



OPEN ACCESS

EDITED BY
Leslie New,
Ursinus College, United States

REVIEWED BY
Elizabeth E. Hieb,
Dauphin Island Sea Lab, United States
Daniel Gonzalez-Socoloske,
Andrews University, United States

*CORRESPONDENCE
Flávia Bonfietti Izidoro
flavia.izidoro@ifal.edu.br

SPECIALTY SECTION
This article was submitted to
Marine Conservation and
Sustainability,
a section of the journal
Frontiers in Marine Science

RECEIVED 25 July 2022
ACCEPTED 31 August 2022
PUBLISHED 21 September 2022

CITATION
Izidoro FB and Schiavetti A (2022)
Associated benefits of manatee
watching in the Costa dos Corais
Environmental Protection Area.
Front. Mar. Sci. 9:1002855.
doi: 10.3389/fmars.2022.1002855

COPYRIGHT
© 2022 Izidoro and Schiavetti. This is an
open-access article distributed under
the terms of the [Creative Commons
Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use,
distribution or reproduction in other
forums is permitted, provided the
original author(s) and the copyright
owner(s) are credited and that the
original publication in this journal is
cited, in accordance with accepted
academic practice. No use,
distribution or reproduction is
permitted which does not comply with
these terms.

Associated benefits of manatee watching in the Costa dos Corais Environmental Protection Area

Flávia Bonfietti Izidoro^{1,2,3*} and Alexandre Schiavetti^{2,4,5}

¹Programa de Pós-graduação em Desenvolvimento e Meio Ambiente, Universidade Estadual de Santa Cruz, Ilhéus, Brazil, ²Laboratório de Etnoconservação e Áreas Protegidas (LECAP), Universidade Estadual de Santa Cruz, Ilhéus, Brazil, ³Instituto Federal de Alagoas, Campus Penedo, Penedo, Brazil, ⁴Departamento de Ciências Agrárias e Ambientais, Universidade Estadual de Santa Cruz, Ilhéus, Brazil, ⁵Investigador Asociado CESIMAR/CENPAT, Puerto Madryn, Argentina

Marine mammals provide diverse and interconnected ecosystem services. According to the literature, the use of these services is associated with human needs related to provision, ecosystem regulation, education, culture, spirituality, and recreation. Tourism with marine animals can provide psychological benefits, emotional connection, fun, and learning, in addition to generating high income in local communities. This study aimed to determine the willingness to pay of the community and visitors for the conservation of the West Indian manatee (*Trichechus manatus*), identify the revenue from manatee watching, and evaluate well-being according to the participants of this attraction. The study was conducted from January 2020 to February 2021, in the Costa dos Corais Environmental Protection Area, Brazil. Data were collected using questionnaires and specific forms for the seven categories of social actors involved with manatee watching. The contingent valuation method was used to evaluate the willingness to pay of the respondents for the conservation of the manatee. The willingness of individuals to conduct voluntary work was also considered and subsequently converted into monetary values. Revenue from manatee watching was calculated through the direct costs of acquiring tour tickets and indirect expenditure on accommodation, food, transportation, and souvenirs. The feelings of the tourists who completed the trip were determined using a semi-structured question and their level of satisfaction was established using a five-point Likert scale. A total of 761 interviews were conducted. Most of the survey respondents were female, with a high level of education, and with a median monthly income of USD 1 800 dollars. The average mean value declared for willingness to pay was USD 3.6 dollars per month. The median hours devoted to volunteer work were 60 hours per year, which is the equivalent of USD 2.59 dollars per month. Direct revenue from this form of tourism was USD 125 595 dollars and total projected revenue was USD 15 392 225.45 dollars in the studied period. The vast majority of tourists managed to see the manatee and declared positive feelings after the trip. We believe that more elaborate promotion of manatee-watching would attract a higher number of tourists to the protected area.

KEYWORDS

sirenians, ecosystem services, valuation, conservation, community-based tourism

Introduction

Ecosystem services can be defined as the benefits that humans derive from nature (Daily, 1997) and they can be maintained through biodiversity conservation (Eastwood et al., 2016). The contribution of biodiversity to the monetary value of certain ecosystem services (Isbell et al., 2015) demonstrates that the benefits of biodiversity conservation can be much greater than the costs of its maintenance (Isbell et al., 2017). The scientific literature shows that in the last 50 years, ecosystem services have been increasingly identified, especially those related to culture such as recreation, tourism, relaxation, and quality of life (Felipe-Lucia et al., 2015). A growing number of publications have focused on marine ecosystem services to inform decision-makers as to their importance for human well-being and the multiple implications of their loss (Sagebiel et al., 2016; Ferreira et al., 2017; Cook et al., 2019; Malinauskaite et al., 2020; Malinauskaite et al., 2021).

Marine mammals provide a wide range of interconnected ecosystem services relevant to humans, such as raw materials (meat, teeth, bones, fins, and oil), ecosystem support and regulation, cultural identity, education, spiritual enrichment, and recreational fun (Cook et al., 2020; Malinauskaite et al., 2021). In the past, marine mammals were mostly exploited for subsistence and commercial hunting (Whitehead, 1977; Domning, 1982; Luna et al., 2008a; Luna et al., 2008b; O'Connor et al., 2009; Silva Júnior, 2010; Hoyt and Parsons, 2014). With respect to sirenians, a combination of subsistence hunting and small-scale commercial hunting eventually reduced known populations to extinction (in the case of Steller's sea cow), or close to extinction, in the case of manatees (Forestell, 2008; Silva et al., 2017). Recently, we have observed a transition accompanied by changes in human understanding of nature. The old strictly utilitarian vision focused on economic exploitation (Sousa and Mota, 2006) and obtaining resources (Sparemberge and Lacerda, 2015), gave way to the recognition and appreciation of aesthetic pleasure and recreation options (Reid et al., 2005). At the same time, the importance given to spiritual and mental well-being needs has become as important as access to other natural resources for consumption. In this perspective, today these animals are emblematic species and considered conservation icons. They are also known as "charismatic megafauna", that is, groups of large animals, usually mammals, with more popular appeal than others (Einarsson, 2009; Hausmann et al., 2017; Lück and Porter, 2017; Cook et al., 2020). They are also considered "emblematic species" because they have great capacity to raise awareness of the need for conservation (Barney et al., 2005; Lück and Porter, 2017). These animals are more likely to trigger sympathy, awareness, and financial resources for conservation, thus enabling funds to be made available for other less attractive species (Lorimer, 2007).

Manatees is among the animals that humans consider charismatic (Thompson and Rog, 2019), arousing the interest of tourists in attractions involving the species. The tourism for

observation and interaction with animals in nature has been considered a potential conservation measure for faunal species (Vidal et al., 2017). This type of entertainment provides for visitors psychological benefits, emotional connection, fun, and learning (Zeppel, 2008; Zeppel and Muloïn, 2008; Silva Júnior, 2017; Patroni et al., 2019), in addition to generating high revenue for the local communities (Beattie, 2005). Many studies have shown the economic and social advantages of whale watching in different locations around the world (O'Connor et al., 2009; Knowles and Campbell, 2011; Cook et al., 2019; Cook et al., 2020; Guidino et al., 2020; Malinauskaite et al., 2020); however, information regarding the effects of manatee watching remains scarce in Brazil.

Manatee watching occurs mainly in two Brazilian protected areas: Barra do Rio Mamanguape Environmental Protection Area (APA Barra do Rio Mamanguape) in Paraíba and Costa dos Corais Environmental Protection Area (APACC) in Alagoas. A long-term program for the release and conservation of West Indian manatee (*Trichechus manatus*) is ongoing in APACC (ICMBio, 2021). The first release occurred in 1994 in the municipality of Paripueira (Andrade et al., 2011; Normande et al., 2015). However, after two releases, translocations were interrupted due to the negative effects caused by proximity to the state capital, Maceio (with an estimated human population of 1 031 597, according to IBGE, 2017). A new site (Porto de Pedras) 70 km north of Paripueira was subsequently chosen and has been used since 1998 (Normande et al., 2015). This location is situated between two disjointed populations of *T. manatus* (Lima, 2008), and, interestingly, the release of animals in this area was an attempt to recover the historical range of occurrence and create gene flow between these subpopulations (Luna et al., 2012). To date, 36 manatees have been released, of which 13 are still sighted in the region (personal communication obtained with the APACC environmental analyst).

The occurrence of the West Indian manatee also triggered new business opportunities, such as community-based tourism, and created tourist reception jobs that positively stimulated the region (Oliveira, 2019). However, wildlife managers were faced with the challenge of providing visitors with opportunities to observe the rare or endangered fauna while protecting the species from harmful impacts (Sorice et al., 2006). For this, in 2009, *Associação Peixe-Boi* was founded with the aim of ensuring that the community would assure and participate in the orderly tourist observation of manatees. Tourism is a tool that helps in the national dissemination of the presence of West Indian manatee and can reduce threats to the species. As a result of the recent tourist interest involving marine animals, there has been an increase in consciousness and changes in long-term pro-environmental conservation behavior (Zeppel and Muloïn, 2008; Silva Júnior, 2017). As in the case of whales (Cook et al., 2020), increasing awareness of the importance of manatees is critical for the creation of conservation policies for this species so negatively

impacted by human action (Parente et al., 2004; Meirelles, 2008; Anzolin et al., 2012; Attademo et al., 2015; Balensiefer et al., 2017).

Manatees also have high cultural values, which vary by taxon and by region (Ponnampalam et al., 2022; Izidoro et al., 2022). There are several methods to value services like these for society (Ferreira et al., 2017), however, fauna assessment is still difficult and complex (Wiener et al., 2020). It is particularly challenging to increase appreciation and valuation toward animals such as whales and other aquatic mammals since they are large, usually wild, and not commercialized (Knowles and Campbell, 2011). The first non-market valuation studies were based exclusively on the contingent valuation method (Cook et al., 2020). This methodology has been used to value a broad range of non-commercial commodities, from air quality to wildlife (Hageman, 1985). As in other studies (Hageman, 1985; Loomis and Larson, 1994; Ferreira et al., 2017), this method was preferred to determine the willingness to pay. Contingent evaluation is a research-based technique to declare the preferences of unusual values or indirect values for society in relation to other items of private consumption (Ferreira et al., 2017). This method estimates the willingness of individuals to pay or accept to guarantee the improvement of their well-being in relation to changes in the availability of this resource (Motta, 1997). In this regard, scenarios that are as close as possible to the real world must be simulated. Thus, preferences are established in the study that should reflect the decisions agents would make if there was a market for the environmental asset described in the hypothetical scenario. In more general terms, willingness to pay (WTP) is the

maximum amount of money an individual would willingly spend to acquire a given product, good, or service, whether environmental or not (Moraes et al., 2015).

That said, the objectives of this study were the following:

1. Determine the willingness of the community and visitors to pay for the conservation of the West Indian manatee in the APACC, in the state of Alagoas, Brazil.
2. Identify the revenue related by manatee watching tourism, particularly within the APACC.
3. Determine the well-being declared by tourists after manatee watching.

Material and methods

Study area

The APACC is a sustainable use conservation unit (Figure 1) that covers the municipalities of Maceio, Paripueira, Barra de Santo Antonio, Passo De Camaragibe, Sao Miguel dos Milagres, Porto de Pedras, Porto Calvo, Japaratinga, and Maragogi, in the state of Alagoas, and Sao Jose da Coroa Grande, Barreiros, Tamandaré, and Rio Formoso, in the state of Pernambuco (Brasil, 1997; ICMBio, 2021). This protected area is a federal marine conservation unit of more than 400 thousand hectares extending for about 120 km along the coast (ICMBio, 2021).

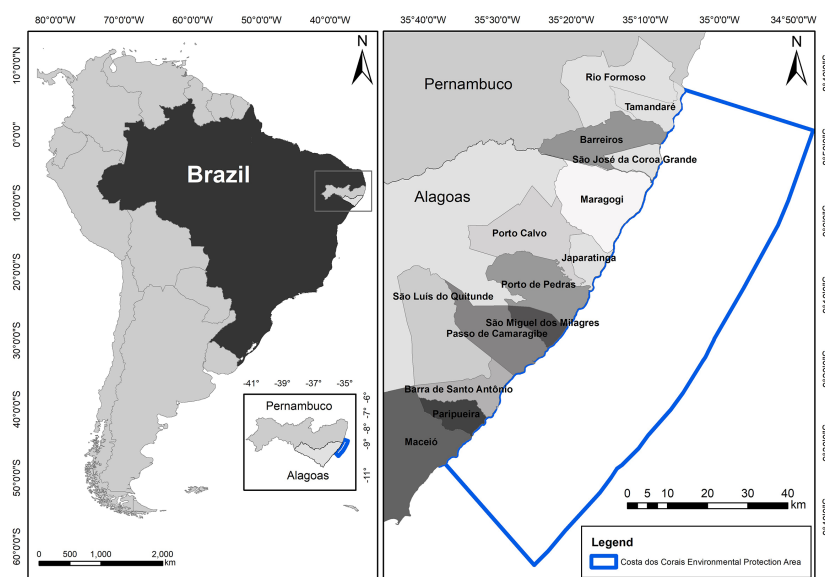


FIGURE 1

Map of the study area with representation of the municipalities that make up the Costa dos Corais Environmental Protection Area (Contribution by Romário Oliveira de Santana).

The trip for tourists to watch the West Indian manatee is carried out on a dinghy steered by rowers (Braga and Selva, 2016) and is only allowed in the estuary of the Tatuamunha River (Porto de Pedras). This estuary includes an enclosure in which the rehabilitated animals remain until their release (ICMBio, 2013). Manatee watching is governed and regulated by the Management Plan of the Costa dos Corais Environmental Protection Area (ICMBio, 2013).

Methodology

This study was based on participant observation, tourism sector interviews and market research. The research was carried out using questionnaires and forms carefully drafted and pre-tested to prevent biased results (Laurila-Pant et al., 2015). Specific questionnaires were created for the seven categories of social actors involved in tourism, namely artisans, business owners (included shops, restaurants, coffee shops, bars, and the like), manatee watching guides (community members who lead manatee watching), tour operators (tourism business owners), tour guides (workers who conduct sightseeing tours), accommodation service providers, and tourists. The social actors (with the exception of tourists) were selected using the non-probability intentional snowball sampling method (Bailey, 1994). The study was initiated during the coronavirus pandemic, at which time visitation to federal conservation units was legally suspended in Brazil (Ordinance No. 227, [Supplementary Material](#)). As a result, the study was first conducted remotely with the accommodation sector, through telephone interviews. When participants showed interest in contributing to the study but were unable to respond at the time of contact, they were given the option of receiving the form (by e-mail or WhatsApp). Remote interviews were conducted between June and October 2020. When tourism resumed at the APACC (Ordinance No. 771, [Supplementary Material](#)), the interviews became face-to-face.

The tourists were interviewed after taking the observation tour, with an opportunistic and voluntary choice according to their interest in participating. Face-to-face interviews were conducted from November 2020 to February 2021. The questionnaire was also sent by e-mail to tourists registered at the *Associação Peixe-Boi* from January 2020 to February 2021. In order to avoid duplication, we asked tourists who had answered the questionnaire in person not to respond to the email.

The questionnaires consisted of different sections according to the interviewed category ([Supplementary Material](#)). The first section, included in all the questionnaires, collected data on the socioeconomic characteristics of the respondents and willingness to pay (WTP) a fee for the conservation of the West Indian manatee. The fee amount was proposed by the interviewee himself and the payment method presented was through an additional charge on a fixed bill such as water, light, or telephone bills (Adams et al., 2003; Ferreira et al., 2017).

If respondents agreed to pay the fee, the next question referred to the amount they would like to donate (i.e. the respondents themselves who set the WTP amounts). The respondents could also choose a preferred and trusted institution (governmental, non-governmental, or private) to manage the donated funds. Moreover, the willingness of the respondents to conduct volunteer work in favor of West Indian manatee conservation was considered under this same topic. Thus, the respondents who declared they could not contribute financially were given the opportunity to participate through volunteer work (Paiva, 2015; Ferreira et al., 2017).

The interviews were used to calculate the percentage of people who accepted WTP for the conservation of the West Indian manatee in the form of a hypothetical tax added to their utility bills (measured in United States dollars - USD) and the percentage of people who were willing to invest their time (measured in hours) in volunteer work. Two types of contributions were considered and subsequently converted into monetary values, namely the WTP in the form of a donation and/or the volunteer work (Ferreira et al., 2017). The number of volunteer hours was converted into a monetary value based on 2080 work hours per year (8-hour workday, 5 days a week, for 52 weeks of the year) and considering the median of declared incomes of all categories.

On the manatee watching guides questionnaire, a second section was included with a question related to the willingness to accept the absence (WAA) of manatee watching tourism. The question was open-ended and the respondent could answer with any value.

The direct revenues attributable to manatee watching and generated from the sale of tickets by the *Associação Peixe-Boi* were also considered to calculate values (O'Connor et al., 2009; Knowles and Campbell, 2011; Guidino et al., 2020). To complement the value of recreational manatee watching, the travel cost method was also used (Sagebiel et al., 2016), including all indirect expenditure related to tourism of the West Indian manatee, such as travel costs, accommodation, food, and souvenirs (O'Connor et al., 2009; Knowles and Campbell, 2011; Guidino et al., 2020). In our study, we considered as travel costs the sum of expenses self-reported by tourists in all means of transport used until arriving the region where manatees and manatee ecotourism occur. Accommodation and food costs were calculated considering the amount paid during the total period in which they stayed in the region. And the spending on souvenirs was calculated from the sum of the value declared by each interviewee. The total amount obtained (sum of direct and indirect expenses) was divided by the number of participants who answered questions about indirect costs (n=362). To calculate the revenue projection, we multiply the average value obtained by the total number of tourists who participated in manatee watching (n=13,955) during the study period (January 2020 to February 2021). As in the case of Knowles and Campbell (2011), the existence value of these animals for humans, for the manatees themselves or other species was not included. The questions related to this information were in a third section on the tourist questionnaires.

A fourth section addressed the feelings of tourists when they saw or if they saw the West Indian manatee during the tour, and their level of satisfaction with the information and guidelines provided during the trip. In this section, a 5-point Likert scale was used (Likert, 1932), ranging from 1 “dissatisfied” to 5 “very satisfied”. As a result, information related to the well-being and satisfaction declared by the tourists was obtained.

Data analysis

All statistical analyses were conducted using R software (R core Team, 2021), and the data are shown in Table 1. Values expressed in USD were considered for WTP, income, and costs declared by the respondents. Some participants omitted certain answers, while others answered inadequately (answers in mismatched fields, or with incoherent alternatives to what was asked), leading to the exclusion of inconsistencies in certain questions. For the descriptive analyses, the information in the entire data set was used. For statistical analyses, only the subset of data with exclusions of inconsistencies was considered.

Results

Socio-economic characteristics

A total of 761 interviews were conducted. Table 2 shows the socioeconomic data of the respondents by category. Among the respondents, 76.15% (n=428) declared having higher education and/or graduate studies.

The median monthly income of respondents ranged from USD 234 (manatee watching guides) to USD 2 160 (tourist). The median values declared by the respondents, in the different categories, are presented in Table 2. Regarding gender, 56.20% (n=426) of the respondents stated they were female and 43.80% (n=332) stated they were male. Men were more present in the categories of manatee watching guides (male=31, female=4), tour guides (male=6, female=2) and tour operators (male=6, female=2). While women were the majority in the artisans (female=17, male=6) and tourists (female=324, male=207) categories. There was no major difference regarding gender between respondents in the business owners (female=30, male=26) and accommodation service providers (male=50, female=47) categories.

Willingness to pay for the conservation of the West Indian manatee through monetary contributions and/or volunteering

Among the respondents, 46.65% (n=355) were in favor of contributing to the conservation fund, 52.56% (n=400) did not

agree to contribute, and 0.79% (n=6) did not wish to comment. Among those in favor of contributing, 83.66% (n=297) mentioned a monetary value. The average monthly value of the declared contribution was USD 3.6 (± 11,45 SD), ranging from USD 3.6 to USD 18 (Table 3). Considering only the tourist-related workers and excluding the tourists, the mean WTP contribution was USD 13.66 (± 15,69 SD).

The respondent categories differed in relation to the monthly amount they would be willing to pay for maintaining the conservation fund (F=29.33; P<0.001). These differences were observed between artisans and manatee watching guides (P = 0.008), tourists and artisans (P = 0.01), tourists and business owners (P = 0.004), tourists and manatee watching guides (P = 0.004) and between tourists and the accommodation service providers (P = 0.004). On average, the manatee watching guides declared a donation to the fund that was USD 13 higher than that declared by the artisans (Figure 2).

In contrast, the tourists intended to donate the lowest amount of all the investigated categories, averaging USD 3.85 per month. Considering only the category of tourists, the amount they were willing to donate to the fund showed differences when the motivation for the trip was to do manatee watching (t=-2.65; P=0.02). Tourists who traveled to the location motivated by manatee watching (16.10%) were willing to donate an average of USD 2.38 more to maintain the conservation fund when compared to those who traveled to the place for other reasons (83.9%).

Statistically, the same proportion of female (53.08%) and males (n=46.92%) respondents agreed to contribute to the manatee conservation fund (X² = 0,04; P = 0,86). Male and female respondents differed in terms of the amount they would be willing to pay monthly to maintain the manatee conservation fund (t = -3.62; P = 0.004). Although no significant differences were observed between the monthly income of the men and women (t=1.14; P=0.18), male respondents declared they would make higher donations (mean USD 5.28) than female respondents (mean USD 2.51, Figure 3A).

The WTP also differed according to the schooling of the respondents (F=19.69; P<0.001). These differences were observed among respondents who had not finished elementary school (P=0.002) and who had finished middle school (P=0.004) and high school (P=0.016) compared to respondents who claimed to have higher education or graduate studies (Figure 3B).

Among the respondents demonstrating WTP, 65.90% (n=232) stated they would choose a non-governmental organization to administer the conservation fund. Moreover, 14.20% (n=50) of respondents chose private institutions and 6.25% (n=22) indicated the government as fund manager. However, 7.95% (n=28) chose institutions other than those listed and 5.68% (n=20) did not answer the question.

Of all the respondents, 55.99% (n=412) stated they were willing to volunteer. The median hours they would devote to volunteer work was 60 hours per year. Considering that the

TABLE 1 Statistical analyses conducted in the study.

Type of test	Reason	Explanatory variable	Response variable	Significance	Packages and functions in R software (R Core Team, 2021)
One-way ANOVA	To evaluate whether the categories of the interviewed social actors differed in relation to the monthly WTP for maintaining the manatee conservation fund.	Respondent category (artisan, business owner, manatee watching guides, tour guide, accommodation service provider, tour operator, and tourist)	Declared WTP value	P<0.05	WPerm package (Weiss, 2015), using the “perm.oneway.anova” function from the wPerm package (Weiss, 2015) and estimated test significance through the Monte Carlo simulation method with 9,999 randomizations. In situations where ANOVA showed significant results, a permutation test for pairwise comparison was used to detect the differences between which categories of respondents occurred. The pairwise comparison was conducted using the “pairwise.perm.t.test” function of the RVAideMemoire package (Hervé, 2021) and the estimated P value considering the Bonferroni correction for multiple tests, with 9,999 randomizations.
One-way ANOVA	To assess whether the WTP value differs according to the respondent’s schooling	Schooling (Elementary School (incomplete) Elementary School (complete) Middle SchoolHigh SchoolUniversity or more)	Declared WTP value	P<0.05	WPerm package (Weiss, 2015), using the “perm.oneway.anova” function from the wPerm package (Weiss, 2015) and estimated test significance through the Monte Carlo simulation method with 9,999 randomizations. In situations where ANOVA showed significant results, a permutation test for pairwise comparison was used to detect in which level of education the differences occurred. The pairwise comparison was conducted using the “pairwise.perm.t.test” function of the RVAideMemoire package (Hervé, 2021) and the estimated P value considering the Bonferroni correction for multiple tests, with 9,999 randomizations.
Student’s T-test	To assess whether respondents of different genders differed in relation to WTP	Gender (male or female)	Declared WTP value	P<0.05	“perm.t.test” function of the RVAideMemoire package (Hervé, 2021), and P-value estimated through the Monte Carlo simulation method with 9,999 randomizations
Student’s T-test	To verify whether income differed between the gender	Gender (male or female)	Declared WTP value	P<0.05	“perm.t.test” function of the RVAideMemoire package (Hervé, 2021), and P-value estimated through the Monte Carlo simulation method with 9,999 randomizations
Student’s T-test	To analyze whether the WTP of the tourists who traveled for manatee watching differed from those tourists who did not initially travel for this purpose	Reason for the trip (yes or no)	Declared WTP value	P<0.05	“perm.t.test” function of the RVAideMemoire package (Hervé, 2021), and P-value estimated through the Monte Carlo simulation method with 9,999 randomizations
Pearson correlation coefficient	To ascertain whether the WTP value of the respondents was related to their income	Income	Declared WTP value	P<0.05	“perm.relation” function from the wPerm package (Weiss, 2015), and the significance of the correlation estimated through the Monte Carlo simulation method with 9,999 randomizations
Chi-squared	To ascertain whether the people who were WTP would also volunteer in manatee conservation projects	WTP (yes or no)	Willingness to volunteer (yes or no)	P<0.05	“chisq.test” function from the stats package
Chi-squared	To identify whether the willingness to volunteer was influenced by gender	Gender (male or female)	Willingness to volunteer (yes or no)	P<0.05	“chisq.test” function from the stats package
Chi-squared	Check whether the WTP for the conservation fund	Gender (male or female)	Willingness to volunteer (yes or no)	P<0.05	“chisq.test” function from the stats package

(Continued)

TABLE 1 Continued

Type of test	Reason	Explanatory variable	Response variable	Significance	Packages and functions in R software (R Core Team, 2021)
One-wayAnova	was influenced by gender To verify whether the respondent's schooling influences the number of hours they are willing to volunteer	Schooling (Elementary School (incomplete) Elementary School (complete) Middle SchoolHigh SchoolUniversity or more)	Hours (minutes) willing to volunteer	P<0.05	WPerm package (Weiss, 2015), using the "perm.oneway.anova" function from the wPerm package (Weiss, 2015) and estimated test significance through the Monte Carlo simulation method with 9,999 randomizations

median monthly income among respondents was USD 1 080, the correspondence of volunteer time with income revealed a contribution of USD 31.15 per year or USD 2.59 per month. The willingness to volunteer was influenced by the WTP to help maintain the manatee conservation fund ($X^2 = 55.9$; $P=0.0001$). The willingness to volunteer was not influenced by the gender of the respondents ($X^2 = 0.07$; $P=0.80$). The number of hours dedicated to volunteering did not differ between the respondents' schooling ($F=1.80$; $P<0.12$); that is, the respondents' schooling did not influence the number of hours they were willing to devote to volunteering. The intention to act as a volunteer was not influenced by the interviewee's gender ($X^2 = 0.07$; $P = 0.80$).

Willingness to accept absence

Among the manatee watching guides, 60% ($n=21$) would accept and suggested monetary compensation if manatees were no longer available for watching, 28.57% ($n=10$) could not state an amount, 8.57% ($n=3$) did not agree to receive compensation,

and 2.86% ($n=1$) declared that no amount of money could compensate the absence of manatees on site.

The median declared WAA value among the guides was USD 198 monthly.

Revenue from tourism related to West Indian manatee

Most tourists traveled in groups of three (46.67%) and stayed for five days or more (47.81%). Between January 2020 to February 2021, 13 955 tourists took the manatee watching. The fee charged for the tour during this period was USD 9, totaling a direct cost of USD 125 595.

Indirect expenditure related to such tourism (including travel costs, accommodation, food, and souvenirs) declared by the tourists totaled USD 273 412.35 (Table 4).

The sum of the direct and indirect costs from manatee watching was the amount this attraction and these animals inject into the local economy, which totaled USD 399 007.40 in the period studied. A total of 362 respondents accounted for

TABLE 2 Level of education and income of the interviewed categories.

Category	n	Schooling					Income Medians of monthly family income (USD)
		Elementary School (incomplete)	Elementary School (complete)	Middle School	High School	University or more	
Artisans	23	2	4	4	6	7	360 (n = 22 respondents)
Business owners	56	1	3	5	30	17	720 (n = 50 respondents)
Manatee watching guides	35	7	10	13	2	3	234 (n = 35 respondents)
Tour operators	8	0	0	1	5	2	900 (n = 8 respondents)
Tour guides	8	0	0	6	1	1	585 (n = 8 respondents)
Accommodation service providers	97	1	2	5	27	62	1 080 (n = 78 respondents)
Tourists	534	0	1	2	55	476	2 160 (n = 419 respondents)

TABLE 3 Willingness to pay (WTP) for West Indian manatee conservation according to interviewed categories.

Category	Accepted to pay and indicated a value of WTP (n)	WTP median in USD	WTP average in USD
Artesian	14	4.95	7.59
Business owners	32	9	12.66
Manatee watching guides	29	18	20.05
Tour operators	3	3.60	4.8
Tour guides	7	9	7.46
Accommodation service providers	31	9	13.71
Tourists	144	2.25	3.85

indirect expenditure, totaling USD 1 102.20 per tourist. By way of projection based on this average cost and the number of tour visitors in the study period, average revenue for manatee watching in the APACC was USD 15 381 623.10.

Feelings of tourists and level of satisfaction

In total, 95.13% (n=508) of the tourists who took the tour managed to view the manatees, while 4.31% (n=23) did not see them, and 0.56% (n=3) did not respond. Regarding their feelings when viewing/if they viewed the animal, 97.72% (n=514) of the tourists declared positive feelings (excitement, confidence, contemplation, awe, emotion, enchantment, enthusiasm, happiness, surprise). Negative feelings, such as frustration and sadness, were reported by 0.95% (n=5); while 1.33% (n=7) said they felt indifferent.

Regarding the level of satisfaction, 74.81% (n=398) of tourists rated the tour with a score of 5, that is, they were very satisfied with the information received. Moreover, 18.80%

(n=100) rate the tour 4, 4.51% (n=24) gave a score of 3, 1.13% (n=6) rated the tour 2, and 0.75% (n=4) rated the tour 1, that is, they were very dissatisfied.

Discussion

In general, most of the survey respondents were had a high level of education, an median monthly income of USD 1 800 and a greater participation, in the responses, of the female gender. In this study, just under half of the respondents were in favor of contributing and would be willing to donate to a conservation fund. This favorable number of respondents corroborates the numbers found in other studies (Solomon et al., 2004; Paiva, 2015; Ferreira et al., 2017). The WTP value of the respondents (excluding tourists) was USD 13.66 per month, which is lower than the value declared by residents interviewed in Florida (Solomon et al., 2004). Excluding the respondents who were unwilling to donate any amount, the current days corrected WTP value in Florida averaged USD 33,63 per survey respondent (Solomon et al., 2004). In the present study, more

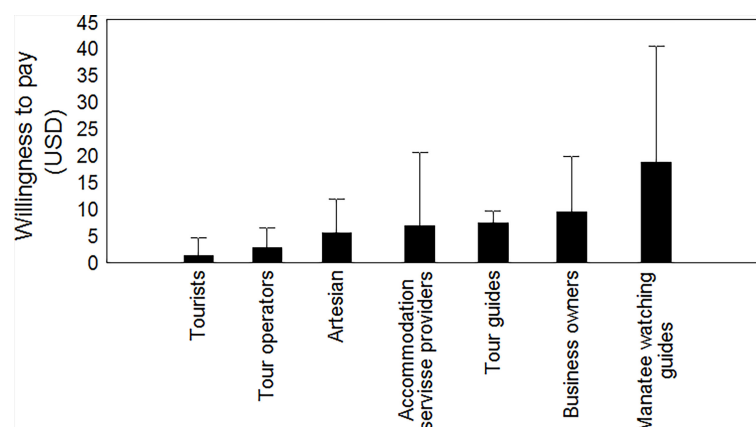


FIGURE 2

Average amounts in dollars (USD) that respondents would be willing to pay to maintain the manatee conservation fund, according to categories. Vertical bars indicate \pm standard deviation.

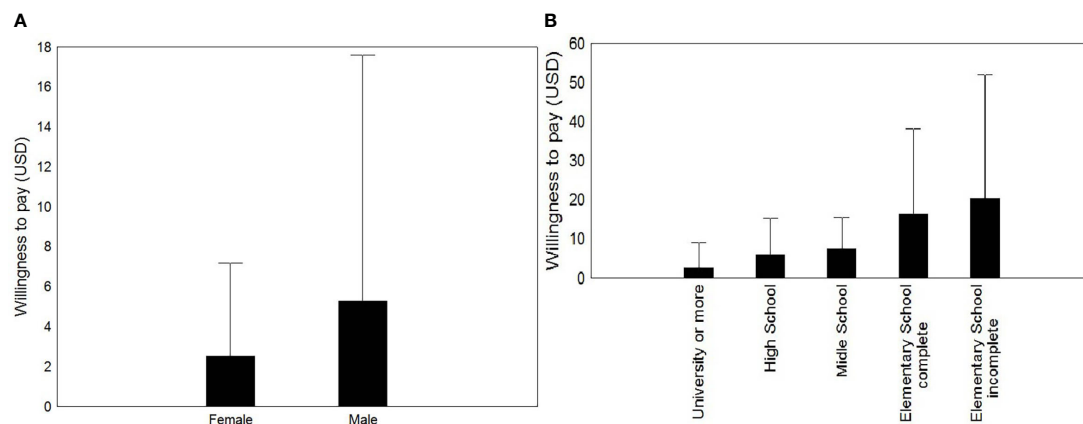


FIGURE 3

(A) Average amounts in dollars (USD) that respondents would be willing to pay to pay (WTP) to maintain the manatee conservation fund, according to gender. (B) Average amounts in dollars (USD) that respondents would be willing to pay to pay (WTP) to maintain the manatee conservation fund, according to their level of education. Vertical bars indicate \pm standard deviation.

women agreed (53.56%) to participate in the research and more willing to pay the fee (53.08%); however, the men stated they would donate a higher amount, as also reported by Paiva (2015) and Solomon et al. (2004). Most of the studies reviewed by Yang et al. (2018), however, showed no significant differences between men and women with respect to recreation, tourism, and other cultural ecosystem services.

In relation to schooling, the categories directly related to the tourism production chain were the respondents with lowest level of education. These actors were also those who wished to donate higher amounts for maintaining the conservation fund compared to those with a higher level of education ($F=19.69$; $P<0.001$). This result was contrary to the results found by Malinauskaitė et al. (2020), who noted that people with a higher school education level were more likely to pay a conservation-oriented fee.

With respect the interaction between income and WTP, it was observed that the higher the income, the lower the amount the respondent was willing to donate to the conservation fund, as also found by Paiva (2015). The monthly income of the tourism-related social actors (except for tour operators) was lower than

the income of the tourists, and yet the WTP of these sectors was higher than that of the tourists. On average, the manatee watching guides were willing to donate the highest amounts. The greater willingness of the tourism-related actors to donate to a conservation fund may be related to the fact that they benefit financially from the presence of manatees at that location. The tourists declared the lowest donation values compared to the others, although their category has the second highest income. The minority of tourists traveled to the location motivated by the presence of manatees, and they were the most favorable regarding WTP. This fact suggests that awareness and conservation campaigns could help promote the tour nationally. Such efforts would attract more visitors interested in viewing the animal and contribute financially to its conservation, if a fund were available for this purpose. About the institution that would administrate the conservation fund, most respondents declared greater confidence in non-governmental organizations for this purpose. By way of justification, some respondents stated they were dissatisfied with the public management of other services and attractions in Brazil. Moreover, in regard to public management, they feared corruption and embezzlement of funds.

The willingness to support the conservation of manatees was also evaluated through volunteer work, which was approved by most of the respondents. The visitors who intended to donate an amount to maintain the fund were also the most willing to work as volunteers, while those who had no intention of contributing financially did not intend to work as volunteers.

Regarding the WAA, most manatee watching guides agreed to contribute and suggested an amount. The mean monthly declared amount in the case of absence of manatee watching operation was equivalent to a minimum wage, which is similar to the amount they usually earn for this activity. Only one driver

TABLE 4 Indirect costs associated with manatee watching from January 2020 to February 2021.

Indirect costs	Values (USD)
Accommodation	154 345.05 (n = 396 respondents)
Food	54 392.94 (n = 432 respondents)
Transport (including airfare)	49 407.30 (n = 306 respondents)
Souvenirs	15 267.06 (n = 313 respondents)
TOTAL	273 412.35

replied that no amount of money would pay for the absence of manatees on site. The locally led ecotourism initiative for the observation of *T. manatus* was established to manage the conflict between fishermen and conservationists, while increasing public awareness of the subject (Normande et al., 2015). Tourism with these animals has gained national visibility in recent years and has promoted the conservation of the species and income generation for the local community (Camêlo and Araujo, 2018). In Greenland, for example, when respondents were asked what would happen to their community should whales disappear from their area, most stated they could not imagine such a scenario since these animals represented a part of what they are as people (Malinauskaite et al., 2021). Similarly, the *Associação Peixe-Boi* strengthened the sense of cooperation among residents, both to promote tourism and to guarantee their rights over the location. Thus, tourism, along with other traditional economic activities, is a strong rallying and support point for local societies that increases the local community's sense of belonging to a place (Camêlo and Araujo, 2018).

According to Goodwin and Roe (2001), in some areas, tourism can generate significantly higher financial returns and revenue than other wildlife uses. The average length of stay of tourists in the present study area was similar to other places with aquatic mammal observation tourism (Tischer et al., 2018). In relation to net revenue, Wilson and Tisdell (2003) showed that whale watching attracted 62,670 visitors and AUD 30 million for the Hervey Bay region (Australia). According to Guidino et al. (2020), the total expenditure of tourists who traveled for whale watching exceeded USD 3 million in Peru. In 2009, around 70 000 visitors spent around USD 2 625 000 in Fernando de Noronha, exclusively due to dolphin watching (Silva-Júnior, 2010). Marine tourism that involves cetacean watching requires high-cost logistics due to the large vessels and need for fossil fuel and skilled crew for navigation, all of which increase the ticket cost. Consequently, cetacean watching can be very costly for tourists (O'Connor et al., 2009). In general, sirenians are much less attractive to tourists than many other marine mammals. In addition to being less well known, sirenians often occur in turbid water with limited underwater visibility, do not exhibit spectacular surface behaviors, and can be wary and difficult to approach. Even so, Florida manatees engender passion and interest in the local populace and visitors alike (Ponnampalam et al., 2022). Regarding the tourist benefits, Solomon et al. (2004) estimated a gross total, the current days correcte, of USD 24 338,79 (considering transportation, lodging, dining and retail purchases) for the 30 000 tourists per year who visit the Citrus County (Florida) to view manatees. However, it is important to emphasize that the logistics structure of the manatee-watching tour in Florida is more expensive than in Brazil. Manatee tourism in Florida is big business and it includes more than a dozen locations throughout the state and a variety of ways to interact and observe them such as: snorkeling, diving, kayaking, canoeing, platform viewing, among others (Solomon et al., 2004). In Brazil,

tourists cannot under any circumstances have any physical contact with the animals (ICMBio, 2021). In the present study, the tourist costs for manatee watching were most likely underestimated regarding the total contribution to the economy of this activity. Since the study was conducted during the coronavirus pandemic, tourist activities were suspended for five months, leading to interferences. Furthermore, of the 534 tourists interviewed, 362 respondents answered the questions related to indirect costs. Therefore, the response rate was 67.74%, thus approaching the response rate presented by Guidino et al. (2020). The highest tourist expenses at the APACC were with accommodation, food, and transportation, as also found by Guidino et al. (2020) and Solomon et al. (2004).

Unlike manatee watching in Florida, which attracts around an estimated 380 000 and 590 000 visitors a year, respectively, to Crystal River and Blue Springs (Ponnampalam et al., 2022) in the present study, only 16.10% of tourists knew about the manatees and visited the location to observe the animals. Most of the respondents learned about the attraction after arriving at the location. In contrast, whale watching has become an important revenue generator in recent years (Einarsson, 2009; Cook et al., 2020). According to the study by O'Connor et al. (2009), global estimated revenue from whale watching was USD 2.1 billion per year, attracting more than 13 million tourists and employing more than 13,000 people in 119 countries. In the case of Iceland, whale watching has expanded with tourism and is currently the largest economic sector in the country, totaling around USD 33 million per year in direct revenue (Malinauskaite et al., 2020). Since whales are highly migratory species that cannot be confined to a marine ecosystem, the forms of regulating, maintaining, and provisioning of associated ecosystem services are limited and difficult to measure when they are not present in a given tourist location (Malinauskaite et al., 2021). Manatees on the central West Coast of Florida aggregate in large numbers in the warm springs during the winter (Sorice et al., 2003; King and Heinen, 2004; Solomon et al., 2004; Sorice et al., 2006; Ponnampalam et al., 2022), which makes them easier to locate by tour operators and guides. In Brazil, part of the manatees observed in Porto de Pedras is released and remains at the location, with no seasonality of occurrence. For this reason, this type of tourism can occur all year round.

In the place where manatee watching is authorized as a tourist product, negative impacts to manatees are low because normative instructions regulate the activity. The transit of motorized vessels is prohibited, avoiding noise disturbance and risk of collisions. However, there are reports of harassment by marine manatees outside the area intended for manatee watching. As a result, in the review of the APACC management plan (ICMBio, 2021), the needs for planning awareness campaigns on harassment and appropriate conduct when encountering a marine manatee were added.

According to Zeppel and Muloïn (2008), marine wildlife tours offer a number of education and conservation benefits to visitors.

The information that tourists receive during the trips seems to directly influence their behavior (Zeppel, 2008). According to Schänzel and McIntosh (2000), this type of tourism provides cognitive benefits, such as improved environmental awareness and mood (endearment). An encounter with a manatee is a unique experience that involves interacting with a large and docile marine mammal (Sorice et al., 2003). In the present study, feelings of well-being and positive emotions were stated by almost all respondents (97.90%) after seeing or if they saw the manatee. Overall, Lück and Porter (2017) noted that respondents were satisfied with the dolphin swim ride, as revealed by high satisfaction scores. Vidal et al. (2013) reported feelings considered positive (joy, excitement) in 53% of respondents who visited the Flutuante dos Botos (floating house of the Amazon River dolphin), in the Parque Nacional de Anavilhanas (Anavilhanas National Park), state of Amazonas, Brazil. Pleasant feelings resulting from charisma provide an “affective” dimension particularly associated with strong emotional responses, especially as feedback for the esthetic appeal of the appearance and behavior of the animal in question (Lorimer, 2007). According to McGinlay et al. (2017), people’s “aesthetic perspective” favors “charismatic megavertebrates”. Factors such as rarity, visual appearance, size, and cultural familiarity can influence our charisma for mammals (MacDonald et al., 2015). According to Malinauskaitė et al. (2021), whale watching guides and operators reported that spotting a whale for the first time can be a highly sought-after and even spiritual experience due to the rarity and sheer size of these animals. Once the protection of charismatic species is guaranteed, these symbols can ensure environmental survival and attract large contingents of people to visit and view them, while providing leisure and a source of income for the local community (Vilas Boas and Dias, 2010). Charisma can be expanded through marketing and is open to a certain degree of construction by conservationists; however, it is also limited by particular ecological characteristics of the species themselves (Lorimer, 2007).

Conclusion

Current knowledge demonstrates that marine mammal watching tourism provides physical and emotional well-being, which is increasingly sought by visitors who appreciate this type of experience. The significance given to the need for spiritual and mental well-being is currently considered as important as access to other natural resources of consumption. Recognizing and understanding the ecosystem services provided by our biodiversity is a major step towards promoting more favorable decision-making and ensuring the protection of the ecosystems that provide these services.

The revenue from manatee watching tourism, shown in the present study, further confirm that maintaining this attraction highly benefits the community in which the manatees occur. Manatee watching in Brazil could become more attractive with

the use of technologies, such as hydrophones equipment, which would provide tourists with the experience of hearing underwater environments and even vocalizations of nearby West Indian manatees. Even with all the advantages resulting from the observation of the manatee, possible negative consequences resulting from the increase in the search for the attraction must be foreseen in the local environmental regulations.

In general, increased awareness and interest in aquatic mammals supports the argument that the ecological and cultural contribution of these animals is more beneficial than when merely used for provision. Moreover, the high satisfaction declared by visitors helps restore and maintain the local way of life.

In this regard, however, the institutions responsible for developing and standardizing the tour did not appropriately promote the attraction. More elaborate and far-reaching advertising in the local and national media and tourism operators could help attract a greater number of tourists who visit the APACC to watch the manatees. Moreover, more widespread awareness of the attraction could add value to local tourism and differentiate it from the other already popular sun and beach tourist destinations in northeastern Brazil.

The information presented in this study is unpublished and sheds valuable insight into the monetary value of manatees and their potential cultural benefits to other APACC communities.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee State University of Santa Cruz (CAAE 03964918.0.0000.5526). The patients/participants provided their written informed consent to participate in this study.

Author contributions

FI, AS contributed to conception and design of the study. FI organized the database and performed the statistical analysis. FI wrote the first draft of the manuscript. FI and AS wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

Funding

This work was funded by the *Universidade Estadual de Santa Cruz* [grant 073.6762.2021.0003339-01] and was supported by the *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq) via a productivity grant granted to AS.

Acknowledgments

Our thanks to all the interviewed dedicated their time to participate in this study. We also thank Romário Oliveira de Santana for the contributions with the figures, Karine Borges Machado for assist in the statistical analysis and Renato de Mei Romero for the discussions and reflections. We are very grateful to the Instituto Federal de Alagoas for allowing the FBI to pursue a doctorate.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

- Adams, C., Aznar, C. E., Motta, R. S., Ortiz, R. A., and Reid, J. (2003). *Valoração econômica do parque estadual morro do diabo (SP)* (São Paulo: Páginas & Letras Editora e Gráfica).
- Andrade, M. C. M., Luna, F. O., and Reis, M. L. (2011). "Peixe-boi-da-Amazônia (*Trichechus inunguis*), peixe-boi marinho (*Trichechus manatus manatus*)," in *Plano de ação nacional para a conservação dos sirênios* (Brasília: Instituto Chico Mendes, ICMBio).
- Anzolin, D. G., Sarkis, J. E. S., Diaz, E., Soares, D. G., Serrano, I. L., Borges, J. C. G., et al. (2012). Contaminant concentrations, biochemical and hematological biomarkers in blood of West Indian manatees *trichechus manatus* from Brazil. *Mar. pollut. Bull.* 64, 1402–1408. doi: 10.1016/j.marpolbul.2012.04.018
- Attademo, F. L. N., Balensiefer, D. C., Freire, A. C. B., Sousa, G. P., Cunha, F. A. G. C., and Luna, F. O. (2015). Debris ingestion by the antillean manatee (*Trichechus manatus manatus*). *Mar. pollut. Bull.* 101, 284–287. doi: 10.1016/j.marpolbul.2015.09.040
- Bailey, K. (1994). *Methods of social research (4th ed.)* (New York: The Free Press).
- Balensiefer, D. C., Attademo, F. L. N., Sousa, G. P., Freire, A. C. B., Cunha, F. A. G. C., Alencar, A. E. B., et al. (2017). Three decades of antillean manatee (*Trichechus manatus manatus*) stranding along the Brazilian coast. *Trop. Conserv. Sci.* 10, 1–9. doi: 10.1177/1940082917728375
- Barney, E. C., Mintzes, J. J., and Yen, C. F. (2005). Assessing knowledge, attitudes, and behavior toward charismatic megafauna: The case of dolphins. *J. Environ. Educ.* 36, 2. doi: 10.3200/JOEE.36.2.41-55
- Beattie, A. (2005). "New products and industries from biodiversity," in *Ecosystems and human well-being: Current state and trends: findings of the condition and trends working group, millennium ecosystem assessment* (Washington, DC: Island Press), 271–295.
- Braga, M. B., and Selva, V. S. F. (2016). O Turismo de base comunitária pode ser um caminho para o desenvolvimento local? *Rev. Eletrônica Do PRODEMA* 10, 1. doi: 10.22411/rede2016.1001.03
- Brasil (1997). *Dispõe sobre a criação da Área de proteção ambiental da Costa dos corais, nos estados de alagoas e pernambuco, e dá outras providências* Vol. 24 (Brasil: Diário Oficial da União).
- Camêlo, A. R. S., and Araujo, L. M. (2018). O Olhar local sobre o turismo na rota ecológica (AL). *Rev. Bras. Ecoturismo* 11 (1), 81–105.
- Cook, D., Malinauskaite, L., Davíðsdóttir, B., Ögmundardóttir, H., and Roman, J. (2020). Reflections on the ecosystem services of whales and valuing their contribution to human well-being. *Ocean Coast. Manage.* 186, 1–12. doi: 10.1016/j.ocecoaman.2020.105100
- Cook, D., Malinauskaite, L., Roman, J., Davíðsdóttir, B., and Ögmundardóttir, H. (2019). Whale sanctuaries – an analysis of their contribution to marine ecosystem-based management. *Ocean Coast. Manage.* 182, 104987. doi: 10.1016/j.ocecoaman.2019.104987
- Daily, G. C. (1997). *Nature's services: Societal dependence on natural ecosystems* (Washington: Island Press).
- Domning, D. P. (1982). Commercial exploitation of manatees *Trichechus* in Brazil c. 1785–1973. *Biol. Conserv.* 22, 101–126. doi: 10.1016/0006-3207(82)90009-X
- Eastwood, A., Brooker, R., Irvine, R. J., Artz, R. R. E., Norton, L. R., Bullock, J. M., et al. (2016). Does nature conservation enhance ecosystem services delivery? *Ecosyst. Serv.* 17, 156–162. doi: 10.1016/j.ecoser.2015.12.001
- Einarsson, N. (2009). From good to eat to good to watch: whale watching, adaptation and change in icelandic fishing communities. *Polar Res.* 28 (1). doi: 10.1111/j.1751-8369.2008.00092.x
- Felipe-Lucia, M. R., Comin, F. A., and Escalera-Reyes, J. (2015). A framework for the social valuation of ecosystem services. *AMBIO* 44, 308–318. doi: 10.1007/s13280-014-0555-2
- Ferreira, A. M., Marques, J. C., and Seixas, S. (2017). Integrating marine ecosystem conservation and ecosystems services economic valuation: Implications for coastal zones governance. *Ecol. Indic.* 77, 114–122. doi: 10.1016/j.ecolind.2017.01.036
- Forestell, P. H. (2008). "Popular culture and literature," in *Encyclopedia of marine mammals*, 2. Eds. W. Perrin, B. Würsig and J. Thewissen (San Diego, CA: Academic Press), 898–913.
- Guidino, C., Campbell, E., Alcorta, B., Gonzalez, V., Mangel, J. C., Pacheco, A. S., et al. (2020). Whale watching in northern Peru: An economic boom? *Tourism Mar. Envir.* 15:1, 1–10. doi: 10.3727/154427320X15819596320544
- Goodwin, H., and Roe, D. (2001). Tourism, livelihoods and protected areas: Opportunities for fair-trade tourism in and around national parks. *Int. J. Tourism Res.* 3. doi: 10.1002/jtr.350
- Hageman, R. (1985). *Valuing marine mammal populations: Benefit valuations in a multi-species ecosystem*. (La Jolla, CA: Southwest Fisheries Center, National Marine Fisheries Service).
- Hausmann, A., Slotow, R., Fraser, I., and Di Minin, E. (2017). Ecotourism marketing alternative to charismatic megafauna can also support biodiversity conservation. *Anim. Conserv.* 20:1, 91–100. doi: 10.1111/acv.12292
- Hervé, M. (2021) *RVAideMemoire: Testing and plotting procedures for biostatistics*. Available at: <https://CRAN.R-project.org/package=RVAideMemoire>.
- Hoyt, E., and Parsons, E. C. M. (2014). "The whale-watching industry: Historical development," in *Whale-watching*. Eds. J. Higham, L. Bejder and R. Williams (Cambridge, UK: Cambridge University Press). doi: 10.1017/CBO9781139018166.006
- IBGE-Instituto Brasileiro de Geografia e Estatística (2017) *Maceió*. Available at: <https://cidades.ibge.gov.br/brasil/al/maceio/panorama> (Accessed 25 June 2022).
- ICMBio - Instituto Chico Mendes de Conservação da Biodiversidade (2013). *Plano de manejo da Área de proteção ambiental Costa dos corais*. (Tamandaré, PE, Brazil: MMA/ICMBio).

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmars.2022.1002855/full#supplementary-material>

- ICMBio - Instituto Chico Mendes de Conservação da Biodiversidade (2021). *Plano de manejo da Área de proteção ambiental Costa dos corais*. (Tamararé, PE, Brazil: MMA/ICMBio).
- Isbell, F., Gonzalez, A., Loreau, M., Cowles, J., Diaz, S., Hector, A., et al. (2017). Linking the influence and dependence of people on biodiversity across scales. *Nature* 546, 7656. doi: 10.1038/nature22899
- Isbell, F., Tilman, D., Polasky, S., and Loreau, M. (2015). The biodiversity-dependent ecosystem service debt. *Ecol. Lett.* 18, 2. doi: 10.1111/ele.12393
- Izidoro, F. B., Romero, R. M., and Schiavetti, A. (2022). Knowledge of marine mammal professionals on ecosystem services associated with the marine manatee (*Trichechus manatus*) in Brazil. *Ethnobiol. Conserv.* 11, 20. doi: 10.15451/ec2022-07-11.20-1-13
- King, J. M., and Heinen, J. T. (2004). An assessment of the behaviors of overwintering manatees as influenced by interactions with tourists at two sites in central Florida. *Biol. Conserv.* 117, 3. doi: 10.1016/j.biocon.2003.07.001
- Knowles, T., and Campbell, R. (2011). *What's a whale worth? valuing whales for national whale day, a report for the international fund for animal welfare (IFAW)* (Melbourne, Australia: Economists at Large).
- Laurila-Pant, M., Lehtikoinen, A., Uusitalo, L., and Venesjärvi, R. (2015). How to value biodiversity in environmental management? *Ecol. Indic.* 55, 1–11. doi: 10.1016/j.ecolind.2015.02.034
- Likert, R. (1932). *A technique for the measurement of attitudes* (5–55: Archives of Psychology).
- Lima, R. P. (2008). Distribuição espacial e temporal de peixes-bois (*Trichechus manatus*) reintroduzidos no litoral nordeste e avaliação da primeira década (1994–2004) do programa de reintrodução (Recife PE: Universidade Federal de Pernambuco), 161.
- Loomis, J. B., and Larson, D. M. (1994). Total economic values of increasing Gray whale populations: Results from a contingent valuation survey of visitors and households. *Mar. Resour. Econ.* 9, 3. doi: 10.1086/mre.9.3.42629085
- Lorimer, J. (2007). Nonhuman charisma. *Environ. Plann. D: Soc. Space* 25 (5), 911–932. doi: 10.1068/d71j
- Lück, M., and Porter, B. A. (2017). Experiences on swim-with-dolphins tours: An importance–performance analysis of dolphin tour participants in Kaikoura, New Zealand. *Journal of Ecotourism* (Informa UK Limited: Trading as Taylor & Francis Group) 18.1, 1–17. doi: 10.1080/14724049.2017.1353609
- Luna, F. D. O., Araújo, J. P., Lima, R. P., Pessanha, M. M., Soavinski, R. J., and Passavante, J. Z. O. (2008b). Captura e utilização do peixe-boi marinho (*Trichechus manatus manatus*) no litoral norte do Brasil. *Biotemas* 21, 1. doi: 10.5007/2175-7925.2008v21n1p115
- Luna, F. O., Bonde, R. K., Attademo, F. L. N., Saunders, J. W., Meigs-Friend, G., Passavante, J. Z. O., et al. (2012). Phylogeographic implications for release of critically endangered manatee calves rescued in northeast Brazil. *Aquat. Conserv.: Mar. Freshw. Ecosyst.* 22:5. doi: 10.1002/aqc.2260
- Luna, F. O., Lima, R. P., and Araújo, J. P. (2008a). *Status de conservação do peixe-boi marinho (Trichechus manatus manatus linnaeus 1758) no Brasil* (10:2, 145–153: Revista Brasileira de Zootecias).
- Macdonald, E.A., Burnhamb, D., Hinks, A.E., Dickman, A.J., Malhi, Y., and Macdonald, D.W. (2015). Conservation inequality and the charismatic cat: *Felis felis*. *Glob. Ecol. and Conserv.* 3. doi: 10.1016/j.gecco.2015.04.006
- Malinauskaitė, L., Cook, D., Daviðsdóttir, B., Ögmundardóttir, H., and Roman, J. (2020). Willingness to pay for expansion of the whale sanctuary in faxesflói bay, Iceland: A contingent valuation study. *Ocean Coast. Manage.* 183, 105026. doi: 10.1016/j.ocecoaman.2019.105026
- Malinauskaitė, L., David, C., Daviðsdóttir, B., and Ögmundardóttir, H. (2021). “Whale ecosystem services and Co-production processes underpinning human wellbeing in the Arctic: Case studies from Greenland, Iceland and Norway,” in *Nordic Perspectives on the responsible development of the Arctic: Pathways to action*. Ed. D. C. Nord (Switzerland, AG: Springer Polar Sciences), 181–202.
- McGinlay, J., Parsons, D. J., Morris, J., Hubatova, M., Graves, A., Bradbury, R. B., et al. (2017). Do charismatic species groups generate more cultural ecosystem service benefits? *Ecosyst. Serv.* 27, 15–24. doi: 10.1016/j.ecoser.2017.07.007
- Meirelles, A. C. O. (2008). Mortality of the antillean manatee, *Trichechus manatus manatus*, in Ceará state, north-eastern Brazil. *J. Mar. Biol. Assoc. United Kingdom* 88, 6. doi: 10.1017/S0025315408000817
- Moraes, A. S., Sampaio, Y. S. M., and Seidl, A. (2015). “Quanto vale o pantanal? a valoração ambiental aplicada ao bioma pantanal,” in *Valoração de serviços ecossistêmicos: metodologias e estudos de caso*. Eds. S. G. Tôsto, L. C. Belarmino, A. R. Romeiro and C. A. G. Rodrigues (Brasília, DF: Embrapa), 95–115.
- Motta, R. S. (1997). *Manual para valoração econômica de recursos ambientais* (Brasília: Ministério do Meio Ambiente, dos Recursos Hídricos e da Amazônia Legal IPEA/MMA/PNUD/CNPq).
- Normande, I. C., Luna, F. D. O., Malhado, A. C. M., Borges, J. C. G., Viana Junior, P. C., Attademo, F. L. N., et al. (2015). Eighteen years of antillean manatee *Trichechus manatus manatus* releases in Brazil: lessons learnt. *Oryx* 49:2, 338–344. doi: 10.1017/S0030605313000896
- O'Connor, S., Campbell, R., Cortez, H., and Knowles, T. (2009). *Whale watching worldwide: tourism numbers, expenditures and expanding economic benefits, a special report from the international fund for animal welfare* (Yarmouth: Economists at Large).
- Oliveira, A. T. (2019). *Avaliação de impactos socioambientais do turismo na rota ecológica dos milagres (AL)* (Arapiraca: Eduneal).
- Paiva, R. F. P. S. (2015). “A valoração ambiental a partir da economia ecológica: Um estudo de caso para a poluição hídrica na cidade de Volta redonda, RJ,” in *Valoração de serviços ecossistêmicos: Metodologias e estudos de caso*. Eds. S. G. Tôsto, L. C. Belarmino, A. R. Romeiro and C. A. G. Rodrigues (Brasília, DF: Embrapa), 95–115.
- Parente, C. L., Vergara-Parente, J. E., and Lima, R. P. (2004). Strandings of antillean manatees, *Trichechus manatus manatus*, in northeastern Brazil. *LAJAM* 3:1, 69–75. doi: 10.5597/lajam00050
- Patroni, J., Newsome, D., Kerr, D., Sumanapla, D. P., and Simpson, G. D. (2019). Reflecting on the human dimensions of wild dolphin tourism in marine environments. *Tourism Hosp. Manage.* 25:1, 141–160. doi: 10.20867/thm.25.1.8
- Ponnampalam, L. S., Keith-Diagne, L., Marmontel, M., Marshall, C. D., Reep, R. L., Powell, J., et al. (2022). “Historical and current interactions with humans,” in *Ethology and behavioral ecology of sirenias*. Ed. H. Marsh (Switzerland, AG: Springer, Cham), 299–349. doi: 10.1007/978-3-030-90742-6_7
- R core Team (2021). *A language and environment for statistical computing* (Vienna, Austria: R Core Team organization, R Foundation for Statistical Computing).
- Reid, W. V., Mooney, H. A., Cropper, A., Capistrano, D., Carpenter, S. R., Chopra, K., et al. (2005). *Ecosystems and human well-being-Synthesis: A report of the millennium ecosystem assessment* (Washington: Island Press).
- Sagebiel, J., Schwartz, C., Rhozyel, M., Rajimis, S., and Hirschfeld, J. (2016). Economic valuation of Baltic marine ecosystem services: blind spots and limited consistency. *ICES J. Mar. Sci.* 73:4, 991–1003. doi: 10.1093/icesjms/ftv264
- Schänzel, H. A., and McIntosh, A. J. (2000). An insight into the personal and emotive context of wildlife viewing at the penguin place, otago peninsula, new Zealand. *J. Sustain. Tourism* 8:1, 36–52. doi: 10.1080/09669580008667348
- Silva-Júnior, J. M. (2010). *Os golfinhos de noronha* (São Paulo: Bambu Editora e Artes Gráficas Ltda).
- Silva-Júnior, J. M. (2017). Turismo de observação de mamíferos aquáticos: benefícios, impactos e estratégias. *Rev. Bras. Ecoturismo* 10:2, 433–465. doi: 10.34024/rbecotur.2017.v10.6614
- Silva, V. M. F., Shepard, G., and Carmo, N. A. S. (2017). “Os mamíferos aquáticos: lendas, usos e interações com as populações humanas na Amazônia brasileira,” in *Olhares cruzados sobre as relações entre seres humanos e animais silvestres na Amazônia (Brasil, Guiana francesa)*. Eds. G. Marchand and F. V. Velden (Manaus, AM: Editora da Universidade Federal do Amazonas), 193–226.
- Solomon, B. D., Corey-Luse, C. M., and Halvorsen, K. E. (2004). The Florida manatee and eco-tourism: toward a safe minimum standard. *Ecol. Econ.* 50, 1–2. doi: 10.1016/j.ecolecon.2004.03.025
- Sorice, M. G., Shafer, C. S., and Ditton, R. B. (2006). Managing endangered species within the use–preservation paradox: The Florida manatee (*Trichechus manatus latirostris*) as a tourism attraction. *Environ. Manage.* 37:1, 69–83. doi: 10.1007/s00267-004-0125-7
- Sorice, M. G., Shafer, C. S., and Scott, D. (2003). Managing endangered species within the Use/Preservation paradox: Understanding and defining harassment of the West Indian manatee (*Trichechus manatus*). *Coast. Manage.* 31:4, 319–338. doi: 10.1080/08920750390232983
- Sousa, G. B., and Mota, J. A. (2006). Valoração econômica de áreas de recreação: O caso do Parque Metropolitano de Pituáçu, Salvador, BA *Revista de Economia* (Editora Universidade Federal do Paraná) 32:1, 37–55. doi: 10.5380/rev.32i1.6826
- Sparemberge, R. F. L., and Lacerda, J. (2015). *Os animais no direito brasileiro: desafios e perspectivas*. (Curiae - Direito - Universidade do Extremo Sul Catarinense: Revista Amicus Curiae) 12:2, 183–202.
- Thompson, B. S., and Rog, S. M. (2019). Beyond ecosystem services: Using charismatic megafauna as flagship species for mangrove forest conservation. *Environ. Sci. Policy* 102, 9–17. doi: 10.1016/j.envsci.2019.09.009
- Tischer, M. C., Schiavetti, A., Lima Silva, F. J., and Silva Júnior, J. M. (2018). A historical perspective on the life cycle of a tourist activity: Dolphin watching in Brazil's Fernando de Noronha archipelago. *Ethnobiol. Conserv.* 7:9, 1–25. doi: 10.15451/ec2018-06-7.9-1-25
- Vidal, M. D., Alves, L. C. P. S., Zappes, C. A., Andriolo, A., and Azevedo, A. F. (2017). “Percepção de pescadores sobre as interações de botos com a pesca e sua relação com o turismo de alimentação artificial em Novo Airão, Amazonas, Brasil,” in *Olhares cruzados sobre as relações entre seres humanos e animais*

silvestres na Amazônia (Brasil, Guiana francesa). Eds. G. Marchand and F. V. Velden (Manaus, AM: Editora da Universidade Federal do Amazonas), 103–120.

Vidal, M. D., Santos, P. M. C., Oliveira, C. V., and Melo, L. C. (2013). Perfil e percepção ambiental dos visitantes do flutuante dos botos, parque nacional de anavilhanas, Novo airão – AM. *Rev. Bras. Pesquisa Em Turismo* 7:3, 419–435. doi: 10.7784/rbtur.v7i3.583

Vilas Boas, M. H. A., and Dias, R. (2010). Biodiversidade e turismo: o significado e importância das espécies-bandeira. *Turismo E Sociedade* 3:1, 91–114. doi: 10.5380/tes.v3i1.16659

Weiss, N. L. (2015) *wPerm: Permutation tests*. Available at: <https://CRAN.R-project.org/package=wPerm>.

Whitehead, P. J. P. (1977). The former southern distribution of new world manatees (*Trichechus* spp.). *Biol. J. Linn. Soc.* 9, 2. doi: 10.1111/j.1095-8312.1977.tb00264.x

Wiener, C., Bejder, L., Johnston, D., Fawcett, L., and Wilkinson, P. (2020). Cashing in on spinners: Revenue estimates of wild dolphin-swim tourism in the Hawaiian islands. *Front. Mar. Sci.* 7. doi: 10.3389/fmars.2020.00660

Wilson, C., and Tisdell, C. (2003). Conservation and economic benefits of wildlife-based marine tourism: Sea turtles and whales as case studies. *Hum. Dimens. Wildl.* 8, 1. doi: 10.1080/10871200390180145

Yang, Y. C. E., Passarelli, S., Lovell, R. J., and Ringler, C. (2018). Gendered perspectives of ecosystem services: A systematic review. *Ecosyst. Serv.* 31, 58–67. doi: 10.1016/j.ecoser.2018.03.015

Zeppel, H. (2008). Education and conservation benefits of marine wildlife tours: Developing free-choice learning experiences. *J. Environ. Educ.* 39:3, 3–18. doi: 10.3200/JOEE.39.3.3-18

Zeppel, H., and Muloin, S. (2008). Conservation benefits of interpretation on marine wildlife tours. *Hum. Dimens. Wildl.* 13:4, 280–294. doi: 10.1080/10871200802187105