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A sea change on the African coast? Preliminary social and ecological outcomes of a governance transformation in Kenyan fisheries

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ABSTRACT

We examined social and ecological outcomes over a period of transformational change in the governance of Kenyan fisheries. Devolving decision-making power to local communities initially promoted a perception of winners and losers among resource users, but after just 6 years, there were virtually no resource users who felt that the new governance arrangement was detrimental to their livelihood. The current lack of negative perceptions toward co-management provides a critical window of opportunity to strengthen local governance institutions by investing in leadership capacity, transparency, and enforcement. This newly acquired authority to capture the benefits from local management resulted in an unexpected proliferation of community-based marine reserves – a substantial change to the anti-reserve discourse that halted the government's most recent attempt to establish a national marine reserve. Several community-based reserves showed increases in fish biomass and coral cover, while others did not and likely suffered from poor compliance and weak management. Despite some seemingly positive early social and ecological outcomes, co-management should not be viewed as a panacea to Kenya's fisheries challenges, but rather as one of many tools for improving the chances of achieving social–ecological sustainability.

1. Introduction

Globally, small-scale fisheries directly employ more than 200 million people (Teh and Sumaila, 2013). These fisheries are challenging to manage through top-down approaches because they are often multi-species, multi-gear, and operate from dispersed landing sites, which together make it particularly difficult to collect data and enforce regulations (McClanahan et al., 2009). Consequently, many top-down managed small-scale fisheries may be unable to simultaneously sustain marine ecosystems and the livelihoods of fishers (Costello et al., 2012). To potentially address these social and ecological challenges, a number of countries have attempted to transform top-down national governance of small-scale fisheries toward more inclusive and participatory approaches – often called co-management (Alcala and Russ, 2006; Gelcich et al., 2010; Olsson et al., 2008). For example, many sub-Saharan African countries have recently developed co-management arrangements that devolve governance of both inland and marine fisheries to a more local level (ranging from local governments to resource user organizations) (Béné et al., 2009; Cinner et al., 2012a).

Although social contexts and governance frameworks under which co-management arrangements operate can vary considerably, co-management generally provides resource users with a greater say in developing and enforcing fisheries rules (Pomeroy and Berkes, 1997; Cinner et al., 2012a; Jentoft, 1989). In principle, this is meant to make management more reflective of local opinions and conditions, take advantage of existing knowledge and capacities, and provide local-scale incentives for people to comply with management initiatives of their own accord (Gutierrez et al., 2011; Pomeroy and Berkes, 1997; Jentoft et al., 1998; Pretty, 2003; Grafton, 2005). Yet, critical questions remain about how governance shifts to co-management actually impact societies and ecosystems (Béné et al., 2009; Blaikie, 2006; Ribot et al., 2006).

Most studies of governance shifts toward participatory marine fisheries management to date have been largely descriptive in nature (e.g., Gelcich et al., 2010; Olsson et al., 2008; Ayers and Kittinger, 2014), rely on one time sampled spatial comparisons (Cinner et al., 2012b), or are meta-analyses gleaned from the literature (Evans et al., 2011; Gutierrez et al., 2011). Few primary

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data studies have quantitatively examined how key social and ecological outcomes associated with governance transformations to co-management change over time (Evans et al., 2011). Here, we quantify how both ecological conditions and resource users' perceptions about their livelihoods changed after a governance transformation in Kenya that transferred key aspects of decision-making power of near-shore fishery resources to resource users (Cinner et al., 2012a).

In 2006, the Kenyan government introduced co-management legislation that allowed 33 pilot coastal communities to develop and enforce local bylaws regarding the use of and access to fisheries. These bylaws can include banning certain gears, restricting access of non-members to fishing grounds, and prohibiting fishing in delineated areas, such as no-take marine reserves (see Cinner et al., 2009, 2012a for a more detailed account of the historical and institutional aspects of Kenyan co-management). The bylaws had to be consistent with existing fisheries laws (i.e. one could not pass a bylaw allowing the use of illegal gears) and all bylaws had to be approved by the Fisheries Department (Cinner et al., 2012a). These co-management arrangements represent a major governance shift from a previously *de facto* open-access governance regime. These governance changes in Kenya, which were associated with a constitutional reform, provided a rare opportunity to address key questions about how transformations in fisheries governance can impact both people and ecosystems. Here, we ask the following research questions: (1) "What forms of management emerge from the ability to create local-level rules?" (2) "How do ecological systems respond to varying rules of devolved management over time?" and (3) "How do resource users perceive impacts of co-management on their livelihoods?"

2. Methods

We randomly selected 10 of the 33 pilot co-management sites (30%) in 2008 and resurveyed 8 of these again in 2012 (pirate and terrorist activity near the Somali border made it impossible to revisit the other two sites in 2012, so these sites were dropped from all analyses). To gather information in each study site [referred to as Beach Management Units (BMUs)], we employed a combination of household surveys and semi-structured interviews with BMU leaders. In total, we conducted 368 resource user surveys from the 8 resurveyed sites (125 surveys in 2008 and 243 surveys in 2012, which were randomly selected from lists of resource users operating out of the landing site) and 16 BMU leader interviews. Our response rate was very high (approximately 95% of respondents agreed to be interviewed), but we did not systematically record refusals because they were so rare.

We examined the types of rules that were developed under co-management by interviewing BMU leaders and key informants about the types of operational rules in place in each BMU. We quantitatively examined three key social dimensions of co-management across the two time periods: (1) Perceived livelihood benefits – responses about the perceived impact of co-management on resource users' livelihoods were ascertained on a five point Likert scale: strongly beneficial, slightly beneficial, neutral, slightly detrimental, strongly detrimental. An alternative response option was 'don't know' but these responses (10% of respondents) were not included in the analysis below. To compare resource users' perceptions of benefits over time, we used a cumulative links mixed model (CLMM) with community as a random effect to account for the non-independence of samples within communities. CLMM is an ordinal regression model that allows for random effects. We employed an information theoretic approach (Burnham and Anderson, 2002), whereby we compared a model with a covariate for time (i.e. 2008 and 2012) against a null model that did not include time. (2) Perceived compliance – resource users were also asked to gauge their perceptions of the level of compliance within their site on a four point Likert scale (full compliance, some people break rules, most break rules, all break rules) for each operational rule limiting resource use (operational rules included protected areas, gear restrictions, and access restrictions). In cases where compliance for separate operational rules was ranked differently (e.g., better compliance for a protected area than a gear restriction), the scores were averaged across rules. To compare compliance scores across time, we used a *T*-test. (3) Training and leadership capacity – we asked BMU leaders whether they had received training on conflict resolution, financial management/accounting, proposal writing, environmental education, roles and responsibilities, health/sanitation, reef/fisheries monitoring, and/or laws/regulations. We used a generalized linear mixed model to compare the average number of trainings per leader in 2008 and 2012, which allowed us to account for the non-independence of samples within a community by including a random effect for community. To quantify whether the number of training events leaders had attended had changed over time, we compared a model with a covariate for time (i.e. 2008 and 2012) against a null model that did not include time.

In addition, we used underwater visual census to examine fish biomass and coral cover conditions over time in eight co-managed and three "control" sites (Table 1). The control sites consisted of

Table 1
Description of the study sites and types of data collected at each site.

Site name	Type of management	Ecological data	Socioeconomic data
Mombasa/Bamburi	National marine reserve/BMU	Y (Pre = 2, 1–3 = 3, 3+ = 16)	Y
Kuruwitu	Tengefu/BMU	Y (Pre = 14, 1–3 = 3, 3+ = 3)	Y
Kibuyuni	Tengefu/BMU	Y (Pre = 1, 1–3 = 2)	N
Mradi	Tengefu/BMU	Y (Pre = 1, 1–3 = 2)	N
Mtangata	Tengefu/BMU	Y (Pre = 1, 1–3 = 1)	N
Tiwi	Tengefu/BMU	Y (Pre = 1, 1–3 = 2)	N
Mayungu	BMU	Y (1–3 = 1, 3+ = 1)	Y
Takaungu	BMU	Y (1–3 = 1, 3+ = 1)	Y
Rasiwatine	BMU	Y (Pre = 10, 1–3 = 2, 3+ = 2)	N
Funzi	BMU	N	Y
Gazi	BMU	N	Y
Shimoni	BMU	N	Y
Vanga	BMU	N	Y
Kanami	None	Y (Pre = 14, 1–3 = 2, 3+ = 3)	N
Diani	None	Y (Pre = 14, 1–3 = 2, 3+ = 1)	N

BMU = Beach Management Unit; CBMR = small, community-based marine reserve; *Y* means data is present; *N* means data is absent. For ecological data, "Pre" refers to the number of years pre-implementation data were collected at each site (i.e. Pre = 2 means there were 2 years of pre-implementation data for that site); "1–3" refers to the number of years that data from the first 3 years after implementation were available, and "3+" refers to the number of years that the site had been surveyed after the management had been in place for more than 3 years.