



Disaggregating ecosystem service values and priorities by wealth, age, and education



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ABSTRACT

Ecosystem services support the livelihoods and wellbeing of millions of people in developing countries. However, the benefits from ecosystem services are rarely, if ever, distributed equally within communities. Little work has examined whether and how socio-economic characteristics (e.g. age, poverty, education) are related to how people value and prioritize ecosystem services. We interviewed 372 people connected to coral reef fisheries in 28 communities across four countries in the western Indian Ocean. Each fisher ranked the importance of nine ecosystem service benefits, and then rated which services they most desired an improvement in quantity or quality. We disaggregated their responses to see whether age, poverty, or years of formal schooling influence how fishers rank and prioritize coral reef ecosystem services. Overall, we found little empirical evidence of strong differences between groups. However, the wealthiest fishers did prioritize improvements in habitat ecosystem services and recreational benefits more than other fishers. Our findings emphasize that people directly dependent on coral reef fisheries for their livelihood hold mostly similar values and priorities for ecosystem services. However, poverty influences whether fishers prioritize improvements in supporting ecosystem services associated with environmental care, in this case habitat benefits. Making the differences and similarities between the importance of and priorities for ecosystem services explicit can help decision-makers to target and frame management to be more socially inclusive and equitable and therefore, more effective.

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1. Introduction

Ecosystem service research has made much progress toward conceptualizing and valuing nature's benefits to people. People need nature's benefits to live healthy, fulfilling lives with fresh water, clean air, and nutritious food (MA, 2005). Yet until the 1990s, these benefits were often undervalued or completely missing from policy (Costanza et al., 1997). Natural capital and ecosystem services thinking emerged to remedy this oversight by explicitly accounting for nature's benefits to people (Daily, 1997). Since the 1990s, ecosystem services research has grown exponentially (Gómez-Baggethun et al., 2010; van den Belt and Stevens, 2016). More recently, a range of institutions and programmes have emerged, aiming to contribute to poverty alleviation and enhance human wellbeing by drawing on ecosystem services approaches and research. For instance, the Millennium Ecosystem Assessment (MA, 2005), Ecosystem Services for Poverty Alleviation (ESPA), and

the International Panel for Biodiversity and Ecosystem Services (IPBES) all focus on improving and safeguarding human wellbeing. This agenda is particularly crucial in developing countries, where people often directly depend on ecosystem services for their sustenance and livelihoods.

Although research has examined the myriad ways that ecosystem services benefits are linked to human wellbeing and poverty alleviation (MA, 2005), the links are not straightforward and remain poorly understood (Fish et al., 2016; Fisher et al., 2014, 2013; Howe et al., 2014). In particular, understanding whether and how ecosystem services benefits to wellbeing differ among different social subgroups remains nascent (Daw et al., 2011). Populations, communities, and societies are socially diverse – i.e. made up of different groups, with varying identities, values, and experiences. This diversity impacts who benefits from ecosystem services, and influences what is considered fair in ecosystem service distribution and governance (Berbés-Blázquez et al., 2016; Daw et al., 2011; Sikor and Baggio, 2014). Large-scale, aggregated ecosystem service studies – the norm in ecosystem services research (Wieland et al., 2016) – are unlikely to reflect the values of poorer or more marginalized people (Brooks et al., 2014), or to

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capture differences across social groups (Daw et al., 2011). Indeed, management based on aggregated studies may have unintended consequences on poverty alleviation, leading to inequitable socio-economic impacts that may further marginalize certain groups' interests (Adams, 2014; Berbés-Blázquez et al., 2016; Daw et al., 2011).

To date, research on social differentiation and ecosystem services has been growing but limited. Most studies addressing social differentiation have been single case studies (Orenstein and Groner, 2014; Lakerveld et al., 2015, although see Sodhi et al., 2010). Studies have differentiated by: livelihood type (e.g. Brooks et al., 2014; Caceres et al., 2015); beneficiary group (Milcu et al., 2015); rural vs urban residents (Orenstein and Groner, 2014); citizenship (Orenstein and Groner, 2014); socio-cultural groups (Lakerveld et al., 2015; Sagie et al., 2013); socio-economic status (Dawson and Martin, 2015; Sodhi et al., 2010); length of residency or location (Dawson and Martin, 2015; Sodhi et al., 2010); and socio-ethnic group (Dawson and Martin, 2015). Studies contrast perceptions of ecosystem services (Caceres et al., 2015; Orenstein and Groner, 2014; Sodhi et al., 2010), needs and benefits (Lakerveld et al., 2015; Milcu et al., 2015), and access (Lakerveld et al., 2015).

Many of these studies have found that people both benefit from and perceive ecosystem services differently. For example, in a valuation of wetland ecosystem services in Asia, government officials and business owners (i.e. decision makers) estimated wetland fisheries to have very little overall monetary value. However, for the livelihoods of poor fishermen and women dependent on the wetland ecosystem services these fisheries benefits were crucial (Brooks et al., 2014). In Argentina, subsistence farmers perceived many cultural ecosystem services benefits from the land, while large farmers perceived none (Caceres et al., 2015). In addition, work investigating urban and rural residents of the Arajun valley in Jordan and Israel has shown that perceptions of ecosystem services can be defined by political border and residential characteristics (Orenstein and Groner, 2014).

Work on the social dimensions of ecosystem services has been predominantly in terrestrial systems. Marine and coral reef ecosystem services remain under-researched from a wellbeing and human dimensions perspective (Rivero and Villasante, 2016), and ecosystem services work on poverty alleviation more broadly has tended to focus on cultivated and forested land (Suich et al., 2015). In line with this trend, most studies addressing social differentiation and ecosystem services are in terrestrial systems (although see Daw et al., 2011). Attention to social differentiation and marine and coastal ecosystem services is crucial not only because empirical research remains nascent, but also because much fisheries policy and research has historically been based on Malthusian narratives of overfishing (Finkbeiner et al., 2017) and technical fixes that rarely include marginalized stakeholders (Degnbol et al., 2006). While often taken as an homogeneous stakeholder group, fisherfolk have diverse perspectives and experiences (Béné, 2003; Eder, 2005), and poverty in fisheries is rooted in complex social and institutional processes (Finkbeiner et al., 2017; Nayak et al., 2014).

Previous studies in the western Indian Ocean have shown that certain socio-economic factors mediate the benefits people perceive from ecosystem services (Hicks and Cinner, 2014). More specifically, social relationships and institutions shape who can access ecosystem service benefits. Hicks et al. (2015) also found a great deal of variability within the ecosystem services that fishers prioritized for improvement. Here, we extend this work to understand how, and whether, wealth, age, and level of formal schooling shape differences. Specifically, we ask whether disaggregating by subgroups might illuminate logical stakeholder groups across scales, and whether we could identify the sorts of

socio-economic characteristics that may shape variation in fishers' ecosystem services priorities. This study thus extends and deepens work on the role of socio-economic characteristics in shaping variability across ecosystem services priorities and importance.

We hypothesize that those who draw their livelihoods from coral reef fisheries directly (i.e. fishers, fish workers, and fish traders) may hold different priorities for ecosystem services depending on other socio-economic aspects of their identities. Here, we explore whether disaggregating the importance of and priorities for coral reef ecosystem services is a useful avenue for understanding fisherfolks' similarity beyond solely fishery-related provisioning services. More specifically, we examined how fishers' socioeconomic characteristics (including age, years of formal schooling, and material wealth) are related to: (i) the relative importance they place on ecosystem services; and (ii) their priorities for improvement in the quality and/or quantity of ecosystem services across 28 communities in four countries in the western Indian Ocean.

1.1. Background and study sites

Countries in the western Indian Ocean are heavily reliant on marine and coastal ecosystem services. The region has a history of cultures and livelihoods based around fishing, maritime trade, and marine resource use, and a vision of 'people prospering from a healthy Western Indian Ocean' underpins key regional policies aimed at sustainable development (Obdura et al., 2017, p. 5). More specifically, coral reef fisheries are extremely important to many coastal communities throughout the region (Cinner and Bodin, 2010), but are highly vulnerable to global environmental change (Cinner et al., 2012). Coastal communities across the western Indian Ocean lack many of the resources necessary to adapt to losses of key coral reef ecosystem services. Our study draws on interviews conducted in 28 communities western Indian Ocean, from Kenya, Madagascar, Seychelles, and Tanzania. These communities were broadly representative of the region's rural fishing communities. Each face similar challenges of environmental stressors and lack of resources, and represent different types of reef management.

2. Methods

2.1. Sampling

This study is drawn from data gathered as part of a larger project on coral reef ecosystem services in the western Indian Ocean (Hicks et al., 2015; Hicks and Cinner, 2014). We surveyed a total of 372 fishers, fish workers, and fish traders (hereafter referred to collectively as fishers) from 28 coastal communities across Madagascar, Tanzania, Kenya, and the Seychelles. Respondents were randomly selected across gear types, residence, and age from fishers, fish traders, and fish factory workers registered with local fisher organizations or the fisheries department (i.e. a stratified random sampling approach). We interviewed between 7 and 32 fishers per community, which represents 20–40% of all fishers. Respondents were mostly men, although we interviewed some women working as fish traders in Madagascar.

2.2. Coral reef ecosystem services

To identify coral reef ecosystem service benefits in the western Indian Ocean, we held five focus groups with managers and scientists. We use the definition of ecosystem services as 'the functions and processes of ecosystems that benefit humans, directly or indirectly' (Costanza et al., 2017). From these discussions, we wrote

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