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To cite this article: Anna Louise Harker, T.A. Stojanovic, A.M Majalia, C. Jackson, S. Baya & K. Dadley Tsiganyiu (2022): Relationships between Livelihoods, Well-Being, and Marine Protected Areas: Evidence from a Community Survey, Watamu Marine National Park and Reserve, Kenya, Coastal Management, DOI: [10.1080/08920753.2022.2126266](https://doi.org/10.1080/08920753.2022.2126266)

To link to this article: <https://doi.org/10.1080/08920753.2022.2126266>



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# Relationships between Livelihoods, Well-Being, and Marine Protected Areas: Evidence from a Community Survey, Watamu Marine National Park and Reserve, Kenya

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## ABSTRACT

At a time of massive expansion of Marine Protected Areas, there is a need to learn more about their sustainability and success. This study draws on a framework which operationalizes three-dimensions of well-being: material, relational, and subjective, in order to measure the range of benefits and disbenefits experienced by local communities from protected areas. 308 respondents from two coastal Kenyan villages adjacent to the Watamu Marine National Reserve participated in a telephone survey in June and July 2020. The study recorded varying levels of dependency on the marine environment for the livelihoods of residents. A key finding of this study was that benefits reported by participants consistently exceeded disbenefits. A principal components analysis identified that the *number* of benefits and disbenefits experienced explained the most variance within the dataset. The benefits and disbenefits reported contributed to each dimension of human well-being. The highest ranked benefits reported contributed to subjective well-being ('better health', and 'ability to enjoy a clean and healthy creek and ocean'), and the most frequently reported disbenefits related to relational and material well-being (for instance 'increased conflict and social tension' 'increased poverty', 'fewer supplies of food'). Practical local conservation efforts can address relational disbenefits through better partnership working, and material disbenefits by supporting pro-conservation, alternative livelihoods. The findings demonstrate the relevance of understanding social trends for marine protected area governance and management. The paper offers insights into how fundamental relations between protected marine environments, livelihoods, and well-being may affect the perceptions and success of conservation initiatives amongst local communities.

## KEYWORDS

Conservation; governance; protected areas; well-being

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 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/08920753.2022.2126266>.

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## Introduction

### *Social dimension of marine protected areas*

Marine protected areas (MPAs) are commonly promoted as “win-win” solutions, which both can and should produce benefits for both the environment and local communities (Bennett and Dearden 2014a). Covering 8.13% (29,452,489 sq. km) of the world’s ocean (UNEP-WCMC and IUCN 2022), with many located in coastal areas, challenges exist around their successful governance and management. Whilst positive outcomes for local communities have been recorded from MPAs, their adverse consequences are often experienced asymmetrically around questions of power, governance, management, and social justice (Arjunan et al. 2006; Bennett and Dearden 2014a). Understanding social impacts arising from conservation initiatives is fundamental because this ensures that biodiversity conservation identifies opportunities to enhance positive relationships between ecosystems, local communities and human well-being. In the global south livelihoods, are often referenced as a key consideration in the development of MPA networks (Lowry et al. 2009) as they provide important assets and capabilities for people to meet their basic needs (see section 1.3). Wellbeing is also reflected in criteria from international initiatives such as CBD, IPBES, and IUCN (CBD Secretariat 2018; Coulthard, McGregor, and White 2018). Furthermore, the CBD’s 14th Aichi Target aims for ecosystems which provide services to health, livelihoods and well-being to be protected and restored (CBD Secretariat 2018).

Recent decades have seen an increase in studies examining social impacts of MPAs on local communities. Positive outcomes include benefits from spillover effects into surrounding waters, tourism development, and alternative livelihoods generation (Bennett and Dearden 2014a; Bryce et al. 2016; Gill et al. 2019; Voyer, Gladstone, and Goodall 2014), whilst adverse impacts from MPAs on local communities in biodiversity-rich areas often relate to restrictions on livelihood activities, resource rights reallocations, and social conflicts (Adams et al. 2004; Bennett and Dearden 2014a; Chan et al. 2019; Mascia and Claus 2009). Both beneficial and adverse impacts affect the resilience and well-being of local communities. Hence, management and governance of MPAs needs to engage with community voices in order to ensure long-term support and successful outcomes (Fox et al. 2014; Jim and Xu 2002; Mizrahi et al. 2019; Nunan et al. 2018; Sodhi et al. 2010; Spenceley 2005; Voyer, Gladstone, and Goodall 2014). More specifically in Kenya and the Western Indian Ocean, empirical research has noted challenges of Marine Protected Area implementation, linked to low staff-community interaction and communication, leadership challenges, and social conflict (O’Leary et al. 2020). Concerning social conflict, both benefits and disbenefits have been shown to arise from MPAs for resource users such as fishers (Cinner et al. 2014) with the range of benefits not evenly spread amongst coastal communities, with increased donor support only arising for some (Mahajan and Daw 2016).

This article presents the methodology and findings from a telephone questionnaire undertaken in coastal Kenya in 2020. The study focused on Watamu Marine National Park and Reserve (WMNPR) gazetted as a protected area in 1968 and as a UNESCO biosphere reserve in 1979 (Cowburn et al. 2018; Muthiga 2009; Tuda and Omar 2012), which protects the coral reef offshore of the town of Watamu and nearby

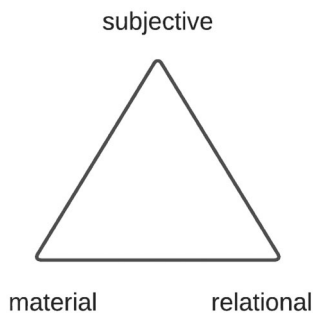
Mida Creek. The MPA faces a range of challenges (see section 2.1 for further context).

Given the length of time since designation, this provides an opportunity to examine long-term links between the protected areas and local communities' livelihoods and human well-being. The study is based on an understanding of livelihoods as the assets and activities which make up an individual's or household's living (Ellis 2010), and of well-being as the "state of being with others which arises where human needs are met, where individuals and groups can act meaningfully to pursue their goals, and where they are satisfied with their way of life" (McGregor, Camfield, and Coulthard 2015, 2).

The article begins by situating the research in the wider field of social impacts literature.

### ***Social impacts: well-being***

Without a universally accepted definition, human well-being has emerged as a key synthetic measure of quality of life, and has been conceptualized in multiple frameworks (e.g., Bottrill et al. 2014; Coulthard, McGregor, and White 2018; McGregor, Camfield, and Coulthard 2015; Milner-Gulland et al. 2014; Pullin et al. 2013, Wali et al. 2017; Woodhouse et al. 2015). Arguments for well-being to be considered as an outcome measure in marine protected area governance and management have centered upon its inclusive approach in comparison to other socio-economic measures, particularly economic activity, and the potential to measure human illbeing arising as a result of the initiatives (Rasheed 2020; White, 2010). In this study we used the terms benefits (good things)/disbenefits (bad things) to characterize the products of interactions between people and nature which contribute to well-being (Rendón et al. 2019) in contrast to the terminology of 'costs' which focuses on material wellbeing, or 'contributions' which suggests only a positive dimension. A number of conceptualizations recognize that well-being is multidimensional, incorporating facets such as societal traditions and beliefs (Wali et al. 2017), psychological health and social cohesion (Bottrill et al. 2014), security and freedom of choice (Woodhouse et al. 2015), and identity and personal perceptions of quality of life (Chan et al. 2019). These recognize that well-being is more than one's material standard of life, and incorporates both "the good life", as well as "living a good life" (White 2010, 160). The three-dimensional, social well-being framework developed by the UK ESRC Research Group on Wellbeing in Developing Countries (White 2010) presents a holistic and comprehensive conceptualization. The framework comprises three dimensions (Figure 1): material well-being, referring to physical human needs such as food, income, shelter, and vital services; relational well-being, including personal and social relations; and subjective well-being, understood as personal perceptions of life (McGregor, Camfield, Coulthard 2015). This "3D" conceptualization recognizes the significance of inter- and intra-personal differences in well-being, and manifests that ignoring social differences can lead to increased injustices toward the poor and vulnerable (Coulthard, McGregor, and White 2018; Milner-Gulland et al. 2014).



**Figure 1.** Social well-being dimensions (after White 2010, 126).

Over the last decade, the literature has highlighted the productiveness of considering well-being within marine protected area governance. Bavinck and Vivekanandan (2011) demonstrate how social heterogeneity and fragmented governance efforts within a south Indian MPA have led to resource conflicts with impacts on human well-being. Different social groups had contrasting and competing aspirations, and the restrictions imposed by a new MPA on the regional fishery did not engage with, but rather magnified, the conflict of these differing perceptions- conflicts which affect both the identity and relational well-being of those involved arise. To counteract this, Bavinck and Vivekanandan (2011) argue that reducing conflicts in MPAs is vital to promote and maintain human well-being, rather than superimposing MPAs onto preexisting conflicts and governance issues. Additionally, Chan et al. (2019) in a study on Jamaican fishers' and Peterson and Stead (2011) in communities on the island of Rodrigues (Western Indian Ocean) argue that alternative livelihoods may fail to replace ecosystem-based cultural heritage which can be lost if conservation initiatives restrict traditional livelihoods such as fishing, particularly where subjective well-being facets such as life satisfaction and self-identity are closely bound to practicing livelihoods in particular ecosystems. More encouragingly, Garcia Rodrigues et al. (2022) report consistently positive subjective wellbeing arising from non-material contributions of MPAs, based on a large-scale survey of a Portuguese MPA. By expanding the view of well-being from material conditions of life to include relational and subjective dimensions, social well-being offers a broader conceptualization to examine relationships between marine conservation initiatives and human well-being. Incorporating both well- and ill-being, as well as measures of the interactions between humans and the environment (Milner-Gulland et al. 2014), therefore provides an effective lens to examine conservation initiatives' impacts on different communities.

### ***Social impacts: livelihoods***

The concept of livelihoods provides a broader conception than employment of how people secure survival and a good standard of living, and the diverse means they draw upon to achieve this (Chambers and Conway, 1992). People's livelihood strategies in many areas of the global south, are strongly dependent on the biodiversity and ecosystems in which they live (Cao et al. 2010), and the interrelationships between poverty

alleviation and conservation have received considerable attention in the academic literature (Adams et al. 2004; Nyaupane and Poudel 2011; Ward et al. 2018). Livelihood diversification—the process where individuals or households engage in increasingly diverse assets and activities to support their living (Ellis 2010, 15)—has been promoted as a way of mitigating adverse impacts on socio-economic systems, and to reduce community and individual vulnerability (Bennett and Dearden 2014a). Some studies have focused on the effects of alternative livelihoods on fishers (e.g., Carter and Garaway 2014; Cinner, McClanahan, and Wamukota 2010; Job and Paesler 2013), however successful implementation of alternative livelihood programs also relies on positive reception by communities (Chan et al. 2019; Peterson and Stead 2011; Robinson, Albers, and Kirama 2014).

Another significant sector is tourism, which has been explored in relation to several MPAs (e.g., Bennett and Dearden 2014b; Job and Paesler 2013; Nyaupane and Poudel 2011; Samaniego and Rebanco 2019). Tourism's potential to provide alternative livelihoods and reduce resource-dependency (Bennett and Dearden 2014b; Nyaupane and Poudel 2011), has been noted to positively affect local communities' views of MPAs even where restrictions to fishing have led to reduced catches and fewer traditional livelihood opportunities (Samaniego and Rebanco 2019). In addition, together with other conservation related activities, it can enable skills development, result in higher incomes, provide leadership training and encourage the development of small-scale enterprises, which can further increase community empowerment and resilience (Nyaupane and Poudel 2011). Nevertheless, despite the potential benefits, over-reliance on tourism can reduce a community's ability to deal with shocks and crises (Job and Paesler 2013). Job and Paesler (2013) argue that over-dependence on single livelihood activities, particularly where changes to tourism-based livelihoods lead to loss of the ability to revert to previous subsistence-based livelihoods, may reduce individual and community resilience. When external shocks hit the tourism industry—for example in this case the post election violence in Kenya in 2017 and COVID-19 Pandemic, resulting impacts on both livelihoods and human well-being have been significant (MTW (Ministry of Tourism and Wildlife, Republic of Kenya) 2020). Alternative livelihood programs must therefore provide multiple opportunities, promote human well-being through social identity, heritage, and occupational pride, and meet the physical and financial needs in order to be sustainable (Kamat and Kinshella 2018).

### ***Gaps in knowledge: whose well-being, which livelihoods?***

Frequently, debates in the well-being and livelihoods literature concern the level at which concepts should be operationalized. Whilst top-down approaches are still more common than bottom-up (McGregor, Camfield, and Coulthard 2015), and universal conceptualizations are important to enable comparisons across different places, times, and studies (Milner-Gulland et al. 2014), it is recognized that conceptualizations also need to have local relevance (Woodhouse et al. 2015). To this effect, Woodhouse et al. (2015) argue that when external ideas of what constitutes well-being are imposed on a community, local perceptions and experiences risk

being overlooked, and potential impacts of conservation interventions misunderstood.

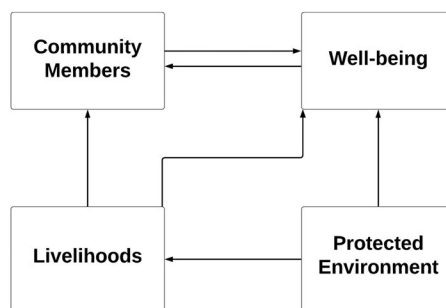
The knowledge base on social impacts of conservation on local communities is still limited (Mizrahi et al. 2019). Due to their dependency on the marine environment, fishers are strongly represented in the literature on MPA impacts on well-being and livelihoods (Musembi et al. 2019), but knowledge gaps exist of how impacts vary across different socio-economic demographics within communities. Impacts particularly across gender, age, education, and ethnicity, are important considerations in order to understand and mitigate risks posed by tradeoffs and disbenefits from conservation initiatives on the poor and vulnerable, and greater attention is needed on this in the literature on well-being and livelihood activities (Badola, Barthwal, and Hussain 2012; Daw et al. 2015; Gill et al. 2019; Woodhouse et al. 2015).

To address this, the present study seeks to understand the varying impacts of WMNPR on people of different socio-economic backgrounds in two villages, Uyombo and Mida, and to understand the relationships between marine conservation initiatives, and local communities' livelihoods and well-being (Figure 2).

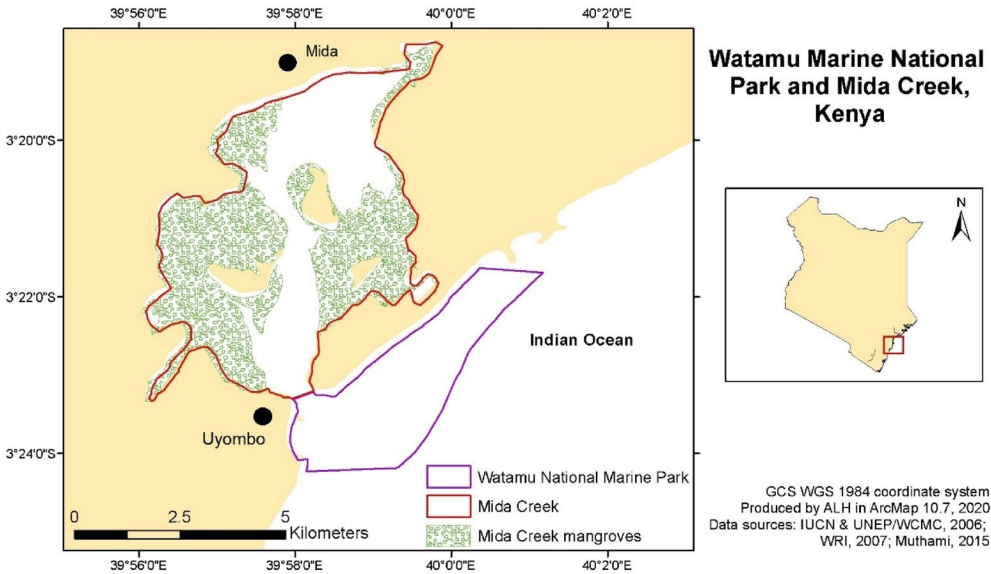
## Materials and methods

### Study site

Watamu Marine National Park (WMNP) and Mida Creek, are part of the wider Watamu-Malindi National Marine Reserve (WNMMPR) complex, in Kilifi county on the Kenyan coast, approximately 100 km north of Mombasa (Figure 3). One of Kenya's first marine protected areas, WMNP was gazetted in 1968 and covers an area of 10 km<sup>2</sup>, with its coral reefs and seagrass habitats forming part of one of east Africa's longest fringing reefs (Cowburn et al 2018; Muthiga 2009). Southwest of WMNP, the mangroves and tidal sandflats of the marine reserve cover 32 km<sup>2</sup> collectively designated a Biosphere Reserve in 1979 (Bush et al. 2017; Frank et al. 2017; Owuor et al. 2017). The creek is an important spawning ground for many species of fish, internationally important wintering grounds for waders, and a foraging area for several species of sea turtles (Cowburn et al. 2018; Frank et al. 2017; Oman, 2013; Owuor et al. 2017). Jurisdictionally, WMNPR falls under the



**Figure 2.** Hypothesized links between the protected environment, livelihoods, well-being, and the community members.



**Figure 3.** Outlines of WMNP (purple) and Mida Creek (red) in southeastern Kenya, and approximate locations of Uyombo and Mida. Data sources: IUCN and UNEP/WCMC (2006), Muthami (2015), WRI (2007).

management of Kenya Wildlife Service (KWS), whilst the marine reserve's mangrove forest is co-managed with Kenya Forest Service (KFS). A wide range of community-based management groups have also recently been established (Nunan et al. 2020). All extractive activities are forbidden in WMNP, but mangrove harvesting, and traditional fishing methods are permitted with licenses in the wider Reserve (Frank et al. 2017; Owuor et al. 2017; Kenya Wildlife Service, 2017). Both the reef and mangroves offer sources of livelihoods for local people, providing opportunities such as fishing, fuelwood harvesting, beekeeping, as well as for tourism, yet both also face ecological threats. WMNP's coral reefs have been found to be degraded due to unsustainable tourism activities (Cowburn et al. 2018) and also likely impacts from coastal development. The extent of the mangrove decreased since the 1960s, followed by recent upward trends in cover (Alemayehu et al. 2014; Kirui et al. 2013), however patches are degraded and the mangroves are at risk of illegal and over-exploitative wood harvesting and extraction, and pollution from plastic and small boat engines (Dahdouh-Guebas et al. 2000; Frank et al. 2017; Kairo et al. 2002; Kirui et al. 2013; Owuor et al. 2019). Some mangrove restoration efforts are underway. Additionally, like elsewhere along the Kenyan coast, land use changes and (particularly tourism) developments pose further threats to coastal ecosystems (Frank et al. 2017).

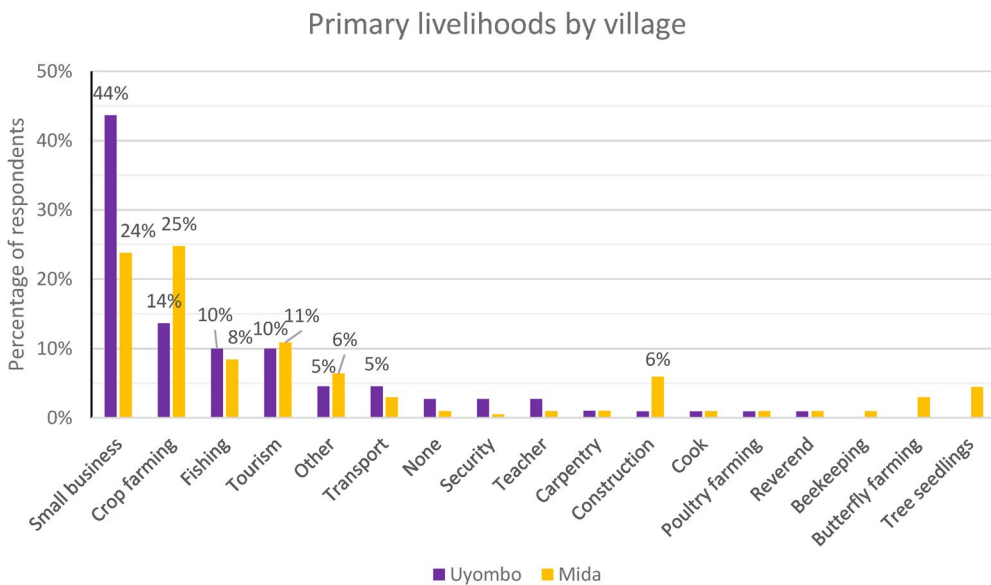
In the wider geographical context, Kilifi county is one of the poorest in Kenya with the human poverty index (HPI) standing at 58.4 against the country's average of 45.2 (Kenya National Bureau of Statistics (KNBS), 2015, p. 52). The coastal region is heavily dependent on tourism (Cinner and McClanahan 2006; Muthiga 2009). WMNP welcomed around 67,000 visitors in 2018, paying entrance fees at USD15 per nonresident adult (KNBS 2019; KWS 2019), though visitor numbers fluctuate with



socio-economic and political conditions (Cowburn et al. 2013). Previous studies have found that people in the region are likely to engage in livelihood diversification (Versleijen and Hoorweg 2008), and that primary sources of livelihoods include tourism-based activities such as curio vending, beach trading, boat operating, sport instructors, tour guide, and ecotourism ventures and boardwalks at Dabaso and Mida Creek (Alemayehu et al. 2014; Dahdouh-Guebas et al. 2000; Owuor et al. 2017).

### Data collection

Data collection was conducted through telephone survey questionnaires with residents of Uyombo and Mida. These two villages were suggested to provide an instructive comparison, as Uyombo is more remote than Mida from the economic activities around WMNP and tourism around Malindi and Watamu (Figure 3), and Uyombo has as a greater proportion of fishers than farmers (see Figure 4). It was hypothesized that this relative remoteness and marine resource dependency would lead to contrasting socio-demographic characteristics between the villages, as well as the relationships between livelihood activities (Figure 4), dependence on the marine protected areas, and reported well-being. Due to COVID-19 pandemic restrictions on social interactions preventing home visits to recruit participants, the study represents an opportunistic sample with participants recruited from contacts, as well as through a process of snowballing participants from previously obtained contacts and community organizations in Uyombo and Mida. 312 telephone surveys were conducted by two locally recruited and trained surveyors in June and July 2020, who were fluent in Kiswahili and the local dialect, and thus able to build rapport with the participants. 308 surveys were completed successfully. Surveys were conducted in Kiswahili and in some cases Giriama and answers recorded in English,



**Figure 4.** Percentages of primary livelihoods in study sample.

having been piloted in both English and Kiswahili prior to deployment. Mindful of the internal validity of the survey instrument, and the challenge of local and culturally appropriate conceptions of well-being, this study used the Kiswahili translation for “content” (“(Ku)ridhika”) when asking participants to report their level of well-being, as the phrasing how one “feels” about their life carries connotations of material well-being, whereas “contentment” better encapsulates all three dimensions of social well-being.

Each participant was given the opportunity to ask questions before taking part, and informed that participation was entirely voluntary and that they could stop the survey at any point. Participants were given a monetary inducement of 1600 Kenyan Shillings for taking part. This figure was assessed to be a meaningful contribution to food security in the COVID-19 pandemic. The study was subject to a full ethical review (see acknowledgements)

The questionnaire operationalized measures of livelihoods, well-being, benefits, disbenefits, and socio demographic factors. Potential benefits and disbenefits from WMNP and Mida Creek were identified from the literature (Bennett and Dearden 2014a, 2014b; Bryce et al. 2016; Chan et al. 2019; Gill et al. 2019; Mascia et al. 2017; Nunan et al. 2018; Voyer, Gladstone, and Goodall 2014), and through discussions with the research team members with knowledge and understanding of the region (Table 1). The survey (Supplemental Material Appendix 1) included a mix of open and closed questions, with particular attention paid to the respondents’ experiences prior to the COVID-19 pandemic. Whilst this increased the possibility for recall bias and the risk that perceptions of previous well-being had been influenced by impacts of the pandemic (Pullin et al. 2013; White 2010), this effect was determined to be minor as the protected area designations have been in place for several decades.

**Table 1.** Benefits and disbenefits operationalized in the questionnaire, and their underlying conceptual ideas.

Key Concept	Benefit from MPA	Disbenefit from MPA
Environmental quality	Ability to enjoy a clean, healthy creek and ocean	Problems due to pollution or waste
Health	Better health	
Social cohesion	Greater community organization	Increased social tension
Livelihood opportunities	Increase in job opportunities	Loss of job opportunities
Resilience & empowerment	Increased ability to deal with problems and challenges	Less control over my own life
Effects of tourism	Increased benefits from tourism	Increased problems due to tourism
External influence	Increased funding and support from outside the community	
Spiritual dimensions	Increased spiritual benefits	Loss of spiritual benefits; More evil spirits
Food security	Increased supplies of food	Less supplies of food
Wealth	Increased wealth	Increased poverty
Participation in management and governance	More participation in natural resource management	Decreased participation in natural resource management
Power balances		Increased conflict and political struggles

## Data analysis

To examine how livelihoods and well-being in Uyombo and Mida relate to WMNP and Mida Creek, focus was placed on investigating statistical significance of relationships between the villages, socio-demographic factors (age, sex, educational attainment, length of village residency, self-identified ethnicity, marital status, relative wealth), and the dependent variables of livelihood activities, and well-being levels. Open questions allowed respondents to identify significant factors not prescribed within the survey. Non-parametric tests (Wilcoxon and Kruskal Wallis) were applied for continuous variables, and Chi-square and Fisher's Exact tests for categorical variables. Principal components analysis (PCA) was conducted on a dataset containing household characteristics (number of household members, size of household land, number of livestock animals, access to tapped water, energy supply, Internet/WhatsApp, and vehicles) to produce a wealth index ('relative wealth'). PCAs, which reduce the number of variables for analysis by producing principal components (dimensions) explaining variances within a dataset, are recognized as a useful method to construct wealth indices where standard economic indices may be inappropriate or unavailable (Vyas and Kumaranayake 2006). With variables measuring household assets, the first dimension returned is often understood to measure economic status (Vyas and Kumaranayake 2006); this was extracted and used to group the respondents into quintiles of relative wealth. A second set of PCAs was conducted to identify the variables explaining the greatest variances in subsets of the data on well-being ([Supplemental Material, Appendices 2–5](#)). One PCA was computed on all respondents (PCA "both Villages"), followed up by two PCAs with the residents sub-divided by village (PCA "Uyombo" and "Mida"). Following this analysis, the number of (dis)benefits reported from WMNP and Mida Creek was the focus for further analysis, investigating statistical significance as above.

Data treatment and analysis was conducted using Microsoft Office Excel 2016 and R 4.0.2 for Windows and RStudio Desktop 1.3.1073<sup>1</sup> (R Core Team 2020; RStudio Team 2020), with statistical significance set to 95% ( $p$ -value < 0.05).

## Results

### Respondent characteristics

#### Demographic profile

109 (35.4%) residents in Uyombo were successfully surveyed, and 199 (64.8%) in Mida ( $n=308$ ). The respondent demographics are presented in [Table 2](#). The PCA-derived wealth index placed 3.3% of respondents in the fifth (lowest) quintile, 15.7% in the fourth quintile, 36.0% in the third quintile, 33.3% in the second quintile, and 11.7% in the first (highest) quintile of relative wealth. No statistically significant difference was found between Uyombo and Mida in terms of sex, age, education, length of residency, ethnicity, marital status, or relative wealth.<sup>2</sup>

#### Livelihood activities

Livelihoods which at least 5% of respondents reported as their primary livelihood are specified. Having a small business included selling goods such as vegetables, clothes,

**Table 2.** Respondent demographics.

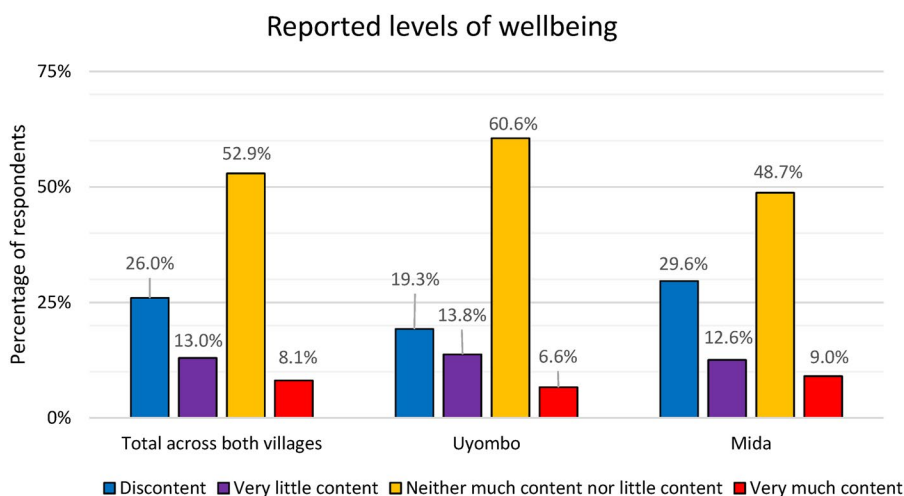
Sex	%	Length of residency in village		Ethnicity	%		
Female	35.4	Whole life	63.0	Baluhya	0.3		
Male	64.6	More than 10 years	27.3	Chonyi	0.3		
		6-10 years	6.4	Digo	0.7		
		1-5 years	2.9	Duruma	1.3		
Age (years)	%	Less than 1 year	0.3	Giriama	81.8		
18-34	25.4	<i>Marital status</i>	%	Jibana	0.7		
35-54	52.2			Married	90.6	Kambe	0.7
55-64	14.0			Unmarried	8.8	Kauma	5.9
65+	8.5			Undisclosed	0.7	Mijikenda <sup>6</sup>	3.9
						Msambaa	0.3
<i>Highest completed level of education</i>	%	<i>Relative wealth</i>	%	Msmbaa	0.3		
Primary education	52.3			Fifth quintile	3.3	Pokomo	0.3
Secondary education	20.8			Fourth quintile	15.7	Taita	0.7
Craft certification	3.9			Third quintile	36		
Diploma	3.9			Second quintile	33.3		
University degree	1.0			First quintile	11.7		
Adult education	4.2						
None	14.0						

fruits, food, and snacks; working in transport implied having a transport business. Working in construction included masonry, and “Tree seedlings” raising and selling the seedlings.

Figure 4 presents primary livelihood activities in each village. Having a small business, (selling vegetables, clothes, fruits, food, or snacks) differed significantly between Uyombo and Mida (Fishers Exact  $P=0.0111$ ), with 43.6% of respondents in Uyombo expressing this as their primary livelihood, and 23.8% in Mida. The most involved-in livelihood in Mida was crop farming (24.8%), followed by having a small business, and tourism (10.9%). In Uyombo, the second highest percentage of people were engaged in crop farming (13.6%), followed by fishing and tourism (10% each). 8.4% of respondents in Mida stated fishing as their primary livelihood. The majority of respondents did not perceive their livelihoods as enough to support them before the COVID-19 pandemic; 198 respondents (64.5%) expressed that their livelihoods could not support them and their households, 77 (25.1%) said that the livelihoods had been enough, and 32 (10.4) said that they had “sometimes” been enough. 122 respondents (39.7%) said that their livelihoods depended on WMNP. This was not statistically different between the villages. 164 (54.0%) expressed a dependence on Mida Creek for their livelihoods, with a statistical difference between Mida (61.6%) and Uyombo (39.6%).

### Reported levels of well-being

As a proxy for well-being, respondents were asked to indicate the level to which they had been “content” with their life before the COVID-19 pandemic. 52.9% replied that they had been “neither much content nor little content.”<sup>3</sup> 8.1% said that they have been “very much content,” 13.0% “very little content,” and 26.0% “discontent”. Figure 5 shows the total reported well-being alongside the percentages for Uyombo and Mida separately. No statistical significance was identified between the villages well-being levels, and this trend was replicated across the socio-demographic variables (sex, age, highest level of completed education, length of residency, ethnicity, marital status, relatively wealth).



**Figure 5.** Levels of well-being among survey respondents using self-reported levels of contentment as a proxy for well-being.

### ***Number of benefits and disbenefits as significant factors for wellbeing***

To further examine trends in the reported levels of well-being, PCAs were applied to find the variables explaining most variance in the dataset. Appendix A3 lists the percentage of variances explained by each dimension in the respective PCAs. A standard cut off point for principal components is where eigenvalue  $>1$ . Relatively small percentages and variances of comparable size were explained past the second dimension. The contributions of first two dimensions were not large—at 24.1% for PCA “both Villages”, 26.0% for PCA “Uyombo” and 33.0% for PCA “Mida.” (See also [Supplemental Material Appendices A2 to A5](#)). However, interestingly, for all PCAs, the variables “Number of disbenefits reported” and “Number of benefits reported” showed the highest level of correlation and contribution, warranting deeper investigation.

### ***Which benefits and disbenefits? Experiences from WMNPR***

Since the number of (dis)benefits experienced from WMNP and Mida Creek were identified in the PCA to explain the largest variance in the dataset, these were examined in greater detail ([Table 3](#)). The average numbers reported were 4.4 benefits (St. dev. 3.5), and 2.5 disbenefits (St. dev. 2.2), and statistically significant differences were found between Uyombo and Mida, different age groups, females and males, length of residency and relative wealth (see [Table 3](#)). Furthermore, the number of benefits varied by educational attainment, whilst no difference was found amongst respondents of different educational backgrounds regarding experienced disbenefits. Neither benefits nor disbenefits differed significantly by ethnicity. [Table 4](#) lists the number of times each (dis)benefit was reported by a respondent, and the social well-being category they primarily relate to. A total of 1386 benefits and 726 disbenefits were reported as each respondent was able to select multiple factors. 205 respondents (67%) stated having received improvements to their health from WMNP and Mida Creek, and 195

**Table 3.** Average number of (dis)benefits experienced from WMNP and Mida Creek for different socio-demographic variables and categories.

Socio-demographic variable	Socio-demographic category	N	Benefits		Disbenefits	
			Average (St. Dev.)	Range	Average (St. Dev.)	Range
Village	Total	308	4.4 (3.47)	0–11	2.52 (2.17)	0–9
	Uyombo	109	4.82 (3.90)	0–11	2.43 (2.32)	0–9
	Mida	199	4.17 (3.20)	0–11	2.15 (2.09)	0–9
Age	18-34	78	5.35 (3.19)	0–11	2.05 (1.90)	0–8
	35-54	160	4.43 (3.48)	0–11	2.59 (2.34)	0–9
	55-64	43	4.00 (3.54)	0–11	1.88 (1.98)	0–7
	65+	26	2.85 (3.32)	0–9	1.77 (1.95)	0–6
Sex	Female	109	3.97 (3.43)	0–11	1.79 (2.01)	0–9
	Male	199	4.69 (3.44)	0–11	2.56 (2.21)	0–9
Highest completed level of education	Primary education	161	4.32 (3.41)	0–11	–*	–*
	Secondary education	64	5.48 (3.45)	0–11	–*	–*
	Craft certification	12	7.08 (3.40)	2–11	–*	–*
	Diploma	12	4.92 (3.82)	0–11	–*	–*
	University degree	3	6.67 (2.08)	5–9	–*	–*
	Adult education	13	2.69 (1.97)	0–6	–*	–*
	None	43	2.93 (3.06)	0–11	–*	–*
Length of residency in village	Whole life	194	5.04 (3.41)	0–11	2.60 (2.14)	0–9
	More than 10years	84	3.17 (3.17)	0–11	1.65 (2.07)	0–8
	6-10years	20	4.65 (3.90)	0–11	1.85 (2.37)	0–7
	1-5 years	9	3.67 (3.08)	0–8	2.00 (2.37)	0–7
	Less than one year	1	2.00 (NA**)	2–2	3.00 (2.35)	3–3
Relative wealth	Fifth quintile	10	5.40 (3.86)	0–11	2.50 (1.96)	0–6
	Fourth quintile	47	5.26 (3.27)	0–11	2.60 (2.63)	0–9
	Third quintile	10	4.84 (3.63)	0–11	2.60 (2.19)	0–9
	Second quintile	100	3.71 (3.28)	0–11	1.98 (2.01)	0–7
	First quintile	35	3.66 (3.45)	0–10	1.69 (2.00)	0–8

Non-parametric tests (Wilcoxon and Kruskal Wallis) were applied for continuous variables, and Chi-square and Fisher's Exact tests for categorical variables

–\* = non-statistically significant figures; NA\*\* = not applicable.

**Table 4.** Number of times each benefit was reported by respondents.

Primary contribution to well-being category	Benefit	Total experienced
Subjective	Better health	205
Subjective	Ability to enjoy a clean, healthy creek and ocean (can be enjoyed from land and does not require going in the water)	195
Material	Increased benefits from tourism	150
Relational	More participation in natural resource management	132
Subjective	Increased ability to deal with problems and challenges	128
Relational	Increase in educational and social facilities	125
Material	Increased funding and support from outside the community	109
Material	Increased supplies of food	104
Material	Increase in job opportunities	96
Subjective	Increased spiritual benefits	81
Material	Increased wealth	51
	Other:	
Material	<i>Better mangrove harvesting practices</i>	3
Subjective	<i>Recreational benefits</i>	2
Material	<i>Environmental benefits</i>	1
Subjective	<i>Increased knowledge about conservation</i>	1
Relational	<i>Increased security</i>	1
Relational	<i>Increased stakeholder collaboration</i>	1
Material	<i>Less erosion</i>	1
Total	All benefits	1386

The well-being category refers to the primary contribution as identified in the literature; however each benefit may contribute to additional well-being categories to lesser extents. Participants were asked to state whether they had experienced a list of pre-identified benefits and given the option to add to the list ("Other").

(63%) indicated that they were able to enjoy a clean, healthy creek and ocean, both which were identified as contributing to subjective well-being. Increased benefits from tourism, more participation in natural resource management, increased ability to deal with problems and challenges, and increase in educational and social facilities, and increased funding and support from outside the community were also all reported greater than 103 times each (i.e., >33% of respondents). The most frequently reported disbenefits contributed to relational well-being: for example, 150 respondents (49%) stated that they had experienced a decrease in natural resource management participation in WMNP and Mida Creek,<sup>4</sup> (yet there was also some contrasting findings with >33% also indicating they had experienced increased participation in natural resource management). 122 (40%) reported they had experienced increased conflict and social tension. These were the two disbenefits reported by >33% of respondents.

## Discussion

Our findings are indicative of the proportions of the villages in the sample, and inferences from the results cannot be extrapolated to represent the entire village populations as this is a non-representative sample; however the patterns shown by the data remain instructive.

We believe our findings have implications for broader study of protected areas, particularly the emerging field considering social impacts of marine protected areas. Firstly, this study found that on average benefits exceeded disbenefits arising from the MPA, contributing to the global debate. Secondly, the total number of benefits and disbenefits experienced from WMNP and Mida Creek explained the greatest proportion of the variance in the datasets. This suggests a need to move beyond assessment in ecosystem services literature which characterize the pathways of nature's contributions, to an understanding of the net benefits for a given target population, in order to manage MPAs effectively. Thirdly, the number of benefits and disbenefits experienced varied significantly according to: age groups, sex, length of residency and relative wealth, demonstrating the variable impact of the MPA across socio-demographic groups. This ramifies the call in the literature to move beyond assessments of impacts on MPAs on particular resource users (e.g., fishers). Finally, the framework deployed, linking livelihoods and three-dimensional wellbeing to protected areas, demonstrated the power of a comprehensive perspective. Further reflections on these key concepts in context and practical implications, including particular strategies to engage with relational disbenefits, are provided below.

## Livelihoods

The analysis of primary livelihood activities found that whilst the largest percentage of respondents in Uyombo indicated having a small business as their primary livelihood, and the most frequently reported primary livelihood in Mida was crop farming, the general pattern was that people in each village were involved in a range of livelihood activities and small business were a significant part of the livelihood mix. Respondents in Mida were more reliant on Mida Creek than respondents in Uyombo, but no village could be confirmed to be more dependent on WMNP for their

livelihoods than the other. This may be because of the laypersons perception that WMNP ‘belongs’ to the government and the Mida Creek ‘belongs’ to the local community. The majority of participants did not believe their livelihood activities had been enough to support them and their household before the COVID-19 pandemic. However, whilst there is genuine poverty, this should be treated cautiously as the local cultural dynamics do not favor individuals to readily admit that their livelihood activities are sufficient.

On one hand, these findings indicate that the influence of WMNPR on the livelihoods of residents in Uyombo and Mida may be smaller than previously believed. This may be related to the wide range of livelihood activities found amongst the participants, which is demonstrated by the fact that despite being located in a coastal region, the majority of respondents did not identify fishing or similar marine activities as their primary livelihood. Furthermore, Versleijen and Hoorweg (2008) found that even where other livelihood activities made larger economic contributions toward a person’s or household’s livelihood, fishers in Mida Creek tended to report fishing as their primary livelihood due to the self- and community identity which being a fisher provided. Our finding that people in Uyombo and Mida engage in a wide range of livelihood activities solidifies the call in the literature (Gill et al. 2019) to examine human dimensions of marine conservation initiatives on demographics as well as occupation, especially more widely than the “fishers and non-fishers” dichotomy present in many studies. Research which too heavily focuses on over-represented demographic groups, or which assumes a higher prevalence of, and dependency on, certain trades, risks failing to identify diversity within communities and may overlook the most vulnerable groups, which are most in need of any potential benefits from marine conservation.

### ***Well-being and livelihoods***

Despite some of the findings showing that coastal populations do not seem to be heavily marine resource dependent, the broader framing provided by our well-being framework demonstrates that dependency on the marine environment in Watamu and Mida Creek extends beyond traditional perceptions of livelihoods that rely upon this environment. Even though the study found that respondents were only partially dependent on the WMNP and Mida Creek protected areas for their livelihoods, a considerably higher percentage of respondents reported being dependent on the marine environment than mentioned fishing as their primary livelihood. This suggests that other livelihoods reported by the participants, such as tourism or having a small business, may be indirectly dependent on WMNP and Mida Creek. The PCAs conducted on the well-being dataset showed that the number of (dis)benefits experienced by each respondent were found to explain the largest variance in each variant of the dataset (both for villages combined and individually).<sup>5</sup> A closer examination of these variables identified that residents in Uyombo reported on average more benefits, as well as disbenefits, than residents in Mida. These results were significant despite the lack of confirmed socio-economic and well-being differences between the villages. Additional factors are likely responsible for this pattern.



**Table 5.** Number of times each disbenefit was reported by respondents.

Primary contribution to well-being category	Disbenefit	Total experienced
Relational	Decreased participation in natural resource management	150
Relational	Increased conflict and social tension	122
Material	Increased poverty (incl. decreased access to resources)	95
Multiple	Increased problems due to tourism pressure	72
Material	Fewer supplies of food	70
Material	Loss of job opportunities	66
Material	Problems due to pollution or waste	61
Subjective	Less control over my own life	27
Subjective	More evil spirits	26
Subjective	Loss of spiritual benefits	19
	Other:	
Material	<i>Logging</i>	5
Material	<i>Illegal fishing and fishing methods</i>	4
Material	<i>Animal attacks</i>	2
Material	<i>Disruption and killing of bird life</i>	2
Relational	<i>Drug abuse and erosion of culture and social life</i>	2
Subjective	<i>Children devalue education for creek-based livelihoods</i>	1
Material	<i>Climate change</i>	1
Material	<i>Oil spills</i>	1
Total	All disbenefits	726

The well-being category refers to the primary contribution as identified in the literature, however each disbenefit may contribute to the reduction of other well-being categories to lesser extents. Participants were asked to state whether they had experienced a list of pre-identified disbenefits and given the option to add to the list ("Other").

**Table 6.** Contribution of benefits and disbenefits to each social well-being category (numbers summarized from Tables 4 and 5, Section 3.4).

Social well-being category	Benefits relating to well-being categories	Disbenefits relating to well-being categories
Material	515	379
Relational	259	274
Subjective	612	73
Total	1386	726

The benefits and disbenefits respondents had experienced contributed to all three dimensions of social well-being (Tables 4 and 5, Section 3.5). The highest frequencies of benefits were reported relating to *subjective* well-being (Table 6), and of individual disbenefits contributing to *relational* well-being. In total, the second most frequently reported benefits, and most experienced disbenefits, related to *material* well-being. The most experienced benefits—better health and the ability to enjoy a healthy creek and ocean—are well-documented environmental benefits in the broader literature (Russell et al. 2013). Whilst the relationship between human health benefits and marine protected areas is understudied (Ban et al. 2019), evidence has been found that being able to enjoy a healthy marine environment with high biodiversity and exhibitions of wildlife behavior provides restorative potential (White et al. 2017), and that a healthy environment can be more valuable to local residents than material benefits from increased jobs and incomes arising from an MPA (Larson et al. 2015). Likewise, the individually most frequently experienced disbenefits, relating to relational well-being, demonstrate similar trends as other marine conservation initiatives, which have found, for instance, that complex systems of governance can struggle to implement inclusive participation in natural resource management and increase interpersonal

conflicts (Bavinck and Vivekanandan 2011). This is further exacerbated by fragmented governance structures where sectors such as environment, fisheries and forestry have separate governance systems from the national to the village level—termed as compartmentalized ‘silos’ as present in Kenya and Zanzibar (Nunan et al., 2020).

### ***Implications for local conservation***

The study has implications for practicable management and on-going efforts to support participatory management with the community. The authors reflected on this matter as representatives of a relevant government agency, conservation NGO and scientific researchers. Further efforts are needed to encourage participation in the management of the WMNPR. Conservation education and tours, workshops and training, adult literacy, and awareness campaigns are some of ongoing initiatives being undertaken by the conservation agency and wider partners. Practically, this is being achieved by engaging with beach management units and numerous community-based organizations involved in ecotourism. These efforts seek to address the reported experiences of decreased natural resource management participation and increased social tensions. At a wider structural level, the recent MPA management plan is being complemented by the foundation of a new partnership bringing together the government agency, NGOs and community groups to strengthen relational networks.

Additionally, understanding about livelihoods informs partners involved in local management on how to link conservation to poverty reduction goals through income generation activities, skills development, and improvement of the quality and marketing of sustainable tourism related products and services. It is hoped that such initiatives will model possibilities to other sectors, including crop farming and sustainable fishing. Practically, this is currently being addressed through promotion of new ecotourism activities such as the case of the recent Prawn Lake conservation group restaurant that sustains the livelihood of the community group members. This might encourage promotion of conservation in WMNPR and provide positive outcomes related to better health and environmental quality.

### **Conclusion**

In order to understand the links between marine conservation initiatives and the livelihoods and well-being of local communities, this study employed a social well-being and livelihoods approach to examine the social impacts of marine environments with protected area designations on two nearby villages. Recognizing that well-being includes more than material dimensions of life, the social well-being framework highlights the significance of benefits such as improved health and the enjoyment of a clean and healthy creek and ocean, and disbenefits such as increased conflicts and social tension. This study found evidence that benefits outweigh disbenefits from MPAs, but that a majority of the respondents’ experience decreased natural resource management participation, and increased conflict and social tension. This implies that the governance of WMNMR needs to further promote bottom-up approaches that will comprehensively address the identified disbenefits. The ability of conservation agencies and NGOs to deliver on their promises to local communities is likely to be part of this issue.

With the increasingly high pressures placed on biodiversity and the natural environment by humanity, identifying links between protected areas, local community livelihoods and well-being can help formulate governance and management interventions with both ecological and social benefits (Chan et al. 2019; Cumming 2016). It is noteworthy that relatively similar numbers of experiences relating to material and relational well-being were reported for benefits and disbenefits, potentially suggesting hidden underlying tradeoffs. Uncovering these relationships will be an important future consideration for effective and fair governance and management of WMNPR and MPAs in general. This justifies further research to understand the relationships between protected marine environments, livelihoods, and well-being,

## Funding

Funding for fieldwork travel and survey costs was supported by the UK Global Challenges Research Fund and Scottish Funding Council projects *Community Capabilities and Marine Protected Area Governance* and *Mitigation of the effects of COVID-19 crisis in coastal Kenya* XFC092, and by the Santander - St Leonard's Postgraduate College Research Mobility Awards.

## Ethical Approval

Ethical review and approval for the research was provided by the University of St Andrews Graduate School for Interdisciplinary Studies Ethics Committee, application GS14804.

## Notes

1. R packages and functions: tidyverse, factoextra, ggpubr, and ggplot2 (Kassambara 2020; Kassambara and Mundt 2020; Wickham 2016; Wickham et al. 2019). PCAs were computed using functions “principal” from the psych package, and “pca” from the FactoMineR package (Le, Josse, and Husson 2008; Ravelle 2020) with the oblique rotation promax, following guidance set out in Brown (2009) and exploration of equal results obtained with both promax and the orthogonal rotation varimax
2. Statistically significant variations were found between Uyombo and Mida regarding some of the variables used to generate PCA for wealth index, e.g. livestock animals and access to transport.
3. See Section 2 for comment on the Kiswahili translations for the English “well-being” terminology
4. Note, ‘More Participation in Natural Resource Management’ ( $N=132$ ) was also ranked highly as a benefit. The survey contained a measure of feedback on the perceptions of the performance of conservation agencies, 90% of respondents agreed they did a good job. Given that one of the major disbenefits reported is increased social tension, one interpretation of these results is that respondents are satisfied with resource management in some domains such as effective enforcement, but generally not satisfied with their level of involvement in decision-making. It is also significant that KWS and KFS work with limited resources, for example limitations on the number of rangers needed for community engagement in the park and their capacity building for marine conservation.
5. Although the treatment of the PCA was simplified, focusing on the two first dimensions is usually sufficient for identifying the variables contributing the largest variance in the dataset (Wold, Ebensen, and Geladi)

6. In order to be culturally sensitive, the survey asked participants an open question about ethnic identity, where respondents were given the opportunity to state their ethnic identity. Whilst “Mijikenda” is a collective term for nine sub-tribes, including some identified by participants such as Giriama, Duruma and Digo, the results are presented as self-identified by respondents.

## Acknowledgements

The wish to acknowledge the support and input of: Dr Bob Sluka (A Rocha International) for advice on project development; (Rosalia) Neema Kahindi and Rachael Sidi Mweri in their paid Swahili telephone survey roles; and Justin Bestwick (now of Bahari Hai) and, Sammy Safari and Kahindi Changawa of Local Ocean Conservation for advice in implementing the community survey, and respondents for giving of their time.

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