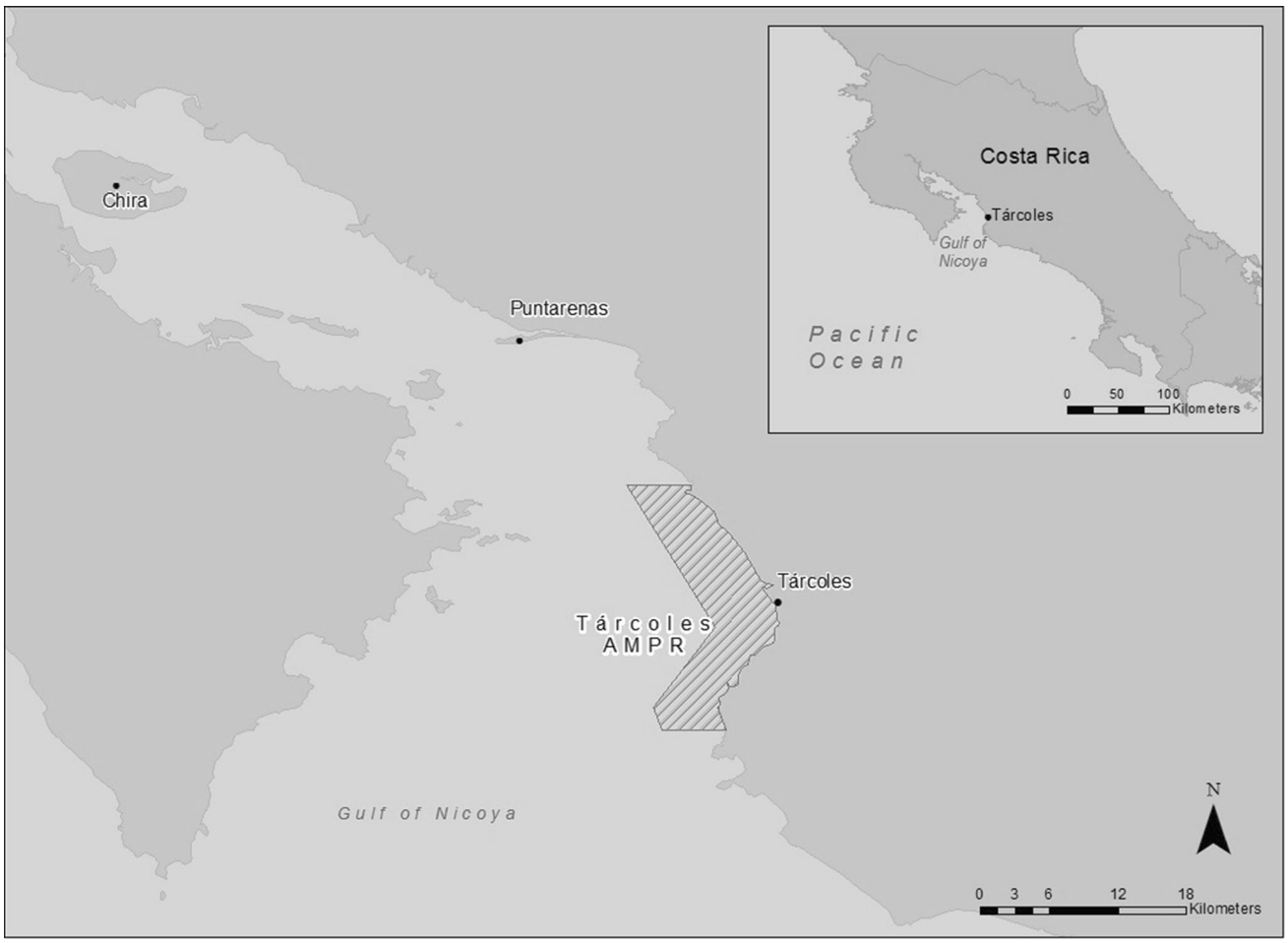

Fig. 1 Small-scale map illustrating the location of the Gulf of Nicoya and Tárcoles and large-scale map showing the location and extent of the AMPR of Tárcoles

referenced here are summarized in Table 1 while interactions and outcomes are listed in Table 2.

Historical Context for Collective Action: Politics, Economics, and Ideology

The town of Tárcoles was established in the 1950s by migrants from other regions seeking economic opportunities (CoopeSoliDar 2010). All community members interviewed reported that their families previously depended on agriculture and livestock, activities in which only one of them currently engages. All fishers interviewed in Tárcoles ($n = 13$) started fishing within the last two generations, usually at an early age as workers aboard vessels or under the direction of elders. The responses of two elders suggest that the high abundance of fish formerly found in Tárcoles, and accordingly the ease of capturing valuable fish, created an important incentive for people to shift from other livelihood strategies. Over time, fishing became central to the cultural identity and livelihoods of Tárcoles where approximately 90 % of the inhabitants were fishers, although that proportion has declined in recent years, likely a result of decreasing resource availability and coastal development for tourism (CoopeSoliDar 2010). From fishers' responses throughout the region, as well as from data collected in nearby communities of Isla Chira (Babeu et al. 2012), it is evident that small-scale fishers have high economic (A8.1) and cultural (A8.2) dependence on coastal resources.

Following an economic crisis in the late 1970s, the most important sectors in Costa Rica (i.e., agriculture and industrial manufacturing) experienced rapid recovery and growth as a result of structural adjustment economic policies adopted in the 1980s (Vega 1996). Between 1976 and 1983, the Costa Rican government implemented a similar development model to increase productivity in the nation's fisheries and improve the socio-economic status of fishers (S1). Approximately $20 million USD was allocated for investments that focused mainly on infrastructure development (e.g., port facilities, vessel construction; S7) and

promotion of fishing cooperatives in the artisanal sector, with some negative results (Ovares 1989). The earlier Law of Cooperative Associations (N° 4179, 1973) created a series of economic incentives for the formation of cooperatives, primarily in the form of tax exemptions. Cooperativism is also an integral part of the political and economic discourse in Costa Rica (S8). Cooperative principles are required in all academic curricula (Law N° 6437, 1983) and there are over 594 cooperatives involving approximately 40 % of the national active workforce (INFOCOOP 2012).

In addition, a number of subsidies have promoted capitalization in the fisheries sector, which act as an important market driver for overexploitation (S5). In the year 2000, approximately 70 % of fisheries subsidies in Costa Rica (~$32 M USD) were the kinds generally classified as harmful (Sumaila and Pauly 2006). That is, they create incentives for increased exploitation and maintain high fishing effort even when fishing is not profitable (e.g., fuel subsidies, tax exemptions). All licensed fishers in Costa Rica are eligible for subsidized fuel (Law N° 8436 of Fisheries and Aquaculture), making it the most common kind of subsidy. Only one informant, belonging to an environmental NGO, pointed to the impact of harmful subsidies on fisheries management in Costa Rica.

Roots of Cooperativism in Tárcoles

In 1985, a group of fishers formed the Cooperative of Fishers of Tárcoles (CoopeTárcoles) to promote collective marketing of fisheries products through a local storefront, although current activities also include processing and export at the regional scale, as well as a developing model for community-based rural tourism. According to the president of the cooperative and three other members, self-organizing efforts to form the cooperative (I7) originated in response to several factors that constituted a shared crisis (A3.1). Valuable fish were becoming increasingly scarce and fishing efforts resulted in diminishing returns. In addition, eight informants cited problems with intermediaries as a major impetus for the formation of the cooperative. Distributors commonly cheated locals, shifting profit away from the community, and fishers accrued debt with suppliers whenever fishing trips were not successful. They adopted the cooperative framework as an instrument for guaranteeing fair prices, selling fishery products independently, and collectively financing expenses. According to one founding member, organizing as a cooperative was also considered beneficial because of tax incentives and ease of access to fishery development programs (S1).

Moreover, we identified equity as a strongly favored social outcome (O1) of cooperativism in Tárcoles. The labor and profit distribution model employed in CoopeTárcoles is characterized by financial equity, an advantage emphasized by seven informants. Once landings from fishing trips are turned in for appraisal and expenses are subtracted, profits are divided equally among all parties aboard a vessel (i.e., the captain and a worker or *peón*, as well as the vessel owner). On the other hand, four fishers cited inequality as a detractor for working aboard larger vessels where workers receive significantly smaller shares. Members of the cooperative who are vessel owners would profit most in a system with stratified division of earnings, but fishers view themselves as part of a community in which equal effort should be rewarded equally, despite differences in the ownership of physical capital. Equity was mentioned a total of 17 different times in key informant interviews.

However, it is important to note the influence of several other factors. Fishers living in Tárcoles share similar educational levels, cultural and religious practices, and a common history of place (A4). Their responses indicate that trust, unity, similarity, and familiarity among members have contributed to the endurance of the cooperative over the years. In addition, the number of cooperative members fluctuates slightly but remains small, at approximately 40 members (A1). Major decisions and elections are made during an annual general assembly and positions for specialized councils (i.e., Administrative, Monitoring, Social Welfare) are elected by majority vote. According to four key informants, annual and extraordinary assemblies provide a forum for rapid conflict resolution and efficient transfer of information, which have been repeatedly identified as important for the endurance of CPR organizations (Cox et al. 2010).

Unlike several other fishery cooperatives in Costa Rica (e.g., Ovares 1989; Herrera-Ulloa et al. 2011), CoopeTárcoles has persisted and grown over time, overcoming internal conflict and poor administration (A3.1). Specific issues reported by informants included deficits in the collective fund, which one informant attributed to excessive leniency in financing fishers' expenses; embezzlement by externally hired administrators; and internal theft of products. According to the president, problems were prevalent during the cooperative's first 15 years. In 2000, the fishers of CoopeTárcoles formed a relationship with CoopeSoliDar, a small NGO (GS5.2) operating under the cooperative framework to promote self-management and solidarity in rural communities. Through the partnership, fishers began making changes necessary to sustain cooperation, not only within the cooperative but also to facilitate networking (I8) and lobbying efforts (I6) that led to the legal recognition of AMPRs.

Collective Action and the AMPR of Tárcoles

According to four cooperative members, resource scarcity in formerly rich waters was a major source of concern for sustainability of resources and associated livelihoods. All fishers interviewed in Tárcoles recognized conservation as important. Three informants expressed a view that their support of conservation was contingent upon their ability to continue fishing in the region. The views of organization leaders and other community members indicate that they are not in favor of protectionist conservation models that exclude access to marine resources. In addition, there is a high degree of inter-sector conflict (I4.2) between artisanal fishers and the semi-industrial shrimp fleet. Fishers believe that unregulated activities of shrimp trawlers resulted in the current state of scarcity that threatens their livelihoods. Nine local fishers interviewed expressed that removing the shrimp trawlers from Tárcoles is critical for conservation. Fishers in Tárcoles and other areas (e.g., Chira, Babeu et al. 2012) also have intra-sector conflict (I4.1) with other artisanal fishers whose practices are detrimental to stocks (A9.2), as well as with government agencies (I4.3). All fishers and non-government informants interviewed expressed dissatisfaction with INCOPESCA, citing lack of responsiveness to fishers, poor enforcement, and implementation of regulations. Gallardo (2009) found similar results with respect to fishers' perceptions of INCOPESCA. Conversely, one government official interviewed expressed that resource scarcity was a result of small-scale fishers' practices. According to four key informants, lobbying to create the AMPR of Tárcoles was an effort to address conflicts while promoting equity in access and sustainability of resources and livelihoods. Doing so required significant investments in time and effort from small-scale fishers, a demographic characterized by low educational attainment and high rates of poverty (Babeu et al. 2012; Solís Rivera et al. 2012).

Informants' responses suggest that previous experiences of cooperation (A3.3) and the involvement of CoopeSoliDar in Tárcoles were also crucial for fostering collective action and establishing the AMPR. Based on the responses of six informants, it is evident that the latter facilitated increases in available forms of capital, social (A6) and otherwise, and promoted the formation of cross-scale linkages (i.e., vertically with other levels of governance and horizontally with other fisher communities; GS5.2.2). CoopeSoliDar and CoopeTárcoles interact through continual informed consent, and cooperative members decide the role of the external organization, which has fostered trust (A6.1) according to two key actors. Members of CoopeSoliDar are experts from various fields (e.g., anthropology, biology, law) who have offered skills and services to the community. According to the president of CoopeTárcoles and two other committee members, capacity-building efforts (GS5.2.1) allowed fishers to shift from hired to local management of the cooperative and to adopt sustainable practices based on the FAO guidelines for responsible fisheries. The partnership has also facilitated fishers' involvement in the broader political arena by bridging educational gaps and providing assistance with the collection of data necessary to develop the management proposal for the AMPR. In addition, workshops with INCOPESCA and the national coastguard have purportedly reduced fishers' distrust of government agencies, according to one informant.

CoopeTárcoles and CoopeSoliDar also collaborate on participatory research efforts, through which community members collect information about socio-economic indicators, fishing effort, and resource abundance. Priorities for investigation are determined through consensus. Results are analyzed and synthesized by members of CoopeSoliDar and used by both organizations to make future decisions (I3), which four key actors recognized as an important means for sharing information (A7.1). Locally generated data on species harvested and increased abundance following fishery closures during the first year were useful for achieving changes in fishing restrictions through direct negotiations between fishers in Tárcoles, the shrimp sector, and INCOPESCA. The initial fishing restrictions in the AMPR included a closure of the marine area for both artisanal fishers and trawlers, which fishers perceived as unfair. After fishers presented data demonstrating the low impact of selective gear and increased abundance of benthic marine life in the area, INCOPESCA permanently banned semi-industrial trawling within the AMPR in 2013. Nonetheless, seven key actors in Tárcoles expressed concern that implementation and enforcement of fishing restrictions are insufficient (GS5.1.1). In addition, according to all informants, there are significant gaps in knowledge about the resource system, not only in Tárcoles but also for AMPRs throughout the region (CoopeSoliDar 2013).

Discussion

Our work is useful for illustrating the influence of various factors on the evolving action situation in which actors, particularly small-scale fishers in Tárcoles and members of CoopeSoliDar, have made decisions that lead to collective action. The formation of CoopeTárcoles and the AMPR constitute decomposable instances of the decision-making process McCay (2002) described as step-wise situated rational choice, whereby actors must first identify a serious problem and then discern cause-effect relationships before deciding on whether and how to act to resolve it.

Recognizing their problematic and detrimental relationship with intermediaries, fishers in Tárcoles adopted the cooperative model as a means of attaining independence and greater control within the stratified value chain. In the case of the AMPR, fishers in Tárcoles recognized resource depletion as a major issue, attributing it to the activities of not only other sectors but also their own, and shifting their practices accordingly before eventually lobbying to remove actors they perceived as responsible from the marine area of Tárcoles. In both cases, the rational choice process from which collective action developed was likely facilitated by several characteristics of the action situation. For instance, the nature of resource units (e.g., mobility, value, distribution) and resource systems (e.g., storage, clarity of boundaries) probably exacerbated the realities and perception of environmental degradation. Pelagic fish (RS1.1) and shrimp (RS1.2) are highly mobile (RU1), with limited potential for storage (RS7). Neither the size (RS3) nor productivity (RS4) of the resource system is well understood, given widespread gaps in investigation by government agencies. Additionally, the high value of target species (RU4) and *de facto* open access conditions (GS6.1), given that no catch limits exist and enforcement of license requirements is extremely limited, contribute to overexploitation and uncertainty for fishers. Our findings suggest that attributes of the coastal community (e.g., group size, social homogeneity) and the availability of cooperativism as an institutional model (S8) may also have promoted the development of social capital necessary for collective action and shaped the nature of fishers' responses to conflict.

Moreover, the kinds of outcomes favored and achieved through collective action, not only socio-economic (O1; equity, economic independence) but also inextricably ecological (O2; improved stocks), seem to have strongly shaped and reinforced cooperation. The economic benefits of cooperativism in Tárcoles are tangible and acknowledged by community members, to a greater degree than those belonging to associations in other communities around the Gulf of Nicoya (García Lozano 2014). Therefore, addressing the socio-economic sustainability of coastal communities is likely to play an important role in promoting participation in co-management. In addition, improvements in stocks as a result of the AMPR represent a favorable, encouraging outcome that seemingly promotes investment in the management model. On the other hand, fishers' rejection of protectionist approaches to management that exclude small-scale fishers (a common response to marine reserves; Cook and Heinen 2005) was probably a strong factor in determining the course of action taken by fishers to protect fishing grounds (i.e., choosing to propose an AMPR as opposed to a MPA). Furthermore, it is evident from our work that the partnership between fishers in Tárcoles and the NGO CoopeSoliDar has played a significant role in fostering collective action, not only by strengthening management of the local cooperative and thereby making more resources available to invest in the political arena, but also by bridging gaps in various forms of capital, promoting capacity building, and connecting fishers to actors at other levels of governance. Participatory research efforts and renegotiations with respect to fishery closures illustrate how the partnership between Coope-Tárcoles and CoopeSoliDar increased the political influence of the local artisanal sector.

Our work also serves to further illustrate the usefulness of the SES framework for examining various environmental management regimes, in this case pertaining to collective action and participatory co-management of pelagic fisheries. We made some modifications to the proposed framework that will have value for examining fisheries co-management in the context of developing nations. In our analysis, it was useful to differentiate among different types of conflict (I4, Table 2) that affect actors' decision-making in a given action situation. It was also important to include previous cooperation (A3.3) as a variable to consider in the emergence of collective action, because it may have influenced fishers' willingness to form a partnership with CoopeSoliDar and their likelihood to act collectively to form the AMPR. Previous experiences of cooperation have been important for the sustainability of CPRs in other contexts (Ostrom 1990). Finally, when describing the socio-economic and political setting of this SES, we determined that discourse and ideology (S8) might play an important role in shaping the kinds of institutional arrangements available to actors. The specific relationship between management regimes and hegemonic forms of discourse, in addition to power relations, is a topic that deserves greater attention in the study of SESs, as suggested by Clement (2010).

Conclusions

Our work provides a starting point from which to examine AMPRs as an emerging approach to fisheries co-management in Costa Rica, as well as get an insight on the dynamics affecting actors in the Gulf of Nicoya, an area with marine resources of great social and biophysical importance. Given the high cultural and economic dependence of small-scale fishers on vulnerable resources exploited by a variety of users, it is clear that ensuring sustained participation in management will require consideration of economic factors. It will also require continual strengthening of local organizations and linkages between fishers and government, as well as education and capacity building for all actors. There is a need to further

examine the role of key variables influencing collective action throughout the Gulf of Nicoya, as well as more broadly for understanding the emergence and sustainability of fisheries co-management in developing nations. Our work is informed by the perceptions of relatively few key actors involved in the management of fisheries in a diverse and complex region, yet their opinions converge and corroborate previous research efforts (e.g., CoopeSoliDar 2010, Babeu et al. 2012) with respect to the major issues facing fisheries management in Costa Rica. Future research should focus on the interactions between resource users and other actors, particularly government agencies and NGOs, and the role of local leadership in fisher communities. Collaboration with NGOs involved in marine conservation and social sustainability has certainly strengthened participation by small-scale fishers in management in Costa Rica, not only in Tárcoles but also in other communities (e.g., Chira; Babeu et al. 2012). However, the effectiveness of co-management through AMPRs remains to be determined, especially considering known gaps in the institutional resources of government agencies in Costa Rica (Alpízar 2006; García Lozano 2014). Variables related to governance systems (e.g., enforcement, funding, cross-scale linkages) are especially likely to play an important role in sustaining collective action and participation in the future, as well as for meeting national goals of sustainability in Costa Rica.

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