

The ‘hollow-middle’: why positive community perceptions do not translate into pro-conservation behaviour in El Vizcaíno Biosphere Reserve, Mexico

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Participation of local communities in conservation is essential for long-term sustainability of biosphere reserves. Yet, questions remain about conditions under which participation is successful. Positive perceptions about a protected area, which may be associated with economic benefits or improved social capital, can promote pro-conservation behaviour, yet relationships are unclear. To assess this, we investigated perception–behaviour relationships in El Vizcaíno Biosphere Reserve, Mexico – a socially and ecologically diverse desert region. Unsustainable and illegal resource use in the reserve has placed ecosystems under pressure. A survey of 367 people in seven rural communities and informal interviews with stakeholders suggested there was strong support for reserve designation among respondents. While conservation was recognized as a primary purpose for designation, respondents perceived the reserve was threatened by illegal and unsustainable activities. Concomitantly, respondents desired effective regulatory management and socio-economic development. Positive perceptions did not translate into pro-conservation behaviour. Respondents were largely unaware of, and had rarely participated in, conservation initiatives. Reasons appear to be related to the limited capacity of government agencies and resource management institutions. The latter require continual external support to develop stronger leadership, management skills and more equitable governance, required to bring local actors into conservation.

Keywords: community-based conservation; participation; perceptions; biosphere reserve; collective management; attitudes

1. Introduction

Protected areas are the cornerstones of global efforts to conserve biodiversity. Yet, their effectiveness is threatened by human population growth and resource use (Chape et al. 2008; Butchart et al. 2012). It has been suggested that a new model for land conservation is needed as protected areas have largely failed to achieve their objectives (Terborgh 2000; Mora & Sale 2011). Part of the problem, which is detailed within a well-established literature, is that many local communities are alienated from protected areas (Pezzoli 2000; West et al. 2006). Commentators have argued for the need to improve community participation in decision-making and to bolster the economic and social benefits that communities receive from protected areas (Thomas-Slayter & Rocheleau 1995; Brechin et al. 2002; Adams et al. 2004). However, research suggests that many such efforts have failed (Kellert et al. 2000; Kiss 2004). One reason for this may be that local people’s perceptions have seldom been factored into decision-making.

Previous approaches to biodiversity conservation in protected areas, based on a top-down ‘protectionist’ model, have profoundly alienated local communities that depend on protected area resources for their livelihoods (Neumann 1992; Ghimire & Pimbert 1997; West et al. 2006). In many cases, protectionist policies, based on the concept that ecosystems function best when isolated from

human disturbance (Terborgh 2000), were met with resistance and hostility. This has resulted in behaviours such as non-compliance with regulations (Wells & Brandon 1993), illegal harvesting, hunting or poaching, and minimal support for conservation (Barkin 2003). Ultimately, such activities have undermined the effectiveness of many protected areas in meeting conservation objectives (Brandon et al. 1998). An alternative model, known as ‘community-based conservation’, seeks to protect larger areas by integrating environmental protection with poverty reduction. The model is based on equitable access to resources and social inclusion (Campbell & Vainio-Mattila 2003; Agrawal & Redford 2006).

Variations of community-based conservation are found in the Integrated Conservation and Development Projects, popular from the 1980s. In these projects, external conservation organizations offered economic incentives to rural communities living adjacent to protected areas in exchange for their support for conservation (Newmark & Hough 2000). More recently, UNESCO’s model for ‘biosphere reserves’ addresses the need to balance conservation of biological and cultural diversity with equitable socio-economic development, using a system of zones. Core areas for protection of key species and habitats are separated from buffer zones, where traditional and alternative resource uses are permitted (UNESCO 2008). Community-based conservation initiatives, including

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agriculture, bio-prospecting, ecotourism and extractive harvesting, have been implemented in biosphere reserves, and other International Union for Conservation of Nature category VI protected areas. This has been based on the assumption that financial benefits and improved social capital will engender positive perceptions about protected areas, leading to greater uptake of pro-conservation behaviour (Schultz et al. 2011; Chapin et al. 2009).

It has been suggested that if local communities could benefit economically from enterprises that depend on natural resources they would conserve and sustainably use those resources (e.g. Salafsky et al. 2001; Campbell 2007). International studies, for example, have examined whether new sources of income from ecotourism generate positive perceptions of conservation benefits (Pegas et al. 2013). Positive perceptions have been related to income diversification from ecotourism in developing countries, including Botswana (Mbaliwa et al. 2011), Tanzania (Baird & Leslie 2013), Brazil and Peru (Stronza & Pêgas 2008). In Uganda, a government agency redirected revenue from tourism to build community infrastructure in rural communities in efforts to offset crop losses from wildlife and to improve local perceptions of conservation initiatives (Archabald & Naughton-Treves 2001). Economic gains, however, have often been insufficient to change community perceptions about resource use, as relatively few permanent jobs have been generated or jobs are only seasonal (Barkin 2003; Brenner & Job 2006). But, economic benefits are not the sole mechanism for improving community acceptance of protected areas and bolstering support for conservation. Improved social capital also performs a significant role (Moore et al. 2006).

Social capital from equitable participation in resource management can foster positive perceptions of conservation (Agrawal & Redford 2006; MacNeil & Cinner 2013). Social capital includes secure rights to resources and equitable local governance (Agrawal & Redford 2006; Sievanen et al. 2013). Collective management regimes for natural resources have been implemented in the belief that local resource users are better placed to implement regulations and can better respond to specific ecological issues than centralized government agencies (Antinori & Bray 2005). The capacity of local governance has been bolstered by alliances with networks of national and international government and civil society organizations (Orozco-Quintero & Berkes 2010). For instance, Gutiérrez et al.'s (2011) review of governance institutions identified that ecological, social and economic success was dependent on strong leadership, equitable access to resources and social cohesion. Oftentimes though, collaborative efforts have emphasized policy and technical models and have de-emphasized capacity building in local institutions and governance (Thomas-Slayter & Rocheleau 1995; Cronkleton et al. 2011).

Community participation in conservation is critical for the success of protected areas. Positive perceptions of protected areas, management agencies or conservation initiatives may lead to positive environmental outcomes

by reducing negative behaviours, such as illegal or unsustainable resource use. They can also increase positive behaviour such as participation in wildlife protection programmes. However, the relationships between people's perceptions and their behaviours are complex, with social, cultural and psychological dimensions (Waylen et al. 2009). Perceptions are influenced by site-specific contexts (Agrawal & Chhatre 2006; Zanetell & Knuth 2004), including geographic and related cultural differences associated with communities (Allendorf et al. 2006; Waylen et al. 2010), livelihood strategies (Stronza & Pêgas 2008; Khadka & Nepal 2010), contact with a conservation organization (Salafsky et al. 2001; Pegas et al. 2013), as well as by demographic variables (Hernández-Ramírez et al. 2008). Few studies have assessed the multiple dimensions of community participation in conservation.

This paper examines perception-behaviour relationships in El Vizcaíno Biosphere Reserve, Mexico, where rural residents depend for their livelihoods on the collective management of fisheries, livestock and alternative tourism enterprises.

2. Methods

2.1. Study area

El Vizcaíno Biosphere Reserve (2.54 million ha) is Mexico's largest protected area. It occupies the central section of the Baja California Peninsula, extending from a 5 km marine buffer zone on the Pacific Coast including the Vizcaíno Desert and the San Francisco Mountains in the interior, to the Gulf of California buffer zone (INE 2000) (Figure 1). Designation of this desert region in 1988 was critical for the biodiversity conservation of northwest Mexico, extending existing whale sanctuaries to include habitat for endangered terrestrial species and cultural heritage elements. Designation was also intended to broaden economic opportunities for the more than 35,000 local residents through alternative resource use enterprises (Ortega-Rubio 2000; INE 2000).

More than 85% of the protected area is tenured as communal ownership through a characteristically Mexican corporate entity – the ejido, which was instituted after the Mexican revolution (1910–1920) to distribute land to poor peasants (Cronkleton et al. 2011). Ejidos have specific membership rules and a collective governance system organized around a land base (Antinori & Bray 2005). In the Vizcaíno Biosphere Reserve, ejidos are relatively recent establishments, occurring since individuals and families migrated from mainland Mexican states during the 1970s to escape poverty and violence (Lagunas-Vázquez et al. 2008). Communal land in El Vizcaíno Biosphere Reserve is mainly used for agriculture and livestock/ranching activities, but it is also used for settlements, tourism enterprises and mining leases. Around 12% of El Vizcaíno Biosphere Reserve is federally owned with <2% private property (INE 2000).

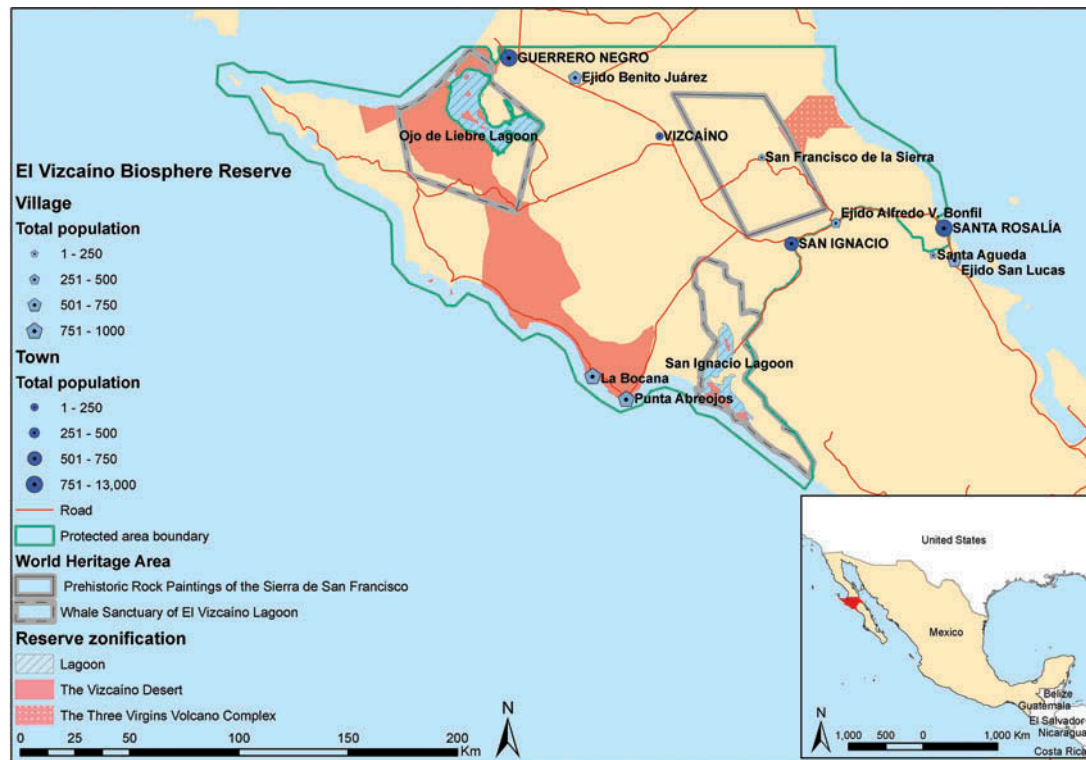


Figure 1. Geographic location of community survey sites in relation to El Vizcaino Biosphere Reserve, Baja California Sur, Mexico.

The regional economy relies on large-scale salt production, intensive agriculture and commercial fisheries. Residents in rural areas rely on fisheries, livestock ranching and small-scale agriculture. In some communities, tourism is also important (INE 2000; Castellanos et al. 2002). As a result of human development, the reserve is threatened by a variety of significant threats, particularly illegal hunting of endangered Bighorn Sheep and Peninsula Pronghorn Antelope; unsustainable fisheries; high levels of sea turtle poaching and by-catch in fisheries; unsustainable use of aquifer water; overgrazing; mining operations, oil and natural gas drilling; and unregulated urban sprawl (INE 2000).

Reserve administration is under federal jurisdiction. The National Commission for Natural Protected Areas 'CONANP', a regional agency of the Ministry of the Environment and Natural Resources 'SEMARNAT', has responsibility for on-site implementation of management and operational plans and biological research. A regional agency of the Federal Attorney General's Office for Environmental Protection 'PROFEPA' investigates violations of environmental laws (INE 2000).

The reserve was included in UNESCO's Man and the Biosphere programme in 1993 and following UNESCO's biosphere reserves model (Möller 2011) is divided into two management zones. Core zones mandate strict protection, while in buffer zones (comprising 84% of the reserve) traditional resource uses compatible with conservation are permitted (Castellanos et al. 2002) (Figure 1). Key agency programmes combining

conservation with development include a stewardship-hunting programme for Bighorn Sheep, whale watching tourism in 'The Whale Sanctuary of El Vizcaino Lagoons' World Heritage Site and cultural heritage tourism in the 'Prehistoric Rock Paintings of the San Francisco Mountains' World Heritage Site (INE 2000) (Figure 1).

2.2. Overview

The study was based on field research in El Vizcaino Biosphere Reserve, Mexico, between September 2012 and February 2014. A mixed-methods approach, comprising a community-based survey (October 2012 to January 2013), informal and semi-structured interviews, and participant observation (September 2012 to February 2014), was used to obtain quantitative and qualitative data from rural residents and other stakeholders about the biosphere reserve (Veal 2011). This information included the reserve's function, status and purpose, its management and its conservation. A community-based survey was administered as a questionnaire to 390 people in seven representative rural communities. A total of 367 people responded to this survey giving a 94% response rate (Table 1 and Figure 1). The survey asked respondents about three key topics: (1) the designation of El Vizcaino Biosphere Reserve; (2) reserve management and (3) their awareness of, and involvement in, conservation initiatives.

Table 1. Socio-economic characteristics of survey respondents in seven rural communities in El Vizcaíno Biosphere Reserve, Mexico (response rate 94%).

Community	Economic activity governance type	Female	Male	Surveys completed	Surveys distributed	Surveys incomplete or not returned
Punta Abreojos	Fishing cooperative	33	33	66	70	4
La Bocana	Fishing cooperative	23	31	54	60	6
Ejido San Lucas*	Ejido	31	31	62	65	3
Santa Águeda*	Livestock ranching within ejido ¹	8	12	20	25	5
Ejido Alfredo V. Bonfil	Livestock ranching within ejido ¹ UMA ² for stewardship-hunting programme for Bighorn Sheep	18	40	58	60	2
San Francisco de la Sierra	Cooperative union of ranchers Cooperative management of cultural heritage tourism	19	40	59	60	1
Ejido Benito Juárez	Private small-scale agriculture Rent of communal lands managed by ejido ¹ Whale watching ecotourism managed by ejido ¹	24	24	48	50	2
Total		156	211	367	390	23

Notes: *The ejidal settlement of San Lucas is adjacent to reserve, with some communal land within the reserve. Santa Águeda is adjacent to the reserve.

¹An ejido is a communal land ownership structure.

²A UMA (Unit for the Conservation, Management and Sustainable Development of Wildlife) is a federal wildlife management strategy integrating social issues and wildlife conservation (Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) 2009).

To enrich and verify survey data, more than 40 semi-structured and informal interviews were held with stakeholders, including management agency staff, conservation organization staff, urban and rural residents, conservation volunteers and tourists. Information was sought on biological conservation issues, relationships between the reserve and local residents and patterns of resource use. Methods were adapted from those delineated by Schelhas (1991) for assessing issues faced by protected areas. Participant observation, which included attendance at tourism excursions, education seminars and a regional sea turtle conservation conference, provided additional data. Informal interview techniques and participant observation are commonly used together in field research of community-based conservation (Bernard 2000; Veal 2011). Qualitative data from interviews and observations helped verify and enrich the survey questionnaire data. One of the authors has lived part-time in Ejido San Lucas, on the southern boundary of the reserve, since 2011.

2.3. Community survey

The survey instrument was designed to assess perception-behaviour relationship of residents in rural areas of El Vizcaíno Biosphere Reserve. The survey was administered as a questionnaire to seven representative rural communities, between October 2012 and January 2013 (Table 1 and Figure 1). Communities were selected to represent the dominant extractive resource uses, pastoralism, fisheries, and small-scale agriculture, and alternative tourism activities, stewardship-hunting, whale watching and cultural tourism (Table 1). Five communities were within reserve boundaries and two were close to its southeastern boundary.

2.3.1. Survey instrument

The questionnaire had eight sections: (1) awareness of the reserve and its two World Heritage Sites; (2) reasons for designation of the reserve and its two World Heritage Sites; (3) support for designation of the reserve and World Heritage Sites; (4) benefits and disadvantages of designation; (5) threats; (6) effectiveness of reserve management; (7) awareness of and involvement in conservation; and (8) community demographics (sex, age, level of education, level of income, occupation and length of residency). The structure (sections 1–6) was informed by Bentrupperbäumer and Reser's (2006) questionnaire used in a community-based survey which examined perceptions about an Australian World Heritage Site. Prior to use, the questionnaire was approved by the home institution's human subjects ethics research committee (ENV/11/12/HREC). After being translated into Spanish, a pilot survey was tested on residents of El Vizcaíno Biosphere Reserve.

To determine perceptions about the designation of the reserve, open-ended questions asked about awareness of the existence of the reserve and its two World Heritage Sites, awareness of reserve boundaries, purpose of reserve designation, purpose of World Heritage designations and benefits or disadvantages of reserve designation. Respondents were asked to rank their support for reserve designation, benefits from reserve designation and severity of threats to the reserve.

To determine perceptions about reserve management, open-ended questions asked about the effectiveness of conservation management and economic management, and what actions were needed to improve reserve management. A yes/no question asked whether the management agency had met respondents' expectations. To

determine perceptions towards conservation, open-ended questions asked about awareness of conservation activities, and current and recent involvement in conservation activities.

2.3.2. Survey administration

The questionnaire was administered by a trained community member to one person from each randomly selected house. All respondents were permanent inhabitants aged 15 years or older. If a selected household could not be interviewed, a neighbouring house was selected to produce the sample size required ($n = 390$). Within ranching communities, a slightly different method was required as extended families live on ranches. From each nuclear family, one member was asked to participate; however, adult family members were also considered to be potential respondents.

All respondents were provided with verbal information and an information sheet defining the nature of the research. This was read to participants if required. Respondents provided their informed consent by fully or partially completing the questionnaire. If respondents were illiterate, the survey questions were read aloud and the interviewer filled in the questionnaire based on respondents' verbal responses. In total, 367 people out of 390 responded to this survey giving a response rate of 94%.

2.4. Data analysis

Data were entered into an Access database and cross-checked for inconsistencies in data entry and survey completion. Data were analysed in Excel and the Statistical Package for Social Science (SPSS version 19; IBM Corp, Armonk, NY, USA). Descriptive analysis (frequencies, case summaries and cross-tabulations) for variables was calculated. Chi-squared statistics were used to determine if there were significant differences among categorical variables: community, sex, age, education and occupation.

3. Results

3.1. Socio-economic characteristics

The typical respondent was a male, aged under 40, with a low income (<US\$320 per month) and possessing a low level of schooling (primary school) (Table 2). Informants' ages ranged from 15 to 60+ years; however, 59% were 40 or younger. The largest group was aged 31–40 years old (22%), followed by 41–50 years (20%), then 21–30 years (19%). More respondents were male (57%). Respondents younger than 40 had usually lived in the community since birth. Although the majority had received some form of schooling (97%), for many this was only between one and five years of primary school (39%). Just 17% of respondents had received tertiary education. Respondents were generally poor. Just 22% of respondents reported monthly household incomes of >4500 pesos (>US\$320) (Table 2), which is considered sufficient to support basic household expenditures such as for food and clothing (Hernández-Ramírez et al. 2008).

The interviews and observations provided more detailed background information concerning the economic situation of the different communities investigated. Residents are largely dependent on extractive resource uses – fisheries, livestock ranching or small-scale agriculture, with low prices for products and experience seasonal unemployment, resulting in low incomes. Informal discussions indicated that obtaining paid work was a priority, although there are few sources of income other than primary production. Fishing jobs provide low and unreliable pay for residents of Ejido San Lucas who depend on depleted, inshore fisheries in the Gulf of California. On the other hand, residents in Punta Abreojos and La Bocana on the Pacific Coast of the reserve can access relatively good income options if they belong to a fishing cooperative.

Collectively managed tourism enterprises in three communities provide modest financial benefits but only for relatively few residents. Cultural heritage tourism provides very limited supplemental income for around 100 ranchers from the community of San Francisco de la Sierra. Whale watching tourism is conducted by Ejido

Table 2. Socio-economic characteristics of survey respondents in El Vizcaíno Biosphere Reserve, Mexico.

Age (years)	%	Occupation	%	Monthly income in Mexican pesos	Monthly income in US\$	%	Education	%
15–20	18	House duties	31	<1500	<107	17	Without schooling	2
21–30	19	Salaried	19	1501–3000	108–214	11	Primary (<6 years)	39
31–40	22	Casual	15	3001–4500	215–320	12	Secondary (7–9 years)	22
41–50	20	Student	15	4501–7500	321–535	8	Finished secondary (10–12 years)	19
51–60	14	Independent work	7	7501–10,000	536–714	5	1–2 years university	7
>60	6	Retired	4	10,001–13,000	715–928	3	College graduate	3
Not given	0.5	Unemployed	5	13,001–16,000	929–1142	3	University graduate	6
		Disability	1	16,001–19,000	1143–1357	0.3	Postgraduate	1
		Not given	3	>19,000	>1357	3	Not given	0.5
				Not given	Not given	38		

Benito Juárez in a section of the World Heritage listed Ojo de Liebre Lagoon where whales reproduce. The concession allows whales to be viewed between December 15 and April 15, thus paid work is seasonal. Tourism infrastructure comprises a visitor centre, restaurant, campground, wharf and skiffs. Seasonal jobs are available to a limited number of residents as guides, cooks, administrators, cleaners or in maintenance. A stewardship-hunting programme for Bighorn Sheep is administered by Ejido Alfredo V. Bonfil in a core protected zone around the Three Virgins Volcano complex (Figure 1). The programme is a Unit for the Conservation, Management and Sustainable Development of Wildlife, a federal strategy integrating social issues and wildlife conservation (SEMARNAT 2009). Around five hunting permits are issued each year, and they are auctioned for around US\$50,000 each. Access to full-time and part-time jobs in the base camp and field camps as guides, cooks, administrators, cleaners and in maintenance is available to a limited number of residents.

3.2. Perceptions of rural residents

3.2.1. Perceptions about the reserve designation

Awareness of the reserve. Responses to survey items indicated that almost all respondents were aware of El Vizcaino Biosphere Reserve (94%), but slightly fewer were aware of the World Heritage Sites. Of the respondents, 84% were aware of the ‘Whale Sanctuary of El Vizcaino Lagoons’ World Heritage Site and 81% were aware of the ‘Prehistoric Rock Paintings of the San Francisco Mountains’ World Heritage Site. Respondents were less knowledgeable about reserve boundaries. The northern limit was correctly identified by 68%, while just 6% gave what could be considered a correct response for the southern limit, with 39% stating they did not know where the southern boundary was. Most were aware that the reserve includes a marine buffer zone on the Pacific Coast (76%); however, almost half (46%) were unaware that the reserve contains a marine buffer zone on the Gulf of California Coast.

Level of support for reserve designation. There was widespread support for the designation of El Vizcaino Biosphere Reserve among communities (Table 3). Ninety per cent of respondents supported the reserve designation, with 71% totally supportive, while only 8% were opposed to designation, of which 5% were totally opposed. Ninety-two per cent of respondents supported designation of the ‘Whale Sanctuary of El Vizcaino Lagoons’ World Heritage Site, of which 80% were totally supportive and only 6% were opposed to designation. Ninety-one per cent supported designation of the ‘Prehistoric Rock Paintings of the San Francisco Mountains’ World Heritage Site, of which 80% were strongly supportive, while only 6% were opposed to the designation.

Table 3. Level of community awareness of, and support for, the designation of El Vizcaino Biosphere Reserve, Mexico, and its two World Heritage Sites.

	Reserve designation %	‘Whale Sanctuary of El Vizcaino Lagoons’ World Heritage Site %	‘Prehistoric Rock Paintings of the San Francisco Mountains’ World Heritage Site %
Aware of the reserve/site	94	84	81
Support	90	92	91
Total support	71	80	80
Opposed	8	6	6
Total opposition	5	3	2
Don’t know	4	4	3
Did not answer	3	3	3

There was a significant difference among residents of the communities in their support for reserve designation ($p = 0.048$). More respondents from the fishing community of Ejido San Lucas, which lies just outside of the reserve’s boundaries, were totally supportive of reserve designation (Table 4). There was also a significant difference among respondents with different occupations ($p = 0.007$). More disabled people and unemployed people were totally supportive of reserve designation (Table 4). There were no significant differences among respondents in their perceptions of total support for the reserve based on sex, age and education.

Purpose of the designation. Many respondents were aware of the importance of the reserve for regional conservation. The region’s biodiversity and specialized ecosystems, for example, were identified as important reasons for reserve designation by 69% of respondents (Table 5). The presence of important archaeological sites was seldom identified (10%). Similarly, few respondents (16%) explicitly identified ‘protection’ or ‘conservation’, although this was implicit in many comments. For example: ‘It is a heritage that our ancestors have left us in order for us to see the marvels of our environment’; ‘It is a part of Mexico that is little known and we have a marvellous natural environment’; ‘Because of so many special plants and animals that exist in extreme places’; ‘We are all owners and protectors of the site’; and: ‘It is an honour to know that in my region we have a biosphere reserve and prehistoric cave paintings’. Integration of conservation and economic objectives was rarely identified (2%). Only one informant, a 40-year-old housewife with primary schooling, indicated that both protection and economic benefits were salient, stating that the reserve was designated because of ‘The variety of species and desert zones that are of benefits to us’.

Benefits or disadvantages of the designation. Most respondents perceived that reserve designation provided important regional environmental and economic benefits.

Table 4. Differences among respondents from different communities, and with different occupations, in their support for reserve designation; perceptions of serious threats to the reserve's natural values; and awareness of, and participation in, conservation initiatives in the reserve.

	Support	Serious threat to reserve					Conservation	
	Total support (%)	Overgrazing (%)	Overfishing (%)	Aquifer overuse (%)	Illegal fishing (%)	Illegal hunting (%)	Awareness (%)	Participation (%)
<i>Community</i>								
Punta Abreojos	62	12	50	59	64	64	29	3
Ejido Benito Juárez	60	23	65	67	85	77	38	10
Ejido Alfredo V. Bonfil	76	38	57	52	83	88	24	5
La Bocana	70	9	67	50	78	81	15	6
Ejido San Lucas	81	26	69	71	79	95	15	6
Santa Águeda	70	50	70	60	75	85	5	0
San Francisco de la Sierra	76	25	81	49	85	90	54	42
<i>Occupation</i>								
Salaried	70	17						
Independent work	70	19						
Unemployed	88	29						
House duties	72	24						
Student	64	16						
Retired	60	53						
Casual	71	25						
Disability	100	25						

Note: Percentage values are reported for the categorical variables for which χ^2 tests identified significant differences.

Table 5. Perception of the different purposes for the designation of El Vizcaíno Biosphere Reserve, Mexico, and its two World Heritage Sites, identified by survey respondents in seven rural communities.

Reason for designation	Biosphere Reserve (%)	'Whale Sanctuary of El Vizcaíno Lagoons' World Heritage Site (%)	'Prehistoric Rock Paintings of the San Francisco Mountains' World Heritage Site (%)
Responded	75	75	69
Natural values	69	65	
Protection	16	5	5
Cultural values	10		63
Economic values	2	9	6
Plants and animals	27		
Animals	11		
Plants	3		
Marine species		13	
Whales	5	57	
Whale reproduction		19	
Biodiversity	16		
Landscapes/ ecosystems	13	9	
Endemic species	9		
Endangered species	13		
Beauty	8		
Unique locations	8	5	
Antiquity			22
Ancestors			14
Legacy			12
History			9
Tourism	2	9	6
Did not know why designated	25	25	31

However, more respondents rated environmental protection as 'very important' to the region (84%) than those rating economic benefits as 'very important' (64%) (Figure 2).

Strong support for the reserve from scale items was reinforced by data from open-ended questions enquiring about perceived or experienced disadvantages as a result of the designation. Few respondents (22%) identified disadvantages. Respondents mentioned the following economic disadvantages – restrictions on use of wild plants (4%), lack of regional development (2%) and regulations concerning livestock (1%). For example, restrictions on

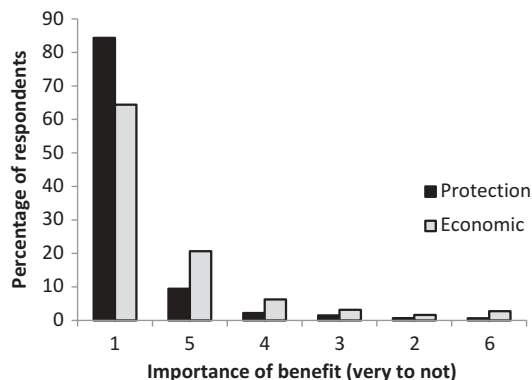


Figure 2. Respondents' ranked importance of protection and economic benefits derived from 1 = very important to 6 = not important.

harvesting timber or cactus fruit were seen as undesirable personal restrictions limiting traditional practices and adding to economic hardships. Similarly, the inability to secure the protection of livestock through shooting predators was seen as an economic liability. Finally, some respondents perceived that management agencies were negligent in their commitment to the regional economy through disallowing industrial development, which they perceived would provide permanent local jobs, and thereby improved standards of living.

Severity of threats. Results suggest high levels of community concern about the effectiveness of the management in terms of environmental protection. An average of 75% of respondents rated three threat categories (illegal hunting, illegal fishing and unsustainable fishing) as a 'serious' threat to the reserve (Figure 3). Illegal hunting was seen as a serious threat by 83% of respondents. This suggests a high level of concern about the effectiveness of federal management programmes for protecting the small population of endangered Peninsular Pronghorn Antelope and Bighorn Sheep. Similarly, illegal fishing was perceived as a serious threat by the majority of respondents (78%) and unsustainable fishing as a serious threat by 65%, indicating strong community concern about the regulation of fisheries.

On the other hand, fewer residents recognized the seriousness of generalized threats from the overuse of aquifers, population growth or overgrazing. An average of 35% rated these three categories as serious threats, 42% as moderate threats and 19% did not perceive these as threats at all. This apparent limited concern about generalized threats may indicate that respondents perceived less personal responsibility for these aspects of environmental management, or were simply unaware.

As with strong support for the designation of the reserve, there was a significant difference among respondents in different communities in their perceptions of serious threats to the natural values of the reserve from

overgrazing ($p < 0.000$), overuse of the aquifer ($p = 0.002$), overfishing ($p < 0.000$), illegal hunting ($p < 0.000$) and illegal fishing ($p = 0.019$).

More people from the ranching community of Santa Águeda perceived a serious threat from overgrazing; fewer from the fishing communities of La Bocana and Punta Abreojos had this perception. More people from the ranching community of San Francisco de la Sierra perceived a serious threat from overfishing. More people from the fishing community of San Lucas perceived a serious threat from aquifer overuse. With respect to threats from illegal resource use, fewer people from the fishing community of Punta Abreojos perceived a serious threat from illegal fishing and hunting (Table 4).

There was a significant difference among respondents with different occupations in their perception of serious threats to the reserve ($p = 0.031$). More retired people perceived that overgrazing was a serious threat (Table 4). There were no significant differences among respondents in their perceptions of serious threats to the reserve's natural values based on sex, age and education.

3.2.2. Perceptions about reserve management

Just under half (44%) of respondents provided their perceptions about management of the reserve through responses to the open-ended questions. Almost a third (28%) identified the need for effective environmental protection; perceiving that conservation was limited by a lack of agency capacity to enforce regulations (8%) and a lack of compliance with regulations (4%). Just two respondents suggested that compliance would be improved if fines were higher.

Close to one-third of respondents wanted support for socio-economic development (32%). This included support for the implementation of more sustainable practices. A male rancher, for example, wanted: 'More support to the rural communities so they can be motivated to care for the area in which they live'. He gave

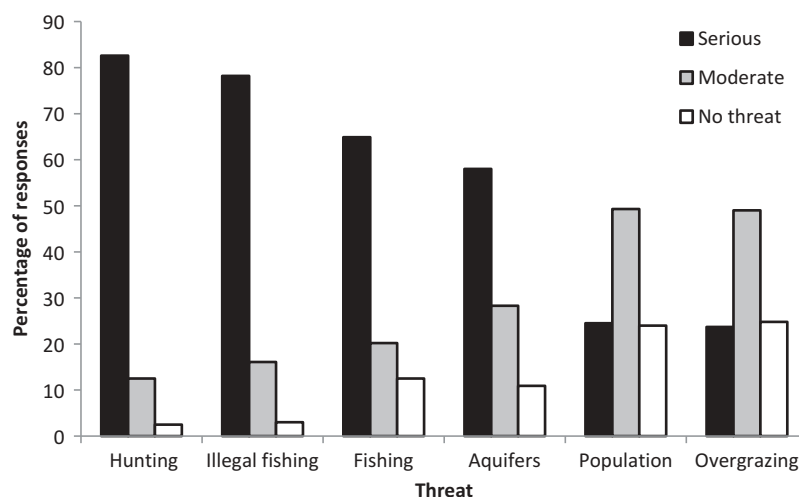


Figure 3. Responses relating to perceived severity of threats to El Vizcaíno Biosphere Reserve, Mexico.

the specific example of building greenhouses enabling ranchers to raise food for livestock, thereby reducing grazing pressure on vegetation. Almost one-quarter of respondents were concerned about the lack of participatory mechanisms that involve residents in conservation (23%). Some wanted better agency–community communication (13%) through environmental education (9%). For example, a female salaried worker wanted better coordination between the agency and schools to: ‘Inform us about the area so that we, the inhabitants of the biosphere reserve can care for the area’.

A few respondents were concerned about agency staff (3%) providing comments such as: ‘The people in charge don’t know how to deal with people from the rural communities, for example the way they treat people and the way they fail to be role models’. Five people identified that government corruption was an issue. A female middle-aged casual worker, for example, was concerned about: ‘The embezzlement of funds that they keep for themselves’.

3.2.3. Perceptions about conservation

Less than one-third of respondents (28%) identified their awareness of conservation by listing a conservation initiative (Table 6). There was very low awareness

of the agency’s key sustainable development programmes – stewardship-hunting of Bighorn Sheep (eight people, 2%), the captive breeding-release programme for Peninsula Pronghorn Antelope (five people, 1%), whale conservation (three people, <1%) and cultural heritage tourism (one person, <1%). Low awareness among residents in the communities administering these programmes is surprising. For example, just one respondent from the community collectively administering whale watching tourism identified whale conservation. Residents were also generally unaware of agency conservation projects for other key species (e.g. royal eagles, sea turtles, agaves, cactus and ironwood).

Residents were more aware of community-based conservation projects than agency programmes; however, awareness was still low (Table 6). Vegetation rehabilitation or monitoring was more commonly listed, with 28 people (8%) from five communities aware of each project type. Awareness of vegetation conservation may be related to the availability of paid temporary jobs for site rehabilitation after road development. Community-based groups working with youth in removing garbage from community streets and public areas, and recycling activities were mentioned by 20 people (5%) from five communities. There was a surprisingly low awareness of community-based sea turtle

Table 6. Awareness of conservation initiatives among survey respondents in seven rural communities in El Vizcaino Biosphere Reserve, Mexico.

Community	Punta Abreojos (n = 66)	Ejido Benito Juárez (n = 48)	Ejido Alfredo V. Bonfil (n = 58)	La Bocana (n = 54)	Ejido San Lucas (n = 62)	Santa Águeda (n = 20)	San Francisco de la Sierra (n = 59)	Total 367
Total number aware of initiative	19	18	14	8	9	1	32	101 (28%)
Agency programme								
Bighorn Sheep			8					8
Pronghorn Antelope		5						5
Whales	1	1					1	3
Cultural heritage					1			1
Other	3	1	2		5			11
Total agency	4	7	10	0	6	0	1	28 (8%)
Community-based project								
Vegetation			2	2	3	1	20	28
Monitoring wildlife	5	1			1		21	28
Clean up/recycling	5	9	2	3	1			20
Education	5	4						9
Livestock management							7	7
Conservation associated with cooperative		1		3				4
Care of estuary				2				2
Aquifer care				1			1	2
Patrolling							1	1
Total community	15	15	4	11	5	1	50	101 (28%)
Other project								
Private business	1		1					2
NGO	3	2					1	6
Total other	4	2	1				1	8
Total number of initiatives	23	24	15	11	11	1	52	137

Note: Respondents oftentimes listed than one conservation initiative.

Table 7. Participation in conservation initiatives among survey respondents in seven rural communities in El Vizcaino Biosphere Reserve, Mexico.

Community	Punta Abreojos (n = 66)	Ejido Benito Juárez (n = 48)	Ejido Alfredo V. Bonfil (n = 58)	La Bocana (n = 54)	Ejido San Lucas (n = 62)	Santa Águeda (n = 20)	San Francisco de la Sierra (n = 59)	Total 367
Agency programme		1	1					2
<i>Community-based project</i>								
Vegetation project					4		12	16
Monitoring							14	14
Clean up/recycling	1	4		2	2			9
Bighorn Sheep			1					1
UMA/whales								
Conservation project				1				1
Patrolling							1	1
NGO project				1	1			2
Miscellaneous	1	2	1				9	13
Total number who participated	2	5	3	3	4	0	25	42 (11%)

Note: Respondents sometimes reported participation in more than one conservation initiative.

conservation in Punta Abreojos, where a community group associated with the local fishing cooperative has been engaged in turtle monitoring and environmental education since 1998. Just five respondents out of a total of 66 from this community listed sea turtle conservation, and interestingly, none were personally involved.

There was very low participation in conservation initiatives, with just 42 people (11%) identifying recent participation in a conservation initiative (Table 7). There were significant differences among respondents from different communities in their awareness of conservation initiatives ($p < 0.000$) and in their participation in conservation initiatives ($p < 0.000$). The majority of people who were aware of a conservation initiative, and had recently participated in a conservation initiative, were from the ranching community of San Francisco de la Sierra. Just over half of the people from that community were aware of at least one conservation initiative (54%), while close to half (42%) had recently participated in at least one conservation initiative (Table 4).

There were no significant differences among respondents in their awareness of, and participation in, conservation based on sex, age and education.

4. Discussion

4.1. Results

Results suggest that residents from economically diverse rural communities in El Vizcaino Biosphere Reserve were strongly supportive of reserve designation. These residents were accessing different natural and cultural resources and infrastructure. Moreover, strong support for reserve designation was common among all communities and demographic groups. This study is unusual in finding widespread support for a reserve among residents who were generally poor. For example, elsewhere in Latin

America, case studies have found that if resource users do not perceive economic benefits as significant, then local support may be limited (Zanetell & Knuth 2004; Campbell 2007). Although community-based tourism (whale watching, cultural heritage and stewardship-trophy hunting) has been conducted in El Vizcaino Biosphere Reserve for over two decades, these enterprises have provided limited seasonal income to relatively few people.

While studies elsewhere have found that positive perceived reserve benefits can be predictors of pro-conservation behaviour (Waylen et al. 2010; Brooks et al. 2013), positive perceptions towards the designation of El Vizcaino Biosphere Reserve did not appear to translate into actions supporting conservation. Results suggest that residents perceived that management agencies are failing to provide effective environmental protection or appropriate support for socio-economic development. In Latin America, community-based fisheries and forest enterprises have provided communities with non-economic benefits by promoting resource management (Antinori & Bray 2005; Castello et al. 2009; Schreiber & Halliday 2013), social/gender equity (Cronkleton et al. 2011) and entrepreneurship or local collective action (Becker et al. 2005; Westermann et al. 2005; Ohl-Schacherer et al. 2008). Studies show that improved social capital has made it possible for local people to exercise more control including the capacity to take action to protect the resources on which their livelihoods depend (TNC 2003; García-Frapolli et al. 2008). Such findings challenge the idea that economic benefits alone motivate participation in conservation. This study shows limited economic benefits, yet the residents we surveyed appear to strongly support the designation of the reserve.

Perceptions of 'total' support for the reserve were high amongst the demographic factors of sex, age, income and occupation. However, these perceptions were especially

evident among respondents listing their occupation as disability or unemployed. This finding differs to studies elsewhere where differences in perceptions towards conservation values were related to demographic variables of sex, education, age and gender but not to occupation (Hernández-Ramírez et al. 2008; Ansong & Røskaft 2011). Differences in El Vizcaíno Biosphere Reserve found in this study may be due to disabled and unemployed respondents having had different interactions with the protected area. Research in developed countries shows that people who have experienced illness, who are socio-economically disadvantaged or who are recovering from stressful life events (e.g. unemployment) report that they experience higher levels of personal well-being and lower levels of stress when they have access to protected areas (e.g. parks and green spaces) (Burls 2007; Van Den Berg et al. 2010). It is possible that a similar process could explain this finding. Future research is required to investigate this potential relationship in El Vizcaíno Biosphere Reserve.

In terms of support for reserve designation according to geographic and related cultural differences (i.e. community), 'total' support for reserve designation was high amongst all communities (62–81%). This perception was most evident in the fishing community of Ejido San Lucas which lies just outside the reserve's boundaries and the ranching community of San Francisco de la Sierra. The latter community was also distinguished by a much higher number of people indicating awareness of, and participating in, conservation. As noted later in this discussion, in San Francisco de la Sierra, perceptions of total support and behaviour relating to conservation may be a consequence of recent, extended contact with a conservation organization. Positive relationships between the on-ground activities of conservation organizations and support for conservation have been reported in multiple use protected areas elsewhere (Salafsky et al. 2001; Allendorf et al. 2006; Stronza & Pêgas 2008; Ka et al. 2009; Waylen et al. 2010). For example, work by Pegás et al. (2013) in Brazil highlighted that the environmental education provided to residents of fishing communities by the Brazilian Sea Turtle Conservation Programme was positively related to perceptions of support for conservation as well as local involvement in conservation activities.

The majority of respondents in all communities perceived that threats from unsustainable and illegal fishing and illegal hunting activities were 'serious'. However, in the ranching community of San Francisco de la Sierra, more people perceived 'serious' threats from fishing activities and illegal hunting activities than from overgrazing. This is perhaps unsurprising since grazing is a substantial livelihood pursuit in that community – in other words, some of these respondents are less likely to recognize their own grazing impacts. Studies elsewhere have also reported that primary producers were less likely to be aware of the environmental impacts of their own livelihood strategies (Khadka & Nepal 2010). In the Subri Forest Reserve Ghana, for example, residents least

concerned with environmental degradation were primary producers deriving a direct economic benefit from forest resources (Ansong & Røskaft 2011). In this study, however, this trend was not found among fishing communities.

The trend found in this study for more retired people to find grazing impacts to be 'serious' may be due to livelihood-related differences as the majority of retired respondents were not from grazing communities. However, the majority of retired respondents perceived that all threat categories were 'serious'.

The problems perceived by respondents in El Vizcaíno Biosphere about the threats from illegal and unsustainable resource use highlight the limited capacity of government agencies to enforce regulations. In addition, it can be inferred from the seeming lack of local participation in conservation that community institutions are weak. This is a problem that must be addressed for the biosphere reserve to serve both conservation and regional development needs. The literature highlights the importance of developing local institutional capacity as a critical intervention for engaging local people in conservation (Agrawal & Redford 2006; Ballet et al. 2007). In El Vizcaíno Biosphere Reserve, there would appear to be limited capacity of both local resource management institutions and government management agencies – contributing to the 'hollow middle'.

4.2. Capacity of government management agencies in Vizcaíno Biosphere Reserve

This study found that respondents who were residents in rural areas perceived that government management agencies have limited capacity to implement effective protection. Moreover, this perception was common among all demographic groups and in all communities. Paradoxically, while protection is based on the agency's capacity to enforce environmental regulations, managers we spoke with recognize that there are insufficient personnel, equipment and funds to achieve effective regulatory control in the reserve. To put this in context, the reserve is larger in size than the Netherlands. Just 21 people protect and manage 2.5 million ha. A resident described agency staff as 'hiding' in their offices in the town of Guerrero Negro. Most staff, 15 people, are located in agency headquarters in Guerrero Negro (Figure 1). Two individuals are in the coastal village of Bahía Asunción monitoring the fishing activities carried out by 16 Pacific Coast fishing cooperatives; two people are in San Ignacio monitoring fisheries and whale watching activities, while just two are on the Gulf of California Coast in the municipal capital of Santa Rosalía. Surprisingly, no staff members are based in the interior of the reserve.

Given the size of the reserve, 21 staff is insufficient to achieve management objectives. Indeed, a staff member suggested that around 100 staff decentralized into operating units would be appropriate. Inadequate staffing and funding of The Secretariat of Environment and Natural Resources 'SEMARNAT', and The Federal Attorney

General's Office for Environmental Protection 'PROFEPA', is common in Mexico. It has led to insufficient enforcement of environmental laws in El Vizcaino Biosphere Reserve and other areas of the Baja California Peninsula (Delgado & Nichols 2005; Senko et al. 2011). The lack of visible agency presence in the reserve likely contributes to perceptions of limited capacity to carry out effective regulatory control of illegal and unauthorized hunting and fishing activities.

Residents we surveyed were also concerned about regional economic management, which they perceived as de-emphasized in favour of conservation goals. This perception may be a consequence of a lack of infrastructure and mechanisms for integrating the economic priorities of rural communities into decision-making processes. It may also be due to a history of conflict between reserve goals for conservation and local economic needs. For example, the process of obtaining the presidential decree for El Vizcaino Biosphere Reserve in 1988 marginalized rural communities from having a say in the conservation policies that would impact the area in which they live, and from which they derive livelihoods (Ortega-Rubio 2000; Castellanos et al. 2002). Better participatory processes and mechanisms could increase trust in managers and their policies, which has been shown elsewhere to effect more efficient and effective uptake of regulations (Ansong & Røskoft 2011).

Additionally, perceptions of economic marginalization have been reinforced by conflicts between reserve goals for conservation and local economic needs (Ortega-Rubio et al. 1998, 2001). Historic conflicts over rights of access to limited resource bases have contributed to current social tensions. For example, a proposal to expand salt mining operations into the relatively pristine San Ignacio Lagoon whale sanctuary was cancelled by a presidential decision in 2000, after five years of intense lobbying of the president and following intense pressure from foreign and local protesters and supporters of the communities of San Ignacio Lagoon that were to be affected (Young 1999b, 2001; Spalding 2006). Local perceptions about the decision to quash the salt-works expansion remain polarized. Some residents we surveyed still distrust the pro-development motives of politicians and state research agencies; others distrust the preservationist motives of the reserve management agency and external conservation organizations.

4.3. Capacity of community institutions in Vizcaino Biosphere Reserve

Residents' awareness of, and involvement in, conservation was low among all communities we surveyed, apart from the ranching community of San Francisco de la Sierra. For that community, the difference in respondents' perceptions may be due to site-specific livelihood and cultural differences, and to recent contact with a conservation non-government organization (NGO) supporting local cultural tourism efforts (Romero-Brito & Varela-Galván 2011).

Ranching families in the community of San Francisco de la Sierra (in the region around the 'Prehistoric Rock Painting of the San Francisco Mountains' World Heritage Site) are among the poorest in the reserve due to isolation and the low prices for goat cheese and meat. Recent efforts by a conservation organization to reduce grazing pressure and diversify incomes have been attempted through supporting cultural heritage tourism. Ranchers have been guiding tourists to see the prehistoric rock paintings in the World Heritage Site since the opening of the 37 km unpaved road from the trans-peninsula highway in 1984 (Crosby & Hambleton 1997). Recent training projects intended to support the development of cultural ecotourism have been well supported by the community (Romero-Brito & Varela-Galván 2011). Yet, tourism provides very limited supplemental income, with no one in the community yet attaining sufficient additional income to be able to cease goat ranching.

Higher awareness of, and participation in, conservation initiatives within the community of San Francisco de la Sierra may also be due to recent government projects to improve the sustainability of goat ranching practices. Although ranchers are very supportive of these projects, they have as yet been unable to change their traditional ranching practices. The Director of The Autonomous University of Baja California Sur Guerrero Negro campus pointed out that this community lacks institutional and individual capacity for sustainable socio-economic development. This situation may be due to a combination of factors including a long history of isolation and a lack of financial resources, management skills and infrastructure (L. Lyle, personal communication, 2013). This situation appears to have hindered the uptake of new knowledge and information supporting pro-conservation behaviour. The experiences of grass-roots conservation groups in other areas of Baja California indicate that building strong community organizations depends on constant external support through conservation networks, technical training, funding and organizational and ideological support (Schneller & Baum 2011; Senko et al. 2011).

Even in communities with stronger resource management institutions uptake of pro-conservation behaviour has been slow. Difficulties in changing unsustainable fisheries practices in this region exemplify this problem. Nine fishing cooperative along the Pacific Coast of El Vizcaino Biosphere Reserve depend on valuable fisheries. Fishing practices among cooperatives are considered to be sustainable due to effective regulation, monitoring and patrolling of valuable red rock lobster and abalone fisheries (Chaffee 2003). Survey respondents from Punta Abreojos and La Bocana access relatively good income options if they belong to a fishing cooperative, with job opportunities provided through fishing, administration, security, maintenance and processing.

Despite Mexico's strong environmental laws, a moratorium since 1991 on the use of sea turtles, (Delgado & Nichols 2005; Peckham et al. 2008), and the presence of fishing cooperatives on the Pacific Coast of the reserve,

illegal harvesting of sea turtles continues. In fact, Punta Abreojos was the only community in the reserve to have a sea turtle conservation group. The group is affiliated with 'Grupo Tortuguero of the Californias', an umbrella conservation organization supporting coastal communities of Baja California Sur in sea turtle conservation. Members of the Punta Abreojos fishing cooperative have participated in turtle conservation activities since the group's beginning in 1998 (D. Valov, personal communication, 2013). Generally however, survey respondents from this community seemed to be unaware of the grass-roots conservation group and its activities within their community.

The key question then is – 'why has unsustainable fishing persisted in this area, despite strong economic management and the presence of a grassroots group with broad and deep affiliations?' The experiences of other groups affiliated with Grupo Tortuguero in Baja California Sur can shed light on this conundrum. Schneller and Baum (2011) observed that involvement of local fishers in Bahía Magdalena in sea turtle conservation depended on constant support through conservation networks, technical training, funding, and organizational and ideological support. Foundation members of a community group in Mulegé, Baja California Sur, pointed out that combating negative peer pressure and social inertia to change resource use behaviours were the key difficulties in motivating local youth and fishermen in collective sea turtle conservation (D. Valov and G. Pacifica, personal communication, 2014). Elsewhere in developing countries, studies have found that grass-roots conservation is best effected through a combination of strategies and approaches based on economic incentives, education/training and better enforcement of regulations (see Campbell 2007, 2010; Pegás & Stronza 2010).

5. Conclusion

Although positive perceptions of the value of conservation can predict conservation behaviour (Brooks et al. 2013), in El Vizcaíno Biosphere Reserve, Mexico, this was not the case. Positive perceptions of reserve designation benefits generally did not translate into actions supporting conservation. An important question arising from this finding is – 'why not?' This study demonstrates that context plays a critical role in conservation behaviour. Government agencies have limited capacity to pursue multiple goals for conservation, economic development and environmental stewardship. The centralized 'top down' approach to protected area management characteristic of Mexico has created, what Thomas-Slayter and Rocheleau (1995, p. 194) described as, a 'hollow middle' between national governments and local communities.

In other areas of Mexico, this has provided opportunities for more equitable collective enterprises to make gains in integrating economic goals and conservation (Antinori & Bray 2005; Cronkleton et al. 2011). But in Baja California Sur, the last state admitted to the Republic of Mexico (Del Río & Altable Fernández 2011), the

capacity of collective resource management institutions to provide opportunities for equitable participation in economic and social development supporting conservation is nascent.

Collective land ownership institutions in Vizcaíno Biosphere Reserve are relatively recent. They were established through the migration of individuals and families from various mainland states during the 1970s, seeking to escape poverty and violence (Lagunas-Vázquez et al. 2008). The communities thus created are, as Young (1999a, p. 373) described, 'a patchwork of individuals and families' struggling to develop collective and individual capacity for economic management and environmental stewardship. Collective institutions oftentimes differ from conventional businesses, having political, social, cultural and environmental goals as well as collective decision-making processes and distribution of benefits (MacNeil & Cinner 2013). Those in Vizcaíno Biosphere Reserve focus on generating income for members. Social and economic inequalities present in rural areas of mainland Mexico have been maintained in the Baja California Peninsula (Young 2001; Soares 2005).

In this biosphere reserve, prospects for resolving social and economic inequities appear to be limited. The management agency appears to lack the capacity to work with local communities. Although NGOs have the flexibility to work with local institutions to bridge the 'hollow middle' between national governments and local communities (Senko et al. 2011), improving collective and individual capacity for conservation in El Vizcaíno Biosphere Reserve will require more than generating economic benefits or providing new skills and information. Capacity building for conservation will require overcoming resistance to change and the distrust many Mexicans feel towards their government and its leaders (Castañeda 2012). In other words, it will require concerted actions to change negative attitudes towards formal institutions associated with conservation.

The lesson from this study is that for an area to become a fully functional biosphere reserve requires more than positive community perceptions of conservation benefits. Protected areas must both conserve regional biodiversity and redress regional socio-economic inequalities. This requires strong local institutions. Such institutions must possess effective communication mechanisms, management skills, and have the hard and soft infrastructure required to build active and ongoing community participation in conservation. Agencies must also be properly staffed and staff should be properly trained for local communities to perceive them to be effective. Only by repairing the hollow middle will effective conservation be possible.

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