



## Tourism-related drivers of support for protection of fisheries resources on Andros Island, The Bahamas



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### ABSTRACT

Fisheries resources in the Caribbean suffer intense pressure from overharvesting. Some of the most valuable fisheries in The Bahamas, such as queen conch (*Strombus gigas*), spiny lobster (*Panulirus argus*), and Nassau grouper (*Epinephelus striatus*), are overexploited and require additional protection. Despite these pressures, we currently know very little about the factors that underlie local residents' support for such protection. We interviewed residents of Andros Island, The Bahamas to evaluate how perception of environmental impacts of tourism, perception of benefits of tourism for their quality of life, income generation from tourism, and education level influenced their willingness to support additional protection of marine resources in the face of a growing tourism industry. We found that respondents supporting additional marine resource protection tended to perceive tourism as having negative impacts on marine resources and neutral to positive effects on their family's quality of life. Attending at least some college also positively influenced support for marine resource protection, although whether residents sold natural products to tourists did not appear to influence their stance on marine resource protection. Our results suggest education in a broad sense, and particularly education highlighting how tourism can both positively affect human well-being and harm marine resources, will promote public support for marine resource protection.

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### 1. Introduction

Overharvesting of marine resources threatens social and ecological sustainability in the Caribbean Basin. Significant commercial and artisanal fisheries (e.g. shellfish, large pelagic species, and shallow reef fishes), which are considered high value for export or for domestic and tourist consumption, are fully to overexploited (CEO, 2005). Reliance on marine resources is especially prevalent in developing island nations of the Caribbean. Resource extraction ranging from forest products to fisheries provides a form of natural insurance for residents with low incomes, unreliable employment, or during times of economic uncertainty (Pattanayak and Sills, 2001). Over-reliance on natural resources has the potential to create a poverty trap by providing a minimum income thereby removing incentive to invest in education or take risks necessary to escape poverty (Delacote, 2009). Protecting fisheries resources can

ensure reliable long-term availability of the safety net associated with these resources while reducing the poverty trap effect caused by overreliance on extraction.

Fisheries protection measures (e.g., protected areas, closed seasons, catch quotas and size restrictions) have proven successful in counteracting the decline of specific fisheries and other marine species (Sluka et al., 1997; Bohnsack, 2000; Bene and Tewfik, 2003). Although protection can promote more sustainable fisheries and communities, such protection requires public and regulatory support, which can be influenced by factors such as residents' beliefs and education (Chen et al., 2011; Gelcich et al., 2005). The absence of public support, combined with minimal enforcement in protected areas, has often resulted in 'paper parks' where marine resources receive little actual protection. The 'paper park' phenomenon is particularly acute when protected areas lack social support from adjacent residents (Hamu et al., 2004; Abecasis et al., 2013) or when exclusionary practices do not address the impacts to residents' livelihood and culture (Meyer and Helfman, 1993).

Factors previously shown to correlate with support for environmental protection include perceived impacts of environmental

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policy on local culture and environment, community involvement in environmental-decision making, and level of education. In The Bahamas, residents of the Exumas who stood to lose access to resources opposed a marine protected area and indicated a willingness to violate a no-take rule (Stoffle and Minnis, 2007). Residents who participate in the process of defining environmental protection strategies are more likely to support resulting restrictions (Sandersen and Koester, 2000; Pollnac et al., 2001; Kideghesho et al., 2007). Belief that the marine environment is in poor condition represented a positive indicator of support for marine reserves on several 'family islands' (i.e., islands not frequently visited by tourists) in The Bahamas (Broad and Sanchirico, 2008). Greater education is often associated with higher levels of acceptance of environmental protection (Fiallo and Jacobson 1995; Infield, 1988; Mehta and Heinen, 2001) although not necessarily with increased environmental-friendly behavior (Olli et al., 2001; Moorman, 2006).

Tourism in the Caribbean has grown substantially in the past few decades, introducing new opportunities to residents of marine resource-dependent island nations, for instance by potentially offering alternative forms of income. Over the same few decades, there has been a growing awareness of the potentially negative impacts of tourism growth. Hall (2001) provides an extensive review of tourism impacts on coastal and marine environments. Tourism also presents additional demand for resources which are already fully or overexploited. The role of residents' perceptions of tourism in influencing their support for marine resource protection has received little attention. The few studies conducted point toward an overall positive view of tourism, a perception of net financial benefits from tourism, and a strong community reliance on tourism as factors influencing support for conservation initiatives (Lindberg et al., 1996; Walpole and Goodwin, 2001; Broad and Sanchirico, 2008). Greater local participation in tourism initiatives and employment in tourism generates pro-conservation behaviors and perspectives (Stem et al., 2003). However, income generation alone does not necessarily encourage pro-conservation behavior (Stem et al., 2003). For instance, residents dependent on tourism for part of their income were less likely to support conservation in Komodo National Park, perhaps due to negative experiences with park authorities (Walpole and Goodwin, 2001).

Many valuable fisheries in The Bahamas, such as queen conch (*Strombus gigas*), spiny lobster (*Panulirus argus*), and Nassau grouper (*Epinephelus striatus*), are overharvested. In The Bahamas, where conch comprises the second largest fishery, extremely low adult population densities have resulted in very low reproductive potential in most populations around Andros Island (Stoner et al., 2009; Stoner and Davis, 2010). The International Union for Conservation of Nature (IUCN) lists Nassau grouper (Ehrhardt and Deleveau, 2007; FAO, 2009), as endangered IUCN, 2012. Almost all Bahamian fishers (95%) harvest spiny lobster which are either fully or overexploited throughout the Caribbean (Buchan, 2000),

and despite steady or increasing fishing efforts in recent years, lobster landings began decreasing in 2007 (FAO, 2009). Thus, multiple fisheries in The Bahamas should benefit from additional protection efforts, but few previous studies have investigated tourism-related factors influencing resident support for such protection.

Here we investigate potential drivers of support for fisheries resource protection on Andros Island, The Bahamas, focusing on residents' perceptions of tourism. We developed and tested four hypotheses (Table 1). Three hypotheses centered on the relatively unexplored role of tourism on support for fisheries resource protection, whereas our fourth hypothesis allowed us to account for potential educational effects identified in previous research.

## 2. Study area

Andros Island is the largest island in The Bahamas (5957 km<sup>2</sup>) and has one of the least dense human populations (7490 people in 2010; Department of Statistics of The Bahamas), with the third longest barrier reef system in the world. Andros comprises several islands treated politically as one unit, and most people live along The Queen's Highway, which primarily runs along the eastern coast (Fig. 1).

Approximately 9000 visitors arrive on Andros annually (Delancy, 2011), mainly for activities such as bonefishing, diving, bird-watching, deep-sea fishing, sailing, and kayaking. Nature-based tourism activities generate \$43.6 million in revenue each year (Hargreaves-Allen, 2010). Andros provides a good case study because approximately 85% of residents derive primary or secondary income from fishing, crabbing and sponging (Hargreaves-Allen, 2010), while some residents also sell straw products and wood carvings to tourists. Environmental protection is salient to residents because the government established five national parks on Andros Island in 2002 to protect the barrier reef, freshwater blue holes, mangrove nursery habitat, and land crab (*Cardisoma guanhumi*, *Gecarcinus lateralis*) habitat. Moreover, the national government has declared Andros as The Bahamas' premier ecotourism destination (Macleod, 2010) with an obvious desire to grow tourism on the island (P. Douglas, personal communication 2011, Broad and Sanchirico, 2008; Christie, 2014). At the same time, The GEO Bahamas, 2005 State of the Environment Report articulated the need for environmental stewardship and protection to grow and maintain tourism on Andros:

"It is clear that the socio-economic environment of The Bahamas is dependent on tourism. In turn, tourism is dependent on the state of the environment. Consequently maintaining a balance between the environment and economic development is essential for Bahamians, both present and future generations" (GEO Bahamas, 2005).

**Table 1**  
Hypotheses of drivers for support of fisheries resource protection examined in this study.

Driver of support for fisheries protection	General hypothesis	Survey prediction
1. Environmental Impacts of Tourism	Individuals that perceive negative impacts of tourism on critical fisheries resources are more likely to support protection	Perception of negative impacts on conch from tourism will positively predict support for additional protection
2. Quality-of-Life Impacts of Tourism	Individuals that perceive positive impacts of tourism on their quality of life are more likely to support protection	Perception of positive impacts on family quality of life from tourism will positively predict support for additional protection
3. Economic Dependence on Tourism	Individuals that depend in part on tourism for financial support are more likely to support protection	Selling natural products to tourists will positively predict support for additional protection
4. Education	Individuals with more formal educational background are more likely to support protection	Higher levels of formal education will positively predict support for additional protection



**Fig. 1.** Map of Andros Island, The Bahamas, illustrating the study region in northern Andros (8 settlements; in italics), the major roads on the island, and the five national parks (boundaries denoted with dotted lines).

Similarly, the 2014/15 Budget Communication by The Bahamas Prime Minister expressed a clear dedication to growing the Andros economy, partly via tourism development, while ensuring that natural resources “must not be spoiled in the name of advancement” (Christie, 2014).

### 3. Methods

In July 2011, we conducted personal interviews with 96 people

who lived in northern Andros Island, including the towns of Fresh Creek, Calabash Bay, Staniard Creek, Stafford Creek, San Andros, Red Bays, Nicholls Town, and Morgan's Bluff (see Fig. 1). We used a purposive sampling strategy by attempting to ensure the broadest diversity of residents in terms of gender, age, employment, and home location, and conducted interviews during mid-day and evening on weekdays and weekends. Although the sample was not random, contexts with small populations, exploratory research, and populations not represented in most sample frames (e.g., not having addresses, phones, or drivers licenses) require alternative sampling strategies (Stevens, 1996; Peterson et al., 2010).

To address our four hypotheses described in Table 1, we examined responses to five questions (Table 2). We measured our dependent variable (support for additional natural resource protection) using the question: “do you think these resources will need additional protection from over-harvest if tourism grows on Andros?” Answers were coded as yes (1) or no (0). A previous question identified four types of natural-resource products (seafood, sponges, straw products and wood carvings). To address our first hypothesis (see Table 1), we asked: “how serious are the environmental impacts caused by tourism on conch” using a 5-point Likert response format where 1 = no impact, 2 = not serious, 3 = moderate, 4 = serious, and 5 = very serious (see Table 2). Although we focused on conch, we collected the same data for lobster, reefs, and blue holes. We used conch in analysis because responses to these questions were collinear, and conch was specifically mentioned in 12 of the 14 cases where respondents mentioned concerns about specific species. To address our second hypothesis, we asked respondents the degree to which they agreed with the statement “tourism development has helped enhance my family's quality of life,” with 3 answer options: 1 = disagree, 2 = neutral, 3 = agree. To examine our third hypothesis, we asked: “do you sell natural products like seafood, sponges, straw products or wood carvings to tourists.” Answers were coded as yes (1) or no (0). For our fourth hypothesis, we asked each respondent “how many years have you gone to school,” which we classified as a binary variable: 0 = 12 years or less (no college), 1 = greater than 12 years (attended some college). We chose to categorize a binary dummy variable rather than use a continuous variable because attending college is a large and socially meaningful distinction on Andros, whereas each year of school is not, largely because schools on the island have different curricula and progress at different rates. We also collected demographic information about age, gender, residency, and tourism related income.

We conducted statistical analysis using IBM SPSS Statistics 19.0. We used multiple logistic regression to evaluate whether perception of environmental impacts of tourism (how serious are the environment impacts caused by tourism on conch), perception of quality-of-life impacts of tourism (tourism development has helped enhance my family's quality of life), economic dependence on tourism (do you sell natural products like seafood, sponges, straw products or wood carvings to tourists), and formal education

**Table 2**  
Interview questions used in regression analysis with response format.

Question	Response format
1. How serious are the environmental impacts caused by tourism on conch?	1 = no impact, 2 = not serious, 3 = moderate, 4 = serious, and 5 = very serious
2. Tourism development has helped enhance my family's quality of life.	1 = disagree, 2 = neutral, 3 = agree
3. Do you sell natural products like seafood, sponges, straw and wood products to tourists?	0 = no, 1 = yes
4. How many years have you gone to school?	Coded 0 = 12 years or less, 1 = greater than 12 years
5. Do you think these resources will need additional protection from over-harvest if tourism grows on Andros?	0 = no, 1 = yes

experience (attended some college) were associated with support of additional fisheries resource protection if tourism grew on Andros.

#### 4. Results

Our respondents were 57% male with a mean age of 40.5 years (ranging from 14 to 72). Approximately three quarters of respondents (77%) had previously lived somewhere other than Andros Island at some point in their lives. The mean number of years lived on Andros was 27.6, and the maximum was 66 years. Over half of respondents (59%) had completed secondary school, and 41% had attended some college. Approximately one quarter of respondents (23%) ran a tourism business, and almost half (46%) worked in a tourism business. Approximately three quarters (73%) considered tourism a moderate or primary source of income. A little more than half of the respondents (59%) expressed support for additional protection of fisheries resources if tourism grows on Andros. By far, the most common reason given for the need of additional protection was fisheries overharvest due to seafood demand (71%; of this, 48% specifically mentioned queen conch, 28% mentioned spiny lobster, 12% mentioned Nassau grouper, and 12% mentioned crabs); other reasons given included protection for sponges (11%) and coral reefs (9%), and the need for more enforcement of regulations (14%). A minority (21%) believed that tourism had serious or very serious impacts on queen conch fisheries. Most (79%) agreed that tourism development had helped enhance their family's quality of life. Almost half of respondents (48%) reported selling natural products to tourists. The most common resource sold by respondents was seafood (55%), followed by straw products (30%), wood carvings (20%), sponges (15%), and shells (13%).

Our multiple logistic regression revealed support for three of the four hypotheses posited in our study (Table 3).

Specifically, respondents who believed tourism had negative impacts on queen conch, believed tourism had neutral to positive benefits on their family's quality of life, or had at least some college education were more likely to support additional fisheries protection if tourism grew. In contrast, whether individuals sold natural products to tourists had no significant effect on their stated support for additional protection. Respondents who perceived moderate to very serious impacts of tourism on queen conch were almost twice as likely to express support for additional fisheries protection in the face of tourism expansion (80–100%) compared to respondents who perceived little to no such impact (52%) (Fig. 2a). Respondents who perceived neutral to positive effects of tourism on their family's quality of life were nearly twice as likely to support additional

fisheries protection if tourism grew (65%) than those who felt that their family's quality of life did not benefit from tourism (33%) (Fig. 2b). Respondents who attended some college were more than one-third more likely to support additional fisheries protection (69%) than respondents that had not attended any college (51%) (Fig. 2d).

#### 5. Discussion

This study provides one of the first assessments of tourism-related factors driving public support for marine resource protection in The Bahamas. The positive relationship between perceived threats to conch populations and support for protection may reflect an intuitive reaction to perceived environmental threats rather than an attempt to prevent ecological decline. Our results support other studies revealing that perceived or experienced environmental threats contribute to pro-environmental attitudes or practices (Baldassare and Katz, 1992; Chen et al., 2013). Previous work on family islands in The Bahamas show that poor environmental conditions positively influence support for marine resource protection, although environmental problems are more likely to be attributed to pollution or natural events rather than overfishing or other extractive activities (Broad and Sanchirico, 2008). This could reflect a lack of local understanding that overharvesting is a problem. Direct experience of negative aspects of an environmental threat help individuals recognize value in protecting environmental resources (Whitmarsh, 2008). However, more than recognition is needed to promote changes in behavior. That residents would support additional protection of conch if they felt this industry was threatened suggests an urgent need to facilitate the connection between personal experience of decreased numbers and smaller size of conch with the reality of overharvesting regardless of whether it is for personal use, income, or tourism.

Although most respondents (79%) believed that tourism enhanced their family's quality of life, those who perceived no such positive benefits of tourism (14%) were much less likely to support additional fisheries resource protection. This suggests that the majority of respondents perceive tourism as beneficial, and fisheries protection measures as a means of rendering tourism more sustainable, while a minority perceived no benefits of tourism and consequently sees little need to support protection of fisheries resources to sustain an industry that does not personally benefit them. Other studies have found that residents living adjacent to protected areas who perceive benefits associated with tourism, also tend to support protection of the area (Lindberg et al., 1996; Mehta and Heinen, 2001; Liu et al., 2010). Thus, perception of benefits of tourism, usually in the form of economic benefits, can positively affect attitudes toward conservation. However, support for protected areas also depends on the distribution of tourism benefits and the distribution of the costs of natural resource protection within a community (Dixon et al., 1993). On several Bahamian islands, communities more reliant on tourism are more likely to support protection, whereas communities more reliant on fishing are less likely to support protective measures (Broad and Sanchirico, 2008). Although our study does not address occupation in relation to tourism benefits, a study in Indonesia indicates that unequal distribution of tourism benefits, where farmers and fishers were excluded, may contribute to more negative perceptions of tourism (Walpole and Goodwin, 2001). Future research could assess the distribution of tourism benefits on Andros Island to identify whether fishers and service industry employees have a similar experience and whether that influences support for fisheries protection.

Surprisingly, having an income partially dependent on selling natural products to tourists did not significantly predict support for

**Table 3**  
Results of multiple logistic regression model examining support for additional fisheries protection on Andros Island, The Bahamas.

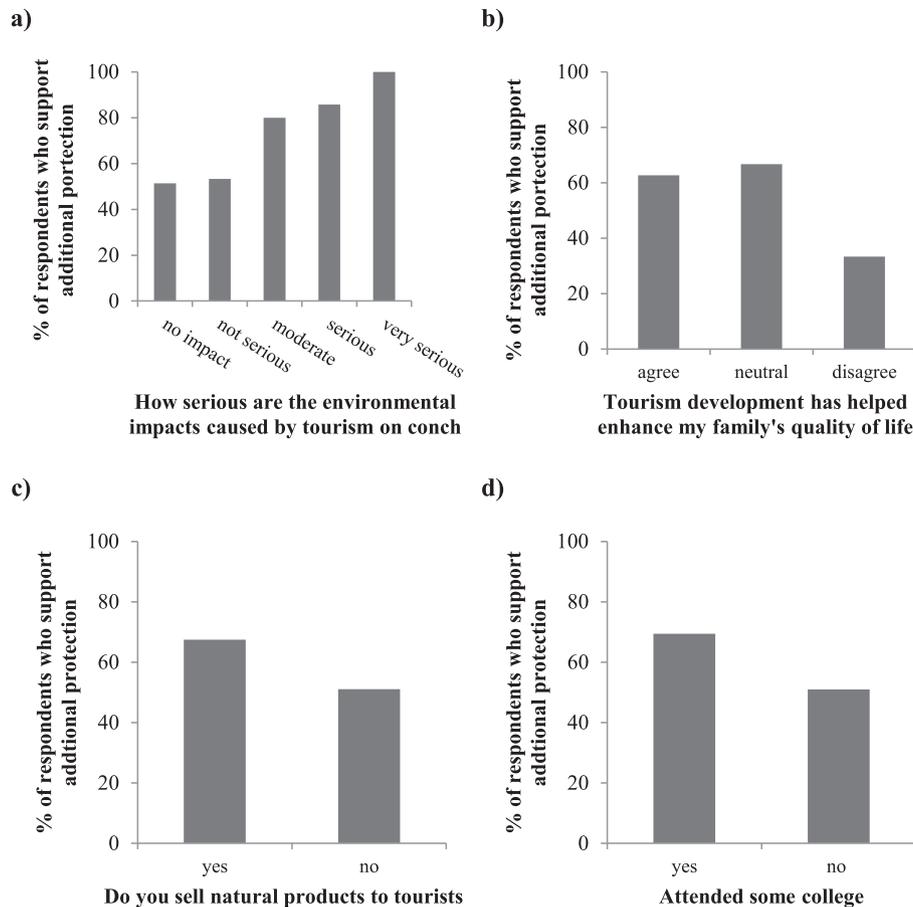
Parameter	$\beta$	Standard error	<i>P</i>	Nagelkerke R <sup>2</sup>
Impact of tourism on conch <sup>a</sup>	0.643	0.305	0.035	0.23
Impact of tourism on quality of life <sup>b</sup>	0.984	0.398	0.013	
Sell natural products <sup>c</sup>	0.487	0.485	0.316	
College education <sup>d</sup>	1.221	0.566	0.03	

<sup>a</sup> Perceived impact of tourism on conch was measured on a 5-point Likert scale where 1 = no impact, 2 = not serious, 3 = moderate, 4 = serious, 5 = very serious.

<sup>b</sup> Perceived benefit of tourism on family's quality of life was measured using an ordinal scale where 1 = disagree, 2 = neutral, 3 = agree.

<sup>c</sup> Selling natural products (seafood, sponges, straw products, wood carvings) was measured as 0 = no, 1 = yes.

<sup>d</sup> Education was measured as 0 = 12 years or less (no college), 1 = greater than 12 years (attended some college).



**Fig. 2.** Percent of respondents who support additional fisheries protection based on a) perceived impacts of tourism on conch, b) perceptions of tourism impacts on family quality of life, c) reliance on selling natural products, and d) education level.

additional resource protection. This could reflect a desire to avoid restrictions on resources that residents rely on for income even though harvesting resources for sale to tourists may contribute to more rapid population declines and negative long-term impacts. Selling natural products to tourists may reflect pride in traditional practices or natural heritage but can also represent a poverty trap (Delacote, 2009) where low-skilled workers earn a minimum income based on extractive activities despite availability of other income-generating opportunities. This result is similar to what Walpole and Goodwin (2001) found with residents near Komodo National Park, suggesting a need to further understand and incorporate local economic factors when implementing new protection strategies.

Our results support the large body of research that unequivocally demonstrates a positive relationship between education and support for conservation (Jacobson, 1995; Kellert, 1996; Mehta and Heinen, 2001), suggesting education should be a priority in any area experiencing environmental threats. Management efforts that include conservation education programs for local schools and adult groups can promote positive attitudes towards natural resource protection (Infield and Namara, 2001) and positive attitudes towards conservation tend to increase with increasing years of school (Infield, 1988). Government workers with higher education levels tend to perceive benefits associated with marine protected areas more than fishers (McClanahan et al., 2005). Education campaigns focusing on local ecological and conservation issues and targeting residents less likely to pursue higher levels of education

can positively impact support for marine resource protection. In addition to adult education programs, comprehensive environmental education in primary schools, college opportunities for younger residents (e.g., an agricultural college on the island) can all provide ways to extend learning as well as empower residents to participate in shaping their future (Stevenson et al., 2012).

## 6. Conclusion

Fisheries protection measures are only effective if they are successfully implemented, which requires support from local communities who are most affected. If tourism increases on Andros Island, protective measures that are already direly needed will only become progressively more important. Sustainable tourism practices can provide an opportunity for additional sources of income that move residents away from the poverty trap as well as offer additional incentive to harvest sustainably. Acquiring local support for acceptance as well as implementation of protective measures can eliminate the “paper park” phenomenon where protective measures exist but are ignored. Developing island nations in the Caribbean are challenged to balance ecological and economic sustainability. Our study indicates that perceptions about tourism impacting the environment and quality of life are potential drivers of support, and highlights the potential value of educational outreach efforts to raise awareness of the causes and consequences of overharvesting. Sustainable tourism development on Andros Island has the potential to promote economic stability for residents

and conservation of fisheries resources.

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