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Musical folklore as a tool for social-ecological change in the Colombian Caribbean

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Large herbivorous fishes, such as parrotfishes, play a critical role in coral reef ecosystems by limiting the coverage of macroalgae. Yet, in the Colombian Caribbean, parrotfishes are being increasingly targeted for human consumption as the demand for fish increases with tourist numbers. The Colombian Caribbean is dominated by Afro-descendant communities, and music is a deeply rooted form of expression and communication. 'Champeta', the local music folklore, is heard at all times of day and danced continuously in the islands off the coast of Cartagena. We conducted a survey of local tourist and fisheries stakeholders to characterise the parrotfish fishery, and designed a contextualised awareness-raising campaign of the ecological role of parrotfish and the need for management in the Islands of the Corales del Rosario and San Bernardo National Park. In doing so, we test if Champeta could be used as a mechanism for social-ecological change in Caribbean coastal communities in the context of coral reef conservation. Locals were engaged in every aspect of the campaign, especially with the song, as the campaign was a process rooted in their culture, interests and idiosyncrasies. Surveys of restaurants illustrated the size of the fishery and the extent of misinformation surrounding the consumption of parrotfish by tourists. We found that both locals and tourists held misconceptions about the ecological role of parrotfish and were supportive of efforts to protect them.

KEYWORDS

traditional ecological knowledge, protected areas, coral reefs, conservation, parrotfish, music

Introduction

Parrotfishes are herbivores that fulfil a key role in coral reef health. Herbivory positively influences reef resilience by maintaining coral dominant states (Mumby et al., 2007). Parrotfishes decrease macroalgal cover, which if left unchecked, inhibits coral growth by dominating bare substrate and restraining coral recruitment (Hughes et al., 2007; Ledlie et al., 2007). Moreover, by scraping algae from rock and coral, parrotfish also act as a major bioeroder, producing large amounts of sand as faeces (Morgan et al., 2016). Hence, protecting parrotfish populations is seen as a way to strengthen long term ecosystem functionality.

Shantz et al. (2020) showed that algal cover of Caribbean coral reef communities was negatively correlated with the density of large parrotfish. This is because fishing targets large individuals and as such, can shift the size structure of populations, increasing the density of small individuals, which are less efficient in controlling algae (Durán and Claro, 2008). Evidence from around the globe suggests that the depletion of parrotfish populations may cause rapid and dramatic changes in reefs structure and functionality, especially when combined with eutrophication, potentially leading to a phase shift from a coral-dominated to an algae-dominated state (Bellwood et al., 2004; Fabricius, 2005; Mumby et al., 2007).

The Caribbean has suffered region-wide declines in coral reef health since the 1970's (Gardner et al., 2003). According to the Atlantic and Gulf Rapid Reef Assessment (AGRRA), which has been conducting regional surveys of coral reef health for 20 years, the regional average macroalgal cover is 40%, while coral cover currently stands at 13% (AGRRA, 2018). Concomitant to declines in coral cover is the intensification of fishing pressure that has caused overfishing of commercial species in most locations (Shantz et al., 2020). This is a worrying situation for many small island developing states and small coastal communities that depend strongly on small-scale fishing for their livelihoods, while relying on many other ecosystem services provided by reefs. Fishing not only is the lifeline for most of the small coastal communities in the Caribbean, but is paramount to their food security and nutrition. Therefore, sustainable management of reef resources in these areas is a complex interdisciplinary process requiring the evaluation and integration of multiple factors (biological, ecological, socioeconomic and institutional) (Pollnac et al., 2010; López-Angarita et al., 2014).

Establishing protected areas is one of the most traditional conservation approaches to halt the degradation of natural ecosystems. However, it has been widely acknowledged that in practice these approaches have historically ignored humans. Therefore, the current state of knowledge seeks to incorporate behaviour science at the heart of conservation in order to develop interventions that directly target the behaviours driving problematic environmental change (Crosman et al., 2022). Concomitantly, there has been a call to incorporate other important social movements related to equity, at the heart of conservation, such as decolonization, sexual abuse, and racism (Crosman et al., 2022). In rural Colombia, poverty, high dependence on natural resources, and illiteracy, make it challenging to convey messages of wildlife conservation to all sectors of society. The creative arts are an effective way to convey ideas and messages in low literacy contexts, but have received relatively little attention as a conservation outreach strategy. Music can be a great tool for conservation education because it attracts attention and evokes emotional responses (Jacobson et al., 2007). Community drama skits were shown to increase gender equality significantly in fishing communities in Zambia (Cole et al., 2018).

In the Corales del Rosario and San Bernardo National Park (CRSB), located in the Colombian Caribbean, an increase in national and international tourism (Pineda et al., 2006) has driven an increased demand for fresh fish. The subsequent increase in fishing pressure has caused herbivorous fish to be targeted along with traditionally valued piscivorous reef and pelagic fish species such as snappers and barracudas (Martínez-Viloria et al., 2011). Historically, herbivorous fish had no commercial value. Moreover, coral bleaching in recent years has caused an increase in coral mortality, and water pollution from regional sewage and riverine contaminants further inhibit coral resilience and recovery (Bejarano et al., 2016).

A research project exploring the conservation status of parrotfish populations in the area was implemented between 2008 and 2011 (López-Angarita, 2017; López-Angarita et al., 2021). The project was developed with the support of Colombian universities, environmental authorities, and non-governmental organisations. This paper summarises the characteristics of the parrotfish fishery in the communities of the CRSB, and reports findings from a communication for social change campaign comprising culturally relevant activities for different stakeholder groups (tourists, fishers, and youth).

Methods

Study site

The National Natural Park Corales del Rosario and San Bernardo (CRSB) located in the Colombian Caribbean (Figure 1) comprises two archipelagos, 30 small islands, and coastal lagoons harbouring mangrove forest, tropical dry forest, rocky shores, seagrass beds and coral reef within a total area of 1,200 km^2 and 68 km^2 of coral reefs. Established in 1977 as the first marine park in the country, CRSB has an important conservation value protecting the most extensive, diverse and developed coral reefs of the continental shelf of Colombia (Pineda et al., 2006). Most of the islands within the CRSB do not belong to the protected area and have been inhabited by native Afro-

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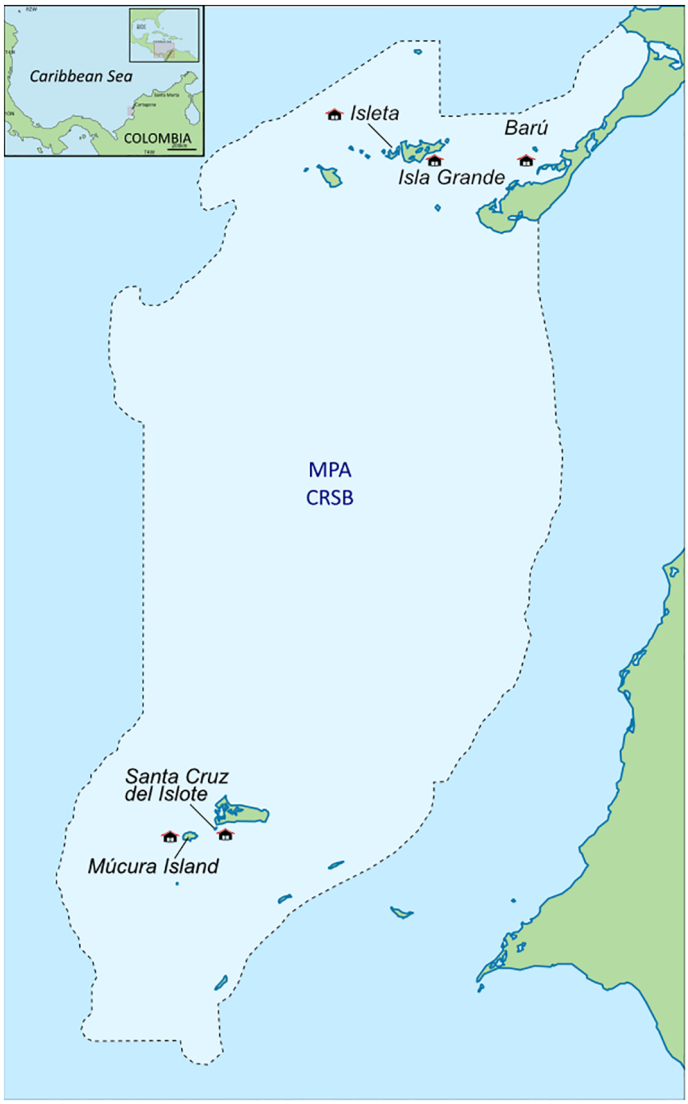

FIGURE 1
Map of the study site, Corales del Rosario and San Bernardo National Park (MPA CRSB), shown in light blue. Local communities surveyed are illustrated by a house icon.

Colombian communities (ethnical minority) from about 300 years (Durán, 2009). Fishing is the main livelihood in the islands of the CRSB, and along with tourism represents the base of the local economy. Despite their proximity to Cartagena, these communities are characterised by low income, lack of access to fresh water, sanitation, health and education, and scarce access to other capitals beyond natural capital (Camargo et al., 2009).

For the first 25 years after the establishment of the national park, a command and control, top-down management approach was enacted by the central government of Colombia (Durán 2007). Under this regime the extraction of marine resources was prohibited even within traditional fishing areas, ignoring the historical livelihoods of locals (López-Angarita et al., 2014). However, the Colombian government introduced in the late 1990s a new policy called 'Social Participation for Conservation', which promoted the engagement of local communities in the national parks of Colombia through environmental education programs and capacity building (López-Angarita et al., 2014). Yet, these efforts of social inclusion of local communities have weakened, following conflicts and tensions between the communities and authorities, involving coastal development, tourism, and land tenure (Durán, 2009).

Community surveys

To characterise the fishing activity and the market for parrotfish, we conducted semi/structured surveys with fishers, households, restaurant managers, tourists and park rangers and three participatory workshops with local communities throughout 2009. Surveys were implemented by a social scientist with previous experience working in the area. Households and fishers were selected randomly and according to their willingness to participate. During the workshops, we carried out different exercises with the fishers to determine the historic profile of the catch (the time since parrotfish had been targeted) and price fluctuations according to seasons (exploring the prices according to the seasonality of target species through the year). Surveys to fishers and park rangers focused on evaluating their knowledge of the ecological role of parrotfish, and surveys of restaurant managers to establish the gastronomic demand of tourists. Finally, we surveyed tourists visiting the CRSB to determine their knowledge about parrotfish and their willingness to pay for not consuming parrotfish (Table 1).

Communication for social change

Communication activities were developed with the objective of devolving knowledge of the ecological importance of parrotfish to the community, focused primarily on children and fishers. To make the message understandable and valuable for the local community, the activities were tailored according to the culture of the region. This was achieved through immersive observation in the communities for more than a year, and by talking to community leaders. Informal educational workshops and talks with fisher groups were organised, as well as art workshops and talks in local schools (held in the communities of Isleta, Isla Grande, Múcura y Santa Cruz El Islote). In the community of Isla Grande we planned the "parrotfish day" and "parrotfish sports week" with the help of the local school and community leaders.

The main strategy of our campaign was to make a song about parrotfish, as local communities across all ages of society in the CRSB are driven by storytelling through music. Particularly, the music genre called 'champeta', a folklore with African roots endemic to the region. The parrotfish song was written by J. Lopez Angarita and A. Cano, who studied champeta to make the lyrics match the traditional style. The original music was written by the Colombian musician Diego Posse and the song was performed and recorded in Spanish by the most popular champeta singer of Colombia, 'Charles King', who is a well-known local artist and environmentalist.

We designed an educational campaign for tourists by printing booklets and posters with key information about parrotfish conservation and distributed them in key sites of Cartagena city and the CRSB (tourism centres, ports, diving shops, hotels, restaurants, eco-hotels). Additionally, for two consecutive years during high season, we gave informal education talks to tourists in tour boats focusing on the anatomical attributes of parrotfishes so tourists could recognize the fish once cooked and plated. Finally, we

TABLE 1 Data collection tools such as community workshops, interviews, surveys, and communication activities outlining number of activities performed per community and stakeholder type.

Tools	Number of activities	Number of participants
Community Workshops		
Isla Grande	2	15
Isleta	1	22
Santa Cruz El Islote/Múcura	2	55
Semi-structured Surveys		
Fishers		40
Tourists		109
Households		68
Park rangers		8
Restaurant managers		6
Interviews		
Fisher		1
Environmental authority (UAESPNN)		1
Environmental educator specialist		1
Communication activities		
Parrotfish day: Theatre play and concert	1	200
Educational talks at schools	5	50
Educational campaign for tourists and talks on boats	53	6500

organised workshops about the biology and ecology of parrotfish for local eco-guides, and designed underwater fish guides and posters for parrotfish identification during their tour activities.

Results

Community surveys

Sixty-eight household surveys were carried out in the biggest communities of the CRSB (15 in Isleta, 35 in Isla Grande and 18 in Barú). Surveys showed that fishing is the principal economic activity of the majority of households and that generated an average income of USD156 per month in 2010. Including other economic activities, the average income of a household per month was USD189, slightly over half the national minimum wage in 2010 ($318 per month). Additionally, 96% of heads of households affirmed that fishing resources had diminished in the last 10 years and 91% proposed that management of resources should be made through agreements between community and authorities.

Only 12% of the 40 fishers surveyed in Rosario (Isleta, Isla Grande and Barú) reported to target parrotfish. These fishers estimated that parrotfish represents 15% of the total daily capture. When asked about the use of parrotfish, 88% confirmed it is used for household consumption. Moreover, during fisher group workshops, the historical analysis showed that the parrotfish market began around 2000 for commercial purposes (Table 2), mainly to substitute snapper in tourist menus. Parrotfish are captured mainly by pole spear, as it is a selective fishing gear that targets plate-size individuals. Some fishers considered parrotfish as harmful to the reefs because they had witnessed parrotfish corallivory.

Our observations in the field and discussions with stakeholders confirm that fishermen catch parrotfish to satisfy the gastronomic demand from tourists, where parrotfish are sold as snapper in the typical Caribbean lunch (whole fried fish, fried plantains, coconut rice and salad). Fishers sell one individual parrotfish to restaurants for USD0.50, who then will sell it to tourists at the price of snapper ($6 plate in 2010) (Table 3). This entire process is conducted in a confidential manner as fishermen are aware restaurants trick tourists and because park staff have recommended fishers against capturing parrotfish.

In restaurant surveys (n=6), only 16% of establishments openly admitted to sell parrotfish on their menus, yet when asked if they would buy parrotfish offered by fishers, 50% of the restaurant owners were prepared to buy these species and offer it in their restaurants as according to them, it is cheaper and has good flavour. Half of restaurants declared that few tourists are capable of identifying the species by its colour, shape or size. We interviewed the families that manage 6 restaurants in Isla Múcura and they confirmed that each restaurant served 15-20 lunches in low season, this number increased to 120-200 in high season, which equates to between 720 and 1800 fish served per day in the island, most of which would be parrotfish.

Of the 109 tourists surveyed (65% male and 34% female), 66% have never heard of parrotfish and 87% were unaware of their important role in the reef. 75% had purchased seafood since their trip began Once informed of the importance of this fish to coral reef health, tourists were asked if they were willing to consume parrotfish at the same price as other commercial species, to which 89% answered negatively, and 80.7% informed they would not consume it even if it was half the price of other fish offered, showing that tourists, once given the knowledge, are willing to make sustainable decisions.

Communication for social change

In the educational workshops we used didactic tools to evaluate the ecological knowledge of fishermen such as games and audio visual props. Many fishermen had misconceptions about the role of parrotfish, and most were unaware of its importance. During the "parrotfish sports week" adults and children had fun playing softball and football and prizes featuring parrotfish were awarded to the winning teams (such as hats, t-shirts, notebooks, CDs). During the "Parrotfish Day", we held a series of events to celebrate parrotfish but respecting the favourite activities of locals. The day started with snorkelling activities for children organised with local eco-guides to spot parrotfish species underwater, followed by a theatrical play about the ecological role of parrotfish performed by the local school along with a pictographic exposition of children's parrotfish drawings, and finalised with a live concert featuring the famous local musician Charles King. The concert presented the first live performance of "La champeta del loro", performed to the whole

TABLE 2 Fishers' perceptions regarding extraction trends, abundance and fishing gears related to the parrotfish fishery between 1980 and 2010.

Variable	Before 1980	1980-1990	1990-2000	2000-2005	2005-2010
Parrotfish extraction	Household consumption around 1985 because scarcity of other species	Low extraction	Low extraction	Extraction increases for commercialization	Very high extraction for commercialization
Parrotfish abundance trends	Very abundant	Very abundant	Very abundant	Very abundant	Very abundant
Fishing gears	Pole Spear	Pole Spear	Pole Spear	Pole Spear	Pole Spear

TABLE 3 Market information for commercial and herbivorous species for the community of Isla Grande obtained during workshops in 2010.

Product	Fisherman Sale Price		Restaurant Sale Price	
	High Season	Low Season	High Seasson	Low Season
Conch	$5 US (Kg)	$3 US (Kg)	$30 US (Kg)	$7.5 US (Kg)
Lobster	$20 US (Kg)	$10 US (Kg)	$35 US (Kg)	$12.5 US (Kg)
Grouper	$7.5 US (Kg)	$4 US (Kg)		
Red snapper	$7.5 US (Kg)	$4.5 US (Kg)	$12.5 – $15 US (Kg)	
Yellow snapper	$6 US (Kg)	$4.5 US (Kg)		
Rainbow parrotfish	$20 US (unit)	$20 US (unit)	Not offered	Not offered
Stoplight parrotfish	$0.5 US (unit)	$0.5 US (Kg)	$6 US	$4 US
Queen parrotfish	$5 US (3-4 Kg)	$5 US (3-4 Kg)	Not offered	Not offered

community. The song was distributed to many local DJs using CDs, and it was featured in local radio stations. Finally, it was posted on YouTube with English subtitles (https://www.youtube.com/watch?v=J4nl8jPbkUU) accompanied with a video summarising the conservation activities of the project. The video was posted in July 2010 and it has 17,775 views to this date with 89% of interactions corresponding to "like".

The lyrics of the parrotfish song are the following: "*the parrotfish dance under the water, while in the islands the skirts move, dance like the loro wet and sticky, and think twice before cooking it and dishing it. Hey brothers, sing this song and together let's protect the parrotfish, because in the ocean they are the boss, cleaning the algae, and taking care of the coral. Keep dancing my rhythm, don't stay still, move your skeleton like the parrotfish, move your fin to this side, keep finning without stopping. In the reefs the parrotfish is our pride, take care of him and protect him, his future is yours. We are fishing them as if they were sardines, but in some years they just won't be here*" (Translated by: J López-Angarita).

For the awareness raising campaign for tourists, we gave informative talks during the high season to 500 people and we trained seven park volunteers to be conservation educators. They were in charge of giving information to tourists at the port prior to departure to the islands of CRSB. Posters were placed in strategic sites, creating an agreement with the owners/managers of the establishments to post it permanently and disseminate information. We estimate that we connected with a total of 6500 people through our tourist campaign. In Isla Grande we trained the leaders of the native eco-guides group with a workshop, snorkelling activities and parrotfish identification guides, and posted two permanent posters on the island that will serve as stop stations to talk about parrotfish when they are giving the tour around the island with tourists.

Six months after the project was finalised, we surveyed 39 fishermen and 8 park officers to determine the effectiveness of our raising awareness activities. We found that 35% of fishermen admitted to having learned about the importance of parrotfish from the project; 100% expressed the importance of conserving them; 89% were willing to stop fishing parrotfish; and 77% proposed to prohibit parrotfish capture as a method to protect it. Regarding park officers, 87.5% understood the ecological role of parrotfish, and 50% of them admitted to having learned this information from the educational activities related to the project.

Discussion

The parrotfish fishery

In the CRSB, parrotfish have low market value for fishermen, but restaurants profit by selling them as snapper, taking advantage of tourists' increasing numbers and inability to identify fish species. Therefore, the existence of a parrotfish market can be a delicate topic and some individuals can be somewhat defensive about the subject. Adding to this, there is a lack of awareness about the role of parrotfish in coral reefs by tourists and locals. Most tourists had never heard about parrotfish before. However, after learning about their important role, most of them were inclined to support their protection. Likewise, during our awareness raising activities with the communities we noticed fishermen held misconceptions about the feeding behaviour of parrotfish.

In the ecological component of this study (López-Angarita et al., 2021), we used underwater surveys to determine the main aspects of parrotfish populations in the CRSB. We showed there is an evident reduction in the total length for all the species of parrotfish in CRSB compared with documented common and maximum sizes (Hawkins and Roberts, 2003). Overall, these results are consistent with other findings in the Caribbean region where parrotfish assemblages dominated by small sizes prevail as a consequence of overfishing (Hawkins and Roberts, 2004). The scarcity of large herbivore species has important effects in the ecosystem functionality because of their key role in reef dynamics (Bellwood et al., 2004). Recent studies have shown that herbivorous action varies according to parrotfish species, as they feed on different algae groups (Burkepile and Hay, 2010). Burkepile and Hay (2010) suggest that this causes species-specific effects in the ecosystem, depending on the developmental state of the community, and provide evidence in support of protecting

herbivore diversity, as this is crucial to promoting recovery processes that enhance overall resilience. In addition, small parrotfish seem to be less effective in their role as herbivores and bioeroders than their bigger counterparts. Lokrantz et al. (2008) showed that a reduction in body size of a parrotfish population causes disproportionate loss in their function. They revealed that to compensate for the loss of a single 35 cm individual of *Chlorurus sordidus*, 75 individuals of 15 cm are needed, suggesting that reefs with high parrotfish abundance may have functionality impairments if dominated by small sizes (Lokrantz et al., 2008).

Aswani and Sabetian (2010) studied the effects of urbanisation on artisanal parrotfish fisheries in the Solomon Islands and found that in less than a year abundance dropped 50% in heavily fished areas, with medium and large individuals declining more sharply. The authors state that in communities with weak forms of customary management adjacent to urbanised areas, parrotfish can suffer a rapid decline in a short period of time (Aswani and Sabetian, 2010). This scenario reveals that it is imperative to start accepting the formal existence of a parrotfish fishery in Colombia, since increasing tourism development and urbanisation are bound to significantly stress artisanal fisheries, causing important cascading effects in coral reefs. Fishing is the main economic activity in the low-income communities of the CRSB, indicating a high level of dependence on marine resources, as principal source of income and protein. Therefore, it is important to include this food security component in any measures imposed.

The most recent survey of parrotfish populations in the Colombian Caribbean took place in 2017 as part of a research initiative supported by the government to guide management (Rincón-Díaz et al., 2017). In their results, they report the steady decline of parrotfish density over time in CRSB along with an observed increase in fishing pressure. This has led to the inclusion of five of the 12 species of parrotfish in the 'Libro Rojo de especies de Peces Marinos de Colombia', which lists endangered species. This research also recommends the legal drafting of specific fishing regulations to protect parrotfish, following initiatives of neighbouring countries. However, to this date such regulations have not been drafted nor implemented in Colombia.

We recommend the design and implementation of a Fisheries Plan of Action jointly between the fishing communities and the environmental authorities (Unidad de Parques Nacionales, INCODER, Coast Guard). In order to make this fisheries co-management strategy work, cooperative alliances between different organisations must be consolidated (Coast Guard, CRSB, INCODER, Capitanía de Puertos) and an effective surveillance and enforcement plan should be implemented.

Music as a conservation tool

Music was an important channel of expression, freedom, and solace for slaves in the Caribbean (Giraldo Barbosa and Vega Casanova, 2014). In local communities of the islands music is still the heart of their culture. Specifically, the genre of folk music and dance called 'Champeta' is the most popular and what most coastal communities identify with. The origin of Champeta dates back to the 1960s as a form of expression for the marginalised communities of afro-descendants in the Caribbean coast of Colombia (Abril and Soto, 2004). The word Champeta is defined as a small machete or knife, but it was used despicably by the economic elite to refer to people from the poorest sectors of Cartagena, who listened and danced to African and Caribbean music (Cueto Quintero, 2016). Therefore, the term was associated with slavery, blackness, and mistreatment (Abril and Soto, 2004). For these communities Champeta was the way to declare their cultural independence from the white upper class and to protect their ethnic identity (Cueto Quintero, 2016).

The dance that accompanies Champeta has also been used as means of resistance, by defying the socially acceptable conventions of gender, conduct, and sexuality (Giraldo Barbosa and Vega Casanova, 2014). Through its highly erotic and seductive movements, Champeta dance disturbs the conservative norms established by the social elites. Through time, the fascinating rhythm and hypnotic dance of Champeta slowly permeated into all sectors of society through music festivals, parties and radio, becoming very popular all over the country. In the islands inside the CRSB, Champeta is heard at all hours, every day of the week; it is the signature of the islands, danced and sung by all ages.

Given the history between environmental authorities and the local communities, and the variable vulnerability of fishers to management changes that impose gear restrictions (Tilley et al., 2018) some local communities had negative attitudes towards conservation policies. Therefore, any effort to change the attitude of locals towards wildlife was likely to be met with resistance. Activities developed during the project to raise awareness of the community regarding the role of parrotfish were designed with the objective of exchanging knowledge between locals and scientists. Communication for social change activities were initially successful in delivering the conservation message and we believe the success may have been the result of building relationships within the community, showing respect, acceptance and interest in local culture, values and livelihoods. In general, we found that these communities were committed to all the activities, providing us with their time, interest, and support. The parrotfish song (with 17,775 views to date - Nov 2022, in YouTube), was particularly successful at delivering the message because it showed locals that the project's main priority was to celebrate local culture, values and livelihoods.

Following intensive awareness-raising activities developed as part of this study, the community started to recognize the vital ecological role of parrotfish in coral reef systems, and suggested a redrafting of the fishing legislation by the environmental authorities, in order to recognise and incorporate the traditional fishing rights of human communities living within the CRSB. The key to sustainable management of these areas is working with local communities to enhance or supplement their

livelihoods, to allow for reduced pressure on reef resources. Tourism is one potential avenue for this, but must be informed and on a scale appropriate to the resource. This highlights the need for more ecological and bioeconomic research to understand the health of the commercial fish stocks (of snappers and parrotfish), determine reasonable levels of exploitation, and guide the design of management measures that drive sustainable use of reef resources, including parrotfish.

Data availability statement

The datasets presented in this article are not readily available because no significant datasets were generated in this research. Requests to access the datasets should be directed to Juliana Lopez, jla_gg@yahoo.com.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

JL-A and MR conceived and designed the study. JL-A, MR, KG, and DE collected the data, performed the analysis and interpreted results in a report prepared for the donor. JL-A wrote this manuscript. All authors contributed to the article and approved the submitted version.

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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.

Publisher's note

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