

*Special Section: Mexico***A New 'Conservation Space'? Protected Areas, Environmental Economic Activities and Discourses in Two Yucatán Biosphere Reserves in Mexico**Sabrina Doyon^{a,#} and Catherine Sabinot^b^aDepartment of Anthropology, Université Laval, Québec City, QC, Canada^bInstitut de recherche pour le Développement, UMR 228 ESPACE-DEV (IRD-UR-UAG-UM2) Nouméa, Nouvelle-Calédonie#Corresponding author. E-mail: sabrina.doyon@ant.ulaval.ca**Abstract**

This article examines some of the local socioeconomic repercussions of two biosphere reserves on the Yucatán Peninsula—Ría Celestún and Ría Lagartos. We analyse aspects of the relationship that the residents of the six villages located within the two reserves have with their environment, by examining both the 'environmental economic activities' residents are involved in and their discourses on, and interpretations of, the notion of environment and the conservation precepts put forward by the biosphere reserves. Our research explores how the objectives of the United Nations Educational, Scientific and Cultural Organization's Man and Biosphere Programme, disseminated by biosphere reserves, are put into practice on the ground. In particular, we look at how environmental economic activities are experienced and practised without necessarily being accompanied by the integration, acceptance, and internalisation of conservation principles—and how these activities contribute, or fail to contribute, to the crystallisation of a new 'conservation space'.

Keywords: conservation, biosphere reserves, fishing, ecotourism, salt extraction, NGOs, Ría Celestún, Ría Lagartos, Yucatán Peninsula, Mexico

INTRODUCTION

The development of conservation projects and environmental protection initiatives has repercussions on the local populations that inhabit the target environments (Adams 2001, 2004; Igoe 2004; West 2005; Biersack and Greenberg 2006; Breton 2006; Igoe 2006; West 2006; Zimmerer 2006; Büsher and Wolmer 2007; Aubertin and Rodary 2008; Duffy 2008; Bebbington 2009). Researchers have notably investigated how such projects sometimes exclude populations from the very areas they occupied or prohibit certain natural resource use and extraction practices (Newman 2004; Ribot and Agrawal 2006; Robbins et al. 2006; West et al. 2006;

Adams and Hutton 2007; Li 2010), and seek, through educational initiatives and new economic activities like ecotourism (Vivanco 2001; Duffy 2002; Kent 2003; West and Carrier 2004; Agrawal 2005; Duffy 2006; Gagnon and Gagnon 2006; Brondo et al. 2007; Hutchins 2007; Duffy 2008; Stronza and Durham 2008; Fletcher 2009), to transform the local populations' relationship with their environment (Haenn 2004; Doyon 2005; West and Brockington 2006; Posocco 2008; Sullivan 2009).

This article seeks to add to this body of research by examining some of the local socioeconomic repercussions of two biosphere reserves on the Yucatán Peninsula—Ría Celestún and Ría Lagartos. We analyse aspects of the relationship that the residents of the six villages located within the two reserves have with their environment by examining both the 'environmental economic activities' residents are involved in and their discourses on, and interpretations of, the notion of environment and the conservation precepts put forward by the biosphere reserves.

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BACKGROUND

The creation of protected areas and the promotion of environmental conservation are not new phenomena; the first national parks in Canada and the United States—Banff and Yellowstone—were established in the nineteenth century. These actions reflected a protection and conservation ethos that saw nature as wild and pure, in opposition to destructive human development and industrialisation. The 1980s, a period marked by emerging neoliberal policies (Harvey 2005), saw a dramatic increase in the number of protected areas worldwide. Many researchers (Haenn 1999; Sullivan 2006; Igoe and Brockington 2007; Brockington et al. 2008; Castree 2008; Garland 2008; Brockington and Duffy 2010) have shown that neoliberal economic development policies are not anathema to environmental conservation, and have demonstrated that the expansion of protected areas and the concomitant crystallisation of neoliberal politics are not fortuitous but rather indicative of a commonality of interest (Scott 1998; Finer et al. 2010). To give just two examples, the development of a major resource extraction project, such as a mine, often comes with the establishment of a protected area, as has been the case in the Cameroon (Lassagne 2005), and in Quebec (Chalifoux 2011). The effect of this type of alliance has often been to camouflage highly destructive resource extraction policies, and even to set aside a pool of resources for future extraction (Goldman 2005; Brockington et al. 2008). These changes, resulting in part from neoliberal policies, have been accompanied by other changes at the international level as governments from numerous countries have redefined modes of governance, allocating fewer state resources to the regulation of local economies and development, and restructuring natural resource and environmental management practices (Brockington et al. 2008; Fraga et al. 2008; Levine 2002; Chapin 2004; Brockington et al. 2008; Fraga et al. 2008), in line with decentralisation processes favoured by neoliberalism.

More and more scholars are examining and commenting on the socio-environmental dynamics generated by the establishment of protected areas worldwide, notably in Latin America and Mexico (Lazos and Paré 2000; Haenn 2002; Murphy 2003; Igoe 2004; Martinez-Reyes 2004; Sundberg 2004; Doane 2007; Fernandez Moreno 2008; Matthews 2008; Fletcher 2010; Taylor 2010; Doyon 2013). Some stress that populations living on newly protected land often face a choice—either collaborate and create alliances or be completely excluded from the newly protected area, losing access to natural resources and seeing their subsistence activities criminalised. Our research demonstrates, however, that alternatives to this model exist, and that there is not a

systematic divide between locals and protected areas. Yet there is no question that socio-environmental relationships are affected by the establishment of reserves—both social and power relationships change when a protected area is created. Transformations include changes to access, privatisation of land and resources, and the creation of new economic opportunities and new ways to use and invest space, as well as the commodification of nature (Breunig 2006; Tazim et al. 2006; Brockington et al. 2008; Duffy 2008; Brockington and Duffy 2010; Büscher and Wolmer 2010; Corson 2010; Duffy and Moore 2010; McAfee and Shapiro 2010). Various categories of reserves exist worldwide. Although all categories of protected areas share the goal of protecting natural resource and diversity, they may or may not exclude human activities (tourism, scientific, and livelihood activities). Indeed, some have the explicit objective of promoting the cultural diversity and the economic well-being of local communities, as is the case of the biosphere reserves studied in this paper (Figure 1).

Founded in 1970, UNESCO’s Man and Biosphere Programme, unlike other biodiversity conservation approaches that exclude local communities from natural resource management processes, recognises the importance of taking community economic development and cultural values into account as part of the protected area construction and conservation process (UNESCO 2012). The creation of the worldwide biosphere reserve network, comprising 580 sites in 114 countries (UNESCO 2012), is one of the most important initiatives of this programme. Its objectives include protecting biodiversity and sustaining research and education while at the same time fostering sustainable development. Reserves are organised into three areas—a protected core, a buffer zone where only conservation-compatible activities like ecotourism and scientific research are tolerated, and a transition zone where the sustainable use and extraction of natural resources is permitted. The legal framework of the biosphere reserves is flexible and leaves room for state involvement. Proceedings are state-initiated and participating states maintain their sovereignty over the territory recognised as a biosphere reserve. Nevertheless, general criteria exist, imposed by the statutory framework adopted in 1995 at the UNESCO General Conference in Sevilla (Bérard and Doyon 2010). In this way, promoting environmental economic activities plays a central role in fostering sustainable development and environmental conservation. As we shall see, these activities are the primary instrument used by the employees of the reserves studied, in their efforts to instil an ‘environmental consciousness’ in the local population.

Drawing on authors who use the concept of space to understand socio-environmental issues (Escobar 2001; Sletto 2002, 2009; Cheng et al. 2003; Vaccaro and Beltran 2007), we attempt to identify the relationships and connections between actors and their environment, whereby space “is produced through social practices, science, planning and technology, and space is lived and understood through symbols, language and images” (West et al. 2006). More specifically we will address West et al.’s call for ‘more analysis of the ways in which protected areas produce



Source: S. Doyon, C. Sabinot, and Department of Geography, Université Laval

Figure 1

Yucatán's biosphere reserves and their villages

space both discursively and materially' (West et al. 2006: 264). These protected spaces contain and combine differentiated practices, discourses, and perceptions that are conducted and interpreted differently depending on the say accorded to the many actors who occupy these spaces. Of note is the fact that new practices being developed in these spaces often reflect global economic and cultural precepts and propose a globalised vision of socio-environmental relationships and conservation (to be paralleled with Sklair's [2001] "sustainable development historic block", Doyon et al.'s [2010] "conservationist nature regime", and Igoe et al.'s [2010] "mainstream conservation"). This involves, among other things, an approach that aims to manage nature by shaping human attitudes and behaviour, and one that views economic and subsistence activities involving resource use as generally destructive, and considers ecotourism as one of the best alternatives to these practices as it "proposes resolutions to environmental problems that hinge on heightened commodity production and consumption, particularly of newly commodified ecosystem services" (Brockington and Duffy 2010: 472).

METHODS

We analyse protected areas as components of a "nature regime" (Escobar 1999; Haenn 2002; Biersack and Greenberg 2006) in which biological, historical, and cultural dimensions are specifically and closely linked. The dynamics and internal logic of these nature regimes are frequently construed as obvious and are often naturalised. "As such, protected areas have become a new cosmology of the natural—a way of seeing and being in the world that is now seen as just, moral, and right" (West et al. 2006: 255), propagating a new classification of nature and the environment (West et al. 2006). In order to arrive at this outcome, nature regimes thrive on a discursive logic, as well as on human, conceptual, and financial resources, and

on transnational organisations with considerable political clout. Through mechanisms such as the creation of economic opportunities or the declaration of environmental prohibitions, these regimes develop a new 'conservation space'. Is this happening in Ría Celestún and Ría Lagartos considering that involved populations are not passive in this process—they internalise and interpret measures on their own level and according to their own values and interests?

This conceptual framework helps us reflect on the mechanisms governing the relationships between the environment and the social actors, with the latter comprising the various groups of individuals involved in specific socio-environmental activities—fishermen, salt producers, ecotourism providers, 'environmental economic project' participants, biosphere reserve employees, and nature enthusiasts promoting a new environmental awareness. Do the resources deployed (human, financial, political, etc.) and the reserves' environmental discourse actually create conservation spaces where local subjectivities are transformed? Do environmental economic projects actually help heighten local interest in conserving the natural resources prioritised by the reserves? Do these activities raise actors' level of environmental concern in a way that profoundly and utterly changes their relationship with the environment? Is there an articulation between the material and discursive dimensions of this conservation space? Is such a link one key to successful conservation and development initiatives?

In 2009 and 2010, the authors jointly conducted 82 days of ethnographic fieldwork in the village of Celestún.¹ This is in addition to research carried out in 5 other villages within the Ría Lagartos Biosphere Reserve in 2003, 2005, 2006, and 2007, and in the Ría Celestún Biosphere Reserve in 2009 and 2010—a combined total of 18 months of fieldwork that forms the foundation for this ethnographic analysis. The authors were assisted by three graduate students. A multi-

method qualitative approach (Denzin and Lincoln 1994) was adopted, based on multi-site case studies. First, we analysed the institutional logic underlying the social construction of coastal spaces by examining environmental development programmes implemented by the state and by national and international NGOs in the Yucatán Peninsula. We then examined the mechanisms of social construction of this coastal space, as well as their application, interpretation, and repercussions through fieldwork in the coastal villages under study. To do so, we analysed the practices and discourses of the various groups of actors in the six villages through participant observation, nearly 200 semi-structured interviews, 68 short questionnaires, mapping of land use and place names, and audio-visual documents. Interviews and questionnaires were processed using discourse analysis software (N'Vivo 8®). This programme facilitated our work to establish, test, and classify the discourses of different groups of actors using a tree-diagram of keywords to identify elements related to the environment, conservation, productive activities, and the biosphere reserves.

CONSERVATION IN MEXICO AND THE YUCATÁN: THE RÍA CELESTÚN AND RÍA LAGARTOS BIOSPHERE RESERVES

Prior to the 1970s, Mexico focussed mainly on economic development—then closely tied to the national forestry policy—without significant regard for resource conservation (Fraga 1999). A notable exception is the six year presidency of Lázaro Cárdenas (1934–1940) during which over 40 national parks were established as part of the process of constructing a Mexican identity (Simonian 1995). The 1970s and early 1980s represented a consolidation phase of environmental policy, characterised by a developing awareness of environmental degradation and the implementation of more environmentally responsible development models (Fraga 2006). Under José López Portillo (1976–1982), the first federal protected areas were established, creating 8,638 sq. km of ‘new spaces’, including two on the Yucatán peninsula—Ría Celestún and Ría Lagartos.

In 1994, responsibility for the environment and resource management (including forests and fisheries as well as biosphere reserves and other protected areas) was vested for the first time in an independent government ministry, *Secretaría de Medio Ambiente, Recursos Naturales y Pesca* (SEMARNAP; The Ministry of Environment, Natural Resources, and Fisheries). SEMARNAP’s mandate of combined environmental protection and resource use management would set the tone for decisions on environmental issues over the course of the following decades (Smardon and Faust 2006). In 2001, Vicente Fox (2000–2006) restructured the ministry to create *Secretaría de Medio Ambiente y Recursos Naturales* (SEMARNAT; The Ministry of the Environment and Natural Resources).² Around this time, in 2000, *Sistema Nacional de Áreas Protegidas* (SINAP; The National System for Protected Areas), an agency of SEMARNAT, also underwent structural changes, becoming *Comisión Nacional de Áreas Naturales Protegidas*

(CONANP; The National Commission for Protected Areas). The newly named body had the same responsibilities as SINAP, but “there is a clearer focus on the protection of these legally delimited areas while “priority regions” have been established for projects of “regional sustainable development”; these are to involve indigenous groups and other rural communities in the design, ownership, and operation of productive activities of a sustainable nature” (Smardon and Faust 2006: 176). All told, there are now 176 federally protected areas in Mexico, 22 of them located on the Yucatán Peninsula (CONANP 2010). The country is home to 41 biosphere reserves, 8 of which are located on the Yucatán Peninsula and about 20% of the peninsula’s territory is under protected status (Smardon and Faust 2006; CONANP 2010). These restructurings were part of the broader process of neoliberalisation under way in Mexico since the 1980s.

The Yucatán reserves have brought new actors to the coastal regions of the peninsula, notably project managers, *tecnicos*³, and NGOs. The number of environmental NGOs in Mexico has also grown considerably over this same period.⁴ This is part of a broader decentralisation process that has affected Mexico’s administrative and decision-making structures since the 1980s (Fraga et al. 2008). This process has manifested itself more specifically in recent changes to the environmental management nexus, especially since sections of the *Ley General del Equilibrio Ecológico y la Protección al Ambiente* (LGEEPA; General Law of Ecological Balance and Environmental Protection) effectively transfer certain responsibilities for environmental management from state and municipal agencies to local civil institutions as well as NGOs.

The Ría Celestún and Ría Lagartos reserves, which cover 814 sq. km and 600 sq. km respectively, were originally designated as ‘Wildlife Refuge Zones’ (*zonas de refugio faunístico*) in 1979. They were established at the outset to combat “environmental degradation caused by human activities” and address the need ‘to protect natural ecosystems in order to conserve [their] animal species’ (CONANP 2007: 5), particularly the pink flamingo.⁵ These objectives focused mainly on the anthropogenic facets of environmental degradation and emphasised the need to protect nature against destructive human activities. In 2004, both reserves obtained UNESCO biosphere reserve status, a milestone in their development. Inclusion on the Man and Biosphere Programme list made them part of an international environmental conservation network that exerts influence through management plans, funding, and relationships with various government and non-government institutions (e.g., Niños y Crias; PRONATURA; JICA; DUMAC⁶).

The Ría Celestún Reserve encompasses two settlements located in two distinct *municipios*⁷ in the neighbouring states of Campeche and Yucatán, namely Isla Arena (in the state of Campeche) and Celestún (in the state of Yucatán)⁸; together they are home to a total of 7,022 inhabitants, 6,243 of whom live in Celestún (INEGI 2005). The Ría Lagartos Reserve has some 7,000 inhabitants spread amongst four settlements in three *municipios*—El Cuyo (in Tizimín); San Felipe, the seat

of the *municipio* of the same name; and the villages of Río Lagartos and Las Coloradas in the *municipio* of Río Lagartos⁹.

The inhabitants of these communities lived off subsistence activities until the 1960s.¹⁰ Since then, fishing cooperatives established in the villages have spurred extensive fishery development. Today fishing remains the primary source of income for nearly all village inhabitants.¹¹ The fishery is now under threat, however, with catches significantly down over the last 20 years, making it an increasingly dangerous and difficult activity. While the fishing cooperatives are losing steam, other associations such as *sociedad de solidaridad socia* (SSS; social solidarity societies) have stepped into the breach, and private businesses have proliferated. Salt extraction has also become an important activity in both reserves, employing over 1,000 men.¹² Beach tourism is on the increase in all coastal villages, with small hotels and restaurants serving a domestic and international clientele.¹³ Celestún and Río Lagartos are the main tourism centres. For some inhabitants with the means to purchase animals and sufficient land, cattle farming has also come to provide a good living that helps them transition away from fishing. Every community also has some residents who practice *milpa*,¹⁴ and hunt for birds and small game, though they are increasingly scarce. Although differences between the six communities were noted in the course of the ethnographies conducted there, the analysis underlying this paper considers the Yucatán coast to be fairly homogeneous in terms of its social dynamics and the structural challenges faced.

LOCAL ENVIRONMENTAL ECONOMIC ACTIVITIES: BIOSPHERE RESERVE PROJECTS AND LOCAL INITIATIVES

UNESCO's biosphere reserves are designed "to promote sustainable development based on local community efforts and sound science' and 'reconcile conservation of biological and cultural diversity and economic and social development through partnerships between people and nature; they are ideal to test and demonstrate innovative approaches to sustainable development from local to international scales." Their main characteristics are "achieving the three interconnected functions: conservation, development, and logistic support"¹⁵ (UNESCO 2012).

To achieve their objectives, the Celestún and Ría Lagartos biosphere reserves rely on permanent employees living inside the reserves and on collaboration from local conservation NGOs (particularly *Pronatura* and *Niños y Crías*), all of whom participate in surveillance activities and in inventorying specific natural resources. Employees monitor and control hunting, fishing, woodcutting, and swidden agricultural practices, and coordinate reforestation of degraded areas. They also protect the feeding, reproduction, and nesting areas of emblematic animals such as flamingos and sea turtles.¹⁶ Scores of researchers, graduate students, and reserve employees also visited the two areas to study the biophysical dimensions of the reserve ecosystems. As specified in the Man and Biosphere

Programme blueprint, the core zone of the biosphere reserves, which represents 40% of the area in the studied regions, is strictly reserved for research and environmental education.

The biosphere reserves promote environmental education activities and participatory management, which, depending on the sponsor and type of activity, may involve children or adults, men or women, and/or local NGOs. These activities combine the socio-environmental vision of the Man and Biosphere Programme with the global conservation discourse, and are critical of other environmental relationships that may prevail in the reserves, specifically those involving natural resource extraction and swidden agriculture. Community residents participate in these activities, but, to paraphrase reserve administrators, they have yet to internalise "the deep environmental conservation consciousness" the reserves' employees are trying to foster, i.e., a genuine concern for protecting all the elements of local ecosystems that transcends individual short term interests and which translates into a coherent and lasting set of conservation practices.

Biosphere reserve employees develop research and assessment measures for local wildlife populations, patrol and monitor illicit natural resource extraction activities,¹⁷ develop conservation activities such as mangrove reforestation, and provide environmental education. Not stopping there, the biosphere reserves also propose environmental economic activities to local populations. Biosphere reserve employees introduce these activities as alternatives that enable residents to be less dependent on their primary economic activities (fishing, salt extractions, cattle-raising, *milpa*), now presented as harmful to the environment. According to biosphere reserve employees, these alternatives are intended not only to protect the environment but also to develop a new way of relating to nature within a conservation framework, thereby possibly forging a new environmental consciousness. Nevertheless, this process is neither simple nor automatic, and is subject to local reinterpretations. The following two sections discuss the different development modalities of local projects, both those administered directly by the biosphere reserves and those stemming more immediately from the initiatives of the residents of the villages affected by the reserves and their activities.

Environmental economic activities: projects introduced by the biosphere reserves

The Yucatán biosphere reserves orchestrate and administer two types of environment-related activities financed by the federal government. First, local residents are hired under temporary employment programmes (PET) to do maintenance, rehabilitation, and cleaning work in certain parts of the reserves. These programmes provide financial support when the fishing is poor or risky.¹⁸ As one technician from the Celestún Biosphere Reserve noted: "During the *nortes*¹⁹ season, when they cannot fish or go to sea, they work with us for a little while"; "they do not really come for the mangroves or for a long term project, but to receive a salary, a smaller one

than when they fish, but a more secure one” (Celestún Reserve employee, Celestún, 2009). Hiring for these short term jobs is done by public announcement or by word of mouth within the villages. To benefit from a PET, the reserves must submit an application (*solicitud*) to SEMARNAT. An employee with the Celestún Reserve informed us in June of 2009 that this approach had its merits, but did not allow for the purchase of equipment or infrastructure investments. This is only possible through other programmes such as *Programas de Desarrollo Regional Sustentables* (PRODERS; The Programmes for Regional Sustainable Development).

In both biosphere reserves, reserve management handles the PRODERS application process. PRODERS have three objectives—promote the conservation of reserve core zones through the participation of men, women and indigenous groups; improve conditions of production in communities near protected areas; and curtail environmental degradation processes (CONANP 2008). These programmes are instruments of public policy designed to reduce poverty in rural communities and counter their increasing marginalisation (CONANP 2007). They distribute public funds throughout the country, primarily to communities lying within or close to federal protected areas. Each biosphere reserve is allotted a certain sum of money (which varies year to year) and is distributed by the reserves to groups organised in cooperatives, or civil associations, so they can carry out sustainable development projects.

Unlike PET, PRODERS allow for the purchase of equipment. For this reason, the reserves and *municipios* often work together to obtain equipment they could not otherwise procure. In Celestún, for example, the reserve and a village civil association applied to PRODERS to establish reliable solid waste collection services. Other projects carried out in El Cuyo, Las Coloradas, San Felipe, and Celestún since 2006 include classes to teach women how to make crafts out of locally available materials such as seashells, plastic containers, and fish scales. PRODERS projects are coordinated by the reserves—reserve employees come up with project ideas, develop projects, train the community groups and civil associations the projects are designed for, and ensure that the projects objectives are met.

PRODERS-financed ecotourism projects have been developed in several villages. Funding has notably gone toward developing tourism infrastructure (such as piers and trails) and training tourist guides (classes are given on subjects like flora and fauna, second language skills, and ecotourism cooperative operations).²⁰ These specific ecotourism projects stem entirely from the initiative of the reserve employees. They choose the types of services to be offered (e.g., hiking, boat excursions), select who will provide the services, and manage the budgets. In the next section, we will look at certain groups that have formed to offer ecotourism services independently of reserve initiatives.

Taken together, these various projects attest to the reserve employees’ willingness to transform the productive activities conducted by community members, as is clear in the following remark by a reserve employee:

Obviously there is a committee that ensures the applications are consistent with policy and the management programme. And what are the goals of this management programme? To promote changes in productive activities, environmental conservation [...] Asking for a motorbike to go to your [salt, or agricultural] patch, this cannot be done. (Río Lagartos Reserve employee, El Cuyo, 2007).

Through activities funded by government programmes, the biosphere reserves become part of an arrangement under which local initiatives come to rely on government agencies that promote values and principles emanating from a transnational institution and its global conservation discourse. This financing structure reinforces the reserves’ importance and enhances their recognition locally, which in turn enables them to consolidate their position within local communities.

Locally led ‘environmental economic initiatives’

Parallel to the economic activities orchestrated by the reserves, locally developed ‘environmental economic alternatives’ initiated by village residents through community groups, cooperatives, and civil associations and funded by governments and NGOs have also emerged in recent years. These projects demonstrate the socio-economic vitality and diversity present on the Yucatán coast despite the common structural pressures communities face, and reflect the various ways in which environmentalist and conservationist discourses have been appropriated.

Ecotourism: present in every reserve village

Independent ecotourism projects have been developed by groups, cooperatives, and individuals in all villages within the reserves, though with uneven results.²¹ These projects, which require SEMARNAT approval, are backed by conservation institutions. In 2004–2005, a cooperative of fisherwomen in San Felipe enlisted the help of a *tecnico* in order to obtain a SEMARNAT subsidy which was consequently used to clear a flood zone in the reserve, to erect a boardwalk allowing for pedestrian access to a *cenote* (natural well), and to plant mangroves. The trail was meant to be an ecotourism attraction operated by the cooperative of fisherwomen. However, owing to internal dissent at the cooperative level and a lack of foreign visitors, the attraction did not generate the kind of success the cooperative expected, and the project has remained inoperative since 2005.

In Río Lagartos, four ecotourism cooperatives employ a total of 45 people. The first of these went into operation in the 1990s, taking advantage of the international tourists drawn to the region by bird watching opportunities, particularly flamingos. Since then, there has been a diversification in the tourist services available in Río, and tourists can now enjoy boat tours, sports fishing, mud baths known locally as ‘Mayan baths’, and more. There are tensions between ecotourism cooperatives and reserve authorities over issues like entrance fees to the reserve and the fact that tour operators feel they are under close surveillance. Since 2007, the tour operators

have to declare their comings and goings in the reserve to an employee of the reserve hired especially for this purpose. At the moment of registration, a fee of MXN 21 per passenger on a boat must be cleared. The cooperative managers, however, are reluctant to pay this fee. On the one hand, they argue that the increased cost of their operations hinder their business opportunities and, on the other hand, they doubt this contribution will be put to good use and they say they do not see the benefits of these costs locally. Some cooperative managers are known for trying to escape the supervision of the reserve and for bringing tourists within its boundaries without clearing the associated fee.

Residents of Las Coloradas, the village neighbouring Río Lagartos, claim their community is the prettiest in the region, with the nicest beach and the most direct access to the flamingos. They want to develop more ecotourism to take advantage of tourist traffic drawn by the presence of the birds. However, because of land tenure issues involving the reserve boundary, municipal officials, and the property claims of the ISYSA salt company, their efforts have made little headway. Land tenure is an issue in every community in the two reserves. Their location within the biosphere reserve along with properties of the ecosystem and soil types²² mean that these communities cannot expand in area²³ and that certain types of real estate development (such as hotels) are strictly regulated.

In Las Coloradas, the land tenure issue that faces all six communities is exacerbated by the presence of the salt company. It is currently impossible for Las Coloradas residents to obtain new land to build ecotourism facilities, and it is also difficult for them to build new walking paths (*senderos*), since the community is surrounded by evaporation ponds adjacent to the salt extraction fields, all places where access is restricted. As a result, residents wishing to develop alternative income-generating activities must do so on their own *patios*. For instance, one woman built three *cabañas* on her property to accommodate visiting tourists, though at no point in our multiple stays did we see them occupied. Ecotourism development is further complicated due to the tensions that have developed between the villages of Río Lagartos and Las Coloradas.²⁴ The former wants to keep the benefits of tourism to itself, by not informing visitors of activities offered in Las Coloradas, while the latter complains about being victim of unfair competition. No group or ecotourism cooperative has thus been formed in Las Coloradas to date. In El Cuyo, three cooperatives were founded in 2006, inspired by the success of those in Río Lagartos. However, visitor traffic to El Cuyo remains limited because the community is not easily accessible; consequently, the three cooperatives do not yet offer a reliable economic alternative.

In Celestún, four cooperatives of tourist guides and boat operators known as *lancheros* have developed a discovery tour of the lagoon, birds, and *cenotes*, employing close to 60 guides, sometimes more, at the height of the busy tourist season. As in the other coastal ecotourism cooperatives, each boat owner is required to have an operating license and the minimum mandatory safety equipment (such as life jackets)

on board. The competition to become a guide is fierce and there is a waiting list to join the cooperatives. Tourists have a choice between 1 hour and 2 hour tours and the price ranges from USD 100 to USD 200 per boat. The price is fixed, but may vary according to the season. Other villagers offer similar ecotourism services, but have no formal status; neither are they recognised by the reserve and the community, nor do they enjoy the same support as the *lancheros*. Celestún is certainly the best known and most successful case in the state of Yucatán. Its tourist market has been growing for over 20 years, and now boasts an international reputation. Isla Arena has not been as successful. It is further away and harder to get to than Celestún (3 hours by car on rough roads from Mérida, though only 30 minutes by boat from Celestún). Its development has been slower and the island looks like it has been kept in a state of isolation.²⁵ A few family-based ecotourism cooperatives and two ecotourism centres with *cabañas* for rent were created to accommodate tourists. Nevertheless, the *cabañas* are empty most of the time and the whole ecotourism scheme is experiencing very slow growth.

The ecotourism initiatives deployed did not arise out of a profound desire for environmental conservation; rather, these initiatives seek to instrumentalise the environment, the resources of the reserves, and the current popularity of ecotourism, as various scholars have shown in other contexts (Agardy 1993; Lindberg et al. 1996; Young 1999; Doyon and Sabinot 2012). Of course, residents and promoters pay lip service to ecotourism, but when asked to elaborate on the topic, they don't really differentiate between conventional tourism and ecotourism. In their view, ecotourism is an activity that allows them to take advantage of their surroundings to secure additional or alternative income (Doyon and Sabinot 2012). Environmental conservation concerns are neither at the heart of these activities, nor at the centre of local discourse. The main focus of these villagers is rather economic. Even though one of the goals of such reserves is to allow residents to use and benefit from selected reserve resources for economic gain in order to help foster conservation and lead to an interest in environmental protection in the long term, our research failed to show such a process in play in the Celestún and Ría Lagartos biosphere reserves. The majority of residents living from the exploitation of the environment through fishing, logging, and salt harvesting, claim that environmental conservation harms them directly as it prevents them from earning a living, as one man enunciates: "[The environment] is an institution that interferes with what it is that we do. It forbids us to accomplish a number of things... The environment put us in jeopardy. What will I do if I can't cut wood and if I don't have money?" (Sea diver, Celestun, 2009). Moreover, our investigations have allowed us to observe new lucrative practices in which the local inhabitants engage massively, such as the intensive fishing of sea cucumbers in 2010, whose environmental consequences are still unknown.²⁶ This attitude dismays reserve employees who would like to see a genuine interest in environmental conservation emerge and take root. The new, alternative economic activities such as ecotourism, putatively performed

without a sense of “environmental awareness,” as some employees of the reserve lament, however are not incompatible with environmental conservation. In this regard, we note the relevance of gaining an understanding of the motivations behind the engagement of the local residents in these practices.

The diversification of environmental economic activities between villages

Some local initiatives are not shared by multiple localities, but instead are specific to a particular village. For instance, the inhabitants of Isla Arena created *Yotoch Aayin* (Mayan for ‘house of the crocodile’). Since 1997, working through SEMARNAT channels, they have been able to develop various tourism and animal breeding facilities. In 2008, several members of the same family formed a ‘management unit for wildlife conservation’ (an UMA, or *unidad de manejo por la conservación de la vida silvestre*), to set up their crocodile breeding and ecotourism centre. There, tourists pay USD 15 to see 15–20 captive adult crocodiles and some hundred juveniles raised in ponds. This activity does not require particular training in the field, and another individual from Isla Arena said he wanted to create an UMA to breed turtles and get himself to diversify his sources of income this way. Some residents have a knack for navigating available government programmes to pinpoint those they are likely to qualify for. Their close ties with certain *tecnicos* are instrumental in this process. However, the environmental merits of such projects are questionable.

In 2002–2003, after working with *Centro regional de investigación pesquera* (CRIP; Regional Centre for Fishing Research) Yucalpeten, a salt cooperative from Celestún set up a company to commercialise brine shrimp (*Artemia salina*), a crustacean found in local salt ponds.²⁷ Project development took two years in collaboration with the department of external affairs and included a cultural exchange with China: ‘The Chinese came here and showed us everything about it,’ said a local worker. The *sociedad de solidaridad social* (SSS; Society of Social Solidarity) known as *Taap-Che*—with financial backing from a large fish processing company, a ‘pescadería grande,’ and the United Nations—worked with three other social solidarity societies to assemble the necessary infrastructure for the maturation of the shrimp larvae, dry and freeze processing, and live transport in oxygenated water bags. This project was under the direction of the *Comisión Nacional de Acuacultura y Pesca* (CONAPESCA; the national commission of aquaculture and fisheries), and in line with the development orientations favoured by the Celestún Biosphere Reserve, which had input into the project. In this example, the salt workers’ motivation was not to develop environmentally responsible practices but to generate revenue from the salt ponds during the months when they were not used for salt extraction. Of the four cooperatives that attempted similar projects, only the Taap-Che cooperative is still active today.²⁸

The project this group of salt producers set up is just one example of the many local initiatives²⁹ aimed at finding economic alternatives to coastal fishing, the main source of income for the villagers, by taking advantage of the ‘ecology’,

‘environment’, and ‘conservation’ niches that opened up thanks to the biosphere reserves. Upon seeing that such projects could qualify for funding, some residents have moved to capitalise on these opportunities. The main difficulties project proponents face are bringing people together to form an association and eventually paying a consultant to complete the impact studies they must provide to SEMARNAT representatives, a mandatory step prior to undertaking any resource use, processing, or extraction process. One fisherman from Las Coloradas who wanted to develop ecotourism in his village put it this way:

There are many obstacles... primarily economic obstacles. I went there [to the reserve office] to see how we could form a tourism cooperative. We had to write up a project, and we had to do an environmental impact study, and that costs a lot of money. We live far from the city of Merida [for administrative formalities], and every so often we have to spend 500 or 1,000 pesos [i.e., MXN]. If all four of us go, a day there is costly, what with food and gasoline (Fisherman, Las Coloradas 2006).

While economic challenges may vary from village to village depending on the distance to Merida, where government offices are located, it is difficult for a villager with no political connections to succeed in formulating and preparing a project eligible for organisational support, especially a villager who is not used to petitioning institutions for financial, structural or human assistance. This brings to the fore issues related to the opportunities and constraints individuals face in conforming to the logic of these institutions.

Despite these difficulties, numerous groups, civil associations, and cooperatives have come together to secure financial support, all the while instrumentalising their environment. As one resident from Isla Arena commented in 2009: ‘There is profit to be made in this area’ (“*Hay buena ganancia*”). Their practices often combine conventional extraction activities with environmental economic activities that may take a number of shapes and forms.

The conservation spaces created by the biosphere reserves incorporate social practices and resources. Environmental economic activities in particular have established themselves, made possible thanks to the technical resources (expertise provided by *tecnicos*), infrastructures, international support, political capital, and a certain approach to planning. They have been embraced by local residents as a promising way to gain access to alternative revenues. However, our research found little indication that they fostered a commitment to other conservation practices and activities, as the next section demonstrates. Are these environmental economic activities linked to local environmentalist perceptions and conceptions? We try to answer this question in the following pages.

LOCAL DISCOURSES ON THE ENVIRONMENT, CONSERVATION, AND BIOSPHERE RESERVES

The biosphere reserves may put forward a constant and clearly defined environmental vision in their management

guide (*Plan de manejo*) and the practices they advocate (through both environmental education and 'environmental economic activities'), but they must contend with diverse local interpretations of, and discourses on, the concepts of environment, conservation, and the reserves. These interpretations and discourses are not always directly related to what the reserves propose, as some have documented in other protected areas (Haenn 2004; Holmes 2003, Klein et al. 2007; Durrant and Durrant 2008; Durand and Lazos 2008; Peterson et al. 2008; King and Peralo 2010). These conceptions correspond to the heterogeneity of local practices, available economic possibilities, and the restrictions imposed by the reserves (see also Mendez Contreras et al. 2008).

Environment

Our survey and interviews suggest that people living in the reserves categorise the environment in three main ways. For approximately 60% of the residents, the environment is a concept that is still beyond their scope of knowledge. The following quotations illustrate the kind of discourse encountered in all villages: "I don't know what the environment is" (salt producer, Las Coloradas, 2006); "The environment? The reserve employees can explain that to you." (fishermen, Las Coloradas, 2006). 40% defines the environment in terms of its own immediate surroundings: "The environment? That can be defined... it is the sea, the beach and the mangroves. That is what the environment is for me. It is the place in which we live" (fishermen, El Cuyo, 2006); "The environment is what we work in, it is where we are, it is our workplace: the fields, the salt, and the fish..." (fisherman, Celestún, 2009). For this group, the environment is neither a problem nor something to be instrumentalised for its environmental or conservation properties. It exists and influences the everyday lives of local residents, and their daily activities. Finally, approximately 20% is increasingly integrating conservation concepts into its definitions of the environment, highlighting the importance of environmental protection: "Well, I think that the streets should be clean. There shouldn't be much smoke. Now they are introducing many four-stroke engines, which are good for the environment. They pollute less." (El Cuyo, 2007). Their concept of the environment integrates certain conservation and protection elements, which can be tied to the principles promoted by the reserves.

Conservation

Conservation concerns are present in the discourse of certain residents. However, with the exception of a few ecotourism stakeholders, some of whom have had the advantage of in-depth courses on different aspects of the ecosystem and are thus more conversant with certain concepts, locals do not talk about protecting the same resources (plants and animals) as the reserve employees do; this is partly because local inhabitants need mangrove wood for cooking, even though cutting is

now prohibited, and appreciate hunting, even though certain species should not be hunted. When asked about environmental conservation, the residents say that it is important and then simply reiterate the messages they get at meetings held by the reserve.³⁰

An important difference in conservation discourses centres on *what* to conserve. The focus of the reserves—and international conservation—differs from that of the residents of Yucatán's biosphere reserves. The reserves concentrate on conservation of mangrove flora and fauna (birds, crustaceans, game, etc.) whereas residents show much less concern for these resources and are far more interested in the fish harvested in the fishery, especially octopus,³¹ and the salt pond. Women of the biosphere reserves also consistently reported that "the reserve" taught them about the importance of trees and their role in creating oxygen: "It's nice because the trees help us breathe and the reserve gives classes to the children" (housewife, Celestún, 2009). This remark is a direct result of the classes and education programmes administered by the reserves; it is reiterated by reserve employees as their basic message. This message about trees and oxygen that the reserves promote remains far removed from peoples' everyday worries.

Local discourse on the environment and its conservation also encompass residents' concerns about their vulnerability in the face of environmental phenomena common to all the coastal communities studied. People living in the reserves believe the environment to be threatened mostly by meteorological phenomena over which humans have no power. It is not humans and their activities that are dangerous for the environment, but hurricanes, red tides, and storms, as one resident bluntly illustrates: "Nature disappears when there are hurricanes and when everything is destroyed, and nature doesn't ask SEMARNAT for a permit!" (fishermen, El Cuyo, 2006). They do not believe this vulnerability is related to their anthropogenic activities.

Finally, it is worth mentioning that a few residents argue that there is too much emphasis on conservation and not enough on people when conservation initiatives are being developed: "They're here now, conservation is here. There are many deer and lizards, there are thousands of flamingos, turtles, and dolphins. Nobody pays attention to them, they are our friends, they do not have predators here; there are plenty. I tell you, it is more difficult for the people than it is for the animals. Conservation should be balanced between humans from El Cuyo and animals, and then everyone will be happy." (fisherman, El Cuyo, 2006).

Biosphere reserves

As for residents' discourses of the reserves, they appear to have evolved in two different directions. On the one hand, some residents, including nearly all local women, mentioned appreciating that the reserve offers 'environment classes' to children. These women also don't fail to mention the importance of the trees for the oxygen they provide.

Others, mainly men, choose to ignore the principles and

regulations that underpin the reserves, when they are not openly criticising them, particularly the bans on logging, hunting, and crustacean fishing. All of these activities continue, though on a small scale, even in the face of reserve efforts to stop them, and over time reserve managers have tended to develop a tolerance towards villagers' actions, particularly in Celestún. Very often, people seem insensitive to conservation arguments and to the elements designated as worthy of protection by the reserves. Some also consider that conservation managers and biologists do not have sufficient knowledge of the environment, particularly the 'red tide' that affects marine ecosystems: "The biologists don't know: they fly in a helicopter and don't see anything, but the red tide is underwater. As a [fish] diver, I know... because I have been diving all of my life" (fisherman, Celestún, 2009).

One man summed up, with this comment, how most villagers perceive the reserves:

In some ways the policies of the reserve are detrimental and in some others they are beneficial. They are detrimental because, as citizens, we must cut firewood so we can eat. If they catch me cutting firewood, they catch me, even though what I'm doing is cleaning up the mangrove and cutting dry, dead firewood. At the same time, they are beneficial because they are protecting the mangrove and because those trees work to purify the air. The trees are like filters. We knew this from a long time ago. When there are fires on the other side of the river, the trees help to prevent the smoke from reaching us. The smoke stays in the mangrove. But this is not beneficial to us as citizens. (Sea diver, Celestún, 2009).

When we question villagers about conservation or the environment without relating the concept to the existence or the doings of the reserve, some still make the link immediately—"That institution bothers us. Many things are prohibited..." (Sea diver, Celestún, 2009)—inextricably associating the environment and conservation with the biosphere reserve.

Residents of designated conservation spaces have integrated a selective language of environment and conservation. Most seem to have internalised the concept of trees and oxygen, but when it comes to other aspects, their vision tends to diverge somewhat from the message promoted by reserve employees. Moreover, the most common view of the reserve is mixed, recognising both the reserve's positive and negative aspects. In practice, many local men show a clear disregard for reserve recommendations, despite the environmental economic activities they promote.

CONCLUSION

The creation of biosphere reserves is part of a series of global, national, and local political processes. Objectives include conserving the environment, developing a sustainable economy for local populations, and integrating economic activities and conservation practices. These proposed goals are actualised through socio-economic practices made possible by financial,

technical, and political resources, whereby some residents actually benefit economically from conservation initiatives rather than being adversely affected.

Reserve employees view environmental economic activities as the preferred means of promoting conservation and instilling an environmental consciousness in the local population. But these same activities are perceived by the local population primarily as promising economic opportunities, often made possible by funding secured from conservation and environmental institutions. Reappropriating the environmental discourses disseminated by these institutions has become a precondition to successfully developing economic activities supported by the reserves, NGOs, and government ministries responsible for the environment. The local residents currently spearheading several projects and activities have skilfully integrated these discourses, but deploy them only in the context of developing new and lucrative activities. From the discourse of biosphere reserve employees, they seem to have retained the notion that the biosphere reserves and environmental conservation in general present economic opportunities. They have also integrated certain conceptual aspects of both the environment—mainly 'everything around us' and 'the trees and the oxygen'—and conservation championed by the reserves, to which they add their own concerns related to environmental phenomena and the conservation of valuable species of fish.

In conclusion, we find that both of these Yucatán biosphere reserves have seen the emergence of new practices and discourses, but that the discourses appear to serve solely as tools to develop these practices. They have not been deeply assimilated by individuals, who have consequently not become the "environmentally conscious" actors sought after by the reserves. The necessary articulation between the material and discursive dimensions of a conservation space does not seem to occur. It seems rather that the biosphere reserves have not (yet?) succeeded in instilling a substantial environmental and conservation ethos in local residents, whose environmental practices in many projects continue to be guided by the search for alternative sources of income. Is this because inhabitants only participate in the reserve activities and not in the reserve decision-making processes? Is internalisation in fact occurring, but is not yet perceptible? Is it possible to conceive effective, lasting environmental conservation without an environmental consciousness? One way to address these issues consists perhaps in furthering research about the relationships existing between economic practices and conservation. Such relationships should not be conceived as antagonistic or incompatible practices, as critical environmental analyses have shown by highlighting the various linkages between neoliberalism and conservation. Articulations such as these must be accounted for, if one wishes, firstly, to expose both pre-existing and newly created socio-economic inequalities as they unfold around conservation initiatives and protected areas, and, secondly, to propose insightful studies examining the role of moral values and ideologies within environmental governance.

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NOTES

- All research for this project was made possible by funding from the Social Sciences and Humanities Research Council of Canada (SSHRC), and Fonds québécois pour la société et la culture (FQRSC).
- Fisheries responsibilities were then transferred to the *Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación* (SAGARPA; Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food).
- This term refers to technicians employed by NGOs or responsible for various tasks in the biosphere reserves including environmental education, sampling and surveying, organising the local population for reforestation initiatives, etc.
- This increase in the number of NGOs can also be attributed to a large number of layoffs, particularly in the ministry of fisheries, following the ministry's restructurings. Laid-off employees created their own NGOs, offering technical services to various community groups involved in institutional environmental protection processes.
- The pink flamingo eats, reproduces, and nests in the salt ponds and lagoons found in these two areas, and migrates seasonally between these two habitats.
- The Yucatecan NGO Niños y Crias was founded in 2000; its mission includes the conservation of the flamingo and the promotion of environmental education. PRONATURA is a Mexican NGO constituted in 1981. It works for the conservation of the environment and promotes alternative economic development opportunities at the local scale. JICA stands for Japan International Cooperation Agency. DUMAC is the Mexican chapter of the NGO Ducks Unlimited.
- A *municipio* is a government unit comparable to a municipality which may include one or several communities.
- In 2005, Celestún, the second largest port in the state of Yucatán after Progreso, had 6,243 inhabitants (*Conteo De Población Y Vivienda INEGI 2005*). Today it has over 7,000 inhabitants, according to our estimates.
- The word *ría*, as in *Ría Lagartos Biosphere Reserve*, refers to the lagoon and is also the name of the area. The village and the municipality, however, are called *Río Lagartos*.
- See Doyon et al. 2010 for details on the social construction of coastal spaces in the Yucatán.
- Fishing techniques used includes nets, lines, longlines/boulters, harpoons, and diving. Octopus and spiny lobster are the main catch.
- Salt extraction is an artisanal industry in Celestún (see Doyon and Sabinot 2012) practised on land conceded by the federal government to groups of residents who have formed cooperatives and social solidarity societies; close to 70 salt ponds are in use, representing a total area of 68 ha. Coloradas is home to an industrial salt extraction operation run by ISYSA, covering 5000 ha. This industry has been present since the 1930s, and continues to operate despite the establishment of the biosphere reserve, with ISYSA claiming that its activities are compatible with those of the biosphere reserve and that the two work together to promote sustainable development in the area.
- Coastal tourism in Yucatán raises important issues of land ownership and gentrification as more and more tourists buy up seaside land and homes.
- Milpa* refers to Mayan-style swidden agriculture.
- This central tenet gives rise to "combine core protected area with zones where sustainable development is fostered by local dwellers and enterprises; multi-stakeholder approach with emphasis on the involvement of local communities in management; fostering dialogue for conflict resolution; integrating cultural and biological diversity; demonstrating sound sustainable development practices and policies based on research; education and training; participate in the World Network."
- Neither biosphere reserve has jurisdiction over fishing. They are concerned with activity in the lagoons (*riás*), but not in the ocean, and thus not with fishing.
- The cutting of *chiit* (*Thrinax radiata*) and *kuká* (*Pseudophoenix sargentii*) for firewood and the hunting of deer (*Odocoileus virginianus*), turtle (*Chelonia mydas* and *Eretmochelys imbricata*), and flamingo (*Phoenicopterus ruber ruber*), among other species, are strictly forbidden.
- These employment programmes pay MXN 50 per day and can provide up to two months of work to as many as 90 people from the same village (for example, the Celestún mangrove reforestation project in 2009 paid villagers MXN 1 per seed sown or MXN 50 per container).
- Los nortes* (northern winds) are low-pressure systems that bring bad weather and increase the risks at sea.
- Funding for these initiatives comes from a variety of sources, and not only PRODERS, including various development project funds, the *municipios*, and individual contributions by participants.
- Handicrafts and plastic bottle recycling are two other examples of activities found in the six communities.
- The villages are built on compacted sand bars surrounded by marshes. In every village, the houses may be surrounded by water and even flooded, depending on the season.
- In Celestún and *Río Lagartos*, residents deal with this issue by filling unbuilt spaces around their homes that belong to the *municipio* with garbage. In this way they 'create' new land by drying it out, then occupy it by constructing buildings (houses, animal pens, etc.). By these illicit means they appropriate new land and enlarge their property every year, a few meters at a time.
- These tensions are also caused by political differences going back to the annexation of *Las Coloradas* by the municipality of *Río Lagartos* (which fall outside the scope of this article).
- The bridge joining the island to the continent was built in 1999, and until 2009 cellular phone and internet services were unavailable on the island. In addition, the island's remoteness from Campeche, the state capital, has increased its isolation.
- The sea cucumber fisheries, promoted by Asian interests, have led to massive harvesting. A sea diver was able to sell its catches at a high price (around MXN 50/kg at the beginning of the season and MXN 20–30/kg at its end) to a middleman, who then would hire approximately 25 people to process the holothurians, paying each of them around MXN 500–1000/day according to their respective work in the transformation chain. The fishery was deployed illegally at first and the coastal populations were called in the local papers the "narco-pepineros", referring to the "narcotraficantes", because of the important income they were gaining illegally as well as the large police and army presence

deployed to intercept them. After much pressure from the local fishermen and middlemen on the provincial legislative body, a special permit was granted allowing for three days of harvesting a week with a maximum of 600 kg a day/boat. Without more delay or any specific impact studies, sea cucumber harvesting became intensive in all communities of the Yucatan coast where it could be found. In Celestún 120 boats were granted the permit to harvest sea cucumber. For a period of three months, we estimate, based on the official guidelines from *Capitania de Puerto*, that approximately 75 000 kg were extracted each day in the sole village of Celestún, although it was actually nearly the double. Sea divers noticed the decrease of the resource over the span the season (the holothurians could be found at six fathoms deep at the beginning of the season and at 13 fathoms at its end), and some worried the harvest of the sea cucumber could impact the fisheries to follow.

27. This pinky red crustacean is part of the pink flamingo's diet and responsible for the bird's colouring.
28. According to one reserve employee, the project ultimately failed because the salt cooperatives were being torn apart by internal conflicts and allegations of corruption; more than anything, he says, they were looking for easy money and fast returns (*'jalar dinero'*), which compromised medium and long term project profitability.
29. In addition to a crocodile farm and the commercial exploitation of brine shrimp, other projects include organic farming in Las Coloradas, aquaculture projects in Isla Arena and Celestún, soft-shell crab production in Celestún, butterfly breeding in El Cuyo, and the creation of the Actan Chuleb Marine Reserve in San Felipe (Doyon and Fraga 2005; Doyon et al. 2008; Guindon 2009; Doyon et al. 2010; Sabinot and Doyon Forthcoming).
30. Reserves also give classes on subjects such as the importance of the environment and conservation as part of the federal *Desarrollo Humano Oportunidades* (Human Development Opportunities) programme. This anti-poverty programme offers food staples and small grants to selected poor residents, on the condition that, among other things, they attend these classes.
31. Conservation messages on fishery resources did not include sea cucumbers, which are not consumed locally; harvesting began in 2010.

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