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The importance of cultural ecosystem services in natural resource-dependent communities: Implications for management

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ABSTRACT

In defining cultural ecosystem services as the recreational, aesthetic, and spiritual benefits people obtain from ecosystems, the Millennium Ecosystem Assessment conveyed a key aspect of nature-society relationships. Yet, it is reasonable to suppose that this aspect may apply more to contexts where people enjoy more leisure time to admire a scenic vista or recreate in nature. How relevant is this aspect of nature-society relationships for people who rely more on natural resources, or provisioning ecosystem services, for livelihoods? We integrated qualitative and quantitative field research methods to examine how people in natural resource-dependent communities perceived the importance of different ecosystem services to wellbeing. We found that people with varying degrees of dependence on coastal, marine, and terrestrial provisioning ecosystem services perceived cultural ecosystem services—particularly scenic beauty, biodiversity, and space to recreate—as very important to wellbeing, and also perceived increases in wellbeing following interventions to foment small-scale tourism and conservation. In terms of global ecosystem management, our findings imply that (1) aesthetics and recreation matter, even if these cultural ecosystem services appear more often in the literature, (2) more efforts may be taken to make cultural ecosystem services more accessible, (3) small-scale tourism and conservation interventions may be reconsidered as potential means to increase wellbeing, and (4) reframing ecosystem management as explicit efforts to augment wellbeing may help to garner more widespread support and participation.

1. Introduction

Scenic vistas, spaces to enjoy the outdoors, and natural places that inspire cultural identity, spirituality, learning, free play and art undoubtedly underpin human wellbeing—the state of feeling healthy and happy (Cambridge Dictionary, 2017). These examples highlight the psychological and subjective needs of people that nature potentially fulfills. Hereon, we refer to these aspects of nature-society relationships as cultural ecosystem services (CES), defined as ecosystems' contribution to the nonmaterial benefits (e.g., experiences, capabilities) that people derive from human-ecological relations (Chan et al., 2011, p. 206). Just as provisioning ecosystem services (e.g., livelihood sources, food, water, fuel) meet people's basic material needs (MA, 2005), CES address people's basic nonmaterial needs for a good, fulfilling life. Yet, how important are CES to wellbeing in contexts where people directly rely on provisioning ecosystem services (e.g., natural resources) to make a living? It is reasonable to suppose that CES might come

secondary, or prove to be more relevant in contexts where people enjoy more leisure time. Understanding the importance of CES to wellbeing constitutes a critical first step in efforts to safeguard what matters most to people. For example, by identifying ecosystem services perceived as priorities, managers can focus efforts and explore how different management scenarios may affect the provision of those services (Elwell et al., 2018).

Most studies on how people perceive the importance of CES relative to other services have focused on contexts where people depend indirectly, if at all, on natural resources for livelihoods and ways of life, in spite of efforts to make ecosystem services frames more inclusive of a wider range of contexts and worldviews (Klain and Chan, 2012; Martín-López et al., 2012; Tengberg et al., 2012; Plieninger et al., 2013; Riechers et al., 2016; Bullock et al., 2018). Notable exceptions include a handful of studies that have focused on natural resource-dependent communities. For example, Gould and Lincoln (2017) and Pascua et al. (2017) found that people in Hawai'i with varying degrees of

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dependence on agriculture and forested land, and familial relationships with nature (i.e., plants and animals considered kin), respectively, described the importance of nonmaterial benefits beyond those widely considered CES (e.g., recreation linked to day-to-day tasks rather than leisure time). Ondiek et al. (2016) found that farmers in Kenyan floodplains highly valued the aesthetic role of wetlands, noting the diverse species of plants and animals that contributed to scenic beauty. Hicks et al. (2014) found that fishers in Seychelles prioritized bequest, or knowing future generations would be able to enjoy benefits from ecosystems enjoyed today. Marín et al. (2014) found that farmers and fishers in Chile highly valued birds, a proxy for terrestrial biodiversity, alongside provisioning ecosystem services. Vilardy et al. (2011) found that farmers and fishers in Colombia perceived aesthetic values and sense of place as very important to wellbeing. These findings suggest positive connections with perceived wellbeing and CES in contexts where people depend directly on natural resources. But if so, such connections remain implicit.

Thus, to begin to fill this gap in the literature, we present empirical data from communities in southern Chile that largely depended on coastal, marine, and terrestrial natural resources for livelihoods and ways of life. We used integrated qualitative and quantitative field research methods to address two questions:

- (1) How do people in natural-resource dependent communities perceive the importance of CES, among other ecosystem services, to wellbeing?
- (2) What does this knowledge imply for global ecosystem management?

We use the term *natural resources* as Berkes (2010) defined them: provisioning ecosystem services (e.g., livelihood sources, food) for human wellbeing. Natural resource-dependent communities, like the ones that participated in this study, depend primarily on the primary sector (i.e., extraction of commercial algae, shellfish, timber), in contrast with communities that rely more on manufacturing and the service sector. We chose this term in order to encompass communities and individuals in any geographical and socioeconomic context (e.g., industrialized or rural areas; developing and developed countries) whose livelihoods and ways of live depend directly on provisioning ecosystem services.

2. Materials and methods

2.1. Research setting

We assessed how people with varying degrees of dependence on natural resources who lived along the Pudeto estuary and its coastal zone (ca. 843 km²) perceived the importance of different ecosystem services to wellbeing. We chose this setting on the northern portion of the Chiloé Archipelago in southern Chile (41°–43°S) because of its cultural heritage of small-scale farmer-fishers who depend directly on the coast, sea, and native forest for livelihoods and ways of life (e.g., gleaning the coast for edible algae, diving for shellfish, heating wood stoves with locally sourced timber) (Fig. 1). Many residents continue to depend on natural resources for livelihoods; however, the arrival of aquaculture processing plants in the 1990s shifted local society toward wage labor (Barrett et al., 2002; Phyne and Mansilla, 2003; Barton and Fløysand, 2010). Processing plants for farmed salmon, shellfish, and algae line a section of the Pudeto estuary zoned for industrial use (Ilustre Municipalidad de Ancud, 2013), while patches of native forest give way to coastal wetlands, critical habitat for migratory birds (Andres et al., 2009) with potential for nature-based recreation (Nahuelhual et al., 2013) (Fig. 1). The estuary's waters contain farms of the red algae *Gracilaria sp.*, grown to produce agar, as well as natural shellfish banks of mussels, clams, and oysters (Fig. 1). We also chose this setting because Chiloé, like other coastal regions, is experiencing

unprecedented environmental change (e.g., algal blooms, droughts) and rapid sea- and land-use change (e.g., unregulated extraction of kelp from sea and *Sphagnum* moss from forest, introduction of industrial-scale wind farms in undeveloped forest and coast). Thus, understanding which ecosystem services people prioritize for wellbeing may constitute a first step to safeguard what matters most.

2.2. Integrated qualitative and quantitative field research methods

In order to assess how people perceived the importance of different aspects of the estuary, we used a sequential exploratory strategy, or three-phase approach (Creswell, 2009). First, we completed participatory mapping and in-depth interviews with key informants whom we purposefully chose in order to capture a potential diversity of perceptions. In this phase, we sought to generate two comprehensive lists to include in a subsequent survey: aspects of the estuary (i.e., ecosystem services) and projected management interventions. In a second phase, we analyzed the qualitative data in order to design and test a survey instrument with wording that fit the local context. Finally, we used this instrument to survey 168 people who lived or worked near the estuary in order to determine the distribution of perceptions among a broader population. The initial qualitative phase followed several months of fieldwork in which the first author analyzed coastal policy, observed how people worked in the estuary, and helped people clean red algae washed ashore. These months of reconnaissance fieldwork helped us gain access into communities (Singleton et al., 1988). All participants gave informed consent as per protocol approved by the Human Subjects Committee at the University of California, Santa Barbara (Submission 12–485, 2012).

2.2.1. Participatory mapping

In March 2013, we completed participatory mapping with two indigenous communities that perceived the estuary as ancestral territory. We chose to start the qualitative phase this way in order to show respect for those who considered the estuary ancestral territory (Singleton et al., 1988), and to capture traditional knowledge and practices associated with the estuary (Poteete et al., 2010). The indigenous communities did not enjoy special rights to the estuary. At the time of writing, the communities intended to solicit rights based on ancestral uses, as several coastal indigenous communities in southern Chile had done in accordance with Chile's Law 20.249 that Creates Coastal Marine Space for Native Peoples (Gobierno de Chile, 2008).

From lists of the two registered indigenous communities, we purposefully selected at least one leader and two members to serve as key informants (Table 1). We used the participatory mapping methods described in NOAA (2009) to facilitate a workshop in which six members of the indigenous communities generated a list of aspects of the estuary that they perceived as important (Table 2). We then visited the area perceived as ancestral territory to mark aspects with a GPS unit so that the communities would have the spatial data for their records. Although six seems like a low sample size, the six members represented four of the eight total households that constituted the two indigenous communities. Four of these six participants served as key informants for the in-depth interviews (Table 1). We took care to show neutrality to everyone who lived and worked in the estuary as we approached additional participants in subsequent research phases (Singleton et al., 1988).

2.2.2. Semi-structured interviews with key informants

Between June and December 2013, we conducted interviews with 41 key informants in order to capture a potential diversity of perspectives based on factors thought to influence what people value and prioritize in an ecosystem. We chose to approach potential informants associated with small-scale fishing organizations that worked in the estuary since we sought to understand different ways that people relied on the estuary for livelihoods and ways of life. Moreover, the ability to

Fig. 1. Map of research setting that shows types of ecosystems, aquaculture processing plants, algal farms, and area perceived as ancestral territory by indigenous communities.

Table 1

The procedures we used to select research participants, and a summary of participants' characteristics.

Initial Qualitative Phase	Quantitative Phase		
	Participatory mapping	Semi-structured interviews	Survey
Participants	Indigenous community members who perceived estuary as ancestral territory ($n = 6$)	People who worked in estuary and/or belonged to a fishing organization in the estuary ($n = 41$)	People who lived or worked in estuary ($n = 168$)
How selected?	Purposefully (Section 2.2.1.)	Purposefully (Section 2.2.2.)	Each house and worksite approached in sectors that bordered the estuary (Section 2.2.3.)
Number of women and men	2 women, 4 men	19 women, 22 men	71 women, 97 men
Age (range and average)	18 to 52 years, ave. 42	21 to 82 years, ave. 51	16 to 82 years, ave. 48
Place of residence			
Urban	5 people (83%)	22 people (54%)	127 people (76%)
Peri-urban	0	5 people (12%)	15 people (9%)
Rural	1 person (17%)	14 people (34%)	26 people (15%)
Time in residence (range and average)	18 to 52 years, ave. 42	< 1 to 82 years, ave. 29	< 1 to 82 years, ave. 20
Membership in organization(s)			
Indigenous community	6 people (100%)	5 people (12%)	16 people (10%)
Small-scale fishing organization*	2 people (33%)	32 people (78%)	53 people (32%)
Neither community nor fishing organization	0	4 people (10%)	104 people (62%)
Livelihoods and dependency on natural resources			
Depended more directly on the estuary's coastal marine resources, or on benefits from a fishing organization in estuary (e.g., boat rental)	6 people (100%)	32 people (78%)	86 people (51%) ¹
Depended indirectly on natural resources	0	4 people (10%)	58 people (35%) ²
Depended more directly on terrestrial and coastal natural resources	0	5 people (12%)	24 people (14%) ³

* Members of small-scale fishing organizations had formal *de jure* access to marine space and resources within designated space, whereas those who did not belong to a fishing organization accessed resources in areas of open access (e.g., remaining open access waters, shoreline).

¹ Participants categorized as *estuarine* included those whose main source of income came from shellfish, *Gracilaria* sp. algae, fish, or a combination of coastal marine resources from the Pudeto estuary. These people depended directly on coastal marine provisioning ecosystem services.

² Participants categorized as *wage earners* included wage workers (e.g., factory workers, people with work contracts), small business operators, pension earners, taxi drivers, electricians, and mechanics. These people depended indirectly on provisioning, regulating, and supporting ecosystem services.

³ Participants categorized as *other* included artisans, carpenters, forest natural resource users, farmers, gardeners, people who sold seafood extracted from areas other than the Pudeto estuary, and a tourism operator. Overall, these people depended more directly on terrestrial and coastal provisioning, regulating, and supporting ecosystem services (e.g., estuary's support in growth of native forest, wetlands that serve as freshwater reservoirs).

access lists of members in fishing organizations allowed us to purposefully select informants based on a set of criteria designed to capture a potential diversity of perceptions.

It is important to note that the term “small-scale fisher” in Chile encompasses a range of activities, including algae and shellfish harvesting, fishing, and boat ownership (Gobierno de Chile, 1991). Many who no longer practice these activities maintain membership in fishing organizations in order to reap benefits (e.g., association with a community organization, ability to access government funded projects, formal access to marine space). Thus, we were able to include nine people who depended almost entirely on sources of livelihood beyond those directly tied to the estuary (e.g., seasonal wage work in aquaculture processing plants, small-scale farming, small businesses, hand-crafts), which helped to ensure that we captured as fully as possible a range of perceptions more or less representative of the broader population we then surveyed.

We first contacted small-scale fishing organizations to request participation and lists of members. From these lists, we purposefully selected at least two members of the organization and one leader from the directorate board (Table 1). Additional criteria for inclusion in this purposeful sample included: livelihood sources (e.g., gleaning or diving for red algae, diving for shellfish, other livelihood sources beyond small-scale fishing) (Gelcich et al., 2009; Hicks et al., 2013; Marín et al., 2014); membership in livelihood-related organizations (e.g., fishing organizations, farmer collectives) (Gelcich et al., 2005); rural versus urban place of residence, years of schooling, age, and gender (Martín-López et al., 2012); ethnicity and ancestral ties to place (Gould et al., 2014; Winthrop, 2014; Gould and Lincoln, 2017; Pascua et al., 2017); and, ability to access ecosystem services (Leach et al., 1999; Daw et al., 2011; Hicks and Cinner, 2014; Wieland et al., 2016). To capture the

latter, we interviewed people who accessed the estuary via territorial user rights (i.e., access gained through membership in a fishing organization), or open access areas. Informants not in organizations were approached at the estuary's shoreline. Table 1 summarizes participants' characteristics, including dependence on different ecosystem services.

We conducted interviews in Spanish at the informants' worksites (shoreline) or homes. Interviews followed a semistructured format of open-ended questions that allowed informants to respond using their own words (Table 2, Appendix A2). First, we collected background information to better understand the informant's history in the social-ecological system, including degree and type of reliance on ecosystems for subsistence and income, harvests per unit effort, and access to natural resources (Ostrom, 1990). We asked informants what the estuary, sea, and coastal zone provided them, and often used the follow-up question, “What, if anything, beyond sources of livelihood or food?” We also asked how they envisioned the estuary's future. For instance, we asked what they would like to see changed or remain the same, and what other potential uses or changes, if any, they thought would add to their wellbeing (Table 2). We did not define the term “wellbeing;” we allowed informants to interpret wellbeing based on their own understanding of the term.

We transcribed interviews and compiled responses to each question according to the interview structure (Kitchin and Tate, 2000). Responses were coded to compose main categories of answers to each question (Saldaña, 2013) (Table 2). Main categories per question were then tabulated in Microsoft Excel to assess response frequency. Quotations that captured common responses or presented different ideas included in this paper were selected and translated to English in order to convey findings.

Table 2
Field research methods applied, questions asked, topics assessed, types of responses elicited, and analytical methods we employed to elicit ecosystem services and examine perceived importance of different ecosystem services to wellbeing.

Field research method	Questions asked	Topic assessed	Type of response	Analysis
Qualitative phase Participatory mapping with indigenous community members ($n = 6$) and semi-structured in-depth interviews with key informants ($n = 41$)	What does the estuary, sea, and coastal zone provide for you and your family? What, if anything, does the estuary, sea, and coastal zone provide beyond livelihood sources and food for you and your family? What, if any, opportunities do you envision for the estuary and its coastal zone? What would you like to see change or remain the same?	Aspects of the estuary and its coastal zone that participants perceived as important to wellbeing (i.e., ecosystem services) Potential management interventions that would somehow alter the estuary	Qualitative	Coded and tallied (Sections 2.2.1. and 2.2.2.)
Quantitative phase Survey of people who lived or worked in the estuary ($n = 168$)	How important is each aspect for the wellbeing of you and your family? What would be the impact on the wellbeing of you and your family following each intervention? [*] What would be the impact on the environment following each intervention? [*] What do you think would change? [*] [*] Follow-up question used for responses marked between -7 and -10 and 7 and 10	Perceived importance of 17 aspects of the estuary and its coastal zone (i.e., ecosystem services) Perceived changes in future wellbeing following interventions Perceived changes in the environment following interventions Reasoning behind perceived impacts on the environment and future wellbeing following interventions	Continuous numeric scale from +10 to -10 Qualitative	Kruskal-Wallis H test and Dunn's posteriori tests to compare mean ranks of scores among participants grouped according to livelihoods (Section 2.2.3.) Coded and tallied* (Section 2.2.3.)

Fig. 2. Photos show examples of livelihoods and ways of life that depended directly on coastal marine provisioning services from the estuary. (A) Fishers raking drifted commercial algae “pelillo” (*Gracilaria* sp.), into boats; (B) Diver using boot to remove debris from mussels (*Mytilus chilensis*) to sell; (C) People gleaning an urban intertidal zone for the edible algae “luche” (*Porphyra columbina*) for subsistence; (D) Fisher removing the tunicate “piure” (*Pyura chilensis*) to sell at a local market.

Fig. 3. Tallied responses to the interview questions, “What does the estuary give you?” and the follow-up prompt, “What, if anything, beyond food and livelihood sources?” Although some mentioned cultural ecosystem services, interviewed key informants mainly cited provisioning ecosystem services.

2.2.3. Survey of people who lived or worked in the estuary

Based on responses to the open-ended questions we asked informants in the participatory mapping workshop and in-depth interviews (Table 2), we compiled a list of 17 aspects of the estuary (i.e., ecosystem services), which we later categorized according to the ecosystem service typologies used in the Millennium Ecosystem Assessment (MA, 2005), and a list of 10 projected management interventions. We corroborated the latter with officials at the local office of Chile’s National Fishing Service to ensure interventions would be plausible. We

then included the lists in a survey questionnaire that mainly included closed questions where participants moved a scale to reflect importance (Appendices A3 and A4). To improve question wording and ensure fluidity, we piloted the questionnaire with a similar population in another area of the municipality. The first author and a trained team then used the finalized questionnaire to survey 168 participants (in Spanish), either in individuals’ homes or worksites (e.g., fishing organization headquarters, shoreline), between 26 February and 3 March 2014. We approached each house in the three main sectors that border the

CULTURAL EXPERIENCES

“Here in Chiloé, we’re surrounded by the sea, and we share a culture linked to the sea that is beautiful. Gleaning the coast for shellfish may be something people do every day here, but for others, it could mean an experience of a lifetime, an experience that fulfills a person.”

IDENTITY AND ANCESTRAL PRACTICES

“From my roots, my essence is the sea. I must be in contact, at least from my house I look out to the sea.”

“If I think of my ancestors who nourished themselves from the sea, the tradition continues. Often we don’t have to buy things, like meat, because we nourish ourselves in a natural way [with what we get from the sea].”

RECREATION AS A FAMILY

“What does the sea give me? Nothing. [Interviewee’s 10-year-old son interjects, “Swimming!”] [Laughter.] True. In summer, we go out on the boat. Yes, recreation as a family.”

“Apart from work, the sea provides food, medicine, a recreational use, and what’s familiar. As a family, we take a day to visit the shoreline, to walk, collect stones, and create memories.”

Fig. 4. Excerpts from key informants’ responses to the follow-up prompt, “What, if anything, does the sea, estuary, and coastal zone give you beyond food and livelihood sources?” that mention cultural ecosystem services. Themes of cultural identity, ways of life, and recreation in interviews intertwined.

Table 3

Similarities in livelihood groups’ mean scores for perceived importance of different ecosystem services to wellbeing.

Category of Ecosystem Service	Ecosystem Service	Total <i>n</i> (SE)	Estuarine (SE)	Wage earner (SE)	Other (SE)	<i>P</i>
Cultural	Scenic beauty	9.2 (0.132)	9.3 (0.166)	8.9 (0.266)	9.2 (0.307)	0.771
Cultural	Variety and number of birds	6.5 (0.319)	6.8 (0.448)	6.0 (0.583)	6.6 (0.666)	0.357
Provisioning	Presence of edible algae (luche, cochayuyo)	5.7 (0.387)	5.9 (0.567)	5.5 (0.656)	5.5 (0.871)	0.544
Regulating	Tidal flow of salt water in the river	5.6 (0.386)	6.5 (0.485)	5.0 (0.732)	4.0 (0.987)	0.055
Provisioning, Regulating, Supporting	Wetlands and peat lands that serve as reservoirs of freshwater	5.1 (0.415)	5.7 (0.578)	4.7 (0.747)	4.0 (0.918)	0.075
Regulating	Ability to eliminate greywater and drainage from houses	2.1 (0.597)	2.8 (0.839)	2.7 (0.956)	−1.8 (1.592)	0.051
Provisioning	Presence of other commercial algae (luga)	1.8 (0.532)	2.7 (0.755)	0.6 (0.864)	1.2 (1.437)	0.088

Size of livelihood groups: Total *n* = 168. Estuarine *n* = 86, Wage earner *n* = 58, and Other *n* = 24. Survey participants marked responses on a continuous line with two anchor points “not important at all” or “not good at all” (= −10) and “very important” or “very good” (= 10), and a clear “indifference” line in the middle (= 0). Responses were recorded as positive or negative distances from the central zero point.

estuary—urban Pudeto, peri-urban La Pasarela, and rural Pupelde (Fig. 1, Table 1). Two people refused to participate and 168 people agreed. We surveyed the household member who was present. Most often only one adult was present. In seven households, we surveyed two members because both were available and presented distinct livelihoods related to the estuary (e.g., diving for shellfish to sell, collecting algae for subsistence) (Table 1).

The questionnaire (Appendices A3 and A4) included:

- A Google Earth image that defined the estuary and its coastal zone (Appendix A5).
- Closed questions to assess the perceived importance of each aspect (i.e., ecosystem service) to personal and familial wellbeing

(Table 2). We asked participants to indicate how important each of the 17 aspects of the estuary proved to be for her or his wellbeing and that of her or his family. To mark responses, we used a continuous scale with two anchor points—“very important” and “not important”, and a clear “indifference” line in the middle.

- Closed questions to assess preferences for 10 plausible interventions that would somehow alter the estuary (Table 2). We asked participants to indicate how each intervention would impact her or his wellbeing and that of her or his family. We marked responses using a continuous scale with two anchor points, “excellent” and “terrible”, and a clear line in the middle, at 0, for “indifference” or “no impact.”
- Responses could be marked from −10 to 10. We chose this scale because participants could intuitively move the scale’s marker either

Table 4

Differences among livelihood groups' mean scores for perceived importance of different ecosystem services to wellbeing.

Category of Ecosystem Service	Ecosystem Service	Total n (SE)	Estuarine (SE)	Wage earner (SE)	Other (SE)	P	
Cultural	Space to recreate and practice sports	6.3 (0.418)	6.9a (0.545)	4.8b (0.842)	7.6 (0.557)	0.043	**
Provisioning, Regulating, Supporting	Support for the growth of native forest	6.2 (0.376)	6.4 (0.570)	6.0 (0.559)	6.1 (1.006)	0.423	
Cultural, potentially Provisioning	Space to develop tourism	6.1 (0.460)	7.1a (0.557)	4.9b (0.875)	5.5 (1.323)	0.046	**
Provisioning	Presence of natural shellfish banks (mussels, clams, oysters)	5.9 (0.378)	6.9a (0.456)	4.3b (0.734)	5.9 (0.902)	0.001	***
Cultural	Spiritual space	5.7 (0.413)	6.3a (0.561)	4.1b (0.731)	7.4a (0.936)	≤ 0.033	**
Cultural	Space to practice traditional activities with family	5.5 (0.419)	6.8a (0.448)	3.7b (0.869)	5.4 (1.074)	0.011	***
Provisioning	Ability to navigate the estuary	5.5 (0.440)	7.4a (0.444)	2.7b (0.872)	5.4 (1.139)	0.000	***
Provisioning	Presence of fish (robalo, pejerrey)	5.2 (0.410)	6.1a (0.520)	3.9b (0.765)	4.8 (1.076)	0.022	**
Provisioning	Quantity and quality of commercial red algae <i>Gracilaria</i> (pelillo)	3.7 (0.494)	6.2a (0.573)	1.0b (0.843)	1.5b (1.373)	≤ 0.002	***
Provisioning, Cultural	Presence of vegetable fibers (junquillo, quilineja) to make crafts	3.1 (0.475)	2.6 (0.707)	2.8 (0.796)	5.6 (0.870)	0.149	

Symbols show significant differences among group perceptions based on Kruskal-Wallis and Dunn's posteriori tests. Livelihood groups that are not statistically significant share the same letter.

Size of livelihood groups: Total n = 168. Estuarine n = 86, Wage earner n = 58, and Other n = 24. Survey participants marked responses on a continuous line with two anchor points "not important at all" or "not good at all" (= -10) and "very important" or "very good" (= 10), and a clear "indifference" line in the middle (= 0). Responses were recorded as positive or negative distances from the central zero point.

** denotes p-values less than or equal to 0.05.

*** denotes p-values less than or equal to 0.005.

positively or negatively away from the zero line in the middle, toward the anchor points.

- Within the segment on interventions, we followed up with the question, "What do you think would change?" to record reasons behind perceived impacts on future wellbeing for responses marked between -7 and -10 or 7 and 10 (Table 2). We did not ask this follow-up question for responses marked between -6.9 and 6.9 for the sake of time.

We used Microsoft Excel, SPSS, and R to analyze the survey data. To facilitate analyses, we chose to group the 168 participants according to main sources of livelihood because, in the initial qualitative research phase, we found that livelihoods best explained residents' relationships to the estuary and captured other differences (e.g., access to ecosystem services; age and gender). Thus, we categorized the 86 participants (51%) who depended directly on shellfish, *Gracilaria* sp. algae, fish or a combination of coastal and marine provisioning services from the estuary as *estuarine*; 58 participants (35%) who earned relatively steady incomes as wage workers (e.g., processing plant workers, people with work contracts), pension earners, taxi drivers, electricians, and mechanics who depended indirectly on provisioning, regulating, and supporting ecosystem services as *wage earners*; and, 24 participants (14%) who sold natural resources from forests (e.g., *Sphagnum* moss, timber) or worked as farmers, carpenters, and artisans, and who, overall, depended more directly on terrestrial supporting, regulating, and provisioning services as *other* (Table 1). We categorized the two participants who sold seafood caught from areas other than the estuary and the sole tourism operator as *other* because they relied on ecosystem services beyond those immediately provided by the estuary (Table 1).

We used a Kruskal-Wallis H test with Dunn's posteriori tests to compare the mean ranks of scores that survey participants marked along a continuous scale from -10 to 10 (Rice, 1989; Elliott & Woodward, 2007; IBM SPSS 24). Written-in reasons behind scores between -7 and -10 and 7 and 10 for interventions were coded to

compose main categories of responses and then tabulated to assess response frequency (Saldaña, 2013) (Table 2).

3. Results

3.1. Qualitative field methods informed the design of a survey questionnaire

3.1.1. Informants identified a wide range of potential ecosystem service priorities

The participatory mapping workshop yielded a comprehensive list of ecosystem services. Members of the indigenous communities identified several aspects of the estuary and coastal zone (i.e., ecosystem services) they considered important to wellbeing, which ranged from regulating (e.g., tidal flow of saltwater) to provisioning (e.g., presence of edible algae gleaned from rocks) to cultural (e.g., space to recreate and play sports, such as rowing). Most of the aspects identified by members through the mapping workshop were mentioned by at least one informant in the semi-structured interviews.

All 41 informants mentioned provisioning ecosystem services in response to the question, "What does the estuary, sea, and coastal zone provide you and your family?" and the follow-up prompt, "What, if anything, does the estuary, sea, and coastal zone provide beyond livelihood sources and food?" Several mentioned CES, including cultural identity, ways of life (e.g., ancestral practice of gathering shellfish for subsistence), and recreation as a family (Fig. 3). These three themes intertwined. For example, informants' explanations of cultural identity included ancestral practices that addressed practical needs: (e.g., food on the table), as well as subjective, psychological, spiritual needs: the sea as fulfilling, experienced both on a personal level and on a broader cultural level to share with others. Similarly, the two informants who mentioned recreation did so in reference to coastal ways of life experienced as a family (e.g., taking out the fishing boat, collecting rocks along the shoreline) (Fig. 4). These two informants also referenced the estuary's scenic beauty as a potential means to foment small-scale

Table 5
Similarities in livelihood groups' mean scores for how potential interventions would impact personal and familial wellbeing (left columns) and the environment (right columns).

Typology	Intervention	Perceived impact on wellbeing					Perceived impact on the environment				
		Total <i>n</i> (SE)	Estuarine (SE)	Wage earner (SE)	Other (SE)	<i>P</i>	Total <i>n</i> (SE)	Estuarine (SE)	Wage earner (SE)	Other (SE)	<i>P</i>
New use	Development of small scale tourism	7.6 (0.263)	7.5 (0.365)	7.7 (0.400)	7.4 (0.893)	0.926	4.8 (0.332)	5.0 (0.464)	4.4 (0.569)	5.1 (0.885)	0.547
Conservation	Creation of a protected area for nature	7.5 (0.271)	7.3 (0.414)	7.8 (0.334)	7.7 (0.881)	0.722	5.0 (0.344)	5.2 (0.481)	4.7 (0.546)	4.5 (1.065)	0.632
Conservation	Installation of a lookout point to observe birds	7.5 (0.228)	7.6 (0.315)	7.2 (0.425)	8.3 (0.461)	0.331	4.8 (0.329)	5.0 (0.450)	4.2 (0.581)	5.4 (0.866)	0.431
New use	Establishment of a mussel farm (seed)	4.8 (0.448)	5.4 (0.644)	4.3 (0.730)	4.0 (1.193)	0.102	2.3 (0.359)	2.9 (0.534)	1.6 (0.549)	2.0 (0.923)	0.344
Expand use	Installation of a new shellfish processing plant	4.2 (0.499)	4.5 (0.695)	5.0 (0.705)	1.3 (1.683)	0.261	0.3 (0.460)	0.1 (0.623)	1.0 (0.783)	-0.7 (1.350)	0.389
New use	Establishment of a salmon farm (smolt)	0.2 (0.575)	-0.9 (0.829)	2.0 (0.899)	0.1 (1.537)	0.192	-2.2 (0.494)	-3.4 (0.692)	-0.8 (0.793)	-1.2 (1.353)	0.078
Development	Filling wetlands to build roads and houses	-0.7 (0.546)	-0.2 (0.736)	-1.6 (0.993)	-0.1 (1.391)	0.465	-3.6 (0.493)	-3.1 (0.715)	-4.4 (0.795)	-3.8 (1.305)	0.469

Size of livelihood groups: Total *n* = 168. Estuarine *n* = 86, Wage earner *n* = 58, and Other *n* = 24. Survey participants marked responses on a continuous line with two anchor points "not important at all" or "not good at all" (= -10) and "very important" or "very good" (= 10), and a clear "indifference" or "no impact" line in the middle (= 0). Responses were recorded as positive or negative distances from the central zero point.

tourism.

Interviews yielded three aspects of the estuary that had not been mentioned in the participatory mapping workshop: benefits associated with fishing organizations (e.g., ability to apply for project funding), the ability to work for one's self (i.e., independence that working as a coastal gleaner, diver, or fisher granted), and benefits not yet known (i.e., that which scientists have yet to study). We did not include the former two aspects in the survey questionnaire for the broader population because they related specifically to small-scale fishing. For the sake of time, we also left out benefits yet to be known. Rather, we included space for survey participants to mention anything else regarding present and future wellbeing associated with the estuary (Appendices A3 and A4).

3.1.2. Informants identified several plausible management interventions

Members of the indigenous communities identified several potential scenarios that would somehow alter the estuary's current management. Key informant interviews yielded additional interventions, which ranged from changes that would affect the broader population who lived and worked near the estuary (e.g., installing a new shellfish processing plant, installing a lookout point for birds) to scenarios that would affect small-scale fishers more directly (e.g., establishing a new territorial rights fishery, expanding algal farms). The 10 management interventions included in the survey questionnaire entailed changes that would somehow alter the estuary's coastal zone, including both terrestrial and marine environments (Appendices A3 and A4).

3.2. Ecosystem services and management interventions prioritized by a broader population

3.2.1. Participants perceived scenic beauty, and other CES, as very important to wellbeing

Scenic beauty—a cultural ecosystem service—stood out as the ecosystem service perceived as most important to wellbeing to the 168 people surveyed, and garnered a mean score of 9.3 out of 10 (Table 3). Mean scores for perceived importance of scenic beauty did not differ significantly among the three livelihood groups. That is, the survey participants we later categorized as *estuarine*, *wage earners* and *other* similarly perceived the importance of scenic beauty to wellbeing, with mean scores of 9.3, 8.9, and 9.2 per group, respectively.

Thereafter, the order of ecosystem services—ranked according to livelihood groups' mean scores—varied among the livelihood groups. Yet, within this variation, CES stood out as priorities for wellbeing, particularly for participants categorized as *estuarine* and *other*. Interestingly, mean scores indicate that *estuarine* participants perceived several CES as more important to wellbeing than some of the provisioning ecosystem services on which they depended for livelihoods (e.g., commercial red algae, fish) (Tables 3 and 4).

Mean scores for perceived importance of CES differed significantly between the *estuarine* and *wage earner* groups in four cases: recreation space ($P = 0.043$), space to develop tourism ($P = 0.046$), spiritual space ($P \leq 0.033$), and space to practice traditional activities with family ($P = 0.011$) (Table 4). In these cases, *estuarine* participants perceived the CES as more important to wellbeing than did *wage earners* (i.e., *estuarine* participants' mean scores $\geq$ *wage earners*' mean scores for the four aforementioned CES). It is important to note that we categorized *space to develop tourism* as a cultural, rather than provisioning, ecosystem service namely because tourism did not provide a source of livelihood for residents (de Groot et al., 2010; Abson and Termansen, 2011; Daw et al., 2011). Livelihood groups' mean scores for perceived importance did not differ significantly for several services, including variety and number of birds—a proxy for biodiversity and a cultural ecosystem service that garnered high mean scores for all three livelihood groups; the presence of edible algae; tidal flow of saltwater; wetlands and peatlands that act as freshwater reservoirs; the estuary's ability to eliminate greywater and drainage from houses; and, the

Table 6

The number of survey participants who perceived strongly positive (scores marked between 7 and 10) and strongly negative (scores marked between −7 and −10) impacts on wellbeing following the development of small-scale tourism, the creation of a protected area for nature, and the installation of a lookout point for birds. These interventions garnered the most widespread support among participants, overall. Reasons behind scores indicate different motivations.

Typology	Intervention	Mean score (SE)	Number of participants (n = 168)	Percent of n
New use	Development of small-scale tourism	7.6 (0.263)		
	Good, for economic reasons (e.g., better for local economy)		90	53.6
	Good, for non-economic reasons (e.g., increased stewardship)		15	8.9
	Vague “good”		7	4.2
	Bad, tourism should be large-scale		2	1.2
	Did not mark score between ± 7 and ± 10		54	32.1
Conservation	Creation of a protected area for nature	7.5 (0.271)		
	Good for nature		77	45.8
	Good for tourism		23	13.7
	Vague “good”		12	7.1
	Bad: we would lose work		1	0.6
	Did not mark score between ± 7 and ± 10		55	32.7
Conservation	Installation of a lookout point to observe birds	7.5 (0.228)		
	Good, for reasons besides tourism (e.g., activity for children)		63	37.5
	Good for tourism		44	26.2
	Did not mark score between $+/-7$ and $+/-10$		61	36.3

presence of commercial algae (Table 3).

3.2.2. Participants perceived strongly positive impacts on wellbeing following tourism and conservation

The 168 people surveyed perceived strongly positive impacts on wellbeing following the development of small-scale tourism (Table 5). Participants reasoned that small-scale tourism would boost the local economy, and encourage stewardship, which, in turn, would help conserve the area and its diverse species (Table 6). Participants also perceived strongly positive impacts on wellbeing following the two conservation interventions—the creation of a protected area for nature (purposefully left vague in questionnaire as to whether the preserve would be marine or terrestrial) and the installation of a lookout point to observe birds (Tables 5 and 6). As Table 6 indicates, several participants thought a preserve and a lookout point would encourage the small-scale tourism perceived as beneficial. Yet most participants who marked strongly positive scores cited reasons other than tourism. These reasons included CES, such as opportunities to relax, admire scenic beauty, recreate as a family, learn more about local species, educate younger generations, and foster stewardship. Mean scores for these three interventions did not differ significantly among the three livelihood groups.

3.2.3. Survey participants agreed on what mattered most, yet diverged on how to achieve it

Finally, although survey participants overwhelmingly perceived scenic beauty as most important to wellbeing, results suggest that participants interpreted scenic beauty differently and diverged on how to achieve it. The intervention of filling wetlands to build roads and houses provided these insights. This was the only intervention to garner negative mean scores across livelihood groups for perceived impact on personal and familial wellbeing (Table 5). Although several participants marked wellbeing impacts at zero (unsure or no impact), overall, scores appeared polarized and thus averaged near zero. Approximately 20% of survey participants (33 people) perceived strongly positive impacts on wellbeing following this development intervention, while approximately 27% (46 people) perceived strongly negative impacts on wellbeing (Table 7). Reasoning varied among proponents and opponents of filling wetlands (Tables 7 and 8). As Table 8 shows, participants on both sides referred to scenic beauty. Some thought filled wetlands would increase scenic beauty because the area would appear cleaner, as people often placed refuse in the wetlands near the estuary. Others believed wetlands, and all the life they attract, contributed to the area's

scenic beauty.

4. Discussion

4.1. Aesthetics and recreation matter, even if these CES appear more often in the literature

Within discussions on how to better include CES in ecosystem management and environmental decision-making, scholars have noted an emphasis on aesthetics—the pleasure and contentedness that people experience in response to environmental stimuli (Gobster et al., 2007)—and recreation (Milcu et al., 2013; Satterfield et al., 2013; Gould and Lincoln, 2017; Pascua et al., 2017). Likely, this is because aesthetics (e.g. scenic beauty) and recreation, rather than CES such as cultural heritage or education, lend more readily to spatial analyses (Chan and Ruckelshaus, 2010; Milcu et al., 2013; Pascua et al., 2017). A scenic vista, for instance, may be spatially represented and quantified according to its different features, including space that supports recreation (see, for example, Nahuelhual et al., 2013). Some scholars have suggested that the importance of these CES to wellbeing may prove to be more relevant in industrialized contexts where people generally rely less on natural resources for livelihoods and ways of life (Satterfield et al., 2013). However, our study shows empirically that aesthetics and recreation indeed mattered a great deal to people with varying degrees of dependence on provisioning ecosystem services in natural resource-dependent communities. Thus, while several CES beyond aesthetics and recreation contribute to human wellbeing (Gould and Lincoln, 2017; Pascua et al., 2017), and although aesthetics and recreation may appear more often in the CES literature, it does not follow that aesthetics and recreation matter any less to constituents in any context.

The importance of aesthetics and recreation to wellbeing may stem from our evolutionary history as a species that shares an innate affinity for life and life-like processes—an assertion known as the biophilia hypothesis (Wilson, 1984; Kellert and Wilson, 1995). Indeed, a long line of studies report a range of positive effects from time spent in nature (Kaplan and Kaplan, 1989; Kaplan et al., 1998; Louv, 2008; Bratman et al., 2015; for a comprehensive list, see Sandifer et al., 2015). The results presented here show that survey participants categorized as *estuarine* and *other*, who relied more on coastal, marine, and terrestrial provisioning services—and consequently spent more time outdoors, perceived several CES (e.g., spiritual space, space to recreate) as more important to wellbeing than some of the provisioning services on which they depended (Tables 3 and 4). Although most survey participants

Table 7
The number of survey participants who perceived strongly negative (scores marked between -7 and -10) and strongly positive (scores marked between 7 and 10) impacts on wellbeing following the filling of wetlands to build roads and houses, and reasons behind those scores. This was the only intervention that garnered a negative mean score. The larger standard error for the overall mean score indicates greater variation of perceived impacts among participants.

Typology	Intervention	Mean score (SE)	Number of participants (n = 168)	Percent of n
Development	Filling wetlands to build roads and houses	-0.7 (0.546)	46	27.4
	Bad, for various reasons (e.g., diminished natural beauty, increased risk of flooding, loss of habitat for birds and other species)		33	19.6
	Good, for various reasons (e.g., signifies progress, reduces moisture and odors, cleans up area)		89	53.0
	Did not mark score between ± 7 and ± 10			

Survey sample population n = 168. Participants marked responses on a continuous line with two anchor points “excellent” (= + 10) and “terrible” (= - 10), and a clear “indifference” or “no impact” line in the middle (= 0). Responses were recorded as positive or negative distances from the central zero point. Reasoning behind score was recorded for any scores marked between ± 7 and ± 10 (Table 2, Section 2.2.3.).

lived in working class or poor conditions, it is important to note that they did have basic material needs met. Perhaps spending more time in nature allowed for an appreciation of the estuary as a space that met needs beyond the material. Participants categorized as *wage earners*, who relied less directly on provisioning services, also perceived these CES as very important to wellbeing, although less so (Section 3.2.1). Perhaps this may be attributed to less time in the day-to-day to appreciate the estuary as a spiritual space or place to recreate. Or, perhaps *wage earners* felt less able to access the estuary to meet such needs. At the same time, *wage earners* perceived the presence of edible algae as quite important to wellbeing (Table 3). Although we categorized this ecosystem service as provisioning (e.g., food), this ancestral practice may be interpreted as cultural subsistence, a cultural ecosystem service (Pascua et al., 2017). In this way, gathering edible algae from rocks, as shown in Fig. 2, yields multifaceted benefits: an opportunity to enjoy scenic beauty and recreation outdoors, an ability to pass on traditional knowledge across generations, and physical activity that boosts health and wellbeing. Future research may examine how perceived importance of ecosystem services relates to time spent doing different day-to-day tasks in nature as well as perceived ability to access different ecosystem services in a given space.

4.2. Making aesthetics and recreation in nature more accessible for everyone

In terms of management implications, perhaps most importantly, the findings we present here underline a need to make CES, including aesthetics and recreation in nature, accessible. Doing so would increase the likelihood that anyone may readily access CES to meet fundamental wellbeing needs. Much of this work is under way. Initiatives in urban areas aim to create more green space so that the public may more readily access nature and its wellbeing benefits (Barbosa et al., 2007; Haaland and van den Bosch, 2015). At the same time, much work remains, especially in terms of ensuring access for people from different socioeconomic backgrounds (Andersson et al., 2014; Kabisch et al., 2015). Similar efforts may be taken in urban, peri-urban, and rural areas in less industrialized regions where municipal resources tend to be scarcer and landscape planning more piecemeal. Ideally, at the spatial scale of locality, plots of restored native habitat with walking trails and informative signs would allow visitors to find respite in nature. Yet even small gestures may make CES and nature in general more accessible. For example, hedges of native trees and shrubs—including edible forest gardens—can encircle public exercise equipment, playgrounds, benches, and other public spaces to encourage more familiarity with local flora, fauna, and food production (Middle et al., 2014; Stoltz and Schaffer, 2018). Simple infrastructure such as a covered bench may highlight a lookout point to observe nature and encourage reflection. Such local-level measures that focus on existing or new public space may make it easier for people who spend more time indoors to readily access scenic beauty, recreation, and other CES. At larger spatial scales, more efforts may be made to encourage people to visit existing preserves, parks, or open space. For example, more efforts may be made through community organizations and schools to bring people from diverse backgrounds to enjoy scenic beauty, recreation, and other CES through time in existing nature refuges. Future studies may assess any changes over time in perceived access to CES before and after interventions that aim to improve access and visitation.

4.3. Small-scale tourism and conservation as potential means to increase access to CES

In this study, participants across livelihood groups perceived highly positive wellbeing benefits following interventions to foment small-scale tourism, install a nature lookout point, and establish a nature preserve. These finding suggests that such interventions may potentially garner widespread support in diverse human communities, including

Table 8

Sample quotes from survey participants who perceived strongly positive (scores marked between 7 and 10) and strongly negative (scores marked between −7 and −10) impacts on wellbeing following the filling of wetlands to build roads and houses.

Development intervention: Filling wetlands to build roads and houses	
Strongly positive impacts on wellbeing	Strongly negative impacts on wellbeing
"[Filling wetlands would make] the place cleaner and more beautiful."	"Bad, because [wetlands] make the area beautiful."
"Anything and everything that is good for progress."	"Wetlands are necessary for birds and views."
"[Filled wetlands] would provided better security when the tide rises."	"We would lose all that wetlands provide."
"[Filling wetlands] would get rid of moisture."	"Birds would no longer come [here]."
"[Good, because] the wetlands are full of trash."	"No, because there are diverse species to observe."
"Good, because [roads and houses] would benefit people."	"No, because [wetlands] are a source of life."
"Yes, because the housing [situation] would improve."	"No, because [filling wetlands] would change the land- and seascapes."

those that rely more directly on natural resources for livelihoods. Granted, we purposefully left the wording of these interventions vague so as to leave them open to interpretation (Section 3.2.2.). For example, "nature preserve" did not specify land or water, and, thus, did not hint at potential winners or losers following the intervention (e.g., restricted access to the estuary's waters to extract algae or shellfish) (Appendices A3 and A4). In reality, interventions—including the development of small-scale tourism or conservation initiatives that often restrict access to certain ecosystem services—invariably affect livelihoods and ways of life. Small-scale tourism and conservation interventions rarely meet simultaneous goals of human development, economic gain, and environmental conservation sustainably and equitably (for examples, see Boo, 1990; Young, 1999; Halpern et al., 2013). And yet, in this study, people with varying dependencies on different ecosystem services perceived small-scale tourism and conservation initiatives would increase wellbeing by creating more opportunities to access CES or by encouraging stewardship, among other reasons (Table 6). This finding underlines a need to re-consider how small-scale tourism and conservation interventions may potentially increase wellbeing and safeguard key ecosystem services, in spite of inherent limits to what these interventions can accomplish. Future studies may examine how people perceive potential changes in different aspects of wellbeing (e.g., physical and mental health; spirituality; feelings of contentedness, calmness, and peace; harmony within family and larger community) following small-scale tourism and conservation interventions.

4.4. Reframing management and conservation as efforts to augment human wellbeing

Finally, the high regard for CES found in this study implies that reframing ecosystem management or conservation as explicit efforts to augment human wellbeing may help to garner more widespread support and participation. This is not to say that we abandon restoring habitats for the sake of non-human species or diminish an emphasis on the intrinsic value of nature. Rather, we may make more explicit the benefits of time in nature (e.g., enjoying scenic beauty, recreating) for human health and wellbeing. For example, along trails or scenic lookout points, signs that highlight human wellbeing benefits may accompany signs that inform visitors of local flora and fauna. Such signs in public green spaces may include suggestions for how to take in nature with the senses (e.g., note patterns of branches or leaves, note what you smell and hear, note how you feel). At regional and global spatial scales, frames to assess and safeguard ecosystem services often reference human wellbeing, either through mentions of livelihoods or physical and mental health. Perhaps emphasizing the human wellbeing component in these frames, and particularly in practice, would inspire collaboration from a wider range of community members.

5. Conclusion

The empirical data we present here suggests that people in natural resource-dependent communities with diverse livelihoods and ways of

life consider CES to be crucial to wellbeing. This finding strikes a hopeful note for global ecosystem management: a high regard for CES such as scenic beauty can serve as a strong incentive for people to safeguard ecosystems. Future work may continue to bridge ecosystem service science and practice with environmental psychology. For example, how do different people with distinct livelihoods and ways of life perceive connections between nature and human wellbeing? How do different people perceive scenic beauty (e.g., wetlands filled versus wetlands left alone)? How might these perceptions relate to attitudes and actions of environmental stewardship? At the same time, we sorely need lessons learned from including CES in actual decision-making processes—replete with power dynamics and politics at various spatial and temporal scales, and especially from regions where planning is sparse. Only then may we assess how ecosystem services science may address wellbeing outcomes for diverse communities.

Declaration of Competing Interest

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

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ecoser.2020.101123>. These data include Google maps of the most important areas described in this article.

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