

Halfway to sustainability: Management lessons from community-based, marine no-take zones in the Mexican Caribbean

Austin Ayer^{a,b}, Stuart Fulton^a, Jacobo Alejandro Caamal-Madrigal^a,
Alejandro Espinoza-Tenorio^{b,*}

^a Comunidad y Biodiversidad A.C, Isla del Peruano 215, Lomas de Miramar, Guaymas, Sonora CP 85448, Mexico

^b El Colegio de la Frontera Sur (ECOSUR), Av. Rancho Polígono 2-A, Col. Ciudad Industrial, Lerma Campeche, Campeche CP 24500, Mexico



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ABSTRACT

Spatial closure regimes such as marine protected areas (MPAs) have emerged as a prominent tool in the effort to balance ecosystem health and fishery productivity. As MPAs have proliferated, the conservation community has begun to supplement traditional biological metrics with social and community considerations in the way it seeks to manage and evaluate such tools. To assess management outcomes and opportunities for a network of community-based, marine no-take zones (NTZs) in the Mexican Caribbean, semi-structured interviews were carried out with fishers and key management stakeholders. Findings indicate that the community-based management strategy has inherent tradeoffs between community engagement and conservation potential. Managers have succeeded in fostering high levels of community support for the initiative, but significant challenges remain, most notably the high presence of illegal fishing within NTZs. Successes and challenges of the community-based management strategy are documented and evaluated within a fisheries resource management framework. As the NTZ network undergoes legal renovation following the completion of its initial five-year term, this work serves as an important resource for both reflection on, and adaptation of, the community-based NTZ management regime.

1. Introduction

1.1. Community-based no-take zones

In response to the degradation of marine ecosystems, marine protected areas (MPAs) have emerged as one of the most popular and fastest growing marine conservation strategies [1,2]. MPAs encompass a broad range of management regimes and realities, including areas fully closed to extractive activities known as no-take zones (NTZs) [3,4]. NTZs confer a greater degree of protection than other forms of MPAs, and are more effective at restoring fish biomass and ecosystem health than partially-protected MPAs [5,6]. In addition to well-documented biomass increases within and immediately around NTZs [7,8], sustainable fishery management is often cited as a primary NTZ motivation. Emigration of mature fish from protected areas to fishing grounds (spillover) and the export of eggs or larvae from protected breeding populations are most often cited as ameliorating benefits to affected fisheries [9,10].

As NTZs have proliferated with variable success, certain management trends have emerged, such as the importance of stakeholder

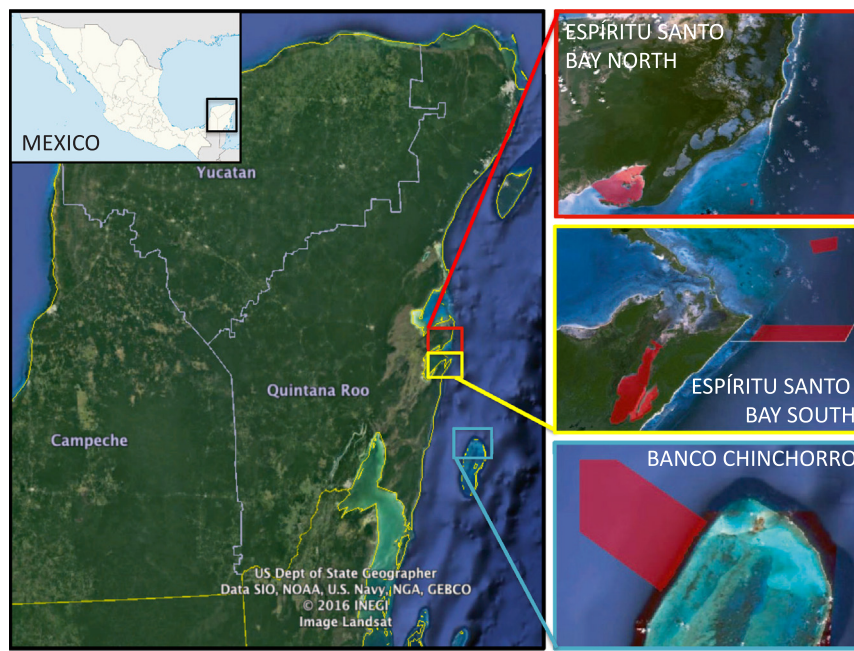
inclusion and the failure of many top-down conservation initiatives [11–13]. These ideas have increased the emphasis placed on the social factors involved in successful NTZ deployment, contributing to the promotion of the community-based NTZ as a bottom-up management strategy more likely to achieve sustained success [14–16]. Community-based NTZs seek to reduce stakeholder conflict by involving affected communities in site management. In addition to confronting compliance and surveillance issues that can frustrate larger, top-down efforts [17,18], community-based NTZs can account for site-specific political, socioeconomic, and ecological context [19] and foster ownership and pride within the community [20].

The prominence of community-based management has begun to affect the way NTZs are evaluated. While the performance of NTZs has traditionally been assessed using biological metrics, increasing awareness of the importance of social factors on the success of marine conservation has supported the implementation of complementary socioeconomic evaluation strategies [21,22]. Indeed, it has been found that social factors are linked to, and sometimes even deterministic of, an MPA's long-term biological success or failure [23–25].

Fishers' inherent interest in NTZ design and implementation, along

* Corresponding author.

E-mail addresses: ayeraustinn@gmail.com (A. Ayer), sfulton@cobi.org.mx (S. Fulton), jcaamal@cobi.org.mx (J.A. Caamal-Madrigal), aespinoza@ecosur.mx (A. Espinoza-Tenorio).



Location (creation year)	Cooperatives	No-take zone	Size (ha)	Management regime
Bahía del Espiritu Santo, North (2012)	Sian Ka'an A (SKA)	1. San Román Sur	1.62	Full Closure
		2. San Román Norte	3.32	Full Closure
		3. La Poza	4.52	Full Closure
		4. Punta Loria	7.20	Full Closure
		5. Gallineros	8.61	Full Closure
		6. Cabezo	9.36	Full Closure
		7. Punta Niluc	15.65	Full Closure
		8. Mimis	998.48	Catch and Release Only
	Subtotal:		1,048.80	
Bahía del Espiritu Santo, South (2013)	Sian Ka'an B (SKB)	9. El Faro II	29.11	Lobster Fishing Only
		10. Anegado de Chal	104.74	Full Closure
		11. El Faro	437.71	Full Closure
		12. Canché Balam	553.90	Catch and Release Only
	Subtotal:		1,125.50	
Banco Chinchorro (2013)	Banco Chinchorro A, B, C (BCA, BCB, BCC)	13. 40 Cañones	12,257.00	Full Closure
		Total:	14,431.30	

Fig. 1. Study Sites. A network of 13 community-based NTZs (highlighted) established in Quintana Roo, México in 2012–2013.

with their ability to heavily influence management success via compliance (or lack thereof) [26,27], make their perceptions of NTZs especially relevant to managers. While social data such as perceptions are rarely objective, their influence on behavior, and thus tangible conservation outcomes, makes them a crucial piece of information [22,28,29]. Fishers' perceptions are fundamental to the social acceptance of NTZs, and thus their ability to achieve desired conservation goals [29,30]. With this in mind, many have called for studies examining the perceptions of fishers toward MPAs [2,28], although such empirical examinations are still lacking [2,24,30].

1.2. Biosphere Reserves Sian Ka'an and Banco Chinchorro

Designated a Biosphere Reserve in 1986 and a UNESCO World Heritage Site in 1987, Sian Ka'an Biosphere Reserve (SKBR) encompasses 528,147 ha along the east coast of the Mexican state of Quintana Roo. Approximately 28% of this territory is marine, including a 110-km segment of the Mesoamerican Barrier Reef System and two large bays: Ascensión Bay and Espiritu Santo Bay (Fig. 1).

Three fishing cooperatives currently operate entirely within SKBR. Caribbean Spiny Lobster (*Panulirus argus*) supports the most important fishery, but a variety of finfish species are also marketed. Lobster fishing rights are granted to cooperatives in the form of exclusive and geographically-defined concessions, a type of Territorial Use Rights Fishery (TURF) [31]. SKBR fishers rely exclusively on free diving and

the use of lassos or hand nets to capture lobster. *Casitas cubanas*, artificial shelters made of concrete [32], are employed in addition to reef diving. All SKBR cooperatives use a *campo* system, in which part or all of the cooperative's concession is divided into distinct parcels, or *campos*, which are then distributed among fishers. While fishers cannot legally own their *campos*, they own the *casitas* deployed within them, and thus exercise exclusive harvesting rights within the parcels [33]. In addition to commercial fishing, recreational fly-fishing tourism is an important income source for some SKBR communities.

The false coral atoll of Banco Chinchorro lies 30 km east of the Caribbean coast of Quintana Roo, and constitutes part of the Mesoamerican Barrier Reef System. Declared a Biosphere Reserve in 1996, Banco Chinchorro Biosphere Reserve (BCBR) encompasses 144,360 ha of marine protected area [34]. Three cooperatives have concessions to fish within the reserve. *P. argus* supports the most important fishery, but queen conch (*Lobatus gigas*) and a variety of finfish species, including deep-water snapper, are also commercially relevant. While certain core areas of BCBR (2587 ha) are designated as permanent NTZs, the majority (> 95%) of the reserve is open to regulated cooperative fishing. Fishing techniques within BCBR consist of free diving with lassos (lobster) and spear guns or bottom fishing rigs (finfish).

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