

Institutional Analysis of the Artisanal Green Turtle Fishery in Eastern (Caribbean) Nicaragua

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1 Part I: System Structure - Collective action

The artisanal green turtle fishery is operated by the indigenous Miskito along Nicaragua's eastern (Caribbean) coast between the city of Bluefields in the south and Puerto Cabezas in the north. The original case study focused on the village of Tasbapauni which is located approximately 40 miles north of the capital Bluefields on a narrow beach separating Pearl Lagoon from the ocean. The initial report covers a time period from approximately 1968 to 1969, as well as part of 1971, and catalogues an action situation involving 106 turtle fishermen, of which 80 turtled exclusively. Lack of employment opportunities and high endogenous and exogenous (international) demand for green turtles facilitated overexploitation of the species. The resource system (natural infrastructure) is the tropical coastal marine ecosystem, including seagrass beds, shoals, turtle banks (shared), and endangered green turtles (common pool).

This case study is part of the original Common-Pool Resource (CPR) database. A summary of the original CPR coding conducted in the 1980s by Edella Schlager and Shui Yan Tang at Indiana University may be found [here](#).

An update conducted in 2015 examines a time period from 1991 to 2011, and an action situation in which an unknown number of Miskito turtle fishers from several communities along the Nicaraguan Atlantic coast operate a quasi-legal commercial fishery under a domestic subsistence use exception to green turtle protections. Rules limiting green turtle harvesting exist at various government levels but are unenforced. Lack of alternative employment opportunities, as well as endogenous and exogenous (domestic) demand for green turtles, continue to facilitate overexploitation of this endangered species.

1.1 The Commons Dilemma

- **The potential over-appropriation/poor coordination of appropriation problem:** The Miskitos traditional green turtle harvesting patterns, which were guided by social norms and seasonal availability, were disrupted by access to international market demand. This led to year-round harvesting of green turtles for cash profits inducing more intensive exploitation of the species for sale outside village kinship networks leading to conflicts with stipulated social behavior, reduced meat availability in Tasbapauni, and significant declines in turtle abundance. The introduction of turtle nets facilitated further over-appropriation of turtles by less-skilled fishers.

- **The potential under-provisioning of public infrastructure:** At the time of the original case study, the Miskito coast was in a 20-year economic bust period which led to the removal of the exogenous input of jobs, currency, and inexpensive goods from the communities. The resulting economic deprivation coupled with an under-provisioning of rules to limit turtle harvesting activities and a lack of monitoring of resource extraction was further fostering green turtle overexploitation.

1.2 Biophysical Context (IAD)

- **Natural infrastructure:** The eastern Nicaraguan coastal marine area hosts the largest seagrass pastures (turtle banks) of the Western hemisphere. 50+ shoal (turtle sleeping) areas and 20 corresponding banks (turtle feeding areas), as well as mud-bottom zones and cays, are scattered across approximately 600 square miles of ocean providing a conducive habitat for the fishery's target species. Green turtles are large, long-lived, migratory marine reptiles which display predictable changes in their spatial and temporal occurrence and distribution according to environmental conditions, as well as daily, seasonal and annual biological cycles. Turtles are more abundant and more easily caught during the dry seasons (February through May, and again in September) with the number of mature turtles decreasing steadily from April through June when they migrate south to their natal nesting site in Tortuguero, Costa Rica. At the time of the study, turtle harvesting was limited by adverse weather conditions (particularly from June to early August), littoral currents, the lunar cycle, and trade winds. Green turtle abundance in the fishery was declining due to endogenous and exogenous overexploitation.

- **Hard human-made infrastructure:** *Public hard human-made infrastructure:* At the time of the original case study, the village of Tasbapauni was one of the largest Miskito settlements along Nicaragua's Caribbean coast. The village and coastal area was culturally and geographically isolated from the rest of Nicaragua with extremely limited road development. Local transportation was primarily by dugout canoe (dori) or via passenger-freight boats commuting along the coast between the major port and market cities, Bluefields in the south and Puerto Cabezas in the north.

Private hard human-made infrastructure included harpoons, recently introduced nylon turtle nets, and wooden turtle-striking dories which were 18-21 feet in length and had a 3-foot beam. Since most dories were propelled by sail and steered with paddles, no rudder was fitted. The use of outboard motors is not mentioned in the text. Dories are operated by teams of two fishers (captain/sternman and turtle strikerman or netsetter).

1.3 Attributes of the Community (IAD)

- **Social Infrastructure** The Miskito engaged in a traditional subsistence economy that was a continuation of pre-contact reciprocal exchange patterns and kinship obligations involving goods, favors, and generosity that created a continuous circulation of labor, food, and materials within the village. The most common way to fulfill social obligations was through the gift of highly esteemed meat, most commonly from green turtles. After social obligations were met, fishermen could sell any meat surplus to other community members. These social patterns began to change with the Miskitos' incorporation into the global market economy via foreign turtle processing plants

leading to an over-reliance on endangered green turtles for individual economic (cash) benefit. This resulted in conflicts between stipulated social and contradictory market behavior within Tasbapauni. In order to avoid conflict and continue to receive cash benefits, many Miskito began selling turtles directly to the factories instead of sharing them with the village. This reduced the meat availability in Tasbapauni fostering food insecurity and social inequality.

- **Human Infrastructure** The Miskito have historically adapted to exploit green turtle behavioral patterns by targeting the animals when they commute between their sleeping and feeding grounds early in the morning and late in the afternoon. Turtle striking dories consist of a team of two fishermen, the captain and the striker or netsetter, who must cooperate closely and who form partnerships based on their individual skills, reliability and temperament. Turtles were harvested by harpoon strike when they surfaced to breath or, more recently, by setting nets over the sleeping shoals to entangle sleeping or commuting turtles. Human infrastructure in Tasbapauni was generally high due to the Miskito turtle fishers exceptional skill and proficiency at locating and capturing turtles at sea. This knowledge was the outcome of a cultural relationship and local knowledge of the marine environment passed down through generations, as well as a personal relationship resulting from years of an individuals experience at turtling. Harpooning required greater skill level than net-setting. The increase in turtle netting may signal a decrease in Miskito turtle harvesting knowledge, since it may facilitate the entry of less experienced fishermen into the fishery (inferred). The Miskitos understanding of rules regulating the exploitation of green turtles and other commercially valuable species is likely constrained by (1) a lack of a collective action forum; and (2) traditional social considerations that are rooted in the belief that everyone has a right to food which may hinder rule development to limit meat-getting activities (inferred).

1.4 Rules in Use (IAD)

It is inferred that the rules in use, i.e., soft human-made infrastructure, are provided by the Miskito turtle fishermen, even though there is no indication of self-regulation per se. Based on Nietschmanns case study (1972, 1973), the following specific rules are relevant:

- **Position Rules:**
 - Any male Miskito capable of engaging in turtle harvesting activity.
 - Captain (sternman).
 - Turtle striker (harpoon or line).
 - Netsetter.
- **Boundary Rules:** The Nicaraguan turtle fishery is generally open access, except for the following limiting conditions:
 - Two turtle fishermen required per boat to hunt turtles (sternman and turtle striker or netsetter).
 - Turtle fishermen must be knowledgeable of fishing grounds (location of turtle feeding grounds and sleeping shoals) and turtle harvesting techniques (more so for harpooning than netsetting).

- **Choice Rules:**

- Tasbapauni community members may hunt, fish for turtle, or do both.
- Turtle fishermen may harvest turtles with a net or harpoon.
- Turtle fishermen may harvest turtles of any size or age group at any time.
- Turtle fishermen may sell turtles to turtle factories for profit.
- Turtle fishermen must fulfill kinship obligations with gifts of turtle meat and may sell surplus to community members.
- Captain (sternman) and turtle strikerman must cooperate with each other.
- Turtle fishermen must not harvest turtles from May 15 to July 15 (central government-imposed moratorium).

- **Aggregation Rules:**

No evidence of aggregation rules in texts.

- **Scope rules:** Offering of cash benefits for turtles by turtle factories motivated year-round fishing of green turtles by turtle fishermen and may have influenced the transition of harvesting methods from harpoons to nets (inferred) with both factors contributing to a reduction in green turtle abundance and concomitant increase in distances traveled and time spent at sea.

- **Information Rules:** No evidence of information rules in the original text.

- **Payoff Rules:**

- Food for community or cash for nuclear family.
- Meat is distributed equally (50/50) among the captain and strikerman.
- In the case of loaned dories, the owner of the dori is given either a front or hind quarter of meat from each turtle taken and 3 cordobas from the sale of the calipee.
- In the case of loaned nets, the owner is given either a front or hind quarter of meat from each turtle taken, unless other arrangements have been made.

1.5 Summary

Throughout the Miskitos long history of economic contact with foreigners, their generalized reciprocal subsistence system operated in conjunction with an economic exchange of subsistence foods and labor which served to equitably distribute food among the community. In the early 1970s, this appeared to be changing with both economies operating in direct contradiction to each other and posing new social and economic problems in the village. A combination of (1) social factors (population growth and reduction in outside labor opportunities); and (2) green turtle population declines due to local overexploitation and a commercial fishery operating at the turtles nesting beach in Tortuguero, Costa Rica, was overloading the subsistence systems capacity to regulate human behavior and curb overexploitation. Younger Miskito were increasingly simplifying the variety of their subsistence activities in favor of targeting green turtles. In 1973, this was leading to a weakening of the traditional reciprocal exchange system and social atomization. Miskito norms also appeared to be ill-adapted to dealing with exogenous economic challenges contributing to further social and ecological destabilization.

2 Part II. Dynamic Analysis - Robustness

2.1 Update on the Commons Dilemma

This update to the Nicaraguan green turtle fishery extrapolates on Nietschmanns original ethnographic analysis by drawing on research published in 2010 and 2014 which examined the current condition of the fishery in both the southern and the northern autonomous regions (RAAS and RAAN). The original case study inferred that a variety of factors were contributing to increased reliance and incipient over-appropriation of endangered green turtles. Based on the case update in 2015 (Garland and Carthy 2010; Lagueux, et al. 2014), this inference was correct. Current harvesting levels in the quasi-legal commercial fishery are at or above the rates recorded by Nietschmann in the early 1970s.

2.2 Exogenous Drivers, Capacities, and Vulnerabilities

Exogenous drivers:

...to and of the Resource (link 7 to R): Protection and conservation of the natal green turtle nesting site in Tortuguero, Costa Rica, may (within limits) positively affect green turtle abundances. Recent reported decreases in green turtle catch rates, reduced take levels, and evidence that the bulk of turtles caught in the fishery are large immature juveniles and adult turtles from the Tortuguero population suggests current take levels are unsustainable.

...to and of the Public Infrastructure (link 7 to PI): The ratification of the Convention on International Trade in Endangered Species (CITES) in 1977 by the Nicaraguan government shut down the turtle factories that were exporting green turtle meat internationally. However, exploitation of green turtles continues at equal to, if not greater, levels which is now driven by domestic demand. A 2005 ban on green turtle harvesting implemented by the Ministry of Environment and Natural Resources (MARENA) was rejected by the governments of the RAAS and RAAN, who instead reinstated the fishery.

...to and of the Public Infrastructure Providers (link 8 to PIP): There appears to be an inherent dislike, distrust and cultural animosity between public infrastructure providers at the national level (Hispanic) and indigenous governance levels. The engagement of local community leaders in the RAAS and RAAN by the NGO Wildlife Conservation Society (WCS) and researchers from Florida State University may facilitate better local resource governance, although more monitoring and sanctioning by the government is needed (C. Lagueux, pers. comm.).

...to and of the Resource Users (link 8 to RU): During the time period of the Nicaraguan civil wars (1974-1979 Sandinista Revolution; and 1979-1990 Contra War), the Caribbean coast of Nicaragua was severely depopulated due to a combination of forcible eviction of indigenous populations by government forces, and the voluntary evacuation of the Miskito and others into Honduras. This resulted in a significant decline of green turtle harvesting pressure allowing recovery of the species from earlier exploitation. However, since the return of the Miskito to the Caribbean coast in the early 1990s, widespread poverty and economic hardship, as well as a lack of alternative employment opportunities have facilitated a continuation of the practices first observed by Nietschmann in the late 1960s, early 1970s. Increased demand for green turtles is also due to a population influx by inland indigenous people and Mestizo. The discarding of drugs at sea by drug traffickers due to

drug interdiction or as payment for passage provides temporary cash relief for families, but not enough to eliminate the need to fish turtles for cash income.

2.3 Robustness Summary

The Nicaraguan green turtle fishery does not represent a robust system of CPR governance. Persistent poverty, lack of alternative employment opportunities, and a high population growth rate (initially within communities, but more recently through in-migration) continue to be the main drivers for the commercialization of this fishery under a domestic subsistence use exception to endangered species protection of green turtles. Instead of protecting the species from exploitation, the ratification of the Convention on International Trade in Endangered Species (CITES) in 1977 by the national government, and subsequent closure of the legal international market for green turtle meat, has merely led to a shift in focus by turtle fishers from responding to international market demands to creating and satisfying a domestic demand for green turtles. Although de jure rules limiting the harvesting of green turtles exist at all government levels, including at the territorial, municipal, and community level in the RAAS and the RAAN, there is no overarching coordination of those rules, and no monitoring or enforcement, but for the collection of harvesting data that is being conducted by a researcher formerly involved with an international NGO. In essence, the fishery is de facto operated year-round without any restrictions. Prior limiting factors, such as the special skills required to navigate sailing dories and harpoon turtles, have been eliminated through the increased use of motor boats and turtle nets. The literature mentions three factors that provide evidence of the long-term unsustainability of the fishery: (1) actual capture rates are believed to be significantly higher than reported; (2) a majority of the animals captured are large, sexually immature juveniles and adult turtles from the Tortuguero natal nesting site, which effectively removes the base for a future breeding population; and (3) recent declines in capture rates in regions with previous turtle abundance (Lagueux, et al. 2014). Given many Miskitos reliance on green turtles as a sole source of cash revenues, a turtle population collapse could have significant social-ecological consequences.

3 Part III. Case Contributors

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