



Gleaning: beyond the subsistence narrative

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Abstract

Coastal resources are important for the wellbeing and livelihoods of people in coastal communities across the world but are used and valued differently by different people at different times. As such, managing coastal resources equitably requires understanding how and when different people value ecosystems. Gleaning is an important activity in many coastal communities. However, the values of gleaners, and women in general, are often left invisible in coastal ecosystem service assessments and rarely examined in different seasons. Here, we use an exploratory case study to elicit the seasonal values of gleaning to women in a coastal community through an in-depth mixed method case study in Timor-Leste. We found that women gave a variety of instrumental and relational reasons for gleaning and that gleaning values shifted across seasons. Notably, subsistence was not a priority for all gleaners. Instead, there were a diverse range of reasons perceived as important for gleaning including to socialise or to spend time in nature. Our findings highlight the need to move beyond oversimplified understandings of gleaning as simply a matter of meeting basic material needs. The diverse and seasonal value priorities of gleaners in our case study indicate the importance of socially and temporally disaggregated assessments of coastal ecosystem services that account for relational values to support more accurate depictions of coastal livelihoods and equitable management in coastal areas.

Keywords Gleaning · Small-scale fisheries · Ecosystem values · Seasonality · Wellbeing · Gender

Introduction

Coastal zones are complex social-ecological systems that support the wellbeing of millions of people, many of whom live in the Global South. Accounting for and sustaining the diverse contributions of coastal ecosystems to human wellbeing is thus particularly important, especially in the context of increasingly unpredictable environments (IPCC 2014). Gleaning—the collection of marine organisms predominantly from the littoral zone—is an important livelihood activity for

the rural poor in coastal regions of developing countries. Gleaning makes a substantial contribution to catches and food security benefits, particularly in the context of seasonal availability and accessibility of other coastal fisheries (Chapman 1987; Kleiber et al. 2014; Tilley et al. 2020), which are influenced by the spatiotemporal distribution of resources, weather, economic constraints, and regulations (Gill et al. 2019; Sievanen 2014; Teh et al. 2007). Gleaning is also an important social activity for women (Whittingham et al. 2003).

Despite its importance, gleaning has remained largely invisible in both policy and research. Gleaning tends not to be a lucrative economic activity and is thus underrepresented in fisheries assessments, decision-making, and coastal resource management (Fröcklin et al. 2014; Harper et al. 2013; Kleiber et al. 2015). When it is included, gleaning is usually seen as an activity valued for its contribution to household subsistence as part of a gendered narrative in fisheries. For example, in a report on fisheries in Timor-Leste, it is stated that “[...] in many communities, women and children dominate the fishery, which shows its importance for household nutrition” (López Angarita et al. 2019, pp.21). While these contributions are a crucial part of highlighting some aspects of the importance of gleaning for food security, they do not look beyond its subsistence values.

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Emphasis on the subsistence value of gleaning represents an extension of the iconic and compelling narrative of women's role in household food security. This narrative, of women as providers and caretakers, has been central to gender mainstreaming in the development discourse (Quisumbing et al. 1996; United Nations n.d.). Such narratives have helped promote better representation of women in decision-making but also underpin an oversimplified representation of women and poverty based in generalisations (Chant 2008; Cornwall et al. 2007). As a consequence, there has been a tendency to attribute women's choices and behaviours to essentialised female traits (Jackson 2009). These essentialised understandings of women's choices and behaviours can obscure priorities, aspects of wellbeing, and values that do not fit within the narrative of women as providers. To move beyond this narrative in gleaning, more empirical work is needed on the values women derive from gleaning and how value preferences shape women's wellbeing.

Ecosystem services provide a framework for moving beyond the subsistence narrative in gleaning by investigating the multiple values of gleaning across time. Firstly, ecosystem services approaches can capture the complex, dynamic, and socially disaggregated links between human wellbeing and ecosystems. Progress in ecosystem services has turned to plural value approaches to account for the diversity and distribution of coastal ecosystem values (Blythe et al. 2019; Lau et al. 2019). Such approaches emphasise that different people derive different values from ecosystems. For instance, work in ecosystem services is starting to illuminate how women and men interact with and benefit from ecosystem services in different ways and are therefore differentially affected by processes of change (Brown and Fortnam 2018; De La Torre-castro 2019; Fortnam et al. 2019). Secondly, work in ecosystem services is beginning to investigate how temporal variability may influence ecosystem values at the landscape scale, in ways relevant to the study of gleaning. For example, seasonal access and availability of ecosystem services determined differences in the values of services to local stakeholders through time in Nepal (van Oort et al. 2015). Given that climate change is predicted to affect seasonal weather and sea conditions in coastal areas (Oppenheimer et al. 2019), extending studies of temporal change in coastal service values presents an important and pressing opportunity.

To address the gap in understanding the plural and seasonal values of gleaning for women in coastal communities, we undertook an exploratory case study of gleaning in a community in Timor-Leste. We asked: (1) What are the seasonal characteristics of gleaning in the community? (2) Why do women glean and what values do they derive from gleaning? (3) How do values associated with gleaning change between seasons? We begin by outlining the theoretical underpinnings of our approach from wellbeing, ecosystem services, and plural values literature. After describing our case study and

methods, we present a characterisation of the gleaning fishery and describe gleaning values over time. Finally, we discuss the implications of our findings and outline future directions for gleaning research to move beyond the subsistence narrative.

Theoretical underpinnings

This section outlines key insights from literature on wellbeing, ecosystem services, and plural values relevant to investigating the role and values of gleaning for wellbeing in coastal communities over time.

Wellbeing

Wellbeing is defined as “a state of being with others, where human needs are met, where one can act meaningfully to pursue one's goals, and where one enjoys a satisfactory quality of life” (McGregor 2008, pp.1). This definition theorises wellbeing as emerging from the interplay between the material (assets and physical “stuff” that people have), relational (social interactions and governance that determine what people can do), and subjective (cultural values and perceptions that influence how people feel) domains of a good life (White 2009). This expanded definition of wellbeing represents an active move away from outdated definitions of poverty that measure the wellbeing of the poor only by material indicators (Chambers 1995; Rojas 2011). The move beyond material measures of wellbeing is viewed as fundamental for understanding and supporting meaningful relationships between people and nature and achieving poverty alleviation objectives in environmental management (Chan et al. 2011). For example, wellbeing approaches are important for capturing the societal values of small-scale fisheries (Johnson 2018), which support more respectful representations of the lives and values of fishers by defining quality of life as more than just the ability to meet basic needs and focusing on what people have, not only what they are lacking (Camfield 2006; Weeratunge et al. 2014). Crucially, multidimensional wellbeing approaches enable disaggregated assessments of environmental contributions to fulfilling a meaningful life, therefore identifying the potential winners and losers, and evaluating the trade-offs and inequalities, of environmental change (Coulthard et al. 2018). As such, wellbeing approaches improve the legitimacy of policy and decision-making through recognition of values and aspirations within fisheries as a way of life and not just a means of making a living (Coulthard et al. 2011). By providing a more comprehensive understanding of why gleaning matters, this multidimensional wellbeing lens can contribute to moving beyond essentialised subsistence narratives of women and poverty in coastal livelihoods.

Ecosystem values

The pursuit of wellbeing influences how people interact with ecosystems to mediate wellbeing outcomes (Coulthard 2012). People manage landscapes to enhance ecosystem structures and processes from which they mobilise flows of ecosystem services; these services are then allocated to a set of benefits that contribute to wellbeing and are attributed value (Fedele et al. 2017). The values people derive through interactions with nature can be instrumental or relational (Box 1) and contribute to the material, subjective, and relational dimensions of wellbeing. People's ability to realise wellbeing from ecosystems is shaped by mechanisms of access (Ribot and Peluso 2003), and the ways in which benefits are coproduced and values co-constructed are influenced by diverse world-views and value systems (Díaz et al. 2015; Fischer and Eastwood 2016). As such, in coastal social-ecological systems, ecosystem contributions to wellbeing are not necessarily linked with biophysical attributes and vary between stakeholders (Bryce et al. 2016), and relational and instrumental values may be inseparable (Fish et al. 2016). Understanding the multidimensional contributions of the environment to human wellbeing is crucial for balancing and integrating human and ecological needs to negotiate conservation and development discourses in environmental management (Chaigneau et al. 2019a). Ensuring coastal ecosystems are sustained in ways that build resilience inclusively will therefore require understanding what matters to whom and why, and how climate impacts will be differentially experienced (Bennett et al. 2015; Kenter et al. 2011; Tschakert et al. 2017). Framing gleaning through ecosystem values provides a way of integrating wellbeing objectives into understanding human-nature interactions in coastal social-ecological systems.

Box 1 Types of ecosystem values

- **Instrumental values** refer to ecosystem services as a means of achieving desired wellbeing outcomes, for instance as a source of nutrition or income, e.g. the market value of fish. Instrumental values that achieve the same wellbeing outcomes are substitutable.
- **Relational values** are the ways through which specific human-nature linkages and interactions contribute to wellbeing through sense of place, cultural identity, and social cohesion, e.g. the ceremonial value of catching and consuming a particular fish species. Relational values are non-substitutable.
- **Intrinsic values** are inherent moral values attributed to an entity for the virtues of what it is regardless of its relationship to people, e.g. the value of knowing that fish exist. Intrinsic values are non-substitutable. (Himes and Muraca 2018; Pascual et al. 2017)

Plural values

Single ecosystem services can support multiple types of value important for wellbeing (Chaigneau et al. 2019b). The diversity of values people derive from how they relate to and care

about nature can fall into incommensurable value domains (Arias-Arévalo et al. 2018), which present different information (Martín-López et al. 2014), and therefore, pluralistic approaches are needed to support equitable ecosystem service assessments (Pascual et al. 2017). Pluralistic value approaches require inclusive definitions of stakeholders and should elicit both the relational and instrumental values derived from human-nature interactions (Chakraborty et al. 2020; Himes and Muraca 2018). Relational values account for the role of morals in preference and choice by explicitly recognising the values people derive from their relationships with nature and other beings, and therefore challenge the misleading dichotomy that environmental management is for either the sake of people or nature (Chan et al. 2016). More specifically, excluding relational values risk commoditising ecosystems in ways that overlook multiplicity in stakeholder values and value systems (Kosoy and Corbera 2010).

Capturing plural, relational values requires moving beyond traditional monetary-based methods commonly used in ecosystem service valuations (Chan et al. 2011). Monetary-based methods are particularly inappropriate for representing the contribution of ecosystem services to human wellbeing in low-income settings where dependence on vulnerable natural resources is high, such as small island states in the Pacific (Folkersen 2018). As such, a number of non-monetary valuation tools are emerging in ecosystem services and other arenas. In ecosystem services, there has been an emphasis on participatory and deliberative approaches for eliciting values (Folkersen 2018; Kenter et al. 2011). Deliberative approaches enable social learning that can reveal deep held values surrounding complex social-ecological linkages (Kenter et al. 2011). In environmental and climate change decision-making, a key priority is developing tools that enable different value languages to engage in the decision-making discourse (Jacobs et al. 2016). For instance, participatory drama and photovoice methods have been used to help identify the concerns and challenges of climate change for coastal communities (Bennett and Dearden 2013; Brown et al. 2017). Hence, to move beyond the subsistence narrative of gleaning requires pluralistic value approaches that use novel and inclusive methods to account for the instrumental and relational dimensions of gleaning.

Background and context

Background

As a small island developing state located at the heart of the Coral Triangle, Timor-Leste is an apt focus for understanding the values of gleaning. Like many other developing countries, coastal areas in Timor-Leste are undergoing rapid environmental and socio-economic change, and sustainably

managing coastal resources for human wellbeing is a key challenge (López Angarita et al. 2019; Rosegrant et al. 2016). Timor-Leste is ranked 132/188 for human development globally (UNDP 2018), 70% of the population lives in rural areas (GDS 2018), and 41.8% live below the national poverty line (WorldBank 2016). Many of Timor-Leste's rural poor live in coastal areas, and fisheries have the potential to contribute substantially to improving food and income security (Farmery et al. 2020; López Angarita et al. 2019). The reefs that fringe the country's coastline support some of the world's highest fish species richness (PIFSC 2017). As tourism and conservation interests in the country grow, the management of coastal habitats and coral reefs face increasing scrutiny over reconciling economic development and conservation with the needs and values of local communities.

Case study

Our case study of gleaning is of a coastal community located on the western coast of Atauro Island, Timor-Leste. At the time of the research, the community contained 26 households and total population of ~ 90 individuals. Similar to many other communities in the Asia-Pacific, the case study community is a rural coastal community with limited infrastructure (no road access, running water, or electricity). Livelihoods in the community are primarily subsistence focused, and households engage in a diversity of mostly natural resource-based activities that are particularly vulnerable to predicted climate changes (López Angarita et al. 2019; Oppenheimer et al. 2019; Rosegrant et al. 2016). Main livelihood activities include crop farming, livestock rearing, and fishing. Crops are primarily used for subsistence, and livestock are gifted or eaten as part of cultural events and sold for income. Fish catches are eaten, sold, and shared amongst households, and seafood is the main source of animal protein consumed. Non-gleaning fisheries are predominantly a male domain, although women often accompany their husbands for gillnet fishing and (unusually for Atauro Island) some women in the study community also spearfish.

Similar to gleaning fisheries elsewhere (Chapman 1987), in the study community, gleaning is a low-tech and female-dominated activity, with catches used predominantly for subsistence. Gleaners are mostly women and children, who travel by foot, usually in small groups of family and friends, talking, laughing, and searching for target species. Gleaning primarily takes place at low tide when intertidal reef flats and rocky habitats are exposed. Gleaners use knives, metal sticks, and bare hands to spear, pry, and gather a variety of marine organisms trapped in pools and crevices. Catches are carried in hand-woven baskets and include molluscs, crabs, eels, octopus, various types of reef fish, and schools of juvenile fish. Gleaning locations extend in either direction along the coast from the community, and the main gleaning areas are within

45 minutes walking time. Gleaning areas are referred to by named sections of the coastline identified by biophysical/physical features. Extractive activities, including gleaning and fishing, are prohibited directly in front of the community by a small (4.5 ha) comanaged no-take zone (*tara bandu*) introduced in 2016. Livelihoods and fishing activities in the study community are sensitive to weather conditions (Mills et al. 2017), and between December and March when westerly monsoon winds create rough sea conditions, non-gleaning fishing almost entirely ceases and gleaning is less intensive (Grantham et al. *in review*). Hence, within the study community, the main fishing seasons are defined as the calm season and the rough season, and this is how we distinguish between seasons in this research.

Methods

We used a mixed method in-depth case study approach over multiple visits to the study community between November 2018 and May 2019. Specifically, to (1) characterise the gleaning fishery in each season and (2) assess seasonal gleaning values, we used a mixture of qualitative and quantitative methods including interviews, surveys, and focus groups (Table 1). Data were collected by the lead author and three research facilitators. Facilitators were Timorese youth, one of whom was a member of the study community. In the following sections, we describe each data collection method in detail, followed by a summary of how data were analysed and a statement on researcher positionality.

Data collection

Interviews

To collect data on individual experiences and perceptions of seasonal gleaning, we used structured interviews with specifically targeted key informants (Table 1, activity A), who included women known to be actively involved in gleaning and non-gleaning fisheries. During interviews, participants were asked to describe their strategies, catches, objectives, and challenges as they changed by season. Interviews were implemented verbally by the lead author following a structured question format. Questions and responses were translated between English and Tetum by a facilitator, with response data recorded in English on a structured recording sheet by the lead researcher. Each interview took roughly 1 hour to complete.

Survey

We collected quantitative data on seasonal household fishing, including gleaning using a household survey (Table 1, activity

Table 1 Summary of data collection methods, including descriptions of activities, date of collection and sample characteristics

Method	Method description	Date	Target sample and size (n)	Sample selection
A Key informant interviews	Structured interviews regarding seasonal fishing activities, focused on gleaning ($n = 4$), and non-gleaning ($n = 2$) methods	November 2018	Female fishers (6)	Targeted
B Surveys	Digitised household survey to collect quantitative data on seasonal fishing by household members	April/May 2019	Household members (16)	Opportunistic
C Focus groups ($n = 2$)	Focus group setting in which a variety of non-written activities were used to collect individual data on gleaning values and seasonality	April/May 2019	Female gleaners ($n = 6, n = 7$)	Targeted

B). The survey included closed question types regarding the regularity of gleaning, demographics of gleaners, nature of gleaning trips, catch quantities, and target groups in each season. The survey was digitised in both English and Tetum using the Kobotoolbox software (Harvard Humanitarian Initiative n.d.). The survey was implemented verbally by a facilitator, accompanied by the lead author, and responses were recorded onto a tablet. Respondents were either the head of the household or their spouse. Each survey took 30–60 minutes to complete.

Focus groups

To explore gleaning experiences and values in each season, we carried out focus groups with women who gleaned (Table 1, activity C). Focus groups were guided by the lead author with the assistance of two facilitators who translated and provided support to participants. Focus groups were run on two separate occasions to keep group sizes small (one group contained six individuals and the other seven) to enable greater interaction between participants and facilitators and to ensure the active engagement of all participants. Focus groups included a number of activities that were completed individually. The study community has very low literacy rates, particularly amongst women, therefore to be inclusive of all voices activities used non-written methods, including drawing and symbol-based scale measures:

Drawing Two separate drawing activities were used to characterise gleaning catches and gleaning scenes for each season. For drawing catches, each participant was given a sheet of paper with two basket outlines in which to draw typical catches for the rough and calm seasons. Participants were asked to think about the types and quantities of organisms they collect in each season. In the other drawing activity, each participant was given two blank sheets of paper on which to draw the typical gleaning scene for each season. For each season, gleaners were asked to think about where they go gleaning, who they glean with, what they can see, and how they feel.

Scale measures We identified a list of possible reasons to glean, coded from interviews and informal discussions with gleaners, and verified these with focus group participants. Symbols to represent each reason were agreed upon, and participants drew the symbols on individual cards, so that every participant had a set of cards representing the different reasons to glean. For each season, participants were asked to rank the importance of reasons for gleaning by organising their “reason cards” from most to least important. The importance ranking results were then copied onto individual recording sheets on which there was a 4-level smiley face satisfaction rating scale. Participants were asked to shade the scale to indicate how satisfied they feel with their ability to achieve each reason in each season. After each focus group activity, we held a discussion of the activity for participants to share thoughts within the group and clarify details of activity outputs. To address shortcomings in the use of structured data collection methods, including scale-measures, associated with issues of contextual relevance (White 2014) data collection tools used in this study were informed by an understanding of local context and discussion within focus groups were used to verify the validity and understanding of tools being used.

Data analysis

Characterising seasonal gleaning

To characterise the gleaning fishery in each season, we analysed the survey data with descriptive statistics to compare household gleaning activities and catches between the calm and rough seasons. Seasonal trends identified in survey data and from discussions with gleaners informed themes used to code comparisons of focus group drawings by individuals of seasonal gleaning catches and scenes. Drawings of seasonal catches were coded according to differences in depictions of the quantity and composition of landings, and the presence of octopus. Drawings of seasonal gleaning scenes were coded according to differences in depictions of the number of gleaners, presence of other types of fishing, diversity of marine organisms, gleaner happiness, and, if location was

indicated, the distance and direction of gleaning. One elderly participant only gleaned in the calm season, so her data could not be included in seasonal comparisons. Insights from interviews and informal discussions on gleaning activities, objectives, and challenges were used to provide an in-depth understanding of some of the context around the seasonal characterisation of the gleaning fishery.

Assessing seasonal gleaning values

We explored seasonal gleaning values by analysing focus group data on reasons for gleaning to assess (i) multiplicity, (ii) seasonal importance and satisfaction, and (iii) seasonal priorities, in gleaning values. We categorised the multiple reasons for gleaning identified according to type of ecosystem value (i.e. instrumental, relational) and whether reasons were associated with the activity or outcomes of gleaning. We then assessed seasonal shifts in the perceived importance and satisfaction with gleaning values by examining changes in individual importance rankings and trends in satisfaction ratings for each reason between the calm and rough seasons. To evaluate the seasonal value priorities of gleaners, we analysed reasons ranked as the top three most important in each season by individuals. The number of focus group participants who ranked a reason highly was used as an indicator of trends in value priorities across gleaners, whilst the co-occurrence of reasons within an individual's top-ranking was used to explore relationships between priority values. Insights from interviews and informal discussions were used to provide an in-depth understanding of some of the context around the findings from focus group activities.

Researcher positionality

The influence of power relations on research and knowledge production raises a number of ethical challenges, particularly for cross-cultural research and the representation of women (Scheyvens and Leslie 2000). Personality and positionality play a crucial role in how researchers are perceived by the researched and therefore the process and outcomes of fieldwork (Moser 2008). An awareness that how the research facilitators and the lead author/researcher were perceived within the study community would affect how people engaged with and understood the research was embedded in the fieldwork design. The facilitators and first author made multiple visits to the study community, staying with families and participating in day-to-day life to build familiarity with research participants and ensure the research questions and activities were grounded in a respectful understanding of the local and cultural context. The first author's identity as a PhD student and the objective of the research to explore diverse values rather than to represent a specific narrative of gleaning were made clear at all times during the research.

Results

In the following sections, we compare the gleaning fishery in the rough and calm seasons and evaluate seasonal gleaning values. Our results highlight distinct differences in gleaning amongst seasons and show that gleaning supports multiple values, which are seasonally dependent.

Seasonal characterisation of gleaning

The seasonal characterisation of gleaning reveals that gleaner demographics and the nature of gleaning activities differ between the rough and calm seasons. Our results show that in both seasons it is more common for female household members to glean than male household members, but that the difference is particularly stark in the rough season because male household members tend to only glean in the calm season (Fig. 1). We also found that for most households, gleaning is a more regular activity in the calm season, when gleaners travel further and harvest seafood from shallow water as well as tidal areas (Fig. 1). In the rough season, gleaners prefer to stay closer to the community (Fig. 1; Fig. 2) and are reluctant to glean alone because of the risks of gleaning. Waves break across the reef flats making gleaning difficult, dangerous, and less enjoyable (Fig. 2) and gleaners have been injured by slipping on rocks, cutting themselves on coral, and being bitten by octopus and eels.

Our results also highlight seasonal differences in typical gleaning catches and the livelihood contribution of gleaning. Catches are smaller and less diverse in the rough season, with fish and octopus being the most seasonal catch groups (Fig. 1; Fig. 3). Octopus are the main high value target group for gleaners, and they can be dried and stored for a number of months. However, octopus are found in shallows and tidal pools making them hard to target in rough conditions, and only one participant depicted octopus in their drawing of rough season catches (Fig. 3). Gleaners described being able to be more selective in targeting preferred catch groups in the calm season than in the rough season. In the rough season, catches are dominated by small shells used for household consumption and there is a greater sense of necessity in gleaning as a source of subsistence seafood because other types of fishing are limited (Fig. 2). However, gleaners expressed their increasing concern of returning with an "empty basket", particularly in the rough season, because as the community grows and more people glean, it is becoming harder to find seafood.

Seasonal gleaning values

Multiplicity

Women described a variety of reasons for gleaning (Fig. 4) associated with the activity itself or gleaning as a means for



Fig. 1 Summary of household survey data on seasonal gleaning

achieving material outcomes (catch). Reasons were sometimes solely instrumental or relational, but also a combination, highlighting that instrumental and relational values can be difficult to separate. Women talked about gleaning to find preferred seafood for personal consumption (*favourite*), a reason in which gleaning is a means of achieving material outcomes that accrue solely to the gleaner, thus representing an instrumental value. Women also mentioned gleaning to find seafood to sell (*income*) and for household consumption, either to be eaten fresh (*food*) or dried and eaten at a later date (*store*). These reasons also specifically refer to material

outcomes as the objective of gleaning (instrumental values), but the benefits are shared with other members of the gleaner's household suggesting these reasons also hold relational values. Women described gleaning to find seafood to give to friends or non-household family members (*share*). Again, this reason is linked to catch outcomes of gleaning, but through sharing the catch the predominant value to the gleaner is relational (although they may also derive instrumental values indirectly through reciprocity). Another reason for gleaning was to teach children how to glean (*knowledge*), which is associated with the activity rather than the outcomes

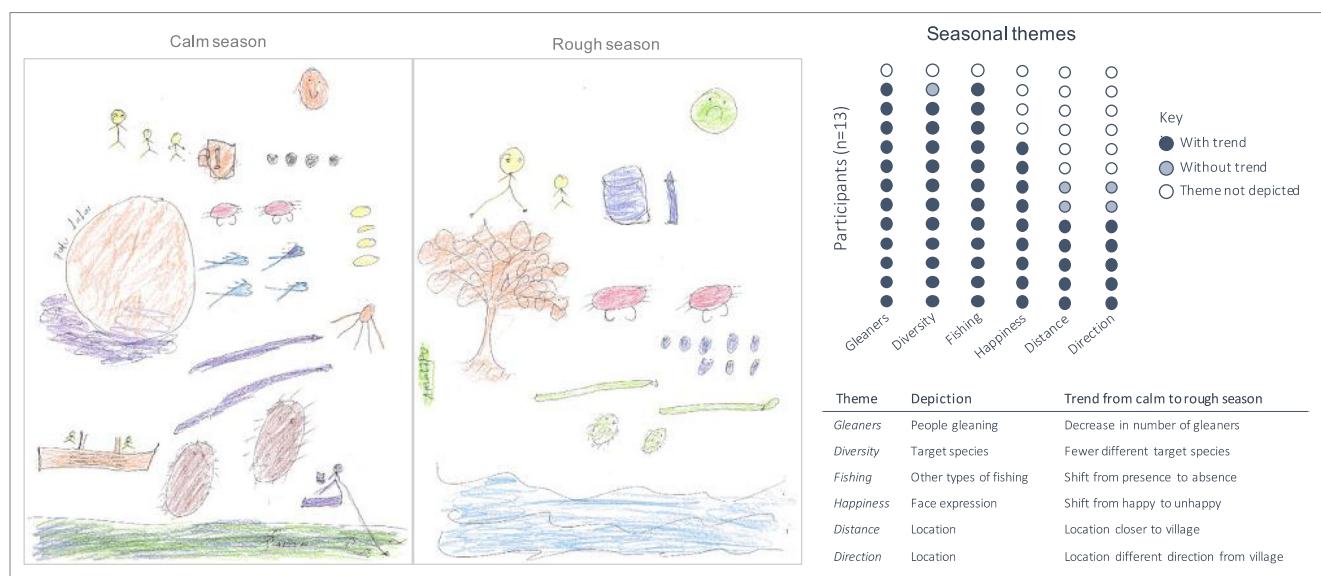


Fig. 2 Example of seasonal gleaning scenes drawing, with summary of themes and seasonal trends depicted in drawings

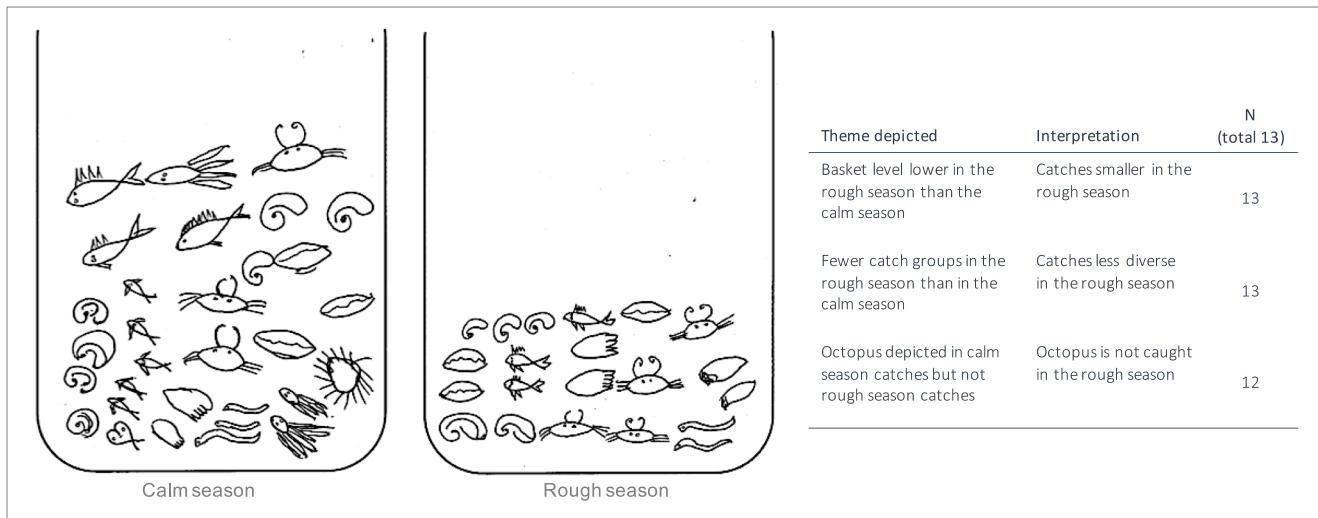


Fig. 3 Example of participant drawing of seasonal gleaning baskets, with summary of catch themes depicted

of gleaning. Teaching children is grounded in relational values but may also support instrumental values indirectly by increasing household gleaning capacity. Other reasons associated with the activity of gleaning include to enjoy the environment (*nature*), for the peacefulness of being away from the village (*peace*), when there is nothing else to do (*boredom*) and to spend time with friends (*socialise*). These reasons refer only to the interactions and experiences supported by gleaning with no mention of material gains and therefore represent relational values. The importance of the relational values of gleaning are illustrated by the example of a pair of elderly sisters in the community who have gleaned together since they

were children and continue to do so despite their limited sight and mobility meaning they often fail to find anything. The different reasons for gleaning were distinct but not mutually exclusive, and a single gleaning trip can fulfil multiple reasons and therefore support multiple wellbeing values.

Seasonal importance and satisfaction

Some reasons for gleaning were more seasonally sensitive than others, and seasonal differences in the perceived importance and satisfaction with reasons for gleaning varied between reasons and individuals. Notably, the importance of



Fig. 4 Description of ten reasons why women glean categorised according to wellbeing values and association with the outcomes or activity of gleaning

gleaning as a source of income (*income*) and seafood to store (*store*) decreased for almost all participants in the rough season (Fig. 5) as did satisfaction ratings with these reasons (Fig. 6). Gleaning as a source of income and seafood to store were both categorised as *instrumental-relational* values associated with gleaning outcomes, specifically catches of octopus. Octopus are typically only caught by gleaners in the calm season, hence the seasonal sensitivity of these values. Gleaners described feeling happy when they catch high value octopus, find lots of seafood or the seafood they most enjoy eating. Reasons that demonstrated a general upward trend in importance in the rough season were finding seafood to share (*share*) and enjoying nature (*nature*); however, satisfaction with these reasons decreased in the rough season for a number of gleaners.

Seasonal priorities

Priorities for gleaning differed amongst individuals and across seasons and indicate that there may be groups of gleaners with different value priorities. In the calm season, all reasons were ranked highly (top three) by at least two participants, with the most common being finding seafood for household consumption, alleviating boredom and peacefulness (Fig. 7). In the rough season, gleaner's priorities converged and more gleaners nominated gleaning to find seafood for household consumption, along with finding preferred seafood and enjoying nature as the most important reasons. There were also more gleaners who prioritised finding seafood to share and spending time with friends in the rough season than the calm season, whilst fewer prioritised finding seafood to store,

peacefulness, alleviating boredom, or teaching children and none included gleaning to earn income. Reasons that co-occur together in individual top rankings point to distinct value priorities. For example, in the calm season, a number of gleaners prioritised gleaning to avoid boredom and for peacefulness. In addition, all gleaners that considered enjoying nature a priority included both alleviating boredom and peacefulness in their top ranked reasons. This finding suggests that there is a group of gleaners for whom the perceived importance of gleaning is grounded in the relational values derived from the activity itself. In contrast, a number of other gleaners highly ranked finding seafood for household consumption along with finding preferred seafood or seafood to store in the calm season. This finding points to another group of gleaners who placed greater importance on the outcomes (rather than process) of gleaning and on instrumental values. This pattern was even clearer in the rough season, when women highly ranked finding seafood for household consumption alongside finding preferred seafood and seafood to share (Fig. 7).

Discussion

The case study presented in this research illustrates that the value of gleaning to wellbeing extends beyond its contribution to subsistence and that values differ between individuals and seasons. Our results speak to three key findings about wellbeing and gender narratives, seasonal ecosystem values, and relationships between ecosystem values, which we discuss in turn, before turning to future research directions.

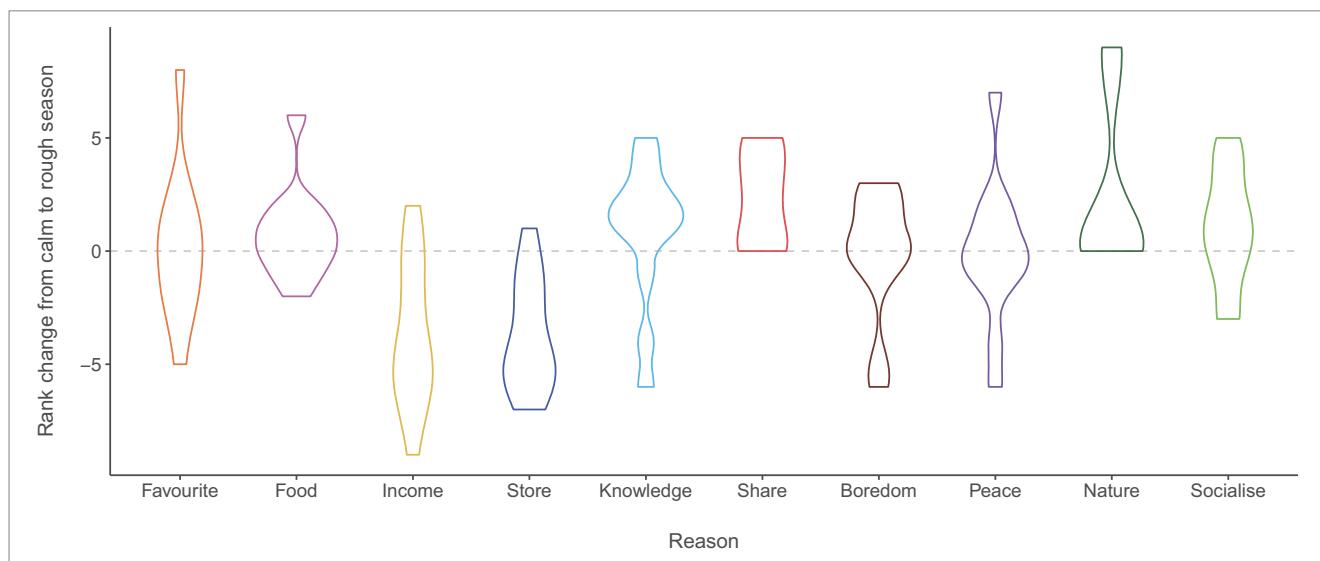


Fig. 5 Violin plot showing change in ranked importance of reasons by individuals from the calm season to the rough season. Dashed horizontal line at 0 represents no change in ranking between seasons, points above the line represent an increase in ranked importance in the rough season

compared with the calm season, whilst points below the line represent a decrease in ranked importance in the rough season. Width of plots indicates number of individuals

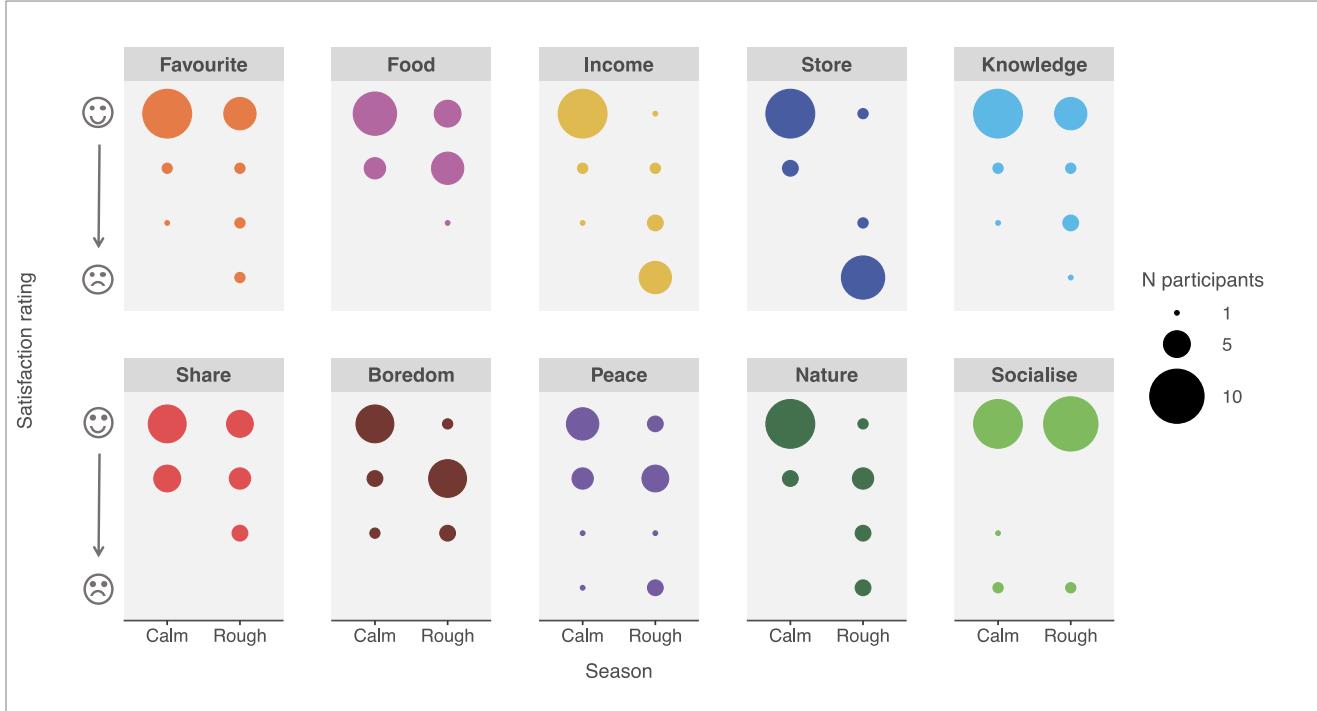


Fig. 6 Chart showing seasonal changes in overall ranking and mean satisfaction with gleaning reasons

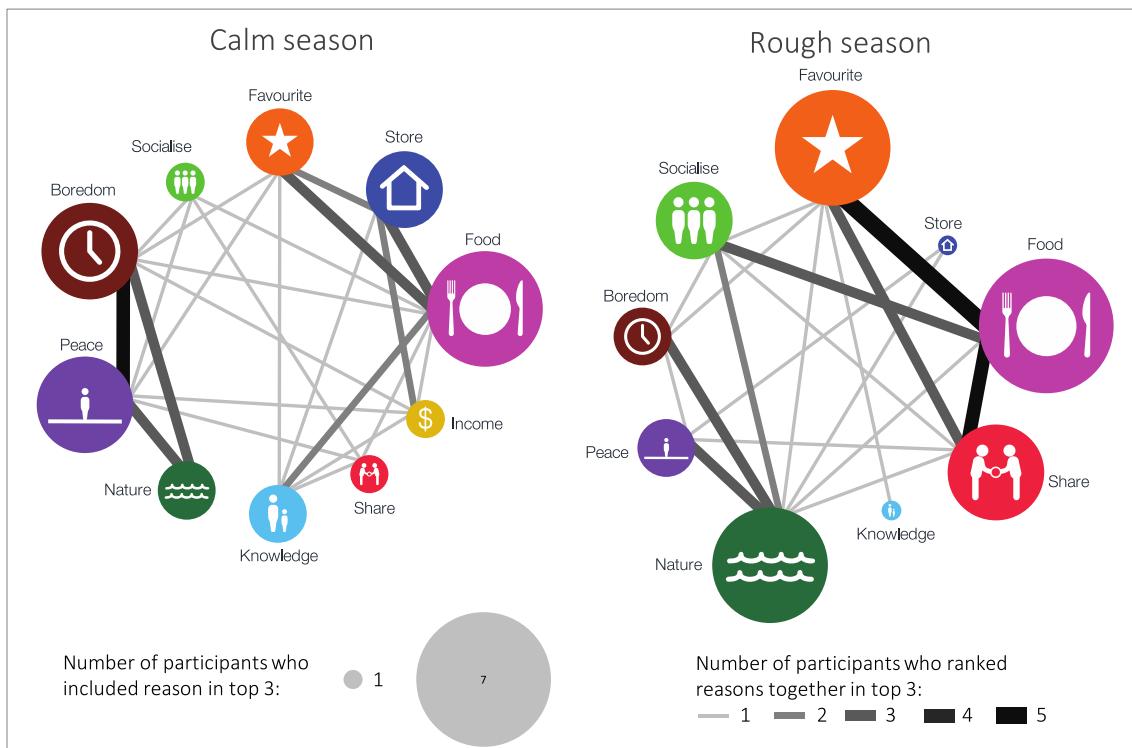


Fig. 7 Number of participants that ranked each reason as top three most important in the calm and rough seasons and the co-occurrence of reasons in top rankings

Wellbeing and gender narratives

The results of this study show that women gleaned for a variety of reasons associated with a spectrum of ecosystem values. Gleaning value priorities highlight that women's choices and actions are linked to a pursuit of wellbeing that extends beyond household subsistence. For example, our results show that spending time with friends was perceived as an important reason to glean. Thus, gleaning is a social opportunity that supports meaningful interactions with other people, which are an important determinant of quality of life (Camfield et al. 2009). We also found that gleaning to enjoy nature was highly ranked, including in the rough season. This finding suggests a sense of connectedness with the environment, which has been positively linked to physiological health and wellbeing (Frumkin 2001; Howell and Passmore 2013; Nisbet et al. 2011). Increasingly, work suggests that connection to nature can support better environmental management through stewardship and tighter social-ecological feedbacks (Bennett et al. 2018). Therefore, our findings re-emphasise arguments that overlooking gleaners likewise overlooks important connections between people and nature relevant for coastal management (De La Torre-Castro et al. 2017).

Our findings also indicate the need to move beyond essentialised narratives of women's contribution to their own and their family's wellbeing. We found that household food and income security—a core part of the subsistence narrative—were not a priority for all gleaners. For example, women described how they sometimes go gleaning to find their favourite seafood that they then cook on the beach to avoid having to share with other household members. This example clearly demonstrates how personal gain and pleasure also influence women's preferences and behaviours, rather than simply gleaning's contribution to material wellbeing. These findings thus support pursuing a more complex understanding of how women's interactions with coastal environments are shaped by the pursuit of multidimensional wellbeing (Coulthard 2012).

The diversity of reasons for gleaning highlight that management or environmental change affecting gleaning will have suite of implications for women's wellbeing beyond material impacts from the loss of catches. For example, coastal regulation that prohibits gleaning would affect women's social lives and limit the opportunities available to women to find peace away from the demands of family and domestic activities. This is particularly important given that the underrepresentation of marginal groups, including women, in decision-making mean that the resources they depend on are often excluded from sustainability strategies (De La Torre-Castro et al. 2017). As coastal resources face increasing stress from climate change, pollution, and human population growth, equitable regulatory mechanisms, particularly for common pool resources such as those targeted by gleaners, will be crucial for

maintaining the wellbeing of marginalised groups (Agrawal 2014). Failure to account for the multidimensional wellbeing benefits derived from marine resources risks exacerbating inequalities and hardship (Coulthard et al. 2020). Specifically, our findings caution against treating fishing communities as homogenous stakeholders and definitions of coastal resource users that incorporate gleaners with other small-scale fishers or overlook them all together.

Seasonal ecosystem values

Our findings highlight how ecosystem service values change dynamically by season. We found seasonal shifts in gleaner priorities and the relative importance of and satisfaction with reasons for gleaning. For instance, for most gleaners, the perceived importance of finding seafood to share increased in the rough season and sharing became a common gleaning priority. This finding reflects an increase in the relational dimension of the values associated with gleaning catches linked to the role of food sharing networks in seasonal food security. Sharing food between households can help ensure that families have secure access to food, even when catch is variable (Winterhalder 1990, 1986). Thus, the perceived benefits of reciprocal altruism may be greater in the rough season when there are limited alternative sources of seafood and gleaning is difficult and catches are smaller and variable. Our results also illustrate how seasonal ecosystem benefits and values are impacted by seasonal service flows. For example, in the rough season, earning income and storing seafood are considered unimportant and unsatisfactory reasons to glean predominantly because of the absence of octopus in catches. Accounting for the complex relationship between ecosystem service flows and ecosystem values created by human-nature interactions is key to effectively managing social-ecological systems (Reyers et al. 2013). This research demonstrates that there can be seasonal differences in these relationships, which ecosystem services must account for, alongside plural values. That is, non-temporal assessments may provide only half the story about how and why ecosystem services matter to different people in coastal communities.

Relationships between values

Linkages between gleaning priorities found in our results indicate that there may be distinct value preferences amongst gleaners. In both seasons, multiple gleaners highly ranked combinations of reasons for gleaning associated with relational values whilst a number of other gleaners indicated a preference for instrumental values associated with gleaning catches. These results point to socially and temporally disaggregated "bundles" of ecosystem values. In ecosystem services, bundles refer to groups of services that co-occur through space and time (Raudsepp-hearne et al. 2010). The interactions and

shared dependencies that link service bundles can lead to synergies and trade-offs in ecosystem management (Bennett et al. 2009) that can raise issues of equity and environmental justice (Dawson et al. 2017). Preferences for bundles of ecosystem services have been linked to socio-economic characteristics of stakeholders (Martín-López et al. 2012) and differences in the bundles of benefits derived from an ecosystem have been shown to influence the acceptability of management strategies, for example in fishery closures (Epstein et al. 2018). However, there has been limited empirical work on when and where coastal ecosystems occur together (i.e. as bundles), and how this relates to wellbeing (Blythe et al. 2019). As an exploratory study into the diversity of gleaning values, analysing the factors that might explain differences in values between individuals was beyond the scope of this research, but other research has shown that coastal ecosystem value priorities relate to level of material wellbeing (Lau et al. 2018). We hypothesise that gleaners who prioritised instrumental values are likely to be more materially vulnerable and reliant on gleaning for food, than those who prioritised purely relational values. It is also likely that the life stage and household context of gleaners shaped how and why different reasons were ranked together (Coulthard et al. 2020). The varied priorities for gleaning within one community support wider calls for disaggregating coastal ecosystem service beneficiaries to assess how and why coastal ecosystem values are distributed socially and therefore to support equitable resource management for poverty alleviation (Chan et al. 2019; Daw et al. 2011; Lau et al. 2019).

Our findings also suggest that women recognised trade-offs amongst the different reasons to glean. Evaluating trade-offs between reasons was beyond the scope of this research, but anecdotal evidence suggests that there can be incompatibilities between achieving certain values from gleaning. For example, during discussions some women explained how when they glean with friends they find less seafood because they are chatting. This observation represents a trade-off between the relational values associated with socialising and the instrumental values derived from catch. Trade-offs between values may influence gleaner choices. For example, whether women choose to glean with friends (and realise relational values) may depend on their willingness to forgo instrumental values associated with finding more seafood, and this choice may in turn differ between individuals and seasons. Interestingly, in the rough season women prioritised socialising in combination with outcome-based reasons (e.g. finding seafood for household consumption or sharing), which may reflect the reluctance to glean alone in rough conditions because of higher risks. Further exploration of the linkages between reasons for gleaning is an important avenue for future research. Understanding how and why women decide to glean can help to build

an understanding of the interdependencies and trade-offs between wellbeing values derived from gleaning. These insights will help ensure that coastal management is congruent with the wellbeing needs of diverse groups across seasons in ways that support livelihoods and reduce vulnerability. Tools developed in ecosystem service studies more broadly, including deliberative approaches and choice experiment scenarios (Kenter et al. 2011), can help to explore relationships between values in gleaning.

Conclusion and future directions

The findings from our exploratory case study highlight a number of important directions for future research. Using the example of gleaning, we have illustrated the need for holistic assessments of coastal livelihoods as human-nature interactions. A lack of assessment and evaluation methods that elicit multiple values, inclusively and in context appropriate ways, limits equitable and sustainable coastal management. To address the persistent inequalities that have shaped the narrow economic focus and historical gender and gleaning blindness in coastal research and management will require carefully designed evaluation tools. Mixed methods and novel methods, such as those used in this research, can help make visible the deeper values held by coastal communities, and particularly gleaners, to ensure their voices are heard in coastal decision making (Kenter et al. 2011). This research also demonstrates how socially and temporally disaggregated assessments are needed to identify and unpack the complex linkages between coastal ecosystems and human wellbeing, including those realised through gleaning. In particular, multiple dimensions of wellbeing (beyond material) should be empirically linked to women's choices and actions to support a more nuanced and accurate representation of women's needs, values, and preferences in coastal management and the development discourse.

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Author's contributions R.G. conceived the research ideas, designed the methodology, collected primary data, and led the writing of the manuscript; J. L and D.K. contributed critically to drafts of the manuscript, including the theoretical grounding of the paper, and agreed to the final version submitted for publication.

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Data availability Data will be made available at the James Cook University Tropical data hub <https://research.jcu.edu.au/researchdata/default/home>.

Compliance with ethical standards

Conflict of interest All authors declare that they have no conflict of interest.

Ethics and consent Data presented in this study were collected as part of research activities conducted in accordance the James Cook University human ethics guidelines. Research activities were approved (reference number H7626) prior to being carried out. At the start of data collection activities, participants were informed of the nature and purpose of the research through a verbal statement in local language and if they were willing to participate they were asked to give signed consent.

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