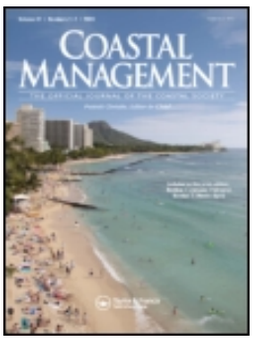

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Establishment of Community Managed Fisheries' Closures in Kenya: Early Evolution of the *Tengefu* Movement

Tim McClanahan[a], Nyawira A. Muthiga[a,b], and Caroline A. Abunge[b]

[a]Wildlife Conservation Society, Bronx, New York, USA; [b]Wildlife Conservation Society, Mombasa, Kenya

ABSTRACT

Community-based management (CBM) could be an essential tool to prevent the depletion of marine resources in the Western Indian Ocean region. In Kenya, political pressure to strengthen local governance, has led to adoption of CBM as a way of reducing over-exploitation and managing the competing uses and impacts on the marine environment. Several communities in Kenya have embraced CBM and have set aside or closed previously fished areas to enhance recovery of fisheries and biodiversity. These community fisheries closures (locally called tengefu), despite being degraded, may recover to finfish abundances and biodiversity levels similar to established MPAs or above thresholds for maintaining some ecological services. Communities see their direct involvement and control of these tengefu as more likely to result in benefits flowing directly to them. Community closures are also important for articulating and resolving community values and strengthening their management capacity. Here, we describe the evolution of the tengefu movement in Kenya and combine information from focus group discussions, interviews, underwater surveys and boundary marking to evaluate the current status, opportunities and challenges facing these tengefu. We show that in some cases community closures suffer from slow and incomplete national and local legislative processes, challenges to compliance, and weak management.

KEYWORDS

alternative income; compliance; coral reef biodiversity; social–ecological sustainability

Introduction

Management approaches for coastal resources that are vital for the livelihoods, food security, and well-being of coastal communities in the western Indian ocean (WIO) are changing from government-led top-down toward more collaborative management that are commonly called co-management approaches (Cinner et al. 2009; Wamukota, Cinner, and McClanahan 2012; Rocliffe et al. 2014). The motivation for this change was driven partly in recognition of the challenges of management, an ideological change that recognized community and stakeholder participation as essential for management of natural resources, and changes in the development agenda toward decentralizing governance to the local level (Cinner et al. 2009; Cinner et al. 2012a). Co-management of small-scale fisheries that first started in the Pacific

CONTACT Tim McClanahan tmcclanahan@wcs.org Wildlife Conservation Society, 2300 Southern Boulevard, Wildlife Conservation Society, 2300 Southern Boulevard, Bronx, NY 10460, USA.

(Bille and Mermet 2002; Johannes 2002; Alcala and Russ 2006; Govan et al. 2009; Lowry, White, and Christie 2009) has now emerged as an important and rapidly growing strategy for small-scale fisheries management in the WIO (Cinner et al. 2012b; Rocliffe et al. 2014; Cinner and McClanahan 2015).

Studies have shown that co-management of fisheries can deliver positive ecological and social outcomes (Evans, Brown, and Allison 2011; Gutierrez, Hilborn, and Defeo 2011; Cinner et al. 2012b). This is especially crucial in small-scale fisheries that comprise more than 80% of the total fish landings in developing countries (Pauly and Zeller 2016). For example, Cinner et al. (2012b) reported that co-management sustained coral reef based fisheries and improved livelihoods across five countries in the Pacific and the WIO. A global meta-analysis of the success of co-managed fisheries indicated that factors such as strong leadership, individual or community quotas, social cohesion, and marine protected areas were key attributes that enhanced effective management (Gutierrez, Hilborn, and Defeo 2011). However, studies have also shown that co-management could increase extraction and social inequalities, thus reducing the social and ecological benefits (Jentoft 2000; Béné et al. 2009; Cinner et al. 2012b).

Despite different political histories in the WIO, motivations and regulatory frameworks, co-management initiatives have proliferated under various governance arrangements. These include the Beach Management Units (BMUs) in Kenya and Tanzania, locally managed marine areas (LMMAs) in Madagascar, collaborative fisheries management areas (CFMAs) in Tanzania, and community fisheries closures (called *tengefu*) in Kenya (Cinner et al. 2012a; Rocliffe et al. 2012). Despite the popularity and rapid growth of co-management in the WIO, there remains a need to better understand the context, processes, and challenges communities face when implementing this shift from top-down to co-management (Davis and Ruddle 2012). In this article we document the evolution of co-management arrangements in Kenya focusing on the largest such movement, consisting of 13 community-led fisheries closures locally called *tengefu* (roughly translates to something that is set aside). We describe the historical and political perspective, the emergence and process of implementation, the ecological status and the opportunities, and current constraints to management of these *tengefu*. Thus, we document the practices that led to their successful establishment or failure in order to inform and guide the future effectiveness of the emerging small-scale co-management process.

Data collection and analysis

The data were collected from thirteen *tengefu* distributed along the Kenyan coastline in the districts of Kilifi, Mombasa, and Kwale (Figure 1). Data and information are from primary and secondary sources, where secondary data and information were compiled from peer-reviewed and grey literature, regulations and policy documents on co-management and small-scale fisheries, as well as records and reports filed over the years by the Wildlife Conservation Society (WCS). This information was used to construct a timeline and narrative of the historical and political context of co-management of coastal small-scale fisheries in Kenya and how this contributed to the process of establishing and managing the *tengefu*.

Ecological and socioeconomic data, mapping information, interviews, focus group discussions, and questionnaires were collected from primary sources in order to examine factors that influenced the process, the site selection, and the establishment and management of the

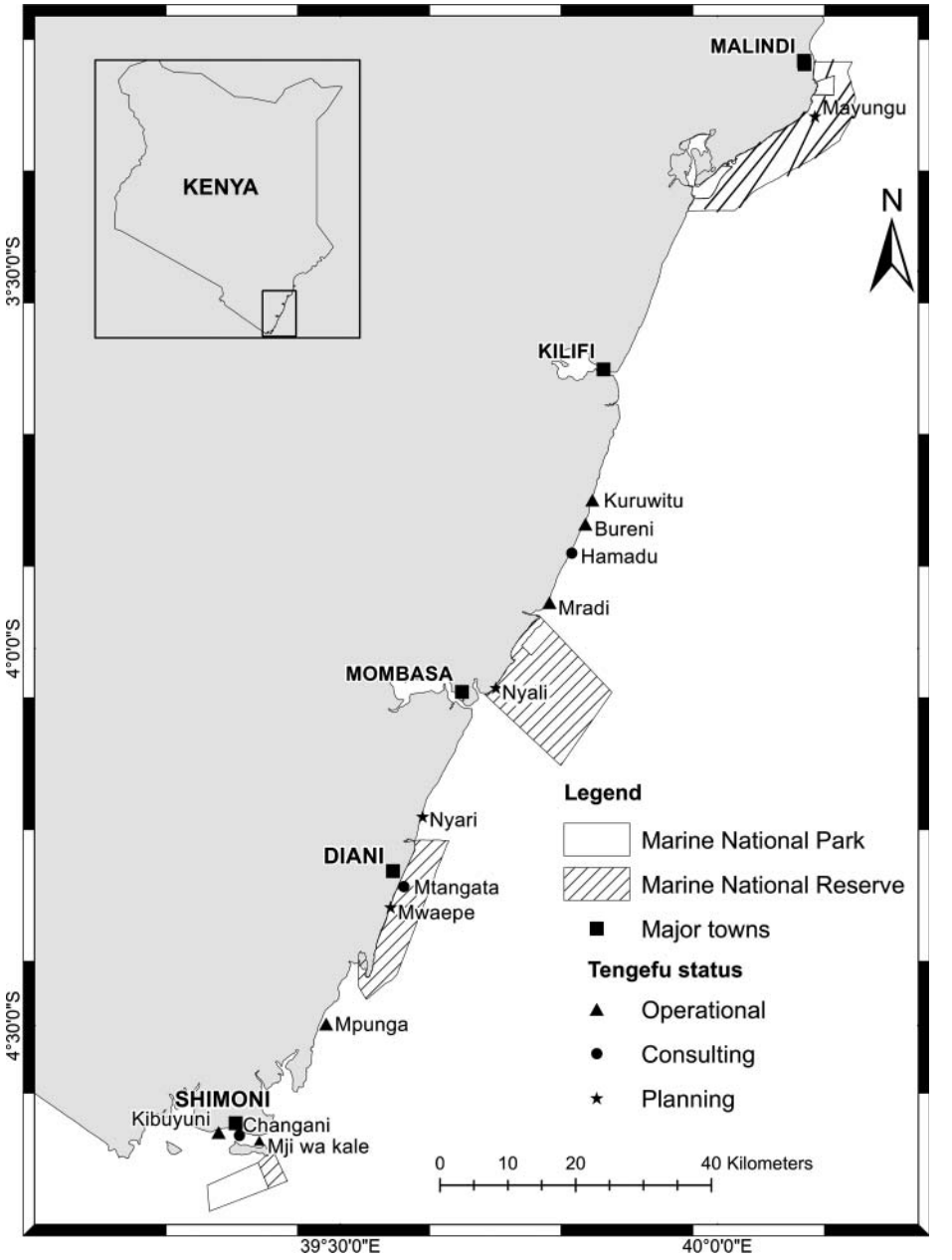

Figure 1. Map of the Kenya coast showing the location of community fisheries closures (*tengefu*) that have followed a process of formation with support from a conservation NGO (WCS). The symbols represent the different stages of formation, triangles are for *tengefu* in the planning stage, diamonds for those in the consultative stage, and stars for those in the operational stage. The location of national marine protected areas are also shown.

tengefu (Cinner and McClanahan 2015). Ecological data on coral reef condition within the *tengefus* were collated from the WCS coral reef monitoring database. These data included benthic cover that was collected using the line-intercept transect method and sea urchin density and biomass that was collected using area-based counts, while belt transects and discrete group sampling methods were used for sampling fish diversity, density, and biomass (McClanahan 2008). Socioeconomic information was collated from data that was collected using standard methods for household surveys, focus group discussions, and personal interviews described in previous papers (McClanahan, Abunge, and Cinner 2012; Cinner and McClanahan 2015).

In order to examine some of the factors influencing the pace and challenges communities faced in establishing *tengefu,* data were collected on social cohesion, conflicts within and between communities, relationships with stakeholders and with management institutions, and the proximity of *tengefu* to nationally managed marine protected area and urban areas. Social cohesion of each community was measured using a proxy—the level of agreement of fisheries closures—collated from a previous study (McClanahan, Abunge, and Cinner 2012). This was measured through a questionnaire survey where respondents ($n = 12–31$ per community depending on the size of the community) were asked to score their level of agreement with statements about management preferences for fisheries closures along a scale ranging from −2 to +2 for completely disagree to completely agree. The scaling variation within each community to this question was estimated as the coefficient of variation (COV,% = 100(SD/mean)) of the responses within the community, which may be seen as a proxy of community conflict and possibly the expected level of compliance. The presence of ongoing conflicts with other communities over fishing grounds and within communities over rule transgressions is reported on a presence/absence basis. These include onsite observation and verbal reports to WCS from key stakeholders, including Fisheries Department, other nongovernmental organizations (NGOs), landowners, and the national park service. The distance to major towns and to national parks for each *tengefu* was estimated using Goggle Earth.

Results and discussion

Historical and political perspective

Coastal management can be said to have gone through three stages in Kenya (McClanahan, Mwaguni, and Muthiga 2005a; Aswani et al. 2012; Cinner et al. 2012a). Before colonial times, and up to the 1920s, traditional informal institutions were in place to regulate resource use (Figure 2). These were upheld by community elders who played a role in granting permission for fishing and mediating conflicts about resource use (McClanahan et al. 1997; Glaesel 2000). The next period was characterized by the emerging colonial and post-colonial government, where centralized and top-down governance systems were attempted, but with a pro-exploitation policy and few government resources to enforce regulations. The result was the creation of an essentially open access fishery surrounding a few fully protected fisheries closures (marine national parks) managed by the national park service. As the main objective of the fisheries policy was to maximize catch and profits, many fishing grounds lacked effective management, which resulted in stock declines (Kaunda-Arara et al. 2003), large changes

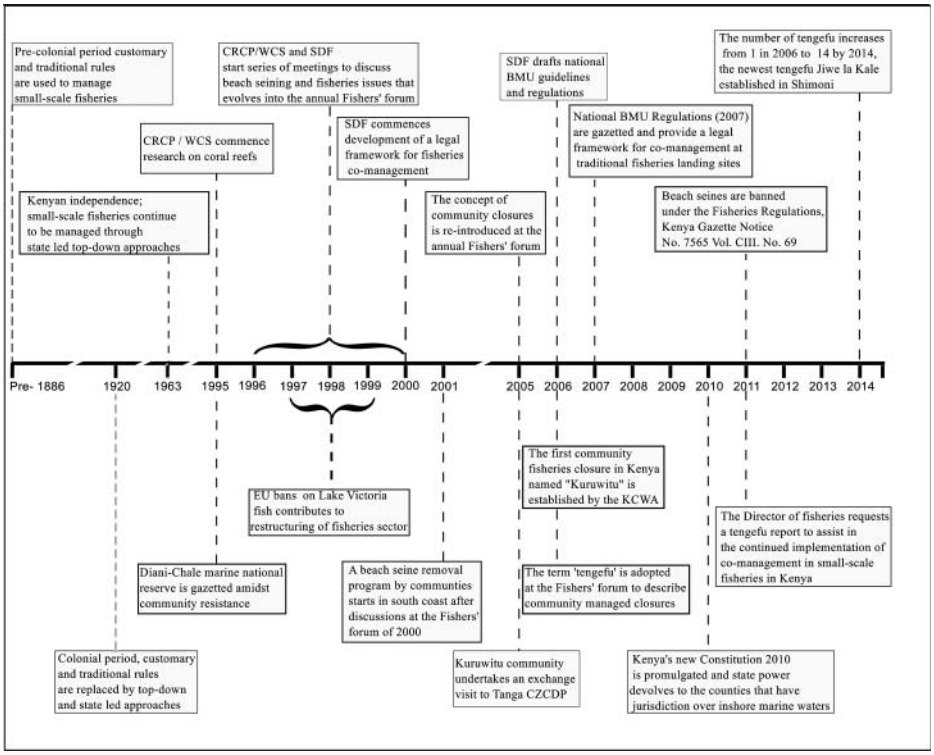

Figure 2. Timeline of important marine management events from pre-colonial to the present. Included are traditional, institutional, policy changes, and other interventions influencing the move toward the co-management of small-scale fisheries in Kenya.

in the composition of the catch (McClanahan, Hicks, and Darling 2008), and ecological changes in the coral reefs (McClanahan et al. 2011).

The third and current stage is a period of change influenced by structural adjustments in governance in Kenya and other nations in the WIO region. These changes were driven by the need for governments to implement programs that reflect development goals, such as good governance, improved efficiency, equity, and poverty reduction (Smoke 2003; Béné et al. 2009; Cinner et al. 2012a). At around the same time, collaborative management was transforming fisheries management from top-down to co-management systems globally. Although this shift first occurred across the Pacific, governments in the WIO region started instituting laws leading to the establishment of various co-management arrangements (Johannes 2002; Govan et al. 2009; Kamau, Wamukota, and Muthiga 2009; Cinner et al. 2012a).

Co-management in Kenya was first advocated in the early 1990s (Ogwang, Odende, and Okwach 2006; Ochieng 2008), and in 2007 the Ministry of Fisheries Development gazetted a law encapsulating co-management—the Fisheries (Beach Managements Units) Regulations 2007 (Government of Kenya Legal Notice 402, 2007). The legislation was advocated by the Lake Victoria Fisheries Organization as a solution to tackling the ineffectiveness of past fisheries regulations, the European Union bans on Lake Victoria fish (Gitonga, Okal, and Mutegi 2005) and the need to streamline the fishery sector, and the growing recognition throughout

the government of the importance of involving stakeholders in natural resource management (Figure 2). The legislation devolved power to a local management entity named the Beach Management Unit (BMU), which is a collective of fisher folk and other stakeholders known as the assembly, led by elected officials that form the executive committee (Ogwang, Odende, and Okwach 2006). In 2012, there were 71 proposed BMUs on the Kenyan coast geographically situated at historical landing sites and adjacent fishing grounds of local communities (Kenya Coastal Development Project 2013). The responsibilities of BMUs include management of activities at landing sites; fisheries catch data collection, enforcement of fisheries regulations within the broader national fisheries laws, and conservation of marine resources.

In tandem with the establishment of the BMU legislation and through the increased efforts of NGOs in community management approaches on the Kenyan coast, communities also started showing an interest in setting up their own community managed areas driven by the potential for improved fisheries and alternative livelihoods through ecotourism. The unfolding community management process resulted in different types of responses on the Kenyan coast including LMMAs, community conservation areas (CCAs), and *tengefu* (Maina, Osuka, and Samoilys 2011; Muthiga et al. 2011). This erosion of traditional and customary management during colonial times and the re-emergence of community involvement in the management of small-scale fisheries in the WIO followed a similar historical trajectory as reported in the Pacific (Govan et al. 2009).

Emergence period of community fisheries closures

In 1995, the Coral Reef Conservation Project (CRCP) of WCS began studying the impacts of fishing on the Kenyan coast (Figure 2). After a period of failed implementation of the Diani Marine Reserve by the national park service (Glaesel 1997; McClanahan et al. 1997), the NGO began a series of meetings between fisheries leaders and the Fisheries Department officials that became known informally as the "Fishers' Forum." The main focus of these early meetings was the presentation of catch and effort data from multiple landing sites where a declining trend in catch per unit effort (CPUE) was recorded and discussions on the causes and possible solutions to address the declines (McClanahan et al. 1997, 2008; Obura, Wanyonyi, and Mwaura 2001). The forum evolved into an annual discussion group on inshore fishing issues as well as a platform for raising awareness about coral reef conservation (Cinner et al. 2012a). Consequently, coral reef ecological monitoring data, including key indicators such as benthic cover, fish and sea urchin biomass, predation on sea urchins, and herbivory at sites with different levels of fishing ranging from no-take (marine national parks) to fully fished areas on the Kenyan coast, were also presented. During this time, WCS scientists also began collecting information by polling stakeholders about their management preferences, as a way of resolving polarized debates that sometimes emerged in the Fishers' Forum and elsewhere (McClanahan, Maina, and Davies 2005b; McClanahan et al. 2008; 2012). The annual communication of information on fish catches, ecological, and management preferences (Figure 2) helped shape debates about resource use and management options. This contributed to increased dialogue and communication between coastal stakeholders and managers and between WCS and fishing communities. Local communities also started becoming interested in establishing their own locally managed fisheries closures called *tengefu* (meaning "set aside" in Swahili).

Several other events converged to trigger increased interest in the *tengefu* management tool. The continuous feedback of fish catch and biomass data from annual monitoring had helped to create a collaborative partnership with fishers over time, which had built a certain amount of trust and raised the understanding among stakeholders on the benefits of fisheries management. Some of this trust was based on early successes where the elimination of beach seine nets at sites in the south coast of Kenya led to subsequent increases in CPUE from 2000–2004 that stabilized in 2005 (McClanahan 2010). In the early stages of the Forum's discussions, closed areas had been suggested as one of a number of potential solutions to fisheries declines. There were, however, lingering resentments from previous experiences of establishing national closures by the Kenyan government (Glaesel 1997; McClanahan et al. 1997), which led to weak support and no consensus. This was exacerbated by a general perception by fishers that these closed areas mainly benefited the government through park entrance revenue (McClanahan, Maina, and Davies 2005b). But, by outlining the various roles of closed areas and potential benefits to fishers and associated communities, these attitudes changed and created a willingness to experiment with trial closures (Cinner and McClanahan 2015).

The idea of community-based management of closures was introduced again at the Forum in 2005 and presented as a way to increase recovery of fish stocks in beach seine removal sites (Figure 2). In addition, for some communities without beach seines or small meshed net conflicts, but with a stronger conservation or pro-tourism ethic, *tengefu* were seen as an activity that could be readily implemented by these communities. The first *tengefu* established was in 2005 in an isolated but cohesive community called Kuruwitu where CRCP had a long-term monitoring site (Figure 1). This community had previously had limited experience with the national government agencies and worked mostly with NGOs including the East African Wildlife Society (EAWLS) and WCS, and local landowners who wanted to increase property value and security in the area (Harrison 2005).

At the same time, EAWLS began a coastal program that funded an exchange trip for fishers north of Mombasa to travel to a community-based program established by the International Union for Conservation of Nature (IUCN) and the Tanga local government in Tanzania. Here, the concept of CFMA had been piloted under the Tanga Coastal Zone Conservation and Development Programme starting in 1997 (Wells, Makoloweka, and Samoilys 2007). Fishers from Kuruwitu were able to observe and exchange ideas and experiences with the communities within the Tanga coastal zone management system, which included some closed areas. This trip and interactions with the conservation NGOs further inspired more Kenyan fishing communities to consider community closures. Subsequently, the name *tengefu* was adopted for community closures at the Fishers' Forum in 2006 after an elder fisher used it publicly for the first time (Figure 2). The name-change from the English-origin word *parki* to the Swahili word *tengefu* also influenced the understanding about closures and implied ownership. This created a more rapid uptake and implementation, as the name *tengefu* lacked the negative implication of post-colonial government ownership and control.

Process of formation

The process of *tengefu* formation proceeded through nine steps from initiation of interest through to monitoring. The process often began when communities approached WCS for support (Table 1). To help WCS plan the required support and to make communities aware

Table 1. The broad steps (1–9) undertaken in the process of establishing *tengefu*. The dates indicate the year a community first showed an interest in establishing a *tengefu* (1) and the year that closure was subsequently implemented (6). Steps started but not complete are denoted by NC, and steps that have been completed are denoted by a tick (√).

Steps	Mayungu	Kuruwitu*	Bureni	Hamadu	Mradi	Nyali	Nyari	Mtangata	Mwaepe	Mpunga	Changani	Kibuyuni*	Mji wa Kale
1. Community interest in setting up a tengefu	2006?	2005	2010	2013	2009	2013	2009	2009	2010	2011	2013	2008	2013
2. Stakeholder analysis	—	√	√	NC	√	NC	NC	NC	NC	√	√	√	√
3. Consultations (community and stakeholders)	—	√	√	NC	√	NC	NC	NC	NC	√	√	√	√
4. Ecological and socioeconomic surveys	NC	√	√	√	√	√	√	√	√	√	√	√	√
5. Mapping and boundary marking	—	√	√	√	√	√	√	√	√	√	√	√	√
6. Initiation of closure and management	—	2006	2014	—	2011	—	2009	2009	—	2014	2013	2010	2014
7. Feedback at Annual Fishers' Forum	√	√	√	√	√	√	√	√	√	√	√	√	√
8. Management guidelines		√	√		√	—	—	—	—	√		√	√
9. Monitoring	NC	√	√	√	√	√	√	√	√	√	√	√	√

of an ongoing process toward stated goals, the *tengefu* were classified into three main categories—planning, consultative, and operational. The planning phase consisted of discussions to develop a vision, goals, evaluate and map, and judge the scale of agreement and consider likely conflicts. The second consultative phase was a more intensive consultative period after community agreement had been achieved that began to address the larger participation and roles of stakeholder and ways to deal with potential rule breakers. The third operational phase started the implementation of management activities, the closure was recognized and rules respected by most fishers, and rule breaking produced a response from the community.

Tengefu formation was organic, so each phase had different characteristics and time frames and depended on prevailing conditions (Table 2). These included factors such as the cohesion of the community, conflict over the fishing grounds within and between communities over the use of different gears, and revisiting previous relationships and roles of management institutions, NGOs, and local landowners. In general, however, the initiation of the process started with discussion by communities about where to site the *tengefu*, followed by identification and discussion with potential local and national stakeholders who could assist in management. These stakeholders could support different *tengefu* management requirements, such as research, monitoring and surveillance, management, and fund raising. During this consultative period, WCS facilitated the discussions and provided profiles that consisted of ecological and socioeconomic information for the proposed *tengefu* (Muthiga et al. 2011). In general, after a community had reached full agreement on the placement of the *tengefu*, a mapping and boundary marking exercise was completed and a management entity composed of community representatives was instituted. In areas where BMUs were fully established, this committee usually included members of the BMU conservation committees.

The *tengefu* formation process reached the three stages of development at different rates (Tables 1 and 2). A number of them moved quickly through that process but at the time of this writing, four *tengefu* (Mayungu, Nyali, Nyari, and Mwaepe) ran into partner difficulties near the final stages despite identifying and mapping the area. Mayungu and Nyali ran into difficulties with the national park service that claimed authority over the areas identified for closures. Nyari had conflicts with its neighbor community over their level of involvement in the process and final decisions. Three *tengefu* (Hamadu, Mtangata, and Changani) had identified the site and undertaken evaluations and mapping but the consultative phase was slow due to unclear relationships and roles of their stakeholders. Seven *tengefu* (Kuruwitu, Bureni, Kanamai, Mradi, Mpunga, Kibuyuni, and Mji wa Kale) went through the whole process and restricted fishing with various levels of compliance but with evidence that rules were being enforced.

Several factors may have influenced the pace and challenges communities faced in establishing *tengefu* including social cohesion, economic incentives, conflicts within and between communities, relationships with stakeholders and with management institutions (Table 2). On average, the level of intra-community agreement of closures was positively associated with the stage of development. Table 2 shows that the lowest intra-community agreement was reported by *tengefu* that were still in the planning stage. Within community variation did not differ between *tengefu* in the consultation and operational stages and they were more than twice as high as those in the planning stage. Conflict between communities over fishing grounds and within communities over gears did not clearly have an association with

Table 2. Factors affecting the duration and establishment of *tengefu*.

Factors affecting duration of consultation and establishment of tengefu		Planning				Consultation					Operational		
Stage of development	Nyali	Mwaepe	Mayungu	Nyari	Mtangata	Changani	Hamadu	Kuruwitu*	Mradi	Mpunga	Mji wa Kale	Bureni	Kibuyuni*
1. Length of time (years) from planning to the operational stage of development	2	4	10	5	5	1	1	9	9	3	3	4	6
2. Level of agreement	−1.7	−0.6	0.9	1.5	−1.4	1.2	1.3	0.9	0.9	1.0	1.1	1.8	2.0
3. Within community variation, COV%	66	326	207	64	97	124	97	167	206	74	144	37	0.0
4. Conflict with other communities	—	√	—	√	—	√	√	—	—	—	√	√	√
5. Conflict within communities over gear use	√	—	—	—	—	—	√	—	—	—	—		√
6. Relationship with fisheries department	—	—	—	√	—	—	√	√	√	√	√	√	√
7. Relationship with national park service	√	—	—	—	—	—	—	√	—	—	—	—	—
8. Relationship with NGOs	—	—	—	√	√	√	√	√	√	√	√	√	√
9. Relationship with landowners	—	—	—	√	—	—	—	√	—	√	—	√	—

The communities are grouped into three categories: planning, consultation, and operational stages and the variables associated with each community are shown. The level of agreement (1) about closures as a management option was estimated on a scale of −2 to +2 (from strongly disagreed, disagreed somewhat, were neutral, agreed somewhat, or strongly agreed) and within community variation (2) was estimated as the standard deviation divided by the mean level of agreement (*100). The ticks (√) denote the presence and the dash (—) denotes the absence of conflict (4–5) or relationships (6–9).

the stage of development but the presence of a relationship with NGOs, landowners, and fisheries department was mainly associated with those *tengefu* that were operational.

The early consultation phase was typically prolonged and could take six to eight months. The challenge was usually to harmonize the various perspectives of the key stakeholders. Nevertheless, allowing this process to proceed at its own pace was crucial since the success of the consultation depended on understanding, joint decision-making and consensus by all the primary stakeholders. For example, the consultation process was notably challenging in areas where several communities shared fishing grounds. The Hamadu, Bureni, Nyari, and Mji a Kale *tengefus* all experienced conflicts where adjacent community problems slowed down decisions on the placement and implementation of the *tengefu*. In the case of Bureni and Mji wa Kale, consultations mediated by the fisheries department and WCS eventually led to resolutions and establishment. In other cases, for example at Mtangata and Mwaepe, conflict with migrant or vagile fishers, continued to slow down the process.

Socioeconomic characteristics, location, and size of tengefu

The socioeconomic characteristics of fishers in communities with established *tengefu* were similar to fishers elsewhere (Table 3). Fishers were on average 39.5 years of age, had six years of education, an average household biweekly expenditure of $62 USD and had 2.7 jobs per household. These socioeconomic characteristics are common for fishing communities along the Kenyan coast (Cinner and McClanahan 2006; McClanahan, Abunge, and Cinner 2012). Mtangata had the oldest and least educated respondents that also reported having fished for the most years. Respondents from Bureni were the youngest, had the highest level of education and had the least number of years spent as fishers.

Communities chose closures that ranged from 5 ha to 85 ha (Table 4) located along the southern Kenya fringing reef where most of the traditional fishing grounds occur (Figure 1). The size of the fishing grounds averaged 252 ha and the *tengefu* averaged 25.3 ha and were approximately 12% of the respective fishing grounds. The size of the selected *tengefu* did not depend on the size of the fishing grounds (Table 4). For example, although the smallest

Table 3. Summary of socioeconomic characteristics of respondents from fishing grounds with *tengefu*. Mean (± SEM) of respondents age, level of education, biweekly expenditure, years in the fishing occupation, number of jobs per household and the number of years resident in the village.

Tengefu/ location	Respondents (n)	Age of respondent	Level of education (yrs)	Biweekly expenditure (USD)	Residency (yrs)	Household occupation (n)	Years fishing
Mayungu	18	41 ± 2.8	5.5 ± 0.9	77.8 ± 6.6	36.7 ± 3.4	2.1 ± 0.2	14.9 ± 2.6
Kuruwitu	31	34.9 ± 1.4	7.9 ± 0.8	52.3 ± 3	34.3 ± 2.1	2.5 ± 0.2	15.7 ± 2.7
Bureni	22	33.6 ± 1.7	8.4 ± 0.5	51 ± 3.2	33.7 ± 1.7	2.1 ± 0.1	10.6 ± 1.4
Hamadu	28	37.8 ± 2.8	6.4 ± 0.8	63.7 ± 10.1	31.9 ± 3.8	2.7 ± 0.4	15.8 ± 2.9
Mradi	11	38.5 ± 3.0	6.1 ± 1.1	52.9 ± 3.4	35.9 ± 4.5	2.5 ± 0.2	15.5 ± 2.2
Nyali	13	49.3 ± 3.4	3.9 ± 0.9	71.5 ± 6.1	39.4 ± 4.2	2.2 ± 0.2	24.8 ± 3.8
Nyari	26	35.1 ± 2	6.7 ± 0.5	56.2 ± 4.3	34.3 ± 2.3	2.5 ± 0.2	12.2 ± 1.9
Mtangata	12	51.3 ± 4.3	3.2 ± 1.2	56.3 ± 5.5	40 ± 7.9	2.3 ± 0.3	31 ± 4
Mwaepe	20	45.6 ± 3.3	4.6 ± 1	57.9 ± 3.4	42.8 ± 4.3	2.7 ± 0.2	20.4 ± 3
Mpunga	26	37.6 ± 1.9	6.8 ± 0.5	75.4 ± 5.5	37.6 ± 1.9	5.3 ± 0.6	15.7 ± 1.7
Changani	18	36.3 ± 3.9	8.2 ± 1.3	61.3 ± 6.5	26.1 ± 5.2	2.2 ± 0.3	13.7 ± 3.4
Kibuyuni	22	37 ± 2.7	5.8 ± 0.8	59.2 ± 4.3	35.7 ± 2.5	2.8 ± 0.2	16.5 ± 2.1
Mji wa kale	14	47.6 ± 5	5.1 ± 1.2	81.8 ± 6.6	45.7 ± 5.8	2.7 ± 0.3	27.9 ± 5.3

Table 4. The estimated size (ha) of *tengefu*, the fishing ground size (ha), the size (%) of the *tengefu* relative to the fishing ground, the depth (m), the distance from shore (km), the distance to a major town ([a]Mombasa, [b]Diani, [c]Shimoni) and distance to a national marine protected area ([a]Mombasa, [b]Diani-Chale, [c]Kisite-Mpunguti).

Tengefu name	Size (ha)	Fishing ground (ha)	Tengefu area (%), ha	Depth (m)	Distance from shore (km)	Distance to a major town (km)	Distance to a national MPA (km)
Kuruwitu	29	140	20.71	1	0.02	34.2[a]	18.9[a]
Bureni	5.2	90	5.6	1.5	0.01	30.9[a]	15.4[a]
Mradi	22	310	7.10	3	0.05	19.9[a]	4.1[a]
Nyari	13	290	3.45	1	0.06	8.0[b]	3.5[b]
Mtangata	11.8	421	2.80	2	0.5	2.3[b]	0[b]
Mwaepe	85	263	32.3	4	0.01	6.7[b]	0[b]
Mpunga	46			4	0.65	19.3[c]	7.4[b]
Changani	11			2	0.15	2.0[c]	3.4[c]
Kibuyuni	27.5			2	0.07	5.3[c]	6.5[c]
Mji wa kale	2.54			2	0.2	1.9[c]	1.8[c]

tengefu, Bureni, had the smallest sized fishing grounds, the largest Mwaepe had an average sized fishing ground, while Kuruwitu set aside 20% of their fishing grounds, which was half the average size of the *tengefu*. The selected *tengefu* areas were mostly close to shore and in front of landing sites with depths of between 1 and 5 meters (Table 4). The proximity of most *tengefu* to shore gave the communities easy access for the monitoring and surveillance activities of their fishing grounds. Additionally, this proximity provided communities with opportunities to undertake tourism activities, such as snorkeling trips. The *tengefu* at Kuruwitu, Mradi and Mpunga each had an engine-powered boat while other *tengefu* use traditional dugout canoes and sailboats to take tourists for sailing and snorkel trips.

Selection Process of the Closure Sites and Ecological Attributes

The decision of where to site the *tengefu* was primarily made by the communities, although WCS provided recommendations on criteria to use when selecting sites. These included the degraded state of the fishery as measured by the finfish biomass, the potential for attracting tourists as measured by coral cover and other reef health attributes, and resilience to climate disturbances as measured by bleaching indices and other environmental parameters (Maina et al. 2008; McClanahan et al. 2014). These criteria took into account ecological attributes such as the potential to provide recovery of the fishery and coral reefs and act as finfish recruitment areas, and also the potential for the development of alternative livelihoods through ecotourism. It was expected that these ecological and socioeconomic attributes would provide sufficient motivation for the communities to maintain permanent closures.

A comparison of the coral cover and finfish biomass data collected at these sites indicated that the selected *tengefu* generally met the attributes described above. The *tengefu* had favorable ecological and tourism values, with relatively high coral cover (~38% higher; Figure 3a) but on average lower fish biomass (~80% lower; Figure 3b) compared to the Mombasa marine national park that has been protected as a no-take area since 1991 (Muthiga 2006). In Kuruwitu, the oldest *tengefu*, finfish and sea urchin biomass were measured for fourteen years prior to the closure and finfish showed a rapid increase after closure for six years after closure (Figure 4). Nonetheless, the lack of a significant change in sea urchin biomass

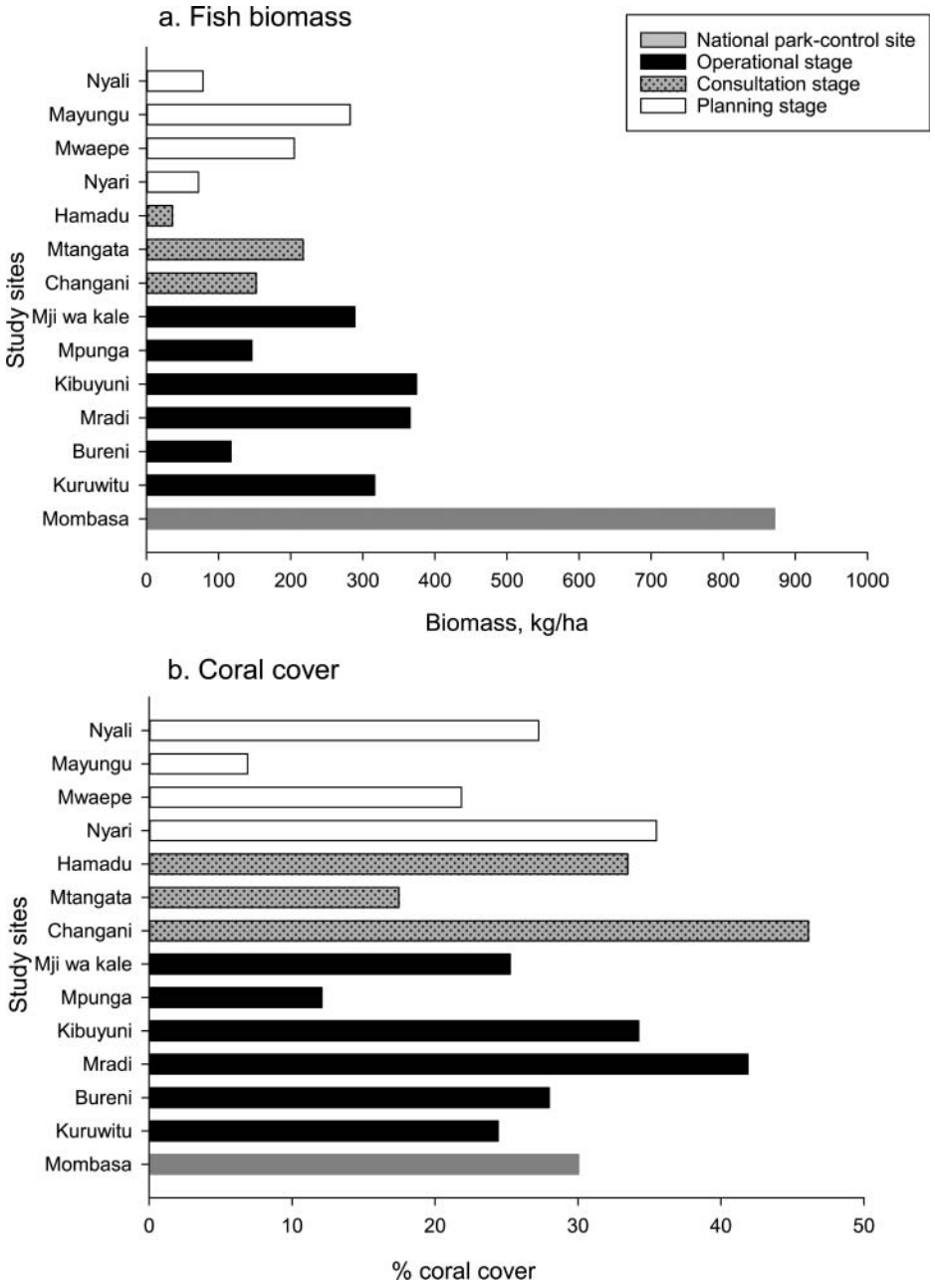

Figure 3. (a) Comparison of coral cover (%) and (b) the biomass (kg/ha) of finfish in community fisheries closures (*tengefu*) compared to the Mombasa Marine National Park, a fully protected marine protected area. The bars represent the stage of formation of the *tengefu*, the black bars represent the operational *tengefu*, the hatched bars represent those in the consultative stage, and the open bars represent those in the planning stage.

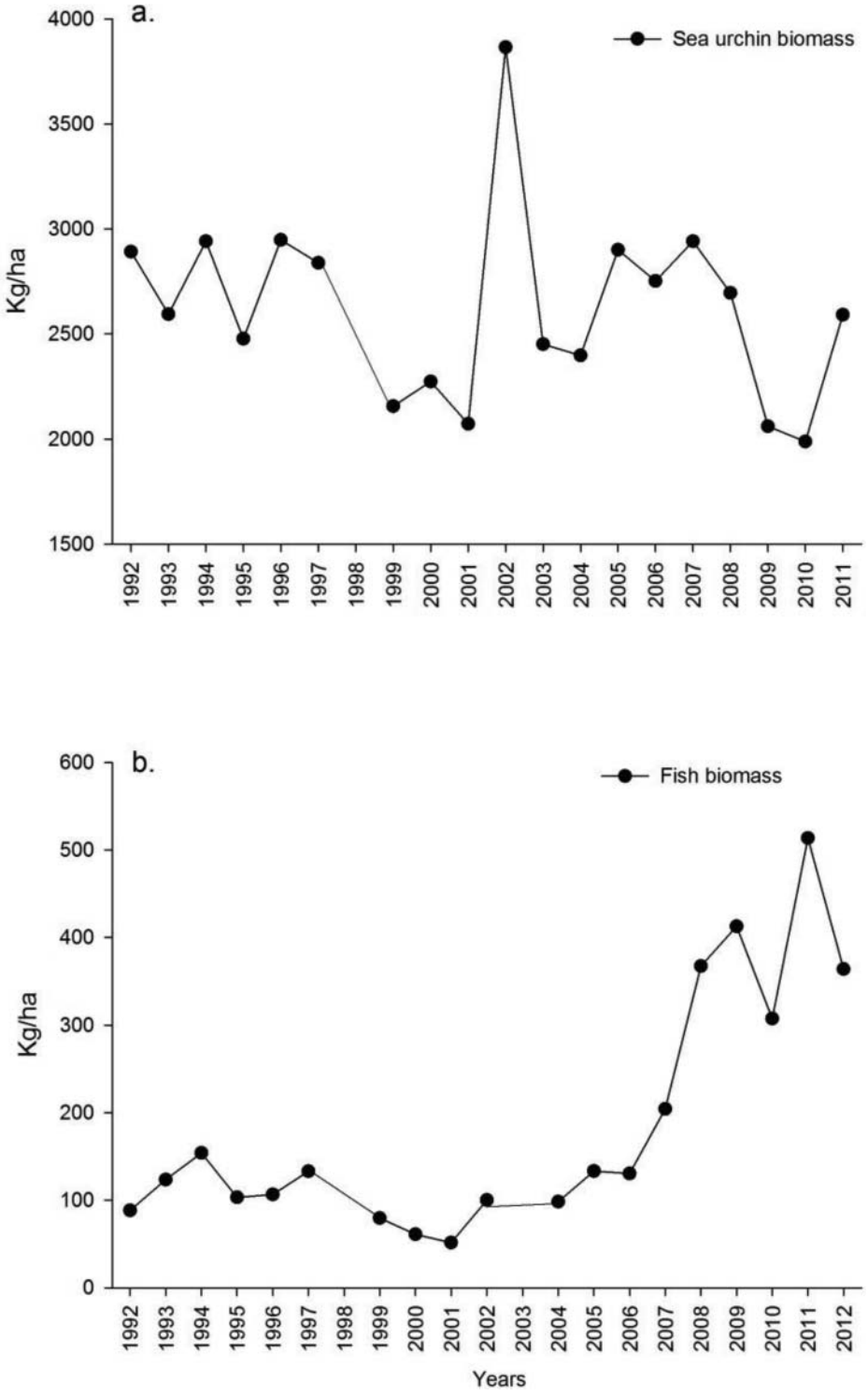

Figure 4. Changes in finfish (kg/ha) and sea urchin biomass (kg/ha) in the oldest community fisheries closure of Kuruwitu. This *tengefu* was surveyed for 14 years prior to the closure.

suggests that the full recovery of key sea urchin predators had not occurred by the end of the study (McClanahan 2000).

Management of the closures

Although community managed terrestrial areas have existed in Kenya through community conservancies, only recently with the institutionalization of the BMU regulations has it been possible for coastal areas. Under this regulation, communities are empowered to institute their own resource use laws and regulations within the limits of the national laws, and to incorporate these into a co-management plan and BMU bylaws. These BMU rules and regulations upon approval by the director of Fisheries can then be enforced. The process of coming up with co-management plans requires technical expertise and is usually fairly lengthy; most of the fisher communities lack the capacity to complete this process if not provided with sustained support. So far, only the Kuruwitu community has begun the process of establishing a co-management area and respective plan. The next phase of the support is to facilitate the *tengefu* from the operational stage toward a process of establishing co-management plans. This will require incorporating the *tengefu* within the co-management framework of the BMUs and to train communities in adaptive management. Meanwhile, *tengefu* communities undertake some basic management activities including monitoring fisheries, coral reef ecology, socioeconomic assessments (with supervision of WCS), and surveillance.

Opportunities and constraints

The Kenya government through the BMU regulations of the Fisheries Act now broadly backs co-management and locally established and managed marine closures. However, there is still a need to develop a systematic and approved process of ensuring that *tengefu* and other community- based management initiatives follow a systematic and harmonized process that incorporates these closures into BMU bylaws and co-management plans. Although there are national guidelines for the management of BMUs (Ogwang, Odende, and Okwach 2006), these fail to incorporate the concepts of adaptive management and some of the other institutional design principles that influence effective management of common-pool resources (Ostrom 1990; Pomeroy, Katon, and Harkes 2001; Berkes 2007).

Nonetheless, some progress has been made to firmly establishment *tengefu* as a robust social institution. At the time of writing, Fisheries Department officials had informally endorsed *tengefu* through statements made by the director of Fisheries at the Fishers' Forums in 2011 (Beja 2011). The Fisheries Department subsequently requested a technical report on *tengefu*, their geographical locations and status of management from WCS (2012) in order to integrate and harmonize *tengefu* into the national BMU process. In addition, the department mediated meetings in areas where community agreement on location of *tengefu* had broken down. For *tengefu* to be incorporated within BMU bylaws, however, the BMUs have to be registered and have an active assembly. Since not all *tengefu* exist within registered BMUs, registration of these BMUs will have to be undertaken prior to the process of co-management planning and incorporation into the bylaws. The link to the BMU legislation is crucial, as this is currently the only legal mechanism that allows communities to report non-compliance of fishing rules to authorities and to prosecute offenders. Nevertheless, some offenses and penalties have been initiated and enforced by the community through the

district police and courts, which suggests a broader civil appreciation for the *tengefu* management system, rather than just a concern of fisheries leaders, NGOs, and Fisheries Department.

As fishers learned more about the benefits of *tengefu* from monitoring results presented during Fishers' Forums, the interest in establishing *tengefu* increased and attitudes toward closures improved (Cinner and McClanahan 2015). For example, a questionnaire deployed during the Fishers' Forum of 2013 designed to evaluate the management measures that BMU's were willing to implement showed that out of 20 BMUs, 14 indicated an interest in establishing *tengefu* within their fishing grounds. In addition, the pace at which communities moved from showing an interest to establishing *tengefu* increased, the older *tengefu* (Kuruwitu and Mradi) took an average of 9 years while the newest tengefu (Mpunga, Mji wa Kale and Bureni) took around 3 years. This could partly be due to learning from the experiences of the older *tengefu*— Kuruwitu leaders were, for example, provided a platform to share about their experiences in the 2011 to 2013 Fishers' Forums. This shared local knowledge combined with the support of government institutions and NGOs that see *tengefu* as a viable management option should continue to facilitate the speed of establishment (Table 2). In addition, as fish biomass increases, ecological changes such as increased herbivory and predation could provide additional ecological benefits (McClanahan et al. 2011; Humphries et al. 2014). The tengefu movement therefore has the potential not only to contribute to the national commitment toward co-management, but also international obligations such as the Convention on Biological Diversity and the Ramsar convention.

Despite the rapid adoption of co-management and the efforts of government institutions, donors, and NGOs in support of co-management, there remains confusion on the part of communities about how co-management works in practice. Moreover, much of the training on co-management is focused on the national legislation and policies with little emphasis on the broader context of co-management, adaptive management, and the potential benefits of this system of governance. A training program designed to build skills in adaptively managing the resource and users within co-managed areas will be an important component for future progress.

In the future, political changes in Kenya may also affect the *tengefu* and BMU movements in ways that are not yet apparent. A new constitution was promulgated in Kenya in August 2010, which initiated a process of territorial decentralization of powers from central to county levels. Responsibility for management of fisheries resources is now apportioned out so that the national government through the State Department of Fisheries will be responsible for offshore waters while the county governments will be responsible for management of the inshore waters within their jurisdiction. The marine national parks and reserves will remain under the jurisdiction of the national park service since national parks and reserves are managed under the Wildlife Conservation and Management legislation. There will be a period of learning and adjusting to the new arrangements and it is not clear exactly how management responsibilities will be partitioned and implemented on the ground.

The BMUs and *tengefu* are likely to be one of the early testing grounds for this new system for managing marine resources. If the county governments adopt the system of performance contracting that the national government institutionalized in 2003 (Kobia and Mohammed 2006), the process of decentralized management may occur more smoothly and transparently. Performance contracting requires all government entities to sign a yearly

contract with the government that includes a work plan and detailed activities that ensure institutions meet their mandates and provide services in an efficient and effective manner. Hence, performance contracting at the county level could result in more sensitivity to stakeholders' needs and more opportunity for stakeholders to influence policy and actions, as a result of the annual evaluations of service delivery by county departments. In addition, small but constant trends in collaborative efforts, such as the annual Fishers' Forum, Environment Days, the BMU sensitization process, the development of the key national policies, such as the Oceans and Fisheries Policy among others, could also generate invaluable lessons for management.

Conclusions

Multiple coalescing events in Kenya are creating a window of opportunity to transition to new forms of marine co-management and governance. The emergence and learning periods for *tengefu* is evolving into a system that has a potential to become more stable and robust, and one that is able to deal effectively with the perpetual common-pool resource challenges. Nevertheless, emergence and firm establishment of the *tengefu* system will depend on a number of external influences. These include difficult-to-predict problems such as insecurity from terrorism, increasing fuel prices that could reduce revenues from tourism, climate change effects on coral reefs and fish communities, and waning social cohesion associated with urbanization. In addition, the ability for local government and communities to bear the financial obligation of *tengefu* management prior to receiving benefits could constrain their implementation (Davis and Ruddle 2012; Sala et al. 2013). For this reason, many believe that communities will likely need alternative livelihoods to support losses of income during potential lags in access to fisheries resources. Mechanisms for dealing with infringements by cynical or uninformed community members and outsiders will be increasingly necessary as fish biomass increases inside closures create greater incentives for breaching rules. A related challenge will be the need for inexpensive and effective monitoring systems for both enforcement and monitoring socioecological attributes that keep closures effective and attractive to tourists. Finally, communities can be naïve about the ability of neighbors and outsiders to undermine local rules, which requires co-management mechanism that can respond to outside forces. Organizations, such as conservation NGOs, have often taken on these conceptual and training roles—including training fishers in social evaluations and ecological research methods—but the ability of fishers and community members to analyze the data and provide quality feedback will remain a challenge. Despite these challenges, the movement is exciting a number of stakeholders, including communities, scientists and the tourism industry and this intrigue may form a basis for sharing costs and contribute to future successes.

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