Environmental Science and Policy 124 (2021) 156–162

Contents lists available at ScienceDirect

Environmental Science and Policy

journal homepage: www.elsevier.com/locate/envsci

Classed conservation: Socio-economic drivers of participation in marine resource management

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ARTICLE INFO

Keywords:
Community-based conservation
Socio-economic drivers
Wealth index
Environmental justice
Marine resources
Principle component analysis

ABSTRACT

Conservation organizations often adopt the normative value of "whole community" participation, predicated on the idea that broad community involvement across categories of identity and social stratification will lead to more successful project outcomes. Analysis of intra-community social stratifications in relation to participation in conservation is important to the pursuit of environmental justice as well as improved efficacy of a given conservation intervention. While a large body of literature broadly examines intra and inter-community dynamics in relation to community-based conservation, few have specifically quantified how wealth influences one's participation in community-based conservation initiatives, especially in the marine realm. To address these questions, we interviewed people living near marine conservation initiatives in Madagascar. Using a principle component analysis, we created an asset-based wealth index and showed that both knowledge of and participation in marine conservation was positively correlated with wealth. Specifically, three of the four participation categories were statistically correlated with wealth, including involvement in any element of the conservation project, involvement in decision-making, and in enforcement. However, wealth was not significantly correlated with participation in monitoring. Ultimately our research highlights the importance of understanding underlying drivers of participation in community-based conservation. If the poorest in a community are underrepresented in local participation, the conservation initiative will not only be unjust, but will also likely be less effective.

1. Introduction

In the past 40 years the community-based paradigm of conservation has permeated most international conservation policy and practice. Starting in the early 1990s, "bottom up" or decentralized conservation became popular in many developing countries, leading to the proliferation of local committees, associations and affinity groups associated with natural resource management projects (Adams and Hulme, 2001; Leach et al., 1999; Brosius et al., 2005; Redmore et al., 2018). Ideologically breaking from earlier "top down" models of conservation, community-based conservation was premised on the idea that populations living adjacent to and using natural areas are more knowledgeable about and motivated to protect the natural resources upon which they rely (Brosius et al., 2005; Ostrom, 1990). A key concept, around which a decentralized management strategy theoretically pivots, is the "community." Although past work has supported the move towards greater community control over natural resource management, an important line of critique in the community-based conservation literature questions the ability of conservation projects to truly enfranchise local populations (Borrini-Feyerabend and Tarnowski, 2005; Kellert et al., 2000; Flint et al., 2008; Baker-Médard, 2019a). Additionally, past worked has highlighted the importance in analyzing the power-dynamics between local and extra-local actors, to examine the ways that within a given community, class, ethnicity, race, age, and gender directly influence access to and control over natural resources (Leach et al., 1999; Agarwal, 2010; Baker-Médard, 2017; Ybarra, 2018; Mollett, 2010).

Although conservation organizations may adopt the normative value of "whole community" participation, numerous scholars show how many conservation organizations globally still fail to recognize intra-community social stratifications that influence who benefits from and bears the burden of conservation interventions (Baker-Médard, 2017; Aswani et al., 2017; Stone and Nyaupane, 2014; Gross-Camp et al., 2019; Brosius et al., 2005; Agarwal, 2010; Mollett, 2010; Leach et al.,

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https://doi.org/10.1016/j.envsci.2021.06.007
Received 21 December 2020; Received in revised form 2 June 2021; Accepted 9 June 2021
Available online 23 June 2021

1999; Kull, 2002; Hanson, 2012). However, while a large body of literature broadly examines intra and inter-community dynamics in relation to community-based conservation, to date few studies have quantitatively examined how wealth influences one's participation in community-based conservation initiatives, especially in the marine realm (Gurney et al., 2016). It is clear that everyone in a given community does not have equal access to decision-making power, or that everyone views the costs and benefits of participation in the same way. Participation has often been found to be limited by miscommunication or a lack of education by the organizations leading the conservation initiative (Ward et al., 2018).

Wealth at the level of the individual, household or community deeply influences natural resource use practices and directly shapes natural resource governance regimes (Agrawal and Chhatre, 2006; Kuntashula et al., 2015; Makate et al., 2019; Davies et al., 2014). Previous work has shown that, generally, wealth is positively correlated with either overall adaptive capacity (D'agata et al., 2020), or participation in marine resource management (Gurney et al., 2016; Cullen et al., 2007). For example, Gurney et al. (2016) found that household wealth in Bali and North Sulawesi, along with other social and institutional factors was positively correlated with individual participation in marine protected area management. Similarly, Cullen et al. (2007) found that in Indonesia, there was an inverse correlation between wealth and marine ecological knowledge and a positive correlation between ecological knowledge and participation in traditional management practices. These studies show the importance of analyzing socio-economic drivers of environmental behavior, and also illustrate that more work is needed to investigate this intersection as it applies specifically to community-based marine conservation initiatives in the Global South.

In the past few decades marine conservation has garnered a great deal of interest and funding globally due to a rise in concern over declining fisheries production and the degradation or loss of marine biodiversity (Burke et al., 2011; Pauly and Zeller, 2016). Increasing the area of marine ecosystems under protection has become a key focus for international environmental policy makers and conservation organizations interested in conserving and sustainably using the oceans (Rees et al., 2017; Venter et al., 2014; Boonzaier and Pauly, 2016; Jantke et al., 2018). Marine protected areas (MPAs), and in particular marine reserves or no-take zones, are seen by many governments and conservation organizations worldwide as a panacea to address fisheries decline and ecosystem degradation (Gaines et al., 2010; Laffoley et al., 2019; Topor et al., 2019). This has led to a precipitous expansion of marine enclosures worldwide. In the past two decades there has been an exponential increase from 2 to over 27 million square kilometers of marine protected areas worldwide (Venter et al., 2014; UNEP-WCMC and IUCN, 2020).

Madagascar is an ideal case study to examine questions related to wealth and participation in conservation. Reports in the early 2010s showed declining catch across multiple fisheries (Le Manach et al., 2012). Fisheries declines, coupled with the status Madagascar holds internationally as a biodiversity hotspot, led a suite of international conservation organizations in conjunction with the Malagasy government to call for greater conservation efforts in the marine realm (Ratsimbazafy et al., 2019). In November 2014 at the World Parks Congress in Sydney, Madagascar's President Rajaonarimampianina committed to triple the country's marine protected areas by 2020. Part of the president's vision to facilitate this ambitious expansion was a commitment to establish a legal framework to protect community management of fishing grounds (Amla, 2014). Most conservation organizations in Madagascar work with communities adjacent to where conservation intervention occurs (Corson, 2011; Pollini and Lassoie, 2011). Legislation codifying community-based management in Madagascar was passed in the mid 1990s (Rakotoson and Tanner, 2006; Pollini and Lassoie, 2011; Kull, 1996) and by the mid 2000s there were hundreds of community-based conservation projects in Madagascar (Harris, 2011; Mayol, 2013). In Madagascar, marine reserves are governed by a mixture of either international non-governmental organizations, a parastatal organization called Madagascar National Parks (MNP), community fishing associations, or in some areas a private company. All of these management authorities attempt to engage the local fishing community in the implementation and monitoring of marine conservation measures, specifically marine reserves, however they vary widely in their ability to truly enfranchise the local population.

One reason so few studies have integrated an analysis of household wealth into research concerning community-based conservation is the difficulty of measuring household wealth, especially in a developing country context (Montgomery et al., 2000). Difficulty gathering data on household income or consumption habits has meant that many researchers conducting wealth-based analyses in the Global South rely on proxies. Asset-based proxies of wealth are some of the more widely used approaches (McKenzie, 2005; Dekker, 2006; Vyas and Kumaranayake, 2006). However, even within asset-based estimates, economists propose several systems for measuring the value of assets including giving assets all the same score and then aggregating the scores or valuing them at the market price (McKenzie, 2005; Filmer and Pritchett, 2001). While these are appealing ways to use proxies to estimate wealth, there are several problems that emerge. The first, and most obvious reason is that not all assets have the same value (McKenzie, 2005). The second is the difficulty of obtaining accurate price estimates for a wide variety of assets, especially house infrastructure variables (McKenzie, 2005; Filmer and Pritchett, 2001). Increasingly, work on estimating household wealth has used principle components analysis (PCA) to understand the influence of socio-economic standing on a variety of outcomes. The PCA gives a score to each asset based on its prevalence among surveyed individuals in order to create a wealth index. As such, PCA doesn't face the problem of flattened weightings or the difficulty of price-based estimates of household wealth. PCA models have been used to identify differences in wealth between individuals in a community and then correlate these data to disease prevalence, food insecurity, education level, and other potential indicators of poverty (Krefis et al., 2010; Makate et al., 2019; Filmer and Pritchett, 2001). Here we use a PCA to understand wealth-based differences of participation in marine resource management in Madagascar.

By creating a wealth index in Madagascar, we are able to establish wealth distinctions and correlate these distinctions with data concerning participation in marine resource management. We examined four levels of participation ranging from more classic categories of management such as decision-making, monitoring, enforcement as well as a very broad catch-all category of involvement that includes any aspect of one's self-reported involvement in the conservation project, including seemingly menial tasks such as fetching water for project personnel. The diversity of activities included provides a deeper investigation of the notion of "participation," thus deepening our analysis of wealth as it relates to these different kinds of activities. We hypothesized that wealth is a significant determinant for knowledge of and participation in marine resource management.

2. Materials and methods

2.1. Participation data analysis

With the help of a team of eight Malagasy researchers, in 2011 and 2012 we conducted 889[1] randomized surveys, stratified by gender across 19 fishing villages in two regions of Madagascar (Fig. 1). All sites were located adjacent to marine conservation projects, and all sites contained at least one marine reserve. Surveys were randomized by estimating the number of houses from Google Earth maps or recent village census data available at district government offices, assigning a number to each house, and then generating a random number table online at stattrek.com (30 numbers/houses for villages over 200 houses, 15 for villages under 200 houses) to select a house. Each survey team, stratified by gender with separate number tables, surveyed the first willing female or male respondent over the age of 18 in each randomly selected house. The survey, a standardized questionaire, focused on a variety of topics including one's opinions about, knowledge of, and participation in marine resource management, one's assets, and a suite of other topics described previously (Baker-Médard, 2017, 2019b; Baker-Médard and Faber, 2020).

[1] Age breakdown of these data are: 18–20=9%, 21–30=29%, 31–40=33%, 41–50=14%, 51–60=11%, and over 61=4%.

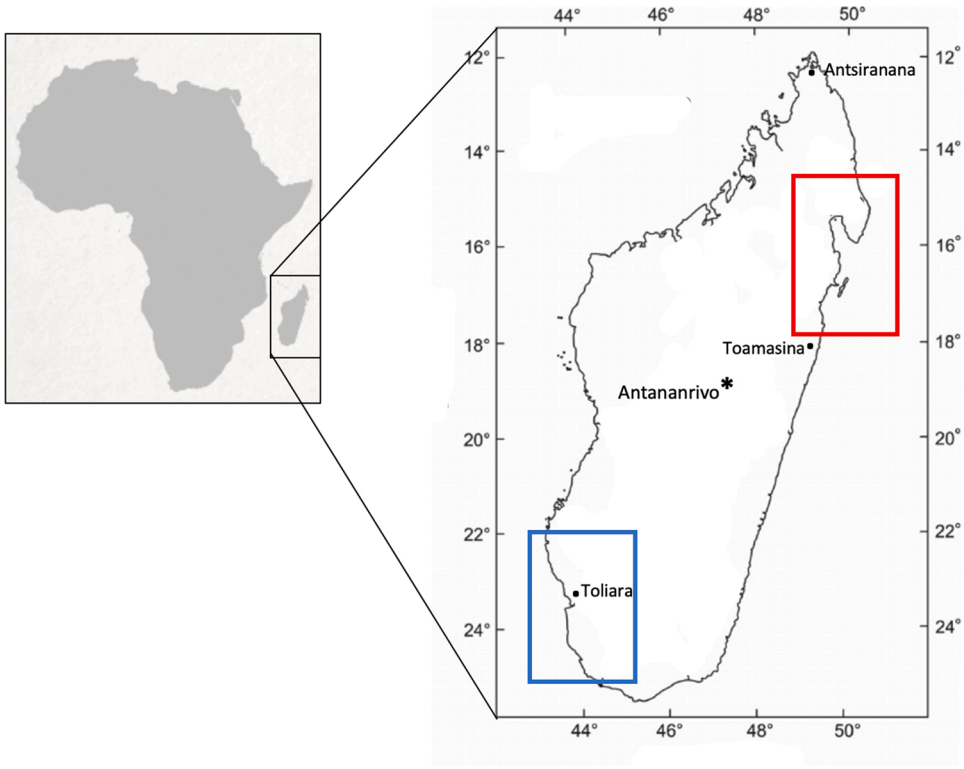

Fig. 1. Surveys were conducted in two regions of Madagascar: northeastern (red) and southwestern (blue).

The survey broke down marine resource management project participation into four categories including involvement in: 1) any way (as defined by the respondent), 2) monitoring, 3) decision-making, and 4) enforcement. The broadest category, "involvement in any way" included activities that local resource users deemed important or helpful to the conservation project, despite the fact that many of these activities may not adhere to a traditional notion of "participation" in conservation. Examples include cooking or fetching water for project representatives, the act of slaughtering an animal to bless the establishment of a protected area, or even allowing project representatives to rest in the shade of a tree on one's property. Anyone who marked that they participated in monitoring, decision-making, or enforcing from "a tiny bit" to "all the time" was marked as a participant.

Following the quantitative questions concerning participation, we also asked each respondent to answer an open-ended question about why they did or did not personally participate in the conservation project. We translated these responses from Malagasy to English. We then randomly selected 20 respondents from the lowest wealth quartile in our dataset to identify key themes within the quartile. We used these answers to help us understand common responses and key rationales used by individuals with some of the lowest wealth scores in terms of why they did not participate. These open ended responses also helped shed light on other dynamics and inhibitors to participation related to education, ethnicity, gender, and other factors.

2.2. Wealth data analysis

In order to analyze the relationship between one's wealth and one's involvement in marine conservation in Madagascar, we assessed survey participants wealth using an asset-based index. Following Filmer and Pritchett (2001), we included assets belonging to three categories: household ownership of consumer durables, characteristics of the household dwelling, and house and land ownership (see supplemental materials Table S1). Some assets were similar to those used in other studies such as radios and TVs (Montgomery et al., 2000; Dekker, 2006), while other assets were specific to our cases such as snorkeling masks and sailboats (Supplemental materials Table S1). In line with past work, we standardized all of our variables to take the values of 0 or 1 (Filmer and Pritchett, 2001; McKenzie, 2005). This allows the weights to be interpreted more easily and reduces the range of certain variable responses. We added certain variables pertaining to house and boat ownership if we felt that reducing an indicator to a binary variable did not account for enough of the variation in ownership. The cut-off points were determined by the distribution of responses. For variables such as roof type with categorical responses, we recoded the responses to a binary variable based on the cost associated with the material. Roof types such as tin and cement received a 1, whereas palm and banana leaf received a 0. If a respondent answered that they used both a low cost and a high cost roof material, we used the more expensive roof material for the asset index.

Since Madagascar is also a country with stark differences in livelihoods and wealth between regions, following Dekker (2006) we identified which variables we could use for the national versus regional asset indices to facilitate a measurement of wealth that works at both scales (Table S1). In southwestern Madagascar we included assets such as fish guns and the number of sail boats owned given that the majority of people make a living from fishing in this region. However, we did not include snorkeling masks, sail boats, or cash crops in the national wealth index because they were rare in other regions, thus diminishing their accuracy as a national-level wealth proxy. A few variables, such as roof type, we only asked in two regions, thus we only include them in regional wealth indices.

2.3. Modeling approach and evaluation

We obtained factor loadings for each asset from the national PCA analysis (Table S2). Then, we summed the factor loadings from the first principal component and assigned each survey respondent a national wealth class score. We then ran generalized linear models with a logistic error distribution (i.e. logistic regression) to see if participation in conservation, coded as a binary variable, was correlated with each survey participant's national wealth score (Fig. S1). We plotted PCA1 and PCA2 to see if regional variation in asset ownership exists (Fig. S2). The linear models include wealth and participation data from the SW and NE regions. For each model, we examined Pearson residuals to verify model assumptions. All models were run in R version

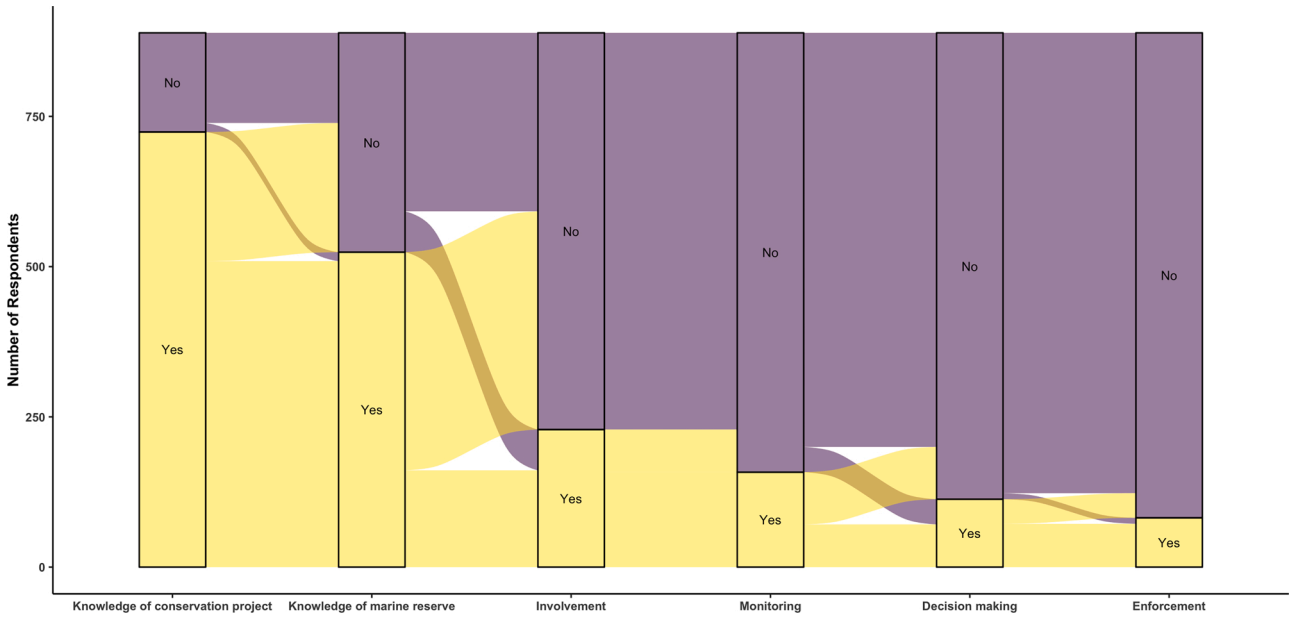

Fig. 2. Flow chart representing number of respondents who reported that they knew about the conservation project, the marine reserve, and contributed to project management by four participation categories. N = 889.

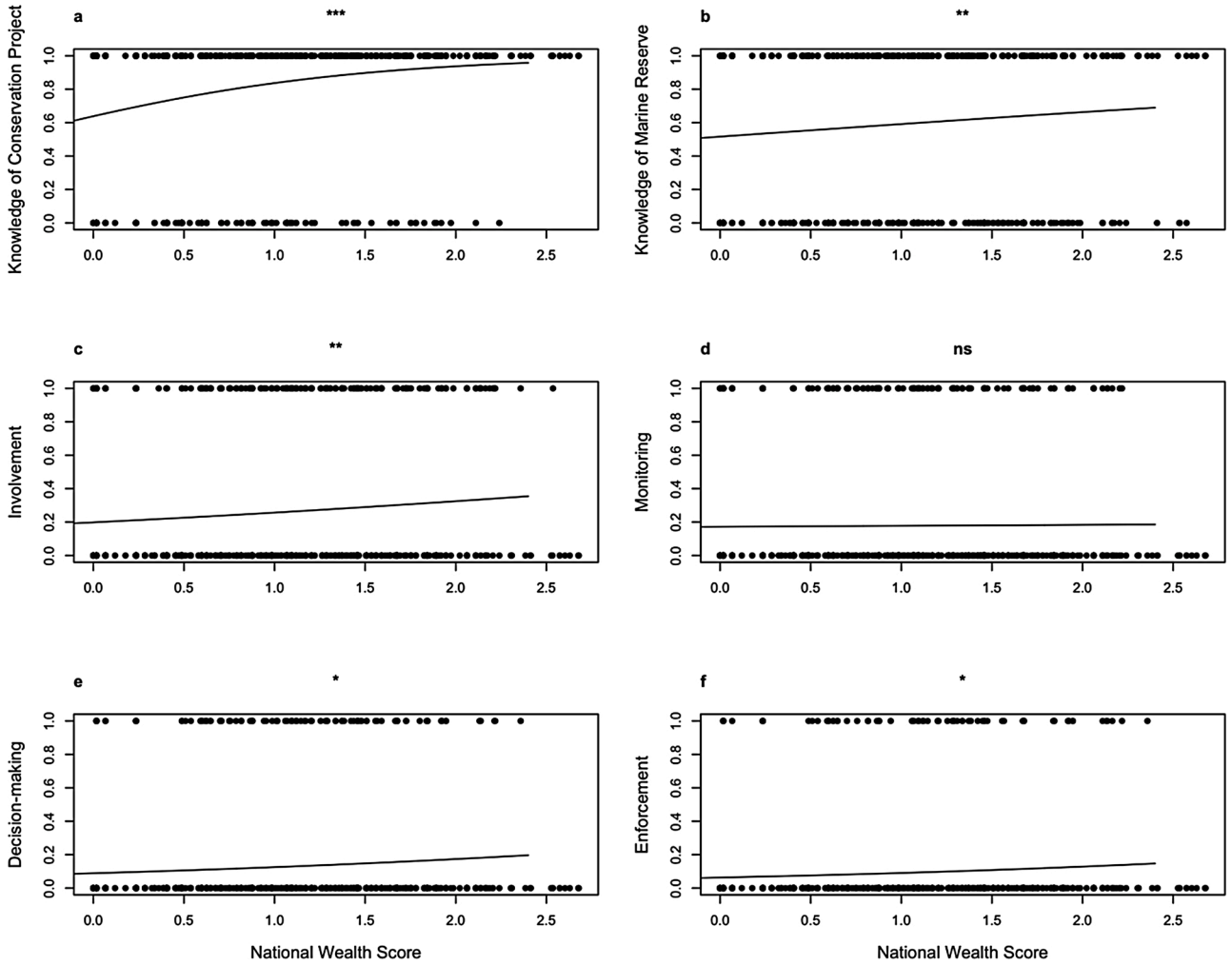

Fig. 3. Wealth scores as they relate to the probability of the survey informant's a) knowledge of the conservation project ($p < 0.001$***), b) knowledge specifically of the marine reserve ($p = 0.00515$ **), c) involvement in any element of the conservation project (0.00623 **), d) involvement in monitoring ($p = 0.3$ (ns)), e) involvement in decision-making ($p = 0.016$ *), and f) involvement in enforcement ($p = 0.0316$ *). N = 889.

1.3.1093.

3. Results

Over half of respondents knew about the conservation project and the protected area, however, less than a third were involved in the project and even fewer participated in monitoring, decision-making, and enforcement (Fig. 2). While potentially counterintuitive, the small group of individuals who responded that they have no knowledge of the marine reserve, but who also responded that they are "involved," indicates that their involvement relates to the broader conservation project, not specifically to the marine reserve.

Knowledge of and participation in marine resource management was significantly correlated ($p < 0.01$) with wealth (Fig. 3). Across all of the categories there is an increasing likelihood of knowledge of the conservation project, the marine reserve, and participation in the project as the wealth score increases. The only category where the wealth score is not significantly associated with participation is monitoring. Within the general trend showing a strong correlation between wealth and knowledge of and participation in the conservation project, the y intercepts illustrate that significant variation between these categories exists. For example, even with the lowest wealth score, there is around a 20 % chance that one would be involved; however, for enforcement, people with the lowest wealth scores have less than a 10 % chance of being enforcers.

4. Discussion

4.1. Impact of wealth on participation in marine resource management

Although most marine conservation projects in Madagascar are community-based or engage a co-management model, our results show a low level of involvement in marine conservation across the board, signaling an important area of growth for conservation organizations working in the marine realm (Figs. 2,3).

Our research builds on past work investigating the relationship between wealth and pro-environmental behavior (Davies et al., 2014; Cullen et al., 2007; Kuntashula et al., 2015; Makate et al., 2019). More specifically, our research contributes to the community-based conservation literature, demonstrating the importance of quantitatively understanding intra-community wealth disparities that contribute to differences in local participation in conservation initiatives (Baker-Médard, 2017; Aswani et al., 2017; Stone and Nyaupane, 2014; Gross-Camp et al., 2019). Additionally, because of our focus on marine conservation, this work also contributes to the growing literature investigating various social drivers of MPA management (Raycraft, 2019; Bennett et al., 2019; Ban et al., 2019; Kamat, 2018; Ward et al., 2018). Ultimately, this information will be critical for governmental and non-governmental conservation organizations so that they can be aware of how wealth disparities influence knowledge of and participation in conservation initiatives, and subsequently better target education campaigns and incentives for certain behaviors.

Our results supported our hypothesis that wealth is a significant determinant for knowledge of a marine conservation project and the corresponding marine reserve, and participation in marine resource management. Based on our analysis, monitoring was the only category that transcended wealth differentials at the national level. We hypothesize that monitoring is either an activity that all people regardless of socio-economic status feel more comfortable participating in, or that conservation organizations are better at recruiting a wider array of individuals to participate in this element of resource management. For the other five categories, people with lower wealth scores were less likely to be knowledgeable of the conservation project and the marine reserve, and less likely to participate. These findings support conclusions made by other studies investigating the impact of socio-economic drivers on community participation in protected area management (Ward et al., 2018; Gurney et al., 2016).

Understanding precisely why wealth is positively correlated with knowledge of and participation in marine conservation requires additional research. However, preliminary analysis of an open-ended question in the survey may help shed light on potential drivers. One question of the survey asked specifically why an informant did or did not participate in marine resource management. Three themes emerged from people in the lowest wealth quintile who did not participate including: 1) not being selected to participate or having the knowledge of how to get involved, 2) literacy as an obstacle for participation, and 3) belonging to a group of people who are deemed less important.

The phrase "I wasn't chosen to participate[2] " was one of the most common responses in the lowest wealth quintile to this open-ended question in the survey. A similar response, "I don't know how to get involved,[3] " also emerged numerous times. These answers both reflect a potential lack of effective outreach by the conservation organization to these individuals, as well as a broader lack of effective information dissemination concerning the ways local people can get involved in management.

Other common responses included variations on "I am not literate.[4] " While wealth and literacy have been shown to be strongly correlated (Hertz et al., 2008; Hemmerechts et al., 2017; Bradley and Corwyn, 2002; Rabearisoa and Zorzi, 2013), literacy is not a prerequisite for involvement in marine conservation initiatives. As marine conservation organization personnel emphasized in semi-structured interviews with us, there are a variety of ways to get involved, most of which do not require the ability to read or write such as helping decide marine resource use rules, weighing in on the location and size of a no-take zone, monitoring resource use, or helping decide possible punishments for those who have transgressed resource use rules (pers. comm. Toliara, June 22, 2018; Toliara, July 1, 2018; Antananarivo April 17, 2019). That said, responses related to lack of literacy reflects what individuals in the lowest quintile perceived were the kind of skills valued or even required by the organizations helping implement marine conservation projects on the island. Thus, similar to the responses above, adequate outreach and information might aid in shifting this commonly held perception among the poorest in a given community.

Lastly, the final category of responses emphasized the importance of identity in shaping why certain people do not participate in marine resource management. Among women, a common phrase was "the project doesn't want women.[5] " Similar to findings regarding formal educational attainment and wealth, numerous studies show that women, especially widowed or single women are overrepresented in low socio-economic categories (Filmer, 2020; Bradshaw et al., 2017). This response from women in the lowest wealth quintile corresponds to a trend in the marine conservation literature showing a generalized lack of women's participation in marine resource management (Baker-Médard, 2017; Bennett, 2005; Gissi et al., 2018; Kleiber et al., 2015).

A related response from people in the lowest wealth quintile when asked why they don't participate were phrases like "I am not wealthy,"[6] or "I'm insignificant,"[7] or "They only want important people."[8] These responses align with a broad finding in the literature the strong relationship between one's wealth and one's social status or political standing (Narayan and Pritchett, 1999; Berg-Schlosser and Kersting, 2003). These responses demonstrate a socio-economic hierarchy of participation in resource management, where wealth itself drives who is and who is not represented in marine resource management. Additionally, these responses help

[2] "*Tsy voatingy*" (southwestern Madagascar), or "*tsy mila ahy zare*" (northeastern Madagascar)

[3] "*Tsy haiko raha idiraka amin'izany*" (northeastern Madagascar)

[4] "*Tsy mahay taratasy*" (southwestern Madagascar)

[5] "*Tsy mila ampela le tetik'asa*" (southwestern Madagascar), or "*viavy tsy agnatiny*" (northeastern Madagascar)

[6] "*tsisy jala*" (southwestern Mada) or "*tsy manam-bola*" (northeastern Madagascar)

[7] "*Tsy manandraha, madiniky zaho*" (southwestern Madagascar)

[8] "*Mila olobe avao rozy*" (southwestern Madagascar)

highlight the possibility that people's assets are indicators of socio-political relations, in addition to, or in some cases instead of simply indicators of finances. This aligns with the anthropological literature in Madagascar illustrating that certain individuals such as elders, "big/important" people (*olobe or ndatybe*), or spiritual leaders are able to secure assets through kinship, royal lineage relations, spiritual practices, and patronage relations instead of or in addition to income generating activities (Lambek, 2004; Feeley-Harnik, 1978; Gezon, 2002).

Lastly, it's clear that some fishers saw a connection between wealth-based participation in marine resource management and social self-importance. For example, one individual in southwestern Madagascar said that he doesn't participate in marine resource management in his village because "all [the conservation project participants] do is show off/strut around."[9] This response demonstrates the relationship between higher socio-economic standing and perceptions of pretention and self-importance. Thus, when a marine conservation strategy becomes caught in wealth-based social divides, it runs the risk of reifying these social hierarchies and forms of social ostracization.

The more qualitative analysis of open-ended responses from individuals within the lowest wealth quartile sheds light on how wealth does not operate in isolation from other factors related to one's identity and socio-political location. These qualitative findings afford a more nuanced analysis of power and participation that feminist political ecologists call for in understanding the way in which class and other intersecting axes of difference such as gender, race, class, caste and nationality, shape human-environment relations as well as resource access and control at local, regional, and global scales (Rocheleau et al., 2006; Resurrección, 2017; Elmhirst, 2011; Mollett and Faria, 2013; Nightingale, 2011).

5. Conclusion

At the national level, wealth was significantly correlated with participation in marine conservation across all participation categories, except for monitoring. Overall, our research shows that people on the lower end of the wealth index were less likely to know the project exists and then even less likely to be involved, make decisions, and enforce the rules. If the poorest in a community are not involved, these marine conservation initiatives may exacerbate class-based inequalities in a community. Additionally, from an efficacy standpoint, if a subset of a community is not involved in conservation efforts, the conservation intervention is likely going to be less effective. As research has shown, greater community participation often results in fewer instances of rule transgression, ultimately benefitting the ecological goals of the project (Agrawal and Chhatre, 2006; Dalton et al., 2012; Mascia, 2003; Giakoumi et al., 2018).

Understanding which groups are more or less likely to participate in marine conservation is critical for conservation organizations helping implement and maintain marine conservation projects. Targeted outreach to the poorest in a community may help improve overall community representation and participation in conservation. However, given answers to the open-ended question of the survey, it's clear that outreach may not be enough. Changing the culture of leadership, understanding that there are socially specific hierarchies that influence participation in a conservation project is also important.

Our findings suggest that conservation organizations should be attuned to wealth dynamics both between regions and within any given participating village. Especially for projects that are designated as community or co-managed, there should be a concerted initiative to bring a representative voice from people regardless of wealth, as well as increase participation in management and involvement. We found that Madagascar has clear regional wealth differences which correlate with involvement in conservation projects. This finding could help inform how conservation organizations go about understanding the interests and needs of coastal communities, and/or how they incentivize participation in MPA management across different regions.

Future research focused on the intersection of wealth and participation in conservation could consider analyzing the corresponding costs and benefits of participation for people with different levels of wealth. Additional research could also consider the impacts on local community wealth and participation as a result of industrial fishing by foreign nations near conservation areas (White et al., 2021). Ultimately, this will help identify strategies to improve participation across wealth disparities. Additionally, as some of our findings indicate, improving analysis of how wealth interacts with gender, education, and other potential covariates will help researchers obtain a more holistic picture of local involvement in conservation initiatives.

Funding

This research was supported by NSF: BCS-1103332, BIO-1923707, and the Fulbright Scholar Program.

CRediT authorship contribution statement

Merrill Baker-Médard: Conceptualization, Methodology, Analysis, Writing-Original Draft, Writing-Review & Editing, Supervision, Project administration, Funding acquisition. **Courtney Gantt:** Conceptualization, Formal analysis, Data curation, Writing- Original draft, Writing-Review & Editing, Visualization. **Easton R. White:** Methodology, Software, Validation, Formal analysis, Writing- Reviewing and Editing, Visualization, Supervision, Funding acquisition

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.envsci.2021.06.007.

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