

Connecting international priorities with human wellbeing in low-income regions: lessons from hawksbill turtle conservation in El Salvador

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Hawksbill turtles (*Eretmochelys imbricata*) are highly endangered in the eastern Pacific Ocean, yet their eggs continue to be an important subsistence resource for impoverished coastal residents in El Salvador. In this study, we use naturalistic inquiry to explain the realities experienced by coastal residents who share habitat with hawksbills in El Salvador, and then suggest implications of the disparities between these realities and international priorities for hawksbill conservation and community development in El Salvador and other low-income regions. To provide a context for understanding hawksbill conservation and its implications for similar challenges related to conservation and wellbeing, we first summarise the conservation context, including the emergence of sea turtle conservation in El Salvador. We then describe our naturalistic approach, including the ethnographic methodology for this study. Finally, we detail the analysis of interviews conducted with *tortugeros* (i.e. local sea turtle egg collectors), to help explain how hawksbills fit into local realities. Our results demonstrate that, from the perspective of *tortugeros*, (1) the primary importance of hawksbills is the economic value attached to egg sales, but there exists a deeper connection to local culture; (2) egg purchase by hatcheries is a socially just conservation strategy that benefits both hawksbill and human wellbeing; and (3) opportunities for local residents to participate in decision-making regarding sea turtle conservation are limited, and should be increased. We argue that harmonising international conservation priorities with local community development realities is one path towards simultaneously contributing to long-term sea turtle recovery and human wellbeing in low-income regions.

Keywords: community-based conservation; conflict management; environmental economics; human need; livelihoods; wildlife policy

Introduction

Sea turtles capture contemporary interest both at international and local levels. Because people consider sea turtles to be charismatic megafauna, they are perceived to have high

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intrinsic value (Witherington and Frazer 2003) and attract significant public attention (Campbell 2003). The complex life cycles of sea turtles and their pressing conservation status draw interest from the international conservation community, such as the Marine Turtle Specialist Group of the International Union for Conservation of Nature (IUCN) and many internationally oriented institutions. At the same time, sea turtles often are viewed as a subsistence resource in low-income regions (Thorbjarnarson *et al.* 2000), which can be rooted in cultural heritages (Nietschmann 1973, Morgan 2007). The divergence of these perspectives fails to exploit potential synergies between local culture and sea turtle conservation, and threatens the viability of existing conservation strategies, including sea turtle egg protection, at both international and local levels.

In this paper, we identify and clarify the implications of discrepancies between local realities and international priorities for hawksbill sea turtle (*Eretmochelys imbricata*) conservation and community development in El Salvador. To provide a context for understanding hawksbill conservation in El Salvador and its implications for other challenges related to conservation and wellbeing, we first draw from the historical record to describe how sea turtle conservation, particularly hawksbill conservation, emerged along the Salvadoran coast. Second, we describe our naturalistic approach to the project, including the ethnographic methodology. Third, we provide detailed analysis of interviews with *tortugueros* (i.e. local sea turtle egg collectors), to help explain how hawksbills and their conservation fit into realities experienced by local residents. Finally, we discuss what our results tell us about the implications of differing international and local priorities for hawksbill conservation and human community development. We argue that hawksbill conservation in El Salvador illustrates the importance of integrating local realities with international conservation priorities in order to simultaneously support long-term sea turtle recovery efforts and human wellbeing in low-income regions.

Conservation context

Conflict over sea turtle conservation illustrates one of today's greatest conservation challenges. It requires difficult decisions regarding appropriate levels of resource allocation for protection and management of ecosystems, landscapes, habitats, and species (White *et al.* 2009, Peterson *et al.* 2013). Although most biodiversity conservation contexts are shaped by conflict, publications that list crucial priorities (i.e. Sutherland *et al.* 2009), deal with conflict only marginally and superficially. When conflict is considered, recommendations typically involve trying to eliminate or resolve it through education, financial compensation, and/or local control (Peterson *et al.* 2013). Although these approaches are valuable additions to conservation efforts, they are rarely envisioned as more than tools to enable policy makers to respond to relatively superficial interests. Numerous studies grounded in critical theoretical perspectives such as political ecology (Campbell 2007) and science and technology studies (Henke and Gieryn 2008, Yearley 2008) indicate that a complex array of experiences, values, beliefs, and social power frame biodiversity conservation. Still, conservation biologists continue to seek a world where conservation policies "are based on science, not emotion" (Shine 2011, p. 6, Peterson *et al.* 2013). This simplistic view of biodiversity conservation is counterproductive, for it blinds its adherents to social and political dimensions that will determine what policies are developed, followed, and enforced (Peterson *et al.* 2007, Francis and Goddman 2010). Hawksbill conservation in El Salvador demonstrates the complex socio-political landscape that conservationists must negotiate. Although hawksbills' international visibility and perceived charisma have driven

adoption of strong protective policies, enforcement of those policies requires at least a minimal level of support from local human communities.

Sea turtles are long-lived, late-maturing, and highly migratory species that frequently cross jurisdictional boundaries while travelling between foraging areas and nesting beaches, which can be separated by entire ocean basins (Nichols *et al.* 2000a, Luschi *et al.* 2003). Seven species of sea turtles exist worldwide, most of which have global distributions. They include the olive ridley (*Lepidochelys olivacea*), green (*Chelonia mydas*), loggerhead (*Caretta caretta*), flatback (*Natator depressus*), leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempii*), and hawksbill turtles. All species, except the flatback, are listed on the IUCN *Red List of Threatened Species* as Critically Endangered, Endangered, or Vulnerable on a global scale.

Historically, hawksbills were prized for their ornate shells that were collected to fabricate a multitude of items for the tortoiseshell trade, including combs and jewellery; however, centuries of exploitation have reduced hawksbill populations by more than 80% worldwide and justified their classification as Critically Endangered by the IUCN (Mortimer and Donnelly 2008). Despite evidence that the listing was based on rigorous scientific investigation, the IUCN decision sparked harsh criticism that highlights the political and economic dimensions of conservation (Campbell 2012). Dramatic declines are evident in the eastern Pacific Ocean, where hawksbills were once common from Mexico to Ecuador (Cliffon *et al.* 1982), but now are among the world's most critically endangered sea turtle populations (Seminoff *et al.* 2003, Wallace *et al.* 2011), with only 200–300 females nesting annually along the region's 15,000 km coastline (Gaos *et al.* 2010). Because roughly 45% of all known nesting for the species occurs along the 300 km coast of El Salvador, conservation efforts targeting hawksbills along the Salvadoran coast have been identified as a top priority (Liles *et al.* 2011). Despite the extensive abatement of the tortoiseshell trade in the eastern Pacific, egg consumption, incidental capture in fisheries, and coastal development continue to threaten hawksbill survival in the region (Gaos *et al.* 2010).

In low-income regions such as El Salvador, the direct use of natural resources remains an essential livelihood strategy for many people (Hutton and Leader-Williams 2003, Mazur and Stakhanov 2008), particularly in rural and coastal areas where poverty is most acute (Lehoucq *et al.* 2004). As the smallest and most densely populated country in Central America, marine resources in El Salvador are commonly overexploited, exacerbating the vulnerability of historically marginalised coastal residents (Gammage *et al.* 2002). Because the need to satisfy immediate needs often takes precedence over concern for dwindling natural resources, virtually unregulated extraction contributed to the collapse of locally important resources (JICA and MAG 2002, Catterson *et al.* 2004) and is compromising future generations' ability to use these resources to meet their basic needs. For example, persistent overfishing contributed to the sharp decline in shrimp and Pacific seabob exports from \$40 million in 1995 to less than \$4 million in 2007 (FAO 2009). Additionally, the reduction of public-sector budgets restricted the ability of state authorities to deliver services, monitor infractions, and enforce environmental laws, allowing further degradation of coastal ecosystems (Gammage *et al.* 2002). This is particularly problematic when the declining resources are endangered species, such as hawksbills along the Salvadoran coast.

Cooperation among nations located within the geographical range of hawksbills is essential for coordinated conservation actions to minimise threats in the eastern Pacific. However, the resulting multi-scalar management strategies often emerge from international agendas that may conflict with local priorities, particularly in resource-dependent areas of

low-income regions. Priorities of the international conservation community, as exemplified by the Marine Turtle Specialist Group, often centre on biological aspects and needs of hawksbills, whereas local priorities of coastal residents tend to focus on socio-economic development and needs of human communities. Focusing on biological dimensions of hawksbill conservation can result in local realities (i.e. context-specific social and environmental conditions) of coastal residents being deemphasised or excluded entirely from nest protection strategies supported by the international conservation community.

Hatcheries and direct payments for conservation outcomes: biological and social dimensions

The ubiquitous use of hatcheries for incubating sea turtle eggs worldwide underscores their importance as a tool for local sea turtle conservation (Mortimer *et al.* 1993, Marcovaldi and Marcovaldi 1999, Formia *et al.* 2003, García *et al.* 2003, Chacón-Chaverri and Eckert 2007, Patino-Martinez *et al.* 2012a). Hatchery design and construction vary depending on a number of factors, such as desired capacity and availability of funds and building materials. Conservation organisations and groups have attempted to standardise hatchery operations by developing guidelines that detail proper methodologies for hatchery construction, clutch extraction and relocation, and hatchling release (Eckert *et al.* 1999, Chacón *et al.* 2008). Despite these efforts, hatcheries often are criticised for operating under poor management practices that produce inadequate biological processes and outcomes (Pritchard 1980), such as low hatching success (Boulon *et al.* 1996), biased sex ratios of hatchlings (Morreale *et al.* 1982), and increased hatchling mortality (Pilcher and Enderby 2001). Indeed, the Marine Turtle Specialist Group has made its position regarding hatchery use unequivocal: “relocation of eggs to a protected hatchery site should be undertaken only as a last resort and only in cases where *in situ* protection is impossible” (Mortimer 1999, p. 175). By utilising proper methodologies throughout the hatchery implementation process, however, many of the undesired biological outcomes can be avoided or successfully mitigated (Marcovaldi and Marcovaldi 1999, Kornaraki *et al.* 2006, Patino-Martinez *et al.* 2012b).

While we understand the potentially negative biological outcomes associated with manipulation of sea turtle eggs and hatchlings, we contend that the value of hatcheries extends beyond their immediate biological output. The widespread implementation of hatcheries in low-income regions speaks to their ability to garner local support for sea turtle conservation, and to open the conservation enterprise to participation by local residents. Initially, hatchery operations can be linked to human wellbeing via egg purchases from *tortugueros*, where coastal residents are rewarded for active participation in nest protection and thus become joint owners of conservation successes. This opens possibilities for more sustainable benefits, where direct payments for conservation outcomes have been shown to be an effective motivator for behavioural change, particularly for initiatives to protect sea turtle nests (Ferraro and Gjertsen 2009). For example, if the desired outcome is to protect a sea turtle nest, the sea turtle nest is purchased directly from the “seller”, or in this case the *tortuguero* that found the nest, for protection. Direct payments for conservation often are more cost-effective than regulatory-based initiatives in dispersed nesting environments (Gjertsen and Stevenson 2011) and offer a socially just strategy for nest protection that recognises human need.

Some observers may conclude that these direct payments for conservation outcomes related to sea turtle eggs placed in hatcheries are yet another example of the universal merits of re-presenting ecosystem functions and related biodiversity as ecosystem services to humanity. Ehrlich and Ehrlich (1981) proposed this re-presentation in order to highlight

the importance of ecosystem functions and related biodiversity to humanity (Peterson *et al.* 2010). It was not until Costanza *et al.* (1997) “conservatively estimated” the economic value of 17 ecosystem services for 16 biomes at US\$16–54 trillion annually (1994 dollars; mean = \$33 trillion annually), however, that ecosystem services became a dominant conservation theme. Certain ecosystem services undoubtedly were far more cost-effective than technological solutions to environmental problems (Daily and Ellison 2002, Pires 2004), and conservation biologists began to perceive neoliberal economics and politics (Aune 2001, Harvey 2005) embodied in the ecosystem series concept as a panacea for conservation conundrums (see Büscher 2008, Child 2009, Redford and Adams 2009). Chan *et al.* (2007), with Paul Ehrlich himself as a co-author, concluded there are numerous situations in which conservationists should argue for conservation for biodiversity’s sake alone rather than for its direct benefits to humanity. Several other conservationists soon provided critiques of uncritical reliance on ecosystem services – and neoliberal economics generally – as a basis for biodiversity conservation (Vira and Adams 2009, Walker *et al.* 2009, Peterson *et al.* 2010, Büscher *et al.* 2012).

Moving beyond the neoliberal economic perspective that grounds the concept of ecosystem services, the marginalisation or social exclusion of *tortugueros* and other local residents from decision-making regarding marine resource use has far-reaching implications for conservation. Because the extraction of wild natural resources is a high-risk endeavour that is prone to uncertainty and seasonal fluctuations, coastal residents in low-income regions tend to pursue diversified livelihood strategies that spread risk of failure across more than one income source (Allison and Ellis 2001). For example, coastal residents are often involved in different ventures that include, but are not limited to, sea turtle egg collection, to reduce the risks of resource variation. This mobility across multiple resources facilitates interactions between coastal residents and diverse economically and/or biologically important resources, which not only plays a fundamental role in local economies (Béné *et al.* 2009) but also offers opportunities for enhanced conservation of myriad marine species. While we understand that local participation is not a panacea for conservation (Almeida and Mendes 2007), we consider the engagement of local residents in conservation an essential step towards achieving sustainable solutions.

We recognise that the *Global Strategy for the Conservation of Marine Turtles* of the Marine Turtle Specialist Group (1995, p. 14) states, “where management projects have excluded rural people as agents in conservation, unsustainable management plans have resulted”. The report suggests developing “marine turtle recovery plans that address and include the political, economic, and cultural conditions of coastal people affected by management actions and promote, where appropriate, the active participation of these communities in marine turtle conservation”. In practice, however, the Marine Turtle Specialist Group recommendations exclude *tortugueros*, who are likely the most knowledgeable members of local communities regarding sea turtles, from turtle conservation activities. One recommendation, for example, directs conservationists to conduct beach patrols to deter “poachers” and to disguise nests by erasing tracks and smoothing out the area to match its surroundings (Boulon 1999).

Natural resource policy and management strategies strongly reflect the socio-political context in which they were created and to which they are intertwined (Yaffee 1994). Because many threats to species are rooted in the cultural, economic, or political dimensions of a situation, conservation actions that focus only the species’ biology invite failure (Clark *et al.* 1994). Therefore, consideration of the political history of El Salvador can give insight into the factors and experiences that shaped Salvadoran society, natural resource use, and sea turtle conservation.

Emergence of sea turtle conservation in El Salvador

In El Salvador myriad socio-political processes and events shaped natural resource use and conservation over the last several centuries, driven in large part by land acquisition for coffee production and the 12-year (1980–1992) civil war between the oligarchy-military alliance and displaced *campesinos* (i.e. local, small-scale farmers). In 1880, coffee overtook indigo as the country's leading export, which prompted the Salvadoran government to pass laws eliminating collectively held lands; communal and public lands then were divided and sold to large-scale coffee and indigo estates in an effort to replace sustenance farming with the production of cash crops (White 2009). Coffee and related exports yielded enormous profits and land quickly became concentrated with a few families, allowing them to diversify their investments and venture into other economic sectors, such as real estate, commerce, and tourism (LeoGrande and Robbins 1980). Between 1979 and 1980, the Farabundo Marti National Liberation Front (FMLN) formed with the purpose of redistributing power and resources to those members of society that had been repressed by the traditional political and economic structure. In 1980, conflict between the oligarchy-military alliance and the FMLN exploded in a civil war that lasted 12 years.

At the signing of the Peace Accords in 1992, the civil war had resulted in approximately 75,000 deaths and over 1 million displaced persons (i.e. 1/5 of the total population). The war impelled many families to emigrate from the highlands and settle in coastal areas (Gammage *et al.* 2002) where they survived on the exploitation of wild natural resources, such as fishing, mollusc extraction, and sea turtle egg collection. High poverty levels are common along the 300 km Salvadoran coast, with most households lacking potable water and waste collection services, discontinuing education at middle-school level, and earning monthly incomes of \$100 (Castillo and Quezada 2010).

As human settlements have increased in coastal areas and overexploitation of sea turtle eggs has become increasingly evident, conservation initiatives to address threats to sea turtles and their habitat have sometimes ignored dramatic divergence between the realities experienced by local and global participants. Four of the seven sea turtle species nest along the Salvadoran coast – the olive ridley, green, leatherback, and hawksbill. The olive ridley is the most abundant sea turtle in El Salvador, followed by the green, hawksbill, and leatherback, which combined lay approximately 9000–13,000 nests annually in El Salvador (Vasquez *et al.* 2008). In 1975, the first project targeting sea turtle conservation was initiated at Barra de Santiago beach with funding from the Ministry of Agriculture and Livestock (MAG) (see Table 1 for chronology of sea turtle egg protection and hatchery management in El Salvador). This project employed the first use of hatcheries to protect and incubate eggs; in 2013 hatcheries remain the primary method of nest conservation along the coast of El Salvador. High human density and acute poverty in coastal areas have made the protection of sea turtle nests *in situ* (i.e. original site of deposition on the beach) infeasible at most beaches. Nearly 100% of eggs deposited by sea turtles are extracted by approximately 4000 *tortugeros* and are sold to either hatcheries operated by local NGOs for protection (flat rate = \$2.50 per dozen eggs) or the market for consumption (mean = \$2.78 [range = 2.10–4.00] per dozen eggs) (Romanoff *et al.* 2008). By purchasing eggs from *tortugeros*, hatcheries provide an alternate economic incentive to sale for consumption and thus have gained acceptance among coastal communities. Although hatcheries vary in size and quality, most are approximately 100 m² with a capacity of ca. 200 sea turtle nests, made from local materials, and placed in the broad sandy nesting areas of beaches. In 2012, 37 hatcheries operated along the coast of El Salvador that protected nearly 1,700,000 eggs and obtained an overall hatching success of 88%, yielding over

Table 1. Chronology of sea turtle egg protection and hatchery management in El Salvador.

Year	Description	Legal framework
1975	First use of hatcheries for sea turtle nest protection	None
1994	Wildlife Conservation Law regulates the sustainable use of wildlife	República de El Salvador (1994b)
1997	Penal Code sanctions 3–5 years in prison for predation of protected species	República de El Salvador (1997)
1997	Ban on consumption of leatherback eggs; mandatory donation of up to 24 eggs per nest of all species to hatcheries; remaining eggs can be legally sold for consumption	MAG (1997)
2009	Ban on consumption of eggs of all sea turtle species; eggs can be legally collected and sold to hatcheries	República of El Salvador (2009)
2010	Guidelines for the management of sea turtle hatcheries	MARN (2010)

1,450,000 hatchlings (MARN 2013). Most hatcheries are project-funded, which means they are economically unsustainable and require external funding for operation. Additionally, funding is typically provided on an annual basis and is unstable. Inconsistent funding has led to dramatic variations in the number of hatcheries that operate and the number of eggs incubated annually.

Since the Peace Accords were signed in 1992, the Salvadoran government has established a legal framework to provide sea turtles protection through the ratification of international agreements, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES; República de El Salvador 1986) and the Convention on Biological Diversity (República de El Salvador 1994a). National legislation recognises and extends protection to sea turtles as endangered species (República de El Salvador 1994b, 1997) and attempts to mitigate the incidental capture of sea turtles in fisheries (República de El Salvador 2001, 2007). Additionally, *tortugueros* were required to donate an average of one dozen eggs per nest, which typically contain 100 eggs, to the local hatchery (if one existed); the remaining eggs then could be legally sold for consumption (MAG 1997). Despite this requirement, few eggs were protected (Vasquez *et al.* 2008), which hampered El Salvador's ability to ratify the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC). To address this problem, the Salvadoran government prohibited the collection and sale of sea turtle products, including eggs, for purposes other than conservation (República de El Salvador 2009), which further elevated the role of hatcheries as a means of encouraging statutory compliance. According to the Ministry of the Environment and Natural Resources (MARN), the decision to develop and approve the moratorium stemmed from national and international pressure and was substantiated by (1) Chapter 17 of the Central American Free Trade Agreement (CAFTA-DR) with the USA, (2) a rapid assessment conducted by the United States Agency for International Development (USAID) that claimed *tortugueros* earned less than \$200 annually from the sale of eggs (Romanoff *et al.* 2008), and (3) a survey of sea turtle nesting beaches conducted by a local conservation organisation and the University of El Salvador that concluded nearly 100% of sea turtle eggs deposited along the Salvadoran coast were collected and sold for human consumption (Vasquez *et al.* 2010). If *tortugueros* earn \$200 annually (which is likely underreported; Gavin *et al.* 2010) and the average annual household income for *tortugueros* is estimated at \$1230 (Castillo and Quezada 2010), then sea turtle egg sales represent a substantial 16% of their annual household income.

For decades, the occurrence of hawksbill nesting along the coast of El Salvador was unclear due to inconsistent data, much of which were anecdotal and inconclusive. Some researchers claimed that existing records of nesting hawksbills were incomplete and could not be confirmed (Hasbún and Vasquez 1999, Arauz 2000), while others stated that low-density hawksbill nesting occurred 30 years ago on Salvadoran beaches, but no longer occurred in modern times (Mortimer and Donnelly 2008). Recently, however, nesting by hawksbills in El Salvador has been confirmed at levels critical to the continued survival of the population in the eastern Pacific (Gaos *et al.* 2010, Liles *et al.* 2011).

Naturalistic inquiry

Guba's (1978) classic treatise identified the extent to which the researcher manipulates some phenomenon in order to study it; and the extent to which categorical constraints are placed on outputs as distinguishing characteristics of scientific inquiry. Naturalistic inquiry, with its aversion to manipulation of a study context, and its open acceptance of any sort of outputs, is an excellent fit with our attempt to better understand the multiple realities experienced by human residents of coastal areas, to explain how those realities shape interactions with hawksbills, and to begin to understand motivations related to hawksbill conservation in El Salvador. Given our objective, we sought to exert minimal manipulation as we began to develop an integrated understanding of local community realities and hawksbill conservation.

Naturalistic inquiry enables discovery of the many ways personal experiences and their social contexts shape people's constructions of reality (Lincoln and Guba 1985). The multiple realities of local residents who interact with hawksbills must be viewed holistically, as they are inseparable from the contexts in which they developed. In addition, fully immersing at least one member of the research team in the study area for prolonged periods of time facilitates learning from the residents how to interpret their realities while at the same time detecting both intentional and accidental fabrications. Further, persistent observation during these years facilitates understanding of tacit knowledge and aids interpretation of interview data. We are not so naïve as to think our inquiry is not influenced by our own values, and the criteria suggested for judging naturalistic inquiry, such as transferability, dependability, and confirmability, have guided us through challenging decisions regarding our ability to interpret events that occur in coastal areas.

Ethnographic approach

Since the discovery and systematic documentation of substantive hawksbill nesting along the Salvadoran coast in 2008, researchers have partnered with local egg collectors to conduct participatory research and conservation activities at the nation's three primary hawksbill nesting sites: Los Cóbanos Reef Marine Protected Area (Los Cóbanos), Bahía de Jiquilisco-Xiriualtique Biosphere Reserve (Bahía), and Punta Amapala (Figure 1; Liles *et al.* 2011). Our research team has participated in this effort. Liles spent most of the past seven years (2007–2013) engaged in multi-sited ethnographic research (Coleman and von Hellerman 2011) in El Salvador. He immersed himself in local community contexts with primary marine resource users and at the national level with decision-makers. In 2007, he made initial contacts with *tortugueros* and community leaders at 64 beaches. During that year, local informants explained to him that nearly 100% of hawksbill eggs were collected by *tortugueros* and sold legally in local markets for consumption. In 2008, Liles secured funding to initiate hawksbill nest conservation activities, including

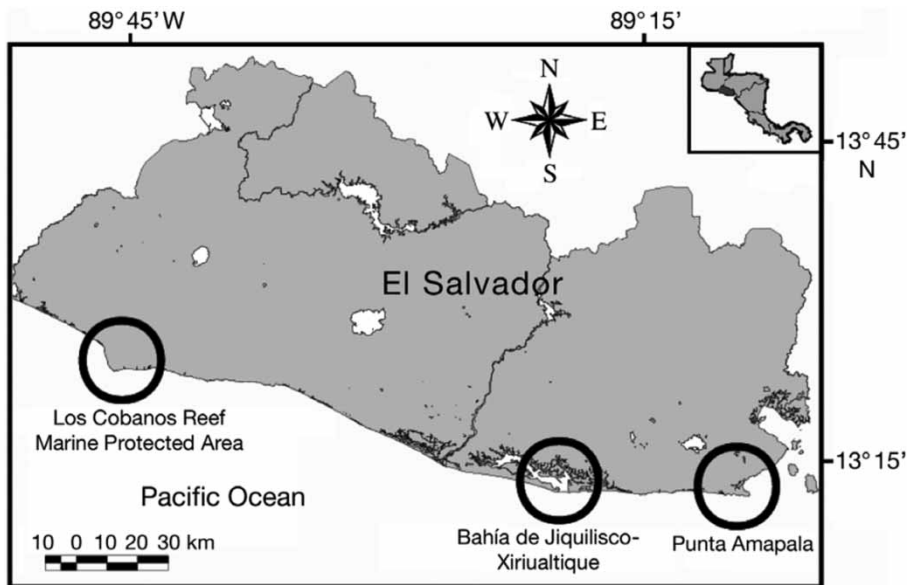


Figure 1. Hawksbill nesting sites (circled) along the coast of El Salvador.

the purchase of eggs from *tortugueros* for protection in hatcheries, which contributed to gradual development of greater rapport with local residents. As relationships deepened and trust strengthened, *tortugueros* began to initiate conversations about sensitive topics such as sea turtle egg consumption and their views of conservation policies in general.

In 2009, Liles returned to the USA for four months. Along with members of the coastal communities where he had lived and worked, Liles was surprised when the Government of El Salvador announced a permanent moratorium on the collection of sea turtle eggs for purposes other than conservation. When Liles returned to El Salvador, most of the *tortugueros* were nervous about interacting with him, especially regarding the now illegal sale of turtle eggs for human consumption. Some members of the community remained willing to work with Liles, and explained that lack of forewarning about the moratorium, combined with Liles' absence at the time it was announced, led some individuals to fear that Liles, along with other conservationists, had betrayed their trust. Since 2010, Liles has focused on rebuilding relationships among conservation organisations, government agencies, and *tortugueros* that were damaged and/or dissolved by the moratorium.

In preparation for conducting this analysis, Liles spent over 2750 hours in the three primary Salvadoran hawksbill nesting sites. During this time, he has taken more than 300 pages of field notes, conducted hundreds of informal interviews with key informants and residents, and participated in over 100 night patrols with *tortugueros* searching for hawksbill eggs. These close encounters with *tortugueros* provided a forum for observing their interactions with hawksbills and with other *tortugueros* and increased the likelihood of obtaining authentic information. Other members of our team have visited and worked with local residents during this time, but remain outsiders. We follow Hammersley and Atkinson's (2007) guidance on selecting ethnographic informants, which means that informants are purposively selected based on their insights, knowledge, roles, and willingness to discuss their experiences. Beginning immediately upon his return following the moratorium

on the collection of sea turtle eggs for consumption, Liles identified key informants to facilitate semi-structured interviews with *tortugueros*. The reason for conducting these interviews was to learn as much as possible about the *tortugueros*' experientially based relationship with hawksbills and their conservation. We selected *tortugueros* because, more than any other group of people, their day-to-day existence connects with turtles.

Collection and analysis of interview texts

We constructed open-ended questions (Peterson *et al.* 1994) in Spanish, and Liles conducted interviews with 34 *tortugueros*, all of whom had long-term experience collecting hawksbill eggs from the three primary hawksbill nesting sites (Figure 1), to help understand how they prioritise hawksbills and their perspectives towards hawksbill conservation in El Salvador. Our ethnographic approach enabled us to perceive how personal experiences and their social contexts shaped informants' perceptions of reality and how language was used to construct that reality (Lincoln and Guba 1985). To identify potential informants at each site, we confided in local contacts with whom we had developed long-standing relationships of trust that had withstood the shock of the 2009 mandate. These local contacts used their established relationships with other *tortugueros* from their communities to arrange interviews. Informants chose the location of the interviews as a means of transferring control from the researcher to the informant in an effort to increase trust and promote a relaxed environment. By fully immersing ourselves in the context of the study area, we learned from informants how best to interpret their realities (Peterson *et al.* 2002). We used a variety of techniques to manage issues of accuracy with the data, including triangulation, informant validation, clarification questions, and continual movement between data collection and analysis (Lincoln and Guba 1985). To ensure accurate data transcription, we requested consent from informants to record the interviews. All fieldwork was conducted by Liles in accordance with Institutional Review Board requirements (IRB Protocol #2009–0277) at Texas A&M University and a native Salvadoran skilled in English transcribed and translated all interviews.

We conducted a thematic analysis (Peterson *et al.* 1994) of the transcribed text and used data from the published literature and unpublished reports to supplement field notes and interview transcripts. Whenever possible, we used the informants' own words to describe their perspectives and experiences.

Results

Three themes emerged that were common across all interviews (see list), which we discuss in detail below.

- (1) All informants valued hawksbills primarily for the economic value attached to egg sales, but many also alluded to deeper connections to local culture.
- (2) All informants identified egg purchase by hatcheries as a socially just conservation strategy that unified hawksbill nest protection with human wellbeing.
- (3) Most informants stated that opportunities for local residents to participate in decision-making regarding sea turtle conservation are limited and biased towards elite, non-residential interests. They suggested involvement opportunities for local residents should be increased.

The value of hawksbills

All interviewees identified the economic value of eggs as the primary value of hawksbills. Because poverty is rampant along the Salvadoran coast and employment options limited, coastal residents are invariably linked to the natural resources that surround them. Whether consumed locally or extracted and sold for income, the livelihoods of coastal community members depend on resources from their local environment for essential goods and services, including hawksbill eggs. One *tortuguero* from the Bahía commented:

To make our community whole, we live off of fishing, mangrove cockles, and the extraction of clams. But in the hawksbill nesting season we depend on the turtle. One goes to the beach and finds a clutch of eggs and with that, you now have enough to buy food for your children and siblings.

This statement demonstrates how resource dependence shifts according to season, which can make these communities particularly vulnerable to resource availability and seasonal fluctuations during certain times of the year. Traditionally, hawksbill egg collection buffered coastal residents from the economic impacts of such transitions and fluctuations, particularly during the winter (i.e. rainy season), which coincides with the peak of the hawksbill nesting season (Liles *et al.* 2011). Concerned about the implications of the moratorium on the sale of sea turtle eggs for consumption during these seasonal shifts in resource abundance and weather, one informant stated:

And in the winter? I explained to the Ministry [of the Environment and Natural Resources] that in the winter the storms cause commerce to decline – mangrove cockles, fish – when you cannot go out [to fish] because of the north winds, the strong, tropical storms, you go to the beach, find turtle [eggs], and on that you maintain yourself.

Informants from all three sites explained that hawksbills typically are preferred by *tortugueros* because they lay more eggs than the other species of sea turtles, which means higher profits. Comments such as those of an egg collector from Punta Amapala were common:

Hawksbills always lay more [eggs]; olive ridleys lay few so it is more advantageous to search for nesting hawksbills – produces more money for the family.

Although all informants highlighted the economic value of eggs, many *tortugueros* described the relationship between hawksbills and egg collectors as more complex and profound than might be expected. Most spoke of hawksbills with a reverence that reflected a deeply held respect and appreciation. In describing his relationship with hawksbills, one informant, who is both a *tortuguero* and community leader in the Bahía, embodied the comments of many other interviewed *tortugueros*:

For me, [hawksbills] have great value because they relieve poverty. They relieve the poverty of coastal communities, those that live along the edge of the ocean. [They provide] a great amount of assistance to maintain families, because we are going from poor to poorer. There is the person that goes to the beach in the evening without so much as 5 cents, he finds a turtle [nest], and come morning he has between \$12 and \$15. Now he can provide for his family. They are content. He returns to the beach; if he does not find a turtle that night, he will find one another night. The primary value that I put on a turtle is that it favours the homes of the poor. For that reason, it has great value to me.

The relationship a *tortuguero* has with hawksbills can transcend economic terms with roots firmly established in tradition. Although some informants spoke indirectly about tradition and culture, one *tortuguero* from Punta Amapala acknowledged it directly:

There are people that now do it [search for nesting hawksbills] as a custom, going every night ... whether they find a turtle or not, it is a tradition.

The habitual act of walking the beach each night demonstrates that the connection between hawksbills and *tortugueros* can be as much of a process as an outcome. The way some informants alluded to the similarities between the life cycle of turtles and humans, and the suffering experienced by both, illustrated an empathic bond our informants claimed with the hawksbills. When asked about his thoughts on hawksbill conservation, one *tortuguero* from Los C6banos responded:

Think about how much a turtle suffers to become an adult; from its birth it has to swim as a hatchling and at 10 or 15 or 20 years old it has to come back to nest. It is suffering to pass through that large trajectory and then, perhaps, it might die in its youth. The life of a turtle is like the life of a human – it is of great value and must be conserved and protected.

Tortugueros are often portrayed by biologists as having very simplistic and superficial interactions with sea turtles, usually driven by short-term self-interest with little concern for the wellbeing of the turtle (Shaw 1991, Campbell 2000, 2002). Most *tortugueros* interviewed for this study demonstrated that their relationships with hawksbills were much more complex and based on respect and appreciation. Although informants identified the economic value of hawksbill eggs as essential, they also expressed a tension between satisfying their immediate economic needs and their desire to conserve the species.

Egg purchase by hatcheries connects the needs of hawksbills and humans

All informants identified egg purchase by hatcheries as a socially just conservation strategy that benefited both hawksbill populations and human wellbeing. Because coastal community members are tied to local natural resources, they are particularly vulnerable to policy decisions affecting the use and management of those resources. In Los C6banos and Punta Amapala, many *tortugueros* commented on the economic hardship created by the moratorium on the sale of sea turtle eggs for consumption due to the absence of operating hatcheries, which essentially outlawed the legal sale of hawksbill eggs. What was once an important source of legal income for many coastal families was now prohibited. Informants emphasised their fear of economic uncertainty and called for alternative sources of employment from the governmental or non-governmental organisations to lessen the impact of the moratorium:

Sincerely, I say, that for me the ban has an impact. I do not look at it negatively; I look at it positively because it is about the protection of sea turtles. What you do see is that it has had an impact and has upset the poor members of the population, the communities that live in this sector, because as egg collectors when the hawksbill nesting season arrives, many of our families earn money to provide for our children [by collecting and selling eggs]. Now with the ban, we have not received any alternatives and although they [the government] say that they are coming, we still do not have a [material] reality to resolve this situation. But the part of the ban being about the conservation, management, and taking care of sea turtles, that is excellent. But we feel the economic void and many families feel abandoned. If the

Ministry [of the Environment and Natural Resources] or other institutions would give some alternative solutions to our families, then we believe that the ban would be good.

The need for alternative sources of income to replace egg sales for consumption was echoed by all informants. They suggested implementation of a variety of alternatives, such as aquaculture, artificial reefs for hook-and-line fishing, and tourism, to help replace the income-loss resulting from the moratorium. However, when asked if these alternatives would prevent hawksbill eggs from being collected and sold illegally for consumption, all informants said that they would not. They also noted that alternative income sources needed to be appropriate to local economic realities. Referring to an article that came out in a local newspaper stating that the government would be providing chicken coops to *tortugueros* as an alternative to collecting and selling eggs, a *tortuguero* from Punta Amapala stated:

To change a person's way of life and say that now they cannot extract sea turtle eggs from the beach, it is necessary to give that person another type of employment. Because one person can change if you give him a chicken coop . . . because that way he can maintain himself with six or seven of those little animals. It would work for him. But they [the government] will not give a coop to everyone along the beach. Not to everyone. If he [motioning to another egg collector] stops collecting eggs, three more will come in and take his place, because we have a dense population . . . him alone [motioning again to the egg collector] has 6 kids. That is why it [chicken coops] will not work.

Informants stated explicitly that if nests were not purchased for protection, they would be sold illegally for consumption; no nest will be intentionally left where it was laid on the beach because if one *tortuguero* does not extract it, another will:

It is very rare that a hawksbill comes up to nest and only the person that collects the nest sees it. There are always others who see who collected it. So, if I leave it there, because for me it is illegal to take it, another person will come that night or later on and will harvest and take it, whether to consume it himself or to sell it illegally. That will always happen. To have 12 dozen turtle eggs at \$3.00 per dozen that he'll be paid for them, how much did he make, eh? That is how people think, in hiding and selling a dozen eggs to such a place or to such a family. If there is only consumption [as an option for income], you hide them and you know it is prohibited; people always feel that necessity.

Many informants mentioned the struggle to negotiate tensions between the protection of hawksbill eggs and the economic benefits generated from egg sales. The solution to this dilemma as offered by all informants was the implementation of protected hatcheries. These hatcheries would purchase the eggs from *tortugueros*, thus providing economic relief for the human population. Hawksbill eggs would be incubated in hatcheries, from where the hatchlings that were produced would be released to perpetuate the cycle.

They [hatcheries and egg purchase] are two things that must be carried out side-by-side, they must be carried out side-by-side because if they are not, one of the two things will be left behind; and that one thing that is left behind will be the hawksbill because the economic situation is always going to be difficult. But by having hatcheries that purchase the eggs from collectors, we can achieve both objectives [hawksbill conservation and human wellbeing] at the same time.

Some informants had hatcheries operating in their communities, while others did not. When one *tortuguero* that lived in a community with a hatchery was asked what would happen if the hatchery did not exist, he answered:

In this area, if there was not a hatchery that was buying hawksbill eggs right now, the *tortuguero* would leave. He would take the eggs and go sell them by the dozen [for consumption] because he would have to get money to live.

Other options, such as increased law enforcement by police, were not likely to result in nest protection:

Of course the moratorium can work here; that's why the community has been requesting that a hatchery be built. [But] if there is no hatchery, it won't work. [Expecting] the police to come [patrol] is dreaming – an illusion.

In an effort to deter the illegal sale of eggs on local markets, the Salvadoran government placed a penalty of up to five years in prison for a person found with turtle eggs that were not destined for conservation purposes. Although many *tortugueros* mentioned that they feared being caught with eggs by the police, they felt that it was extremely unlikely. When asked how the threat of law enforcement by local police affected *tortugueros*, one informant from Punta Amapala replied:

The authorities here, the agents of authority like the police, we don't have their true support because they don't have dedication; they don't have the adequate capacity to, let's say, support, help, or protect hawksbills. They don't have it. I know that here there are only eight policemen available and for all the communities that they have to attend to here, they are not able to handle all of the work they have to do. The vehicles that they drive to go from one place to another are often deficient; sometimes they don't have gasoline, or the personnel aren't around because they are in one place or another. So there are many demands that they can't cover at the time that you need them. They just can't handle it all.

Such statements by *tortugueros* indicate their awareness that Salvadoran authorities are unlikely to enforce laws designed to protect hawksbills, often due to lack of resources and political will. This situation leaves the fate of hawksbill nests resting in the hands of the *tortugueros*, since ultimately they decide whether to sell the eggs for conservation or for consumption. This local reality underscores the power and control *tortugueros* wield in determining the success or failure of hawksbill conservation initiatives in El Salvador and the importance of including them as stakeholders in conservation decision-making processes.

Conservation decision-making excludes local residents

The success of sea turtle conservation initiatives that use hatcheries as tools for nest protection relies on the direct participation of *tortugueros* and other coastal residents. The long history of hatchery use in El Salvador has fostered relationship building among *tortugueros*, government agencies, and conservation organisations. The acknowledgement of coastal residents as important stakeholders in sea turtle conservation efforts recognises and validates local agency in influencing conservation outcomes. As one *tortuguero* put it:

Each year [sea turtle] numbers decline and we have worked with many institutions to protect and conserve turtles since 1997. Think about how if we hadn't done this since that time, there would be fewer turtles; we are now seeing the results of the hatchlings that we had released back then that are now coming back to nest. So, you can see that sea turtle protection and conservation have a huge impact and keeps them from disappearing here, because if not, in 10, 15, or 20 years our children and nieces and nephews won't experience them.

Active participation by coastal residents in the design and execution of sea turtle projects fosters joint-ownership and promotes resource stewardship. However, *tortugueros'*

motivation to protect sea turtles via collaboration with public and private institutions is not unconditional. To exclude local communities from decision-making processes that have outcomes that affect them may jeopardise the relationships of trust and understanding that have been built over decades. Most informants expressed feelings of betrayal at the surprise announcement of the moratorium on the sale of sea turtle eggs for consumption. They were angered that they received no advance communication regarding the decision; instead, they simply heard or read about it through media outlets. Given El Salvador's socio-political history, many viewed the moratorium as another example of government catering to elite interests while sacrificing those of the poor. One stated:

[Coastal] people are human; although we may be poor, we are human. All of us are humans; we feel and everything the same. It is necessary to communicate with [poor] people during the [decision-making] process, because [the decision] will harm some and not others. Clearly, there is the one that has everything, like the [rich] that has, let's say, cattle, property, has a place to live. Then there is the one that doesn't have anything, that is in his little shack and living off of the ocean – that is the one that it harms.

Interviewees suggested that actively involving coastal residents in decision-making processes that will affect them may produce negotiated outcomes that are more likely to be sustained than outcomes forced upon stakeholders. Decisions that are formulated without the participation of those who will be responsible for adhering to them (e.g. *tortugueros*) may not have incorporated local realities. For example:

They [lawmakers] said yes [to the moratorium] without thinking about the poor that survived [on egg sales], that is the big problem. They didn't think, meditate, about the poorest of the poor that maintained themselves off of that, maintained their children, their home. I am certain that if the [local] communities would have been able to provide ideas then coastal residents would have been more flexible to some sort of negotiation – even if the agreed upon outcome was not exactly what we wanted, at least we would have been able to negotiate.

Some informants also questioned the validity of the decision by the Salvadoran government to prohibit egg consumption, which affects the poor, instead of addressing adult turtle mortality by industrial fisheries, which would affect more powerful interests. Many *tortugueros* claimed that improving regulations on industrial shrimp trawls would reduce the number of adult turtles killed and have much larger conservation impacts than focusing efforts on egg protection. As one respondent put it:

Tortugueros, the poor people, we are the victims. Those that have made large sums of money, the most powerful in our economy, by using the famous bribes to government officials to exploit our resources, it's because of them that the turtles are faced with extinction. And now this moratorium comes that affects all of us, even though we are not to blame for the endangerment of these resources. The maximum authorities should be thinking of how the government has committed enormous errors by permitting the millionaires of the country to do illegal things, inadequate uses of resources, uses of land, and whatever other use that hurts the poor populations. They know that we know and that's why government officials never come to meet with fishers or *tortugueros*. They know we will criticize the authorizations that have come down from above to help the rich, so instead they send people to hand out t-shirts and hats, to appease the victims until their term is over.

Overall, informants expressed high levels of distrust in current decision-making processes regarding conservation policy and expressed frustration with perceived corruption within the government. With few exceptions, interviewed *tortugueros* desired more participation in political processes that have a direct influence on their wellbeing.

Discussion

Our informants highlighted the economic value of egg sales as the primary value of hawksbills, but spoke of deeper connections to turtles that transcended neoliberal economics and drew on experiences rooted in local culture. Informants identified egg purchases by hatcheries as a conservation strategy that benefited both hawksbills and human communities, and unequivocally stated that any hawksbill eggs not purchased for protection by conservation initiatives were sold for human consumption. Finally, our informants desired more participation in decision-making regarding sea turtle conservation, which they deemed to be biased towards elite interests.

Divergence of international priorities from local realities

Hawksbills are highly regarded by both the international conservation community and coastal residents in El Salvador; however, local and international priorities concerning hawksbills diverge. Priorities of the international conservation community often centre on the biological aspects and needs of hawksbills, whereas local priorities of coastal residents tend to focus on the socio-economic development and needs of human communities. By prioritising the biological dimensions of hawksbill conservation, local realities of coastal residents are deemphasised or excluded entirely from nest protection strategies supported by the international conservation community. Examples include pressure to protect eggs *in situ* and disapproval of payments for conservation outcomes – because they are considered economically unsustainable – such as the purchase of hawksbill eggs for their relocation to hatcheries. To emphasise this point, an influential Marine Turtle Specialist Group member stated:

To address poaching – I argue that to move the eggs to a new nest cavity 20 feet from its current location works just fine to shut down poachers, they'll never know where to look.

These experts from the international conservation community are pursuing nest protection tactics that appear to ignore the need for coexistence between humans and sea turtles. When our informants analogised the struggles experienced by hawksbills with the struggles experienced by local human residents, they offered the basis for a sustainable conservation strategy with deep links to both human and turtle wellbeing. Considering *tortugueros* as essentially inanimate objects to be “shut down” like an unwanted machine negates the ties they have to sea turtles and invalidates the context within which they live.

Practices such as these foster a false conservationist versus *tortuguero* dualism that promotes a sense of direct competition for resources between the two groups. Situating *tortugueros* as enemies to sea turtles is both a simplistic and inaccurate construction of local reality that fails to acknowledge the underlying contexts in which egg collection occurs. Advocating a sort of conservation where conservationists compete with impoverished *tortugueros* for resources that support local livelihoods is not only ethically questionable, but also can escalate tensions and provoke latent conflict between international conservation organisations and local residents.

In contrast, both material and symbolic realities of coastal residents dictate local priorities and nest protection strategies that are informed by community concerns, including, but not limited to existing socio-economic conditions. Examples include the use of hatcheries for egg protection and belief in the justice of payments for conservation outcomes. Direct payment schemes are considered ethical by members of communities where human population density and poverty are high. Our informants' adamant claims that offering

alternative sources of income to replace the income lost from the collection and sale of eggs would not result in sea turtle egg protection in El Salvador are consistent with these results. Although our informants expressed a clear preference for direct payment for turtle eggs for protection, we are not suggesting that market forces somehow will guarantee the wellbeing of both hawksbills and *tortugueros* in El Salvador. *Tortugueros* sell sea turtles eggs at market value, just as commercial fishers sell fish at market value. The fact that some of the eggs are purchased by conservation organisations, as opposed to those wanting turtle eggs for consumption, does not guarantee that *tortugueros* are any more likely to employ sound conservation practices than commercial fishers whose livelihood also relies on the natural resource. What it does accomplish, however, is to alter *tortugueros*' position in the hawksbill conservation milieu. By selling turtle eggs to hatcheries for conservation, these local residents become part of the conservation effort, which opens possibilities for acting on our final finding: the perceived need to include local residents in decision-making about hawksbill conservation policies.

The divergence between the priorities of international conservation experts and those of coastal residents in low-income regions can have serious implications for conservation and local community development. As Campbell (2007, p. 313) observes, "when these experts are active in policymaking at the international and national levels, and in designing conservation projects at the local level, their beliefs translate into material outcomes for local people living with sea turtles". International rejection of local residents as legitimate participants in conservation extends beyond hawksbills in El Salvador to any biodiversity conservation situation where human wellbeing is at stake. The approval or disapproval of a given practice by the international conservation community can essentially grant or deny its legitimacy in the eyes of international policymakers and funding organisations (Rodríguez *et al.* 2007).

Connecting international priorities with local realities: hawksbill conservation in El Salvador

The three principal hawksbill nesting sites in El Salvador represent the largest known hawksbill nesting aggregation in the eastern Pacific Ocean (Gaos *et al.* 2010). With roughly 45% of all nesting activity in the region occurring in the Bahía (Figure 1), it is a top priority for conservation interventions (Liles *et al.* 2011). These relatively high numbers of nesting hawksbills interspersed with coastal communities offer a unique opportunity to integrate sustainable local development into an equally sustainable process of hawksbill recovery along the Salvadoran coast.

Sustainable sea turtle conservation requires integration of coastal communities into conservation initiatives (Nichols *et al.* 2000b). Despite the possibilities suggested by our informants and other critical social science research, however, experts within the international conservation community often limit the role of coastal communities to superficial levels, citing limited decision-making capacity as justification (Campbell 2000, 2002). Our research suggests the benefits of a fundamentally different approach, where *tortugueros* are recognised as key contributors in hawksbill research and conservation, whose direct participation in the development and implementation of project activities is critical to success.

Conclusions

To effectively link international conservation priorities with human wellbeing at the local level where most conservation occurs, conservationists must first understand primary

resource users. Marginalised members of low-income regions collect millions of sea turtle eggs each year throughout the world, a number that can only be expected to rise as human numbers continue to increase in these regions. A myopic focus on the biological dimensions of sea turtle nest protection that dismisses the inherent social dimensions of conservation fails to address the livelihood needs of egg collectors, which are rooted in the specific contexts of individual nations and cultures. The international conservation community has the power and prestige to shape international policy and to determine funding priorities for sea turtle conservation activities. This can have seriously negative consequences for local conservation efforts that do not align with international conservation priorities, particularly in low-income regions that require context-specific approaches to conservation that are informed by local realities. The divergence of international policy and funding priorities from local realities can dissuade local participation in conservation activities and construct a false dualism that fosters a perception of local egg collectors as the enemy of conservation and escalates latent conflict via direct competition for livelihood resources. In contrast, connecting international conservation policy and funding priorities to local realities, as has occurred with hawksbill conservation in El Salvador, enables all participants to build on existing synergies to garner local support for conservation that promotes joint-ownership in decision-making and active participation in all aspects of research and conservation. Ultimately, such synergies are required for sustainable, socially just conservation outcomes.

Our study of sea turtle conservation in low-income regions of El Salvador supports a growing body of evidence demonstrating that attempts to impose internationally negotiated uniform conservation strategies are failing in some cases where more locally shaped strategies have been more effective (Sayer and Collins 2012). Thus, understanding realities experienced by primary resource users is a prerequisite to analysis of the power structures operating in resource-based processes. Moreover, successfully aligning conservation strategies with local realities benefits wildlife and human wellbeing in both low- and high-income regions (Hutton and Leader-Williams 2003, Naughton-Treves *et al.* 2005, Robards and Lovcraft 2010). For all these reasons, conservation policies and practices must account for dynamic social contexts, distributions of power, and interests of stakeholders – including primary resource users – to maximise the probability of their success.

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References

- Allison, E.H. and Ellis, F., 2001. The livelihoods approach and management of small-scale fisheries. *Marine Policy*, 25 (5), 377–388.
- Almeida, A.P. and Mendes, S.L., 2007. An analysis of the role of local fishermen in the conservation of the loggerhead turtle (*Caretta caretta*) in Pontal do Ipiranga, Linharea, ES, Brazil. *Biological Conservation*, 134 (1), 106–112.
- Arauz, R., 2000. *Diagnóstico de la situación actual de las tortugas marinas en El Salvador*. San Salvador: MARN, technical report.
- Aune, J.A., 2001. *Selling the free market: the rhetoric of economic correctness*. New York: Guilford Press.

- Béné, C., *et al.*, 2009. Fish as the “bank in the water” – evidence from chronic-poor communities in the Congo. *Food Policy*, 34 (1), 108–118.
- Boulon Jr., R.H., 1999. Reducing threats to eggs and hatchlings: in situ protection. *In*: K.L. Eckert, *et al.*, eds. *Research and management techniques for the conservation of sea turtles*. Publication no. 4. Washington: IUCN/SSC Marine Turtle Specialist Group, 169–174.
- Boulon Jr., R.H., Dutton, P.H., and McDonald, D.L., 1996. Leatherback turtles (*Dermochelys coriacea*) on St. Croix, U.S. Virgin Islands: fifteen years of conservation. *Chelonian Conservation and Biology*, 2 (2), 141–147.
- Büscher, B.E., 2008. Conservation, neoliberalism, and social science: a critical reflection on the SCB 2007 annual meeting in South Africa. *Conservation Biology*, 22 (2), 229–231.
- Büscher, B., *et al.*, 2012. Towards a synthesized critique of neoliberal biodiversity conservation. *Capitalism Nature Socialism*, 23 (2), 4–30.
- Campbell, L.M., 2000. Human need in rural developing areas: perceptions of wildlife conservation experts. *The Canadian Geographer*, 44 (2), 167–181.
- Campbell, L.M., 2002. Science and sustainable use: views of marine turtle conservation experts. *Ecological Applications*, 12 (4), 1229–1246.
- Campbell, L.M., 2003. Contemporary culture, use, and conservation of sea turtles. *In*: P.L. Lutz, J.A. Musick, and J. Wyneken, eds. *The biology of sea turtles*, 2nd ed. Boca Raton: CRC Press, 301–331.
- Campbell, L.M., 2007. Local conservation practice and global discourse: a political ecology of sea turtle conservation. *Annals of the Association of American Geographers*, 97 (2), 313–334.
- Campbell, L.M., 2012. Seeing red: inside the science and politics of the IUCN Red List. *Conservation & Society*, 10 (4), 367–380.
- Castillo, W.G. and Quezada, M.L. 2010. *Caracterización económica y social de 22 comunidades ubicadas en las playas donde anida la tortuga marina en El Salvador*. San Salvador: USAID, technical report.
- Catterson, T.M., Hasbún, C.R., and Dreikorn, C., 2004. *El Salvador: biodiversity, tropical forestry and water resources assessment*. San Salvador: USAID, technical report.
- Chacón-Chaverri, D. and Eckert, K.L., 2007. Leatherback sea turtle nesting at Gandoca Beach in Caribbean Costa Rica: management recommendations from fifteen years of conservation. *Chelonian Conservation and Biology*, 6 (1), 101–110.
- Chacón, D., *et al.*, 2008. *Manual sobre técnicas de manejo y conservación de las tortugas marinas en playas de anidación de Centroamérica*. San José: CIT.
- Chan, K.M.A., *et al.*, 2007. When agendas collide: human welfare and biological conservation. *Conservation Biology*, 21 (1), 59–68.
- Child, M.F., 2009. The Thoreau ideal as a unifying thread in the conservation movement. *Conservation Biology*, 23 (2), 241–243.
- Clark, T.W., Reading, R.P., and Clarke, A.L., 1994. Synthesis. *In*: T.W. Clark, R.P. Reading, and A.L. Clarke, eds. *Endangered species recovery: finding the lessons, improving the process*. Washington, DC: Island Press, 417–431.
- Cliffon, K., Cornejo, D.O., and Felger, R.S., 1982. Sea turtles of the Pacific coast of Mexico. *In*: K.A. Bjorndal, ed. *Biology and conservation of sea turtles*. Washington, DC: Smithsonian Institution Press, 199–209.
- Coleman, S. and von Hellerman, P., eds., 2011. *Multi-sited ethnography: problems and possibilities in the translocation of research methods*. New York: Routledge.
- Costanza, R., *et al.*, 1997. The value of the world’s ecosystem services and natural capital. *Nature*, 387 (6630), 253–260.
- Daily, G.C. and Ellison, K., 2002. *The new economy of nature: the quest to make conservation profitable*. Washington, DC: Island Press.
- Eckert, K.L., *et al.*, eds., 1999. *Research and management techniques for the conservation of sea turtles*. Washington, DC: IUCN/SSC Marine Turtle Specialist Group, Publication no. 4.
- Ehrlich, P.R. and Ehrlich, A., 1981. *Extinction: the causes and consequences of the disappearance of species*. New York: Random House.
- FAO (Food and Agriculture Organization), 2009. *El Salvador: estado del recurso “camarón”*. San Salvador: FAO, Reporte técnico.
- Ferraro, P.J. and Gjertsen, H., 2009. A global review of incentive payments for sea turtle conservation. *Chelonian Conservation and Biology*, 8 (1), 48–56.
- Formia, A., *et al.*, 2003. Sea turtle conservation along the Atlantic coast of Africa. *Marine Turtle Newsletter*, 100 (1), 33–37.

- Francis, R.A. and Goddman, M.K., 2010. Post-normal science and the art of nature conservation. *Journal of Nature Conservation*, 18 (2), 89–105.
- Gammage, S., Benitez, M., and Machado, M., 2002. An entitlement approach to the challenge of mangrove management in El Salvador. *Ambio*, 31 (4), 285–294.
- Gaos, A.R., et al., 2010. Signs of hope in the eastern Pacific: international collaboration reveals encouraging status for a severely depleted population of hawksbill turtles *Eretmochelys imbricata*. *Oryx*, 44 (4), 595–601.
- García, A., Caballos, G., and Adaya, R., 2003. Intensive beach management as an improved turtle conservation strategy in Mexico. *Biological Conservation*, 111 (2), 253–261.
- Gavin, M.C., Solomon, J.N., and Blank, S.G., 2010. Measuring and monitoring illegal use of natural resources. *Conservation Biology*, 24 (1), 89–100.
- Gjertsen, H. and Stevenson, T.H., 2011. Direct incentive approaches for leatherback turtle conservation. In: P.H. Dutton, D. Squires, and M. Ahmed, eds. *Conservation of Pacific sea turtles*. Honolulu: University of Hawaii Press, 164–182.
- Guba, E.G., 1978. *Toward a methodology of naturalistic inquiry in educational evaluation*. Los Angeles: UCLA Center for the Study of Evaluation.
- Hammersley, M. and Atkinson, P., 2007. *Ethnography: principles in practice*. New York: Routledge.
- Harvey, D., 2005. *A brief history of neoliberalism*. New York: Oxford University Press.
- Hasbún, C.R. and Vasquez, M., 1999. Sea turtles of El Salvador. *Marine Turtle Newsletter*, 85 (1), 7–9.
- Henke, C.R. and Gieryn, T.F., 2008. Sites of scientific practice: the enduring importance of place. In: E.J. Hackett, et al., eds. *The handbook of science and technology studies*, 3rd ed. Cambridge: MIT Press, 921–947.
- Hutton, J.M. and Leader-Williams, N., 2003. Sustainable use and incentive-driven conservation: realigning human and conservation interests. *Oryx*, 37 (2), 215–226.
- JICA (Asociación de Cooperación Internacional de Japón) and MAG (Ministerio de Agricultura y Ganadería), 2002. *El estudio sobre el desarrollo de la pesca artesanal en El Salvador*. San Salvador: JICA-MAG, Reporte técnico.
- Kornaraki, E., et al., 2006. Effectiveness of different conservation measures for loggerhead sea turtle (*Caretta caretta*) nests at Zakynthos Island, Greece. *Biological Conservation*, 130 (3), 324–330.
- Lehoucq, F., et al., 2004. *Conflict assessment: El Salvador*. San Salvador: USAID, technical report.
- LeoGrande, W. and Robbins, C., 1980. Oligarchs and officers: the crisis in El Salvador. *Foreign Affairs*, 58 (5), 1084–1103.
- Liles, M.J., et al., 2011. Hawksbill turtles *Eretmochelys imbricata* in El Salvador: nesting distribution and mortality at the largest remaining nesting aggregation in the eastern Pacific Ocean. *Endangered Species Research*, 14 (1), 23–30.
- Lincoln, Y.S. and Guba, E.G., 1985. *Naturalistic inquiry*. Newbury Park: Sage.
- Luschi, P., Hays, G.C., and Papi, F., 2003. A review of long-distance movements by marine turtles, and the possible role of ocean currents. *Oikos*, 103 (2), 293–302.
- MAG (Ministerio de Agricultura y Ganadería), 1997. *Veda al aprovechamiento de huevos, manejo de neonatos y productos derivados de las tortugas marinas en El Salvador*. Resolución 01-97, Servicio de Parques Nacionales y Vida Silvestre, 21 Julio.
- Marcovaldi, M.Á. and Marcovaldi, G.G., 1999. Marine turtles of Brazil: the history and structure of Projeto TAMAR-IBAMA. *Biological Conservation*, 91 (1), 35–41.
- Marine Turtle Specialist Group, 1995. *A global strategy for the conservation of marine turtles*. Gland: IUCN.
- MARN (Ministerio de Medio Ambiente y Recursos Naturales), 2010. *Manual para el manejo de corrales de incubación de huevos de tortugas marinas*. San Salvador: MARN.
- MARN (Ministerio de Medio Ambiente y Recursos Naturales), 2013. *Resultados de las actividades para la conservación de las tortugas marinas en El Salvador en 2012*. San Salvador: MARN.
- Mazur, R.E. and Stakhanov, O.V., 2008. Prospects for enhancing livelihoods, communities, and biodiversity in Africa through community-based forest management: a critical analysis. *Local Environment*, 13 (5), 405–421.
- Morgan, R.C., 2007. Property of spirits: hereditary and global value of sea turtles in Fiji. *Human Organization*, 66 (1), 60–68.
- Morreale, S.J., et al., 1982. Temperature-dependent sex determination: current practices threaten conservation of sea turtles. *Science*, 216 (4551), 1245–1247.

- Mortimer, J.A., 1999. Reducing threats to eggs and hatchlings: hatcheries. In: K.L. Eckert, *et al.*, eds. *Research and management techniques for the conservation of sea turtles*. Publication no. 4. Washington: IUCN/SSC Marine Turtle Specialist Group, 175–178.
- Mortimer, J.A., Ahmad, Z., and Kaslan, S., 1993. The status of the hawksbill *Eretmochelys imbricata* and green turtle *Chelonia mydas* of Melaka and Negeri Sembilan. *Malayan Nature Journal*, 46 (1), 243–253.
- Mortimer, J.A. and Donnelly, M. (IUCN SSC Marine Turtle Specialist Group), 2008. *Eretmochelys imbricata*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2 [online]. Available from: www.iucnredlist.org [Accessed 17 February 2013].
- Naughton-Treves, L., Holland, M.B., and Brandon, K., 2005. The role of protected areas in conserving biodiversity and sustaining local livelihoods. *Annual Review of Environment and Resources*, 30 (1), 219–252.
- Nichols, W.J., *et al.*, 2000a. Transpacific migration of a loggerhead turtle monitored by satellite telemetry. *Bulletin of Marine Science*, 67 (3), 937–947.
- Nichols, W.J., Bird, K.E., and Garcia, S., 2000b. Community-based research and its application to sea turtle conservation in Bahía Magdalena, BCS, Mexico. *Marine Turtle Newsletter*, 89 (1), 4–7.
- Nietschmann, B., 1973. *Between land and water: the subsistence ecology of the Miskito Indians, Eastern Nicaragua*. New York: Seminar Press.
- Patino-Martinez, J., *et al.*, 2012a. How do hatcheries influence embryonic development of sea turtle eggs? Experimental analysis and isolation of microorganisms in leatherback turtle eggs. *Journal of Experimental Zoology*, 317A (1), 47–54.
- Patino-Martinez, J., *et al.*, 2012b. A potential tool to mitigate the impacts of climate change to the Caribbean leatherback sea turtle. *Global Change Biology*, 18 (2), 401–411.
- Peterson, T.R., *et al.*, 1994. Using informant directed interviews to discover risk orientation: how formative evaluations based in interpretive analysis can improve persuasive safety campaigns. *Journal of Applied Communication Research*, 22 (3), 199–215.
- Peterson, M.N., *et al.*, 2002. Cultural conflict and the endangered Florida key deer. *The Journal of Wildlife Management*, 66 (4), 947–968.
- Peterson, M.N., *et al.*, 2007. Reconciling wildlife management's conflicted purpose with a land community worldview. *The Journal of Wildlife Management*, 71 (8), 2499–2506.
- Peterson, M.J., *et al.*, 2010. Obscuring ecosystem function with application of the ecosystem services concept. *Conservation Biology*, 24 (1), 113–119.
- Peterson, M.N., *et al.*, 2013. Why transforming biodiversity conservation conflict is essential and how to begin. *Pacific Conservation Biology*, 19 (2), 94–103.
- Pilcher, N.J. and Enderby, S., 2001. Effects of prolonged retention in hatcheries on green turtle (*Chelonia mydas*) hatchling swimming speed and survival. *Journal of Herpetology*, 35 (4), 633–638.
- Pires, M., 2004. Watershed protection for a world city: the case of New York. *Land Use Policy*, 21 (2), 161–175.
- Pritchard, P.C., 1980. The conservation of sea turtles: practices and problems. *American Zoologist*, 20 (3), 609–617.
- Redford, K.H. and Adams, W.M., 2009. Payment for ecosystem services and the challenge of saving nature. *Conservation Biology*, 23 (4), 785–787.
- República de El Salvador, 1986. *Convención internacional sobre el comercio de especies amenazadas de fauna y flora silvestres CITES*. Diario Oficial No. 93. Tomo No. 291, 23 Mayo, San Salvador.
- República de El Salvador, 1994a. *Convenio sobre la diversidad biológica*. Diario Oficial No. 92. Tomo No. 323, 19 Mayo, San Salvador.
- República de El Salvador, 1994b. *Ley de conservación de vida silvestre*. Diario Oficial No. 133. Tomo No. 352, 16 Julio, San Salvador.
- República de El Salvador, 1997. *Código Penal*. Diario Oficial No. 105. Tomo No. 335, 10 Junio, San Salvador.
- República de El Salvador, 2001. *Ley general de ordenación y promoción de pesca y acuicultura*. Diario Oficial No. 240. Tomo No. 353, 19 Diciembre, San Salvador.
- República de El Salvador, 2007. *Reglamento de la ley general de ordenación y promoción de pesca y acuicultura*. Diario Oficial No. 88. Tomo No. 375, 17 Mayo, San Salvador.
- República de El Salvador, 2009. *Veda total y permanente al aprovechamiento de huevos, carne, grasa, aceite, sangre, huesos, especímenes disecados, caparazones, fragmentos y productos elaborados de caparazones de todas las especies de tortugas marinas*. Diario Oficial No. 23. Tomo No. 382, 4 Febrero, San Salvador.

- Robards, M.D. and Lovcraft, A.M., 2010. Evaluating comanagement for social-ecological fit: indigenous priorities and agency mandates for Pacific walrus. *Policy Studies Journal*, 38 (2), 257–279.
- Rodriguez, J.P., et al., 2007. Globalization of conservation: a view from the South. *Science*, 317 (5839), 755–756.
- Romanoff, S., Benitez, M., and Chanchan, R., 2008. *La comercialización de los huevos de las tortugas marinas en El Salvador*. San Salvador: USAID, technical report.
- Sayer, J.A. and Collins, M., 2012. Forest governance in a changing world: reconciling local and global values. *The Round Table: The Commonwealth Journal of International Affairs*, 101 (2), 137–146.
- Seminoff, J.A., et al., 2003. Occurrence of hawksbill turtles, *Eretmochelys imbricata*, near Baja California. *Pacific Science*, 57 (1), 9–16.
- Shaw, J.H., 1991. The outlook for sustainable harvest of wildlife in Latin America. In: J.G. Robinson and K.H. Redford, eds. *Neotropical wildlife use and conservation*. Chicago: Chicago Press, 24–34.
- Shine, R., 2011. How can we ensure that conservation policies are based on science, not emotion? *Pacific Conservation Biology*, 17 (1), 6–10.
- Sutherland, W.J., et al., 2009. One hundred questions of importance to the conservation of global biological diversity. *Conservation Biology*, 28 (3), 557–567.
- Thorbjarnarson, J., et al., 2000. Human use of turtles: a worldwide perspective. In: M.W. Klemens, ed. *Turtle conservation*. Washington, DC: Smithsonian Institution Press, 33–84.
- Vasquez, M., et al., 2008. *Sea turtle research and conservation in El Salvador*. San Salvador: FUNZEL-ICMARES/UES, technical report.
- Vasquez, M., Diaz, A., and Herrera, N., 2010. *40 años de conservación de tortugas marinas en El Salvador*. San Salvador: FIAES.
- Vira, B. and Adams, W.M., 2009. Ecosystem services and conservation strategy: beware the silver bullet. *Conservation Letters*, 2 (4), 158–162.
- Walker, S., et al., 2009. Why bartering biodiversity fails. *Conservation Letters*, 2 (4), 149–157.
- Wallace, B.P., et al., 2011. Global conservation priorities for marine turtles. *PLoSOne*, 6 (9), e24510.
- White, C.M., 2009. *The history of El Salvador*. Westport: Greenwood Press.
- White, R.M., et al., 2009. Developing an integrated conceptual framework to understand biodiversity conflicts. *Land Use Policy*, 26 (2), 242–253.
- Witherington, B.E. and Frazer, N.B., 2003. Social and economic aspects of sea turtle conservation. In: P.L. Lutz, J.A. Musick, and J. Wyneken, eds. *The biology of sea turtles*. 2nd ed. Boca Raton: CRC Press, 355–384.
- Yaffee, S.L., 1994. The northern spotted owl: an indicator of the importance of sociopolitical context. In: T.W. Clark, R.P. Reading, and A.L. Clarke, eds. *Endangered species recovery: finding the lessons, improving the process*. Washington, DC: Island Press, 47–71.
- Yearley, S., 2008. Nature and the environment in science and technology studies. In: E.J. Hackett, O. Amsterdamska, M. Lynch, and J. Wajcman, eds., 2008. *The handbook of science and technology studies*. Cambridge: MIT Press, 921–947.