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“Às vezes eu sou natureza. Não sou direto não. Quando sou, me sinto livre. Me sinto um pássaro voando esse mundo todo. Mas tem horas que eu me sinto retraída um pouquinho, e aí eu não me acho que sou natureza não.”

I., marisqueira de Siribinha (BA)
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ABSTRACT

Coupled with the environmental changes of the Anthropocene, cultural erosion has been threatening livelihoods and knowledge of local communities around the world. This accelerated loss of biological and cultural diversity makes it imperative that conservation initiatives effectively consider the multiple forms of human-nature relationships (HNRs). HNRs consist of the intricate set of beliefs individuals hold about the non-human environment and encompass different dimensions, such as affective, ethical, and ontological. They are built through mental processes shaped by socio-cultural contexts and are the basis for the way people relate and value nature. They allow understanding the plurality of views on how to interact and treat nature, supporting conflict mediation and conservation of biocultural diversity, being especially relevant among territorially contextualized people in socio-environmental conflict areas. Yet, assessing HNRs in such contexts is challenging, given the complexity and intangibility of such relationships. Empirical research on HNRs has been focusing mostly on human-nature typologies that provide a variety of narratives and metaphors describing discrete categories of people's relationship with nature. These studies use two main approaches: quantitative and deductive, or qualitative and inductive. Both have limitations: psychometric scales used in quantitative-deductive studies do not individually account for the multidimensionality of relationships with nature, whereas qualitative-inductive approaches limit generalizations and comparisons across different contexts. Yet, the comparison across contexts provided by quantitative-deductive methods and the consideration of the complex, multidimensional character provided by qualitative-inductive approaches are both essential to effectively contribute to bringing pluralism to conservation. Research on HNR thus lacks a tool that manages to unite the advantages of each approach. Here, we aim at filling this methodological gap by: 1) developing a tool to identify and describe shared ways of thinking about HNRs; and 2) investigating the relevance and adequacy of this tool by applying it in a specific context: the artisanal fishing community of Siribinha (Conde, Bahia, Brazil), where a long-term transdisciplinary project takes place. We used Q-Methodology, a mixed (quantitative/qualitative) methodology from psychology, suitable for identifying shared ways of thinking on complex topics through the sorting of statements. We reviewed the literature to identify a coherent, plural typology of human-nature relational models to conceptually support the development of statements expressing a comprehensive set of HNR types and dimensions. After developing 44 statements based on the chosen typology, we went through an iterative process of language adaptation to suit the application to varied people, while still accurately expressing the ideas behind the dimensions of HNRs. The tool was applied among strategically chosen Siribinha's residents, visitors, and researchers, totaling 23 participants. We identified three distinct, shared ways of thinking that differed mainly on the agency and rights of non-human beings, the feelings that nature in Siribinha inspires, and the extent to which they see themselves fighting for nature to be protected and isolated. All identified ways of thinking assigned great importance to appreciating learning with Siribinha's nature, retributing to nature for all it gives and following rules to allow it to persist through time, ideas originated from non-Western modern relational models. It was consensual across viewpoints to reject ideas derived from urban and modern Western relational models, especially the Dominance and Detachment models. The application revealed the tool's ability to access the diversity of ways of thinking about the relationships with nature, to pinpoint main agreements and disagreements, and to grasp the links between occupation, religion, age and human-nature relationships among the participants. By allowing the interpretation of these worldviews grounded in conceptually based human-nature relational models, the tool facilitates comparisons across contexts. Given its transparent and replicable methodological development and the amplitude of its conceptual base, it can also be easily adapted to assess HNRs among local actors in different contexts, and thus contribute to increasing plurality and effectiveness in conservation by being a way to listening to people and helping dialogue and conflict resolution.

RESUMO

Associada às mudanças ambientais do Antropoceno, a erosão cultural tem ameaçado a subsistência e o conhecimento de comunidades locais em todo o mundo. Esta perda acelerada da diversidade biológica e cultural torna imperativo que as iniciativas de conservação efetivamente considerem as múltiplas relações humano-natureza (RHNs) existentes. As RHNs são um intrincado conjunto de crenças individuais sobre o ambiente não-humano, e abrangem diferentes dimensões, como afetiva, ética e ontológica. São construídas através de processos mentais moldados por contextos socioculturais e dão base à forma como as pessoas se relacionam com a natureza. Permitem compreender a pluralidade de pontos de vista sobre como interagir com e tratar a natureza, apoiam a mediação de conflitos e a conservação da diversidade biocultural e, por isso, são especialmente relevantes em contextos locais de conflito socioambiental. Entretanto, avaliar as RHNs é um desafio, dada sua complexidade e intangibilidade. Estudos empíricos sobre as RHNs têm adotado tipologias humano-natureza que fornecem uma variedade de narrativas e metáforas descrevendo categorias discretas da relação das pessoas com a natureza. Estes estudos utilizam duas abordagens principais: quantitativa e dedutiva, ou qualitativa e indutiva. Ambas têm limitações: as escalas psicométricas dos estudos quantitativos-dedutivos não dão conta da multidimensionalidade das RHNs, enquanto as abordagens qualitativas-indutivas limitam generalizações e comparações entre diferentes contextos. Contudo, tanto a comparação entre contextos proporcionada pelos métodos quantitativos-dedutivos, quanto a consideração do caráter complexo e multidimensional das RHNs nas abordagens qualitativas-indutivas são essenciais para contribuir efetivamente para promover o pluralismo na conservação. Assim, falta uma ferramenta que consiga unir as vantagens de cada abordagem. Nosso objetivo é preencher esta lacuna metodológica 1) desenvolvendo uma ferramenta para identificar e descrever formas partilhadas de pensar sobre as HNRs; e 2) investigando a relevância e adequação desta ferramenta, aplicando-a num contexto específico: a comunidade pesqueira de Siribinha (Conde, Bahia, Brasil), onde ocorre um projeto transdisciplinar de longo prazo. Utilizamos a Metodologia Q, método misto (quantitativo/qualitativo) da psicologia, adequado para identificar formas de pensar sobre temas complexos por meio da ordenação de frases. Revisamos a literatura e identificamos uma tipologia abrangente de modelos relacionais humano-natureza para apoiar conceitualmente o desenvolvimento de frases que expressam um conjunto abrangente de tipos e dimensões das RHNs. Após desenvolver 44 frases baseadas nesta tipologia, realizamos um processo iterativo de adaptação da linguagem, garantindo a precisão das ideias subjacentes às dimensões das HNR. A ferramenta foi aplicada entre residentes, visitantes e pesquisadores de Siribinha estrategicamente escolhidos, totalizando 23 participantes. Identificamos três formas de pensar distintas e partilhadas que diferiam quanto à agência e aos direitos dos seres não-humanos, aos sentimentos que a natureza inspira, e à medida que os participantes se veem lutando pela proteção e isolamento da natureza. Os pontos de vista atribuíram importância à apreciação da aprendizagem com a natureza de Siribinha, à retribuição à natureza por tudo o que ela provê e a seguir regras que lhe permitam persistir ao longo do tempo, ideias originadas em modelos relacionais não-ocidentais modernos. Foi consensual entre eles rejeitar ideias derivadas de modelos relacionais urbanos e ocidentais modernos, especialmente dos modelos de Dominância e de Desapego. A aplicação revelou a capacidade da ferramenta de acessar a diversidade de formas de pensar sobre as RHNs, identificar os principais acordos e desacordos na comunidade, e compreender as ligações entre ocupação, religião, idade e as RHNs. Ao permitir a interpretação destas visões de mundo fundamentadas em modelos conceituais, a ferramenta facilita as comparações entre contextos. Seu desenvolvimento metodológico transparente e replicável e a amplitude da sua base conceitual permitem fácil adaptação para diferentes contextos, e assim contribuem para aumentar a pluralidade e eficácia na conservação, sendo uma forma de ouvir as pessoas e ajudar no diálogo e na resolução de conflitos.

INTRODUCTION

Human action is now considered a geological force, driving unprecedented global environmental changes that characterize a new period in Earth history, which has been called the Anthropocene (Steffen et al. 2015). Less attention has been given, though, to the cultural erosion coupled with these environmental changes, threatening livelihoods and knowledge of Indigenous, rural and local communities around the world (Aswani et al. 2018; Riechers et al. 2020). Many have argued that this accelerated loss of biological and cultural diversity makes it imperative that conservation and environmental governance effectively consider the multiple forms of human-nature relationships beyond those characterizing urban, modern, Western populations (Berghöefer et al. 2010; Brondizio & Le Tourneau 2016; Coscieme et al. 2020; Ducarme et al. 2020; Pascual et al. 2021). Being attentive and effectively listening to this diversity of human-nature relationships in target conservation sites brings legitimacy to environmental governance by preventing the most affected populations, those with the closest relationship to a territory, from being excluded (Brondizio & Le Tourneau 2016; Mistry & Berardi 2016). In addition, knowledge systems of Indigenous, rural and local communities can be key in helping to adapt to the complex and urgent socio-ecological crisis created by typically modern Western ways of relating to nature (Mistry & Berardi 2016).

Human-nature relationships refer to an umbrella concept that has gained prominence and diversified in many scientific fields such as environmental psychology, anthropology, biodiversity conservation, and resource management (Braito et al. 2017). The concept accounts for a wide range of socio-cultural constructs related to how humans interact with and think about nature (Braito et al. 2017; Muhar et al. 2018). At an intangible, individual level, they concern how people think, feel about, and conceive their own and other people's relationship with non-human aspects of the world (Muhar et al. 2018). They are the views or the intricate sets of beliefs and values that "people hold about their appropriate relation with nature" (van den Born, 2008:87). As such, human-nature relationships are gradually built throughout the life of individuals by mental processes that are shaped by cultural and social contexts, thus varying not only across individuals, but also among societies, cultures, religions, and over time (Gould & Schultz 2021).

Human-nature relationships have been pointed out as a key element of social-ecological systems, as these relationships mediate the interactions between social and environmental processes, while also emerging from and influencing these interactions (Muhar et al. 2018). From these relationships, it emerges how and why people value nature in contextualized, not

substitutable ways, i.e., ways that are rooted in a particular territory and livelihood (Chan et al. 2018). As such, they can be seen as key leverage points for deep changes aiming at sustainable transitions (Ives et al. 2018). Understanding them is then crucial to mediating socio-environmental conflicts, as they often stem from divergent conceptions and valuing of nature (Berghöefer et al. 2010; Muradian & Pascual, 2018; Coscieme et al. 2020).

Despite the centrality of human-nature relationships for triggering transformations in any context, the strong association between biological and cultural diversity (Aswani et al. 2018; Ducarme et al. 2021) puts Indigenous, rural and local communities, their territories, livelihoods and ways of relating with nature at the center of conservation endeavors (Coscieme et al. 2020; Zafra-Calvo et al. 2020; Pascual et al. 2021). Albeit not homogeneous and with many complexities and specificities, these communities have in common the drastic socio-environmental pressures that threatens their ways of life and leads them to poverty (Brum 2021), such as gentrification and predatory tourism (Thompson et al. 2016; Ouassini & Ouassini 2020; Lu et al. 2022), climate change (Zentner et al. 2019; Ojea et al. 2020), overfishing (Jönsson 2019), construction of dams (Ribeiro & Morato 2020), oil pipelines (Jonasson et al. 2019), dredging (Adekola & Mitchell 2011), and resource degradation (Nayak et al. 2014; Jentoft et al. 2018). Listening to these often-marginalized communities is aligned with the recent calls for more pluralism in conservation science and in processes of nature valuation (Kenter et al. 2015; Arias-Arévalo et al. 2018; Zafra-Calvo et al. 2020; Coscieme et al. 2020; Berghöefer et al. 2020; Pascual et al. 2021).

Yet, despite the centrality of human-nature relationships to conserving cultural and biological diversity, identifying and describing these relationships is challenging, given the complexity, multidimensionality, and intangibility of such relationships (Gould & Schultz 2021). In recent decades, empirical research on human-nature relationships has been focusing mostly on human-nature typologies (e.g, Kellert et al. 1996; de Groot & van den Born 2003; Zeng & Yoshino 2003; Bauer et al. 2009). A typology is an organized set of multidimensional types (Doty & Glick, 1994), being appropriate to synthesize and organize complex phenomena (Mandara, 2003). In these typologies, a variety of narratives, metaphors and types describes discrete categories of people's relationship with nature (Braito et al. 2017). Yet, some common dimensions are used to describe human-nature categories – how nature is understood (as fragile, resilient, powerful, etc.), the character of the bond between humans and non-humans (a spiritual bond, a utilitarian bond, etc.), and the positionality between humans and non-humans (humans superior, inferior or equal to nature) – and some categories, such as Master

over nature and Stewardship with nature, are recurrent across typologies (see Flint et al. 2013 for a revision on human-nature typologies).

Research on typologies of human-nature relationships is based on two main approaches (Flint et al. 2013). One is quantitative and deductive, proposing conceptual typologies and comparing them with empirical data obtained through psychometric scales that rank people on just one or a few dimensions of the many characterizing multifaceted human-nature relationships (e.g, Hunka et al. 2009; de Groot & de Groot 2009; Marais-Potgieter & Thatcher 2020). Most of these quantitative and deductive studies have been developed and applied in Western, modern, urban contexts. Another approach is qualitative and inductive, using open in-depth interviews and being rooted in local contexts rather than in general conceptual dimensions that are comparable and generalizable (e.g, Osherenko 1992; Berghöefer et al. 2008; Buijs et al. 2008).

Quantitative-deductive approaches dominate the literature (Flint et al. 2013), perhaps because psychometric scales allow statistical sampling and analyses, generalization, and comparisons of results, as well as correlation with variables of interest (Schultz & Martin-Ortega, 2018). Nevertheless, psychometric scales have limitations. To be reliable they should be unidimensional, that is, measure a single construct. Thus, individually, they do not encompass the multidimensionality of relationships with nature (Muhr 2020). They focus mostly on certain well-delimited cognitive aspects (Restall & Conrad 2015) and do not represent more complex mental models about nature (Fischer & Young 2007; Shepardson et al. 2007) or subjective definitions of nature (Freeman et al. 2015; Windhorst & Williams 2015). In turn, qualitative-inductive approaches make it possible to understand the multiple constituent aspects of the human-nature relationship in greater depth. However, they do not allow for large surveys or statistical analyses, and limit generalizations and comparisons across different contexts (Schultz & Martin-Ortega, 2018). Yet, the comparison across contexts provided by quantitative-deductive methods and the consideration of the complex, multidimensional character provided by qualitative-inductive approaches are both essential to effectively contribute to the understanding of social-ecological systems, the mediation of social-environmental conflicts, and to bring pluralism to environmental governance.

Research on human-nature relationships thus lacks a tool that manages to unite some advantages of each approach, generating in-depth, contextualized descriptions of the multiple forms of relating with nature, anchored in conceptual dimensions that facilitates comparing human-nature relationships across local contexts. We aim at filling this methodological gap by:

1) developing a tool to identify and describe shared ways of thinking about human-nature relationships to assist the mediation of contextualized socioecological conflicts through a mixed methodology; and 2) investigating the relevance and adequacy of this tool by applying it in a specific context: the artisanal fishing community of Siribinha in Northeastern Brazil, where a long-term transdisciplinary project focused on education and conservation is being carried on.

METHODS

Choosing a suitable methodology

To develop a tool capable of uniting advantages of existing methods to describe human-nature relationships, we used Q-Methodology that involves both quantitative and qualitative stages of analysis. Designed in the context of Psychology (Stephenson, 1935) as a holistic approach to the study of subjectivity, this methodology prompts participants to give their opinion about a list of statements by evaluating each of them in relation to all others and according to a guiding question. This produces a normal distribution of statements across a ranking scale of agreement, called a Q-sort (Figure 1). Rather than focusing on the agreement with each statement separately, as in psychometric scales (Watts & Stenner 2012), the distribution of statements (Q-sort) produced by each participant is analyzed as a whole, allowing the identification of ways of thinking about complex topics or themes instead of quantifying agreements with particular statements.

Guiding question:	How do you see, perceive, and feel the nature here in Siribinha?										
	← **Mostly disagree**										**Mostly agree** →
Categories	**-5**	**-4**	**-3**	**-2**	**-1**	**0**	**+1**	**+2**	**+3**	**+ 4**	**+5**
Nº of items	1	2	4	5	6	8	6	5	4	2	1

Example of Q-sort

Figure 1. Example of a Q-sort with the instructions for sorting the 44 statements used to identify ways of thinking about the human-nature relationships in the artisanal fishing community of Siribinha.

In Q-Methodology, first Q-sorts are subjected to factor analysis to identify groups of highly correlated Q-sorts (quantitative stage). Then, a descriptive narrative of the way of thinking for each group of correlated Q-sorts is developed by interpreting the meaning of significant statements with the support of recorded interviews, in which participants explain their distribution of statements (qualitative stage).

In this methodology, the development of the set of statements (Q-set) should be anchored in a conceptual framework that represents the range of ideas regarding the research topic in order to allow participants to freely express their opinions. As such, it is possible to confront the identified ways of thinking in a specific context with the conceptualized human-nature relationships represented in the framework. This key feature enables the comparison of results obtained using the same framework but in distinct specific contexts. Hence, Q-Methodology combines some of the advantages of purely quantitative-deductive or qualitative-inductive approaches for identifying human-nature relationships (see Introduction). Indeed, because it can describe the complexity of people's ways of thinking, the methodology is especially suited for the study of controversial topics (Barry & Proops 1999) and has been increasingly applied to untangle the social aspects involved in conservation and sustainability

issues (e.g, Barry & Proops 1999; Krueger et al. 2001; Mattson et al. 2006; Sandbrook et al. 2011; Neff & Larson 2014; Cairns et al. 2014; Holmes et al. 2016; Bertuol-Garcia et al. 2020).

Choosing a suitable conceptual framework on human-nature relationships

The conceptual framework supporting the development of the set of statements (Q-set) is known as the "concourse" and should be chosen to be as representative as possible of the range of ideas about the research topic (Watts & Stenner 2012). We chose to use as concourse a recently published typology of human-nature relational models proposed by Muradian & Pascual (2018). The typology is structured on five dimensions that characterize human-nature relationships – Ontology, Goal Orientation, Emotional Drivers, Practices, and Main Mode of Interaction –, which define, when combined, seven relational models, each of which with distinct positions in those dimensions (Appendix S1). It is the most comprehensive human-nature relationship typology we are aware of, as it considers not only relational models typical of Western urban cultures and modern science (i.e., Dominance, Detachment, Utilization, and Wardship models), but also models characteristic of local communities and non-Western cultures (i.e., Stewardship, Devotion, and Ritualized Exchange models). In addition to the diversity of covered relational models, a distinctive feature of this typology, in comparison to others (reviewed in Flint et al. 2013), is its clear definition of the dimensions that account for the main cognitive structures involved in human-nature relationships.

Hence, the structure of the chosen typology – organized in relational models that vary according to their position in well-defined dimensions – allowed us to use it in a systematic manner in the process of developing the Q-set (Appendix S1). We started by mapping the positions of each relational model in each dimension. Then, to ensure that each statement would express a single idea, we divided the dimensions that contained multiple ideas – for example, the Goal Orientation dimension was sub-divided into “Preference” and “Nature Perceived As” aspects. To complement our concourse and guarantee that it represented the full range of ideas about human-nature relationships, we searched the literature on human-nature typologies for ideas that were not accounted for in the relational models proposed by Muradian & Pascual (2018). We then created one statement representing the position of each relational model on each dimension or sub-dimension as well as additional ideas, arriving at a total of 44 statements (Appendix S1). Although the statements were written to adapt the language to a specific context (see below), they can be easily adaptable to other contexts.

Choosing a suitable context for applying the tool

We chose to investigate the adequacy of the tool in the fishing community of Siribinha (11º48’49"S, 37º36’38"W), located on a strip of land between the sea and the mangroves of the Itapicuru river estuary, in the municipality of Conde, state of Bahia, northeastern Brazil (Figure 2A). The community has about 500 residents and is located in a region of well-preserved mangroves, and remnants of shrubby thicket-like forests growing on sand dunes (known as “*restingas*”), also including coconut monocultures (Guimarães et al. 2019, Tng et al. 2021) (Figure 2B).

Siribinha is an artisanal fishing community that, due to the lack of road access, remained relatively isolated until the 1990s, when small-scale tourism began to emerge through initiatives of the community members themselves (Bollettin et al. 2022). Despite the growing presence of tourism as a source of income since then, Siribinha is still essentially a fishing community, and fishing and shellfish gathering is the main source of sustenance and income of most residents (Renck et al. 2022). The community has a living fishing culture, with new generations being recruited to the craft of fishing and shellfish gathering and processes of oral transmission of knowledge from the older to younger community members still taking place (El-Hani et al. 2022). Fishing is characterized by family work, with family members involved in different stages of catching and processing the fish and shellfish. Fishing is typically a male activity, while shellfish gathering is carried out primarily by women (Renck et al. 2022).

Although still maintaining an artisanal fishing culture and living within relatively well-conserved ecosystems, Siribinha is facing a number of socio-environmental pressures that have been transforming the community (Bollettin et al. 2022). Some of the issues that has been affecting it are predatory and insufficiently managed tourism, growing problems with waste management, pressure from industrial fishing, decrease in fish and shellfish populations, and the advance of real estate construction that attracts people from large urban centers, displacing local dwellers and increasing the price of houses and land. Other problems such as lack of sanitation, silting of rivers, poor access to health, education, and leisure services, and the recent large-scale oil spill that affected the Brazilian shore from August 2019 to January 2020 (Lourenço et al., 2020) highlight the social and environmental injustice present in the community, which depends directly on the integrity of natural resources and local culture for its survival.

Researchers from the Federal University of Bahia have been conducting transdisciplinary research project with the community (as well as in other fishing communities in the Itapicuru river estuary) since 2016, focusing on ethnobiology, intercultural education and conservation

through collaborative knowledge coproduction (e.g, Fonseca 2020; Tng et al. 2021; Bollettin et al. 2022, El-Hani et al. 2022; Renck et al. 2022). The context of this community – grounded on artisanal fishing culture but facing many pressures – is likely to lead to a diversity of views on how to conceive of and treat nature, and a variety of conflicts among these views. Understanding this variety of viewpoints is central for the successful development of the ongoing long-term transdisciplinary process with the community, as such processes depend on creating trust and dealing with conflicts. Hence, Siribinha can be considered a suitable context to apply our tool and verify its ability to contribute to the understanding of potentially shared positions and of conflicts regarding the relationship between humans and nature aiming at strengthening transdisciplinary processes.

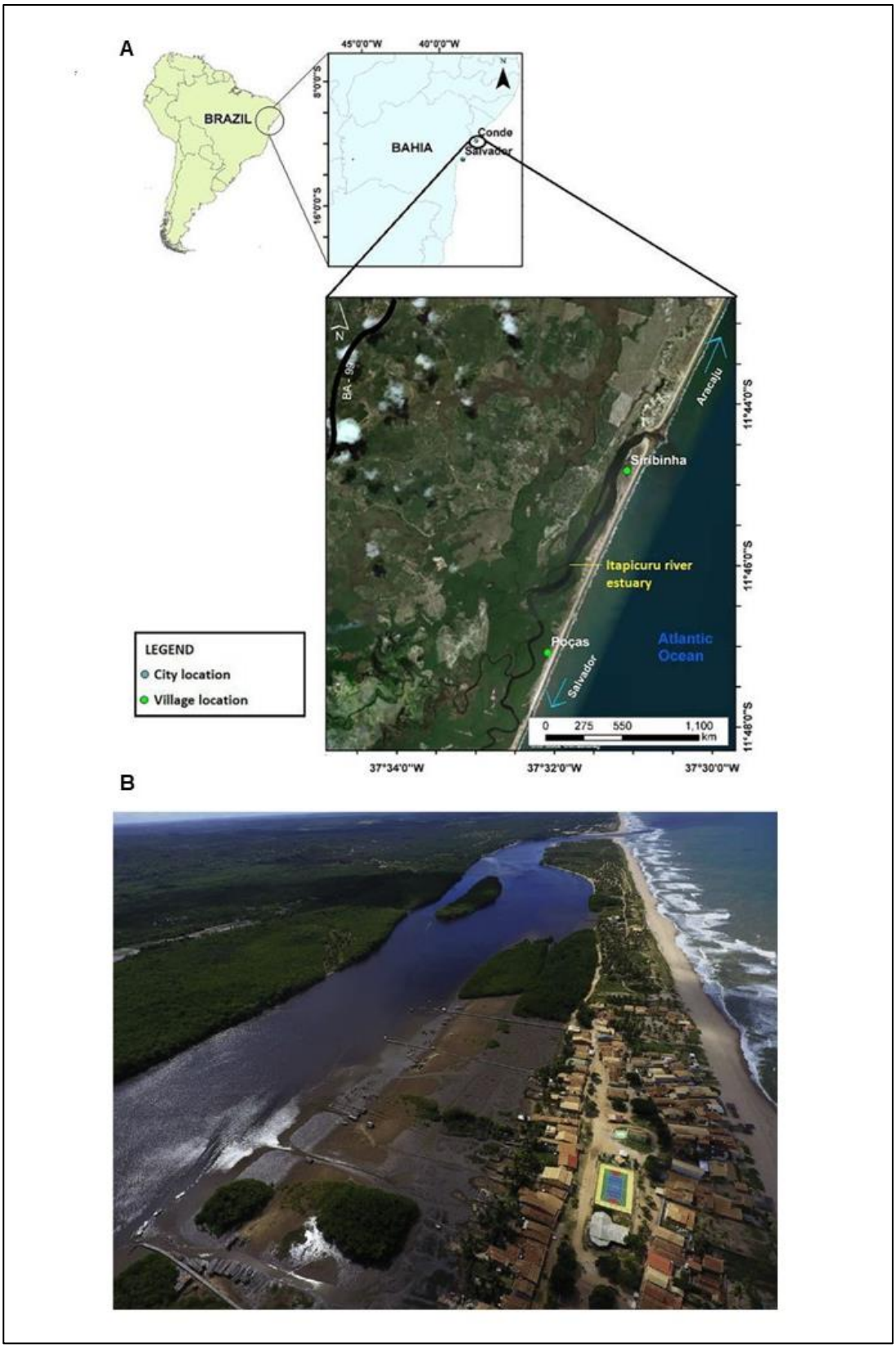

Figure 2. A: Location of the artisanal fishing community of Siribinha in the Itapicuru river estuary, Conde, Bahia, northeastern Brazil. Figure taken from Renck et al. (2022, modified from Guimarães et al. 2020). **B:** The community of Siribinha is located in a strip of land between the mangroves and the sea in a region of well-preserved mangroves, which also presents coconut monocultures, small dunes and restinga remnants. Photograph: José Amorim Reis Filho, reproduced under permission.

Choosing participants (P-set)

In Q-Methodology studies, because the goal is to identify existing viewpoints, participants should be chosen to represent varied ways of thinking, rather than to statistically represent – and generalize findings to – a larger population (Watts & Stenner 2014). Moreover, because participants are treated as variables in the analysis (see below), the number of participants should be at maximum around half the number of statements (Watts & Stenner, 2012). To guarantee a diversity of local people that represent relevant and varied ways of thinking about human-nature relationships in Siribinha, we used purposive sampling to select participants (Zabala et al. 2018). We stratified the sample into three groups that have markedly different relationships within the community, assuming this would affect their way of thinking about human relationship with nature: 1) Siribinha residents, who were born in the community or nearby region; 2) frequent visitors/non-native residents; and 3) researchers from the transdisciplinary project carried out by the Federal University of Bahia who have spent long periods in the community.

Within the group of native residents, we selected 18 people representing the variety of occupations, ages, and gender in the community. Within this group, eight women and 10 men were interviewed, varying in age from 18 to 81 years old and representing 12 different occupations. Within the second group, we selected one frequent visitor (female) and one non-native resident (male), and among the researchers we selected three researchers (all females) who currently have ongoing projects in the community and had already lived in Siribinha for at least two consecutive months. In total, we had 23 participants, 12 women and 11 men. Additional information on the participants obtained through the application of a questionnaire (see below) are presented in Appendix S2.

Characterizing participants

To assist in the interpretation of the different ways of thinking on the human-nature relationships in Siribinha, we administered a close-ended questionnaire prior to the application of the Q-Methodology containing questions (1) intended to characterize participants regarding education, occupation, residency history, and daily activities, (2) about socio-environmental issues faced by the community, and (3) addressing the participants' perception of the values of nature (Appendix S3). In the socio-environmental section, participants had to indicate their opinion about each of seven socio-environmental issues through a bipolar scale and then orally explain their opinion in detail. In the section about the values of nature, they had to order, from

"very important to my life" to "not important at all to my life", ten cards with distinct benefits that the nature in Siribinha could bring to their lives (Appendix S3).

Data collection

In-person interviews were conducted individually with each participant by the same researcher (BDA). We first obtained from the participant a written voluntary and informed consent to participate in the study. The questionnaires, Q-set and interview procedures were all evaluated and approved by the Research Ethics Committee from the Biosciences Institute of the University of São Paulo (CAAE 53059421.7.0000.5464). We then applied the close-ended questionnaire followed by the Q-Methodology activity, both with the mediation of the researcher (Figure 3).

Concerning the Q-Methodology activity, participants were asked to sort the Q-set into a 11-point ranking scale ranging from highest disagreement (-5) to highest agreement (+5) according to how he/she saw, perceived and felt the nature in Siribinha. To facilitate the understanding of how the sorting activity works, we used a customized board (Figure 1). Statements were provided in random order, in separated and numbered cards. The researcher read each statement and the participant first indicated whether that statement was to be placed in the provisional categories of agreement, disagreement or neutral. Then, they fine-sorted statements – beginning with the extreme categories of provisional agreement – into a fixed distribution along the 11-point ranking scale, in which the number of statements per rank of agreement is fixed but variable across the ranks, forming a normal distribution (Figure 1, 3A). The resulting distribution of statements is the Q-sort. Throughout the sorting process, participants were asked to explain their choice for the statements with which they most strongly agreed or disagreed (categories -5, -4, -3 and +3, +4, +5) and others they considered also relevant to express their ideas about nature. These explanations were recorded in audio to support subsequent interpretations.

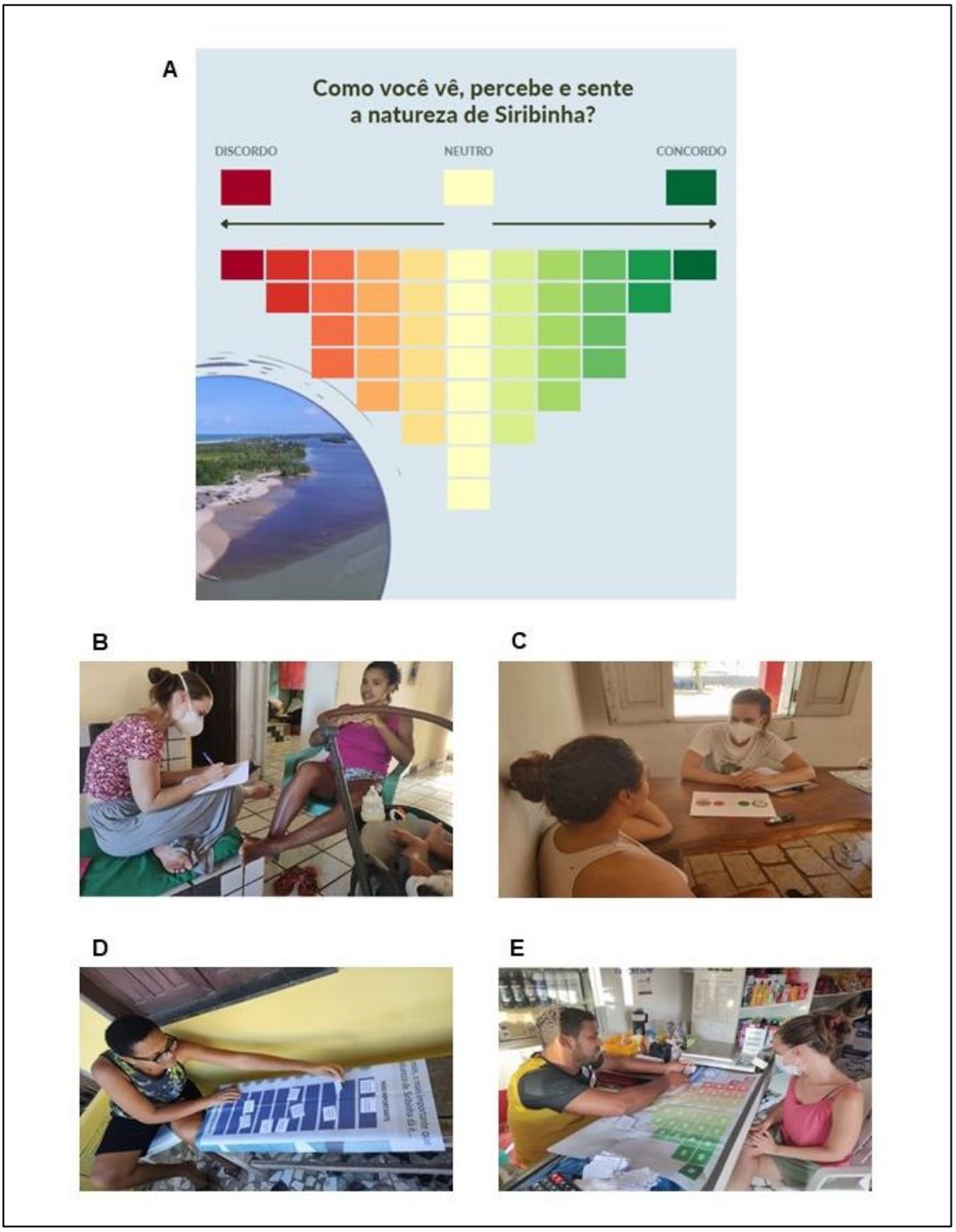

Figure 3. A: Customized Q-methodology board used for the study in Siribinha. At the top, the original guiding question in Portuguese and the three categories "disagree", "neutral", and "agree" (from left to right). The guiding question translated into English is: *"How do you see, perceive and feel Siribinha's nature?"*. **B – E**: Study participants at different stages of the interview. **B:** researcher applies questionnaire to characterize participant background. **C:** researcher applies questionnaire about the perception of socio-environmental issues faced by the community. **D:** participant organizes cards with statements about benefits brought by Siribinha's nature in the activity to assess values of nature. **E:** researcher follows the sorting of cards by the participant performing the Q-Methodology on the customized board. Photographs: Nina Garcia Prado, reproduced under permission.

All stages of data collection were conducted in Portuguese. Prior to data collection, we conducted pilot interviews with 12 people residing in Siribinha to elucidate what they understood when the term "nature" was used and thus created a definition vignette (Appendix S1). In addition, through these pilot interviews we also tested the application of the questionnaire and the Q-Methodology activity, the adequacy of the language of the statements and identified the main socio-environmental issues faced by the community and the main perceived values of nature addressed in the close-ended questionnaire.

Data analysis

To identify the shared ways of thinking or viewpoints on human-nature relationships in Siribinha, we searched for groups of highly correlated Q-sorts using Pearson's r and then performed a principal component analysis on the participant-by-participant correlation matrix of Q-sorts. Based on criteria described in Watts & Stenner (2012), we extracted and rotated the first three components (or factors) (Appendix S4). These factors represent a combination of participants that have produced similar Q-sorts, presenting shared ways of thinking about the human-nature relationships in Siribinha. We used the qmethod package (Zabala 2014) in R environment (R Development Core Team 2008) for calculations.

To describe the three ways of thinking, we created an ideal-typical Q-sort for each of the three factors by calculating weighted normalized sum of the Q sorts that were highly correlated to that factor only (Watts & Stenner 2012) (Appendix S4). We then qualitatively interpreted these ideal-typical Q-sorts of each factor based on information from four sources. First, we identified agreement and disagreement statements among the three ways of thinking following Neff & Larson (2014). Agreement statements have similar ranking among the typical Q-sorts, while disagreement statements have divergent ranking. We estimated how strongly each statement was ranked across typical Q-sorts (i.e., the statement salience) and the level of disagreement across typical Q-sorts (Appendix S4). Agreements and disagreements are the most salient (above average) statements that presented either the lowest (below average) or the highest (above average) level of disagreement across typical Q-sorts. Second, following Watts & Stenner (2012), to guide the interpretation of the ways of thinking associated with the factors, we identified the statements ranked higher or lower in each of them compared to the others, as well as the statements ranked +5 and -5. Third, we examined recorded explanations of the sorting of statements by participants whose Q-sorts were highly correlated to each factor. Fourth, we used information from the questionnaire on participant´s background, perspectives about socio-environmental issues and values of nature to look for patterns in responses of

participants associated with each factor. Using these four sources, we created a narrative for each factor that represents our interpretation of the different ways of thinking about the human-nature relationships in Siribinha and chose a symbolic name expressing the main feature in each of them. Quotations from recorded audios were translated by the authors into English for publication only, being kept as literal as possible. Original Portuguese transcripts of the quotations mentioned in the Results section are presented in Appendix S5.

RESULTS

Overview

We identified three factors representing distinct, shared ways of thinking (hereafter viewpoints) about the human-nature relationships in Siribinha (Table 1), explaining 64.1% of the total variance of the 23 Q-sorts. In all, 17 of the 23 participants (74%) – including 13 native residents, the three researchers, and one non-native residents – had their Q-sorts associated with one of these factors (Table S4-2, Appendix S4). Typical Q-sorts had a low to moderate correlation ($0.32 < r < 0.55$), indicating that each factor is a distinct and independent viewpoint with moderate agreement across viewpoints (Brown 1980; Watts & Stenner 2012).

Table 1: Factor scores of the three identified shared ways of thinking about human-nature relationships in Siribinha. Statements – characterized in terms of the conceptual dimension and relational model they represent – are ordered from highest to lowest salience among typical Q-sorts. Ranking ranges from - 5 to +5, indicating, respectively, highest discordance or concordance with each statement. **Salience** measures how strongly (in terms of either concordance or discordance) each statement was, on average, ranked across typical Q-sorts. **Disagreement** measures differences in the ranking of each statement across typical Q-sorts. Statements in green background are agreement statements because of their above-average salience and below-average level of disagreement across viewpoints. Statements in red background are disagreement statements because of their above-average salience and above-average level of disagreement across viewpoints. "Not applicable" was used when the statement represented ideas from the Ontology dimension whose positions are not exclusive to only one relational model, or in the case of the statement developed to represent the idea of intellectual pleasure, not derived from any model, but rather from Berghöefer et al. (2008).

Nº	Statement text	Dimension	Relational Model	F1	F2	F3	Salience	Disagreement
14	*I wish that in the future Siribinha becomes a big city.*	Goal orientation: Preferences	Detachment	-4	-4	-2	1.53	0.45
7	*Siribinha's nature is not important.*	Goal orientation: Nature perceived as	Detachment	-5	-2	-3	1.53	0.53
31	*I don't mind people doing whatever they want with the nature here in Siribinha.*	Practices	Detachment	-4	-2	-4	1.50	0.59
8	*The nature here is a threat for Siribinha to grow and develop further.*	Goal orientation: Nature perceived as	Domination	-2	-3	-5	1.46	0.35
42	*I fight for all of the nature here in Siribinha to be protected and isolated from people.*	Mode of interaction	Wardship	-2	-4	4	1.34	1.69
21	*I feel nothing towards the nature here in Siribinha.*	Emotional drivers	Detachment	-3	-5	-1	1.34	0.93
17	*I wish that in the future people use the nature here in Siribinha with care so that it will continue to exist.*	Goal orientation: Preferences	Stewardship	0	2	5	1.15	1.03
20	*I wish that in the future people be able to earn more from nature in Siribinha than they do today.*	Goal orientation: Preferences	Utilization	2	-1	-4	1.04	1.26
32	*People have the right to explore all the nature here in Siribinha.*	Practices	Domination	-2	-3	-3	1.04	0.25
22	*I am afraid of the sea, the mangrove and the animals here in Siribinha.*	Emotional drivers	Detachment	-3	-3	-1	1.03	0.60
4	*People are superior to animals, plants, the river or the sea of Siribinha.*	Ontology: Human position vis a vis nature - superior	Not applicable	-2	-3	-2	0.92	0.44
36	*People have to give back to the nature in Siribinha for all it gives.*	Practices	Ritualized exchange	3	1	3	0.92	0.34
2	*The plants and animals here in Siribinha feel and have their wills.*	Ontology: Agency – biotic beings	Not applicable	0	4	-3	0.91	1.33

18	*I wish that in the future the nature here in Siribinha be protected and isolated from all people.*	Goal orientation: Preferences	Wardship	-2	-2	-1	0.90	0.34
24	*I feel whole and complete here in the nature in Siribinha.*	Emotional drivers	Stewardship	-1	3	3	0.89	0.71
34	*People have to respect the rules and take care of Siribinha so that nature stays alive.*	Practices	Stewardship	4	1	2	0.89	0.48
30	*Learning with the nature here in Siribinha is very good.*	Emotional drivers – Intellectual pleasure	Not applicable	1	3	2	0.86	0.46
6	*The plants and animals here in Siribinha have the same right to exist as people.*	Ontology: Rights of biotic beings	Not applicable	2	3	-1	0.85	0.93
10	*Siribinha's nature is the conviviality between plants, animals, river, sea, and the people of the community.*	Goal orientation: Nature perceived as	Stewardship	2	2	-2	0.83	0.92
23	*I feel God in the nature here in Siribinha.*	Emotional drivers	Devotion	5	0	0	0.82	1.01
12	*Siribinha's nature is alive and tells us a lot.*	Goal orientation: Nature perceived as	Ritualized exchange	3	4	0	0.81	0.66
41	*I interact with the nature here in Siribinha all the time and it always gives me things for my life.*	Mode of interaction	Stewardship	-1	1	4	0.79	0.77
27	*I feel a duty to give back to the nature here in Siribinha all that it offers me.*	Emotional drivers	Ritualized exchange	1	2	2	0.78	0.33
15	*I wish that in the future nature will not hinder the development of Siribinha.*	Goal orientation: Preferences	Domination	-1	-2	-2	0.76	0.09
40	*I treat the nature here in Siribinha as a gift from God.*	Mode of interaction	Devotion	4	0	1	0.75	0.80
35	*People have to choose some places in Siribinha to be isolated and protected from everyone.*	Practices	Wardship	-3	0	-1	0.74	0.57
38	*I keep myself away from the nature here in Siribinha.*	Mode of interaction	Detachment	-3	-1	-1	0.73	0.48
3	*The river and the sea here in Siribinha feel and have their wills.*	Ontology: Agency – abiotic beings	Not applicable	0	2	1	0.73	0.33
26	*I feel at peace in the nature here in Siribinha.*	Emotional drivers	Wardship	3	1	-1	0.73	0.78
5	*The plants, the animals, the river and the sea of Siribinha are as important as people.*	Ontology: Human position vis a vis nature – equal	Not applicable	1	5	0	0.71	0.84
9	*The nature here in Siribinha is sacred.*	Goal orientation: Nature perceived as	Devotion	2	1	2	0.69	0.17

1	*I am part of Siribinha's nature.*	Ontology: Human X nature distinction – no distinction	Not applicable	1	0	3	0.65	0.36
25	*I feel responsible for taking care of the nature here in Siribinha.*	Emotional drivers	Stewardship/Wardship	0	2	1	0.64	0.30
37	*People have to get financial benefit from the nature here in Siribinha.*	Practices	Utilization	-1	0	-3	0.62	0.91
19	*I wish that in the future the nature and the people in Siribinha be seen as having the same importance.*	Goal orientation: Preferences	Ritualized exchange	0	3	0	0.62	0.76
11	*Siribinha's nature is fragile and needs to be protected from people.*	Goal orientation: Nature perceived as	Wardship	0	-2	1	0.56	0.75
16	*I wish that in the future the nature here in Siribinha remains the way it has always been to please God.*	Goal orientation: Preferences	Devotion	1	-1	1	0.55	0.68
43	*I give back to the nature here in Siribinha what I receive from it.*	Mode of interaction	Ritualized exchange	1	-1	1	0.52	0.65
28	*I feel that the nature here in Siribinha fulfills my basic needs, such as for food.*	Emotional drivers	Utilization	2	0	2	0.51	0.46
13	*Nature here in Siribinha serves to provide us food and sustenance.*	Goal orientation: Nature perceived as	Utilization	3	0	0	0.50	0.68
39	*I explore the nature here in Siribinha.*	Mode of interaction	Domination	-1	-1	-2	0.48	0.17
33	*People have to take care of the nature here in Siribinha because that is what God wants us to do.*	Practices	Devotion	0	0	3	0.43	0.54
29	*Observing the beauty of the nature here in Siribinha is very good.*	Emotional drivers	Wardship	0	1	0	0.30	0.32
44	*I seek to use and make money from the nature here in Siribinha.*	Mode of interaction	Utilization	-1	-1	0	0.27	0.39

By examining the agreement and disagreement statements (Figure 4), it is possible to identify the ideas that bring together or differentiate the three viewpoints. On the one hand, it is consensual across viewpoints to agree with normative ideas derived from non-Western, modern relational models, as well as with the idea that it is good to learn with the nature in Siribinha (idea included from Berghöefer et al. 2008). In contrast, all the statements with which all three viewpoints consensually disagree were derived from typically urban, Western modern relational models, mainly the Dominance and Detachment models, but also from the Wardship model. Overall, these consensus statements suggest that all participants enjoy learning with nature and agree that people should retribute to nature and follow rules to allow it to persist, while all of them reject ideas of nature as a threat, of unrestricted exploitation of nature, of urban development as a desired goal, of indifference to – or fear towards – nature, and to a lesser degree of isolating nature from humans to protect it (Figure 4). On the other hand, the main dissent across viewpoints concerns the agency and rights of non-human beings, the feelings that the nature in Siribinha inspires, and the preference for people carefully using the nature in Siribinha or earning more money from it (Figure 4). In addition, although all three viewpoints rejected (but not strongly) that in the future the nature in Siribinha should be protected and isolated from all people, they disagree in the extent they see themselves fighting for that. Next, we will describe in detail each shared way of thinking about human-nature relationships in Siribinha.

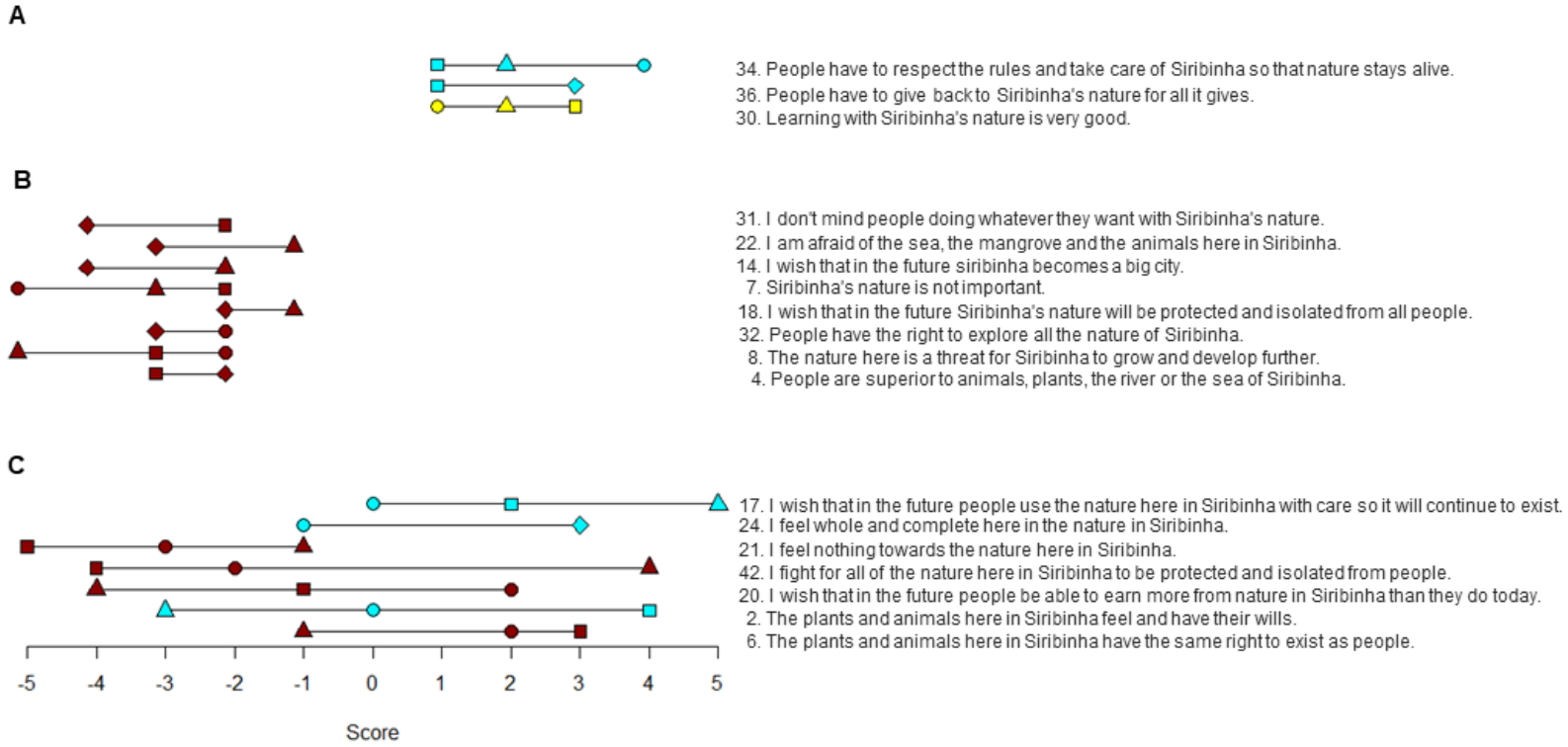

Figure 4: Agreement and disagreement statements across the three identified shared ways of thinking on human-nature relationships in Siribinha. Scores given to statements is represented by different symbols for each viewpoint (circle = Factor 1; square = Factor 2; triangle = Factor 3; diamond = two factors with the same score). **A** and **B**: agreement statements (i.e., statements with above-average salience and below-average level of disagreement across viewpoints). Statements in **A** are statements with a positive score (i.e., the consensus is to agree with them) and statements in **B** are statements with a negative score (i.e., the consensus is to disagree with them). **C**: disagreement statements (i.e., statements with above-average salience and above-average level of disagreement across viewpoints). The colors represent human-nature relational models from which the statement was developed from. Dark red = typically modern Western models – Detachment (statements 7, 14, 21 and 22), Wardship (statements 18 and 42), Domination (statements 8 and 32), Utilization (statement 20) – and dimensions in which these typically modern Western models are positioned (statement 4, human superiority over nature, Domination; statement 2, agency in biotic beings, Ritualized Exchange; statement 6, rights of non-human entities, Wardship). Light blue = typically non-Western models – Stewardship (statements 24, 34 and 44) and Ritualized Exchange (statement 36); Yellow = position added in the Emotional Drivers dimension from Berghöefer et al. 2008 to express intellectual pleasure with nature.

Participants associated with factor 1: Careful explorers of God's gift

Characterization

Factor 1, which we named "Careful explorers of God´s gift", has an eigenvalue of 6.37 and explains 27.7% of the total variance. In contrast to the participants associated with the other two factors, all the 10 participants associated with factor 1 were born in the community or in the nearby region (Table S2-2, Appendix S2). This is the group with the highest proportion of men (70%), the greatest variation in age (minimum age 18 and maximum age 81), the highest proportion of Christians (80% in total, 30% Catholic and 50% Evangelical), and the highest proportion of people who did not finish school (10% did 0-4 years and 20% did 5-9 years of basic education). They included a range of different occupations – retired teacher and retired mason, students, hotel owner, beach bar owner, grocery shop owner, fisherman, fishing colony employee, and nursing technician. Although only one of them makes his income strictly from fishing, all the seven men identified themselves as fishermen/retired fishermen and considered fishing an important part of their routine and/or identity, and two of the female participants identified themselves as shellfish gatherers/retired shellfish gatherers, even though shellfish gathering is not their main occupation and source of income nowadays. They have thus a fairly deep-rooted relationship with the community; yet, many of their income-earning occupations involve intense interaction with people from outside, promoting contact with urban lifestyles and technologies and/or a linkage to the economic gain people from outside bring to the community.

The Careful explorers of God's gift consider to be bad (-2 score) or partially bad (-1 score) the industrial fishing (80% of them, the highest percentage of these scores among the three factors) (Table S2-5, Appendix S2), and are the group with the highest percentage (60%) of people who think that excursionist tourism is bad. Yet, they are the ones with the highest percentage (50%) of people who think that outsiders buying land in Siribinha is good (+2) or partially good (+1). When asked about the values of nature, they were the group with the highest percentage (80%) of "most important" score for the benefit provided by fish, crabs and aratus (local name for the crab species *Goniopsis cruentata*) and for being able to keep fishing and shellfish gathering (40%) (Table S2-6, Appendix S2). They are also the group with the highest percentage of "most important" score for the knowledge (60%) and freedom (60%) Siribinha's nature brings (60%), for pure air and water (50%), and for being able to have fun and relax in Siribinha's nature (40%), although they are the group with the lowest percentage of "most important" score for the beauty in Siribinha's nature (25%).

Shared way of thinking on human-nature relationships

The Careful explorers of God´s gift understand that the nature in Siribinha serves to provide food and sustenance for its residents (13, +3)[1]. The participants associated with this factor have in common a strong perception of nature's role in their sustenance and income. As put by three of them:

"I feel that nature satisfies my needs because many times there is a lack of meat at home, I go to the river and catch a fish, so this helps a lot, and there are other things too, like boat rides, people come here because they find nature beautiful, so this is what makes us earn money here." – P5, 18, male[2]

"I always made my living, I was able to build my house through what I got from nature, fishing aratu, fishing with a net, catching massunim... and thank God I was able to give my children everything they needed, what I needed, build my house." – P10, 42, female

"If you stay three, four years without tourism, people can maintain themselves, because it is self-sufficient to feed themselves; in these two years of pandemic, what gives us sustenance is the river, fish, crabs." – P13, 35, male

The Careful explorers wish that in the future residents may get more income from nature than they do nowadays (20, +2). To a greater extent than participants associated with the other two viewpoints, they hope nature will not hinder the development of the community in the future (15, -1), but believe that this development should not imply the village growing into a city (14, -4). They are also unfavorable to the idea that some places in Siribinha should be isolated and protected from all people (35, -3). Furthermore, this is the viewpoint least opposed to the idea that people have the right to exploit the nature in Siribinha (32, -2), whilst understanding that rules should be respected and nature taken care of so that it stays alive (34, +4). These intricate themes were addressed by the participants in the interviews. Some considerations made by them are as follows:

"I think that for you to earn more in the future [you should] take care of it [nature], the more you take care of it, the tendency is for you to earn more; because if here is a place well taken care of (…) the tendency is for people to come here and bring us income; (...) I can't survive here if I don't

[1] the notation used refers to: (statement number, score of the statement in the typical-Q sort of that Factor)
[2] the notation used refers to: participant ID code, participant age, participant gender

explore nature, but I want to explore it and preserve it, because if I don't take care of it I won't be able to explore it." – P22, 51

“It [nature] has to be protected, but not isolated; I think Siribinha has to be exploited in the right way, but yes, exploited." – P3, 22, female

"They [governmental environmental agencies] don't want to improve the road, they don't want to pave it, they don't think that Siribinha should grow (...) to preserve you don't need to isolate the area, you can preserve it as long as people know about it, that they don't do things that are not allowed (...) I think you have to be careful and have duties, but how can I forbid you to get into the river, just because it is protected? Protected from what? From whom? It is not by prohibiting that you preserve.”– P11, 60, male

They are less positive about wishing that people in the future use nature carefully so that nature can persist (17, 0) and do not feel personally as responsible for taking care of nature as participants associated with the other viewpoints (25, 0), even though nature is important to them (7, -5) and they stay close to it (38, -3). They do not necessarily interact with nature all the time (41, -1) and they feel less obligation to give back to nature for what it offers (27, +1), when compared to the other two viewpoints.

Although they do not feel whole and complete by being in nature (24, -1), they feel God in nature (23, +5) and treat it as a gift from God (40, +4). This association between God and nature is essential for this point of view, as the participants put:

"Who gave us this gift [of nature] was Him (...) this place was planned by God."– P13, 35, male

“It was He [God] who created everything, and He is present in the simplest things, like water (…) surely I feel God in these simplest things that nature offers.” – P3, 22, female

"God wants us to do good things. (...) If you destroy nature, if you finish nature, He won't be pleased."– P10, 42, male

In summary, this viewpoint understands nature as a divine and precious gift, which guarantees the sustenance and income of Siribinha's residents directly or indirectly. For them, this gift should be fully enjoyed and exploited, as they consider their own occupation exploitative of nature. This exploitation, however, does not resemble the idea of destruction and hostility characteristic of the Domination relational model that drove the development of modern Western societies; it is rather a cautious use, upon which human life in Siribinha depends; a use that must be prudent but not hindered. Humans have the right to get food,

sustenance, and income from nature, for this is the gift that a providing God has given us. Retribution for God's gift is indeed understood as cautiously using what nature gives. Hence, there must be rules so that the use of the gift of nature does not destroy it. Nevertheless, these rules cannot prevent the economic development and use of nature. There are responsibilities towards the gift, but in a distant, less personal way.

Participants associated with factor 2: Appreciators of equity between humans and non-humans

Characterization

Factor 2, which we named "Appreciators of equity between humans and non-humans", has an eigenvalue of 4.35 and explains 18.9% of the total variance. Four participants, three researchers and one native resident, are associated with it (Table S2-3, Appendix S2). All of them are female near or in their thirties and have lived in urban centers, and the native participant had just returned from a five-year period living in big cities. The main occupation of the native resident is quarrying and selling food, and she often goes shellfish gathering as a hobby. The researchers are Ph.D. candidates at a European university – two Brazilians (background in ecology and development and sustainability studies) and one from the Netherlands (background in social sciences) – who carry out their projects through immersive field trips in the community. Regarding the socio-environmental issues faced by the community, it is notable that this was the group that gave the most neutral or partial scores (i.e., 0, -1 and 1) across the three groups (Table S2-5, Appendix S2). Concerning the values of nature, they were the group that gave the highest percentage of "least important" score for being able to fish and carry out shellfish gathering, and for the freedom nature brings, but gave the highest percentage of "most important" score for the beauty of Siribinha's nature (Table S2-6, Appendix S2).

Shared way of thinking on human-nature relationships

The Appreciators of equity between humans and non-humans reject the idea of human superiority over other beings and entities (4, -3). For them, the plants and animals in Siribinha have the same right to exist as people (6, +3) and none of them is superior to the others (5, +5), indicating the importance to them of the idea of equality among all beings. This horizontality and equal rights perspective are also reflected in the belief that non-humans feel and have wills. The agreement with the idea of agency is stronger when they consider living beings (2, +4), but they also regard it to be present in non-living entities (3, +2). This goes along with the perception of nature as a living entity, capable of telling many things (12, +4). As the participants state:

"(…) the idea of reciprocity is… [that] we all live together, some depend more on others …, and not just because we depend, but because of this relationship, look what I've received [from nature], look what they [non-human entities] have done for me, look how many lives have died to keep me alive, so try to respect, be thankful, and understand that these other beings also have their power, their will to be here."– P19, 28, female

"All [animals, plants and people from Siribinha] have the same importance, because they are living beings, some speak, others don't, but all have the same importance."– P12, 34, female

For those who share this point of view, it is important that in the future people and nature are seen with the same importance; after all, they understand humans and other beings as equivalent parts of nature:

"People have to perceive themselves as part of nature, and as a part they have equal importance [as non-human entities]."– P20, 31, female

"People are never more important than nature, nor is nature [more important than people], it's all of us, it's a whole, one needs the other in order to survive."– P12, 34, female

Interestingly, this is the viewpoint that agrees least with the statement "I am part of the nature in Siribinha" (1, 0), as well as with the statements about satisfying basic needs through nature (28, 0) and giving back to nature for what it gives (43, -1). Indeed, they are the group that least valued nature making them feel as part of it (Table S2-6, Appendix S2). This is probably associated with a self-perception of the three researchers as not being part of the community, so consequently not being part of nature there. This self-perception as someone from outside may also explain the higher disagreement of this viewpoint with normative (i.e., "people have to...") statements about giving back to nature (36, +1) and respecting rules (34, +1), as these researchers avoid meddling and dictating right and wrong to residents and try to remain aware of their position in the community. About avoiding giving opinions on community issues, a researcher explains:

"Not only because I don't live here, also because I am European, white, blonde, have other experiences ... I am really not from here."– P2, 30, female

However, working as a researcher in the community may also imply a sense of responsibility to care for the nature in Siribinha, as this is the viewpoint that most agrees with the statement about feeling responsible for taking care of local nature (25, +2). As one researcher participant explains:

"I think that since I started coming here [to Siribinha] and started working here, and considering all my background as a biologist, ecologist, all my knowledge, it's kind of my duty to take care of this place too, that helps me work, develop research." – P20, 31, female

Yet, the responsibility of taking care of nature is not viewed as associated with nature fragility or the need to isolate it from people, as this viewpoint is the most contrary to the idea that the nature in Siribinha is fragile and needs to be protected from people (11, -2), and that they should fight for nature to be protected and isolated (42, -4) (though they oppose to indifference to nature; 21, -5). These ideas were emphasized by the participants:

"I think people [of the community] are part of the nature in Siribinha, so I can't fight for nature to be isolated from a part of it." – P20, 31, female

"It is very difficult to isolate nature from the human being, so I disagree [that nature should be isolated] (...) and it is not that it has to be protected, people have to know how to enjoy the nature of Siribinha (...) people who come here should know how to enjoy the nature here."– P12, 34, female

"I disagree a lot when people talk about nature as something without power, will you say that the sea is fragile?! (...) I don't think it works; that just fencing and separating an area from people is enough, I find it difficult, counterproductive."– P19, 28, female

Intellectual and aesthetic aspects were also relevant to participants associated with this viewpoint, as statements about the beauty of the nature in Siribinha and the possibility of learning from it were ranked higher (30, +3; 29, +1) than by participants associated with the other viewpoints.

In short, this point of view is characterized mainly by the relevance given to the idea of equality between humans and non-humans. Humans are seen as a part of nature equivalent to other beings, not superior to them, and precisely because they are part of nature, it makes no sense to isolate the latter from people in order to protect it. The participants associated with this way of thinking believe in equal rights between humans and non-humans, who they see as entities that have feelings and wills. They see humans as part of a strong and powerful nature which includes the livelihoods and way of lives of people in a markedly contextualized and territorialized way. The researchers (who makes up the majority of this factor) understand that the community members are part of Siribinha nature, but not themselves, who come from outside, with no place for dictating right and wrong to residents, even though holding feelings

of responsibility to be useful and retribute to the community. Additionally, these participants present a strong aesthetical and intellectual link to nature.

Participants associated with factor 3: Defenders against threat

Characterization

Factor 3, which we named "Defenders against threat", has an eigenvalue of 4.01 and explains 17.4% of the total variance. Three participants, all Siribinha residents, are associated with it (Table S2-4, Appendix S2). Two of them are female native residents in their thirties, whose main occupation is shellfish gathering. One of them is a 66-year-old non-native and foreign resident man who has lived in the community for more than two decades in an isolated location on the estuary and lives off subsistence. All of them make their living exclusively from activities that involve a high degree of direct contact with nature and, thus, they are strongly dependent on natural resources and preserved landscapes. All of them are religious, two being Evangelical. It is noteworthy that all of them consider industrial fishing, high flux of boats and jet skis, excursionist tourism and outsiders buying land in Siribinha as bad (presenting the highest percentage of bad and partially bad among the viewpoints), and fishing regulation and nature tourism as good (with the highest percentage of good and partially good scores) (Table S2-5, Appendix S2). Effectively, they are the group that least valued the tourism and freedom nature brings to Siribinha (Table S2-6, Appendix S2), and instead gave the highest score to the value of nature "making me feel I am part of it [nature]" (Figure S4-2, Appendix S4).

Shared way of thinking on human-nature relationships

The Defenders against threat consider themselves part of nature (1, +3) and recognize that they relate to nature all the time and that it always brings things into their lives (33, +3). Yet, they see greater distinction between humans and non-humans than the participants associated with the other viewpoints (in particular the Appreciators of equity between humans and non-humans) (2, -3; 10, -2; 6, -1; 5, 0).

They believe that people do not have the right to exploit nature for profit, as they have the highest disagreement among the ways of thinking with the idea that they themselves exploit the nature in Siribinha (39, -2), that in the future people should earn more from nature (20, -4), that people have to profit financially from nature (37, -3), and that nature is a threat to development (8, -5). As put by one of them:

"This is the worst thing [taking financial advantage of nature], because nature was not created for us to make money, no, it was made for us to take care of." – P15, 66, male

While Careful explorers of God´s gift understand their use of natural resources to earn income is a type of exploitation that is necessary and may not be harmful, Defenders against threat understand the idea of exploitation as something intrinsically bad and associated with deforestation of the restingas and mangroves. They have also witnessed changes in Siribinha that led them to the realization that nature is under threat from unbridled exploitation. One participant described these changes in the landscape as follows:

"To exploit is to deforest (...) if you knew the mangroves and the restinga before, what it is now, it is totally different. Before there was a lot of fruit, then they cut down the mangaba trees, the cashew trees, it was too good (...) it is totally different now."– P18, 36, female

"You can't exploit nature, you have to take care of it, take what you need, but give it back. If you just take without giving anything back, then you will be left with nothing. And that's what they are doing (...) They are destroying everything (...) Because they are abusing... this is the point, you have to use and not abuse (...) Why are human beings destroying nature? Because of greed, because they are exploiting it, to be able to have more." – P15, 66, male

This viewpoint is the most favorable to the idea of fighting for nature to be protected and isolated from people (42, +4). It is also the way of thinking that rejects the least the idea that nature is fragile and needs to be protected (11, -2). For the Defenders against threat, the threat are precisely humans. Concerned about the fate of nature, they wish that in the future people could use the nature in Siribinha carefully in order for it to continue to exist (17, +5). As these participants state:

"People are a threat to nature." – P9, 35, female

"If people don't take care of it, then what will happen? Then they won't be able to catch fish to sell, and then it will be scarce. If we deforest, how will we live? Because most of the people here in Siribinha survive only on fishing, and if the fish are gone things will get difficult for us."– P18, 36, female

"You have to teach not to destroy, so you don't have to protect."– P15, 66, male

In short, the Defenders against threat see themselves as different but a part of nature, with which they interact all the time, and that sustains their way of life. This way of living, directly dependent on natural resources, is not seen by them as a threat to development, which they believe should not include taking financial profit from nature. They understand that nature is under threat from unscrupulous exploitation for profit, not survival, and believe that it is necessary to defend it to guarantee its existence in the future. They see nature as being

destroyed in Siribinha and themselves fighting to protect it. For them, nature, and consequently their own way of life, is vulnerable and under threats (such as from tourism), as verified also in their positions on socio-environmental issues.

DISCUSSION

In this study we strive to develop a consistent tool that would allow for in-depth assessment of views on the human-nature relationships and at the same time ensure the possibility to make comparisons with conceptual human-nature relational models and applications in different contexts through simple adaptations. By conducting a Q-methodology study with 18 native residents, one non-native resident, one visitor, and three researchers, we identified three distinct ways of thinking about human-nature relationships in the fishing community of Siribinha. These viewpoints differed mainly on the agency and rights of non-human beings, the feelings that nature in Siribinha inspires, and the extent to which they see themselves fighting for nature to be protected and isolated. Nonetheless, all identified ways of thinking assigned great importance to appreciating learning with Siribinha's nature, retributing to nature for all it gives and following rules to allow it to persist through time, ideas originated from non-Western modern relational models. It is also consensual across the three ways of thinking to reject ideas derived from urban and Western, modern relational models, especially the Dominance and Detachment models. In the next sections, we first examine possible explanations and implications for the identified viewpoints and then discuss the developed tool for identifying viewpoints about the human-nature relationships and its relevance to conservation science.

Shared ways of thinking about human-nature relationships in Siribinha

The aim of Q-methodology studies is to identify and explore viewpoints about a particular subject, highlighting nuances of agreements and disagreements among ways of thinking (Watts & Stenner, 2012). Rather than generalizing findings, as in typical quantitative surveys, this methodological approach relies on a small number of strategically chosen participants, whose opinions are assessed in depth. By purposively selecting the residents and researchers to participate in our study, we were able to identify a diversity of existing ways of thinking about human-nature relationships in Siribinha. Although the inclusion of different participants could reveal other viewpoints, this does not lessen the relevance of those described in this study. We did not aim at investigating the predominance of these viewpoints in a wider population, though future studies can later assess this using surveys or psychometric scales

developed based on the identified viewpoints applied to larger sets of participants (Danielson 2009).

By using a conceptual typology to ground the concourse used to develop our tool, we did not expect to find the exact conceptual relational models of the chosen typology among the participants. Rather, our goal was to depart from a comprehensive concourse for developing a coherent Q-set that would account for varied types of human-nature relationships, so that participants would have the possibility to express their unique views from a variety of perspectives. Indeed, none of the three identified viewpoints strictly fit one of the seven relational models from the human-nature typology utilized to develop the Q-set. All three viewpoints are a mix of ideas derived from different relational models, constituting unique ways of thinking. Neither native residents of Siribinha fit strictly to the Stewardship model, which describes the sense of interdependency between humans and nature and nature-centered management rules that are typical of many local communities (Lee et al. 2019), nor researchers present the Wardship model view and its ideas of wilderness and nature protection from humans that are characteristic of traditional, mainstream conservation science (Fletcher et al. 2021; Mesquita & Pardini, under review). Similarly, we found people from different backgrounds with similar viewpoints about nature, and participants did not fit into relational models based on labels such as artisanal fisher or researcher. These findings reveal the complexity and richness of human-nature relationships and their context dependency, highlighting the relevance of the specificities of the sociocultural contexts and life experiences in the construction of the beliefs about the non-human world (Muradian & Pascual 2018).

Indeed, it is possible to identify some links between the participants' life experiences and occupations and the ways of thinking described by each factor. In Factor 1, the Careful explorers of God's gift, participants are mostly Christian and, consequently, their view of Siribinha's nature is closely tied to ideas proper of this religion, such as the idea of divine gifts for humans – as we can verify in the high value assigned to the fish, crab, water, and air, all seen as gifts from God. In fact, studies have shown that religion is a key determinant of how people conceive the non-human world (de Groot & van den Born 2007; Kloek et al. 2018). Besides their religion, other factor that might be influencing their way of thinking are their occupations, something that other studies also indicate to be relevant in connection with human-nature relationships, but in a broader sense (i.e, as social actors' groups; Berghöefer et al. 2009; Duong & van den Born 2019). No matter if they sell fish and crab, have guests and costumers, do boat rides, among other occupations, the participants associated with this factor are somehow dependent on tourism and outsiders coming to the village. Even though they do not wish

Siribinha to become a big city, these participants are the ones with least objection to ideas related to earning more money with nature and developing the community, and they do not perceive nature in Siribinha as being threatened by current human activities. The fact that they are the least opposed to outsiders coming to buy houses and land in the community might be also associated with this dependence on occupations that are more profitable when there are people with money circulating in the village.

Beyond religion and occupation, there might be also an age factor influencing the will for development, as the two youngest participants were associated with this factor. The youth in Siribinha has full access to internet through smartphones and usually visits larger cities, like the state capital Salvador or cities in the nearby state (Sergipe), having contact with urban life and facilities that might make them want to see changes in their community and exchange with outsiders. Again, in other studies age has been pointed out as a factor influencing conceptions of nature (de Groot & van den Born 2003; Fischer & Young 2007). In any case, it is important to highlight that this group of people include only natives and is the most numerous and diverse in terms of occupations and age, indicating that this view – more open to development and outsiders – is potentially important and prevalent in the community. This finding is far from the idealization common within the scientific community of the so-called "local" communities (Trimble & Johnson 2012; Long et al. 2016) as well as from the relational model conceptually associated with these communities (Stewardship model). We purposively chose participants to be diverse so that they can represent the variety of existing opinions; yet, many of them – irrespectively of their age – that share occupations that are dependent on outsiders see that nature is not under threat in Siribinha and should be used to earn more profit in the future.

Concerning Factor 2, the researchers associated with it gave greater importance to intellectual and aesthetic aspects of nature when compared to the other two viewpoints, which is consistent with a previous study that indicated that these aspects are quite characteristic of the relationship researchers usually hold with nature (Berghöefer et al. 2009). Nonetheless, this aspect may also be related to the fact that participants associated with this viewpoint have significant and recent contact with urban centers – not only the three researchers, but also the native resident, as living in cities influences affective responses to nature (Bashan et al. 2021) and might be linked to this greater aesthetic appreciation and perception of nature as less fragile.

As seen in their responses to the socio-environmental issues and in the lowest agreement with normative statements, the researchers are self-aware of the need of respecting

points of view within the community and not muffling the voice of native residents. Although this posture is not necessarily widespread among researchers working collaboratively with local communities (Long et al. 2016), researchers from the transdisciplinary project that takes place in Siribinha are concerned with this topic and investigate their own practices and how to improve them to avoid potential harms to the community (e.g., Milberg 2021; Bollettin et al. 2022).

Their perspective of equal rights between humans and non-humans, the belief that non-humans have feelings and wills and the view that humans are a part of nature that includes the livelihoods and way of life of people in a contextualized and territorialized way, are probably associated with the research field in which the three researchers work. Although with different backgrounds, nowadays all of them have broad contact with the social sciences and with fields such as feminist political ecology, care, and participatory research. These subjects are uncommon among natural scientists, who still are the most frequent scientists in conservation science and practice. As such, the ideas of the three researchers that participate in our study are closer to those of the Stewardship model (especially the understanding of nature as a system of interdependencies) than to the Wardship model that prevail in mainstream or traditional conservation.

In Factor 3, the Defenders against threat present a view of nature as a fragile entity that is in danger of human exploitation and needs to be protected. Not coincidentally, they are the participants with a way of life that depends most directly on natural resources being intact and are the least dependent on tourism for income. Because they live off the extraction of crabs and other products, they understand that the danger to local nature comes from the intensification of tourism and fishing, and therefore present the greatest objection to ideas of development for the community. Their ideas about the nature in Siribinha being destroyed and themselves fighting to protect it, as well as their understanding that they are different from nature but part of it, constantly interacting with and depending on it, are in agreement with perspectives proper of the Stewardship model and indicate their care and concern for something they feel they are part of.

Dilemmas within fishing communities and their implications

Around the world, fishing communities are facing complex changes in their structure (Thompson et al. 2016), induced by the advance of global capitalism (Trimble & Johnson 2012) and the process of rural gentrification, through which amenity migration of middle-class people from urban centers displace natives, elevate the cost of living, and deeply transform the

landscape (Bartos et al. 2008; Lu et al. 2022) and social relationships (Thompson et al. 2016; Lu et al. 2022). As a result, the strictly fishing and shellfish gathering way of life is no longer sufficient, making it necessary for the residents to have other occupations, often related to tourism, in order to increase income (Trimble & Johnson 2012; Thompson et al. 2016). These complex changes are happening in places with high touristic potential, especially in coastal areas (Thompson et al. 2016), as exemplified by the Itapicuru estuary, where Siribinha is located, and have been identified as a transition of "resource-dependent" to a "tourism-dependent" community way of life in artisanal fishing communities (Trimble & Johnson 2012). Although fishermen and shellfish gatherers see fishing not only as merely a job, but as a way of life with many positive aspects (Trimble & Johnson 2012), the raised cost of life makes them conciliate fishing/shellfish gathering with more profitable occupations. This transition may lead to a dilemma, in which residents see both positive – the increase in income provided by tourism, described as “the only game in town” (Thompson et al. 2016: 171) – and negative – the gradual loss of fishing culture and difficult access to housing (Trimble & Johnson 2012; Thompson et al. 2016) – aspects of this transformation process. These studies, though, do not focus on resident’s views on human-nature relationships and how these views are affected by this transition process.

Interestingly, the two viewpoints associated only with participants that are part of the community and live in Siribinha (Factor 1 and Factor 3) represent two distinct and contrasting understandings of the local nature, how people should relate to it and what is expected for the future of the community. While the Careful explorers of God's gift place value on the fishing way of life and wish the community not to be de-characterized, they are more distanced from nature by having other occupations besides fishing and do not see nature as currently threatened, are more open to ideas of exploiting nature, wish that nature would not hinder development and that they could make more money from it in the future, and are less opposed to outsiders buying land in the community. Conversely, the Defenders against threat relate with nature closely in a daily basis, take their sustenance from it and see the danger nature already faces in Siribinha, are fully opposed to ideas of exploitation and development and are against the advance of tourism there. Hence, these two contrasting views of human-nature relationships can be seen as resulting from the dilemma faced by local communities around the world as a response to a gentrification process that causes a transition of "resource-dependent" to a "tourism-dependent" community way of life. In this sense, our work suggests that such widespread transitions – beyond changing the main source of income – may change human-nature

relationships in fishing communities, potentially creating conflicts, and hindering community self-organization.

It is then essential that researchers do not assume that community members have homogeneous views for their future, or that they know how the future of a community should be, without first listening to residents and trying to access the complexity of the situation in which they live, without value judgments. What has been described as a livelihood transition may bring about changes in the way people perceive and value nature, and create dissent and conflict. To envision the future of communities exposed to these processes of change and contribute to dealing with the conflicts that may arise from them can be seen as a major and critical challenge to community-based research projects. As researchers, understanding the way of thinking about human-nature relationships in contextualized territories might be a key step to being more prepared to act in a fairer and more horizontal way.

Relevance of the tool for assessing human-nature relationships in conservation

The set of statements that we developed constitutes a new tool to describe human-nature relationships in detail, capturing the main ways people view and relate to nature in a community. Although the typology of human-nature relational models used to ground the concourse used to develop the statements is not necessarily exhaustive, it accounts for the main cognitive structures underpinning human-nature relationships (Muradian & Pascual 2018), and was able to provide elements for individuals to express their beliefs about nature in unique ways. The statements were written to be context-specific, focusing on Siribinha; yet, they are easily adaptable to different contexts due to the transparent and replicable way we used to develop them. In sum, we departed from a conceptual, generic typology to develop a tool that allows for the collection and analysis of empirical data that results in in-depth descriptions of shared ways of thinking on human-nature relationships in specific territories. The tool makes possible to compare unique, contextualized viewpoints to conceptual relational models and can be easily adapted to different contexts.

This new tool can open paths for fostering plurality, legitimacy, and effectiveness in conservation initiatives by helping to bring to light the intricate views about nature in different local contexts. As recently argued (Muradian & Pascual 2018; Himes & Muraca 2018; Chan et al. 2018), rather than valuing nature through highlighting its instrumental values (as in the ecosystem services approach), conservation should embrace views that allow for better understanding of the properties of the relationships people hold with nature. Changing how people treat and value nature depends on addressing how individuals cognitively frame their

relationship with it, and on acknowledging that perceptions on socio-environmental issues are based on these frames. These cognitive frames of nature (the viewpoints or ways of thinking in our present study) can often be different and competing among social groups, especially in contexts of marked power inequalities, and socio-environmental conflicts frequently arise from these differences (Muradian & Pascual 2018). Thereby, it is critical that conservation efforts depart from identifying and mapping these diverse ways of thinking about nature among relevant social groups involved in socio-environmental conflicts, as a way to engage and respect people, facilitate dialogue, strengthen collaboration and find consensual ways forward. We hope our tool can contribute to make this process more feasible and viable.

By applying the tool in Siribinha, a local fishing community where a long-term transdisciplinary project is being carried on, our findings suggest the tool can indeed help collaborative practices that have been strongly advocated in conservation (Reyers et al. 2010; Margules et al. 2020). The two contrasting viewpoints on human-nature relationships we identified among Siribinha residents allow understanding and better characterizing the divergences and dissent within the community that can limit engagement. It can also help finding points of common desires for the future, which can inspire cohesion, as for instance the consensual rejection of the community becoming a city, or the wish of learning from Siribinha´s nature. In addition, the application of the tool to researchers themselves permits addressing the differences in conceptions between residents and researchers, strengthening the possibilities for dialogue. It may also stimulate reflexivity among researchers on how their worldview and feelings for the nature of places where they work influence their research approach – a process that has been considered key in conservation science (Boyce et al. 2022). In sum, the use of the tool may contribute to rejecting simplistic and homogenizing ideas about the communities' views and desires for themselves that are common among researchers who work in fishing communities (Trimble & Johnson 2012), and to facilitate that researchers consider their own viewpoints and their implications for the relationships with the community.

Finally, because our tool is rooted in a generalized, conceptual typology, it allows comparisons with conceptual relational models and, more importantly, across different communities. Cross-comparisons such as these can help highlighting the great diversity within what have been termed "local" communities, as well as the varied nature and dynamics of the processes they are facing. This should help, in turn, conservation science leaving behind idealized views of communities (Long et al. 2016), and embrace their diversity, dynamics, controversies, and right to determine their future.

CONCLUSIONS

We developed and applied a new tool to identify shared ways of thinking about human-nature relationships using a well-established methodology (Q-Methodology) and a comprehensive conceptual framework on human-nature relational models (namely, the typology proposed by Muradian & Pascual 2018). The application of the tool in Siribinha, an artisanal fishing community that faces socio-environmental pressures, and is part of a long-term transdisciplinary project, suggests the potential of the tool for conservation initiatives. By bringing to light the intricate views of nature, the consensus and dissensus about how to treat nature and what is expected from it, the tool can help setting more legitimate and effective grounds to collaboratively developing conservation actions.

We identified three distinct ways of thinking among residents and researchers working with the community that highlighted different conceptions about Siribinha's nature. We were also able to identify some factors that might be influencing these viewpoints, such as participants' occupations, age and religion, and the links between the ways of thinking and the views on socio-environmental issues in the community and the values of nature embraced by its members. The examination of the two viewpoints with which only residents were associated revealed contrasting views of nature resulting from the complex process of transition (from resource-dependent to tourism-dependent) the community is facing. While some residents with occupations that are dependent on outsiders see a need to explore and earn more money with Siribinha's nature, others who directly depend on the integrity of natural resources and do not work with tourism fear that nature is under threat and are generally against the presence of outsiders. Beyond changing the source of income, these widespread transitions may be changing the ways of thinking about nature in Siribinha and may generate conflicts. We hope the tool we developed can contribute to identifying diverse viewpoints about nature and investigating important links between these views, factors influencing them, and processes local communities are undergoing. All these aspects are key as they are in the center of socio-environmental conflicts and, therefore, should be addressed in order to achieve plurality, justice, and effectiveness in conservation practice.

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SUPPORTING INFORMATION

Appendix S1 - Additional information on the concourse and the Q-set

For the development of the Q-set, we departed from an elementary typology of human-nature relational models proposed by Muradian & Pascual (2018). The typology is structured in a grammar composed of five basic dimensions that characterize seven relational models of nature (Table S1-1), defined by the authors as cognitive representations of the external reality constructed by the individuals based on their experiences, perceptions and understandings of nature. The authors propose that it is possible to categorize a finite number of discrete human-nature relational models, which vary across cultures and over time and are associated with a set of normative and motivational conventions.

We used the positions of the different relational models in the distinct aspects of the five dimensions as the concourse to guide de development of the 44 statements of the Q-set (Table S1-2). In doing so, we consider that some opposed positions could be represented by one statement only (e.g., by agreeing or disagreeing with the statement that expresses the idea of no differentiation between humans and nature, we can infer what the participant thinks about the differentiation between humans and nature). We also separated some dimensions in more

aspects than the original typology to assure statements express individual, isolated ideas (e.g. to further explore the agency aspect of the ontology dimension, we created a statement expressing the idea of agency of biotic entities and another statement expressing the idea of agency of abiotic entities). Finally, we included one statement that came from Berghöefer et al. (2008) to complement the concourse with a position not associated with any of the relational model proposed by Muradian & Pascual (2018) (i.e, intellectual pleasure).

Table S1-1. The position of each of the seven human-nature relational models in each dimension and brief description/definition of each relational model/dimension as presented by Muradian & Pascual (2018). *Indicates aspects that were originally within the same dimension but we divided to ensure that we would cover all each ideas in a separate statement.

Relational models and their positions in each dimension							
Dimensions	**Detachment**	**Domination**	**Devotion**	**Stewardship**	**Wardship**	**Ritualized Exchange**	**Utilization**
Ontology: cognitive structure or social representation that defines the boundaries between the self and the otherness; **it includes 4 aspects**: the degree to which nature and society are differentiated; whether non-human entities are considered to have agency (i.e, entities that act intentionally); how nature is positioned in relation to humans (inferior, superior, equal); if non-human entities have intrinsic rights*	Nature is distinct from society, has no agency, and its position in relation to humans is one of non-existence and invisibility.	Nature is distinct from society, has no agency, and there is a hierarchical relationship of subordination and inferiority of nature vis-à-vis humans.	Nature is distinct from society, but it has agency and there is a hierarchical relationship in which nature is divinity and superior to humans.	Nature is not distinct from society, has no agency, humans are part of nature.	Nature is distinct from society, has no agency, but has intrinsic rights.	Nature is not distinct from society, it has agency and is equal to humans.	Nature is distinct from society, has no agency, and is a separate entity with no intrinsic rights.

Goal Orientation: general goals of society that guide decision-making and that determine the evaluation criteria; **it includes 2 aspects:** how nature is perceived*; and what the preferred conditions of nature are*.	Nature perceived as not important; preference for urban and technological spaces.	Nature perceived as a threat; preference for human control over nature.	Nature perceived as sacred; preference for situations believed to be those that favor the deities.	Nature perceived as a comprehensive system that encompasses humans; preference for human restraint in order to respect nature.	Nature perceived as a separate entity that needs to be protected; preference for pristine conditions and spaces.	Nature perceived as an interactive agent; preference for equality.	Nature perceived as a source of goods and services and disservices; preference for maximizing benefit-cost ratios.
Emotional Drivers: feelings and mental states that steer behavior and decisions, as opposed to rational thinking.	Indifference.	Fear.	Seek of transcendence; obligation.	Sense of belonging, identity, care.	Aesthetic experience, care, peacefulness.	Obligation.	Needs satisfaction, hedonic pleasure.
Practices: codified social conventions that set normative barriers, especially about the allocation of rights and responsibilities; they dictate what can and cannot be done in a particular context based on the dominant morality	Absence of codified practices.	Rules and norms based on the human right to appropriate nature, and on human superiority.	Sacredness yielding religious practices (rituals including taboos).	Rules and norms about nature-centered management and self-imposed behavioral limits.	Rules and norms in which the delimitation of pristine spaces and biocentrism (intrinsic rights of nature) prevail.	Rules and norms based on the sense of partnership.	Rules based on rational calculation and market orientation.

Main mode of interaction: summarizes the way the relationship with nature is concretized or operationalized.	Isolationism.	Destruction (hostility).	Wordship.	Livelihoods integration into nature.	Preservation of the wilderness.	Partnership.	Utilization forprofit-maximization.
RELATIONAL MODEL CHARACTERIZED BY:	Indifference to non-human entities because they are considered irrelevant or unnoticed. Consequence of ignorance and lack of experience with nature. Associated with the use of technologies and increasing urbanization, which can lead to the perception of natural entities as abstract and distant objects, and consequently, irrelevant or invisible.	A sense of human right over nature and the perception of nature as a possible threat that inspires fear. Nature is seen as a space to be conquered and a category opposed to "civilization". There is a clear separation between society and nature and an antagonistic view of nature, perceived as an obstacle to progress. Hostility and annihilation of natural entities is the mode of interaction.	Hierarchical relationships (nature is superior), with natural entities being conceived as having divine agency and properties that are above humans. Religious/spiritual rituals are the basis of social conventions that give meaning and form to human-nature relations.	A notion of interdependence between humans and nature. Nature is not seen as an entity with agency, but humans are seen as part of nature and dependent on it. This notion of interdependence underlies the sense of human responsibility toward nature, which is expressed through self-imposed limits on human actions and nature-centered	A sense of responsibility for the guardianship of nature, which is seen as a distinct entity with its own intrinsic rights. It promotes the protection of natural spaces from which humans must be removed, and/or care and management of species for non-utilitarian reasons. Shares with the stewardship relational model the sense of human constraint for	The agency given by humans to natural entities, with whom humans engage in exchanges governed by ritualized codes of fairness, balance, and reciprocity.	A clear separation of society from nature, and the appropriation of nature's goods and services, via extraction and consumption. Dominated by a utilitarian logic, which leads to the use (exploitative or conservationist) of nature and often to the commodification of its properties. Strongly

		management rules.	the sake of nature, but with a preference for either pristine/wilderness areas or for control over natural entities.	associated with instrumental (substitutable) values, it lies behind the metaphors of green economy and ecosystem services.

Table S1-2. The final Q-set with 44 statements, in which the positions of each relational model in each aspect of the dimensions corresponds to one statement. *indicates aspects that were originally within the same dimension but we divided to ensure that we would cover each idea in a separate statement. ** indicates that we have included additional positions not addressed in the original typology. *** indicates that we chose to represent only one or some of the opposing positions, as ranking of agreement would itself represent the opposing positions. ****: indicates that the statement did not come from the original typology, but was added from another source. *****: indicates that information from the relational model description rather than from the table of the typology in Muradian & Pascual (2018) was used to create the statement.

Original definition vignette of the term "nature" in Portuguese: *o rio, o mar, os animais, a praia, o mangue e as plantas de Siribinha.*
Definition vignette of the term "nature" in English: *the river, the sea, the animals, the beach, the mangrove and the plants of Siribinha.*

Original guiding question in Portuguese: *Como você vê, percebe e sente a natureza de Siribinha?*
Guiding question translated to English: *How do you see, perceive, and feel the nature in Siribinha?*

Dimensions	Aspects	Original statements in Portuguese	Statements translated to English
Ontology	**Clear self-nature distinction*** **	**1. Sim:** Eu sou parte da natureza de Siribinha.	**1. Yes:** I am part of Siribinha's nature.
	Nature entity with agency**	**2. Sim biótico**:** As plantas e bichos aqui de Siribinha sentem e têm suas vontades. **3. Sim abiótico**:b** O rio e o mar aqui de Siribinha sentem e têm suas vontades.	**2. Yes – biotic**:** The plants and animals here in Siribinha feel and have their wills. **3. Yes – abiotic**:** The river and the sea here in Siribinha feel and have their wills.
	How nature is positioned vis-à-vis humans* **	**4. Superior*:** As pessoas são mais importantes do que as plantas, os bichos, o rio ou o mar de Siribinha. **5. Igual:** As plantas, os bichos, o rio e o mar de Siribinha são importantes igual as pessoas.	**4. Superior*:** People are superior to animals, plants, the river or the sea of Siribinha. **5. Equal:** The plants, the animals, the river and the sea of Siribinha are as important as people.

	Rights*/*	**6. Sim:** As plantas e bichos de Siribinha têm o mesmo direito de existir que as pessoas.	**6. Yes:** The plants and animals here in Siribinha have the same right to exist as people.
Goal orientation	**Nature perceived as***	**7. Desimportante (*desapego)*:** A natureza de Siribinha não é importante.	**7. Unimportant (*detachment)*:** Siribinha's nature is not important.
		8. Ameaça, obstáculo ao progresso e ente a ser conquistado *(dominação)****:** A natureza daqui é uma ameaça para que Siribinha possa crescer e se desenvolver mais.	**8. Threat, obstacle to progress, and entity to be conquered *(domination)******:** The nature here is a threat for Siribinha to grow and develop further.
		9. Sagrada *(devoção)*: A natureza aqui de Siribinha é sagrada.	**9. Sacred (*devotion*):** The nature here in Siribinha is sacred.
		10. Sistema abrangente que inclui o ser humano *(manejo)*: A natureza de Siribinha é a convivência entre as plantas, bichos, rio, mar e a gente da comunidade.	**10. Comprehensive system that encompasses humans *(stewardship)*:** Siribinha's nature is the conviviality between plants, animals, river, sea, and the people of the community.
		11. Ente a ser protegido do ser humano *(tutela)*: A natureza de Siribinha é frágil e precisa ser protegida das pessoas.	**11. Entity to be protected from humans (*wardship*):** Siribinha's nature is fragile and needs to be protected from people.
		12. Agente interativo *(troca ritualizada)*: A natureza de Siribinha é viva e nos conta muita coisa.	**12. Interactive agent *(ritualized exchange)*:** Siribinha's nature is alive and tells us a lot.
		13. Fonte de recursos, serviços e desserviços *(utilização)*: A natureza de Siribinha serve para nos dar alimento e sustento.	**13. Source of goods, services and disservices *(utilization)*:** Nature here in Siribinha serves to provide us food and sustenance.
	Preference*	**14. Urbano *(desapego)*:** Desejo que no futuro Siribinha vire uma cidade grande.	**14. Urban *(detachment)*:** I wish that in the future Siribinha becomes a big city.
		15. Controle humano *(dominação)*: Desejo que no futuro a natureza não atrapalhe o desenvolvimento de Siribinha.	**15. Human control *(domination)*:** I wish that in the future nature will not hinder the development of Siribinha.
		16. Favorecer divindades *(devoção)*: Desejo que no futuro a natureza de Siribinha permaneça do jeito que sempre foi para agradar a Deus.	**16. Favor deities *(devotion)*:** I wish that in the future the nature here in Siribinha remains the way it has always been to please God.

		17. Restrições às ações humanas em respeito à natureza *(manejo)*: Desejo que no futuro as pessoas usem com cuidado a natureza de Siribinha para que ela continue existindo.	**17. Human restraint in order to respect nature *(stewardship)*:** I wish that in the future people use the nature here in Siribinha with care so that it will continue to exist.
		18. Condições pristinas/selvagens *(tutela)*: Desejo que no futuro a natureza de Siribinha seja protegida e isolada de todas as pessoas.	**18. Pristine and wild conditions *(wardship)*:** I wish that in the future the nature here in Siribinha be protected and isolated from all people.
		19. Igualdade *(troca ritualizada)*: Desejo que no futuro a natureza e as pessoas daqui de Siribinha sejam vistas com a mesma importância.	**19. Equity *(ritualized exchange)*:** I wish that in the future the nature and the people in Siribinha be seen as having the same importance.
		20. Aumento de custo-benefício *(utilização)*: Desejo que no futuro as pessoas possam ganhar mais com a natureza de Siribinha do que ganham hoje.	**20. Maximizing benefit-cost ratios *(utilization)*:** I wish that in the future people be able to earn more from nature in Siribinha than they do today.
Emotional drivers		**21. Indiferença *(desapego)*:** Não sinto nada em relação a natureza de Siribinha.	**21. Indiference *(detachment)*:** I feel nothing towards the nature here in Siribinha.
		22. Medo *(dominação)*: Sinto medo do mar, do mangue e dos bichos aqui de Siribinha.	**22. Fear *(domination)*:** I am afraid of the sea, the mangrove and the animals here in Siribinha.
		23. Busca por transcendência *(devoção)*: Sinto Deus na natureza de Siribinha.	**23. Seek of transcendence *(devotion)*:** I feel God in the nature here in Siribinha.
	Does not apply	**24. Senso de pertencimento *(manejo)*:** Me sinto inteiro e completo aqui na natureza de Siribinha.	**24. Sense of belonging *(stewardship)*:** I feel whole and complete here in the nature in Siribinha.
		25. Senso de cuidado *(manejo e tutela)*: Me sinto responsável por cuidar da natureza de Siribinha.	**25. Sense of care *(stewardship and wardship)*:** I feel responsible for taking care of the nature here in Siribinha.
		26. Senso de paz *(tutela)*: Me sinto em paz na natureza de Siribinha.	**26. Peacefulness *(wardship)*:** I feel at peace in the nature here in Siribinha.
		27. Obrigação *(troca ritualizada)*: Me sinto no dever de dar de volta à natureza de Siribinha tudo o que ela me oferece.	**27. Obligation *(ritualized exchange)*:** I feel a duty to give back to the nature here in Siribinha all that it offers me.

		28. Satisfação das necessidades humanas *(utilização)*: Sinto que a natureza de Siribinha satisfaz minhas necessidades básicas, como de alimento.	**28. Needs satisfaction *(utilization)*:** I feel that the nature here in Siribinha fulfills my basic needs, such as for food.
		29. Prazer estético *(tutela)*: Observar a beleza da natureza de Siribinha é muito bom.	**29. Aesthetic pleasure *(tutela)*:** Observing the beauty of the nature here in Siribinha is very good.
		30. Prazer intelectual**:** Aprender com a natureza aqui de Siribinha é muito bom.	**30. Intellectual pleasure****:** Learning with the nature here in Siribinha is very good.
Practices		**31. Inexistente *(desapego)*:** Não me importo que as pessoas façam o que quiserem com a natureza de Siribinha**.**	**31. Absence of codified practices *(detachment)*:** I don't mind people doing whatever they want with the nature here in Siribinha.
		32. Direito dos humanos se apropriarem da natureza *(dominação)*: As pessoas têm o direito de explorar toda a natureza de Siribinha.	**32. Human right to appropriate nature (*domination*):** People have the right to explore all the nature here in Siribinha.
		33. Práticas religiosas *(devoção)*: As pessoas têm que cuidar da natureza de Siribinha porque é isso que Deus quer que a gente faça.	**33. Religious practices *(devotion)*:** People have to take care of the nature here in Siribinha because that is what God wants us to do.
	Does not apply	**34. Manejo respeitoso centrado na natureza *(manejo)*:** As pessoas têm que respeitar as regras e cuidar de Siribinha para que a natureza permaneça viva.	**34. Nature-centered management *(stewardship)*:** People have to respect the rules and take care of Siribinha so that nature stays alive.
		35. Delimitação de espaços pristinos *(tutela)*: As pessoas têm que escolher alguns lugares em Siribinha para ficarem isolados e protegidos de todos.	**35. Delimitation of pristine spaces *(wardship)*:** People have to choose some places in Siribinha to be isolated and protected from everyone.
		36. Parceria *(troca ritualizada)*: As pessoas têm que retribuir à natureza de Siribinha por tudo que ela dá.	**36. Partnership *(ritualized exchange)*:** People have to give back to the nature in Siribinha for all it gives.
		37. Orientação para o mercado *(utilização)*: As pessoas têm que ter proveito financeiro com a natureza de Siribinha.	**37. Market orientation *(utilization)*:** People have to get financial benefit from the nature here in Siribinha.

Main mode of interaction	**Does not apply**	**38. Isolamento *(desapego)*:** Eu me mantenho longe da natureza de Siribinha.	**38. Isolationism *(detachment)*:** I keep myself away from the nature here in Siribinha.
		39. Destruição *(dominação)*: Eu exploro a natureza de Siribinha.	**39. Destruction *(domination)*:** I explore the nature here in Siribinha.
		40. Adoração *(devoção)*: Eu trato a natureza de Siribinha como um presente de Deus.	**40. Worship *(devotion)*:** I treat the nature here in Siribinha as a gift from God.
		41. Integração dos meios de vida na natureza *(manejo)*: Eu me relaciono com a natureza de Siribinha o tempo todo e ela sempre dá coisas para minha vida.	**41. Livelihoods integration into nature *(stewardship)*:** I interact with the nature here in Siribinha all the time and it always gives me things for my life.
		42. Preservação do selvagem *(tutela)*: Eu luto para toda natureza de Siribinha ficar protegida e isolada das pessoas.	**42. Preservation of wilderness *(wardship)*:** I fight for all of the nature here in Siribinha to be protected and isolated from people.
		43. Parceria *(troca ritualizada)*: Eu dou de volta à natureza de Siribinha o que recebo dela.	**43. Partnership *(ritualized exchange)*:** I give back to the nature here in Siribinha what I receive from it.
		44. Aumento dos lucros *(utilização)*: Eu busco usar e ganhar dinheiro com a natureza de Siribinha.	**44. Profit-maximization *(utilization)*:** I seek to use and make money from the nature here in Siribinha.

Appendix S2 - Additional information on participants

The information collected via questionnaire about the participants associated with the three identified shared ways of thinking was synthesized concerning three major themes – characterizing participants (section 1 of the questionnaire; Tables S2 1- 4), socio-environmental issues (section 2 of the questionnaire; Table S2-5), and nature values (section 3 of the questionnaire; Table S2-5) – and are presented as percentages of all participants, of participants from particular groups (native residents, researchers, etc), or of participants associated with each of the three factors/ viewpoints. In the case of the socio-environmental issues and nature values, the values represent percentages of each score given on the scales used.

Table S2-1. Percentage and number of participants – by group of participants (i.e, native residents, researchers and frequent visitors/non-native residents) and by the way of thinking about human-nature relationships (F1 = Careful Explorers of God's Gift; F2 = Appreciators of equity between humans and non-humans; F3 = Defenders Against Threat) – within different categories of gender, age, years of education, religion and residency.

		% of native residents	% of researchers	% of frequent visitor/non-native resident	% of all participants	% of participants associated with Factor 1	% of articipants associated with Factor 2	% of participants associated with Factor 3
Sex	Male	56 (10)	0	50 (1)	52 (12)	70 (7)	0	33 (1)
	Female	44 (8)	100 (3)	50 (1)	48 (11)	30 (3)	100 (4)	67 (2)
Age	18 - 25	16 (3)	0	0	13 (3)	20 (2)	0	0
	26 - 33	6 (1)	100 (3)	0	17 (4)	0	75 (3)	0
	34 - 41	44 (8)	0	50 (1)	40 (9)	2 (2)	25 (1)	67 (2)
	42 - 49	6 (1)	0	0	4 (1)	10 (1)	0	0
	50 - 57	11 (2)	0	0	9 (2)	20 (2)	0	0
	58 - 64	11 (2)	0	0	9 (2)	20 (2)	0	0
	65 - 72	0	0	50 (1)	4 (1)	0	0	33 (1)
	73 - 80	0	0	0	0	0	0	0
	81 - 88	6 (1)	0	0	4 (1)	10 (1)	0	0
Years of basic education	0 - 4	6 (1)	0	0	4 (1)	10 (1)	0	0
	5 - 9	11 (2)	0	0	9 (2)	20 (2)	0	0
	9 - 12	83 (15)	100 (3)	100 (2)	87 (20)	70 (7)	100 (4)	100 (3)
Religion	Not religious	22 (4)	33.3 (1)	0	22 (5)	20 (2)	25 (1)	0
	Christian - catholic	22 (4)	0	0	18 (4)	30 (3)	0	0
	Christian - evangelic	56 (10)	0	0	44 (10)	50 (5)	25 (1)	0
	Christian - spiritism	0	0	50 (1)	4 (1)	0	0	67 (2)
	Afro-origin - Umbanda	0	33.3 (1)	0	4 (1)	0	25 (1)	0
	Afro-origin - Candomblé	0	33.3 (1)	0	4 (1)	0	25 (1)	0

	Xamanism	0	0	50 (1)	4 (1)	0	0	33 (1)
Has lived in an urban center*	Yes	89 (16)	100 (3)	100 (2)	91 (21)	80 (8)	100 (4)	33 (1)
	No	11 (2)	0	0	9 (2)	20 (2)	0	67 (2)

***:** we considered as urban centers those greater than 100,000 residents and only if participants had lived there for at least one year.

Table S2-2: Characterization of participants associated with the first viewpoint (Factor 1), called the Careful explorers of God's gift, regarding their ID code, age, sex, main occupation, residency current status and residence history, years of basic education (complete basic education in Brazil = 12 years) and religion.

Participant	Main Occupations	Siribinha's Resident	Born in Siribinha	Born in nearby region	Has lived in an urban center for at least 1 year	Years of basic education	Religion
P3, 22, female	Student	Yes	Yes		Yes	12	Evangelic
P5, 18, male	Student, fisherman	Yes	Yes		No	12	Evangelic
P7, 59, female	Retired teacher	Yes	Yes		Yes	8	Catholic
P8, 41, male	Fisherman	Yes	No	Yes	No	10	Evangelic
P10, 42, female	Employee of the fishing colony, crab gatherer	Yes	No	Yes	Yes	12	Catholic
P11, 60, male	Nursing technician	Yes	Yes		Yes	12	Not religious
P13, 35, male	Grocery shop owner	Yes	Yes		Yes	12	Evangelic
P21, 81, male	Retired mason	Yes	No	Yes	Yes	5	Evangelic
P22, 51, male	Beach bar owner/fisherman	Yes	No	Yes	Yes	12	Catholic
P23, 56, male	Hotel owner	Yes	Yes		No	0	Not religious

Table S2-3: Characterization of participants associated with the second viewpoint (Factor 2), called the Appreciator's of equity between humans and non-humans, regarding their ID code, age, sex, main occupation, residency current status and residence history, years of basic education (complete basic education in Brazil = 12 years) and religion.

Participant	Main Occupation	Siribinha's Resident	Born in Siribinha	Born in nearby region	Has lived in an urban center for at least 1 year	Years of basic education	Religion
P12, 34, female	Food saleswoman, crab gatherer	Yes	Yes		Yes	12	Evangelic
P2, 30, female	Researcher	No	No	No	Yes	12	Not religious
P19, 28, female	Researcher	No	No	No	Yes	12	Afro-origin - Umbanda
P20, 31, female	Researcher	No	No	No	Yes	12	Afro-origin - Candomblé

Table S2-4: Characterization of participants associated with the the third viewpoint (Factor 3), called the Defenders against threat, regarding their ID code, age, sex, main occupation, residency current status and residence history, years of basic education (complete basic education in Brazil = 12 years) and religion.

Participant	Main Occupation	Siribinha's Resident	Born in Siribinha	Born in nearby region	Has lived in an urban center for at least 1 year	Years of basic education	Religion
P9, 35, female	Crab gatherer and housewife	Yes	Yes		No	12	Evangelic
P18, 66, male	Lives on subsistence	Yes	No	No	Yes	12	Shamanism
P15, 36, female	Crab gatherer and housewife	Yes	Yes		No	12	Evangelic

Table S2-5: Percentage of participants associated with each of the three viewpoints (F1 = Careful Exploiters of God's Gift; F2 = Appreciators of Equity between Humans and Non-Humans; F3 = Defenders Against Threat) that gave different scores to seven socio-environmental issues. Participants were asked to indicate on a bipolar semantic scale ranging from -2 to 2 how "bad" (-2) or "good" (2) they thought a certain socio-environmental issue was, and then to explain orally why they gave such score. Each socio-environmental issue was contextualized by the researcher using the text presented in the table below.

Socio-environmental issue	Factor	-2	-1	0	1	2
Nature tourism: *Recently, a different kind of tourism started here in Siribinha: people who come to see the birds here, take boat trips through the mangrove, get to know the plants and animals. How much do you think this new type of tourism that has been happening here is a good thing or a bad thing?*	F1	0	0	30	10	60
	F2	0	0	25	50	25
	F3	0	0	0	33	67
Excursionist tourism: *Here in Siribinha there used to be a lot of tourism from people who would come by bus, bring a box with food and drinks and spend the day on the beach or in Boca da Barra. How much do you think this kind of tourism was a good thing or a bad thing?*	F1	60	20	20	0	0
	F2	0	50	25	25	0
	F3	33.3	33.3	33.3	0	0
Flux of speedboats and jet skis: *The number of motorboats and jet-skis on the river has increased a lot in recent years, especially near Boca da Barra, because of the transportation of tourists. How much do you think this increase in the number of motorboats and jet-skis on the river is a good thing or a bad thing?*	F1	50	40	0	10	0
	F2	50	0	50	0	0
	F3	33	67	0	0	0
Outsiders buying land: *There are a lot of people from big cities like Salvador and Aracaju that always come to Siribinha, sometimes spending several months and end up buying land and building or buying houses already built in the village. How much do you think that these outsiders buying houses or land here is a good thing) or a bad thing?*	F1	20	30	0	30	20
	F2	25	25	25	0	25
	F3	67	0	0	0	33
Industrial fishing: *There are several shrimp trawlers that come here at certain times of the year and stay for a few days at the Siribinha sea. How much do you think the presence of these trawler boats here is a good thing or a bad thing?*	F1	60	20	10	10	0
	F2	50	25	25	0	0
	F3	100	0	0	0	0

Protected areas: *The government, be it Municipal, State or Federal, often creates Conservation Units, which are places that are chosen because they have a very important nature that should be preserved, kept intact. When a Conservation Unit is created, the place starts having several rules regarding how nature can be used there, in relation to people visiting, among others, and this varies according to the type of Conservation Unit. How much do you think that the creation of these Conservation Units is a good thing or a bad thing?*	F1	0	10	20	30	40
	F2	0	25	25	25	25
	F3	0	33.3	0	33.3	33.3
Fishing relugation: *Here in Siribinha there is a closed season for sea bass and crabbing, when you can't fish or crab gather, and the fishermen and crab gatherers receive the Insurance for Small-scale Fishermen. How much do you think that this ban on fishing and crab gathering during the closed season is a good thing or a bad thing?*	F1	0	20	0	0	80
	F2	0	25	25	25	25
	F3	0	0	0	0	100

Table S2-6: Percentage of participants associated with each of the three viewpoints (F1 = Careful Exploiters of God's Gift; F2 = Appreciators of Equity between Humans and Non-Humans; F3 = Defenders Against Threat) that gave different scores (1 to 10) to values of nature. Participants were asked to rank ten cards on a scale ranging from 1 = "least important to my life" to 10 = "most important to my life". Each card contained a sentence about something important that Siribinha's nature can give to a person's life (i.e. nature's values). The participant was allowed to rank more than one card in each score (i.e. to consider that two or more things have the same importance), and leave scores with no cards.

Value of nature – "*the most important thing Siribinha's nature give to my life is…*"	**Factor**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pure air and water	F1	0	0	0	0	0	0	10	10	30	50
	F2	0	0	0	0	0	0	0	50	50	0
	F3	0	0	0	0	0	0	33.3	33.3	0	33.3
Being a good place for the children here to grow up and live in the future.	F1	10	0	0	0	10	0	0	40	10	30
	F2	0	0	0	0	0	0	25	0	50	25
	F3	33.3	0	0	33.3	30	0	0	0	0	33.3
Knowledge	F1	0	0	0	0	0	0	10	10	20	60
	F2	0	0	0	0	0	25	0	25	0	50
	F3	0	33.3	0	0	0	0	33.3	0	0	33.3
Freedom	F1	0	0	0	0	0	0	10	10	20	60
	F2	25	0	0	0	0	0	25	0	0	50
	F3	0	0	0	0	0	67	0	0	0	33.3
Being able to keep fishing and crab gathering the way we do it here	F1	0	0	0	0	0	0	0	30	30	40
	F2	0	0	0	0	0	0	25	50	0	25
	F3	33.3	0	0	0	0	0	0	0	67	0
Making me feel I'm part of it	F1	10	0	0	0	0	10	10	10	0	60
	F2	0	0	0	0	0	0	25	50	0	25
	F3	33.3	0	0	0	0	0	0	0	0	67
All its beauty	F1	0	0	0	0	0	60	30	10	0	0
	F2	0	0	0	0	0	0	0	50	25	25
	F3	33.3	0	0	0	33.3	0	0	0	0	33.3
	F1	10	0	0	10	0	0	0	30	10	40

Being able to have fun and relax in the places around here	F2	25	0	25	0	0	0	0	25	25	0
	F3	33.3	33.3	0	0	0	0	0	0	0	33.3
The tourism it brings to Siribinha	F1	0	0	0	10	0	30	10	10	30	10
	F2	25	0	0	25	0	25	0	0	0	25
	F3	33.3	0	0	0	33.3	0	33.3	0	0	0
The fish, crabs and aratus	F1	0	0	0	0	0	0	0	10	10	80
	F2	0	0	0	0	0	0	25	25	25	25
	F3	0	33.3	0	0	0	0	0	33.3	0	33.3

Appendix S3 - Additional information on the closed-ended questionnaire

Below, we present the complete, original questionnaires in Portuguese used in face-to-face interviews with participants. The sections of the questionnaire that differed between the groups of participants (i.e., native residents, researchers, and frequent visitors/non-native residents) are indicated and presented separately.

1: Characterizing section

A. Native Residents

Nome do(a) participante:

Número de identificação:

Nota: *os trechos em itálico são instruções ao entrevistador e não devem ser lidos para a pessoa entrevistada.*

Ler ao participante: O(A) senhor(a) pode escolher **não** responder a qualquer uma das perguntas que vou fazer a seguir.

1 - CARACTERIZAÇÃO DO(A) PARTICIPANTE

Vou começar fazendo umas perguntas sobre o(a) senhor(a) e a sua família.

<table>
<tr><td colspan="4">1.1 Sexo:
Feminino ☐ Masculino ☐ Prefiro não responder ☐</td></tr>
<tr><td colspan="4">1.2. Idade: Que idade o senhor(a) tem?
Prefiro não responder ☐</td></tr>
<tr><td colspan="4">1.3. Local de nascimento: Onde o(a) senhor(a) nasceu?
Prefiro não responder ☐
Se a pessoa responder “Siribinha”, ir para 1.4.2; se não, ir para 1.4.1</td></tr>
<tr><td colspan="4">1.4.1. Contexto antecedente: Há quantos anos o(a) senhor(a) vive em Siribinha?
Prefiro não responder ☐
Ir para 1.4.3</td></tr>
<tr><td colspan="4">1.4.2. Contexto antecedente: O(A) senhor(a) já viveu em outro lugar além de Siribinha?
Sim ☐ ir para 1.4.3 Não ☐ ir para 1.4.4 Prefiro não responder ☐</td></tr>
<tr><td colspan="4">1.4.3. Contexto antecedente: Por favor, o(a) senhor(a) poderia me dizer:
Prefiro não responder ☐</td></tr>
<tr><td>1.4.3 I
O nome dos lugares em que já viveu além de Siribinha</td><td>1.4.3 II
Se o lugar era uma cidade grande, uma vila ou zona rural</td><td>1.4.3 III
Quantos anos morou nesse lugar</td><td>1.4.3 IV
Quantos anos tinha quando viveu nesse lugar</td></tr>
<tr><td colspan="4">1.4.4. Contexto antecedente: Seu pai ou sua mãe viveram em Siribinha?
Não sei informar ☐
Sim – pai e mãe ☐
Sim – apenas pai ☐
Sim – apenas mãe ☐
Não ☐ ir para 1.5.1
Prefiro não responder ☐</td></tr>
</table>

1.4.5. Contexto antecedente: Por favor, o(a) senhor(a) poderia me dizer: Não sei informar ☐ Prefiro não responder ☐	
1.4.5 I **O nome do lugar onde seu pai ou mãe nasceram** ***(anotar se pai ou mãe)***	**1.4.5 II** **Se o lugar era cidade grande, vila ou zona rural**
1.5.1. Ocupação: Por favor, o(a) senhor(a) poderia me dizer com qual ou quais coisas trabalha?	

Trabalho(s) atual	**Anos exercendo**	**Fonte de renda (R), subsistência (S) ou ambas (A)**

1.5.2. Ocupação: O(A) senhor(a) poderia contar um pouco de como é seu dia a dia nesse(s) trabalho(s) que exerce atualmente? Por favor, comente sobre o que o(a) senhor(a) faz num dia comum de trabalho, o que mais e menos gosta de fazer, os lugares que tem ir... *Gravar* Prefiro não responder ☐
1.5.3. Ocupação: O(A) senhor(a) teve algum trabalho no passado que hoje em dia não tem mais? Sim ☐ *ir para 1.5.4* Não ☐ *ir para 1.6.1* Prefiro não responder ☐
1.5.4. Ocupação: Qual(is)? Prefiro não responder ☐

1.5.4 I **Trabalho antigo**	**1.5.4 II** **Ano em que parou de exercer**
1.6.1. Escolaridade: O(A) senhor(a) estuda ou estudou na escola? Sim ☐ *ir para 1.6.2* Não ☐ *ir para 1.7.1* Prefiro não responder ☐	
1.6.2. Escolaridade: O(A) senhor(a) estudou na escola por quantos anos? Prefiro não responder ☐ *Para pessoas que responderem um número de anos maior ou igual a 11, ir para pergunta 1.6.3*	
1.6.3. Escolaridade: Depois da escola, o(a) senhor(a) continuou estudando, fez algum curso técnico ou faculdade? Sim ☐ *ir para 1.6.4* Não ☐ *ir para 1.7.1* Prefiro não responder ☐	
1.6.4. Escolaridade: O(A) senhor(a) poderia me dizer: Prefiro não responder ☐	
1.6.4 I **Qual curso técnico ou faculdade cursou?**	**1.6.4 II** **Cursou durante quantos anos?**
1.7.1 Espiritualidade & religião: O(A) senhor(a) possui alguma religião? Sim ☐ *ir para 1.7.2* Não ☐ *FIM; ir para seção 2* Prefiro não responder ☐	
1.7.2. Religião: Qual? Prefiro não responder ☐	
1.7.3. Espiritualidade & religião: O(A) senhor(a) pratica essa religião hoje em dia? Sim ☐ Não ☐ Prefiro não responder ☐	

B. Researchers

Nome do(a) participante:

Número de identificação:

Nota: *os trechos em itálico são instruções ao entrevistador e não devem ser lidos para a pessoa entrevistada.*

Ler ao participante:
Você pode escolher **não** responder a qualquer uma das perguntas que vou fazer a seguir.

1 – CARACTERIZAÇÃO DOS PARTICIPANTES

Vou começar fazendo umas perguntas mais gerais sobre você e a sua pesquisa na comunidade de Siribinha.

1.1 Gênero: Com qual gênero você se identifica?

1.2. Idade: Qual é a sua idade?
Prefiro não responder ☐

1.3. Local de nascimento: Onde você nasceu? Se possível, por favor informe o município, estado e país.
Prefiro não responder ☐

1.4. Local de residência: Onde você reside atualmente? Se possível, por favor informe o município, estado e país.
Prefiro não responder ☐

1.5.1. Contexto antecedente: Você já viveu fora de centros urbanos (em zonas rurais, vilas de pescadores, quilombos, aldeias indígenas)?
Sim ☐ *ir para 1.5.2* Não ☐ *ir para 1.6.1* Prefiro não responder ☐

1.5.2. Contexto antecedente: Por favor, você poderia me dizer:
Prefiro não responder ☐

1.5.2 I **Nome do lugar fora de centros urbanos em que viveu**	**1.5.2 II** **Se o lugar era em uma zona rural, em uma vila de pescadores, em quilombo, aldeia indígena etc.**	**1.5.2 III** **Por quantos anos morou nesse lugar**	**1.5.2 IV** **Quantos anos tinha quando viveu nesse lugar**

1.6.1. Trajetória acadêmica: Em qual etapa da pós-graduação ou carreira acadêmica você se encontra atualmente?

Graduando(a) ☐
Mestrando(a) ☐
Doutorando(a) ☐
Pós-doutor ☐
Entre mestrado - doutorado ☐
Entre doutorado – pós-doutorado ☐
Pesquisador contratado(a) ☐
Prefiro não responder ☐

1.6.2. Trajetória acadêmica: Por favor, você poderia me dizer
Prefiro não responder ☐

1.6.2 I Curso, ano de conclusão e universidade - **graduação**	**1.6.2 II** Curso, ano de conclusão e universidade - **mestrado**	**1.6.2 III** Curso, ano de conclusão e universidade - **doutorado**	**1.6.2 IV** Ano de conclusão e universidade - **pós-doutorado**	**1.6.2 V** Ano de contratação e universidade - **pesquisador contratado**

1.6.3. Trajetória acadêmica: A qual Universidade você está vinculado(a) atualmente?
Atualmente não estou vinculado(a) a nenhuma Universidade ☐
Prefiro não responder ☐

1.7.1. Pesquisa em Siribinha e comunidades: Por favor, você poderia me dizer
Prefiro não responder ☐

1.7.1 I Qual o tema da(s) pesquisas que realiza ou realizou em Siribinha	1.7.1 II Tempo estimado que passou em Siribinha realizando essa(s) pesquisa(s)	1.7.1 III Principais atividades em um dia típico quando está ou estava realizando a(s) pesquisa(s) em Siribinha

1.7.2. Pesquisa em Siribinha e comunidades: Você já realizou pesquisa(s) em outros lugares fora de centros urbanos além de Siribinha?
Sim ☐ *ir para 1.7.3* Não ☐ *ir para 1.8.1* Prefiro não responder ☐

1.7.3. Pesquisa em Siribinha e comunidades: Por favor, você poderia me dizer
Prefiro não responder ☐

1.7.3 I Lugar onde realizou a(s) pesquisa(s)	1.7.3 II Tema(s) da(s) pesquisa(s)

1.8.1. Espiritualidade & religião: Você possui alguma religião?
Sim ☐ *ir para 1.8.2* Não ☐ *FIM; ir para seção 2* Prefiro não responder ☐

1.8.2. Religião: Qual?
Prefiro não responder ☐

1.8.3. Religião: Você pratica essa religião atualmente?
Sim ☐ Não ☐ Prefiro não responder ☐

C. Frequent visitors/Non-native resident

Nome do(a) participante:

Número de identificação:

Nota: *os trechos em itálico são instruções ao entrevistador e não devem ser lidos para a pessoa entrevistada.*

Ler ao participante:
O(A) senhor(a) pode escolher **não** responder a qualquer uma das perguntas que vou fazer a seguir.

1 – CARACTERIZAÇÃO DOS PARTICIPANTES

Vou começar fazendo umas perguntas sobre o(a) senhor(a) e a sua família.

1.1 Sexo: Feminino ☐ Masculino ☐ Prefiro não responder ☐

1.2. Idade: Que idade o senhor(a) tem?
Prefiro não responder ☐

1.3. Local de nascimento: Onde o(a) senhor(a) nasceu? Se possível, por favor informe o município, estado e país.
Prefiro não responder ☐

1.4. Local de residência: Onde o(a) senhor(a) reside atualmente? Se possível, por favor informe o município, estado e país.
Prefiro não responder ☐

1.5.1. Contexto antecedente: O(a) senhor(a) já viveu fora de centros urbanos (em zonas rurais, vilas de pescadores, quilombos, aldeias indígenas)?
Sim ☐ *ir para 1.5.2* Não ☐ *ir para 1.6.1* Prefiro não responder ☐

1.5.2. Contexto antecedente: Por favor, o(a) senhor(a) poderia me dizer: Prefiro não responder ☐			
1.5.2 I **Nome do lugar fora de centros urbanos em que viveu**	**1.5.2 II** **Se o lugar era em uma zona rural, em uma vila de pescadores, em quilombo, aldeia indígena etc.**	**1.5.2 III** **Por quantos anos morou nesse lugar**	**1.5.2 IV** **Quantos anos tinha quando viveu nesse lugar**
1.6.1. Ocupação: Por favor, o(a) senhor(a) poderia me dizer com qual ou quais coisas trabalha?			
1.6.1 I Trabalho(s) atual	**1.6.1 II Anos exercendo**		
1.6.2. Ocupação: O(A) senhor(a) poderia contar um pouco de como é seu dia a dia nesse(s) trabalho(s) que exerce atualmente? Por favor, comente sobre o que o(a) senhor(a) faz num dia comum de trabalho, o que mais e menos gosta de fazer, os lugares que tem ir... *Gravar* Prefiro não responder ☐			
1.6.3. Ocupação: O(A) senhor(a) teve algum trabalho no passado que hoje em dia não tem mais? Sim ☐ *ir para 1.5.4* Não ☐ *ir para 1.6.1* Prefiro não responder ☐			
1.6.4. Ocupação: Qual(is)? Prefiro não responder ☐			
1.6.4 I **Trabalho antigo**	**1.6.4 II** **Ano em que parou de exercer**		
1.7.1. Relação com Siribinha: Há quantos anos o(a) senhor(a) visita Siribinha? Prefiro não responder ☐			
1.7.2. Relação com Siribinha: Com qual frequência o(a) senhor(a) visita Siribinha? Prefiro não responder ☐			
1.7.3. Relação com Siribinha: Quantos dias em média o(a) senhor(a) costuma ficar em Siribinha? Prefiro não responder ☐			
1.7.4. Relação com Siribinha: O(A) senhor(a) costuma ficar em casa própria, casa alugada ou pousada? Prefiro não responder ☐			
1.7.5. Relação com Siribinha: O que o(a) senhor(a) mais gosta de fazer em Siribinha? *Gravar* Prefiro não responder ☐			
1.8.1. Escolaridade: O(A) senhor(a) estuda ou estudou na escola? Sim ☐ *ir para 1.7.2* Não ☐ *ir para 1.8.1* Prefiro não responder ☐			
1.8.2. Escolaridade: O(A) senhor(a) estudou na escola por quantos anos? Prefiro não responder ☐ *Para pessoas que responderem um número de anos maior ou igual a 11, ir para pergunta 1.7.3*			
1.8.3. Escolaridade: Depois da escola, o(a) senhor(a) continuou estudando, fez algum curso técnico ou faculdade? Sim ☐ *ir para 1.7.4* Não ☐ *ir para 1.8.1* Prefiro não responder ☐			
1.8.4. Escolaridade: O(A) senhor(a) poderia me dizer: Prefiro não responder ☐			
1.8.4 I **Qual curso técnico ou faculdade cursou?**	**1.8.4 II** **Cursou durante quantos anos?**		
1.9.1. Espiritualidade & religião: O(a) senhor(a) possui alguma religião? Sim ☐ *ir para 1.8.2* Não ☐ *FIM; ir para seção 2* Prefiro não responder ☐			
1.9.2. Religião: Qual? Prefiro não responder ☐			
1.9.3. Religião: O(a) senhor(a) pratica essa religião atualmente? Sim ☐ Não ☐ Prefiro não responder ☐			

2: Interactions with nature section

A. Native residents

2 – INTERAÇÕES NA NATUREZA

Agora vou fazer algumas perguntas sobre quanto tempo aproximadamente o(a) senhor(a) usou nos últimos sete dias para realizar atividades que envolvem estar em contato com o rio, o mangue, o mar, as plantas e bichos daqui do Itapicuru, seja no trabalho ou por prazer. Se os últimos sete dias tiverem sido muito diferentes do que o de costume, por favor tente pensar no tempo que o(a) senhor(a) utiliza para essas atividades em uma semana normal. Por favor, me diga quantas horas aproximadamente o(a) senhor(a) utilizou nos últimos sete dias:

Atividade	**Horas gastas nos últimos sete dias**
2.1. Pescando no rio ou no mar Prefiro não responder ☐	
2.2. Catando marisco Prefiro não responder ☐	
2.3. Na praia Prefiro não responder ☐	
2.4. No Cajueirinho ou no Cavalo Russo Prefiro não responder ☐	
2.5. Na barra de Siribinha Prefiro não responder ☐	
2.6. Subindo o rio Itapicuru de barco (a trabalho ou lazer) Prefiro não responder ☐	
2.7. Realizando ou acompanhando observação de aves Prefiro não responder ☐	
2.8. Transportando turistas Prefiro não responder ☐	
2.9. Cuidando de roça, de animais de criação ou plantas Prefiro não responder ☐	
2.10. Trabalhando em restaurante Prefiro não responder ☐	
2.11. Trabalhando em pousada Prefiro não responder ☐	
2.12. Trabalhando em barraca na Boca da Barra Prefiro não responder ☐	
2.13. Tirando coco Prefiro não responder ☐	
2.14. Outros. Qual(is): Prefiro não responder ☐	

B. Researchers and frequent visitors/non-native residents

2 – INTERAÇÕES NA NATUREZA

Agora vou fazer algumas perguntas sobre suas experiências e atividades na natureza no seu dia a dia.

Interações na natureza não relacionadas a sua ocupação atual
2.1. Anteriormente ao período de quarentena imposto pela pandemia, com que frequência em média o(a) senhor(a) costumava visitar (mesmo que visitas curtas) parques urbanos, praças, reservas peri-urbanas ou sítios, chácaras e casas de campo? A) ☐ Menos de 1 vez por mês B) ☐ 1 vez por mês C) ☐ 1 vez a cada quinze dias D) ☐ 1 vez por semana na maioria das semanas E) ☐ 2 ou mais vezes por semana Prefiro não responder ☐
2.2. Nas suas últimas férias antes do período de quarentena imposto pela pandemia (considere férias um período de pelo menos 15 dias consecutivos), qual a porcentagem de dias que o(a) senhor(a) passou em áreas bem preservadas, como parques nacionais e estaduais ou seus arredores, e regiões de florestas, cerrados ou campos nativos? A) ☐ Entre 0 e 25% B) ☐ Entre 25% e 50% C) ☐ Entre 50% e 75% D) ☐ Entre 75% e 100% Prefiro não responder ☐
2.3. Na sua infância (até os 10 anos de idade), com que frequência o(a) senhor(a) frequentava ambientes rurais fora de centros urbanos? Para responder, considere ambiente rural como qualquer área menos urbanizada do que os centros urbanos das cidades (por exemplo, fazendas, chácaras, sítios, casas ou clubes de campo, áreas menos urbanizadas e mais verdes nas periferias das cidades). A) ☐ Vivi em ambiente urbano e nunca ou raramente ia ao ambiente rural B) ☐ Vivi em ambiente urbano, mas ia a ambientes rurais ocasionalmente nos finais de semana e férias C) ☐ Vivi em ambiente urbano, mas ia a ambientes rurais boa parte dos finais de semana e férias D) ☐ Vivi em ambiente rural durante parte da infância E) ☐ Vivi em ambiente rural durante toda a infancia Prefiro não responder ☐
2.4. O(a) senhor(a) tem algum hobby que pratique com alguma frequência (pelo três vezes ao ano) que exija contato com a natureza? A) ☐ Caminhada ou trilha B) ☐ Acampar C) ☐ Pescar D) ☐ Escalar E) ☐ Observação de aves (*birdwatching)* F) ☐ Mergulho G) ☐ Outros (cite qual): Prefiro não responder ☐

3: Socio-environmental issues section: all participants

3 - ATITUDES EM RELAÇÃO ÀS QUESTÕES SOCIOAMBIENTAIS

Agora queria saber sua opinião pessoal sobre algumas coisas que acontecem aqui em Siribinha, como a pesca e a comunidade crescendo. Não tem certo ou errado, quero saber sua opinião mesmo. Para me dizer o que acha, vou pedir para o(a) senhor(a) apontar aqui nessa figura *(mostrar figura com a escala)*. As bolas grandes das pontas representam extremos opostos: ruim *(mostrar bola maior vermelha)* e bom

(mostrar bola maior verde). E as bolas do meio são intermediários, por exemplo, algo que o(a) senhor(a) considere um pouco bom fica na bola verde clara, algo que o(a) senhor(a) considere um pouco ruim vai na bola vermelha clara. E se o(a) senhor(a) não acha nem ruim nem bom, vai na bola branca do centro.

Questões socioambientais

3.1. Turismo de natureza: recentemente começou a ter aqui em Siribinha um tipo de turismo diferente, de pessoas que vêm para ver as aves daqui, fazer passeios de barco pelo mangue, conhecer as plantas e os bichos. O quanto o(a) senhor(a) acha esse novo tipo de turismo que tem acontecido aqui uma coisa **boa** *(apontar bola verde maior)* ou **ruim** *(apontar bola vermelha maior)*?

Prefiro não responder ☐

Ruim				**Bom**
-2	-1	0	1	2

O(A) senhor(a) poderia me contar o porquê acha isso bom/um pouco bom/neutro/um pouco ruim/ruim? *Gravar resposta*

3.2. Turismo bate e volta: tinha aqui em Siribinha muito turismo de pessoal que fazia bate-volta, vinha nos ônibus, trazia isopor com comida e bebida e passava o dia na praia ou na Boca da Barra. O quanto o(a) senhor(a) achava esse tipo de turismo uma coisa **boa** *(apontar bola verde maior)* ou **ruim** *(apontar bola vermelha maior)*?

Prefiro não responder ☐

Ruim				**Bom**
-2	-1	0	1	2

O(A) senhor(a) poderia me contar o porquê acha isso bom/um pouco bom/neutro/um pouco ruim/ruim? *Gravar resposta*

3.3. Fluxo de lanchas e jet-skis: tem aumentado muito nos últimos anos o número de lanchas a motor e de jet-skis no rio, principalmente perto da Boca da Barra, por conta do transporte de turistas. O quanto o(a) senhor(a) acha que esse aumento no número de lanchas e de jet-skis no rio é uma coisa **boa** *(apontar bola verde maior)* ou **ruim** *(apontar bola vermelha maior)*?

Prefiro não responder ☐

Ruim				**Bom**
-2	-1	0	1	2

O(A) senhor(a) poderia me contar o porquê acha isso bom/um pouco bom/neutro/um pouco ruim/ruim? *Gravar resposta*

3.4. Veranistas de fora: tem bastante pessoal de cidade grande tipo Salvador e Aracaju que vem sempre para Siribinha, às vezes passam vários meses e acabam comprando terreno e construindo ou comprando casas já construídas na vila. O quanto o(a) senhor(a) acha que essas pessoas de fora comprando casa ou terreno aqui é uma coisa **boa** *(apontar bola verde maior)* ou **ruim** *(apontar bola vermelha maior)*?

Prefiro não responder ☐

Ruim				**Bom**
-2	-1	0	1	2

O(A) senhor(a) poderia me contar o porquê acha isso bom/um pouco bom/neutro/um pouco ruim/ruim? *Gravar resposta*

3.5. Barcos de arrastão: tem vários barcos de arrastão de camarão que em algumas épocas do ano passam aqui e ficam alguns dias no mar de Siribinha. O quanto o(a) senhor(a) acha a presença desses barcos de arrastão aqui uma coisa **boa** *(apontar a bola verde maior)* ou **ruim** *(mostrar bola vermelha maior)*?

Prefiro não responder ☐

Ruim				Bom
-2	-1	0	1	2

O(A) senhor(a) poderia me contar o porquê acha isso bom/um pouco bom/neutro/um pouco ruim/ruim? *Gravar resposta*

3.6. Unidades de conservação: o governo, seja Municipal, Estadual ou Federal, muitas vezes cria Unidades de Conservação, que são lugares que são escolhidos por terem uma natureza muito importante e que deve ser preservada, mantida intacta. Quando é criada uma Unidade de Conservação, o lugar passa a ter várias regras em relação a como se pode usar a natureza dali, em relação à visitação de pessoas, entre outras, e isso varia de acordo com o tipo da Unidade de Conservação. O quanto o(a) senhor(a) acha que a criação dessas Unidades de Conservação é uma coisa **boa** *(apontar a bola verde maior)* ou **ruim** *(mostrar bola vermelha maior)*?

Prefiro não responder ☐

Ruim				Bom
-2	-1	0	1	2

O(A) senhor(a) poderia me contar o porquê acha isso bom/um pouco bom/neutro/um pouco ruim/ruim? *Gravar resposta*

3.7. Regulação da pesca: aquí em Siribinha tem período de defeso do robalo e da andada do caranguejo, quando não se pode pescar e mariscar, e os pescadores e marisqueiras recebem o Seguro Defeso do Pescador Artesanal. O quanto o(a) senhor(a) acha que essa proibição da pesca e da mariscagem no período do defeso é uma coisa **boa** *(apontar a bola verde maior)* ou **ruim** *(mostrar bola vermelha maior)*?

Prefiro não responder ☐

Ruim				Bom
-2	-1	0	1	2

O(A) senhor(a) poderia me contar o porquê acha isso bom/um pouco bom/neutro/um pouco ruim/ruim? *Gravar resposta*

4: Values of nature section: all participants

4 - VALORES

A natureza de Siribinha dá muitas coisas para quem vive aqui. Esses cartões frases sobre algumas dessas coisas que a natureza de Siribinha dá. O(A) senhor(a) pode por favor colocar esses cartões aqui nesse tabuleiro na ordem do que o(a) senhor(a) acha que é menos importante *(apontar extremo inferior "menos importante")* para o que o(a) senhor(a) acha que é mais importante *(apontar extremo superior "mais importante")* entre as coisas que o estuário dá para sua vida? O(A) senhor(a) também pode colocar mais de um cartão no mesmo nível de importância.

Tipo de valor	Frase: *para mim, a coisa mais importante que a natureza de Siribinha dá é...*	Importância de 1 (mais importante) a 10 (menos importante)
Valor de uso indireto	**4.A.** O ar e água puros.	
Valor de não uso	**4.B.** Ser um bom lugar para as crianças daqui crescerem e viverem no futuro.	
Valor de uso direto não consumível	**4.C.** O conhecimento que ela me traz.	
	4.D. A liberdade que ela me traz.	
	4.E. Poder continuar com a pesca e a mariscagem do jeito que fazemos aqui.	
	4.F. Me fazer sentir que sou parte dela também.	

	4.G. Toda sua beleza.	
	4.H. Poder me divertir e relaxar nos lugares daqui.	
	4.I. O turismo que ela traz para cá.	
Valor de uso direto consumível	**4.J.** Os peixes, caranguejos e aratus.	

Appendix S4 - Additional information on data analysis

PCA, varimax rotation and factor extraction

In Q-methodology, the shared ways of thinking are identified by performing Pearson's *r* to correlate participants' Q-sorts. The data matrix is inverted (called Q-matrix), that is, the participants are the variables (columns), and the statements are the observations (rows). Next, a Principal Component Analysis is performed on the participant-by-participant correlation matrix to extract components (also called factors) (Table S4-1). Each factor is a synthesis of the most correlated Q-sorts.

Table S4-1. Unrotated components extracted in the principal components analysis of the correlation matrix of Q sorts and criteria for selecting the number of components for rotation.

Extracted component	EV[a]	Variance explained (%)	Cumulative Variance (%)	Q-sorts with significant loadings (α=0.05) [b]	Cross-product of two highest Q-sort loadings[c]
PC1	**11.98**	52	52	**23**	**0.77**
PC2	**1.48**	6	59	**2**	**0.39**
PC3	**1.28**	6	64	**3**	**0.20**
PC4	**1.18**	5	69	**2**	0.13
PC5	**1.09**	5	74	**3**	0.14
PC6	0.89	4	78	**3**	**0.16**
PC7	0.83	4	81	1	0.07
PC8	0.67	3	84	1	0.08
PC9	0.59	3	87	0	0.07
PC10	0.47	2	89	2	0.11
PC11	0.41	2	91	0	0.07
PC12	0.35	2	92	0	0.02
PC13	0.31	1	94	0	0.03
PC14	0.25	1	95	0	0.03
PC15	0.23	1	96	0	0.03
PC16	0.22	1	97	1	0.03
PC17	0.19	1	97	0	0.02
PC18	0.15	1	98	0	0.01
PC19	0.14	1	99	0	0.02
PC20	0.12	0	99	0	0.01
PC21	0.09	0	100	0	0.01
PC22	0.05	0	100	0	0.00
PC23	0.05	0	100	0	0.00

[a]Values in bold fulfill the Kaiser-Gutmman criteria of selecting for rotation the components with eigenvalue (EV) greater than 1 (Watts & Stenner 2012).

[b] Values in bold fulfill the criteria of selecting for rotation the components with two or more Q-sorts with significant loadings (Watts & Stenner 2012).

[c]Values in bold fulfill the Humphreys's rule of selecting for rotation the components with the cross-product of their two highest Q-sort loadings exceeding one or two standard errors (SE) of the forced distribution of the 44 statements into a ranked scale varying from -5 to +5, with fixed number of statements per ranking category (Watts & Stenner 2012). The standard error (SE) of the forced distribution was 0.15, calculated from the equation $SE = 1/\sqrt{N}$, where N = number of statements in the Q set (Brown 1980).

To maximize the number of Q-sorts correlated to the factors, we performed varimax rotation, a mathematical solution that captures the greatest amount of variance common to the group by ensuring that each Q-sort has a high loading on only one of the factors (Watts & Stenner 2012). To perform the rotation, it is necessary to choose how many factors will be extracted. There are different criteria to choose the number of factors to rotate and extract (Watts & Stenner 2012), and only the first three components meet all criteria (Table S4-1); therefore, we extract the first three components to be rotated. The results of the three rotated factors are shown in Table S4-2.

Calculating ideal typical Q-sorts

To produce the ideal typical Q-sort for each of the three factors, we combined the Q-sorts of participants highly correlated to that factor only (i.e., the defining Q sorts as in Zabala, 2014) (Table S4-2). These defining Q-sorts are Q-sorts of participants that had significant loadings in that factor and that the square loading in the factor is greater than the sum of the square loadings in all the other factors. To combine these defining Q sorts, we used a weighted sum, in which the defining Q-sorts with higher factor loadings in that factor contribute more to the typical Q sort (Watts & Stenner 2012). By normalizing the summed values for each statement and converting them to integer, each statement received a value from -5 to +5, producing the so-called factor array.

After rotating and extracting three factors and calculating ideal typical Q-sorts for each of them (Table 1 in the main text), we were able to see that each of three factors have at least three defining Q-sorts associated with it, as indicated in Q-Methodology literature (Brown 1980; Watts & Stenner 2012). To investigate the appropriateness of choosing to rotate and extract four or five factors, we run the analysis with four and five components. Only by choosing three factors it is possible to ensure that all factors have at least 3 associated Q-sorts. Moreover, in choosing three factors we also had the lowest correlations between factor scores, the highest reliability (i.e, highest correlation between the Q-sorts associated with the factor) and lowest standard errors of factor scores.

Table S4-2. Loading of each participant in the three extracted factors (F1 = Careful Explorers of God's Gift; F2 = Appreciators of equity between humans and non-humans; F3 = Defenders Against Threat), representing the distinct shared ways of thinking about the human-nature relationships in Siribinha, and participants' main occupations. Values in grey are the defining Q-sorts for each factor.

Participants	F1	F2	F3	Main occupations
Native resident	0.63	0.25	0.25	Student
Native resident	0.54	0.35	0.28	Student, fisherman
Native resident	0.65	0.23	0.24	Retired teacher
Native resident	0.51	0.18	0.41	Fisherman
Native resident	0.57	0.52	0.20	Treasurer of the fishing colony, crab gatherer
Native resident	0.83	0.24	0.09	Nursing technician
Native resident	0.74	0.22	0.51	Grocery shop owner
Native resident	0.69	0.28	0.39	Retired mason
Native resident	0.76	0.23	0.12	Beach bar owner, fisherman
Native resident	0.75	0.29	0.12	Hotel owner
Native resident	0.41	0.65	0.31	Food saleswoman, housewife, crab gatherer
Researcher	0.11	0.86	0.11	Researcher
Researcher	0.34	0.74	0.21	Researcher
Researcher	0.34	0.79	0.15	Researcher
Native resident	0.27	0.12	0.79	Crab gatherer, housewife
Non native resident	0.41	0.30	0.57	Lives on subsistence
Native resident	-0.01	0.11	0.90	Crab gatherer, housewife
Frequent visitor	0.36	0.24	0.41	Social worker
Native resident	0.55	0.42	0.56	Eventual worker at the beach shack
Native resident	0.54	0.57	0.43	Civil servant
Native resident	0.47	0.33	0.46	Salesman
Native resident	0.28	0.42	0.45	Fisherman, church missionary, lifesaver
Native resident	0.40	0.45	0.36	Teacher

Appendix S5 - Original quotations in Portuguese

Quotation in main text	Original quotation
Factor 1: Careful explorers of God's gift	
"I feel that nature satisfies my needs because many times there is a lack of meat at home, I go to the river and catch a fish, so this helps a lot, and there are other things too, like boat rides, people come here because they find nature beautiful, so this is what makes us earn money here."	"Eu sinto que a natureza satisfaz minhas necessidades porque muitas vezes falta carne em casa, vou no rio pego um peixe, então isso ajuda muito, e tem outras coisas também, tipo passeio de lancha, o pessoal vem pra cá porque acha bonito a natureza, então é isso que faz a gente ganhar dinheiro aqui."
"I always made my living, I was able to build my house through what I got from nature, fishing aratu, fishing with a net, catching massunim... and thank God I was able to give my children everything they needed, what I needed, build my house."	"Eu sempre tirei meu sustento, consegui construir minha casa através do que eu tirava da natureza, pescando aratu, pescando de rede, pegando massunim... e graças a Deus consegui dar tudo que meus filhos precisavam, o que eu precisava, construir minha casa."
"If you stay three, four years without tourism, people can maintain themselves, because it is self-sufficient to feed themselves; in these two years of pandemic, what gives us sustenance is the river, fish, crabs."	"Se você ficar três, quatros anos sem turismo, as pessoas se mantém, porque é autossuficiente pra se alimentar; nesses dois anos de pandemia, quem dá o sustento é o rio, peixes, caranguejos, aratu, siri."
"I think that for you to earn more in the future [you should] take care of it [nature], the more you take care of it, the tendency is for you to earn more; because if here is a place well taken care of (…) the tendency is for people to come here and bring us income; (...) I can't survive here if I don't explore nature, but I want to explore it and preserve it, because if I don't take care of it I won't be able to explore it."	"Eu penso que pra você ganhar mais no futuro você tem cuidar [da natureza], quanto mais você cuida, a tendência é você ganhar mais; porque se aqui é um lugar bem cuidado (…), a tendencia é o povo vir pra cá e trazer renda pra gente; (...) Eu não tenho como sobreviver aqui se eu não tiver explorando a natureza, mas eu quero explorar ela e preservar, porque se eu não cuidar eu não vou poder explorar."
"It [nature] has to be protected, but not isolated; I think Siribinha has to be exploited in the right way, but yes, exploited."	"Ela [a natureza] tem que sim ser protegida, mas isolada não; acho que Siribinha tem que ser explorada da maneira certa, mas sim, explorada."
"They [government environmental agencies] don't want to improve the road, they don't want to pave it, they don't think that Siribinha should grow (...) to preserve you don't need to isolate the area, you can preserve it as long as people know about it, that they don't do things that are not allowed (...) I think you have to be careful and have duties, but how can I forbid you to get into the river, just because it is protected? Protected from what? From whom? It is not by prohibiting that you preserve."	"Eles [órgãos do meio ambiente] não querem melhoria da estrada, não querem asfaltar, eles não concordam que Siribinha cresce (…) pra se preservar você não precisa isolar a área, você pode preservar contanto que as pessoas tenham conhecimento disso, que não façam coisas que não são permitidas (...) eu acho que você tem que ter cuidados e deveres, mas como vou proibir você entrar no rio, só por que é protegido? Protegido de que? De quem? Não é proibindo que se preserva."
"Who gave us this gift [of nature] was Him (...) this place was planned by God."	"Quem nos presenteou foi Ele (...) aqui é um lugar que foi planejado por Deus"

“It was He [God] who created everything, and He is present in the simplest things, like water (…) surely I feel God in these simplest things that nature offers.”	“ (...) foi Ele quem criou tudo, e Ele está presente nessas coisas mais simples, como a água (...) com certeza nessas coisas mais simples que a natureza oferece eu sinto Deus.”
"God wants us to do good things. (...) If you destroy nature, if you finish nature, He won't be pleased."	“Deus quer que a gente faça as coisas boas. (...) Se você destruir a natureza, se acabar a natureza, Ele não vai se agradar.”

Factor 2: Appreciators of equity between humans and non-humans

"(…) the idea of reciprocity is… [that] we all live together, some depend more on others …, and not just because we depend, but because of this relationship, look what I've received [from nature], look what they [non-human entities] have done for me, look how many lives have died to keep me alive, so try to respect, be thankful, and understand that these other beings also have their power, their will to be here.”	“(…) a ideia da reciprocidade é: a gente vive junto, todos, uns dependem mais dos outros que outros, e não só porque a gente depende, mas por essa relação, porra, olha o que eu já recebi, olha o que já fizeram por mim, olha quantas vidas não morreram pra me manter viva, então tentar respeitar, agradecer, e entender que essas outras existências também tem o seu poder, a sua vontade de estar aqui.”
"All [animals, plants and people from Siribinha] have the same importance, because they are living beings, some speak, others don't, but all have the same importance.”	“Todos [bichos, plantas e pessoas de Siribinha] têm a mesma importância, porque são seres vivos, uns falam, outros não, mas todos têm a mesma importancia.”
"People have to perceive themselves as part of nature, and as a part they have equal importance [as non-humans entities]."	“As pessoas têm que se perceber como parte da natureza, e como parte elas têm a mesma importância.”
"People are never more important than nature, nor is nature [more important than people], it's all of us, it's a whole, one needs the other in order to survive.”	“As pessoas nunca são mais importantes que a natureza, nem a natureza [é mais importante que as pessoas], é todos, é um conjunto, uma precisa da outra para poder sobreviver”
"Not only because I don't live here, also because I am European, white, blonde, have other experiences ... I am really not from here."	“Não só porque eu não moro aqui, também por ser europeia, branca, loira, ter outra vivência... eu sou muito não daqui.”
"I think that since I started coming here [to Siribinha] and started working here, and considering all my background as a biologist, ecologist, all my knowledge, it's kind of my duty to take care of this place too, that helps me work, develop research."	“Eu acho que desde que eu comecei a vir pra cá e comecei a trabalhar aqui, e pensando em todo meu background enquanto bióloga, ecóloga, todo meu conhecimento, é meio meu dever cuidar desse lugar também, que me ajuda a trabalhar, desenvolver pesquisa.”
"I think people [of the community] are part of the nature in Siribinha, so I can't fight for nature to be isolated from a part of it."	“Eu acho que as pessoas fazem parte da natureza de Siribinha, então eu não posso lutar para que a natureza fique isolada de uma parte dela.”
"It is very difficult to isolate nature from the human being, so I disagree [that nature should be isolated] (...) and it is not that it has to be protected, people have to know how to enjoy the nature of Siribinha (...) people who come here should know how to enjoy the nature here."	“É muito difícil você isolar a natureza do ser humano, então eu discordo [que a natureza deve ser isolada] (...) e não é que ela tem que ser protegida, as pessoas que têm que saber como estar usufruindo da natureza de Siribinha (...) que as pessoas que venham saibam usufruir da natureza daqui.”

"I disagree a lot when people talk about nature as something without power, will you say that the sea is fragile?! (...) I don't think it works; that just fencing and separating an area from people is enough, I find it difficult, counterproductive."	“Eu discordo muito quando começam a falar da natureza como uma coisa sem poder, vai dizer que o mar é frágil?! (...) eu não acho que funciona isso de só cercar e separar uma área das pessoas, acho difícil, contraprodutivo.”

Factor 3: Defenders against threat

"This is the worst thing [taking financial advantage of nature], because nature was not created for us to make money, no, it was made for us to take care of."	“Essa é a pior coisa [tirar proveito financeiro da natureza], porque a natureza não foi criada pra gente ganhar dinheiro não, foi feita pra gente cuidar.”
"To exploit is to deforest (...) if you knew the mangroves and the restinga before, what it is now, it is totally different. Before there was a lot of fruit, then they cut down the mangaba trees, the cashew trees, it was too good (...) it is totally different now.”	“Explorar é a pessoa desmatar (...) se você conhecesse a restinga antes, o que ela é agora, é totalmente diferente. Antes tinha muita fruta, aí cortaram as mangabeiras, os cajueiros, era bom demais (...) está totalmente diferente agora.”
"You can't exploit nature, you have to take care of it, take what you need, but give it back. If you just take without giving anything back, then you will be left with nothing. And that's what they are doing (...) They are destroying everything (...) Because they are abusing... this is the point, you have to use and not abuse (...) Why are human beings destroying nature? Because of greed, because they are exploiting it, to be able to have more."	“Não pode explorar a natureza, tem que cuidar, pegar o que você precisa, mas devolver. Se você só fica pegando sem devolver nada, então você vai ficar sem nada. E é isso que estão fazendo (...) Estão destruindo tudo (..) Porque está abusando... o ponto é esse, tem que usar e não abusar (...) Porque o ser humano está destruindo a natureza? Pela cobiça, porque tão explorando, para poder ter mais.”
"People are a threat to nature."	“As pessoas que são uma ameaça para a natureza.”
"If people don't take care of it, then what will happen? Then they won't be able to catch fish to sell, and then it will be scarce. If we deforest, how will we live? Because most of the people here in Siribinha survive only on fishing, and if the fish are gone things will get difficult for us.”	“Se o povo não cuidar e aí, como vai ficar? Ai eles não vão poder pegar o peixe pra vender, e aí vai ficar escasso né. Se desmata mesmo, como é que vai viver? Porque a maioria do povo aqui de Siribinha sobrevive só da pesca, e aí se acabar e aí, o bicho vai pegar.”
"You have to teach not to destroy, so you don't have to protect."	“Tem que ensinar a não destruir, para não ter que proteger.”