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Evaluating outcomes of conservation with multidimensional indicators of well-being

Emmanuel K. Mbaru[1,2] | **Christina C. Hicks**[3] | **Georgina G. Gurney**[1] | **Joshua E. Cinner**[1]

[1] ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Queensland, Australia

[2] Kenya Marine and Fisheries Research Institute (KMFRI), Mombasa, Kenya

[3] Lancaster Environment Centre, Lancaster University, Lancaster, UK

Correspondence
Joshua E. Cinner, ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD 4811, Australia.
Email: joshua.cinner@jcu.edu.au

Article Impact Statement: Adoption of a conservation intervention has a slightly positive effect on human well-being.

Abstract

Many conservation interventions are hypothesized to be beneficial for both the environment and people's well-being, but this has rarely been tested rigorously. We examined the effects of adoption or nonadoption of a conservation intervention on 3 dimensions of people's well-being (material, relational, and subjective) over time. We focused on a fisheries bycatch management initiative intended to reduce environmental externalities associated with resource extraction. We collected panel data from fishers (n = 250) in villages with (adopters and nonadopters) and without (control) the conservation intervention 3 times over 2 years. We found no evidence that adoption reduced any of the 3 dimensions of well-being in the local populations affected by the intervention. There were modest improvements in material (t = –1.58) and subjective livelihood well-being (p = 0.04) for adopters relative to nonadopters over time. The variations in well-being experiences (in terms of magnitude of change) among adopters, nonadopters, and controls across the different domains over time affirmed the dynamic and social nature of well-being.

KEYWORDS

fisheries, human dimensions, human well-being, impact evaluation, social network, bienestar humano, dimensiones sociales, evaluación de impacto, pesquerías, redes sociales

Evaluación de los Resultados de la Conservación mediante Indicadores Multidimensionales de Bienestar

Resumen: Se plantea que muchas intervenciones de conservación son benéficas tanto para el ambiente como para el bienestar de las personas, pero esto rara vez ha sido analizado rigurosamente. Examinamos los efectos de la adopción o no adopción de una intervención de conservación sobre tres dimensiones del bienestar de las personas (material, relacional, subjetivo) a lo largo del tiempo. Nos enfocamos en la iniciativa de manejo de la captura accesoria de una pesquería cuya intención es reducir las externalidades asociadas con la extracción de recursos. Recolectamos datos de panel de los pescadores (n = 250) en aldeas con (adoptantes y no adoptantes) y sin (control) la intervención de conservación tres veces durante dos años. No encontramos evidencia de que la adopción redujera cualquiera de las tres dimensiones del bienestar en las poblaciones locales afectadas por la intervención. Con el tiempo, notamos que hubo mejoras modestas en el bienestar de sustento material (t = −1.58) y subjetivo (p = 0.04) para los adoptantes en comparación con los no adoptantes. Las variaciones en las experiencias de bienestar (en cuanto a la magnitud del cambio) entre los adoptantes, no adoptantes y los controles a lo largo de los diferentes dominios a través del tiempo reafirmaron la naturaleza dinámica y social del bienestar.

PALABRAS CLAVE:

bienestar humano, dimensiones sociales, evaluación de impacto, pesquerías, redes sociales

INTRODUCTION

Biodiversity is in decline globally, particularly in the tropics (Barlow et al., 2016). In response, conservationists are looking to identify successful interventions that can be scaled up (Mills et al., 2019). The success of many conservation interventions depends on environmental and social outcomes (Adams et al., 2004), but evaluations of the impacts of conservation interventions on people are far less common than those focused on ecological outcomes (Ban et al., 2019; de Lange et al., 2016). Researchers who have analyzed the effects of conservation on people have tended to focus on monetary indicators or material measures of well-being (Charles et al., 2015; Cochrane, 2000), until relatively recently (e.g., Beauchamp et al., 2018; Gurney et al., 2014). A reliance on material measure was largely premised on material deprivation and a deficit-centered perspective (Coulthard, 2012; Weeratunge et al., 2014).

It is increasingly recognized that a multidimensional approach to understanding well-being in the context of conservation and environmental management is needed (Ban et al., 2019; Leisher et al., 2013). Such an approach includes the Well-being in Developing Countries framework, a 3-dimensional framework composed of material, relational, and subjective dimensions (Abunge et al., 2013; Gough & McGregor, 2007). Material well-being captures objective material resources that people can draw on to meet their needs, such as food, assets, employment, services, and the natural environment (Gough & McGregor, 2007). Relational well-being captures critical social relationships, such as love, kinship, social embeddedness, and even forms of collective action (Gough & McGregor, 2007). Given the complexities associated with social relationships that exist in different contexts and the theoretical claim that relational well-being outcomes are affected by the structure of relationships and social network processes among people, researchers have begun to adopt a network perspective that emphasizes the importance of relational balance as an objective indicator of relational well-being. Relational balance is grounded on the notion of giving and receiving, which allows relational benefits, such as social capital, to be shared among members of a social system through social exchange (Leana III & Van Buren, 1999). A good social relational balance is a critical component of social relationships because it underpins how people's relationships can be evaluated especially where social connections constitute critical pathways through which people access other human needs and benefits in the society (Sadilek et al., 2018). Indeed, relational balance can determine how individuals are socially embedded in network structures and processes (Tóth et al., 2018). Subjective well-being encompasses how people think and feel about their life and what they have and do with what they have (White, 2010).

Considering and understanding the impacts of conservation interventions on material, relational, and subjective dimensions of well-being matters for both moral and pragmatic reasons. For example, conservation project implementers are morally responsible for ensuring conservation interventions do not undermine the well-being of local communities (Hutton et al., 2005). Further, negative impacts on well-being can erode local support and therefore jeopardize environmental outcomes (Woodhouse et al., 2015). Similarly, the interplay between people and their relational circumstances can explicitly determine their scope for personal and collective action to safeguard a common resource (Charles et al., 2015). Multidimensional well-being indicators not only provide a more comprehensive way to examine conservation outcomes on people, but also represent an analytical lens that can help draw policy attention to the nonmaterial outcomes of conservation.

Despite an emerging recognition of the need to use multidimensional indicators of well-being in evaluating conservation outcomes, no impact evaluation has compared changes in multidimensional well-being of actors involved and those not involved in a conservation initiative (but see Gurney et al. [2014] who used impact evaluation to examine the impacts of community-based conservation on multidimensional poverty). To address this gap, we examined the impacts of a conservation intervention based on data collected in intervention and control communities 3 times over 2 years. Specifically, we asked how adoption of a conservation intervention influences people's material, relational, and subjective well-being? We studied the example of a modified fish trap that allows juveniles and narrow-bodied, low-value fish species (i.e., bycatch) to exit through an escape slot, while larger, wider-bodied target species are retained (Johnson, 2010). This intervention, heretofore called an escape slot trap, was introduced into Kenya with the explicit aim of making fisheries more sustainable by reducing the capture of undersize fish and bycatch (Condy et al., 2014).

METHODS

Conservation Intervention

We studied 6 major fishing landing sites along the Kenyan coast. Across all sites, fishing is largely artisanal, characterized by a range of gear use and management strategies (McClanahan et al., 2008). Approximately 70% of the coastal community primarily depend on the multispecies coral reef fishery for direct employment, monetary income, and animal protein (Ochiewo, 2004). However, with almost 23,000 fishers catching over 16,000 t of fish annually, the local fishery is grappling with a number of management challenges (Mbaru & Barnes, 2017). Some of the major problems facing the fishery include a rise in excessive and destructive fishing and the number of small-scale fishers (McClanahan, 2010). To deal with these problems, Kenya has prioritized a number of measures to conserve and manage the country's natural resources; these include the establishment of marine protected areas (MPAs) and beach management units (BMUs). A BMU delegates responsibility to stakeholders to administer their natural resources at the local level (Cinner et al., 2012). More recently, Kenya implemented gear-based management approaches by eliminating beach seines that catch very small fish (McClanahan & Mangi, 2004) and is discouraging the use of spear guns, which are often associated with loss of catch (Cinner et al., 2009).

Given the bottlenecks encountered during implementation of gear restrictions, local resource managers have recommended modifications to existing gears instead of outright prohibition (Mbaru & McClanahan, 2013). One such gear modification is the escape slot trap. This is a modified trap that allows juveniles and narrow-bodied, low-value fish species (i.e., bycatch) to exit through a small gap, while larger, wider-bodied target species are retained (Johnson, 2010). This low-cost, low-tech intervention was introduced to increase fishery selectivity and sustainability by reducing high bycatch of juveniles, ornamental species, and ecologically important herbivores (Condy et al., 2014). However, it is expected that improved catches over time will translate to positive outcomes (e.g., improved income and livelihoods that will continue to accrue over the long term) (Christie & Patrick, 2000). Indeed, fishing gear or technology-based interventions intended to reduce negative spillovers or environmental externalities associated with resource extraction have been a key part of the global marine conservation agenda (Kaiser et al., 2000). The escape slot trap, which allows fishers to modify existing fish traps, rather than purchase new ones, was introduced in September 2015 by a nongovernmental organization based in Kenya. No payments were made for adoption. Throughout the project implementation period, we researched the adoption process and assessed the social and economic consequences associated with adoption or nonadoption.

Study Design

To assess whether the slot traps affected well-being, we used a before-after-control-intervention (BACI) design. We compared changes in well-being indicators of adopters of the escape slot trap relative to nonadopters in project villages and to fishers in control villages (where the escape slot trap was not introduced) over time. The technology did not exist in all treatment sites; hence, all fishers started at the same point. The BACI design, therefore, accounted for bias due to initial differences in well-being among adopters, nonadopters, and controls and changes in well-being that resulted from broader-scale trends (Ferraro & Hanauer, 2014). Controls were selected based on their similarity to the intervention sites in regards to a suite of measurable conditions, such as fishing gear utilization and resource dependency. To avoid spillover effects of the project or contamination by other interventions, we selected control sites that did not have an ongoing conservation project and that were situated several kilometers away (>20 km) from the intervention sites. This selection criterion is consistent with the guiding principles for evaluating impacts of conservation interventions on human well-being (Woodhouse et al., 2015).

The target population was derived from active trap fishers ($n = 250$) because they had a realistic chance of adopting the conservation intervention. Data were collected using questionnaires administered in face-to-face interviews in 6 fish landing sites (2 control and 4 experimental sites) dominated by trap fishers (>40). The Kenyan coastal fishery is differentiated into 2 main sectors—the south coast and north coast fisheries—that show clear differences in socioeconomic characteristics (e.g., education, religion, and ethnicity). Because there are more trap fishers in the south relative to north, we selected more sites (4) in the south than the north (2 sites). In addition to the higher numbers of trap fishers, the 6 sites were prioritized because they had no active conservation project. Because of the differences in socioeconomic conditions between the north and south, we included 1 control site in each of the 2 regions.

The 249 respondents we included in our study completed at least 2 rounds of surveys. A total of 259 respondents were surveyed during the 3 rounds of data collection (Appendix S4). We defined adoption according to use of an escape slot trap. A fisher was considered an adopter if the person fabricated an escape slot trap or modified at least 1 existing trap by introducing the escape slots. Across all 6 sites, trap fishers used 3–10 traps. In experimental sites, the average number of new traps used by adopters was 5, although this ranged from 2 to 7. In many cases, the adoption process was gradual; fishers opted to modify a few traps for a start and thereafter increased their adoption intensity over time. To ascertain whether changes in well-being were immediately or eventually reflected in conservation outcomes, we collected data from October 2015 to January 2018. We conducted a baseline survey before the conservation practice was rolled out, followed by 2 follow-up surveys 8 and 16 months later after the launch of the project. The same questions were asked of the same participants in experiment and control sites in all 3 survey periods. Our methods were approved by the James Cook University Human Research Ethics Committee prior to commencement of surveys. Survey questions are in Appendix S8.

During the first follow-up survey (T_1), 6 fishers who were surveyed during T_0 (baseline survey) could not be traced. However, there were 27 new fishers who adopted the modified trap at T_1 but did not participate at baseline stage. We, therefore, administered baseline survey questionnaires to this new group of fishers during T_1. During T_2, 14 respondents out of the combined total of 259 surveyed during T_0 and T_1 were unavailable. However, 4 respondents that could not be traced during T_1 (but were surveyed at T_0) were available and were interviewed (Appendix S3). In all, only 2 respondents were surveyed once. Our results, therefore, include responses from individuals that were interviewed at least twice.

Overcoming Biases Associated with Panel Data

We used panel data—often considered the gold standard in impact evaluation. Panel data, when the same individual is surveyed overtime, allows multiple sources of variance to be held constant (Lohse et al., 2000). Panel data are sometimes associated with attrition bias (loss of panel members overtime), panel selection bias (when people surveyed differ systematically from the population), and conditioning effects. Conditioning effects occur when the process of conducting surveys affects individuals' responses (Lohse et al., 2000). For example, when people are asked repeatedly whether they intend to adopt a product, they may come to the conclusion that they should develop such an intention (Kinnear & Taylor, 1996). Here, panel attrition was

TABLE 1 Multidimensional framework used in the assessment of well-being outcomes related to a conservation intervention*

Wellbeing dimension	Indicator type	Outcome	Indicator	Data type
Material What you have	Basic needs satisfaction	Wealth	1. Material style of life (i.e., possessions of key assets & type of household structure)	Interval
Relational Your social connections	Social relationships	Relational balance	2. Reciprocity (i.e., number of reciprocated ties)	Interval
Subjective How you feel about what you have and your social relationships	Experienced quality of life	Perceptions about food & income	3. Quantified satisfaction levels regarding food & income	Ordinal; Likert scale 1-5
		Perceptions about social cohesion	4. Quantified satisfaction levels regarding relationship with community members	Ordinal; Likert scale1-5
		Perceptions about work enjoyment	5. Quantified satisfaction levels regarding work enjoyment & identity	Ordinal; Likert scale1-5

*Qualitative and quantitative indicators and data sources for the multiple domains of well-being. The indicator of relational of well-being (i.e., reciprocity), number of reciprocated ties, is based on fishing and information sharing ties. The 2 relationships (fishing and information exchange) are deemed critical for fishers in their pursuit of well-being because the majority of households depend primarily on fishing to support their livelihoods.

almost negligible because only 2 fishers (2 or 259) were lost during the project implementation period. We addressed panel selection bias by sampling over 95% of the target population at each of the 4 villages. An 8-month interval between surveys was considered long enough to minimize any conditioning effects.

Operationalizing Well-Being

We measured 1 component of material well-being, wealth, represented by material style of life (MSL) (Table 1). The MSL is an indicator of wealth based on a locally grounded assessment of a wide range of household possessions and structure (Cinner et al., 2009). We used a factor analysis to create a wealth metric from the first axis of a principal component analysis. However, because each respondent had 3 observations in time, each with potentially different material assets, we used factor loadings created from the baseline state to weight each of the MSL items, which allowed us to create wealth scores that were directly comparable among the 3 sampling periods. To assess the reliability of scores across the different sampling periods, we used the Cronbach's alpha technique (Tavakol & Dennick, 2011), which yielded a value of 0.89, indicating reliability at the 5% level of significance.

Relational well-being was operationalized using a measure that captures relational balance of social relationships as elucidated in the network theory (Buunk & Schaufeli, 1999; Sadilek et al., 2018; Tóth et al., 2018). To capture network data, each respondent was asked to name up to 10 individuals with whom they fished or exchanged important information about fishing (SI). In the current context, these 2 relationships (fishing and information exchange) are critical for fishers in their pursuit of well-being because the majority of households depend primarily on fishing to support themselves. Respondents could list their crew members, fellow captains, or any other stakeholder they fished or shared information with about fishing. We used recall methods (Wasserman & Faust, 1994) in which each respondent reported his relations. We then looked at reciprocity (i.e., number of reciprocated ties), based on fishing and information sharing ties, as an indicator of relational balance. Network analysis was based on binarized ties (i.e., 1 if there was a tie and 0 otherwise). Reciprocity is a network measure that deemphasizes numeric properties and can therefore be applied in an evaluation design even where only a few nominations are made (Abbott & Wallace, 2012). Network data were collected in 3 periods: time 0 (T_0), before the intervention was rolled out (baseline surveys); time 1 (T_1), 8 months after the intervention was launched (first follow-up surveys); and time 2 (T_2), 16 months after the launch of the project (second follow-up surveys).

Subjective well-being was operationalized using 3 indicators that captured individuals' perceptions of different components of their lives. In developing these indicators, we drew on a framework developed from in-depth well-being assessments of coastal fishing villages in Kenya similar to those included in our study. The 3 most important domains for respondents quality of life are participants satisfaction with their food and income situation (subjective livelihoods well-being); quality of their friendships (subjective social cohesion well-being); and their job satisfaction (subjective work related well-being) (Abunge et al., 2013) (Table 1). Each domain of subjective well-being was measured by means of 5-point Likert scale questions. We triangulated these subjective measures by including a categorical question to measure perceived change in well-being. Specifically, we asked fishers to state whether they felt a change (based on a 5-point

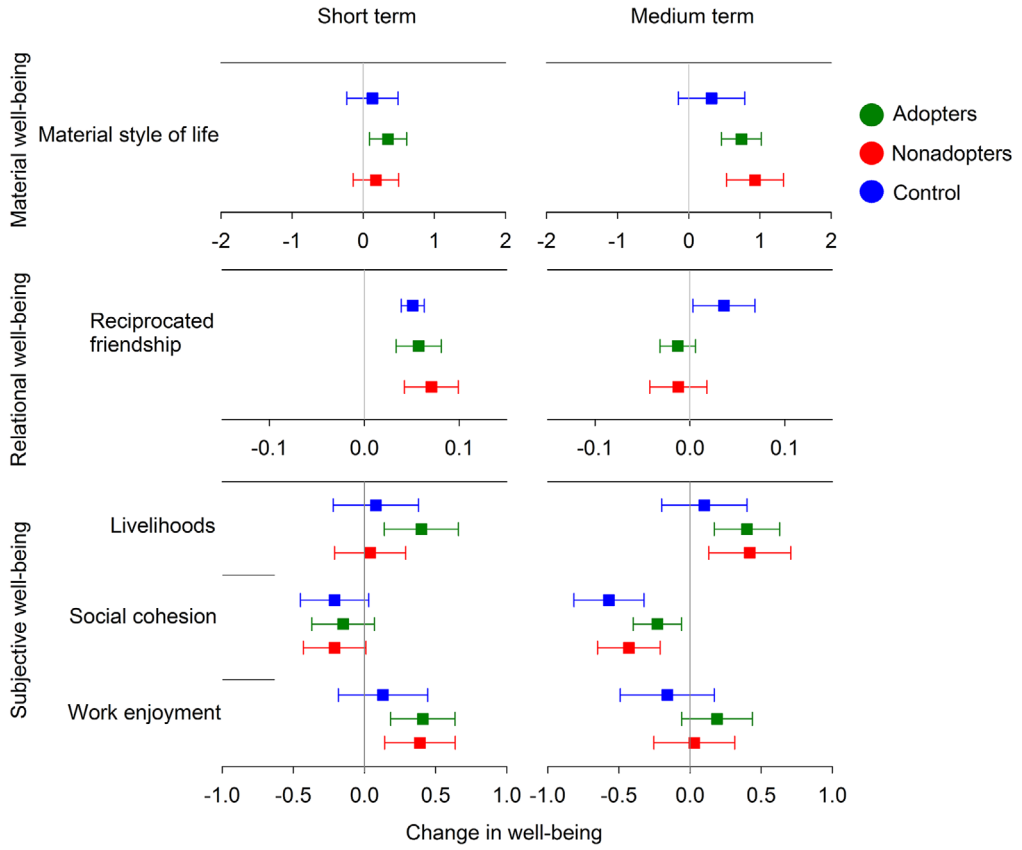

FIGURE 1 Mean changes in well-being related to a conservation intervention among adopters, nonadopters, and controls (no intervention occurs) over the short and medium term relative to a baseline (squares, mean [Δ]; error bars, standard errors). Domains for subjective well-being are how satisfied participants were with their financial situation, the quality of their friendships, and their job satisfaction. The indicator of relational of well-being, reciprocity (number of reciprocated ties), is based on egocentric networks (Borgatti et al., 2002)

Likert scale) in the 3 domains of subjective well-being over the study period.

Analyses

First, we examined whether there were differences in well-being conditions among adopters, nonadopters, and controls at the baseline time with the rank-based Kruskal–Wallis *H* test. We then used proportional odds models to test for differences in the 3 dimensions of subjective well-being (ordered categorical data) and linear mixed models to examine material and relational well-being (continuous data). All analyses on differences between adopters, nonadopters, and controls are presented as deltas (i.e., the difference between well-being conditions at baseline level, T_0 from conditions during the first follow-up [short term, T_1—8 months after implementation] and second follow-up [medium term, T_2—16 months after implementation]). The design involved testing the effect of the categorical explanatory variable (adoption, control villages, and nonadoption) on each of the different domains of well-being (response variables). Our analyses, however, did not differentiate between early and late adopters of the escape slot trap.

Adopters were set as the reference category so that differences among adopters, nonadopters, and controls could be visualized simultaneously (Appendix S5 shows analyses with the controls set as the reference category). To aid in attributing observed impacts to the intervention, we controlled for covariates that influence well-being outcomes in fisheries socioecological settings (Andam et al., 2010). These are formal leadership, fishing dependency (level of dependency in fishing), access to credit, occupational multiplicity (total number of income generation activities), age (age of the fisher years), education (maximum grade completed in formal education), and marital status (Cinner et al., 2009; Coulthard et al., 2014; Gurney et al., 2015) (Appendix S1). An examination of variance inflation factors indicated that there was no sign of multicollinearity among these socioeconomic variables. Site was included as a random factor to account for the hierarchical nature of the data (i.e., individuals nested in sites). The relevant assumptions were tested for each of the statistical models (e.g., normality and homogeneity of variances for linear mixed models). Network data were analyzed using UCINET for Windows 6 and Gephi 0.9.2 (Bastian et al., 2009; Borgatti et al., 2002). All statistical analyses were conducted using R software (version 3.4.5).

RESULTS

Baseline Conditions

Of the 250 respondents, 42% adopted the escape slot trap, whereas nonadopters and controls were represented by 29.2% and 28.8% of the sample, respectively (Appendix S1). We found no evidence that there were differences in baseline values among adopters, nonadopters, and control villages for the different domains of well-being, except for MSL, which was significantly higher in adopters at the baseline (Appendix S2). This suggests that the parallel trend assumption is likely to hold, except for MSL, and thus those results in particular should be interpreted with caution. Among our predictor variables, only baseline conditions of occupational multiplicity and formal leadership differed among treatment groups (Appendix S3).

Changes in Well-Being Over Time

Adopters experienced increases in material wealth in the short and medium term, whereas nonadopters experienced improvements in the medium term (Figure 1). Adopters, nonadopters, and controls all experienced similar increases in relational well-being (reciprocity) in the short term. Short-term gains in relational well-being among adopters and nonadopters were, however, lost in the medium term (Figure 1). However, the increase in relational well-being in control villages was maintained at a similar level in both periods.

In the short term, only adopters experienced improvements in subjective livelihood well-being, whereas adopters and nonadopters had increased levels of subjective livelihood well-being in the medium term relative to baseline conditions. Changes in subjective livelihood well-being among adopters and control villages were maintained at the same level from the short to medium term (Figure 1). There was a decline in subjective social cohesion well-being among all 3 groups in the medium term, which appeared to begin in the short-term (although error bars did not cross 0 in the short term). Adopters and nonadopters reported increased levels of subjective work-related well-being in the short term, which were not maintained in the medium term (Figure 1).

Impact of the Intervention on Well-Being

Adoption of the escape slot trap did not clearly sustain differences in any dimension of well-being over time relative to either nonadopters or controls. Short-term differences were evident for the livelihoods domain of subjective well-being (Figure 2); adopters showed significantly greater positive change in perceived livelihood satisfaction in the short term. However, these differences were not sustained in the medium term. Relative to adopters, the control group experienced lower medium-term differences in material well-being and social cohesion. However, there were no significant differences between adopters and nonadopters in these domains. Importantly, adopters never fared significantly worse than control or nonadopters in any dimension of well-being.

Testing for robustness of our subjective measures of well-being, reported and measured change were strongly correlated across all 3 domains for the 3 groups (Appendix S6). Socioeconomic factors related to changes in well-being dimensions included occupational multiplicity, formal leadership, education, fishing dependency, and marital status (full model results in Appendix S7).

DISCUSSION

The impacts of conservation on people remain poorly understood (e.g., Ban et al., 2019) and a topic of contentious debate (Milner-Gulland et al., 2014; Woodhouse et al., 2015). Taken together, we found no evidence that adopting the conservation intervention we studied harmed people across multiple domains of well-being over time. This is particularly relevant given that the intervention we studied is designed specifically to let fish escape from a fisher's trap, and pilot studies showed a possibility of associated reduced profits (Condy et al., 2014). Conservation organizations and development agencies often try to promote mutually beneficial interventions (i.e., both people and ecosystems benefit from conservation interventions) (McShane et al., 2010). Yet, these situations are rare in practice (Adams et al., 2004; McShane et al., 2010; Chaigneau & Brown, 2016). We found that a conservation intervention that has potential benefits for the ecosystem (Mbaru et al., 2019) is not negatively affecting associated resource users.

The intervention even appeared to improve in the short-term livelihood well-being relative to control and nonadopters, although this difference was not sustained in the medium term. These findings are mirrored in other studies of the impacts of integrated conservation and development. For example, Gurney et al.'s (2014) study of MPAs in Indonesia showed that the positive impacts that occurred during the implementation phase were not sustained over the long term. These trends could be due to respondents' expectations of project outcomes that were not realized. As a result, initial optimism was followed by disillusionment—a scenario that could lead to distrust. Thus, it is imperative to the success of such projects that stakeholders have realistic expectations of outcomes and related benefits, a recommendation made also by a recent evaluation of a terrestrial conservation and development project (Pelser et al., 2013). We found that relative to the control group, adopters experienced improvements in MSL in the medium term and had higher social cohesion. However, given that all 3 groups of fishers experienced declines in social cohesion over time, this should be interpreted as less of a loss, rather than a gain. Nevertheless, this still reflects a positive impact of the intervention.

Importantly, though, adopters did not have medium-term differences in MSL and social cohesion relative to nonadopters. Two possible interpretations exist for this. First, despite our best efforts to match control and experimental sites, different social processes were at play in these sites. Second, it is possible that certain benefits of the escape slot traps spilled over to

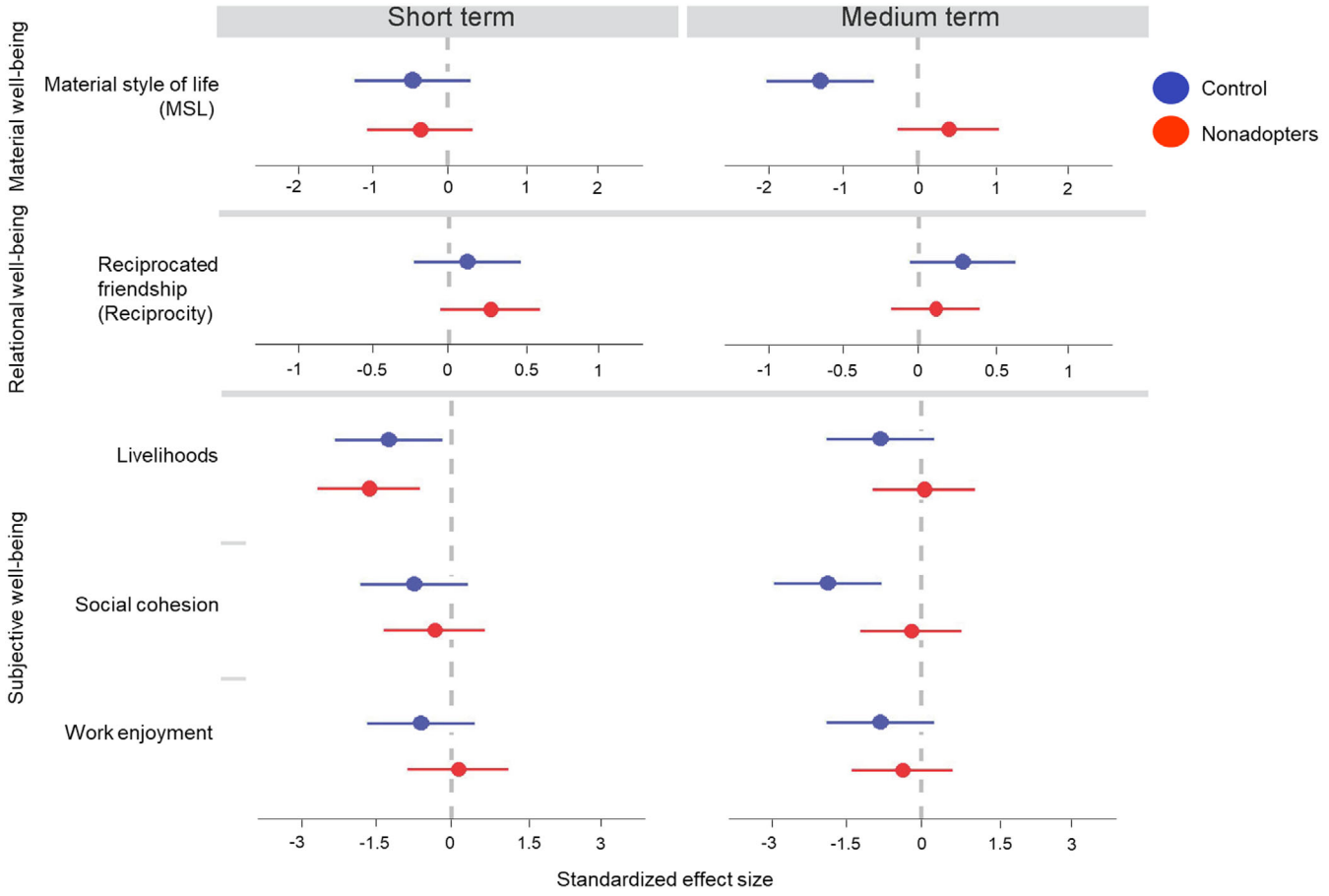

FIGURE 2 Difference in changes in well-being among controls (no intervention offered) and nonadopters (intervention offered but not adopted by respondent) of escape slot traps (circles, mean; error bars, confidence intervals). Differences in changes in well-being associated with the response variable were contrasted with the base category adoption

nonadopters. For example, the traps are intended to reduce bycatch by letting small and nontarget fish exit though escape slots (Johnson, 2010), which can lead to increased catches over time (McClanahan & Kosgei, 2018)—a benefit that could be most easily captured by the nonadopters (Mbaru et al., 2019). Elucidating these potential relationships—including whether a higher level of adoption of the escape slot trap is required to achieve a real conservation gain—requires integrated social-ecological systems monitoring (e.g., Gurney et al., 2019).

We emphasize the relevance of multiple domains of well-being to better understand how a fisheries conservation intervention (i.e., escape slot trap) affects both what people have (objective measures) and how they feel about what they have (subjective measures) (Coulthard et al., 2011). Previous studies have often relied on either tangible (objective) or intangible (subjective) indicators of well-being. Overall, we found notable variations in the magnitude of change in well-being conditions experienced by adopters, nonadopters, and controls over time. This affirms that well-being is not a discrete outcome; it changes over time or in the course of an intervention (Woodhouse et al., 2015). Further, social impacts of conservation can differ by social subgroup (Gurney et al., 2015), providing an important avenue of inquiry for future research. The discrepancies in findings we observed between social cohesion and relational well-being, for example, suggest that relying on one indicator alone may be insufficient to accurately evaluate impacts of conservation interventions. Prior to this study, evaluations on relational outcomes of conservation favored subjective questions that simply captured how satisfied people were with their social relationships in the wide community (Breslow et al., 2016; Britton & Coulthard, 2013)—as we did here. However, relying on such general questions that are far removed from the intervention can result in attribution errors because people tend to maintain social relationships comprising hundreds of members (Woodhouse & Emiel de Lange, 2016). The buffering effect associated with the presence of escape slot traps within experiments (i.e., subjective social cohesion decreasing less among adopters and nonadopters than controls) was not reflected in the patterns of relational well-being (i.e., reciprocity). Instead, controls appeared to have more reciprocated ties (i.e., improved relational well-being) compared with adopters and nonadopters in the medium term. We cannot conclude that there was a decrease in relational well-being among adopters relative to nonadopters and controls because differences between the 3 groups

were not significant. Thus, our approach effectively adds value to understanding of social, economic, and subjective implications of conservation for people. The novel approach to evaluating relational well-being with an indicator of relational balance (i.e., reciprocity—the tendency that 2 people who are connected speak to each other), as captured in network theory, can potentially challenge the traditional approach to conceptualizing relational well-being in impact evaluation research.

We used a set of comprehensive indicators that captured the complex and multidimensional nature of well-being (Breslow et al., 2016; Dawson et al., 2018). This evaluation is the first to compare multidimensional well-being concepts between adopters and nonadopters of conservation initiatives. Thus, the lack of robust investigations of the impacts of conservation on multiple categories of participants is a considerable knowledge gap addressed here. Some degree of correlation was found between objective and subjective measures of well-being, although clear discrepancies emerged among the 3 domains of well-being. We, therefore, advocate for the use of multiple measures to ensure different dimensions of well-being are assessed.

We found no evidence that the voluntary adoption of the conservation practice was detrimental to the overall well-being for adopters. This study, therefore, provides wider legitimacy and support for gear-based conservation strategies, particularly in rural economies where acceptability of participatory conservation interventions remains a key challenge. Longer-term monitoring is recommended to allow understanding of whether different benefits or costs will accrue over time.

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ORCID

Emmanuel K. Mbaru https://orcid.org/0000-0002-3608-9380
Christina C. Hicks https://orcid.org/0000-0002-7399-4603
Georgina G. Gurney https://orcid.org/0000-0002-4884-7468
Joshua E. Cinner https://orcid.org/0000-0003-2675-9317

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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