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Place attachment, wellbeing, and conservation in surf destination communities

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Frequently visited surf breaks are nested within unique ecosystems that face many underappreciated threats. This manuscript first explores the contribution of surfing to local wellbeing and analyses how wellbeing is impacted by different threats to surf ecosystems. The second aim is to gather local knowledge of, and desires for surf break protection in Bocas del Toro, Panama. Through qualitative interviews ($N = 17$) and surveys ($N = 46$), findings suggest that place attachment is tied to frequently visited surf breaks and is strongly correlated to the wellbeing derived from surfing. Surfing was also found to be the main reason 68% of the respondents moved to the archipelago. Length of time residing in Bocas, however, was not a predictor of place attachment. This might suggest that people migrate for certain aspects of surf ecosystems and that place attachment can perhaps be selected for and grow through experiences. Positive surfing experiences were also found to be under threat from several converging challenges related to sea level rise, coastal development, declining reef health, and overcrowding. Local surfers recognize that these threats are tied to global forces but seem more reactive in their fight to alleviate imminent visible threats. This research emphasizes the urgent need for dedicated institutions to effectively preserve frequently visited surf ecosystems in areas that are neither covered by global non-governmental surf protection organization campaigns nor dedicated legal protection frameworks. We also call for more attention dedicated to understanding how the benefits of surfing are nuanced, context based and tied to vulnerable places.

KEYWORDS

place attachment, wellbeing, protected areas, surf, conservation, development

Introduction

Surfing is a very important activity for an estimated 35 million people around the world (Mach and Ponting, 2021; Towner and Lemarie, 2020). Research dedicated to valuing the coastal environments where surfing takes place often rely on the direct expenditure approach, which assumes the value of surf breaks can be approximated by the amount surfers are willing to pay to visit and utilize these natural resources (Manero and Mach, 2023).

These valuations have been conducted at individual surf breaks like Uluwatu in Bali, Indonesia where researchers found that the break attracts more than 35 million USD per year in direct expenditures (Margules et al., 2014). Research has also been conducted on regions like Australia's Gold Coast where between 126 and 233 million AUS was found to

be spent per year (Lazarow, 2009) and nations like the United Kingdom, which was found to draw 4.95 billion UK per year (Mills and Cummins, 2015). Total international surf travel expenditures per year were also approximated at between 32 and 65 billion USD (Mach and Ponting, 2021; Manero and Mach, 2023).

This research has been conducted to highlight previously invisible values and often to incentivize surf break preservation against competing coastal uses (e.g., the construction of a marina or other coastal modifications). These direct expenditure techniques, however, limit our understanding of the various market and non-market benefits that can be derived from the rare coastal places around the world that provide quality and consistent surf experiences (Buckley and Cooper, 2023; Manero and Mach, 2023; Manero, 2023).

Cultural ecosystem services (CES) are the “[n]on-material benefits humans derive from the environment, and which contribute to our wellbeing in one or multiple ways” (Manero and Mach, 2023, p. 10). Mental health benefits (e.g., stress reduction, balanced mind and reduced mental healthcare costs) and overall wellbeing (e.g., an individual’s realization of the interconnected benefits associated a healthy body, balanced mind, social connectedness and connection with nature) are interlinked and have been argued to be important CES provided by surf ecosystems (Manero and Mach, 2023; Buckley and Cooper, 2023; Gibbs et al., 2022). The global mental health benefits from surfing have recently been valued somewhere between 380 billion and 1.3 trillion USD each year, which suggest these benefits alone equal as much as 13.5 times more than the direct expenditures (Buckley and Cooper, 2023). These benefits are said to come from physical immersion in blue spaces (Olive and Wheaton, 2020; Lisahunter and Stoodley, 2021). Surf therapy programs have also been developed with results suggesting that these interventions have great potential to relieve health issues associated with traumatic brain injuries (Gibbs et al., 2022), post-traumatic stress disorder (Caddick et al., 2015), and others (Britton et al., 2020).

More research is needed to holistically understand the level of benefits tied to particular places (Lisahunter and Stoodley, 2021; Waiti and Awatere, 2019; Wheaton et al., 2021). We find research to be lacking in terms of understanding whether a surfer can go anywhere and achieve the same wellbeing from a surfing session, or if this wellbeing should be ascribed to specific attributes of places and the communities that form around them? In our increasingly technological era, this is also wrapped up with understanding whether or not a surfer can achieve the same mental and physical health benefits from surfing in a wave pool as they can from surfing experiences in nature (Roberts and Ponting, 2018; Mach, 2017). In short, we need better ways of understanding how wellbeing is tied to specific surf ecosystems.

Save the Waves Coalition (STW), a non-governmental organization dedicated to protecting surf breaks around the world based in San Francisco, California, defines surf ecosystems as “the land to sea interface that create the conditions for breaking, rideable waves, and the flora and fauna and human communities that are dependent upon it” (STW, 2023). Surfing is incredibly important and valuable and surf experiences are inexorably tied to places around the world that provide quality sessions. Surf conservation has been argued to be especially critical in the context of the

accelerating vulnerabilities (e.g., rising sea levels, pollution, and coastal development) threatening the ability of surf ecosystems to continue to provide the conditions necessary to be enjoyed by surfers (Reineman et al., 2017; Manero and Mach, 2023; Arroyo et al., 2019; Sadrpour and Reineman, 2023). At present, most research dedicated to valuing surf breaks takes the actual ecosystem services required as static and assumes their perpetuation into the future (Buckley and Cooper, 2023; Mach and Ponting, 2021). This disregards how much value might be lost by the failure to preserve the conditions that allow for valuable surfing experiences in different places around the world. Knowledge is specifically lacking on the surfing and wellbeing nexus in the Global South.

To help address these gaps, this research is dedicated to understanding the local surf community in Bocas del Toro, Panama (Bocas), an emerging and reef dependent surf tourism destination. Interview data suggests that surf tourism began to take off on the archipelago in 2009 after a Red Bull video showed pro surfers Julian Wilson, Ian Walsh, and Jamie Obrien surfing and praising several of the reef and beach breaks on the archipelago (Mach, 2019). At the time, these pro surfers were recorded saying that they were alone surfing some of the best and most powerful waves they had seen (Red Bull Surfing, 2009). This is the type of desirable imagery that conveys the critical symbolic elements (e.g., uncrowded surf, pristine tropical environment, and quality waves) propelling the multi-billion dollar surf tourism industry (Ponting, 2009; Ponting and McDonald, 2013). In 2009, surfers also had an *ad hoc* trash dump moved from the surf zone, which opened that break (Dumpers) and the coast beyond it for further surf exploration (Mach, 2021). The confluence of cleaning up surf-breaks and more information getting out about wave quality facilitated the surf tourism industry to grow alongside of a general tourism boom. Many surfers have since moved to the archipelago and residents have picked up surfing (Mach, 2021). The goal is to understand place attachment to surf ecosystems around the archipelago and its ties to holistic determinants of wellbeing (Gibbs et al., 2022) derived from surfing amidst the background of rapid tourism growth and converging environmental threats. Threats impacting surf-related wellbeing and knowledge of, and desire for protected surf ecosystems are also explored.

Literature review

Surfing and wellbeing

Immersion in blue spaces (aquatic environments) through surfing has been attributed to enhanced wellbeing created through strong bonds between surfers and coastal spaces, which links health between marine environments and people (Wheaton et al., 2021; Lisahunter and Stoodley, 2021). People who live closer to the coast generally display better mental health, such as lower levels of depression and anxiety (Amrhein et al., 2016). Associatively, they have been found to participate in physical activity more often than those who live inland (White et al., 2020). Research is lacking on the general mechanisms that might induce the wellbeing benefits associated with surfing. Moreton et al. (2022) proposed theoretically that these benefits are likely derived from some

combination of the ways surfing facilitates (1) social and (2) environmental connection; (3) disrupts inflammation through exercise and transcendent emotions; (4) natural light exposure; (5) and by providing respite from negative rumination. Surfing was also found to be vital toward maintaining surfer wellbeing during the pandemic through generating positive emotions, staying physically healthy and relieving stress (Usher, 2023; Mach, 2021). Surfers also reported high levels of stress and frustration during lockdowns when they were unable to surf (Usher, 2023).

Surfing and wellbeing has been studied more in relation to the therapeutic benefits associated with targeted surf therapy programs (Britton et al., 2020; Caddick et al., 2015; Gibbs et al., 2022). To examine the benefits of a surf therapy program for people recovering from acquired brain injuries, Gibbs et al. (2022) utilized the GENIAL framework for assessing the holistic determinants of wellbeing (derived from a biopsychosocial ecological perspective) and their interrelatedness. GENIAL is an acronym for: “Genomics and its interaction with the Environment through health outcomes, highlighting a major regulatory role for the vagus Nerve over social Interaction and Allostatic regulation, subsequently leading to premature mortality or Longevity (Gibbs et al., 2022, p. 2). The authors emphasized the core domains of wellbeing: individual (including balanced mind and healthy body), the community (social connectedness) and the environmental domain (connection with nature) and found that surf therapy provided “a cascade of mechanisms for positive change” and enhanced holistic wellbeing in participants in the program (Gibbs et al., 2022). Studies such as Gibbs et al.’s (2022) corroborate the enduring mental and physical health benefits of participating in curated surf group therapy programs, but the general benefits derived from your average surfer taking to the waves most days in different contexts around the world require more dedicated research.

Surf ecosystems, place attachment, and protection

Because the land and sea are intertwined in the coastal spaces where surfing occurs, it is important that green and blue spaces be examined together (White et al., 2020) as complex and unique surf ecosystems (Manero and Mach, 2023; Arroyo et al., 2019; Scheske et al., 2019). In New Zealand, Atkin (2023) found that high quality surfing conditions occur in 0.0003% of the country’s coastline. While we cannot say this proportion is accurate for all nations, we argue surfing only occurs in a very small fraction of the earth’s coastal spaces, and it is therefore important that surf ecosystems be viewed distinctly. In Santa Cruz, California, research suggested that property prices close to surf breaks were on average \$100,000 USD higher than comparable homes of a similar distance from beaches without quality surfing resources (Scorse et al., 2015). Coastal communities should never be viewed as homogenous because they are always comprised of individuals representing different stakeholder groups (e.g., Indigenous residents, fisherfolk, tourism developers, government officials, and ocean recreationalists) who have both competing

and converging interests (Scott et al., 2024). There are also many diverse stakeholders representing a multitude of interests in surf ecosystems (Mach and Ponting, 2018). Surf breaks in those places, however, emerge as one of the most important ecosystem interactions for the historic residents who surf, as well as those who migrate to, or visit the area primarily to surf (Manero and Mach, 2023). While many studies have assessed the economic benefits of surf tourism and its contributions to economic growth (McGregor and Wills, 2016; Mach and Ponting, 2021), few have researched the multifaceted values surfers migrating to (or near) different surf ecosystems around the world bring to individuals and communities.

Surfers have been shown to possess a great deal of place attachment (defined as a combination of how much one identifies with and is dependent upon a place) to the areas where they surf (Reineman and Ardoin, 2017; Anderson, 2013). Dedicated surfers have also been proposed as effective citizen scientists. The amount of time they spend immersed in particular ecosystems allows them to develop highly specialized wave riding knowledge and facilitates a hyper sensitivity to changes in coastal spaces over time (Brewin et al., 2015; Reineman et al., 2017). Reineman and Ardoin (2017) found that surfers displayed place attachment to surf breaks and saw the surf breaks they knew best as a part of their identity.

This place attachment can manifest in diverse ways. Some surf communities focus efforts on localism, defined as local surfers’ territorial defense of “their” surfing space from outsiders (Usher, 2017; Nazer, 2004; Walker, 2005). Localism can be mild (e.g., enforcing etiquette) or heavy (e.g., violence and property damage) (Mach and Ponting, 2018). Place attachment can also manifest in the service of environmental protection when surfers band together to create protected areas to ensure their surf ecosystems are not influenced in ways that might negatively impact surf breaks (Arroyo et al., 2019; Manero, 2023; Falaix et al., 2021). This is advantageous to other more broad conservation objectives because most of the world’s quality surf resources are in biodiversity hotspots and near-to, but outside of, existing protected areas (Reineman et al., 2021).

To our knowledge, only two countries (Peru and New Zealand) have specifically enshrined surf ecosystem protection into law, but other nations (e.g., USA, Australia, and Costa Rica) are considering following this path (Manero, 2023; Orchard et al., 2023). Save the Waves Coalition (STW) also accepts proposals from coastal communities around the world to enter surf breaks (and the ecosystems surrounding them) into their World Surf Reserves (WSR) program. While WSR status does not inherently imply concomitant binding legal protections, designations are reliant on the creation of robust and diverse leadership councils and awards are based on the strength of their proposals to work toward ensuring surf-break protection (Arroyo et al., 2019). Currently there are 12 WSRs (STW, 2023).

Few surf ecosystems, however, are currently under any form of formal protection. In this vacuum, it would be helpful to better understand the general knowledge surfers have about existing wave protection laws or the World Surf Reserve program, and the general desire surfers have to place waves under protected status. This could help researchers better understand the barriers to surf break protection.

Methodology

Case context and rationale

Due to the frequent foreign incursions into Bocas after European “discovery” in the early 1500s, Indigenous communities have often fled and repopulated the archipelago depending on the level of interference they might receive from outsiders (Young and Bort, 1999). Following the construction of the Panama railway and Canal in the early 1900s, thousands of Afro-Antillean workers originally from Barbados, Santa Lucia, Martinique, and Jamaica migrated to Bocas to work on banana plantations operated by the United Fruit Company (UFCO) (Pleasant and Spalding, 2021; Guerron-Montero, 2006). When a disease ravaged the plantations in the 1920s and 1930s the UFCO left the archipelago, but many Afro-Antillean workers and Indigenous residents stayed to participate in subsistence agriculture and fisheries and small-scale commercial fisheries and charcoal production (Gordon, 1982).

Tourism has been growing rapidly since the early 2000s. Accurate visitation statistics are not kept, but there were only three hotels registered in the 1990s, in 2022, there were 118 registered hotel properties and 254 rentals listed on Airbnb.com (Mach et al., under review). Bocas del Toro is now one of the most popular tourism destinations in Panama. The country receives 16% of GDP from Tourism (WTTC, 2024). Spalding (2013) showed that the foreign-born population on the archipelago increased >250% between 2000 and 2010 and the foreign-born population continues to grow.

Bocas now attracts many different types of tourists including wildlife tourists (Mach et al., 2023; Sitar et al., 2017), party tourists (Mach et al., 2022), beachgoers, surf tourists (Mach, 2021) and divers. Younger tourists stay in hostels and budget lodging in Bocas Town (the urbanized southern tip of Isla Colon). They often visit bars and night clubs in that zone after spending the day taking boat trips to beaches, wildlife locations (e.g., Dolphin Bay, Starfish Beach, Sloth Island etc.), and snorkel and diving sites located on or near outer islands. More tourism investment is now occurring on outer islands (Scott et al., 2024) as well as outside of Bocas Town on Isla Colon including many hotels, restaurants, and Airbnbs—all being connected by a new major road construction project (Mach et al., In Press). This growth is coming with many social and ecological challenges (Bocas Breeze, 2023). Most of this investment is being driven by entrepreneurs and retirees from outside of Bocas and many local residents lack the capacity to participate effectively in the growing tourism economy (Pleasant and Spalding, 2021).

In neighboring Costa Rica, 17 percent of its 3 million annual international tourists participate in surfing (Boschetti and Hodges, 2021). It is not known what percentage of the tourism industry is inspired by surf tourism in Panama, but research suggests that it was one of the first forms to return to Bocas after the COVID-19 pandemic and that it is growing rapidly, which is causing over visitation to surf resources (Mach, 2021). The concomitant construction (e.g., roads, hotels, and plazas) is also having ecological impacts causing local tensions (Mach, 2021). Surf tourists now typically stay on Isla Colon, Carenero, or Bastimentos. They surf the waves on those islands, but also travel by boat to visit different reef and beach breaks (located in Figure 1) depending upon the prevailing conditions and their ability levels.

Surf tourists visit predominantly between mid-December and March (Bocas Breeze, 2022). This is when the temperature gradient between the heating in northern South America converges with cold winter air surging down from North America. This causes trade winds that blow mid period swell toward Bocas from the Northeast with the most consistency (Korte, 2019). This climactic phenomenon tends to coincide with the general holiday high season, so surf tourism does not inspire visitation during the off season like it does in other locations (Hritz and Franzidis, 2018; Machado et al., 2018), instead it heightens visitation when Bocas is already at its busiest. Another possible factor contributing to these heightened levels of surf visitation is that this high season for surf in Bocas coincides with smaller swells on Central America's Pacific coasts, which draws surfers seeking larger surf and warmer weather during winter in the Northern hemisphere.

Data collection and analysis

This research was designed as an exploratory case study. A mixed method approach, combining surveys and semi-structured interviews was utilized with three interconnected aims: to understand the (1) connection between surf breaks and surfer wellbeing, (2) the relative importance of different threats impacting the most frequently visited surf breaks, (3) and the knowledge of, and desire to potentially implement different existing institutions for surf ecosystem protection. The target population for this research were all surfers living on the archipelago either year-round or seasonally. Data on the number of surfers living in the archipelago was not available, so questions were also asked to approximate this by asking local surfers at each break how many local surfers they felt frequented each surf break in the analysis. The survey and semi-structured interviews were both designed with same theoretical grounding (discussed below) and were divided into three sections following the aims listed above.

Demographic questions focused on understanding surfers currently living on the archipelago. Then using the GENIAL framework (Gibbs et al., 2022; Kemp and Fisher, 2022), seven-point Likert-scale questions were developed to ascertain the relative contribution of surfing (at their most frequently visited spot) on the core domains of wellbeing: individual (e.g., balanced mind and healthy body), the community (e.g., social connectedness), and environmental (e.g., connection with nature). Questions related to place attachment were borrowed from Reineman and Ardoin (2017).

The next section was devoted to the relative importance of different environmental attributes for connecting with nature as well as different environmental and social threats impacting surfer wellbeing. Threat questions came from the literature review, which identified coastal development and tree removal (Mach, 2021; Manero, 2023; Valencia et al., 2021), declining reef health and sea-level rise (Sadrpour and Reineman, 2023; Reineman et al., 2017), crowding (Mach and Ponting, 2018; Buckley, 2002), and pollution (Evers, 2019; Tagholm, 2015). The third section of the survey asked surfers their knowledge of existing laws developed specifically for surf-break protection (Manero, 2023; Orchard et al., 2023) and the World Surf Reserve (Arroyo et al., 2019) program as well as



FIGURE 1
Surf map of Bocas del Toro, Panama.

desires to place the wave they most frequently surf under protected area status.

Answers to survey questions were first aggregated to gain a broad understanding of responses. The Shapiro-Wilk test is most appropriate for testing normality when the sample size is small (Mishra et al., 2019). A Shapiro-Wilk test was performed on the dependent variables, which confirmed a normal distribution with 95% confidence. ANOVAs were then run to see how demographic factors impacted each response (only significant results and those discussed further in the text are displayed in tables). For the questions that were organized into different constructs (e.g., wellbeing and place attachment), Cronbach's alphas were calculated to analyze the internal consistency within groups and alphas between 0.70 and 0.95 were required to justify running statistical tests on the group averages (Tavakol and Dennick, 2011). ANOVAs were run to understand if surfers with low, medium, or high levels of place attachment provided significantly different responses to one another on questions related to the wellbeing they derived from surfing as well as the other questions in our analysis. This allowed us to ascertain how place attachment influenced other survey responses. Demographic questions were also analyzed to discover their relative impacts on wellbeing. In any case where an ANOVA returned a significant *P*-value, Tukey-Kramer *post-hoc* tests were conducted to demonstrate the location of the internal differences.

After the survey, researchers asked if participants would answer three open ended questions following the same three aims listed above. These interviews were recorded, translated (if conducted in Spanish), and transcribed. Each author first individually isolated themes they found under each question, themes were then discussed and agreed upon from an iterative discussion process (Krippendorff, 2013). After consensus themes emerged, each author counted the number

of times the theme was mentioned and pulled an exemplar of each theme.

Each author (one faculty member and three trained undergraduate students) participated in the conducting the survey and interviews daily between November 20th and December 4th and lasted between 7 and 35 minutes (μ 14 minutes). Two members of the research team were fluent in Spanish and participants chose Spanish or English based on their preference. The first author has been an active surfer in Bocas for the last seven years and surveys and interviews began with his contacts. A snowball sampling technique was also employed by asking initial participants to recommend and provide contact details for other local surfers. IRB approval was granted by the School for Field Studies Office of Academic Affairs.

Results

Local surfers and frequently visited surf breaks

Almost a third of the respondents were born and raised in the archipelago (see Table 1). Ten identified as Bocatoreno, one as Latino(a) and two as Indigenous (Ngöbe). Of those not born on the archipelago, 64% moved to Bocas primarily for surfing. Most migrated to Bocas from other parts of Panama or other Latin American countries followed by the U.S. and Canada (12%), Europe (4%) and Australia (2%). Seventy-five percent have lived on the archipelago for more than 5 years and the majority self-evaluated as advanced or expert surfers. Age was evenly distributed, and most respondents lived close enough to use sustainable transportation (walk or bike) to arrive at the break they surf most frequently.

TABLE 1 Local surfer demographics (*N* = 49).

Status	Count	Percent	Time in Bocas		
Born and raised In Bocas	13	27%	Less than 1 year	3	6%
Moved to Bocas primarily for other reasons (Panama)	3	6%	1 to 3 years	5	10%
Surfing is the main reason I moved to Bocas (Panama)	10	20%	3 to 5 years	4	8%
I moved to Bocas primarily for other reasons (Abroad)	10	20%	5 to 10 years	10	20%
Surfing is the main reason I moved to Bocas (Abroad)	10	20%	10 to 15 years	9	18%
Seasonal (to surf)	3	6%	More than 15 years	18	37%
Identity			Surf Ability		
Latino(a)	28	57%	Beginner	3	6%
Bocatoreno(a)	10	20%	Intermediate	11	22%
US/Canada/Aus/Euro	9	18%	Advanced	22	45%
Indigenous	2	4%	Expert	13	27%
Age			Surf Spot		
18–26	13	27%	Paunch	19	39%
27–34	13	27%	Dumpers	6	12%
35–42	11	22%	Beach Breaks (Bluff/Wizard)	9	18%
43–58	12	24%	Carenero (La Punta)	9	18%
			Carenero (Black Rock)	6	12%
Transport to Surf Spot					
Walk	12	25%			
Bike	16	33%			
E-bike	3	6%			
Motorcycle	4	8%			
Car	1	2%			
Boat	12	25%			

TABLE 2 Local surfers and recreational carrying capacity per break.

Surf break	Local surfers per break	# of surfers for break to be crowded	How often the break is crowded; mean (SD)
Paunch	25	25.5	5.53 (1.12) ^a
Dumpers	15	7.5	3.83 (1.94)
Bluff & Wizard	8	15.5	3.44 (1.94)
La Punta	15	15.5	5.78 (1.30)
Black Rock	8	15.5	6.33 (0.82)
Total	79	126 ^b	

^a1 Never, 2 Rarely, 3 Sometimes, 4 Neutral, 5 Often, 6 Very Often, 7 Always.

^bEstimated recreational carrying capacity threshold of surfers in the water at any given time around the archipelago before wellbeing becomes impacted by crowding.

As for surf spots, we asked each surfer where they surf most frequently, as a proxy for their local surf-break. We also asked them how many local surfers there were at that break and how often they think it is crowded enough to reduce their satisfaction on a

scale from 1 (never) to 7 (always). This information is displayed on Figure 1 and Table 2. Based on the average response for local surfers at each break, we estimate there are around eighty local surfers on the archipelago.

Most said they surfed Paunch most frequently, which is the most consistent reef-break on the most populous island (Isla Colon) and surfers find it often crowded. Dumpers is a reef-point break on Isla Colon where locals try and limit tourist visitation. Interestingly, those who frequent the break said there are about 15 local surfers but think the spot can only hold around 7 at any given time. Locals have labeled it on public surf maps as a “locals only” spot and it was rated as rarely crowded on our survey.

The beach breaks had the fewest local surfers and were found to be crowded the least often. This is likely due to the combination of remoteness, difficulty to surf (often closeout close to shore), and ability to spread out along the beach. Carenero point had the second most surfers and this is a consistent reef-point break on that island. It is also frequented by surfers who live in Bocas Town and have access to boats. Black Rock is currently the busiest spot for surf lessons as it is a rolling reef that is protected on the inside of Carenero Island. Local surfers to that spot find it to be crowded the most often. Carenero, like Isla Colon, is interesting because local

residents historically have lived on the southern end of the island, but hotels and restaurants are beginning to be built up the east coast heading north toward the surf.

ANOVAs were conducted to discern how each demographic category [local surf spot, age, status (migration rationale and where from), time spent in Bocas, and surf ability] influenced perceptions of crowding. Interestingly, only surf ability displayed a significant *P*-value, which suggests for all other categories the mean responses (Table 2) are a good proxy for the sentiments of the sample. Expert surfers, however, were the least likely to have their wellbeing negatively impacted by crowding.

Place attachment and wellbeing

Surfers reported deriving remarkably high levels of wellbeing from surfing at the surf break they visit most frequently. Surfers felt strongest that it improved their physical health (see Table 3).

TABLE 3 Place attachment and wellbeing.

Question/ group (N = 49)	Question mean (SD)	Group mean (SD)	Cronbach's alpha
Wellbeing		6.15 (1.17)	0.72
Balances my mind	6.18 (1.41)		
Improves my physical health	6.61 (1.08)		
Connect to a community of local surfers	5.47 (1.89)		
Connect to nature	6.33 (1.31)		
Place attachment		5.61 (1.38)	0.83
Identity			
This break is a part of me	5.63 (1.68)		
This break means a lot to me	6.24 (1.41)		
Dependence			
This is the best wave for my style	5.43 (1.85)		
This is the best wave for how I like to surf	5.14 (1.96)		
Place attachment	Wellbeing¹	Sea-level Rise Threat	Participation in conservation initiatives
Low (N = 7)	4.43 (1.71) ^{a,b}	2.86 (1.21)	3.0 (1.55) ^{a,b}
Medium (N = 11)	6.18 (0.98) ^a	4.55 (2.20)	5.18 (1.94) ^a
High (N = 31)	6.58 (0.63) ^b	4.94 (2.22)	5.13 (1.93) ^b
<i>P</i> -value	<0.001*	0.073	0.043*
F-Stat	15.64	2.76	3.37
Surf ability	Frequency crowded		
Beginner	6.0 (1.0) ^a		
intermediate	5.82 (1.25) ^b		
Advanced	5.23 (1.55)		
Expert	3.62 (1.66) ^{a,b}		
<i>P</i> value	0.002*		
F	5.54		

¹* *p*-value below 0.01; ^{a,b} means with common superscript letters indicate significant pairwise differences as determined by Tukey-Kramer *post-hoc* analysis assuming $\alpha = 0.05$.

The connection to nature was the second most important benefit. Based on the mean responses from Likert scale questions ranging from strongly disagree (1) to strongly agree (7), the most valuable attributes for facilitating a positive connection to nature from surfing were lack of pollution (6.77), healthy coral reefs (6.27), limited development (6.15) and seeing wildlife (5.69). This is especially important considering coastal development and declining reef health were seen as the most significant current threats to local surf breaks (Table 4).

Surfers also felt strongly that surfing their local surf-break helped them to balance their mind. In the qualitative results (Table 5) surfers talked about how surfing relieves a great deal of stress and reduces anxiety. Almost half said surfing made them feel connected to the local community. Four surfers also discussed how working more online can be isolating, but that getting out into their spot and interacting with familiar people helps ground them in a community.

Half of those who mentioned the importance of connecting to other people and the community through surfing feel they are building an intergenerational surf community. They stressed that passing surfing on to the youth through different programs and informally is critical to their own wellbeing and helping to pass on ethics of environmental care. Three respondents also stressed that surfing provided the youth opportunities outside of working in the party scene and doing things like drinking and partying too much. Though we did not ask about financial wellbeing from surfing in our questionnaire (not part of the GENIAL framework), during the interviews, a quarter of the respondents mentioned this as important. Making a living doing what they love most, to them, provided a contribution to their wellbeing worthy of them mentioning unsolicited and for us to include in the results.

Generally, place attachment was significant for many local surfers. They tended to identify more with the wave (i.e., it is important to me or a part of who I am), then feel dependent upon it, but scored high on both subcategories of place attachment (Table 3).

To understand correlations between place attachment and wellbeing we divided the sample into three categories of place attachment: low (<4) medium (4.1 to 5.5) and high (5.6 to 7). The higher one's place attachment, the higher levels of wellbeing they reported from surfing the spot they visited most frequently. This shows that wellbeing is tied to experiences at particular places. Those with higher place attachment also reported higher levels of participation in conservation efforts. Those with higher levels of place attachment were also more concerned about the impacts of sea-level rise at their local break, than those with low levels of place attachment.

Threats to surf breaks

On a rapidly growing archipelago, surfers saw coastal development as the most pressing threat to their local surf breaks (Table 4). As mentioned in the background context, this mostly involves development (e.g., updated roads, single family homes for Airbnb, hotels, restaurants, and shops) migrating outside of Bocas Town and encroaching closer to each surf-break analyzed.

TABLE 4 Surfers and the environment.

	Mean (SD)		Mean (SD)
Relative importance of environmental attributes to connecting with nature while surfing at local surf-break		Relative importance of different threats to local surf-break	
No pollution	6.77 (.90)	Coastal development	5.56 (2.08)
Healthy coral reefs	6.27 (1.58)	Declining reef health	5.42 (1.93)
Limited development	6.15 (1.57)	Crowding	5.13 (2.07)
Seeing wildlife	5.69 (1.95)	Tree removal	5.10 (2.22)
		Pollution	4.90 (2.21)
		Sea-level rise	4.60 (2.18)
Current actions and organization			
I participate in surf conservation	4.88 (1.99)		
The surf community is organized effectively to address current threats	4.31 (1.85)		
Knowledge of surf protection institutions		Desire for different modes of protection	
Other countries have laws specifically for surf protection	5.91 (1.36)	I want my local break to become a surf protected area	6.43 (1.26)
I am aware of the World Surf Reserve Program	2.88 (2.20)	I want to from a community organization for surf break-protection	5.73 (1.76)

While surfers also suggested that it was important to their wellbeing that they surf in areas not overdeveloped, they also were concerned about more tangible threats related to the direct impacts of development on surf-break integrity. As the following quote suggests, of the 70% who mentioned a concern for coastal development half placed these fears directly at the hands of an active ring road project making its way around Isla Colon (the most populous island with the expressed intent of enhancing tourism) which could impact Paunch, Dumpers, Tiger Tails, and Bluff:

I do worry about the construction of the new road because I don't know if the right studies were done to make it so close to the shore. They [the government contractors] are going to build barriers to protect the road from sea level rise, but for the waves, we know that will make backwash that could ruin the wave. And that could move the sand that makes the waves so perfect. So, I'm very worried.

This shows that surfers fear that developers are not taking the precautionary principle when building, or considering surf breaks. This quote also indicates that surfers recognize that infrastructure

TABLE 5 Qualitative results.

Category/theme	Mention %	Representative quotes
Wellbeing		
Stress relief	41	If you stay in low season... you have like five months of no waves and for sure this is going to affect you. You don't realize how much stress relief you get from surfing until you are not doing it. All that energy you usually put into surfing manifests as anxiety or depression when you can't surf.
Physical health	53	There's no amount of exercise that you could do in a gym or whatever that can keep you as fit as surfing does.
Connection to nature	18	Surfing helps me to connect with nature. I have had the chance to see animals in their wild state while surfing several times, and for me these have been some of the best experiences or moments in my life.
Financial well-being	24	My whole family lives from surfing. I need surfing to live, to make money. I love that my passion can be my career.
Connection to other people/ community	41	Introducing these kids to surfing gives them something else to do rather than just being in the street. Surfing is really good for the communities here. It teaches people to take care of the ocean and each other.
Perceptions of threats		
Sea level rise	47	I started surfing in Bocas in 2016 and then I noticed that some breaks always worked. Now, at high tide, some waves don't even break because it's too much water.
Runoff	12	All the wastewater from those hotels and houses behind the wave have to go out to the sea at some point. Yeah. And this is what bothers me the most, to be honest.
Development of the road / Coastal armoring & backwash	70	Right now when they build houses near our beach or very tall buildings, everything, that is, the wave is always affected, because in order to surf every day we need the wind to be perfect. If you build a very big house, the wind will never, ever hit like a wave. So, for us the worst thing is that they build very close to the beach
Reef integrity	35	There used to be an orange patch of coral I would use to know how to be in the right spot for the for that section of the wave. But now I can see there's a white patch there, so I know, okay, that's a dead coral now. It's still there, but it is dead, so when it breaks down what will happen? Will the wave still break? Since Bocas is getting more popular for surfing, one of the impacts is the coral is suffering with all the anchors from the boats
Garbage/pollution	35	The worst here is pollution in Bocas overall. You just see trash everywhere.
Harm to wildlife	18	When you build a house near the surf, you have to cut down all the trees, which removes all the animals that are nearby. I mean, it's just what we don't want. We want Bluff to always remain natural, natural and perfect.
Crowding	40	It fucking crowded. Its most annoying on small days when you just want to have some fun and there are not alot of waves. In low season these sessions are fun and there are just a few locals out. In high season, it's chaos.

exacerbates issues associated with sea-level rise, but they seem to focus more on the construction decisions that they think they can influence, rather than sea-level rise (which they reported not being able to influence). In that sense, coastal development ranks as the highest threat because local surfers see it as something that does not necessarily need to happen, and which could potentially occur in ways that are sensitive to the ecosystem features necessary to provide quality surfing experiences. Interestingly, at the time of writing, the road project had not yet reached any area where there was an actively surfed spot considered in our analysis. Concern about the project's impact on surf conditions may increase as the road moves closer (see [Figure 2](#)).

Surfers saw declining coral reef health as the second most important active threat. This is interesting because it is one of the first studies dedicated to the wellbeing of surfers who predominantly surf reef-breaks. The intricacies of the reef were discussed as helping interviewees know how to position themselves

(e.g., they suggested they position themselves at different patches of reefs depending on the prevailing conditions) and that features of the reef cause waves to break in the way they cherish. Five surfers reported seeing reef changing color and shape and worried that it might be actively dying, which could impact their ability to see wildlife and the integrity of the wave. Twelve percent of interviewees focused on local threats to reefs like gray and blackwater runoff from hotels flowing directly into the water where they surf. Three surfers from Carenero specifically focused on anchor damage (associated with boats dropping anchor to wait for surfers to finish surfing and then taking them back to their destination) and want to mitigate these risks.

Crowding ranked as the third most severe active threat in the quantitative survey and 40 percent of our interviewees mentioned crowding in the qualitative section. During the interviews, those who mentioned this said that it seems to be getting worse every year. Paunch and Carenero were considered crowded often, while



FIGURE 2

Evidence of coastal erosion impacting the road infrastructure at Tiger Tails surf break. Interviewees expressed concerns related to how new road infrastructure plans might negatively impact surf breaks like this one.

Black Rock was considered crowded very often. As the results above indicate, crowding is more of an issue for intermediate and advanced surfers than experts or beginners, which might explain why it scores lower than other threats generally.

Results also suggest that sea-level rise, above all else, is reducing the frequency of time when certain waves can be surfed. The Caribbean has a small tidal range. Historically, tidal changes have influenced how waves broke in Bocas, but not whether a wave broke in a manner that was rideable. Surfers suggested in the past you could surf all tides and more often (see Table 5 for example). Now, with sea-level rise, many surf breaks receive too much water to break unless the swell is considerable and often do not break on higher tides. One surfer who migrated to Bocas more than two decades ago said:

When I came here 24 years ago, all that shore was palm trees and it's nothing now. We can't surf small swells here [Paunch] now, we must go to different places because the water level is so high the wave doesn't break. So now we need to wait for big swells to actually surf.

Surf ecosystem protection

Survey responses indicated that surfers participate in surf break conservation, but not at high levels (4.88 out of 7). Through the interviews, it became clear that for most surfers this meant organizing and participating in beach clean ups as well as efforts to beautify surf spaces through murals and artwork geared at inspiring care. Others also spoke about participating in protests to stop the construction of a pier in the past at Paunch. They do not however, feel the surf community is effectively organized to address threats, but seem confident surfers will react when necessary to address imminent human-caused threats.

Surfers were aware that other countries have laws dedicated to preserving surf ecosystems, but they were mostly unaware of the World Surf Reserve Program, which is an effort

driven by Save the Waves Coalition to form local stewardship councils for the preservation of surf ecosystems around the world. Surfers reported a strong desire for having their local surf breaks placed under protected area status and want to create a community organization for the preservation of surf breaks (Table 4).

Discussion and conclusions

The importance of place and visitation frequency for wellbeing

Surfers are hypermobile and itinerant (Mach and Ponting, 2021; Sotomayor and Barbieri, 2016) members of a global subculture (Stranger, 2011). They also have close connections to the places that they call home and often seek to protect these places from “outsiders” (Beaumont and Brown, 2016; Towner and Lemarie, 2020) and environmental threats (Arroyo et al., 2019; Scheske et al., 2019). To further complicate matters, surfers typically do not rely on surfing any one place all the time while at home, but instead travel locally based on the prevailing conditions (Reineman and Ardoin, 2017). International surf travel is also a therapeutic and integral part of the surfer habitus with surfers often developing fidelity for visiting certain places repeatedly (Krause, 2012; Stranger, 2011). In trying to understand more about surfers and place attachment, Reineman and Ardoin (2017, p. 328) asked surfers to answer survey questions based on the “surf spot they know best” and found that many referenced places from their past or other places that they did not surf frequently. In short, most surfers feel different degrees of attachment to many places (near and far), and this is difficult to account for in research dedicated to place attachment, surfing, and wellbeing.

For these reasons, we asked surfers to specifically discuss the places they surfed most frequently. In so doing, many interesting findings emerged. For one, surfers with higher degrees of place

attachment to their most frequently visited surf break reported higher levels of wellbeing. This suggests that visitation frequency may help provide an anchor for the general benefits that surfing affords (i.e., surfers with access to surf spots they can surf frequently may experience higher levels of wellbeing relative to surfers who lack consistent access to a particular spot). Based on our results, we can support claims that visitation frequency allows surfers to form a community through sharing surf experiences (Beaumont and Brown, 2016) and allows the spot to become a part of their identity (Reineman and Ardoin, 2017). Also that surfing facilitates frequent engagement in important forms of valuable exercise and fosters the ability to connect with and understand different components of the ecosystem that both afford and are ambient to the immersive surf experience.

We also found place attachment did not significantly change based on one's migration status or length of time living in the archipelago. Many participants selected where they live based on the proximity to certain surf breaks and formed place attachment through the frequency of visitation. These surfers are critical to forming the type of destination Bocas is (and evolves into) and are very concerned about threats to surf breaks. They should not be discounted or viewed only as outsiders seeking to exploit wave resources in ways that are socially and environmentally destructive (Ruttenberg and Brosius, 2017). Visitation frequency (and ecosystems that afford this), we argue, should be seen as central and should not be taken for granted when discussing the wellbeing derived from surfing.

Other scholars have noted that the wellbeing from surfing is derived from a complicated mix of multisensory stimuli (Moreton et al., 2022; Lisahunter and Stoodley, 2021). There are therapeutic and mental health benefits from curated surf therapy programs (Britton et al., 2020; Caddick et al., 2015; Gibbs et al., 2022) and mental health benefits have also been estimated to accrue through the act of surfing generally, each time someone is able to go (Buckley and Cooper, 2023). Others have suggested that wellbeing may also be derived from surfing in artificial environments like manmade surf pools (Roberts and Ponting, 2018). Each of these lines of research warrant dedicated attention, but we caution against the homogenization of surf experiences implied in the suggestion that all surf experiences everywhere provide equivalent mental health and wellbeing benefits (Buckley and Cooper, 2023). Surf outings during curated surf therapy programs might produce higher levels of wellbeing, but very few people have access to these programs, and this would still require validation through research. If surfing a wave pool provides the same benefits as surfing in nature, then it might become politically expedient to allow for the loss of waves to development or environmental changes if they can be replaced by profitable wave creating enterprises. Our findings stress the importance of understanding how critical frequently visited surf ecosystems are for surf related migration and surfer wellbeing and we wish to highlight that these key places around the world might warrant special consideration for conservation. Surf spots around the world that are the products of ecosystems which allow for frequent surf experiences are rare (Atkin, 2023), coincide with high levels of biodiversity (Reineman et al., 2021) and will be very difficult, or even impossible to replace.

Social and environmental threats to wellbeing

Over the past decade, Bocas has experienced an average annual sea-level rise of 3.3 millimeters, and this is predicted to increase to 10 centimeters per year by 2050 (Ciniglio et al., 2021). In Bocas, communities are already being displaced by sea-level rise (Visser, 2021) and climate change is exacerbating water security, flooding (Kim et al., 2024), fisheries decline (Dorsett and Rubio-Cisneros, 2019), and substantial heat related coral mortality (Cramer et al., 2020). Our findings allow us to discuss the current and potential future impacts of these changes on surfing ecosystems and surf related wellbeing.

Sadrpour and Reineman (2023) proposed theoretically that reef-breaks in areas with small tidal ranges and coastal armoring should be considered the most vulnerable to sea level rise. Certain areas in the Maldives are beginning to provide empirical evidence of this precarity (Haro, 2021). We found generally that sea-level rise is already reducing how often important surf breaks can be surfed and this is before even considering proposed infrastructure projects that might exacerbate issues and the predicted acceleration of sea-level rise in the future. This suggests that when surf breaks are discussed in the context of sea-level rise, the temporal dimension is very important to foreground. For some areas, waves might not be lost completely, but instead, the frequency when they can be surfed may be reduced incrementally. This reduced frequency may also be a stage in a process toward disappearance. Regardless, the ways surfers respond to these changes and the wellbeing impacts will be important to analyze over time to better understand these important human/ecosystem interactions.

Reducing the amount of time a wave can be surfed has important, but under evaluated impacts on both the frequency of visitation and crowding. In relation to crowding, we found that surfers think the number of local surfers at the two most popular breaks (Paunch and Carenero Point) on the archipelago are about equal to the threshold of surfers in the water at a given time that begins to reduce their wellbeing. This is a novel finding and suggests that spreading surfers (both locals and tourists) throughout the day at any given spot is critical to avoid the negative psychological impacts of overcrowding. If sea-level rise is reducing the amount of time per-day a wave can be surfed, this will likely coerce more surfers into entering the water during the shrinking optimal tide range. This has great potential to reduce the wellbeing derived from surfing and can potentially attract different types of surf tourists who are not crowd sensitive, like experts who tend to outperform for waves while reducing the enjoyment others experience (Mach et al., 2018). At this point, we cannot say precisely how much wellbeing local surfers lose due to crowding or how frequently crowding must be experienced to make notable changes in the overall wellbeing they gain from surfing at a particular place. Our findings do suggest that future studies dedicated to understanding this phenomena could lend critical depth to our understanding of how a global situation characterized by a growing surf population, heightened levels of surf travel (Mach and Ponting, 2021), a reduction in the relative abundance of surf breaks (Reineman et al., 2017) and the potential reduction in the amount of time many breaks can be surfed might impact the general wellbeing surfers

gain from participating in the activity and the response surfers develop to adapt.

The intermediate and advanced surfers who spend a lot of money to travel (Sotomayor and Barbieri, 2016) and might be most likely to migrate to areas like Bocas, may be deterred by the confluence of increased surf tourism and reduced time available for surfing. These problems are likely to increase as sea-level rise and coastal infrastructural investments (e.g., coastal armoring to protect roads, dwellings, hotels and restaurants) compound. Beyond this, coral mortality is being exacerbated by climate change, sea level rise, and runoff in Bocas (Cramer et al., 2020). If these threats persist, coral would be unlikely to maintain the vertical growth necessary to continue to provide the structural bathymetry necessary to facilitate consistent surf experiences in places like Bocas off into the future (Sadrpour and Reineman, 2023).

Surfers in California suggested that they would drive farther to surf if a place they were attached to stopped providing surf potential due to environmental changes (Reineman and Ardoin, 2017). In an archipelago where consistent waves are few and spread out, however, the transition or replacement to other waves would be much more difficult if not impossible. And the loss of any surf-break in a context of limited alternatives would likely have much more detrimental impacts to surfer wellbeing, tourism, and migration. Surfers suggested that their mental health was negatively impacted by not being able to surf much in the low season (Table 5) and other studies corroborated this in the context of people not being able to surf during the COVID-19 Pandemic (Mach, 2021; Usher, 2023). We might, therefore, assume that reducing the frequency of quality surfing conditions from sea-level-rise and reef mortality will reduce their wellbeing, we just cannot say what the threshold is at this point. Surfers might experience mental health issues related to these changes and experience them as another form of ecological grief (Scott et al., 2024). Surfers born in Bocas may also be less likely to migrate over wave quality and consistency reductions (or losses), so understanding how they cope would also be very important to our evolving understanding of place attachment and surfer wellbeing.

Political response

Because surfers demonstrated specialized knowledge related to how sea-level rise is impacting their frequently visited spots (Reineman et al., 2017), policy makers should trust their concerns related to how infrastructural change might impact surf ecosystems. Surfers overwhelmingly wanted their frequently visited spots to be legally protected and we learned that surfers believe these legal protections should include at minimum prohibiting: (1) hard structures in the coastal zone adjacent to a surf break (e.g., sea walls or gabions used to fortify the construction of a road or hotel), (2) runoff that could negatively affect coral and water quality, and (3) anchor damage to reefs.

More national governments, we argue, need to create laws that allow municipalities to initiate precautionary principle-based protections around entire surf ecosystems (Manero, 2023; Orchard

et al., 2023). To ensure surf protected areas do not become “paper parks” (i.e., protected areas that exist without enforced protective measures) (Rife et al., 2013), or inequitable, these need to be established and administered by a coalition of stakeholder groups beyond the surf community. If meaningful conservation coalitions cannot be formed in certain geographical contexts, then we do not wish to argue that surf break preservation should take priority over other local concerns. There are surely cases where surf tourism industry practices or proposals, do not necessarily align with the sustainable development goals of other ocean dependent residents (Ponting and McDonald, 2013; Kushner, 2023). In Bocas specifically, however, the interests of local surfers appear to align with most other local stakeholder groups who are concerned about infrastructure potentially causing environmental harm. So in this case, surfers’ concerns about wave quality reduction align with the fears of local fisherman and tourism operators related to how infrastructure might negatively impact the coastal spaces they rely upon—especially as sea-level rises, oceans warm, and fish stocks diminish (Dorsett and Rubio-Cisneros, 2019).

In Bocas, we argue, elevating the concerns that infrastructure might have on surf breaks might help advance other local causes and draw needed international attention and support, as it has in the past (Douglas, 2017). Our research suggests, however, that despite two big surfer driven environmental initiatives, one to move a dump facility and the other to halt the construction of a pier (Mach, 2021), there has yet to be a formal surf break protection organization created. Surfers come together and form *ad hoc* coalitions to react to specific imminent issues, but have not worked to implement policy change in the direction toward a clear vision for preserving its most visited surf ecosystems off into the future.

Our research shows that surfers are aware that some countries have laws for protecting surf break specifically, but they were not aware of one of the leading global surf NGOs that lobbies for these protections. This research emphasizes the urgent need for dedicated institutions to effectively preserve frequently visited surf ecosystems in areas that are neither covered by global non-governmental surf protection organization campaigns, nor dedicated legal protection frameworks. Bocas is just one example of the many surf destinations where surfers’ desires align with other local stakeholders, but formal surf ecosystem protection organizations, institutions and laws are lacking. Can organizations like Surfrider Foundation and Save the Waves Coalition effectively reach small and remote communities like Bocas? It is not reasonable to assume they can be involved in protecting the nearly 5,000 surf breaks documented in 113 countries (Bukoski et al., 2024). But to reach more areas outside of their current priorities, would they need more funding and personnel, or do threat levels need to rise and draw more attention? Or must local communities rely upon themselves to create their own organizations? Which path would be most effective and feasible for Bocas and other similar destinations?

In closing, surf ecosystems are incredibly biologically diverse (Reineman et al., 2021) and Bocas del Toro is no exception

(Collin et al., 2024). Research has also recently suggested that Panama's surf ecosystems should be considered among the top five most important in the world for storing irrecoverable carbon (Bukoski et al., 2024). Protecting surf ecosystems generally, and in Bocas specifically, therefore, has ecological benefits in addition to the wellbeing that surfers reported gaining from surfing in these spaces. This lends weight to the argument that place is very important to surfers and that certain surf ecosystems warrant special levels of protection to ensure the perpetuation of important cultural ecosystem services like mental health, wellbeing, and the communities that form around and within the places that allow for frequent surf experiences.

Limitations and future research

This research helps to enhance understanding of place attachment and surf related wellbeing, but there were noteworthy limitations. Bocas del Toro is a relatively small surf community and roughly half of the resident surfers (based on estimates derived in the study) participated in this study. This is likely because the survey was not conducted during the high surf season, so many seasonal residents were not available. While a larger sample would have lent greater validity to the results, a high proportion of the year-round residents were represented. The consistency between the qualitative and quantitative results also enhanced the validity of the findings and validated reporting both, despite the small sample size. The results, we argue, should be seen as providing exploratory insights into a unique surf destination context. Because context is very important and the communities that form around surf breaks are unique, we also advocate for more targeted case studies in areas experiencing rapid change. These findings would help illuminate the influence of certain environmental changes on surf ecosystems and how surfers respond to them, which could help other areas better prepare for the future.

Allowing participants to select either Bocatoreno (anyone from the province) or Indigenous in the demographic portion of the survey reduced our ability to compare Indigenous residents to others. Other studies have found that Indigenous surfers have higher degrees of place attachment than other surfers (Waiti and Awatere, 2019; Wheaton et al., 2021), but we were not able to comment on this, despite the presence of Indigenous surfers in Bocas. Future studies should have a specialized question for Indigeneity. Our results, however, still suggest that those born on the archipelago (Indigenous or otherwise) have comparable levels of place attachment and reported wellbeing from surfing frequently visited locations as other migrant surfers. This warrants further research, both in Bocas and other locations with high proportions of migrant surfers. The ability to compare this with other sites would help us to discover if this might be unique to Bocas or perhaps something that is common in areas with high levels of surf migration. Our results show that many surfers migrate primarily to surf, but there has not been much dedicated research to this phenomenon elsewhere to isolate the specific attributes

of places that draw particular surf migrants to certain places around the world. How much is surf migration influenced by objective environmental components of surf breaks or other destination attributes (e.g., access to restaurants, culture, and cost of living)? How do surfers choose which surf ecosystems are worth migrating to?

The last noteworthy limitation relates to how we asked general questions about the wellbeing derived from surfing a most frequently visited spot. While this did illuminate important findings, it did not allow us to say with much precision the degree to which wellbeing was negatively impacted by things like crowding, or the changing optimal tidal range of surf breaks. All we know is that wellbeing is currently high and tied to frequent visitation, but we do not know if it was higher before many of the threats mentioned in the interviews were being experienced acutely. Future research might benefit from tying wellbeing questions to specific surf sessions and repeating them multiple times with the same participants to evaluate how certain social and environmental factors affect the wellbeing derived from different surf sessions. Replicating this over time could also be valuable for understanding changes over time related to more general changes in conditions and the frequency of crowding. In short, if we are arguing that surf sessions should not be homogenized when trying to understand their contributions to wellbeing, we need more information related to how changing conditions (e.g., crowd, wave quality, and water clarity) impact the wellbeing derived by particular sessions. Forming a time series with this data could also illuminate trends in how (or if) the wellbeing derived from a surf ecosystem changes over time and what factors might be driving these changes.

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 humans were approved by School for Field Studies office of academic administration. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

LM: Formal analysis, Supervision, Writing – original draft, Writing – review & editing. ER: Conceptualization, Project administration, Resources, Writing – original draft. SS: Writing – original draft. JN: Investigation, Project administration, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships

References

- Amrhein, M., Barkhoff, H., and Heiby, E. M. (2016). Spirituality, depression, and anxiety among ocean surfers. *J. Clin. Sport Psychol.* 10, 155–171. doi: 10.1123/jcsp.2015-0016
- Anderson, J. (2013). Surfing between the local and the global: identifying spatial divisions in surfing practice. *Trans. Instit. Br. Geograph.* 39, 237–249. doi: 10.1111/tran.12018
- Arroyo, M., Levine, A., and Espejel, I. (2019). A transdisciplinary framework proposal for surf break conservation and management: Bahía de Todos Santos World Surfing Reserve. *Ocean Coast. Managm.* 168, 197–211. doi: 10.1016/j.ocecoaman.2018.10.022
- Atkin, E. (2023). *The Development of Tools and Guidelines for Surfing Resource Management*. Hamilton: The University of Waikato.
- Beaumont, E., and Brown, D. (2016). 'It's not something I'm proud of but it's ... just how I feel': local surfer perspectives of localism. *Leisure Stud.* 35, 278–295. doi: 10.1080/02614367.2014.962586
- Bocas Breeze (2022). "Bocas del Toro Panama Surf Guide," in *The Bocas Breeze*. Available at: <https://thebocasbreeze.com/surf/bocas-del-toro-surf/> (accessed February 4, 2024).
- Bocas Breeze (2023). "Isla Colon road update: stakes in the sea and dozens of trees marked for removal along playa paunch," in *The Bocas Breeze*. Available at: <https://thebocasbreeze.com/community/playa-paunch-road/> (accessed February 4, 2024).
- Boschetti, M., and Hodges, T. (2021). *Surfonomics Playa Hermosa, Costa Rica the Economic Impact of Surf tourism on the Local Economy*. Florianópolis: UFSC. Available at: https://www.savethewaves.org/wp-content/uploads/2022/01/PlayaHermosa_SurfonomicsStudy_English_2021_Web.pdf (accessed February 4, 2024).
- Brewin, R., de Mora, L., Jackson, T., Brewin, T., and Shutler, J. (2015). On the potential of surfers to monitor environmental indicators in the coastal zone. *PLoS ONE* 10:e127706. doi: 10.1371/journal.pone.0127706
- Britton, E., Kindermann, G., Domegan, C., and Carlin, C. (2020). Blue care: a systematic review of blue space interventions for health and wellbeing. *Health Promot. Int.* 35, 50–69. doi: 10.1093/heapro/day103
- Buckley, R. (2002). Surf tourism and sustainable development in Indo Pacific Island - recreational capacity management and case study. *J. Sustain. Tour.* 10, 425–442. doi: 10.1080/09669580208667177
- Buckley, R., and Cooper, M. (2023). Mental health contribution to economic value of surfing ecosystem services. *NPJ Ocean Sustain.* 2:20. doi: 10.1038/s44183-023-00027-5
- Bukoski, J., Atkinson, S., Miller, M., Sancho-Gallegos, D., Arroyo, M., Koenig, K., et al. (2024). Co-occurrence of surf breaks and carbon-dense ecosystems suggests opportunities for coastal conservation. *Conservat. Sci. Pract.* 6:e13193. doi: 10.1111/csp2.13193
- Caddick, N., Smith, B., and Pheonix, C. (2015). The effects of surfing and the natural environment on the wellbeing of combat veterans. *Qual. Health Res.* 25, 76–86. doi: 10.1177/1049732314549477
- Ciniglio, S., Machado, V., Vallarino, R., and Saavedra, F. G. (2021). Análisis de aumento del nivel del mar en Isla Colón, Bocas del Toro. *Revista de Iniciación Científica*. 7, 39–49. doi: 10.33412/rev-ric.v7.2.3337
- Collin, R., Adelson, A., Altieri, A., Clark, K., Davis, K., Giddins, S., et al. (2024). Using forty years of research to view Bahía Almirante on the Caribbean Coast of Panama as an integrated social-ecological system. *Estuarine, Coast. Shelf Sci.* 306:108878. doi: 10.1016/j.ecss.2024.108878
- Cramer, K., Jackson, J., Donovan, M., Greenstein, B., Korpanty, C., Cook, G., et al. (2020). Widespread loss of Caribbean acroporid corals was underway before coral bleaching and disease outbreaks. *Sci. Adv.* 6:eaa9395. doi: 10.1126/sciadv.aax9395
- Dorsett, C., and Rubio-Cisneros, N. (2019). Many tourists, few fishes: Using tourists' and locals' knowledge to assess seafood consumption on vulnerable waters of the archipelago of Bocas del Toro, Panama. *Tour. Manage.* 74, 290–296. doi: 10.1016/j.tourman.2019.03.011
- Douglas, A. (2017). *Help Save One of the Caribbean's Best Waves*. Available at: <https://www.surfer.com/features/help-save-one-of-the-caribbeans-best-waves/> (accessed February 4, 2024).
- Evers, C. (2019). Polluted leisure. *Leisure Sci.* 41, 423–440. doi: 10.1080/01490400.2019.1627963
- Falaix, L., Lemarié, J., and Lafargue, J. (2021). Activist surfing-based groups in the tourism transition: localism and universalism in the French Basque Country. *Géocarrefour* 95:18491. doi: 10.4000/geocarrefour.18491
- Gibbs, K., Wilkie, L., Jarman, J., Barker-Smith, A., Kemp, H., and Fisher, Z. (2022). Riding the wave into wellbeing: a qualitative evaluation of surf therapy for individuals living with acquired brain injury. *PLoS ONE* 17:e266388. doi: 10.1371/journal.pone.0266388
- Gordon, B. L. (1982). *Panama Forest and Shore*. Pacific Grove: Boxwood Press.
- Guerron-Montero, C. (2006). Racial democracy and nationalism in Panama. *Ethnology* 25, 209–228. doi: 10.2307/20456595
- Haro, A. (2021). "Maldives surf breaks are in danger from rampant coastal development," in *The Inertia*. Available at: <https://www.theinertia.com/surf/maldives-surf-breaks-are-in-danger-from-rampant-coastal-development/> (accessed February 4, 2024).
- Hritz, N., and Franzidis, A. (2018). Exploring the economic significance of the surf tourism market by experience level. *J. Destin. Market. Managm.* 7, 164–169. doi: 10.1016/j.jdm.2016.09.009
- Kemp, A., and Fisher, Z. (2022). Wellbeing, whole health and societal transformation: theoretical insights and practical application. *Global Adv. Health Med.* 11, 1–16. doi: 10.1177/21649561211073077
- Kim, A., Scott, C., and Swartz, W. (2024). Local perspectives on marine ecotourism development in a water-insecure island region: the case of Bocas del Toro, Panama. *Front. Mar. Sci.* 11. doi: 10.3389/fmars.2024.1377053
- Korte, K. (2019). *Fire?, Ask A Forecaster: Why Does the Caribbean Coast of Costa Rica and Panama*. Available at: www.surflife.com: <https://www.surflife.com/surf-news/ask-forecaster-caribbean-coast-costa-rica-panama-fire/68291> (accessed February 4, 2024).
- Krause (2012). Pilgrimage to the Playas: surf tourism in Costa Rica. *Anthropol. Action* 19, 37–49. doi: 10.3167/aia.2012.190304
- Krippendorff, K. (2013). *Content Analysis: An Introduction to its Methodology*. Los Angeles, CA: Sage.
- Kushner, D. (2023). "The Surf Bros, the villagers, the wave doctor, the tech money, and the fight for Fiji's soul," in *Vanity Fair*. Available at: <https://www.vanityfair.com/style/2023/05/fiji-surf-wars> (accessed February 4, 2024).
- Lazarow, N. (2009). Using observed market expenditure to estimate the economic impact of recreational surfing to the gold coast, Australia. *J. Coast. Res.* 56, 1130–1134.
- Lisahunter and Stoodley, L. (2021). Bluespace, senses, wellbeing, and surfing: prototype cyborg theory-methods. *J. Sport Soc. Issues* 45, 88–112. doi: 10.1177/0193723520928593

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- Mach, L. (2017). "Surfing in the technological era," in *Surfing and Sustainability*, eds. D. Borne, and J. Ponting (New York: Routledge), 41–71.
- Mach, L. (2019). *Surf Tourism Destination Governance in Bocas del Toro, Panama*. Annapolis, MD.
- Mach, L. (2021). Surf tourism in uncertain times: resident perspectives on the sustainability implications of COVID-19. *Societies* 11:75. doi: 10.3390/soc11030075
- Mach, L., Connors, J., Lechtman, B., Plante, S., and Uerling, C. (2022). Party tourism impacts on local stakeholders. *Anatolia* 33, 222–235. doi: 10.1080/13032917.2022.2040914
- Mach, L., Guttentag, D., Stronbom, S., Bloom, S., and Straud, M. (In Press). Lifestyle migration and the emergence of Airbnbburbs in the Global South. *Tour. Geographies*. 36:2.
- Mach, L., McPherson, B., and Hayes, R. (2023). Wildlife tourism maps and the governance of environmental collapse. *Tour. Geograph.* 25, 1465–1482. doi: 10.1080/14616688.2023.2231423
- Mach, L., and Ponting, J. (2018). Governmentality and surf tourism destination governance. *J. Sustain. Tour.* 26, 1845–1862. doi: 10.1080/09669582.2018.1513008
- Mach, L., and Ponting, J. (2021). Establishing a pre-COVID-19 baseline for surf tourism: trip expenditure and attitudes, behaviors and willingness to pay for sustainability. *Ann. Tour. Res. Empir. Insights* 2:100011. doi: 10.1016/j.annale.2021.100011
- Mach, L., Ponting, J., Brown, J., and Savage, J. (2018). Riding waves of intra-seasonal demand in surf tourism: analysing the nexus of seasonality and 21st century surf forecasting technology. *Ann. Leisure Res.* 23, 184–202. doi: 10.1080/11745398.2018.1491801
- Machado, V., Carrasco, P., Contreiras, J. P., Duarte, A. P., and Gouveia, D. (2018). Governing locally for sustainability: public and private organizations' perspective in surf tourism at Aljezur, Costa Vicentina, Portugal. *Tour. Plann. Dev.* 15, 692–704. doi: 10.1080/21568316.2017.1415958
- Manero, A. (2023). A case for protecting the value of 'surfing ecosystems'. *NPJ Ocean Sustain.* 2:6. doi: 10.1038/s44183-023-00014-w
- Manero, A., and Mach, L. (2023). Valuing surfing ecosystems: an environmental economics and natural resources management perspective. *Tour. Geograph.* 25, 1602–1629. doi: 10.1080/14616688.2023.2261909
- Margules, T., Ponting, J., Mustika, P., and Pardee Wright, J. (2014). *Assessing direct expenditure associated with ecosystem services in the local economy of Uluwatu, Bali, Indonesia*. Santa Cruz: Save the Waves Coalition. Available at: https://www.savethewaves.org/wp-content/uploads/Bali_Surfonomics_Final%20Report_14_11_28_nm.pdf (accessed February 4, 2024).
- McGregor, T., and Wills, S. (2016). *Natural Assets: Surfing a Wave of Economic Growth*. Oxford: OxCarre.
- Mills, B., and Cummins, A. (2015). An estimation of the economic impact of surfing in the United Kingdom. *Tour. Marine Environm.* 11, 1–17. doi: 10.3727/154427315X14398263718358
- Mishra, P., Pandey, C., Singh, U., Gupta, A., Sahu, C., and Keshri, A. (2019). Descriptive statistics and normality tests for statistical data. *Ann. Cardiac Anaesth.* 22, 67–72. doi: 10.4103/aca.ACA_157_18
- Moreton, S. G., Brennan, M. K., Nicholls, V. I., Wolf, I. D., and Muir, D. L. (2022). Exploring potential mechanisms underpinning the therapeutic effects of surfing. *J. Advent. Educ. Outdoor Learn.* 22, 117–134. doi: 10.1080/14729679.2021.1884104
- Nazer, D. (2004). The tragic comedy of the surfers' commons. *Deakin Law Rev.* 9, 655–714. doi: 10.21153/dlr2004vol9no2art259
- Olive, R., and Wheaton, B. (2020). Understanding blue spaces: sport, bodies, wellbeing, and the sea. *J. Sport. Soc. Issues* 45:1. doi: 10.1177/0193723520950549
- Orchard, S., Reiblich, J., and dos Santos, M. (2023). A global review of legal protection mechanisms for the management of surf breaks. *Ocean Coast. Manag.* 321:106573. doi: 10.1016/j.ocecoaman.2023.106573
- Pleasant, T., and Spalding, A. (2021). Development and dependency in the periphery: From bananas to tourism in Bocas del Toro, Panama. *World Dev. Perspect.* 24:100363. doi: 10.1016/j.wdp.2021.100363
- Ponting, J. (2009). Projecting paradise: The surf media and the hermeneutic circle in surfing tourism. *Tour. Anal.* 14, 175–185. doi: 10.3727/108354209789116510
- Ponting, J., and McDonald, M. G. (2013). Performance, Agency, and Change in Surfing Tourist Space. *Ann. Tour. Res.* 43, 415–434. doi: 10.1016/j.annals.2013.06.006
- Red Bull Surfing (2009). *Red Bull Surf Team Storms Panama*. Available at: <https://www.youtube.com/watch?v=97hdQ1HJsmg> (accessed February 4, 2024).
- Reineman, D., and Ardoin, N. (2017). Sustainable tourism and the management of nearshore coastal places: place attachment and disruption to surf-spots. *J. Sustain. Tour.* doi: 10.1080/09669582.2017.1352590
- Reineman, D., Koenig, K., Strong-Cvetich, N., and Kittinger, J. (2021). Conservation opportunities arise from the co-occurrence of surfing and key biodiversity areas. *Front. Mar. Sci.* 8, 1–7. doi: 10.3389/fmars.2021.663460
- Reineman, D., Thomas, L., and Caldwell, M. (2017). Using local knowledge to project sea level rise impacts on wave resources in California. *Ocean Coast. Manag.* 138, 181–191. doi: 10.1016/j.ocecoaman.2017.01.020
- Rife, A., Erismann, B., Sanchez, A., and Aburto-Oropeza, O. (2013). When good intentions are not enough.. Insights on networks of "paper park" marine protected areas. *Conserv. Lett.* 6, 200–202. doi: 10.1111/j.1755-263X.2012.00303.x
- Roberts, M., and Ponting, J. (2018). Waves of simulation: Arguing authenticity in an era of surfing the hyperreal. *Int. Rev. Sociol. Sport* 55, 1–17. doi: 10.1177/1012690218791997
- Ruttenberg, T., and Brosius, P. (2017). "Decolonizing sustainable surf tourism," in *The Critical Surf Studies Reader*, eds. D. Hough-Snee, & A. S. Eastman (Durham: Duke University Press), 85–109.
- Sadrpour, N., and Reineman, D. (2023). The impacts of climate change on surfing resources. *Shore Beach* 91, 32–41. doi: 10.34237/1009113
- Scheske, C., Arroyo Rodriguez, M., Buttazzoni, J., Strong-Cvetich, N., Gelcich, S., Monteferrri, B., et al. (2019). Surfing and marine conservation: exploring surf-break protection as IUCN protected area categories and other effective area-based conservation measures. *Aquatic Conserv.: Marine Freshwat. Ecosyst.* 29, 195–211. doi: 10.1002/aqc.3054
- Scorse, J., Reynolds, F., and Sackett, A. (2015). Impact of surf breaks on home prices in Santa Cruz, CA. *Tourism Economics* 21(2). doi: 10.5367/te.2013.0367
- Scott, C., Mach, L., Lucas, K., and Myers, A. (2024). Whose cultural ecosystem service values matter? Exploring power inequities in diverse mangrove communities. *Human Ecol.* 52, 81–97. doi: 10.1007/s10745-023-00462-5
- Sitar, A., May-Collado, L., Wright, A., Peters-Burton, E., and Parson, E. (2017). Tourists' perspectives on dolphin watching in Bocas del Toro, Panama. *Tour. Marine Environm.* 12, 79–94. doi: 10.3727/154427316X1482097775343
- Sotomayor, S., and Barbieri, C. (2016). An exploratory examination of serious surfers: implications for the surf tourism industry. *Int. J. Tour. Res.* 18, 62–73. doi: 10.1002/jtr.2033
- Spalding, A. (2013). Lifestyle migration to Bocas del Toro Panama: Exploring migration strategies and introducing local implications of the search for paradise. *Int. Rev. Soc. Res.* 3, 67–86. doi: 10.1515/irsr-2013-0005
- Stranger, M. (2011). *Surfing Life: Surface, Substructure and the Commodification of the Sublime*. Burlington, Vt.: Ashgate.
- STW (2023). *Surf Conservation*. Available at: <https://www.savethewaves.org/surf-conservation/> (accessed February 4, 2024).
- Tagholm, H. (2015). "Waves, environment, community: surfing, sustainability & Surfers Against Sewage," in *Sustainable Stoke: Transitions to Sustainability in the Surfing World*, eds. G. Borne, & J. Ponting (Plymouth: Plymouth University Press).
- Tavakol, M., and Dennick, R. (2011). Making sense of Cronbach's alpha. *Int. J. Med. Educ.* 2, 53–55. doi: 10.5116/ijme.4dfb.8dfd
- Towner, N., and Lemarie, J. (2020). Localism at New Zealand surfing destinations: Durkheim and the social structure of communities. *J. Sport Tour.* 24, 93–110. doi: 10.1080/14775085.2020.1777186
- Usher, L. (2017). "Foreign Locals": transnationalism, expatriates, and surfer identity in Costa Rica. *J. Sport. Soc. Issues* 41:212. doi: 10.1177/0193723517705542
- Usher, L. (2023). "Without [surfing], it's kind of like Groundhog Day, but the ... Twilight Zone version": A phenomenological study of surfers' experiences of the COVID-19 pandemic. *Leisure/Loisir.* 48, 527–563. doi: 10.1080/14927713.2023.2224370
- Valencia, L., Monterrubio, C., and Osorio, M. (2021). Social representations of surf tourism's impacts in Mexico. *Int. J. Tour. Policy* 11, 29–51. doi: 10.1504/IJTP.2021.114454
- Visser, B. (2021). "We are fine here": Ngābe Perspectives on Urban Living, Poverty, and Well-being in Bocas del Toro, Panama (Doctor of Philosophy (PhD) thesis) University of Kent, Canterbury, United Kingdom.
- Waiti, A., and Awatere, S. (2019). Kaihekengaru: Māori Surfers' and a Sense of Place. *J. Coast. Res.* 87, 35–43. doi: 10.2112/SI87-004.1
- Walker, I. H. (2005). Terrorism or native protest? *Pac. Hist. Rev.* 74, 575–602. doi: 10.1525/phr.2005.74.4.575
- Wheaton, B., Waiti, J., Olive, R., and Kearns, R. (2021). Coastal communities, leisure and wellbeing: Advancing a trans-disciplinary agenda for understanding ocean-human relationships in Aotearoa New Zealand. *Public Health* 18:450. doi: 10.3390/ijerph18020450
- White, P., Wheeler, W., Herbert, S., Alcock, I., and Depledge, H. (2020). Coastal proximity and physical activity: Is the coast an under-appreciated public health resource? *Preventative Med.* 69, 135–140. doi: 10.1016/j.jpmed.2014.09.016
- WTTC (2024). *World Travel Report*. London: WTTC.
- Young, P., and Bort, J. (1999). "Ngobe adaptive responses to Globalization in Panama," in *Globalization and the Rural Poor in Latin America*, ed. W. M. Loker (London: Lynne Reinner Publishers), 111–136.