Marine Turtle Conservation on Holbox Island, Quintana Roo, Mexico: The Fishermen's Perceptions

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ABSTRACT. – Interview data were collected from fishermen on Holbox Island, Quintana Roo, Mexico, regarding compliance with the ban on marine turtle harvesting, knowledge and perceptions of marine turtles, conservation policy, and management actions. Findings indicate that fishermen are knowledgeable about turtles and aware of the ban on harvesting, yet interpret it liberally. Annual capture by fishermen was estimated at 215 turtles. The study revealed a social norm that considers limited harvesting for personal consumption acceptable and commercial use unacceptable. This norm exists in spite of the fact that fishermen are supportive of conservation and environmental education efforts and demonstrate behavior that helps to achieve those ends. Fishermen's perceptions of local management presence, and a lack of international enforcement for bans on marine turtle harvesting. Researcher observation and follow-up interviews revealed a major threat from unplanned development near nesting beaches. Recommendations are made for activities and management actions that may improve compliance and local support.

KEY WORDS. – Reptilia; Testudines; Cheloniidae; sea turtle, conservation; fishermen; perceptions; norms; compliance; pile sort; Mexico

In the Yumbalam Flora and Fauna Refuge on Holbox Island, Quintana Roo, Mexico, the Mexican non-profit organization Pronatura Peninsula de Yucatan (PPY), the Secretariat of Environment and Natural Resources (SEMARNAT), and the Federal Environmental Protection Agency (PROFEPA) are working together to protect the loggerhead (Caretta caretta), hawksbill (Eretmochelys imbricata), and green turtles (Chelonia mydas). To this end, fishing and marine turtle protection must now coexist in an area where turtles have historically been routinely harvested. Essential to this effort is understanding the level of compliance with the current ban on turtle harvesting, and fishermen's perceptions about marine turtles and the current and potential management actions utilized to protect them. An interview study done to collect this information was conducted from September to December 2000.

METHODS

The study site, Holbox Island, is located on the northeast coast of Mexico's Yucatan Peninsula. It is approximately 40 km long, from 1 to 5 km wide and is largely undeveloped. Its human population of 1500 is concentrated on the northwestern section of the island extending 6 km to the northeast. Holbox maintains its rural character and its residents make a living from fishing, local commerce and, increasingly, tourism.

A stratified sample of 94 fishermen were interviewed during two phases of interviewing. This sample represented 30% of the members from each of the three local fishing cooperatives. Eight interviews were conducted with local authorities, PPY volunteers, and employees in the marine turtle conservation program as a source of secondary data and validity check.

A photo-ordering/pile-sort methodology (Bernard, 1995) was used during phase I to develop rapport with fishermen, and to elicit the vocabulary, salient concerns, and concepts needed to refine the interviews used in phase II. During a simultaneous display of 19 photos related to marine turtles, subjects were asked if any particular photo commanded their attention. They were then asked to explain why they chose that photo. After having reacted to these general questions about the photos, subjects were asked to sort photos into piles in a way that made sense to them. They were then asked to explain why they did. Finally, fishermen were asked to rank only the photos pertaining to turtles in a way that indicated the most acceptable photo to the least, and to explain why they chose this order.

In phase II, semi-structured interviews were conducted with 47 subjects (15% of the total fishing cooperative membership). Respondents were selected at random from membership lists. Interview questions dealt with knowledge about marine turtles, perceptions of conservation policies, regulations, compliance levels, community participation, and current and proposed management actions.

Pile sorts were analyzed using ANTHROPAC software (Analytic Technologies, Version 4.92, 1996), similarity matrices, and an SPSS (Norusis, 1999) cluster analysis. SPSS was also used to generate descriptive statistics from both phases of interview data. A mode analysis was utilized to develop the harvest and compliance estimates. Ten years of PPY turtle population data and interviews with SEMARNAT, PROFEPA, and local authorities were analyzed to complement findings.

RESULTS AND DISCUSSION

Thirty-two photo display/pile sort interviews and 47 traditional interviews yielded valid information. Fifteen other photo based/pile sort interviews were not used because of difficulties the subjects faced in understanding the intent of the activity.

Communicating with Fishermen. — Certain terms emerged as marine turtles were discussed and fishermen's vernacular usage was analyzed. While sorting photographs, two fishermen used the term "*conservar*" (= to conserve) in the context of contrasting it to exploitation. One example: "*This is conservation, research. In this case, what I see in these photos is teaching...in this case, kids.*" And in contrast: "*This is exploitation, the complete opposite.*"

The most frequently used term was "*cuidar*," (= to take care of), a word often used to refer to the care of crops, tending to animals or children, and one's self. Researchers used this, and other culturally appropriate vocabulary revealed in phase I, in subsequent interviews. The term "*cuidar*" can often include a sense of personal investment in the future of a place or object. It approaches the notion of sustainability or protection and goes beyond the way "conservation" is used in Western societies. Such results reveal the importance of understanding local vernacular usage in order to develop the proper terminology for use in research. An example of a quote from a fisherman:

My buddies haul them in. But when they haul them in, and they do, I throw them back. And I try to tell them not to do it and I tell them, "As long as this is my boat, I'm going to take care of them." And I try to make them aware.

Knowledge of and Compliance with Turtle Harvesting Bans. — Of the 94 fishermen interviewed in both phases, all but one was aware that marine turtle fishing was permanently prohibited. The ban was so much a part of their daily life that most fishermen did not remember how long it had been in effect. The following statements illustrate that, although it did have some impact when implemented, fishermen seem to have adjusted to the ban and, in hindsight, appreciate it.

Well there were some unhappy people but we did see that the species was getting finished off. I mean there had been a lot of turtles, a lot, and yes they were getting finished off, so yes, they were angry but not now. Now they are aware.

So it did have an effect. At least a lot of people felt that way and I did too. But I got to thinking that if we finish off the species and the government hadn't taken that measure and banned it there wouldn't even be turtle to eat. I mean at least now we eat them, secretly. We give ourselves the luxury, the pleasure of eating them, or eating the meat but if I take them all the time or if the government hadn't banned them, there wouldn't even be turtles to steal.

In phase I of this study, 63% of fishermen offered information about compliance with the ban on turtle capture. Of these, 89% either freely admitted to harvesting turtles, stated that turtles were harvested in the community, or both. One man stated:

I'm not going to lie to you. We even take one a year. One a year to eat, (respondent emphasizes) you understand. But not like those predators you see there (in the photo). Here on Holbox there isn't a person who doesn't eat turtles.

There was little difference among responses for both phases and interview methods (Table 1). There seemed to be widespread agreement about the fact that limited harvesting exists. Analysis of interview data, follow-up interviews with institutional sources, and researcher observations supported the view that the ban was not rigorously enforced and that most fishermen and local authorities deemed limited annual harvesting to be an acceptable norm. There was both ambivalence about compliance and the belief that current harvesting levels are minimal. A local SEMARNAT representative stated: "*Poaching, yes. It undeniably exists. It is minimal but it does exist.*" These comments were echoed by the local PROFEPA representative:

In the old days they had a tradition, before protection existed. They sold turtles and after SEMARNAT-PROFEPA were created, they began to understand what an endangered species is and they are concerned for that species. I mean they are more aware of what a turtle is. I'm not going to tell you that they don't take them or they don't eat them. They do eat them but less. In smaller quantities.

Table 1. Fishermen's reports on occurrence of turtle capture.

Responses to statements	Phase I $(n = 29)$	Phase II $(n = 36)$
1. I harvest marine turtles (statement 1 affirmed)	10%	8%
2. Marine turtles are harvested once a year in the community (statement 2 affirmed)	51%	50%
3. Marine turtles are harvested once a year and I harvest them (both statements 1 and 2 affirmed)	28%	33%
4. Marine turtles are commercially used	3%	3%
5. Marine turtles are not harvested	7%	3%
6. Other	1%	3%

Estimated Rates of Harvest. --- Fifty-two percent of all the fishermen interviewed who commented that turtles were harvested (54 of 94 subjects), reported that they harvested turtles. Though isolated reports expressed that some people exceed the one-per-year capture, conservative calculations can be based on one turtle a year being harvested per fisherman. There are a total of 314 fishing cooperative members on Holbox; taking 52% of them yields 163, so fishermen in cooperatives harvest about 95 turtles each year. There are also approximately 100 fishermen in the community who do not belong to the cooperatives. Assuming that independent fishermen behave in a similar way and applying the same formula to a ratio of these fishermen, it would be estimated that about another 52 turtles are taken per year, for a total harvest on Holbox of about 215 turtles per year.

Net Bycatch. — Though it was not determined what percentage of the turtles harvested were taken from net bycatch, the danger nets pose was widely commented upon in the first phase of interviews. Fifty-eight percent reported them to be a problem. In phase II, respondents were asked specifically about turtles being caught in nets. Sixty-eight percent of respondents answered that they had seen turtles caught in nets and that nets were very dangerous to turtles, particularly during nesting season. Researchers attempted to discern how frequently turtles were caught in nets and what was done with them. In phase II, fishermen were asked what they would do if they caught a turtle in their net and it was alive. Fifty-three percent said they would take a live turtle caught in the net and eat it. Forty-seven percent would let the turtle loose. All respondents who raised the possibility of finding a dead turtle in their net (20) said they would cut it open and sink it to the bottom. The most commonly stated reasons were to keep the turtle from making the beach ugly, to feed the fish, and return the turtle to the ocean. However, a few fishermen indicated their purpose in sinking the turtle was to protect themselves from the authorities and hide the turtle's death:

You let it go adrift. Why are you going to bring it to the beach? So they can tell you that you killed it? That is a problem that one can't...it already died in the net. What can you do?

In phase I of the study, fishermen were shown a photograph depicting a turtle stranded in a shark fishing net. This photo generated much comment, with 58% reporting that shark nets were banned and that they were extremely dangerous to turtles. They were not, however, shown photographs of other types of nets. Future research about the threats nets may pose to marine turtles must specifically focus on the type of nets being used, the season that they are used, and the number of fishermen using them in order to be included in any harvest estimate.

Reporting Illegal Harvest. — Fishermen don't openly invite a conversation with the authorities regarding turtle captures (i.e., turn in a tag). From their comments, however, it seems evident that they are not afraid of being caught when harvesting turtles. They are less afraid of other fishermen, who repeatedly stated that they would not turn in a person they saw harvesting turtles. On this small island, family conflicts are steeped in history, yet even those families who have feuded with each other for generations reported that they would not turn in an enemy for turtle harvesting.

Fishermen provided detailed testimonials as to why they did not report people they saw harvesting turtles. An evaluation of these testimonials led the researchers to believe that in addition to a sense of empathy with other fishermen and feelings of powerlessness to change things, islanders do not report on one another, even those who might be staunchly anti-harvesting:

So I see that guy take one and I'm not gonna say "Don't do it again because I'm gonna turn you in." Nobody does that. Besides the fact that you are gonna make an enemy, there is no authority to go report to.

And to be realistic, we know each other, people from Holbox. We're always going to protect ourselves, you understand? I'm not saying this as an authority. We are always going to protect ourselves. And sometimes we'll even do things we ought not do to protect—against the law even. Understand?

These opinions were supported by local authorities who were also natives of the island, one of whom stated that this "island effect" made it important to have managers who are outsiders in the community. Management presence with an outsider's involvement might encourage fishermen to report illegal behavior.

Commercial Harvest. - Though interviewees reported that a limited harvest for consumption occurs and is acceptable within the community, they did not consider commercial harvesting acceptable. The aversion to commercial harvesting was illustrated by the results of the photo ordering technique, where five out of the six most unacceptable photos represented commercial harvesting of marine turtles. Likewise, all of the photos considered to be acceptable by fishermen either depicted turtles roaming free, conservation efforts, or environmental education. These results were reiterated through the pile sorts, which yielded three distinct groups which researchers labeled as: "turtle predation" (included photos depicting commercial use), "free turtles," and "environmental education/conservation." Table 2 provides examples of what fishermen typically said about the piles as they sorted.

The pile sorting exercise clearly revealed the dichotomy between commercial turtle harvesting and limited personal consumption; the latter being far more acceptable. Phase II respondents supported this dichotomy with multiple observations like the following: "*The worst would be to sell it. The best is to conserve it, to have turtle conservation.*"

Traditional Ties to Turtles. — The knowledge fishermen had of turtles was extensive and included legends of

Table 2. Illus	trative comments gleane	d from two fishermen	in the pile sort.
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Photo Topic	Comments
Turtle Predation	Here they are exploiting everything. People aren't taking care of the species. Here they are collecting to exploit.
Free Turtles	This is how we should leave nature. Let it work on its own. What is in the ocean and on land is free. Nobody should bother it. They have to be in their natural habitat. They are free and this is understood. Nobody's going to bother them.
Environmental Education and Conservation	These are the people who are taking care of them. This is what we should do with turtles. Teach children, take pictures. Conserve the eggs so that they hatch out and teach children how to free them. How to free the hatchlings and watch how they go to the ocean and so they can see the work it takes for them to get to the shoreline.

their scientific observations. The traditional positive association between Holbox fishermen and marine turtles was very evident. The majority of the motives (75%) for harvesting turtles were tied to family or local traditions and, one might say, sense of place (Williams and Stewart, 1998). There were numerous references to having grown up watching, appreciating, and eating turtles. Quotes from a former PPY volunteer and a fisherman illustrate how strong this tie is and why it might be difficult to change.

Since we were little kids, we've had the importance of eating turtles impressed upon us. It's as if they taught you, as a child, to believe in the Virgin Mary, the Virgin of Guadeloupe, and then from one day to the next they tell you not to believe in her.

For example, some people kill one during the season. Here it isn't for sale. Here it is a deep desire. Since we were kids they have given us eggs and meat and you eat it once a year and that is it. But not everybody. The pressure would be too much.

Other comments described a degree of admiration for the turtle because turtles are "prehistoric" and need long periods of time to reach sexual maturity. Yet conversations with community members revealed that they were proud to make jewelry from turtle shells and just as proud that they would not sell this jewelry but give it to "special people" in their lives. Admiration and respect for turtles seemed to lead not to total preservation, but to limited harvest. It is common to see community members wearing turtle shell products and using them, either for decoration or for other purposes.

Environmental Education. — Without being asked directly, 26% of fishermen suggested that environmental education was an important part of community involvement in marine turtle conservation. Environmental education photos were most frequently chosen as acceptable in phase I. The following comment represents one fishermen's reaction to Fig. 1.

Because it teaches children to not do what a lot of people do. To not destroy them and since it is an animal that is in danger of extinction, it is prehistoric, it is one of the prehistoric ones that still exist in this earth, it is good to observe them. From childhood on they should learn that we've got to take care of turtles.

Local authorities shared the opinion that environmental education was important. Both fishermen and authorities sometimes reported that this was the only hope for the future of marine turtles. One fisherman put it this way:

There is no hope for fishermen. You have to get to them through children and adolescents who become aware through environmental education.

Fishermen concurred that educating children was the preferred course of action for long-term conservation. However, a few of them also offered comments on how they themselves were helping marine turtles. Seventeen respondents elaborated on their efforts to help turtles, by not capturing them, freeing them when they were entangled, and transporting biologists.



Figure 1. An example of community involvement in environmental education.

Perceptions of Management Actions. — Fishermen were critical of the way marine turtles were being managed. One commonly held concern was about the indirect mortality of marine turtles from predation of hatchlings. Particular reference was made to raccoons (*Procyon lotor*) and the Magnificent Frigate Bird (*Fregatamagnificens*), locally known as "*chimay*" or "*rabiahorcada*." Fishermen witnessed raccoons eating eggs on the beach and floating hatchlings being eaten by frigates. They described these hatchlings as defenseless, and a common suggestion was to provide them a "headstart" by raising them in captivity for anywhere from three days to three months. This, some fishermen assured, would enable them to develop their lung capacity and dive down under the water, thus avoiding frigate birds. Some suggested it would also be a tourist attraction:

It is a tourist attraction and it helps the ecology, killing two birds with one stone. For tourism, you know if there is a place, a corral where the turtles are, all of the tourists are going to go see it and with the little that you charge them, ten, five pesos each, you make the money to manage it.

While headstarting is a conservation mechanism supported by some fishermen it may also be seen as releasing them from some stewardship responsibility (Taubes, 1992; Heppell et al., 1996) and justifying an easing of harvest restrictions.

Responses indicated that fishermen themselves are divided about the degree to which managers should interfere with natural predation, as illustrated through the following quotes:

But then why not take them and put them in a corral and later in the open ocean? A place where less birds will eat them. Because it is harder for birds to reach the open ocean, particularly the ones that eat them—seagulls, frigates, those are the ones who most eat hatchlings.

But it is part of the ecosystem, you see. It is one chain and you shouldn't hinder the chain. You're not going to kill all of the raccoons to save the turtles, it is something natural.

Another management issue raised by fishermen had to do with the lack of managerial presence to monitor and enforce regulations. Early in the season, the appearance of the first turtles stimulates the desire for limited harvest but agency or NGO personnel have not yet established their presence in the community:

The biologists arrive late in the season. They come...at the end of April turtles come up, in May they are harvested by the bunch and the biologists come late in the season. They come in the middle of May and when they come people have already put in their orders. And when they know the biologists are coming nobody goes to the beach. And they say to them when they come, "Why are you here? People are tired of eating hawksbills." And that is why the government needs to take more interest and put money into it.

Fishermen extended their observations about the lack of enforcement and management presence beyond Holbox. Thirty-eight respondents from both phase I and phase II commented about harvesting in other places in Mexico and abroad. Fifty percent referred to either Isla Mujeres, Cancun, or Cozumel. Others mentioned Oaxaca, Baja California, and Campeche (21%). Neighboring Belize received much criticism for continuing to harvest turtles, with 21% citing it as a problem. Another 8% alluded to lack of management in countries like China and Japan. One fisherman explained his disappointment with neighbors as follows:

It doesn't seem fair that in Mexico we are taking care of the turtles. We are taking care of the turtles that arrive here and come up on the beaches. I think that turtle goes pretty far from here and crosses the line from one country to another... it doesn't seem fair that in Belize they exploit the turtle a lot and we take care of it...there is no law that allows us to capture at least a few...How much money does the Mexican government spend on turtles...and later that turtle just goes somewhere else and that's it (for the turtle).

It is important to recognize that fishermen are expressing a valid concern and it is encouraging that they hold this broader view of marine turtle conservation. It is also important to make fishermen aware of the legislation and conservation efforts that do exist elsewhere in order to counter the attitude that "Others do it, why shouldn't 1?"

Another problem identified by fishermen was a lack of communication between fishermen and biologists. Results suggest some degree of resentment of the biologists and their work. At the same time, it was apparent that those people who had become personal friends of biologists knew more about marine turtle conservation programs and participated in them more than those who had no personal connection with biologists. Fishermen may be motivated to comply with regulations out of respect for them rather than from a fear of sanctions:

People watch themselves a lot with the biologists, but there isn't that fear. They watch themselves, mostly out of respect because they know that they (the biologists) don't have the authority to detain them. They do have the authority to report them but they are an NGO.

This study identified several opportunities that could be useful in increasing local involvement with turtle management. Fishermen reported finding turtles in nets, both dead and alive. Fishermen could be encouraged and then rewarded for reporting incidental bycatch and tag information since such sightings provide important population and dispersal data. Experience suggests that over time and with continued outreach, these fishermen could become part of a much improved and ongoing monitoring effort (M. James, J.W. Nichols, *pers.comm.*).

Beach Development. --- While the interview activities or questions did not directly address the connection between coastal development and marine turtles, it became apparent to researchers that the community was divided over development. In fact, the outcome of development efforts on Isla Holbox may well decide the future of marine turtle nesting beaches and, as such, the island's marine turtles. The half of the community that belongs to the Ejido (a communal land unit) has favored selling off the properties adjacent to the shoreline, both to the northeast and northwest of the town. Because these lands are "Ejidal," they have this right. The other half of the community has been trying to stop it. Their argument is that the Ejido is selling off lands for short-term gain and is not taking into consideration the long-term effect that this will have on the community. They fear that they will lose control over the future development of the Island and their cultural identity. Without a locally developed vision and a development review process that implements that vision legally, development can easily take over (Wallace et al., unpubl. data). Neighboring examples such as Cancun and, to a lesser extent, Isla Mujeres, have proven just that. No interview questions addressed development and only one fisherman commented on development, however, he stated that it was the biggest threat to marine turtles on the Island. Follow-up interviews with Protegemos Unidos a Holbox, A.C. (PUHAC), the local NGO, reiterated the concern for unchecked development.

At the time of data collection, PUHAC was making an effort to explore possible legal controls by way of a federal overlay category that would protect turtle nesting beaches. Scientists have demonstrated that Isla Holbox provides the most important nesting beach for the hawksbill turtle in the state of Quintana Roo (Garduño-Andrade et al., 1999). Unchecked development could decimate critical habitat of this critically endangered species.

Conclusions and Recommendations. - Fishermen have extensive knowledge about marine turtles and are aware of the ban on harvesting. While they are generally supportive of efforts to conserve and manage turtles, the norm is to continue a limited harvest for non-commercial or household use. Turtles are harvested and eaten once a year by many people and no one is reported or penalized, indicating that the norm is widely held. Given that poor enforcement and management presence nourish this behavior, the level of restraint reported might be surprising. It seems tempered by a genuine desire to maintain turtle populations. Fishermen reject the commercial use of turtles and have a traditional tie to the turtle that may suggest that it contributes in some way to their sense of place and the continuity in their lives. They have articulated their respect and admiration for the turtle in a variety of ways. They have demonstrated that they will assist with management efforts and approve of environmental education about marine turtle conservation. All of these factors contribute to the development of a social norm that approves of only a limited harvest.

Study results can be seen as optimistic and reveal a number of things that might be done to garner increased support and respect from fishermen for conservation actions. Management presence must increase—especially at critical times. Communication between managers and fishermen must improve around a variety of issues. Managers have the opportunity to close information gaps and dispel misperceptions about headstarting, predation, and management efforts elsewhere in Mexico and in other countries. Such information may increase the degree of local responsibility felt for the recovery of marine turtles. Environmental education efforts must continue with both children and parents. Incentives can be developed for fishermen who agree to assist with the monitoring of turtles caught in nets.

The profound threat represented by potential beach development suggests that SEMARNAT, PROFEPA, and PPY should assist community planning efforts in any way possible. This might include providing information exchanges and support to help the community develop and articulate desired future conditions and to strengthen the community structures and processes needed to carefully review proposed projects.

In order to conserve marine turtles, the threats they face in all stages of their lives must be addressed. Research related to community perceptions can help managers better understand the range and complexity of that task while helping win the support of local populations for needed management actions.

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