

Collective Action in Response to Coastal Degradation? Cultural Multi-Level Selection for Analyzing the Emergence and Dynamics of Community-Based Associations in Ecuador

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Abstract: Throughout the 1990s on the Ecuadorian coast, a growing number of local fishing associations began to emerge around sustainability challenges of coastal degradation, mangrove deforestation, and declining catch rates in artisanal fisheries. The spread of shrimp aquaculture provoked mobilizations among advocacy groups and communities experiencing social conflict and displacement from their ancestral fishing grounds within mangrove swamps. Were such forms of collective action an outcome of new social dilemmas associated with rising concerns about environmental degradation and social injustice stirring within the grassroots? How did these concerns become institutionalized in the proliferation of local associations uniting at regional levels within larger networks of “ancestral users of the mangrove”? How and why do such regional alliances encourage new participation among some individuals while disillusioning others? Theories of cultural evolution provide interesting insights about the specific mechanisms by which institutions, cooperative behaviors, and other cultural adaptations emerge and evolve from selective pressures. In this paper, I apply the Cultural Multi-Level Selection framework (Waring et al 2015) to explore these selective pressures in response to dilemmas at different levels of social organization. The paper documents the emergence and spread of over 50 custodias since 2000, which placed over 50,000 hectares of mangroves under the protection and stewardship of nearly 5000 mangrove guardians, thereby providing empirical evidence for understanding the dynamics of governance. The findings suggest that collective action, i.e. the coordinated efforts among individuals, appears to have emerged in response to perceived social dilemmas associated with the rise of shrimp aquaculture on the Ecuadorian coast at the group level; but as alliances across groups emerged at regional scales, such local enthusiasm for collective action may have faded away in some locations. Drawing on interviews with association members, former members and leaders, as well as ethnographic research on mangroves as a social-ecological system in multiple sites throughout the Ecuadorian coast, this paper contributes new empirical insights about the evolution of coastal governance and marine resource management to advance theories of cultural evolution.

1. Introduction

Addressing sustainability challenges associated with the cumulative effects of environmental degradation requires collective action, which could be understood as both an adaptive response and a basis for changes in governance. The large body of research on the commons has advanced knowledge about collective action (Ostrom 1990, Agrawal 2001, Cox et al. 2010) as well as outcomes of such self-organization (Pagdee et al. 2006, Persha et al. 2010, Agrawal and Benson 2011, Persha et al. 2011). Garrett Hardin's (1968) prediction of the inevitable tragedy of the commons triggered decades of debate about the evolution of collective action in response to social dilemmas and the role of institutions in commons management. Ostrom's (1990) design principles provided the analytic framework for hundreds of case studies by identifying the conditions under which groups organize for the sustainable management of forests, pastures, fisheries, and other common pool resources. Theories of polycentric governance offer conceptual insights about how to facilitate collective learning and experimentation at multiple scales (Ostrom 2010) to address the long-standing and well-recognized challenge of scaling up the lessons from case studies (Ostrom et al. 1999, Berkes 2005).

Despite these theoretical and empirical advances, much of commons theory has been based on snapshots of collective action documented in hundreds of case studies. As also pointed out by Waring et al (2017), there remains a gap in understanding the dynamics of collective action and the specific evolutionary mechanisms involved in the emergence and spread of institutions that promote cooperation. Cultural Multi-level Selection (CMLS) has been proposed by Waring and colleagues (2015) as a framework to strengthen theoretical propositions about the causal mechanisms driving the emergence and evolution of cultural traits in a population over time. The framework is derived from group selection theories and applies evolutionary logic to explain how cultural traits, i.e. norms, beliefs, attitudes, values, and practices are transmitted through social learning and imitation (Boyd and Richerson 2005, Boyd and Richerson 2009). The framework predicts that as individuals and groups learn from one another (and their environment) through a process of co-evolution, the outcome will result in an institutional 'fit.' Examination of this process helps explain the emergence of Ostrom's Principle 2, or congruence between the resource environment and governance structure (Ostrom 1990:90). In this way, the CMLS framework has potential to improve understanding of the dynamics of cooperation and processes that create 'fit' (Waring and Acheson 2018), i.e. how cooperation changes over time, and in turn, how group and larger network structures interact to influence individuals.

This paper uses the CLMS framework to examine the emergence of civil society organizations and the evolution of governance on the Ecuadorian coast. Beginning in the 1980s, the growth of the shrimp aquaculture industry raised concerns about sustainable development and the conservation of mangrove forests in the intertidal zones throughout the coast. Increasing scientific awareness about the impacts of mangrove deforestation on fisheries prompted institutional change within government agencies at multiple levels and mobilizations among advocacy groups aroused by social justice concerns (Olsen 2000, Latorre 2014, Beitel 2016). Throughout the 1990s on the Ecuadorian coast, a growing number of artisanal fishers created

fishing associations in response to declining catch rates and the loss of fishing grounds by encroaching shrimp ponds. In 2000, local fishing associations became eligible to apply for *custodias* or mangrove concessions to promote local stewardship of mangroves and associated fisheries as per an agreement between each of the associations of the Ministry of Environment (Bravo 2000). Their dependence on mangroves for their livelihoods and subsistence made them ideal guardians to prevent and report illegal mangrove cutting for shrimp farming or other reasons. Associations worked with partner technicians to develop management plans, some of which contain explicit rules concerning the use and management of benthic fisheries like mangrove cockles (*Anadara tuberculosa*, *A. similis*, and *A. grandis*) and crabs (*Ucides Occidentalis*). Some of these management plans highly reflect the design principles proposed by Ostrom (Beitl 2011).

While governance should be broadly understood as a continually evolving complex process of distributing power and effort among multiple actors, including government entities, NGOs, civic organizations, communities, private businesses, political parties, the media, and the general public (Jentoft and Chuenpagdee 2009:554-555), the focus here is on collective action. Specifically, I focus on two different expressions of collective action as a cultural trait: 1) motivations and mobilizations of individuals, groups, and advocacy networks in response to environmental degradation; 2) the collective choice rules stipulated in the institutional arrangements of *custodias* granted by the government to over 50 local associations. This focus provides a window into the complex dynamics of coastal governance over the past four decades in Ecuador. Moreover, this application of the CMLS framework illuminates important theoretical insights about governance as an evolving process largely contingent on dynamic feedback between human behavior, social organization and the biophysical environment.

The following sections present evidence for endogenous forms of self-organization based on interviews with members of associations about their motivations for organizing. The paper documents the spread of *custodias* between 2000 and 2013 in five coastal provinces, placing over 50,000 ha of mangroves under the care of nearly 5,000 beneficiaries. Were such forms of collective action an outcome of new social dilemmas associated with rising concerns about environmental degradation and social injustice stirring within the grassroots? How did these concerns become institutionalized in the collective choice agreements stipulated by management plans for each *custodia*? To what degree have local associations united at regional levels within larger networks of “ancestral users of the mangrove”? How and why do such regional alliances encourage new participation among some individuals while disillusioning others? By examining these questions, we can gain deeper insights about the processes that result in institutional fit, or congruence between environmental conditions and the social factors influencing resource use.

2. Theory/ framework:

Cultural Evolution theory posits that individuals learn from others and differentially imitate those behaviors that appear to have some advantage. Based on the logic and principles of Darwinian evolution, beneficial traits are selected to eventually become more prevalent within

a population. In the past two decades, research has increasingly challenged assumptions that evolution favors competitive behaviors and replicators of a selfish trait. Cooperative traits such as kin selection, group selection, and different kinds of reciprocity (indirect, network, and group) are increasingly recognized as a potential mechanism driving the evolution of cooperative behaviors and collective action in society (Nowak 2006). Such drivers of cultural traits have important implications for sustainability science and theories of environmental governance.

Similar to the logic of Darwinian evolution, the assumption is that there is variability in traits among individuals in a population: some individuals are self-interested and others are cooperative (Richerson et al. 2014). Group selection favors traits that are beneficial to the group. A cultural adaptation emerges at the level corresponding to the social dilemma (Waring et al 2015). When the social dilemma occurs at the level of the group, cooperative individuals will be selected. The cooperative trait will continue to persist as long as group level benefits exceed individual costs. The decline of cooperative trait is likely to occur when cooperation becomes too costly.

The persistence of cooperative groups is similarly explained by selective pressures. When the social dilemma occurs at the level of a larger regional network, then more cooperative groups will be selected over less cooperative groups. On the other hand, if the regional networks do not produce observable outcomes to benefit groups and individuals, then the persistence of non-cooperative groups would result in an overall break down of collective action. In this way, outcomes are directly related to the decline or proliferation of cultural traits (Brooks et al. 2018). Moreover, these selective processes provide insight into multi-level interactions, or the endogenous processes that facilitate self-organization among individuals and how groups and larger networks interact to influence individuals.

The CMLS framework has been used to analyze the emergence and persistence of synchronized cropping and rituals that have sustained Balinese rice production over millennia (Brooks et al. 2018). It has also been applied to explain the emergence of conservation behaviors favoring pollinators in the blueberry agricultural industry (Hanes and Waring 2018). It has also advanced understanding of the processes that create a 'fit' between institutions and environmental conditions in the lobster fishery (Waring and Acheson 2018). Here, we use it to explain the processes that create institutional fit in Ecuador's mangrove fisheries where 58,790 ha of mangroves are under the protection of over 5000 guardians in five coastal provinces (Figure 1).

3. Ethnographic setting

Since the 1970s, Ecuadorian mangroves have been cleared for aquaculture to supply rising global demand for farm-raised shrimp. Meltzoff and Li Puma (1986) described the early years as a "self-generating industry" with minimal input from government agencies, international aid organizations, or private investment based on foreign capital. Despite legislation protecting mangroves, the heterogeneous nature of the coastal zone paved the way for corruption and the exploitation of loopholes in the law (Pérez 1999, Beitzl 2016). These processes led to a

decline in habitat for viable fisheries productivity and increased community conflicts (Mera Orcés 1999, Martinez-Alier 2001, Ocampo-Thomason 2006, Veuthey and Gerber 2011, Beiti 2014a, Latorre 2014, Romero Salgado 2014).

Upon recognition of the conflicts, governance structures began to respond through various levels of institutional change inspired by global paradigms advocating sustainable development through Integrated Coastal Management (ICM). Artisanal fishers were able to voice their concerns about the loss of fishing grounds to various government agencies and advocacy groups. Ecuador was a pioneer for ICM in the 1980s (Olsen and Christie 2000). In 1989, a cooperative agreement between the University of Rhode Island's Coastal Resource Center and the US Agency for International Development (USAID) led to the establishment of the Programa de Manejo de Recursos Costeros (PMRC). This national agency for coastal resource management used a learning-based, participatory approach to address some of the most pressing challenges of coastal zone management (Robadue 1995, Olsen et al. 1998). Five problem areas were identified: 1) destruction of mangrove wetlands; 2) decline of nearshore fisheries; 3) opportunities for sustainable mariculture; 4) inappropriate shorefront development; 5) declining coastal water quality and inadequate sanitation (Robadue 1995, Olsen 2000).

The PMRC's decentralized approach involved partnerships with non-government and academic institutions. They established five ZEMs throughout the coast from Esmeraldas in the north to El Oro in the South, each with their own executive committee and assessor committee. The executive committees of each ZEM consisted of representatives from government institutions who had legal authority to manage coastal resources. This decentralized approach orchestrating multi-level collaborations allowed for a more effective execution of management plans designed to address locally-specific challenges.

At the same time, environmental justice organizations sprouted in places like Muisne, and increasing numbers of artisanal fishers and ancestral user groups formed organizations officially recognized by the State. Reflecting broader social movements throughout the region in which livelihoods, identity, and environment are linked to increasing tolerance of ethnic pluralism (Escobar 1998, Bebbington 1999, Whitten 2003, Escobar and Paulson 2005, Whitten 2007), artisanal fishers along the Ecuadorian coast have united under a collective identity, "ancestral users of the mangrove" to defend the wetlands that support the livelihoods of several thousand artisanal fishers. Numerous civil society organizations (CSOs) have emerged over the last 15 years and resistance movements have consolidated into local management institutions such as *custodias* (territorial arrangements) and fishing associations (Ocampo-Thomason 2006). To varying degrees of success, community associations are engaged in habitat restoration, planting mangroves, monitoring, and alternative livelihood projects to reduce pressure on resources.

From the perspective of CMLS and theories of cultural evolution, I contend these forms of collective action were driven by perceptions of a social dilemma, namely a particular kind of injustice that dispossessed people of their ancestral fishing territories and displaced them from

their livelihoods. I will show that the formation of civil society groups was an adaptive response to widespread perceptions of injustice and the idea there is strength in numbers.

4. Methods:

To understand how these two expressions of collective action emerged out of rising concerns about environmental degradation and social injustice stirring within the grassroots (Trait #1), I relied primarily upon ethnographic data gathered from 2009 to 2020 on the fishery for mangrove cockles and 13 additional semi-structured interviews with association members in two provinces, Esmeraldas and El Oro (see Figure 1).

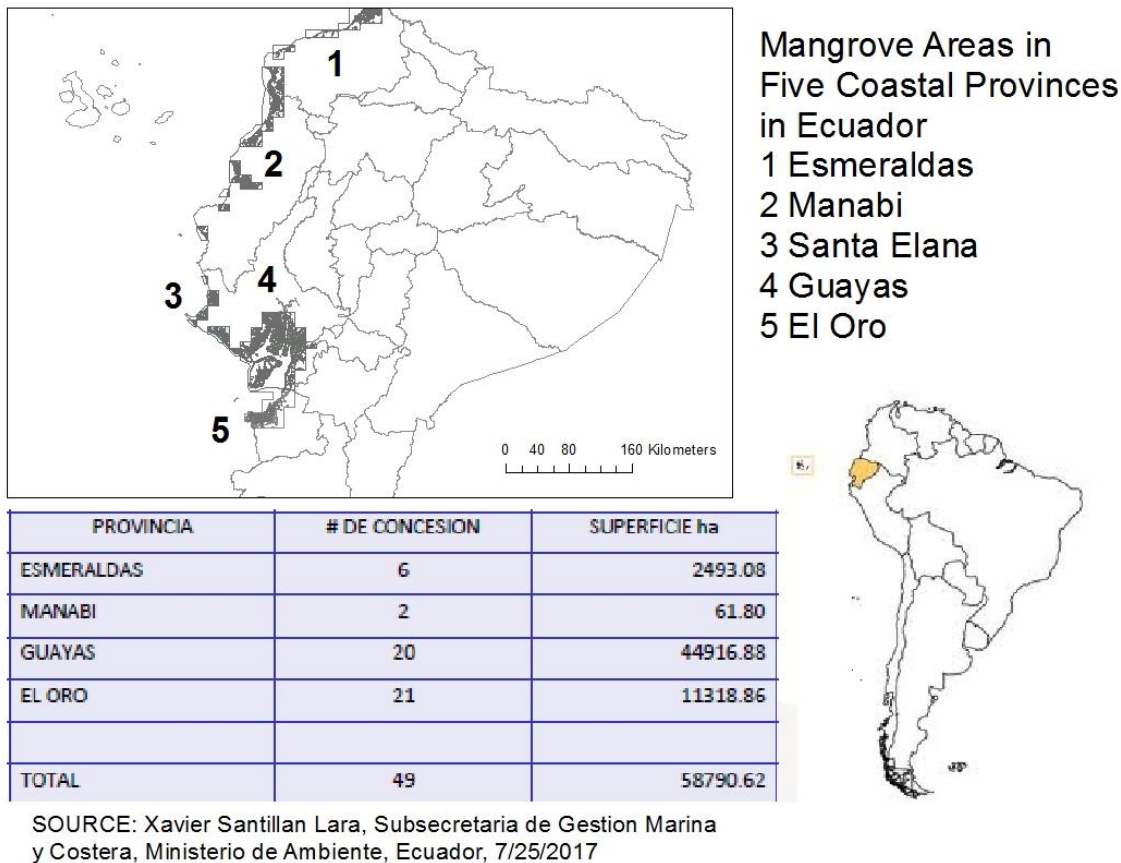


Figure 1. Location of mangroves and the total number of concessions in five coastal provinces in Ecuador as of July, 2017.

Altogether, I spoke with individuals representing membership in 16 different associations in the provinces of Esmeraldas and El Oro. In the interviews I asked socios questions about the following: 1) their mission and principle activities as an association; 2) their motivations for organizing; 3) any challenges they may have encountered as a group; 4) personal motivations for joining the group; 5) their obligations as members. All of the semi-structured interviews allowed for free-flowing conversations emerge. I also relied on two key open-ended interviews with one community leader in each province, in which the topic of collective action dominated

the direction of the conversation. I interpret all of the responses in light of conversations during separate interviews with cockle fishers (n=153), of which with 82 were current and former members of associations (Beitl 2014a). Additional insights were drawn from my observations at key events bringing together multiple groups under a larger regional network, including the 3rd Congress of Ancestral Users of the Mangrove in October of 2009 and the Fisherman's March in February of 2010. Finally, I reviewed a number of evaluations, thesis, and management plans for 30 custodias. These combined data sources provided considerable insight into the emergence and spread of collective action at multiple scales.

To understand how these kinds of collective action became institutionalized in custodias, or agreements for the sustainable use and stewardship of mangroves (Trait #2), I drew primarily on technical reports and news articles to compile a database of recipient organizations, including information about the date, location, number of hectares of mangroves, primary rules of use (for fishery resources), and whether the custodia was renewed or transformed into new kinds of institutional arrangements upon expiration. The purpose of creating this database is to document the rising number of custodias, beneficiaries, and overall area of mangroves held in stewardship arrangements by communities. This allowed me to analyze the evaluative processes that allowed these institutions to continue and spread.¹ Moreover, this database will later serve as a sampling frame for subsequent research to assess the effectiveness of this model of governance.

5. Results & Discussion: The CMLS framework applied

To apply the CMLS framework, Waring et al (2015) suggest a set of guiding questions: 1) What is the focal trait (behavior or organizational trait)? 2) What is the organizational environment for the trait? 3) What are the levels of selection? And finally, 4) what is the history of the trait? In this social-ecological system there are three nested levels of organization: individual, group (community/ association), and the regional network. Table 1 addresses these questions by describing the three different levels of organization for those traits that serve as proxies that representing different expressions of collective action in this paper: 1) motivations and mobilizations of individuals, groups, and advocacy networks in response to environmental degradation; and 2) the collective choice rules stipulated in the institutional arrangements of each custodia. Institutions are a group-level trait since institutions are comprised of individuals that collectively contribute to an outcome that is impossible to replicate by each individual alone (Smaldino 2014, Waring et al. 2017). This framework demonstrates how group-structured cultural evolution leads to formation of local associations and collective choice agreements among members concerning the use of common pool resources. The application of the CLMS framework in the following sections further illuminates how and why such patterns of collective action emerge and persist, as well as insights about why and when they do not.

¹ This database relied heavily on the information presented in Bravo 2013. Additional information between 2014 to present was compiled from a variety of sources, including other evaluation reports, online news articles from two media outlets in Ecuador, *El Universo* and *El Comercio*, as well as news from the MAE page and Conservation International's news.

Table 1. Summary of Two Focal Traits at Different Organizational Levels

Levels	Trait 1: Motivation for mobilization among individuals, groups, networks	Trait 2: Collective Choice Rules in the institutional arrangements of the custodia
Individual Level	<p>In interviews, individuals described their motivations for organizing into an association during the late 1990s and 2000s (Table 2). Variable responses included concerns about mangrove deforestation, habitat destruction, overexploitation in fisheries, competition with outsiders, the right to work and food security. Responses were variable but reflected an overall sustainability ethic and concerns about social justice and environmental degradation.</p>	<p>In open access areas, individuals harvested from individual territories based on their personal preferences shaped by social and ecological conditions; when fishing grounds are no longer viable due to declining ecological conditions or increased competition, individuals move on or move out (Beitl 2014; 2015)</p>
Group Level (Association)	<p>Cooperative behavior traits are selected as individuals perceive benefits of organizing to confront more powerful forces that displace them from fishing grounds and lead to economic marginalization.</p>	<p>When a group is granted a custodia, the rules shift from a system based on individual choices to collective choice agreements (Beitl 2015). Management plans of custodias formalize collective choice agreements about the rules of resource use in benthic fisheries for cockles and crabs (Bravo 2013)</p>
Regional Network Level	<p>The formation of alliances and networks among groups is similarly motivated by the recognition that there are benefits to unite against a more powerful enemy in order to compete more fairly. The logic is the same as there is more power in forming alliances than standing alone. Empirical examples of such regional alliances include organizations with global connections and international funding (e.g. C-Condem) or national government connections (e.g. FENACOPEC).</p>	<p>Co-management arrangements on a national level allow for some autonomy of groups to self-govern, but ultimately, it is the State that evaluates the performance of the custodia to determine whether the custodia should be renewed (Bravo 2013).</p>

Table 2. Summary of Responses from Semi-Structured Interviews

Trends in the responses	Examples/ Explanation	Frequency (n=13)
The principle motivation for organizing as a group was in response to the threat of mangroves or a decline in fisheries	Across the 13 interviews, there were variable reasons cited as a motivator for organizing: to prevent mangrove felling; to promote responsible fishing; to defend the ecosystem and the right to work; to defend fishing grounds from outsiders (i.e. Peruvians); to receive support from the government against the threat of illegal shrimp farming;; to pursue one's livelihood; to receive a mangrove concession. The only alternative explanation came from one group that organized for food security and family while three of the interviewees were unaware of the motivations of their founding members.	9
The mission and principle activities of the association reflects a sustainability ethic directly related to mangrove and/ or fishery stewardship.	Examples included: the desire to obtain mangrove custodias; mangrove planting; the creation of nurseries for cultivating shellfish; to obtain legal rights to mangroves; to create ecotourism enterprises; to improve wellbeing in the community; to gain legal support for enforcement of law; to incentivize local vigilance to protect mangroves; to ensure an improved future for the children	11
Other activities (and incentives for organizing)	To get boats, loans, subsidized fishing gear, technical assistance, workshops, negotiate good prices for the product, recycling motors, ecotourism.	8
Challenges of coordinating as a group	Four did not answer the question and another four said there were no challenges. Those five who talked about challenges included comments like: personal investment; struggling to get the custodia; Difficulty in patrolling the areas they manage since they do not live in the mangrove (custodia); larger problems of poverty and unemployment; lack of support from the local government; some spoke vaguely "like all organizations there are challenges."; internal fights	5
Personal motivations for joining the group reflect a pro-social orientation	Seven of the responses reflect collective orientation, e.g. so that "we" could feel supported and "to advance as a community" and "if we are united, we are more." Five responses reflect individual orientation, e.g. "so that I can get close to a shrimp farm without being harassed or threatened since they treat socios better than they treat independents." Only one did not answer the question.	7

5.1. How did Trait#1 emerge and spread at multiple scales?

We contend that the two different expressions of collective action as a cultural trait: 1) motivations and mobilizations; 2) the collective choice rules of custodias serve as both an adaptive response to social-environmental change and the basis for transformations in governance structures.

5.1.1. Motivations and mobilizations of individuals, groups, and advocacy networks

The majority of those interviewed were members of associations that formed after the year 2000, with about 3 or 4 founded in the late 1990s. In interviews, people described their motivations for organizing into an association (Table 2). The frequency reflects the number of responses that were coded this way of the total 13 interviews. Overall, the interviews reflected widespread perceptions of disenfranchisement and a desire to resist powerful forces that transformed the landscape upon which they depended for their livelihoods. According to theories about the evolution of cooperation (Nowak 2006), costly individual behaviors are likely to become prevalent through the process of group selection, i.e. group-level benefits outweigh individual-level costs.

Results from interviews provide evidence and further suggest that local self-organization was driven by a sustainability ethic, concerns about mangrove deforestation, habitat destruction, overexploitation in fisheries, competition with outsiders, the right to work and food security at the individual level. The majority of those interviewed explained their reasons for organizing into an association was a response to the threat of shrimp farming. They saw promise and power in the formation of groups and alliances to strengthen resource rights and gain more government support of their livelihoods. Thus there was a willingness for those participants to bear the cost of their contribution to collective action causes for the perceived benefits that as a group they were able to leverage more political power than as individuals (Figure 2).

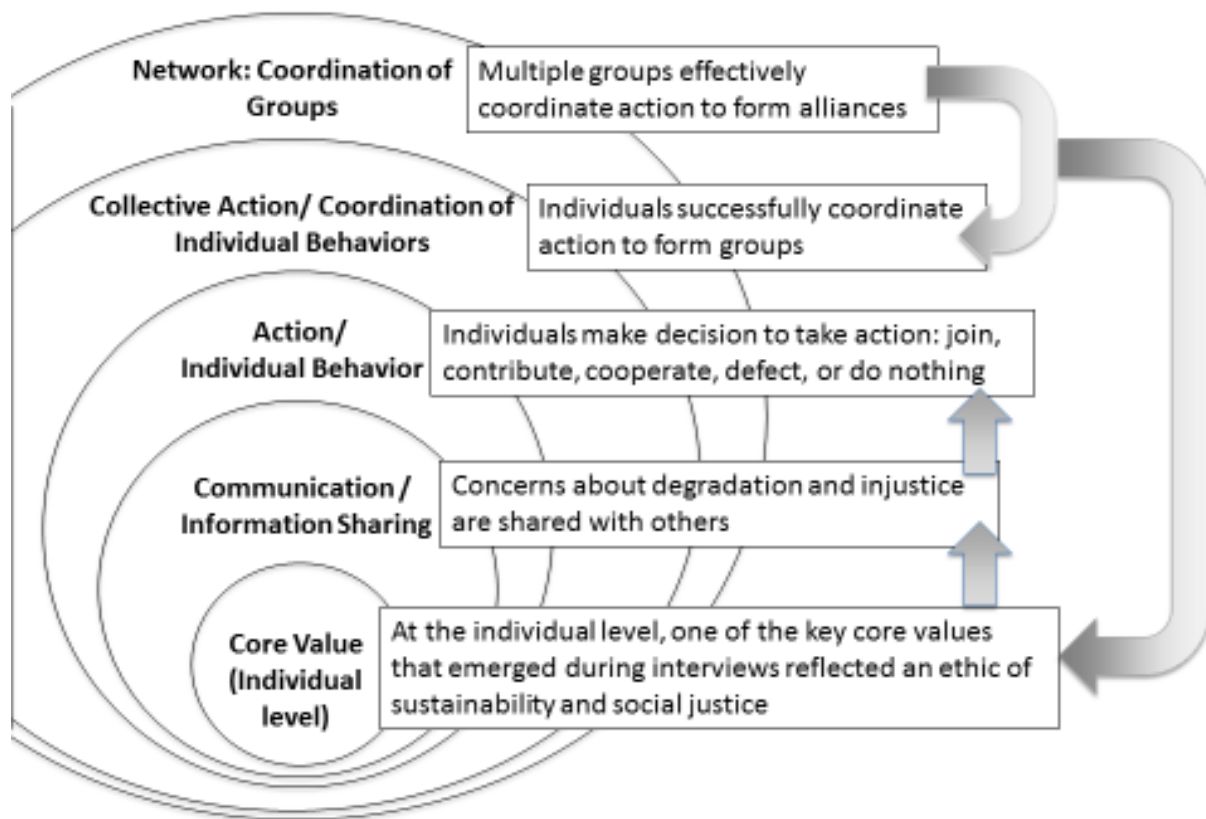


Figure 2. According to the CMLS framework, cultural adaptations emerge endogenously at the level corresponding to the underlying social dilemma. Once groups and networks are formed, collective action is facilitated by the presence of an institution, a community or a networks structure that facilitates social interaction and information sharing. In the case of Trait #1, individuals and groups unite to confront a more powerful enemy. In the case of Trait #2, groups comply with rules or defect based on the strength of the institutional arrangements.

5.1.2. Institutionalization of collective action

Members of associations (*socios*) bear the cost of investing time, money (i.e. membership dues), and other resources. Interestingly, socios seem to exhibit a more prosocial attitude than their independent counterparts (Beitl 2014). They do not explicitly describe these efforts as a "cost." One respondent did not answer the question and five responses reflected an individualist orientation, e.g., "so that I can get close to a shrimp farm without being harassed or threatened since they treat socios better than they treat independents." (Interview#905 from El Oro). Others discussed being motivated by group benefits like subsidies, credits, and custodias for the association.

Seven of the 13 socios described group goals when they were asked to comment on individual incentives and motivations (Table 2). Examples of a prosocial orientation were reflected in statements like my motivation for joining was so that “we could feel supported” or so that we could advance as a community,” and “if we are united, we are more.”

Another example came from two interviewees who appeared to have learned about the benefits of cooperation by engaging in collective action when one stated, "at first I didn't know what it meant to be associated, but (now I understand that) socios have an important responsibility to conduct good management so that we can advance." (Interview #906, El Oro).

Another statement that reflected both individualist and collective orientation (Interview #908, El Oro):

“I did not think there were so many benefits at the beginning, but now if you realize that yes: money to the partners, help with illness, loans, and capital to the family, participation in projects, a choice about intermediaries, loans, capital, etc...”

Such statements suggest that cooperation should not always be treated as a form of sacrifice or cost since some collectivist-oriented individuals derive pleasure in cooperation. Moreover, since 2000, individuals are further incentivized to form or join existing groups for the promise of custodias and other group-level benefits (Table 2). Especially since 2000, more individuals have been able to observe the efficacy of self-organization as custodias began to emerge (Figure 3). The institutional arrangements promised by the agreement of custodias offered a solution to the social dilemma of displacement from customary fishing grounds by the emergence and spread of a more powerful actor (the shrimp industry). As individuals felt powerless to the dilemma of encroaching shrimp farms, many individuals and groups began to realize that groups were better situated to effect change and compete with those who have more political and economic power (like shrimp farmers), especially if their resource rights were formally recognized.

5.1.3. Integration of groups into larger networks

To what degree did the associations integrate into larger networks? At the level of group selection, groups imitate other groups. However, as pointed out by others, there is a great deal of variability in the ability of associations to contribute to outcomes of environmental governance, mangrove conservation, social justice, and sustainable fisheries (Coello et al. 2008, Latorre 2014, Lewis 2016).

As small associations formed and gained legal recognition throughout the 1990s and 2000s, new alliances began to emerge to create advocacy networks and federations. Empirical examples of such regional alliances include organizations with global connections and international funding (C-Condem) and the National Federation of Artisanal Fishers (FENACOPEC). These networks coordinate community-based groups through the organization of congresses, marches, and demonstrations. They lobby the government to create new

legislation in their favor and further promote awareness of their cause through newsletters, online fora, social media, and events like "Dia del Pescador Ecuatoriano" (FENACOPEC) and Dia del Manglar (C-Condem, RedManglar Intl, etc). As in the case with groups, these alliances and social movements reflect an adaptive response to a social dilemma widely perceived as a national or global problem. They facilitate platforms and collaborate spaces for local groups to share information about their local experiences so they may collectively strategize to effectively compete with more economically and politically powerful forces.

These examples from Ecuador corroborate evidence from 81 cases worldwide which highlight the important role of social movements as key actors governing the commons and protecting local use and management rights against certain government decisions or actions by global corporations (Villamayor-Tomas and García-López 2018). The growth of such networks gain visibility in the global arena, especially through social media. In the process, new social imaginaries, or visions for sustainability and wellbeing may emerge, spread and gain influence that can be translatable to action on the ground to further reinforce collective action and social change (Yepez-Reyes 2018). Such processes have great potential to feed back into strengthening individual and group commitments on local levels.

On the other hand, I learned from open-ended interviews and informal discussions in Esmeraldas that local NGOs and associations were losing their strength. One interviewee attributed this waning of organizational strength to the departure of PMRC. When PMRC funding ran out, the small associations began to fall apart since they were not financially self-sustaining. He suggested that when PMRC left there was little funding and resources to incentivize individual participation in the projects (Interview A, 6/10/2010). That members were poor with little money to invest in their local organizations suggests there is a larger structural problem of poverty that restricts the ability of groups to organize and maintain their force.

Similarly, according to another interviewee in Esmeraldas (Interview B, 6/10/2010), participation in activities coordinated by the local grassroots organization was declining. They do not organize reforestation events like they did in the past. Nor did they form groups of protest to break shrimp pond walls as they did in 1999 during the height of the shrimp industry's productivity. During the time of this fieldwork in 2010, there was not as much passion or protest, which he believed may have been a driver motivation individual participation in the past. The leadership had changed – it was less effective than in the past. He further elaborated that ever since these mobilizations had consolidated into institutions, people seem to have gotten bored or in some cases, no longer trusted their leaders. Some believe that members of the local organizations are corrupt, pocketing funds for themselves and “profiting from the poor.” Therefore in addition to larger structural concerns about poverty, there are differences in resources, political capital, social capital, economic situation, constituents, leaders (Ortiz Lemos 2012). Generally, groups differ significantly in their circumstances, outcomes, and their overall ability to cooperate.

5.2 How did trait #2 (collective choice rules in benthic fisheries) emerge?

Like Maine’s lobster fishery before the emergence of territoriality (Waring and Acheson 2018), gathering grounds for cockles and crabs are individual territories (Beitl 2014b). In open access areas, individuals harvested from individual territories based on their personal preferences shaped by social and ecological conditions (Beitl 2014b); when areas are no longer viable due to declining ecological conditions or increased competition, individuals move on or move out (Beitl 2015).

Since 2000, the government began allocating collective stewardship rights to selected fishing associations for mangrove conservation and community-based cockle and crab management. As more fishing grounds for benthic species like cockles and crabs shift from open property to common property (Moritz et al. 2018), collective choice agreements about where to harvest and which areas to set aside come part of the norm formalized within management plans (Bravo 2013). When a group is granted a custodia, the system of rules shifts from one based on individual choices to collective choice agreements (Beitl 2015).

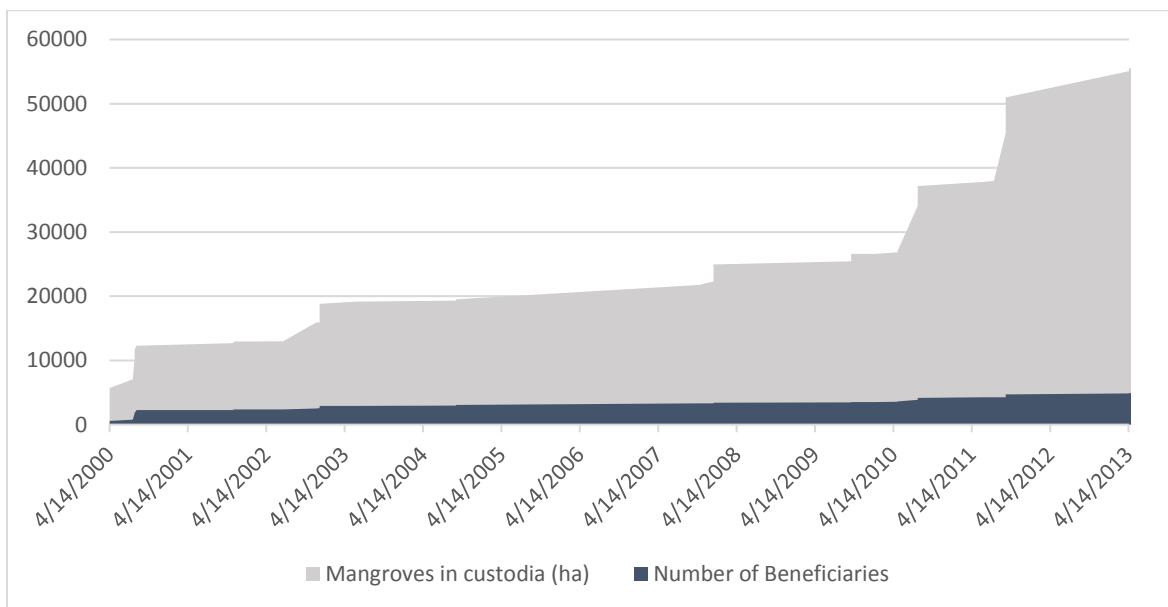


Figure 3. Rise in the number of beneficiaries and hectares placed under the protection of custodias from 2000 to 2013 (data from Bravo 2013).

5.2.1. The efficacy and proliferation of Trait #2 (collective choice rules in benthic fisheries)

Since the first four custodias were granted to communities in the year 2000, the number of mangrove hectares placed under stewardship of local associations has risen from 5,683 to 55,515, thereby benefiting just under 5,000 socios by the year 2013 (Figure 2). Of the 39 custodias granted between 2000 and 2013, a total of 33 included the management of benthic fisheries like cockles and crabs, 9 included management plans for fishing and shrimp larva collection, and three were designated for other uses like conservation and tourism (Bravo 2013).

According to one study of 8 different concessions in Guayas province (Moreira Arcentales 2013), 94% of socios believe custodias is beneficial all the time and 6% say it's beneficial some of the time. 96% claimed their the quality of life had improved since receiving the custodia and 86% claimed their custodia improved mangrove habitat. There was widespread consensus that socios always respect the rules (100%) while they recognized the challenges of dealing with outsiders who do not respect their boundaries. According to the study, 65% of the respondents in the 8 custodias do not feel fully supported by the authorities (Moreira Arcentales 2013).

Despite these overwhelmingly positive perceptions of the ability of custodias to overcome collective action problems in mangroves and fisheries, one evaluative report pointed to an increase in social conflict between concessionaries and groups from outside in the province of Esmeraldas (Coello et al. 2008). The typical response has been for local groups to denounce infractions to the authorities (per their agreement), but according to the study, many of the socios complained they did not have the capacity to do this. With the exception of two associations, the majority of beneficiaries had trouble “taking real possession of their areas” for lack of local organization, control and vigilance, and management of the resource (Coello et al. 2008: 44). At the same time, the report suggested despite these challenges, all of the beneficiaries of the concessions recognized the importance of guarding the mangrove and some of the associations have created a system of patrolling and vigilance.

Co-management arrangements on a national level allow for some autonomy of groups to self-govern, but ultimately, it is the State that evaluates to determine whether the custodia should be renewed based on the following criteria (Bravo 2013). In 2013, 24 associations failed to comply by not turning in semi-annual reports. Others lost mangrove trees within their concession, but were not held accountable since the groups successfully reported the mangrove deforestation and replanted trees. Some of the custodias were not renewed. For example, the number of custodias in Esmeraldas province declined from 13 in 2013 (Bravo 2013) to only six in 2017 (Santillán Lara 2017). In the case of one custodia in El Oro that was not renewed, the cooperative trait among individuals for the management of the cockle fishery not only persists, but also the rules evolved to include (and cooperate) with more community members, despite the lack of formal recognition of their stewardship on paper (Beitl observation, January 2019).

In sum, the process of institutionalization of collective action is not entirely autonomous nor endogenous. The reasons for fading collective action in Trait #2 may more accurately reflect certain exogenous factors (i.e. failure of a partner to submit paperwork correctly, paternalism, perception by reviewer) rather than endogenous factors. Thus the process of selection could reflect endogenous factors (i.e. failure to self-organize, comply, or meet the criteria). A finer scale, more nuanced analysis would be needed to examine each case individually in order to identify patterns that explain the emergence, persistence, and decline of cooperation under institutional arrangements.

6. Conclusions: strengths and limitations of CMLS analytical framework:

This paper has addressed a gap in commons theory by integrating cultural evolutionary theoretical perspectives with the concept of polycentric governance to explain processes that create institutional fit and co-evolutionary feedback in Ecuador's coastal mangroves. As demonstrated, collective action has been the basis of mobilizations among people marginalized by global forces threatening to displace them from their livelihoods. Collective action has also been the base of common property institutional arrangements that formalize cooperative practices among individuals in benthic fisheries like cockles and crabs. The focus here on these two expressions of collective action as a cultural trait has provided an appropriate window to strengthen theoretical perspectives on how collective action emerged, became institutionalized, and spread throughout larger networks. This paper further sheds light on questions of local autonomy and the tradeoffs of collective action for individuals, groups, and social-ecological systems at large to advance understanding of the specific mechanisms that may strengthen or weaken social ties and institutions that reinforce collective action over time.

One important point this analysis demonstrates is that regional networks do not always reinforce collective action at other levels. In some cases, especially in locations where custodias are not present, the scaling up of collective action and cooperation can result in scalar disconnect in which locals feel disconnected as their advocacy groups and leaders become increasingly integrated into regional and global networks. This may have contributed to increasing feelings of distrust by those who feel they have been left behind and still in the same precarious situation they always found themselves while grassroots movements take off (Beitl 2014a), similar to what Igoe (2003) found in Tanzania.

This analysis of Trait #2 demonstrates scaling up is also necessary for transformations in polycentric governance, but there may be tradeoffs at other levels as individuals and groups interact with regional networks. As we saw from the analysis of the spread of custodias between 2000 and 2013, decisions about renewal were not made locally based on endogenous processes. Instead, external agencies evaluating custodia performance based on sets of criteria were making decisions about whether to renew. In this way, local autonomy of groups is compromised in its nesting within a regional system. From the perspective of cultural evolution theory, those groups unwilling to compromise or cooperate with other levels will most likely fade. Local groups may lose trust in their leadership (Beitl 2014a), or as shown here, local institutional arrangements may not be renewed.

On the other hand, there are some limitations of the CMLS framework. First, the research is based on a relatively short temporal scale of only three decades. Thus, it is unclear how baseline cultural traits developed and evolved over time. Second, it is not always clear the degree or extent to which the cultural traits examined here can be explained by self-organized endogenous or deliberately orchestrated exogenous processes. For example, institutional change that resulted in the national implementation of integrated coastal management through the PMRC was inspired by global institutions and frameworks for sustainable development (Cicin-Sain 1993). It is also unclear the degree to which mobilizations at the grassroots level may have been influenced by complex interactions among international actors, Ecuadorian government agencies, and NGOs (Lewis 2016). What is clear is that there is feedback between these processes. More research is needed to systematically analyze motivations of associations and variability in individual levels of participation. Such research would provide more robust understanding about the politics of participation to advance understanding of polycentric governance, dynamics of collective action, and the processes that create institutional fit. This application of the CMLS framework here represents a first step in illuminating important theoretical insights about governance as an evolving process, which is highly dependent on dynamic feedback between individuals, social organization, and the biophysical environment.

7. References

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