



Fisheries' Property Regimes and Environmental Outcomes: A Realist Synthesis Review



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SUMMARY

Our paper describes the application of a realist approach to synthesizing evidence from 31 articles examining the environmental outcomes of marine protected areas governed under different types of property regimes. The development of resource tenure interventions that promote sustainable management practices has been challenged by the difficulties of determining how contextual factors affect environmental outcomes given the complexity of socio-ecological systems. Realist synthesis is a promising evidence review technique for identifying the mechanisms that influence policy intervention outcomes in complex systems. Through a combination of inductive and deductive analysis of the links between context, mechanisms, and outcomes, realist synthesis can help clarify *when, how, where, and why* property regime interventions are likely to result in positive environmental outcomes. Our study revealed the importance of disaggregating property regimes into sub-categories, rather than treating them as homogenous categories. More importantly, use of a realist synthesis approach allowed us to gain a deeper understanding of the ways in which three mechanisms—perceptions of legitimacy, perceptions of the likelihood of benefits, and perceptions of enforcement capacity—interact under different socio-ecological contexts to trigger behavioral changes that affect environmental conditions. The approach revealed the multi-faceted and interactive nature of perceptions of legitimacy, in which legal legitimacy, social acceptability, and ecological credibility combined to create robust legitimacy. The existence of robust legitimacy in turn appeared to be an important contributor to the success of regulatory systems reliant on voluntary compliance. Our study contributes to the field of natural resources governance by demonstrating the utility of a systematic review method which has received little attention by property scholars but which has promise to clarify understanding of how complex systems work. Our study also highlights that achieving long-term sustainability requires paying greater attention to the mechanisms that support or undermine people's willingness to voluntarily engage in conservation behaviors.

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1. Why property regimes matter

Practitioners, planners, and policy makers increasingly consider the socio-ecological effects of property regimes in the design and implementation of sustainable development and other conservation-oriented policies and programs (Yin, 2016). Property regimes—configurations of rights, duties, and legal authority structures over land or natural resources (Cousins, 1992)—are a key aspect of natural resource governance systems, shaping how the costs and benefits of those resources are distributed. The allocation of costs and benefits, in turn, affects the incentives for individuals, households, communities, and other social actors to engage in ecologically sustainable resource use and management (Lawry, 1990).

Four decades of empirical work have shown that positive environmental outcomes for common pool resources (i.e., resources characterized by subtractibility and high exclusion costs) can be achieved under any type of property regime (Yin, Zulu, Qi, Freudenberg, & Sommerville, 2016). However, much property regime research consists of single case studies or relatively small-n comparative studies, making it challenging to evaluate the patterns that distinguish effective regimes from ineffective ones. Evidence reviews of empirical studies, such as meta-analyses, systematic reviews, and evidence syntheses are increasingly being used to address these shortcomings (Yin *et al.*, 2016). These reviews evaluate whether property regime interventions, such as rights devolution or formalization, are effective at improving environmental conditions (Halpern, 2003; Yin *et al.*, 2016).

Many evidence reviews on property regimes have examined the institutional design attributes associated with common pool resource systems managed sustainably under common property regimes (Brooks, Waylen, & Borgerhoff-Mulder, 2013; Cox, Arnold, & Villamayor Tomás, 2010). Identifying the socio-ecological contextual factors that influence whether property regimes are successful at achieving positive ecological outcomes has proved more challenging. When a particular set of contextual and institutional design factors will result in positive environment outcomes under a given property regime remains unclear (Brooks et al., 2013; Porter-Bolland et al., 2012; Robinson, Holland, & Naughton-Treves, 2014; Yin et al., 2016).

In the fields of public health and education, an evidence review approach known as realist synthesis is increasingly being used to identify the mechanisms that condition policy intervention outcomes when complex systems are involved. Realist syntheses seek to “develop middle-range theories that explain how the context (C) influences mechanisms (M) to generate outcomes (O), often called context-mechanism-outcome (C-M-O) configurations” (Durham & Bains, 2015, p. 3). Realist synthesis may prove equally useful for clarifying *when, how, where, and why* property regime interventions, which typically occur in the context of complex socio-ecological systems, are likely to result in positive environmental outcomes (Nilsson, Baxter, Butler, & McAlpine, 2016).

In this article, we adopt a realist synthesis approach to synthesizing evidence from a subset of articles included in a systematic review that examined relationships between property regimes and environmental outcomes for forestry, fisheries, and rangelands (Ojanen et al., 2014, 2017). Due to limitations in time and resources available, we limit our synthesis to the fisheries’ cases covered by that review. We selected to focus on fisheries’ regimes because they have received less attention than forest regimes. Our synthesis had two objectives. The first objective was to gain a better understanding of the social mechanisms that influence the environmental outcomes of marine protected areas. An additional objective of our synthesis was to determine whether marine protected areas (MPAs) governed under different types of property regimes—state, community, and hybrid—differed in their environmental outcomes, and if so, whether it was possible to discern what factors contributed to those differences in outcomes. For the second objective, we did not assume a priori that any of the regime types would be more effective than the others. Using a realist synthesis to evaluate these fisheries’ cases revealed the importance of disaggregating hybrid property regimes, which are characterized by the sharing of property rights between more than one institution, into sub-categories rather than treating them as one category. It also allowed us to reach a better understanding of three social mechanisms—perceptions of legitimacy, perceptions of the likelihood of benefits, and perceptions of enforcement capacity—that condition conservation behaviors. Improved understanding of these mechanisms will facilitate progress toward achieving the Sustainable Development Goals (United Nations, 2015), including SDG 1,¹ No Poverty; SDG 12,² Responsible Consumption and Production; and SDG 14,³ Life Below Water. Additionally, our study

contributes to the resource governance field by demonstrating the utility of an alternative approach to systematic reviews that has promise for yielding insight into the workings of complex socio-ecological systems.

(a) Rationale for a realist synthesis

A realist synthesis focuses attention on outcomes, the mechanisms that lead to them, and the contextual factors that trigger particular outcomes (Durham & Bains, 2015; Pawson & Tilley, 1997). A key assumption of realist synthesis is that social change is a function of individuals interacting with the social structure in which they are situated. Policy interventions work by changing the resources and opportunities available to people affected by the interventions, leading to changes in their decisions (Wong, Westhorp, Pawson, & Greenhalgh, 2013). Another assumption of realist syntheses is that policy interventions do not produce outcomes in and of themselves. Rather, it is the mechanisms that underlie interventions that result in outcomes (Durham & Bains, 2015). Astbury and Leeuw (2010) define mechanisms as the “underlying entities, processes, or structures which operate in particular contexts to generate outcomes of interest” (p. 368). Drawing on Pawson and Tilley’s (1997) work, Dalkin, Greenhalgh, Jones, Cunningham, and Lhuissier (2015) describe mechanisms as “a combination of resources offered by the social programme under study and stakeholders’ reasoning in response” (p. 3). In realist synthesis parlance, policy interventions are not mechanisms. Instead, interventions provide (or limit) resources or opportunities, leading to particular sets of responses as a result of the affected individual’s reasoning (Dalkin et al., 2015).

The context-mechanism-outcome (CMO) configurations identified during a realist synthesis make explicit the theories of change that underlie the intervention being evaluated (Durham & Bains, 2015). Because mechanisms are functions of the interactions that take place between participants and their context, interventions implemented across different social contexts may result in different outcome patterns (Wong et al., 2013). A realist synthesis relies on a combination of inductive and deductive analysis to study CMO configurations (Rycroft-Malone et al., 2012). Each of the cases included in the synthesis is examined to identify themes relevant to the observed interactions between the theoretical framework components (i.e., context-mechanisms-outcomes). Counterexamples are looked for as themes are identified, and the theoretical framework is modified accordingly.

(b) Our theory of change

Figure 1 depicts the theory of change that guided our realist synthesis. Our theory of change is an adaptation of the SES framework (McGinnis & Ostrom, 2014), itself a variant of the IAD framework (Ostrom, 2011). As described by Ostrom (2007, p. 15182), the SES framework enables one to examine how the attributes of a resource system, the resource units it generates, the system’s users, and its governance “jointly affect and are indirectly affected by interactions and resulting outcomes at a particular time and place”. Following Ostrom (2007), our theory of change posits that property regimes are situated in socio-ecological systems, and many contextual factors can affect their outcomes. In keeping with the SES framework, we grouped the external factors that could affect property regime outcomes into three major categories—socio-economic, political, and biophysical. However, we added time elapsed since the property intervention occurred as a fourth external factor to account for the lag that may occur before impacts are visible. Institutional design attributes of the property regime are included in our theory of change as proximate contextual factors.

¹ Specifically sub-goal 1.4, “By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance.”

² Especially sub-goal 12.2, “By 2030, achieve the sustainable management and efficient use of natural resources.”

³ Sub-goal 14.B encourages parties to, “Provide access for small-scale artisanal fishers to marine resources and markets.” Progress toward achieving the sub-goal would be measured based on Indicator 14.B.1, “Progress by countries in the degree of application of a legal/regulatory/policy/institutional framework which recognizes and protects access.”

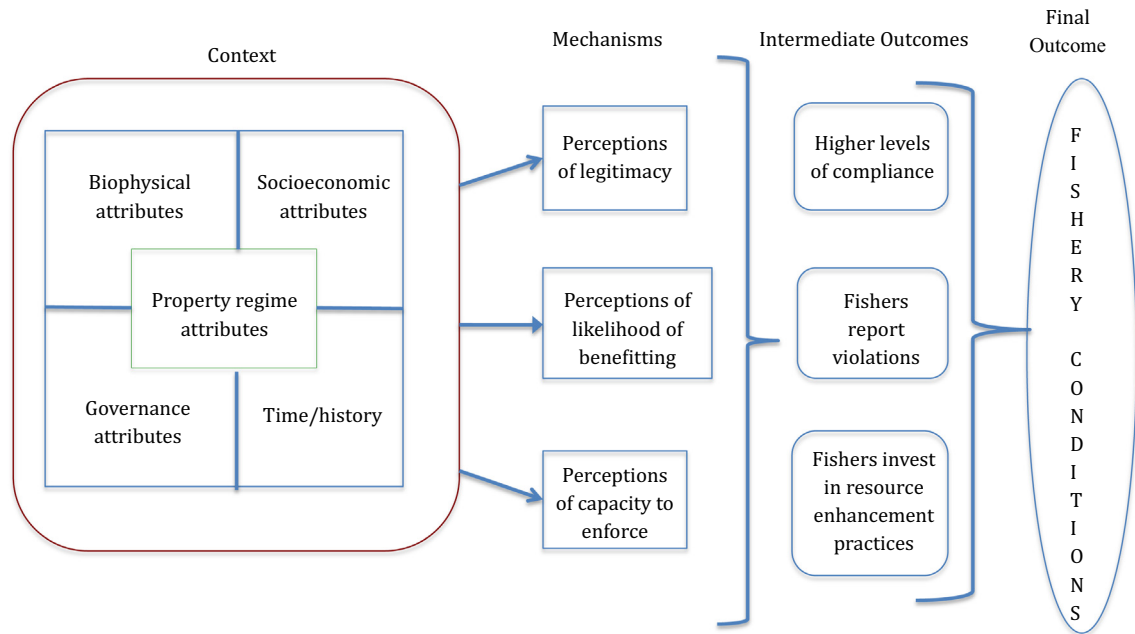


Figure 1. Theory of change framework.

Drawing on property theory and empirical studies of CPR systems (e.g., Agrawal & Benson, 2011; Brooks *et al.*, 2013; Cox *et al.*, 2010; Gutiérrez, Hilborn, & Defeo, 2011; Ostrom, 2007; Robinson *et al.*, 2014), we focused on investigating three mechanisms by which a property regime intervention may lead to changes in environmental outcomes. Recall that mechanisms in a realist synthesis are not institutional design structures, processes, or policies, but rather consist of the combination of changes in resource availability brought about by a program or policy intervention *and* stakeholders' reasoning in response to those changes (Dalkin *et al.*, 2015). Drawing on Cox *et al.*'s (2010) elaboration of Ostrom's original eight design principles we posited three likely mechanisms. One mechanism, perceptions of the regime's legitimacy, is related to institutional design principles 1A (well-defined boundaries), 1B (well-defined resource users), 2A (congruence between rules and local conditions), and 3 (resource user participation in rule making). By perceptions of legitimacy, we mean recognition on the part of resource users that the individual or collectivity holding the resource has (or does not have) the authority to make decisions about how the resource is managed. Such authority could be grounded in a country's formal legal system, but it could also be grounded in social norms and customs (Turner *et al.*, 2016). DeWit and Iles (2016) define legitimacy as existing when "people accept something—knowledge, norms, customs, or technologies—as credible and authoritative, and express or practice it widely." A second mechanism, perceptions on the part of resource users as to whether the resource holder is able or likely to enforce management decisions, is related to institutional design principles 4A/B (monitoring) and 5 (graduated sanctions). The third mechanism, the resource user's perceptions as to whether she will benefit from the intervention, either now or in the future, is related to institutional design 2B (benefits proportional to investment in terms of labor, money, or materials). According to our theory of change, a property regime intervention, such as setting aside areas for protection, will trigger one or more of these three mechanisms, resulting first in intermediate outcomes as reflected in behavioral changes on the part of individuals or groups, and subsequently leading to changes in environmental

conditions. The C-M-O analysis that characterizes the realist synthesis approach complements the SES framework and the design principles described by Ostrom (2011) and elaborated upon by Cox *et al.* (2010) in that the mechanisms identified through this approach seek to explain what it is that makes the design principles work.

2. Methods

The cases examined were selected from a dataset of 103 articles that scientists at the Center for International Forestry Research had previously identified through a systematic review process (Ojanen *et al.*, 2014, 2017). That dataset included studies that provided quantitative measures or qualitative assessments of the changes or differences in environmental conditions between the property regimes being compared; the cases also specified which social actors held one or more of the rights associated with the property regimes under study. To keep the scope of the realist synthesis manageable, we included only the fisheries' articles from the original dataset. We excluded nine of the 40 fisheries' articles (Supplemental file 1), leaving 31 articles encompassing 49 cases (Supplemental files 2 and 3). Figure 2 depicts our article identification and selection process.

The 31 publications included 28 peer review journal articles and three technical reports (Supplemental file 3), most of which were published during 2005–2013 (Figure 3). Studies in Latin America or the Caribbean were most common (15), followed by Asia/Pacific Islands (12), and Africa (6). The majority of articles dealt with coral reef fish populations (21 articles); other types of fisheries included invertebrates, such as abalone, cockles, and rock lobster (7 articles), fish and invertebrates (1 article), river turtles (1 article), and a lake fishery (1 article).

We define a property regime as the set of rights and duties that specify how individuals or groups relate to each other with respect to land or a natural resource (Bromley & Cernea, 1989). Property rights scholars often group property regimes into three major categories—private, state, and common property—based on how the

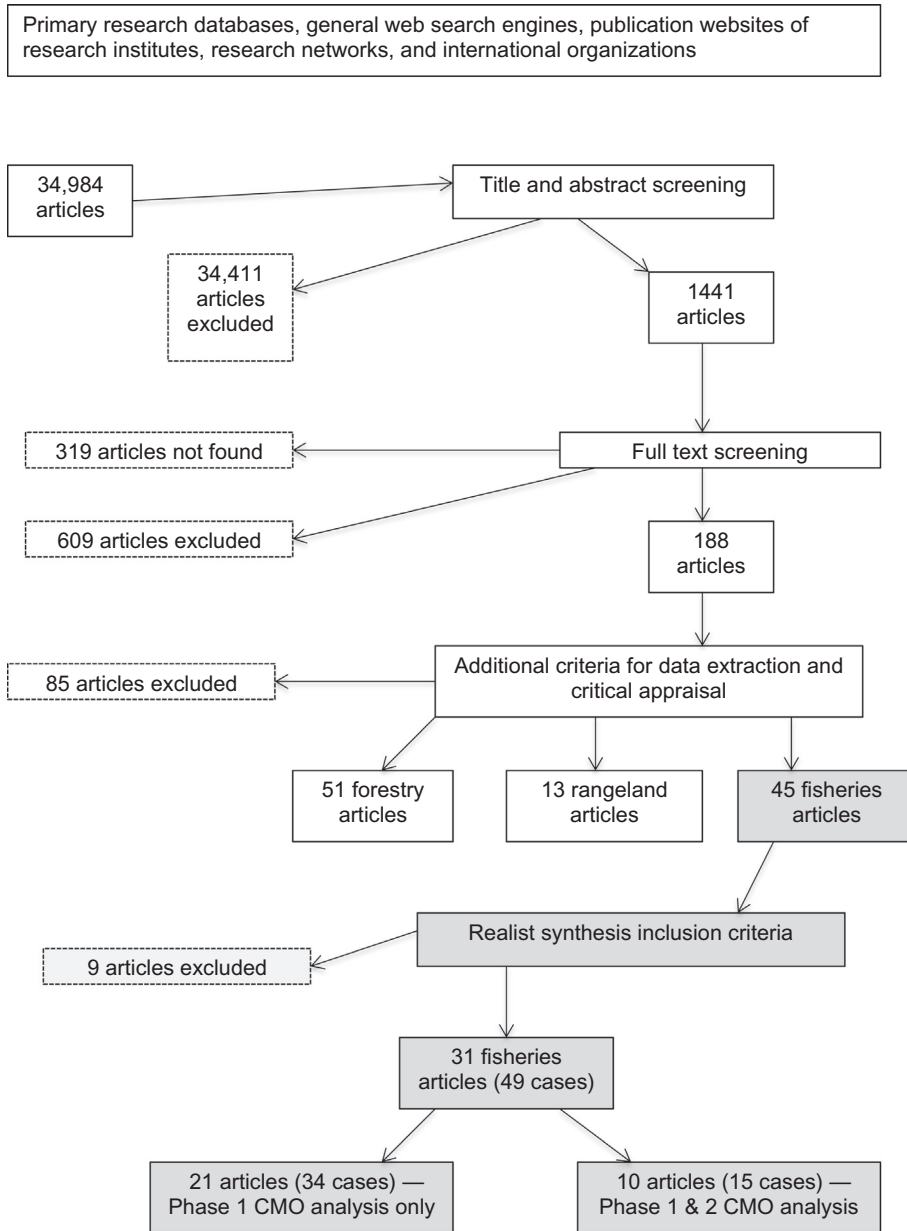


Figure 2. Article identification and selection; realist synthesis steps in gray highlights.

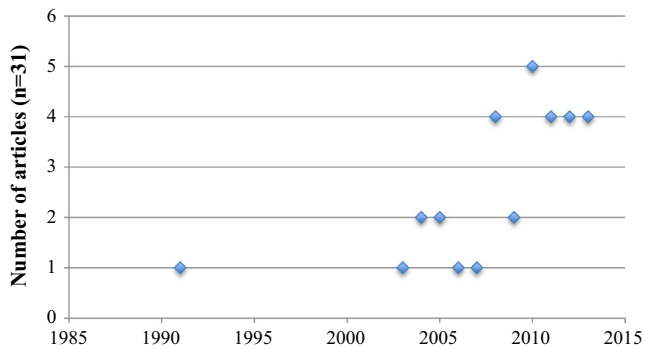


Figure 3. Temporal distribution of articles included in the realist synthesis.

property rights and responsibilities are distributed among social actors (Bromley & Cernea, 1989; Schlager & Ostrom, 1992). Moreover, many common pool resource systems are characterized by

the presence of “linkages and blurred boundaries between discrete property types, rights holders and property regimes” (German, 2010, p. 572). The concept of property as consisting of a bundle of rights (Schlager & Ostrom, 1992) emphasizes the hybrid nature of property regimes, with ownership best understood in the context of a variety of rights being associated with any given piece of land or resource. The rights in the bundle can be either *de jure* rights that have been explicitly granted to the resource user by a government or *de facto* rights which resource users have defined and enforced, but which are not recognized by state authorities (Schlager & Ostrom, 1992).

We initially grouped the property regimes in each case into one of three broad categories—state, hybrid, and customary tenure. (No private property regimes were present in the 49 fisheries’ cases). However, it quickly became apparent that the hybrid regimes differed considerably in how they distributed rights and responsibilities among social actors. To better capture these distinctions, we divided the hybrid regimes into three sub-categories:

Table 1
Definitions of property regimes included in our dataset and their geographic distribution

Regime type/definition	Geographic distribution
A. Customary ($n = 16$) Regimes in which access to fishery resources is controlled by social units, which are operative over a bounded geographical space, and where local people and their traditional authorities control access and enforce the rules	Fiji (4) Indonesia (2) Papua New Guinea (2) Solomon Islands (6) St. Lucia (informal) (1) Mexico (informal) (1)
B. Hybrid ($n = 19$) Regimes in which interdependencies exist either between entities with jurisdiction over defined property regimes or where self-organized and formal governance institutions exist in complementarity	
B1—Community-managed state concessions ($n = 3$) State regimes within which the state has granted a resource user long-term exclusive use rights to resources located within a defined geographical area. The concessionaire undertakes to manage the resource sustainably in exchange for exclusive use rights for a designated time period	Ecuador (1) Mexico (1) Nicaragua (1)
B2—Community-based co-management ($n = 8$) Regimes in which planning, management, and decision-making is shared among government, local users, and other stakeholders associated with the marine protected area. The degree to which the government retains control varies greatly among co-management regimes. Goetze and Pomeroy (2005) situate co-management regimes along a continuum of shared control, ranging from consultative co-management in which the government seeks input from communities but makes the decisions, to collaborative co-management in which the government and resource users share decision-making authority, to delegated co-management in which the government cedes decision-making authority through a formal agreement to a community or user group	Brazil (3) Philippines (4) Tanzania (1)
B3—NGO-based co-management ($n = 8$) Cases in which state agencies had established formal agreements with NGOs to manage marine protected areas were defined as NGO-CM regimes. The NGO to which the government delegates its authority can be a local NGO or an international NGO, such as The Nature Conservancy or World Wide Fund for Nature, and the degree to which local resource users are involved in managing such fisheries varies greatly (Espinosa-Romero, Rodriguez, Weaver, Villanueva-Aznar, & Torre, 2014)	Belize (3) Indonesia (2) Panama (1) Tanzania (2)
C. State ($n = 14$) Regimes in which the government holds and manages fishery resources on behalf of its citizens	Belize (1) Brazil (1) Colombia (1) Grenada (1) Indonesia (1) Mexico (1) Philippines (1) South Africa (6) St. Lucia (1)

Source: Realist synthesis analysis (2016).

community-managed state concessions, community-based co-management (CBCM), and NGO-based co-management (NGO-CM). Definitions of the regime categories are provided in Table 1.

3. Data extraction

We adopted a two-phase CMO analysis process to explore how well our theory of change framework was represented in the 49 cases. For each case, the lead author extracted data (a form of coding) pertaining to each of our theory of change elements to create a preliminary CMO chart (see Supplemental file 4a for an example chart and Supplemental file 4b for a list of variables used to assess the elements). After a preliminary chart was created for each case, the lead author then carefully reviewed all of the cases as a group to ensure that the coding was consistent for each element of the theory of change across the cases. Because the same researcher did all of the coding, we did not use an inter-coder reliability process. Once the first round of data extraction was done, we assessed the charts for their coverage of each of our theory of change elements. We grouped each case into one of three categories: (1) minimal to no data for most elements, (2) a cursory description for most elements, and (3) a robust description for most elements.

4. Results of the Phase 1 CMO analysis

The Phase 1 CMO analysis revealed that the coverage of the framework elements was generally weak. Fishing effort was the most commonly reported type of socio-economic data, but despite

its clear relevance to conservation was provided in less than 50% of the cases (Figure 4a). Socio-demographic data were present in only 22% of the cases. Less than one-third of the cases provided robust data on regime attributes, governance factors, intermediate outcomes, and mechanisms. About one-fifth of the cases provided data about compliance (Figure 4b); and 12% included data on motivations for compliance and/or changes in fishing or livelihood practices in response to protection strategies. Of the 49 cases in our initial selection, only 15 had robust data on all or most key elements of our theory of change framework.

Table 1 shows the distribution of the Phase 1 cases across regime categories and regions. Roughly one-third (16) of the cases assessed the environmental outcomes of protected areas or periodic closures of fisheries governed under customary regimes. Nineteen cases involved some form of hybrid property regime and 14 involved protected areas held or managed by nation-states. Customary regimes were most likely to result in better environmental outcomes than control sites (69% of cases) (Figure 5a and b), followed by hybrid regimes (58%) and state regimes (43%). Figure 5b suggests that the hybrid regime sub-categories may differ in terms of their environmental outcomes, with community-managed state concessions accounting for much of the difference between the performance of hybrid and state regime categories. Although the sample sizes are too small to draw definitive conclusions as to differences among the hybrid regimes, these results suggest that disaggregation of hybrid regimes into sub-categories would be an important step for larger N studies. The lack of key data in the majority of the studies also points to the need for future research

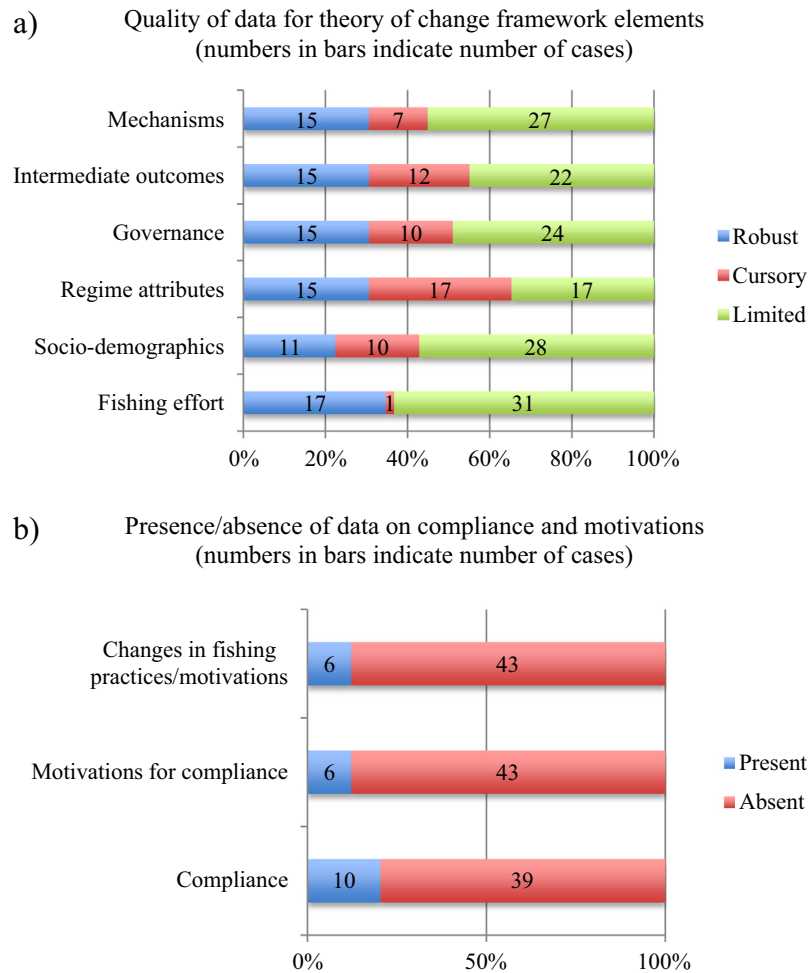


Figure 4. (a and b) Extent of coverage within articles for key factors.

to be more conscientious about reporting socio-demographic and contextual data as well as providing better coverage of regime attributes, governance factors, mechanisms, and outcomes.

(a) Results of the Phase II CMO analyses

For Phase II, we selected the 15 cases identified as having robust data (i.e., data on all or most of the elements in our theory of change framework as they were the only cases with sufficient detail to allow for in-depth analysis (see Supplemental file 5 for a summary chart of the cases). Through case narratives for each regime type, we examine whether the three mechanisms (perceptions of legitimacy, perceptions of the likelihood of benefits, and perceptions of enforcement capacity) were present, the contexts associated with these mechanisms, and how the CMO patterns aligned with environmental outcomes.

(i) Customary regimes

Three of the cases (Ahus Island, Muluk, and Kakarotan) examined during the in-depth CMO analysis involved customary fisheries' regimes with deeply embedded practices. The other two cases (Roviana Lagoon and Puerto Peñasco) dealt with customary regimes in which new fisheries' protection strategies were introduced through collaborations between local fishers and outside scientists. The ecological outcomes of the Ahus Island, Muluk, Kakarotan, and Roviana Lagoon regimes were better than control

sites; they were worse for the informal customary tenure regime in Puerto Peñasco.

Culturally embedded practices (Ahus Island, Muluk, Kakarotan): The Ahus Island (Cinner, Marnane, & McClanahan, 2005), Muluk (Cinner, Marnane, McClanahan, & Almany, 2006), and Kakarotan (Cinner et al., 2006) protection strategy consisted of closing designated areas of coral reefs and then opening them to fishing for brief periods at times when large quantities of fish were needed for ceremonial occasions. The primary purpose of the closures was to ensure a supply of fish for ceremonial occasions, with conservation being byproduct rather than the main goal (Cinner, 2005). Perceptions of legitimacy for these practices, which were deeply rooted in the cultures, were widespread among local fishers and the broader community. The closures' legal legitimacy stemmed from customary law, but also from the communities' respective nation-states (Papua New Guinea and Indonesia), which formally recognized the authority of these traditional marine tenure regimes. The authors described the customary systems as being strong enough that outsiders respected the authority of customary leaders. In all three cases, the periodic closure systems had strong ecological credibility and social legitimacy within the community. Customary leaders relied on their ecological knowledge and input from experienced fishers to determine what areas should be closed and when they were ready to be opened temporarily. Perceptions of social legitimacy were established through the periodic openings and associated celebrations where the ecological benefits were made visible (i.e., fish were harvested), the community received tangible

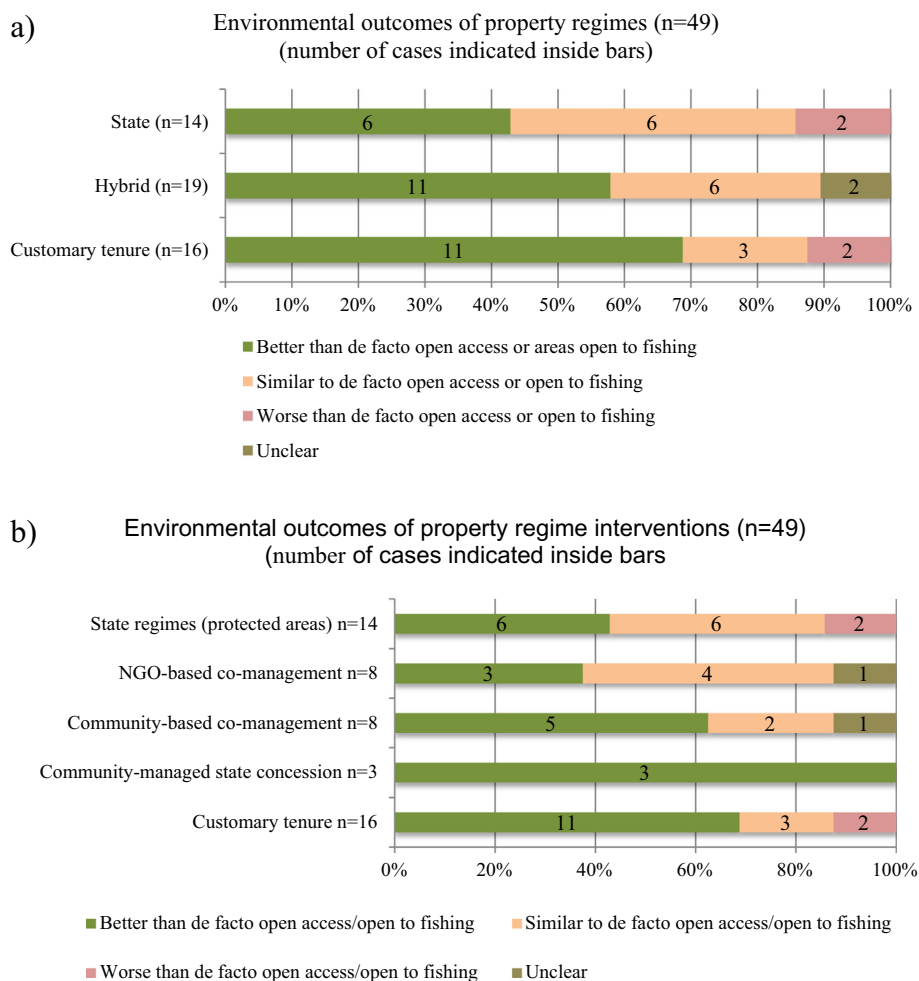


Figure 5. (a and b) Environmental outcomes of property regimes.

benefits (i.e., fish were distributed to all participants), and the rules governing the closures were reiterated publicly in ceremonies associated with the feast.

Because everyone benefitted from the closures, community members had an incentive to comply with the rules and to make sure that others complied as well. High levels of voluntary compliance meant that organized patrols were unnecessary, and the economic and social costs of enforcement were low. The closed areas were situated in areas where poachers could easily be seen, providing further incentive for voluntary compliance by reinforcing the likelihood that fishers would perceive that infractions were likely to be noticed. The positive feedback between the intersecting mechanisms of perceptions of legitimacy, benefits, and enforcement capacity likely contributed to the positive outcomes observed in the closure sites relative to nearby control sites open to fishing. In these three cases, both a viable protection strategy and the governance structure for implementation were already firmly in place, and realizing positive environmental outcomes was largely dependent on the capacity of the communities to continue reinforcing the legitimacy of the closures and the customary legal framework in which they were embedded. Contextual factors likely contributing to the success of these systems included the communities' relative physical isolation, small and homogeneous populations, strong traditional leaders, state recognition of the customary system, and the crucial role that periodic feasts played in the maintenance of social and trading relations within the community and with neighboring communities.

New practices in existing customary regimes: The Roviana Lagoon (Aswani & Weiant, 2004) and Puerto Peñasco (Cudney-Bueno & Basurto, 2009) cases shed light on the role that perceptions of legitimacy, likelihood of benefits, and enforcement capacity play in facilitating or undermining efforts to embed new practices in resource systems governed under customary regimes. In Roviana Lagoon, two customary regimes had been in place for many generations and their authorities were recognized under the Solomon Islands' national law. A history of inter-clan and intra-clan rivalry existed within and between lagoon communities. Although both customary tenure systems had periodic fishing grounds closures, the proposed practices of temporary closures for shellfish and permanent no-take areas were new. Because the practices were new, many women, who were the primary shellfish collectors, were skeptical that reductions in access to key harvesting grounds would be sufficiently offset by improvements linked to the closures.

Supportive leadership on the part of local authorities proved to be crucial to the success of the project. The initial resistance to seasonal closures was only overcome after widely respected church authorities intervened. Once villagers participating in monitoring events observed positive results in a test site closed for one year, the participating communities agreed to designate permanent no-take areas. However, illegal harvesting remained a problem, suggesting that a significant portion of collectors may have perceived a weakness in local capacity to enforce the closures. Contextual factors that likely played a role in the positive outcome of the

closures, despite the initial skepticism and strong inter-clan and intra-clan tensions, included the lagoon's relatively remote location, reliance on a participatory design and implementation process for establishing the no-take zones, and the support from a widely respected spiritual authority.

In Puerto Peñasco (Mexico), a fishing cooperative established several permanent no-take zones for benthic invertebrates. However, the fishing cooperative lacked state-recognized authority to make and enforce fishing regulations that applied to persons who did not belong to the cooperative. Support within the cooperative for the no-take reserves was high, with the closures' legitimacy being rooted in a design process in which fishers' knowledge informed the siting and size of the protected areas. Additionally, most cooperative members believed that the no-take areas would result in an improved fishery. The cooperative relied on voluntary compliance and informal sanctions within the group to enforce the rules. Initially the cooperative received support from local officials to keep outside fishers from fishing in the reserves. However, when the supportive local fisheries' official was replaced, his replacement refused to enforce the reserve boundaries. This left the cooperative with no legal means to stop outsiders from fishing in the reserves. Once cooperative members saw that outside fishers fished in the reserves with impunity, they too began to disregard the restrictions. Within a few months of losing state backing for enforcement, the populations of benthic invertebrates in the former no-take zones had dropped precipitously. Contextual factors that likely contributed to the initially positive ecological outcomes for the Puerto Peñasco reserves included the presence of a well-organized cooperative with strong internal social capital, personal relations between cooperative members and local enforcement officials, and a generalized agreement among the cooperative members that they needed to take action to protect their fishery. Additionally two of the reserves were situated such that poachers were easily identified, and informal surveillance was used to monitor compliance in the third reserve. However, the cooperative's lack of legal legitimacy in the eyes of local state officials and outside fishers left the reserves vulnerable to outside encroachment when informal arrangements with local officials collapsed. The case illustrates the pivotal role that a single individual can play in determining outcomes, and points to the importance of identifying such weak points and seeking ways to build in redundancies so as to reduce the likelihood of system collapses tied to the actions or decisions of a single individual.

(ii) State regimes

The two state regimes included in the dataset were the first marine protected areas established in their countries. The Sumilon Island sanctuary (Walmsley & White, 2003) was established in 1974 in the Philippines and the National Natural Park Rosario and San Bernardo Corals (hereafter referred to as RSB Corals) (Camargo et al., 2009) in Colombia was created in 1977. Ecological conditions at monitored sites within the RSB Corals park differed little from adjacent de facto open access control sites; they were poorer within the Sumilon Island sanctuary than in adjacent de facto open access control sites. Both regimes are best described as relatively mature but dysfunctional.

The Sumilon Island national fish sanctuary is located off a small, uninhabited island in the central Philippines. Those who fished in the area came from several communities located on a nearby island. Initially the municipality in which Sumilon Island sanctuary is located managed the reserve, and the sanctuary had the support of the local mayor. However, the sanctuary's legitimacy was undermined when a new mayor opposed to the sanctuary took office. Fishers' skepticism about whether they would benefit from the sanctuary may have played a role in fostering chronic illegal fishing

(Walmsley & White, 2003). When it became clear that the new mayor would not enforce the sanctuary's boundaries or gear restrictions, the national government took over the sanctuary's management. However, illegal fishing and destructive fishing practices continued, suggesting that fishers disagreed with the restrictions and perceived that the state lacked the capacity to enforce the restrictions. Contextual factors likely contributing to the sanctuary's poor performance relative to control sites included typhoon damage to the sanctuary's coral reef in the 1980s, absence of a nearby settlement, sustained local political opposition to the sanctuary, and failure to involve fishers in the initial planning (Walmsley & White, 2003).

The RSB Corals' case involved a multi-zone MPA located off the coast of Colombia in which certain fishing practices (e.g., use of gunpowder) and gear restrictions (e.g., prohibition on small-mesh nets) were in force, and industrial fishing was prohibited. Perceptions that the reserve lacked social legitimacy among local fishers were evidenced during simulation games in which the fishers' behavior suggested that many disagreed with the restrictions on fishing methods and fishing area closures. Additionally, the games revealed that fishers felt that the park rangers treated industrial fishers more leniently than local fishers and did not enforce the prohibition on industrial fishing. Eighty-six percent of the park staff stated that the rules were hard to enforce (Camargo et al., 2009), indicating that many fishers perceived the state's enforcement capacity to be low. Fishers justified their failure to adhere to the park rules on the grounds that their extreme poverty together with the lack of other livelihood options forced them to engage in illicit fishing activities. This suggests that the fishers felt that any benefits from following the rules were outweighed by the cost in terms of their ability to support their families. Contextual factors that likely contributed to the park having ecological outcomes similar to control sites included the park managers' failure to involve local communities in developing park objectives and regulations, lack of communication between the park staff and local community members regarding the park's on-going management, and a very high percentage of households living in poverty with few livelihood options.

(iii) Community-based co-management regimes

The CBCM cases involved the simultaneous introduction of new fisheries' protection practices with new fisheries' governance systems. The cases included three small MPAs in the Philippines (Apo, Balicasag, and Pamilacan Islands) (Walmsley & White, 2003), no-take zones in a large marine extractive reserve in Brazil (Itacolomis Reef) (Francini-Filho & Moura, 2008), and several small no-take zones in Tanzania (Fumba) (Crawford et al., 2010). The MPAs in the Philippines were established in the 1980s. Their governance regimes were widely supported, and functioned well. The no-take zones in Fumba and Itacolomis Reef dated from the early 2000s. Their governance regimes were struggling to establish legitimacy among fishers and develop their enforcement capacity. A feature common to all five cases is that the communities had legally recognized exclusive use rights to the protected areas. The Apo, Balicasag, and Pamilacan Island MPAs and Itacolomis Reef's no-take zones showed positive environmental outcomes relative to control sites; the Fumba no-take zones had environmental outcomes similar to adjacent control sites.

The fishery protection strategy for Apo, Balicasag, and Pamilacan Islands consisted of establishing small permanent no-take zones. The Apo and Pamilacan sanctuaries were managed under local municipal ordinances. The Balicasag sanctuary was initially managed by the local municipality under a similar ordinance, but later was jointly managed by the local municipality and the national tourism agency. Local support for all three sanctuaries was high (100% in all three communities) (Walmsley & White,

2003), an indicator that they were widely perceived as legitimate. Moreover, 100% of the interviewees from Apo and Pamilacan and 90% of those from Balicasag perceived that the entire community had a say in managing the sanctuary. These figures are indicative of a widely held sense of ownership, reinforcing perceptions of the sanctuaries' legitimacy. Moreover, most local fishers believed that the reserves would yield benefits. Fishers stated that their catch had remained stable or increased during recent years and that they were spending less time fishing to catch the same amounts. Key informants stated that they had been successful in excluding outsiders and locals from fishing in the sanctuaries, an indicator that most fishers perceived that the communities had the capacity to enforce the boundaries of the no-take reserves. [Walmsley and White \(2003\)](#) attribute the low levels of poaching to broad community support for the reserves, resulting in widespread willingness to comply voluntarily with the restrictions. Contextual factors likely contributing to the success of the Apo, Pamilacan, and Balicasag sanctuaries included their small size, which made them socially acceptable to local fishers, and their proximity to villages, which facilitated enforcement, the presence of a small and culturally homogenous resource user group, and state legal backing that enabled community members to exclude outsiders.

For Itacolomis Reef (Brazil), the fishery protection strategy consisted of the establishment of a large no-take zone in the Marine Extractive Reserve of Corumbau (MERC) ([Francini-Filho & Moura, 2008](#)). The Brazilian government formally recognized MERC and only local fishers were allowed to fish within its boundaries. Fishers had a fifty percent plus one representation on the MERC management council. The reserve covered 930 km², and included multiple no-take zones, with the 10-km² no-take zone on the Itacolomis Reef being the largest. The no-take zones have been the focus of much controversy among local fishers, many of whom have resisted attempts to restrict their access to traditional fishing grounds. Some fishers opposed the siting of no-take zones in the inner coral reefs because they were unable to reach the outer reefs with their non-motorized boats. The strong opposition to the no-take zones was a sign that the no-take zones lacked social legitimacy despite the council's legal authority to designate them. The evidence suggests that the lack of social legitimacy was linked to local fishers' perceptions that the benefits of the no-take zones would not make up for the loss of access. This conclusion is supported by the fishers' initial proposal to limit the no-take area to one km² (a tenth of its final area) to keep reductions in access to traditional fishing grounds to a minimum. Violations of the no-take zone occurred frequently, suggesting that fishers perceived that enforcement capacity for the reserve was weak and that fishers felt little peer pressure to comply voluntarily with the restrictions. The absence of peer pressure and the associated cultural norms that would have encouraged voluntary compliance is another indicator that the no-take zone lacked social legitimacy. Resistance to the no-take zones remained strong, even though long-term monitoring results, which showed that the biomass of several commercially important species was consistently higher in the no-take zones, were shared with local fishers each year. [Francini-Filho and Moura \(2008\)](#) attribute the lack of compliance by fishers to their weak position in commercial markets combined with increased demand for large-bodied fish, such as parrotfishes. In short, the costs of compliance outweighed the risks associated with non-compliance. It is puzzling that the no-take zone had better environmental outcomes than nearby control sites. Based on the limited data provided, one can surmise that the fact that local fishers have a sizeable representation on the management council may translate into sufficiently high buy-in among local fishers of the need to decrease fishing effort in the reserve that the fish population is able to do marginally better inside the reserve than out-

side of it. Indeed, [Francini-Filho and Moura](#) found that fishing pressure did decrease significantly during the first year of the no-take zone; but over time it has gradually increased. It remains to be seen whether the gains made early on will be sufficient to offset the observed increase in illegal harvesting over the long run. Contextual factors that may have contributed to the improved ecological outcomes observed in the protected area compared with adjacent open fishing grounds were not identified by the authors of the Itacolomis reef study.

The Fumba Peninsula (Tanzania) case involved an outside-funded initiative to establish several small (2–6 ha) no-take zones for cockles along Zanzibar's coast ([Crawford et al., 2010](#)). To secure their rights to the cockles, the communities established a set of by-laws, developed ordinances laying out the rules and penalties for non-compliance, and created a committee to manage the no-take reserves. These actions gave them exclusive rights to the resources under Zanzibar's Resources Management and Conservation Act. However, the communities' selection of poor-quality sites for some of the reserves suggests that some doubt exists as to whether the benefits from the reserves will outweigh loss of access. Poaching by villagers and outside harvesters has plagued the sites, indicating the presence of a widespread perception that local villagers lack the capacity to enforce the no-take reserves. The high level of poaching at the beginning of Ramadan, when the need for extra cash is particularly great, may reflect beliefs among community members that the reserves lack social legitimacy. Contextual factors that likely contributed to the lack of difference in ecological outcomes between the no-take zones and control sites in Fumba included siting of no-take zones in poor-quality habitat and the small size of the no-take zones, community members' periodic need for cash along with cockle harvesting being one of the few options for earning income, and the high demand for cockles in an area close to a major market.

(iv) NGO-based co-management

Our sample included one NGO-CM regime, Karimunjawa National Park (Indonesia) ([Campbell et al., 2012](#)). Karimunjawa's protection strategy consisted of revising the park's zoning to incorporate fishers' input into the siting of use zones and the rules governing them. The park's original zoning plan was created with little local input and the park's spatial restrictions had been widely ignored. In 2005, self-organized village planning groups participated in an NGO-supported community consultation process to develop new use zones. These included two types of no-take zones and several types of use zones. Four years of ecological monitoring found that coral cover had increased in all zones in the park, but had decreased in the open access control sites. However, while fish biomass was greater in all park zones than in the control sites, fish biomass within the park had declined over time.

[Campbell et al.'s \(2012\)](#) study indicates that local fishers were ambivalent about the legitimacy and ecological credibility of the no-take zones. Awareness among local fishers of the new gear and spatial restrictions was high, but whereas most fishers complied with the gear restrictions, compliance with the spatial restrictions was poor. Discussions with local fishers and community members revealed that fishers perceived that the gear restrictions had a positive impact on the fishery. However, they were less certain as to whether the spatial restrictions would improve the fishery enough to make up for the loss of valued fishing grounds. [Campbell et al.](#) reported that local fishers, many of whom depended on fishing for their livelihoods, saw little benefit to respecting the no-take zones given that community members would not be able to harvest fish in them. Concern about the loss of benefits from no-take zones was further evidenced by local fishers' refusal to have no-take reserves located near settlements where they could be easily patrolled. They argued that close-in

no-take zones would negatively affect community members who were dependent on gleaning shellfish or fishing in areas close to land. In short, gear restrictions were considered socially acceptable, ecologically credible, and economically beneficial, whereas spatial restrictions were not.

Fishers' selective adherence to the park's restrictions also appears to have been linked to their perceptions of the state's differential capacity to enforce restrictions. Campbell *et al.* found that the state commonly enforced gear violations but rarely patrolled or enforced the no-take zones. Moreover, the penalties for gear violations were much higher than those for fishing in the no-take zones with legal gear. The no-take zones were all situated some distance from settlements, increasing the likelihood that fishers could fish in them with impunity. Contextual factors likely contributing to better ecological outcomes in the park management zones despite the state's limited enforcement capacity included widespread involvement of fishers in developing the new zoning plan for the park and subsequent high levels of awareness about park restrictions, as well as widespread willingness to comply with gear restrictions.

(v) *Community-managed state concessions*

Isla Costa Rica (ICR) in Ecuador (Beitl, 2011) and Aserradores Estuary in Nicaragua (Crawford *et al.*, 2010) involved community managed state concessions. In both cases, the communities established protected areas for cockle habitat, and the ecological outcomes for the protected areas were better than for control sites.

In the ICR's state concession, several formally organized community associations implemented short-term rotating closures along with minimum shell size restrictions to improve cockle productivity off the coast of Ecuador. The concession, known as a custodia, provided the associations with 10-year renewable use rights to an area over which members had ancestral resource rights claims. In return for use rights, the concessionaires had to develop a state-approved management plan and by-laws. All the ICR community members interviewed during Beitl's (2011) study supported the custodia, indicating that the cockle protection measures were widely perceived internally as socially legitimate. Support for the protective measures was strongly reinforced once the association members saw that the rotational closures and size restrictions resulted in more and bigger cockles.

Support for the cockle bed closures was less widespread within neighboring communities. Objections to the closures were grounded in a long-standing tradition among the area's inhabitants that everyone had a right to gather cockles in the mangrove forest. ICR's assertion of exclusive use rights to its custodia thus existed in strong tension with a deeply rooted belief among area inhabitants that depriving someone of cockle beds in the mangrove forests was morally wrong. To defend the cockle enclosures, the ICR associations developed a rotating system of guards to prevent poaching by insiders and outsiders. To facilitate surveillance, the cockle beds designated for rotational closures were located in an area easily accessible by community members. The closed areas were physically situated so that a watcher in a central location could see if poachers were present. Within-group adherence to the rules was strong. And as it became clear that ICR had legal backing from the state to exclude outsiders, trespassing by outsiders virtually ceased. The near absence of poaching in the rotational closure areas at the 10-year mark was indicative that insiders and outsiders alike perceived ICR's enforcement capacity to be strong. Contextual factors that contributed to the ecological success of ICR's cockle bed closure included the relatively remote location, the community's small and culturally homogenous population, and the heavy dependence of most households on mangrove resources, including cockles, for subsistence and cash income. Also important was the strong internal social capital within the custodia associa-

tions, as well as the bridging social capital created through the associations' involvement in a regional fishing alliance and the technical and legal assistance provided by an outside NGO.

The Aserradores Estuary case involved a project in which scientists and extension agents affiliated with an outside-funded conservation and sustainable livelihoods initiative worked with women cockle harvesters to establish a network of small-scale permanently closed cockle reserves. Initiative leaders persuaded the Nicaraguan Ministry of the Environment and Natural Resources (MARENA) to issue an experimental permit providing the participants temporary exclusive use rights to cockle grounds in the study area. The permit gave the cockle reserve network legitimacy in the legal sense, but social acceptability and ecological credibility took longer to develop. Community members were initially skeptical that the no-take reserves would improve cockle productivity enough to make up for reduced access. As a result, they hesitated to set aside no-take areas and once they agreed to do so, they were reluctant to select areas with good-quality habitat. However, once group members saw that the increased productivity offset the loss of access, participants began to see the no-take reserves as both ecologically and socially legitimate. The shift in the community's perceptions was reflected in their decision to establish two additional no-take reserves in better quality habitat. The initiative's participatory ecological monitoring program, which enabled the women to see for themselves the increase in cockle densities, was an important factor in convincing participants of the ecological viability of the reserves.

In the initiative's second year, the legal legitimacy of the reserves was nearly undermined when the national government made a top-down decision to ban the sale of cockles in the Aserradores Estuary. With assistance from university researchers, the community group negotiated an agreement with state officials in which the local mayor was given authority to control cockle harvests in the Aserradores Estuary and issue commercial permits to the cockle harvester group. Although the rights granted were tenuous, the agreement nonetheless reflected "a degree of formal delegation of responsibility from the central government to the local municipality and the cockle harvesters to manage the harvest and sale of cockles from the estuary" (Crawford *et al.*, 2010, p. 203). The agreement also formalized the group's exclusive right to sell cockles, which amounted to the granting of an exclusive use right for much of the cockle harvest. By the end of the initiative's third year, support for the no-take reserves within the Aserradores communities was strong. High levels of compliance indicated that locals perceived that the cockle harvesting group's capacity to enforce the rules was strong. However, the increased productivity of the no-take reserves attracted the attention of neighboring villagers, and poaching by outsiders was on the rise, suggesting that outsiders were not convinced that the Aserradoresans had a legitimate claim to exclusive rights to the reserves, and also that the enforcement system, which relied on voluntary compliance, was ineffective against encroachers. Contextual factors that likely contributed to the no-take reserves' positive outcomes included the community's remote location, a large percentage of households reliant on cockle harvesting for subsistence and cash income, and the threat of national legislation prohibiting the sale of cockles, a law which directly threatened Aserradoresans' livelihoods.

5. Discussion

A realist synthesis of the 31 fisheries' articles included in our dataset makes visible the wide range of contexts in which fisheries' protection strategies are being implemented in Africa, Asia, and Latin America. As well, the 15 in-depth case narratives highlight

the important role that perceptions of legitimacy, enforcement capacity, and likelihood of benefits can play in both strengthening and weakening protection efforts. The next section sums up the key findings of our synthesis, focusing first on the importance of disaggregating the hybrid regime category and then on exploring how the three mechanisms present in our theory of change framework supported or undermined fisheries' protection in these cases.

(a) *Disaggregating the hybrid regime category*

A comparison of the environmental outcomes of the customary, hybrid, and state regimes relative to control sites showed that hybrid regimes were more likely to have positive outcomes than state regimes but less likely to have positive outcomes than customary regimes. However, disaggregating the hybrid regime category into sub-categories revealed that the community-managed state concessions had better environmental outcomes relative to co-management regimes. Among the co-management regimes, CBCM regimes had slightly better outcomes than NGO-CM regimes. However, the sample sizes are too small to draw definitive conclusions. Expanding the number of cases and geographic coverage for each regime type in future studies would help determine whether the patterns identified here hold up more broadly and what factors might explain differences.

(b) *Deconstructing the mechanisms*

Perceptions of legitimacy, likelihood of receiving benefits, and enforcement capacity emerged as important mechanisms influencing behavior in marine protected areas in the 15 cases with robust data. The following section summarizes our findings with respect to these three mechanisms.

(i) *Perceptions of legitimacy and likelihood of benefits*

Perceptions of legitimacy centered around three types of legitimacy: Legal legitimacy, social acceptability, and ecological credibility. Perceptions of legal legitimacy took into consideration whether the regime was formally recognized and whether it was based in informal law or tradition. Formal recognition was most critical in situations where outsiders came to fish in an area (e.g., Fumba, Isla Costa Rica, Puerto Peñasco). However, formal recognition alone was insufficient to confer legitimacy on fisheries' protection strategies, as evidenced by the Itacolomis Reef fishers' resistance to no-take zones and Karimunjawa fishers' decisions to ignore spatial restrictions in the national marine park. Both cases illustrate the importance of social acceptability and ecological credibility as aspects of legitimacy.

The social acceptability aspect of legitimacy hinges on the fact that recognition of an institution's legal authority to make decisions does not necessarily translate into agreement with or adherence to the decisions that are made under that authority (Tyler, 2006). The two state cases (Sumilon Island and RSB Corals) and three of the co-management cases (Fumba, Itacolomis Reef, and Karimunjawa) most clearly illustrated how the absence of social acceptability can undermine legal legitimacy. The CMO analyses also revealed that expectations of benefits and social acceptability are closely linked, with social acceptability being unlikely to exist in the absence of a widespread perception that benefits will be forthcoming. Importantly, however, perceived benefits were not restricted to economic benefits but also included social and psychological benefits. For example, Walmsley and White (2003) found that communities with MPAs supported them even when the ecological improvements were small. They attributed this support to community members' enhanced sense of pride and ownership. Beitzl (2011) also identified the development of a sense of pride and ownership as an important benefit of the custodia in Isla

Costa Rica, as did Crawford et al. (2010) for the Aserradores case in Nicaragua. Whether resource users perceived the restrictions to be fairly applied also influenced whether the restrictions were considered socially acceptable. The importance of fairness was most evident in the RSB Corals case in which fishers saw no reason to comply with the rules given that they felt that the state was not applying the prohibition on industrial fishing within the park. This finding dovetails with McCay et al.'s (2014, p. 54) study of state fishery concessions where the researchers found that perceptions of fairness increased compliance among Mexican fishing cooperatives. Studies of legitimacy in other contexts have shown that fairness in the application of rules is a fundamental factor in whether rules are perceived as legitimate or not (Tyler, 2006).

Ecological credibility was a third aspect of legitimacy that became visible through the CMO analysis. We interpreted a decision as ecologically credible when resource users' knowledge of the fishery's ecosystem processes led them to believe that the decision would result in the outcomes predicted by proponents of the decision. Perceptions of the likelihood of benefits were intimately linked to perceptions of ecological credibility; a finding that dovetails with Lawry's (1990) study of the efficacy of newly imposed communal grazing rules in Lesotho. This makes sense since it is unlikely that benefits will materialize if the interventions being implemented are premised on an incorrect understanding of ecological conditions and processes (Lawry, 1990).

Figure 6 shows how the three aspects of legitimacy combine to create perceptions of what DeWit and Iles (2016) call "thick" legitimacy and for which we use the term "robust" legitimacy. DeWit and Iles' use of the term "thick" legitimacy borrows from Geertz' (1973) concept of "thick description" (which itself was borrowed from Ryle's (1949) use of the term "thick" description), in which the task of the ethnographer is to convey the multiple layers of facts, meanings, and interpretations that woven together make up cultures. Similarly, DeWit and Iles (2016) research shows how legitimacy takes the form of a bundle of processes including "scientific validation, recognition in policy-making and government, practical testing against experiences, and verification by civil society actors." They argue that a more robust legitimacy emerges from the combination of these processes, through creating an authority that is strong and broadly recognized because it is "woven into the knowledge-making of scientific and political institutions, and embedded in widely practiced social conventions." A working hypothesis for our study is that in cases where legal legitimacy, social acceptability, and ecological credibility are present, ecological outcomes are likely to be better than in cases where one or more of the three aspects is weak or absent.

(ii) *Perceptions of capacity to enforce*

Perceptions of the capacity to enforce were closely bound up with perceptions of legitimacy. The Puerto Peñasco case, in which outsiders ignored the fishing cooperative's harvesting restrictions once the state ceased to provide informal support, provided the clearest example of how these two mechanisms are linked. Importantly, however, an organized surveillance system was not necessarily required for fishers to perceive that a governance regime had the capacity to enforce restrictions. Peer pressure and internalized cultural norms provided adequate incentives for fishers to abide by rules in some cases. Voluntary compliance appeared to work better in the cases where the resource users perceived the regime to have legal legitimacy and where the restrictions were perceived as socially acceptable and ecologically credible. Communities that relied on voluntary compliance (as well as some of those which did not) increased the likelihood of compliance by siting marine protected areas in places with where poachers were likely to be seen. These findings have important policy and programing implications because a system that can function effectively

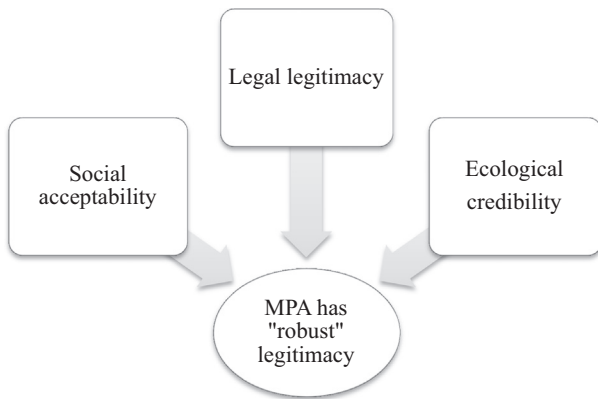


Figure 6. The multiple facets of legitimacy in natural resource governance systems.

through voluntary compliance is less costly to maintain (Tyler, 2006) and, provided that cultural norms and values supporting that system are regularly reinforced, is more likely to endure. It is worth noting that our cases showed that voluntary compliance can occur in other contexts other than customary tenure regimes. In the Maria Islands (St Lucia) case, one of the 34 cases not included in the in-depth CMO analysis, voluntary compliance was sufficient for enforcing a sea urchin harvesting moratorium in a state-managed nature reserve despite the absence of state enforcement. Smith and Berkes (1991) attributed the informal enforcement system's success to strong and widespread support for the reserve, agreement with the sea urchin harvesting moratorium, and local residents' desire to ensure that the rules were applied equally to all.

The Roviana case also demonstrates that the effectiveness of voluntary compliance is context-dependent. Initially the Roviana reserve system relied on shellfish collectors to self-enforce, but three factors undermined this strategy. First, many collectors were skeptical that the no-take zones would increase shellfish productivity enough to offset loss in access to harvesting sites, and, as a result, some collectors continued to harvest in the no-take zones. Second, some of the shellfish beds were in mangrove forests where poachers were hard to detect and the shellfish, which had a high market value, could easily be concealed during transport. As a result, some women were willing to risk harvesting illegally. Third, some community members who felt they had not been compensated for their rights to the no-take zones chose to ignore harvesting restrictions. The Roviana case suggests that willingness to comply voluntarily with restrictions may be linked not only to how people perceive that benefits will be distributed, but also to how they believe they *should* be distributed. Ultimately, reliance on voluntary compliance proved insufficient in Roviana and the communities involved took steps to establish a more formalized system.

(c) Revisiting our theory of change framework—Conceptualizing mechanisms as bundles

At the outset of this review, we conceptualized mechanisms as operating in tandem but more or less independently of each other. As we analyzed the cases, it became apparent that it is more useful to think of mechanisms as comprised of a bundle of interacting components. The fisheries' cases suggest the presence of a legitimacy-benefits-capacity mechanism bundle that links socio-ecological contexts and environmental outcomes. The case examples show that the three mechanisms in the bundle can both reinforce and undermine each other. The practical implication is that policy interventions focused only on changing the conditions

under which one mechanism is triggered are likely to have unanticipated consequences. More reliable results are probable if interventions take into account how the three mechanisms interact with each other. It is also worth noting that in three of the cases, Roviana, Puerto Peñasco, and Sumilon, perceptions of the legitimacy of the MPAs was strongly linked to the presence of single influential actors. This highlights the importance of recognizing the role that leadership plays in the success or failure of collective action related to natural resources (Lobo, Vélez, & Puerto, 2016).

(d) Comparisons with other reviews

Nilsson *et al.*'s (2016) review of community-based conservation behaviors and our review of the environmental outcomes of different property regimes are pioneering applications of the realist synthesis method to the study of how and under what circumstances natural resource conservation and governance interventions work (or don't work). Nilsson *et al.* (2016) explored three mechanisms that can potentially trigger conservation behaviors (perceptions of economic value associated with conservation behaviors, perceptions of cost/benefits of changing behavior, and degree to which communities exercise authority over resource management decisions) and tentatively identified two additional mechanisms through their CMO analyses (knowledge of conservation behavior and understanding the importance of conservation). Additionally, they found preliminary evidence of the existence of other mechanisms, including confidence that conservation behaviors will result in the promised benefits, as well as feelings of respect, trust, and autonomy.

Our findings complement Nilsson *et al.*'s study by providing a nuanced understanding of the mechanism they labeled "community authority", which partially overlaps with our mechanism, "perceptions of legitimacy". Moreover, we found that in our set of cases, social acceptability and fairness of benefits distribution, both of which Nilsson *et al.* identified as contextual factors influencing perceptions of the cost/benefit ratio of conservation behaviors, were important factors in determining whether fishing restrictions were perceived as legitimate. Additionally, our study revealed the bundled nature of mechanisms, and highlighted the importance of understanding how mechanisms interact to undermine or support each other.

Our study complements quantitative systematic reviews related to fisheries and protected areas. Our findings concur with Sciberras, Jenkins, Kaiser, Hawkins, and Pullin (2013) evaluation of the biological effectiveness of MPAs, in which they found that few studies included data on fishing effort inside and outside the reserves, and even fewer provided data on levels of enforcement or compliance data. Through a close reading of cases, we illustrate how such data can be used to develop hypotheses as to why and when interventions dependent on compliance for success are likely to succeed or fail. Our study complements Gutiérrez *et al.*'s (2011) investigation of attributes associated with successful community-based co-managed fisheries. They identified strong leadership, social cohesion; catch share quotas, and protected areas as the leading contributors to successful co-management. The combination of self-enforcement mechanisms linked with self-interests was found to be especially important. Our analysis provides further insights as to when self-enforcing mechanisms are likely to work and when they are not. Our study also supports Cetas and Yasué's (2016) findings that successful projects tended to rely more on intrinsic motivations to engage in conservation behavior whereas less successful projects tended to rely on extrinsic motivations. This finding dovetails with our review, which highlights the critical role that perceptions of legitimacy play in promoting voluntary adherence to fishing restrictions. However, our study also suggests that a combination of intrinsic and extrinsic motivations are likely needed to support widespread voluntary compliance

with fishing restrictions, adoption of different fishing practices, or adoption of alternative livelihood strategies.

(e) *Limitations of the study*

Several factors limit the generalizability of our findings. Many of the articles included in the review had limited data related to our theory of change framework's components and most lacked data about important social, economic, and governance factors, as well as intermediate outcomes and mechanisms. Given the diversity in property regime types and geographical areas represented by those cases that did have sufficient data for in-depth CMO analysis, our findings are best viewed as a basis for formulating hypotheses about how property regime interventions might work in different circumstances, rather than as definitive statements about how an intervention will play out in a given context. However, we emphasize that datasets characterized by insufficient and inconsistent reporting on key variables are not a problem unique to realist syntheses but are common to other types of systematic reviews of complex socio-ecological systems as well (Brooks et al., 2013; Sciberras et al., 2013). The trend in science away from producing monographs toward splitting scientific findings into "minimum publishable units" (Lee, 1997) has contributed to a situation in which data relevant to a study is scattered across many small papers rather than being published in one comprehensive monograph, thereby complicating the task of conducting systematic reviews. The problem this presents is evident in our Phase I CMO analysis, which found that fewer than 50% of the cases included data on fishing effort, and only a fifth provided data on compliance levels, both factors that would almost certainly affect environmental outcomes of MPAs. Another limitation of our synthesis is that our review's scope was limited primarily to tropical marine fisheries, with over-representation from a small number of countries and under-representation for most others. Notable gaps in geographic coverage were countries in Africa other than Tanzania and South Africa, and mainland countries in Asia. Realist syntheses applied to other types of fisheries, other countries, or other types of resource systems, such as forests or rangelands, might reveal somewhat different CMO configurations. As noted in our introductory discussion, interventions implemented across different contexts may result in different outcome patterns because mechanisms are functions of the interactions that take place between participants and their context (Wong et al., 2013). Therefore, it would be imprudent to assume that CMO configurations associated with marine protected areas will necessarily manifest themselves in other resource contexts, and a comparative analysis across resource systems could prove useful (Ojanen et al., 2017).

(f) *Policy and research implications*

The analysis of the 49 fisheries' cases highlights the importance for researchers and policy makers to recognize the variability within property regime categories if their goals include providing practitioners with useable data or effective policies and programs. This is particularly true for hybrid and customary regimes, which often are lumped into broad categories, despite often-significant differences among sub-categories in how rights and responsibilities are distributed. As well, contexts are diverse, and efforts by researchers and policy-makers to generalize across broad regions and diverse resource systems are likely to prove counter-productive.

The in-depth CMO analysis points to the need for policy interventions that take into account the multiple dimensions of legitimacy, how perceptions of the likelihood of receiving benefits support or undermine legitimacy, and how perceptions of legitimacy support or undermine perceptions of enforcement capacity. Increased attention to understanding the mechanisms that encourage or dis-

courage voluntary compliance in different socio-ecological contexts and the types of policies that can bolster those mechanisms is a promising avenue for laying a foundation for conservation policies and practices that are sustainable over the long term.

Inconsistencies and gaps in the coverage of key variables in publications on natural resource governance is a challenge that realist synthesis practitioners, but also practitioners of other types of systematic reviews, are likely to continue to face. Previous studies have called for authors to include more details, either in the body of their articles or in the form of *Supplementary materials*, when writing up their research results (Brooks et al., 2013; Yin et al., 2016). Although we concur that the inclusion of additional details in published studies would be useful, we question whether the current culture of academic publishing, which rewards authors who produce more articles and discourages the publication of lengthy articles, provides the necessary incentive structure, even given the expanding opportunities for including *Supplemental materials*. Instead, we suggest that systematic reviewers consider adopting a middle-ground alternative that would modify the review process so that it better fits the data likely to be available for studies of complex socio-ecological systems. During our review, it became apparent that many of the articles we included were just one of a sometimes extensive set of studies about the protected area. This was especially true for cases involving long-term interdisciplinary research projects focused on a specific geographical location. It is likely that our analyses would have been much more robust if we had centered our analyses on the case as reflected in the set of publications available on the protected area under study, rather than on the case as reflected in a single article. We therefore recommend multi-sourcing of case data as a strategy for developing robust realist syntheses.

(g) *Suggestions for further reading*

For readers interested in learning more about using a realist synthesis approach to evidence review, Pawson and Tilley's (1997) "Realistic evaluation" is an important starting point. It lays out the principles of scientific realism and describes how the context-mechanism-outcomes framework derived from those principles is a powerful tool for program evaluation when complex systems are involved. Rycroft-Malone et al.'s (2012), "Realist synthesis: illustrating the method for implementation research", provides a succinct and accessible step-by-step description of the realist synthesis process as applied to public health programs, starting from the development of a theoretical framework, continuing with data extraction and validation, and ending with a synthesis of the evidence. Dalkin et al.'s (2015) article, "What's in a mechanism? Development of a key concept in realist evaluation", helps clarify the concept of mechanism as it is used in realist synthesis, and emphasizes the critical importance for evaluators to identify the changes in reasoning brought about by interventions. Nilsson et al.'s (2016), "How do community-based conservation programs in developing countries change human behaviour? A realist synthesis", illustrates how realist synthesis can be fruitfully applied to the evaluation of the contextual factors affecting conservation behaviors, and highlights the need for conservation research to pay greater attention to the reasoning of individuals affected by conservation policies.

For readers interested in exploring further how perceptions of legitimacy influence individual and group behavior, Tyler's (2006) article "Psychological perspectives on legitimacy and legitimation", provides an overview of social thought on the concept of legitimacy, with an emphasis on the role that perceptions of legitimacy play in encouraging voluntary compliance with regulations. De Wit and Iles' (2016) study, "Toward thick legitimacy: Creating a web of legitimacy for agroecology", offers an insightful exploration

of the ways in which multiple social and political processes interact to legitimize (or delegitimize) scientific knowledge. Among the studies included in this review, [Cudney-Bueno and Basurto's \(2009\)](#) article, “Lack of cross-scale linkages reduces robustness of community-based fisheries management”, and [Campbell et al.'s \(2012\)](#) study, “Weak compliance undermines the success of no-take zones in a large government-controlled marine protected area”, provide the most explicit assessments of the links between perceptions of legitimacy and conservation behavior.

6. Conclusion

We report on a pilot application of a realist synthesis approach to the systematic review of evidence regarding factors that influence environmental outcomes of fisheries' management under different types of property regimes. The realist synthesis approach enabled us to better understand how the three mechanisms examined through a C-M-O analysis (perceptions of legitimacy, likelihood of benefits, and enforcement capacity) operated in different socio-ecological contexts to support (or undermine) behavioral changes that affected environmental conditions. Based on that analysis, the multi-faceted nature of the concept of legitimacy was revealed, with robust legitimacy shown to result when all three facets—legal legitimacy, social acceptability, and ecological credibility—are strong and broadly manifested. When one or more of the facets is weak, behaviors that undermine conservation objectives are likely to be triggered. Finally, the more granular understanding of the diverse mix of property rights arrangements in hybrid systems generates insights into greater practical value to policy makers and resource managers in shaping programs better adapted to real-world contexts. Hybrid systems are adaptive to the richness and diversity of human experience. Where their historical and social antecedents and strengths and weaknesses are better understood, more humane and democratic solutions to resource governance problems are likely to emerge.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.worlddev.2017.09.016>.

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