Human Dimensions of Fish and Wildlife Management

PROJECT REPORT

HUMAN DIMENSIONS OF COMMUNITY-BASED CONSERVATION OF ENDANGERED SEA TURTLES ON SHELL BEACH, GUYANA

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Acronyms

AA	Amerindian Act
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung
CARICOM	Caribbean Community
CITES	Convention on International Trade in Endangered Species
EPA	Environmental Protection Agency
GDP	Gross Domestic Product
GMTCS	Guyana Marine Turtle Conservation Society
IUCN	International Union for the Conservation of Nature
KfW	Kreditanstalt für Wiederaufbau
LCDS	Low Carbon Development Strategy
MoAA	Ministry of Amerindian Affairs
MoNRE	Ministry of Natural Resources and the Environment
MOU	Memorandum of Understanding
OPM	Office of the Prime Minister
PAA	Protected Areas Act
PAC	Protected Areas Commission
REDD	Reducing Emissions from Deforestation and Degradation
NGO	Non-Governmental Organization
USD	United States Dollars
WMCR	Wildlife Management and Conservation Regulations
WWF	World Wide Fund for Nature

Abstract

In this report I investigate Human Dimension aspects of community-based sea turtle conservation on Shell Beach, Guyana with special emphasis on stakeholder conflicts. Based on personal observations, literature review, personal comments and unpublished data I identified the project conditions as being characteristic of a wicked problem. Further analysis revealed 5 key conflict situations (traditional subsistence use of sea turtles vs. conservation, local fishing and farming vs. sea turtle conservation, poaching, stakeholder interests and conflicts, alternative income development) arising from different values, beliefs and attitudes among stakeholders. I found the current management approach to be in a transition stage from Scenario Planning towards Adaptive Management. I discuss technological, cognitive and structural fixes as responses to the existing conflicts. Four aspects (clarification of management structure and stakeholder roles, permanent presence of PAC representative, improving community support for turtle conservation and building of national and international awareness) which should be addressed with priority and recommended measures to be taken are suggested.

1. Introduction and presentation of the human dimensions issue

There are currently 7 species of sea turtles worldwide with all of their populations being either endangered or vulnerable (IUCN, 2014). The reasons for their demise are manifold. Although sea turtles, like small populations in general, face certain risks from environmental, genetic and demographic stochasticity, the key threats - fishing, pollution, poaching and habitat loss- are deterministic in character and linked to human activities. This is good news because it offers viable starting points for instigating changes towards improved management with realistic chances of conservation efforts to succeed.

Despite the fact that most sea turtles are highly mobile creatures, with some species (e.g. the leatherback *Dermochelys coriacea*) displaying migration patterns of global dimension, they are confined to a narrow range of ideal environmental and geomorphological conditions for reproduction: their nesting beaches throughout tropical and sub-tropical regions. This "Achilles' heel" situation in their proliferation is further amplified by the circumstance that female sea turtles need to return to their natal beaches in order to lay their eggs, just like spawning salmon are dependent on their hatching streams.

Throughout the globe tropical beaches are generally facing enormous development pressures resulting from population growth and connected economic activities (e.g. in-shore fishing and coconut farming) as well as large-scale tourism. Being located primarily in developing countries, there are often insufficient financial, legal and administrative means to balance conservation with development. As a consequence, the challenges arising from the wildlife-human-habitat triage as well as the "clash" of human-system vs. eco-system are particularly pronounced.

This provides an ideal opportunity to investigate human dimensions issues within a wildlife management framework. Shell Beach, located in the northwest of Guyana is an important nesting beach for 4 species of sea turtles. Using the primarily Amerindian community of Almond Beach (which is located on Shell Beach in Guyana, see Figure 1) as an example, I will describe, analyze and suggest solutions to the following conflicts and challenges from a human dimensions perspective:

(1) Traditional subsistence use of sea turtles vs. conservation

(2) Local fishing and farming vs. sea turtle conservation

(3) Poaching

(4) Stakeholder interests and conflicts

(5) Alternative income opportunities

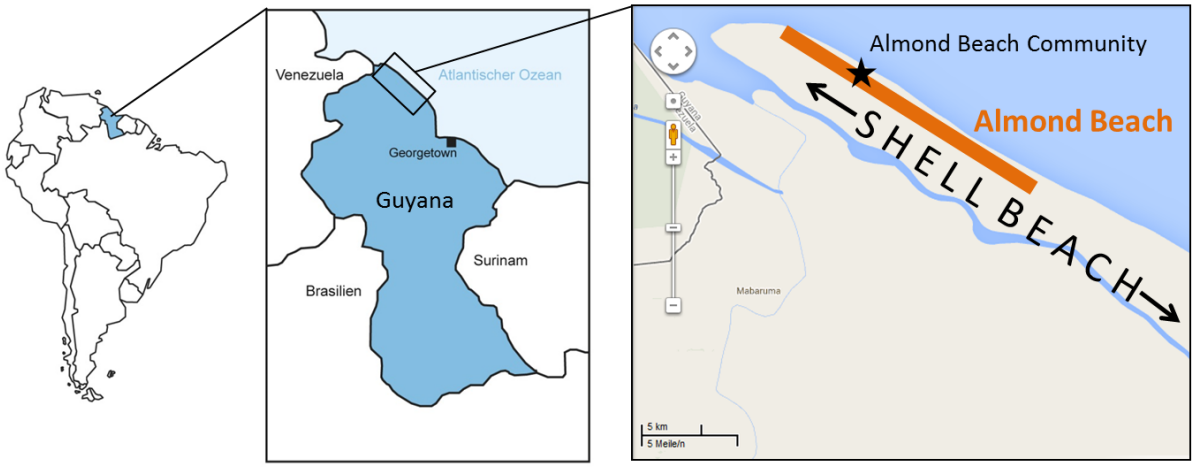

Fig. 1 Map of the project area. Shell Beach encompasses approximately 120km of coastline, consisting of beaches, mudflats and mangrove forests. It was designated a National Protected Area in 2011. Almond Beach, ca. 10km in length, is one of several important sea turtle nesting beaches on Shell Beach. Almond Beach Community is located on Almond Beach. (Source: EEREPAMI Regenwaldstiftung, Google Maps®)

2. Methods and analytical approach

Based on four 4 years of personal experience as managing representative for one of the stakeholders (EEREPAMI Foundation) I will describe the background of the project and its history as well as the different stakeholders involved. Throughout this paper, deductions from personal observations will be augmented by scientific literature review, reference to relevant laws and regulations, media releases and the use of unpublished records, like Memoranda of Understanding (MOUs), project reports, and minutes of stakeholder meetings.

By developing a graphic model, I will attempt to entangle and illustrate the complex web of stakeholder interactions in the Almond Beach turtle conservation project.

Due to the many actors, dynamic changes in political, economic and social structures, as well as a volatile natural environment, turtle conservation efforts on Shell Beach are facing a high degree of uncertainty. I hypothesize that the situation constitutes the characteristics of a so-called wicked problem and will test this hypothesis by subjecting it to Balint's et al. (2011) "checklist" for wicked problems.

With guidance from Heberlein (2012) I will investigate different attitudes towards turtles among selected stakeholders by analyzing the underlying beliefs and values with an emphasis on identifying conflicts between them.

As its key focus is to reduce uncertainty, adaptive management has often been suggested as an approach to wicked problems (e.g. Keith et al., 2011, Tyre and Michaels, 2011, Allen et al., 2011, Smith et al., 2013). I will examine to which extent adaptive management has already been successfully applied to the turtle project management but also discuss its limitations in the light of 9 common pathologies as described by Allen and Gunderson (2011).

Based on my findings I will identify potential solutions, alternatives and improvements for future management with special emphasis on discussing technological, cognitive and structural fixes. Because it forms a substantial component of the conservation work on Shell Beach, "Educating the Public" will receive special scrutiny.

I will conclude by highlighting key aspects of the project which require further action, draft a suggested priority ranking and identify the research required to develop the appropriate measures.

3. In-depth description of the problem

Although wildlife management has generally been recognized as having 3 dimensions - human, wildlife, and habitats – the latter two have conventionally been receiving the most attention (Decker et al., 2012). In this paper I shall primarily focus on the human dimension; not solely out of a sense of duty towards an arguably neglected aspect but rather because the analysis of human dimension issues might hold the key to unlocking solutions towards improved sea turtle management on Almond Beach. Since all three dimensions are interconnected, advances in one can be expected to also benefit the other.

PROJECT BACKGROUND AND HISTORY

The Cooperative Republic of Guyana, often still incorrectly referred to as "British Guyana", achieved independence from Great Britain in 1966 and forms the only English-speaking country in South America. Located within the northeastern portion of the continent and bordering with Venezuela, Brazil and Suriname, the country comprises approximately 215,000 km² of tropical rainforests, savannas and agricultural land, with the latter being primarily located within the fertile coastal lowland zone. Largely due to its checkered colonial history, Guyana's 750,000 inhabitants form a distinct multi-ethnic society with strong ties to Caribbean culture as is also reflected in the country's CARICOM membership. Approximately 90% of the population lives along the coastal belt; the remaining 10% inhabit the interior. Although large socio-economic improvements have been achieved in recent years, Guyana remains one of South America's poorest countries with a per capita GDP of currently around 3.000 USD (Guyana Bureau of Statistics, 2011). Major industries are mining (gold, diamonds and bauxite), agriculture (rice, sugar cane), forestry and fishing. Tourism, especially nature-tourism, is continuously gaining importance.

Shell Beach is the overarching name for a stretch of approximately 120 km of mostly pristine coastline in northwestern Guyana consisting of beaches, mudflats, mangroves and swamp forests. The area is an important nesting ground for four species of sea turtles: leatherbacks, green turtles, hawksbills and olive ridleys. The area has been traditionally used by local Arawak and Warrau Amerindians for subsistence turtle hunting since time immemorial. While historically local subsistence use might have been sustainable, the latter decades of the 20th century, with the added effects of commercial harvest, pollution, fisheries by-catch, poaching and destruction of nesting beaches, have seen a sharp decline in sea turtle populations worldwide. This prompted the International Union for the Conservation of Nature

(IUCN) to include all species of sea turtles on their Red List of Threatened Species. In Guyana, the demise of the sea turtles was first brought to public attention by the Florida-based American researcher Dr. Peter Pritchard. Working with local people on Shell Beach, Dr. Pritchard instigated the first conservation measures. By the 1980's the numbers of nesting sea turtles on Shell Beach had declined so strongly, that even traditional subsistence use became questionable. This sparked the formation of a local conservation NGO, the Guyana Marine Turtle Conservation Society (GMTCS) in 1988. Although Guyana had signed on to CITES in 1977, thereby banning the trade of sea turtle products to the outside of the country, within the borders there was no legal basis to effectively prevent people from harvesting sea turtles and their eggs. The problem was somewhat alleviated by the fact that large tracts of coastline were fairly remote and inaccessible and human population densities generally low. In the Shell Beach area, a stretch of approximately 15 km on the northern end, known as Almond Beach, developed into a sea turtle conservation hotspot. During the 1990ies a permanent community (also called Almond Beach) of about 180 people of mostly Amerindian heritage became established from what previously had been only seasonal hunting and fishing camps. The local people also successfully established coconut farming along the beach, gaining a legal right of residence in the area via agriculture leases. Meanwhile, the development of gold mining in the hinterland led to an influx of settlers into Guyana's northwest and rapid growth of the nearby community of Mabaruma, which is roughly 40km distant from Almond Beach and currently has approximately 5.000 inhabitants. This provided markets for fish and agricultural goods to the benefits of the Almond Beach community members but sadly also fostered a "grey market" for turtle meat and eggs. Legally there was little that could be done; therefore the local conservation organization GMTCS and its national and international supporters were largely restricted to outreach programmes and "prevention by presence", trying to convince community members and fishermen from neighboring villages to voluntarily refrain from turtle harvesting. As shall be discussed in further detail later on, the success rates and results varied and the conservation work was often impeded by local conflict. With the beginning of the new millennium, conservation in general and the work on Shell Beach in particular received an unexpected backing. From approximately 2006 onwards, the Guyana government, spearheaded by former President Bharrat Jagdeo, sought assistance from the international community in preserving the country's vast rainforests as a contribution to global efforts of mitigating the effects of climatic change. Guyana, up to this day, has become very involved in REDD/REDD+ initiatives and has also officially launched a national Low Carbon Development Strategy (LCDS) of its own. Guyana also realized the need to

modernize and strengthen legislation in the environmental sector and embarked on developing a system of protected areas by both, drafting a legal framework and identifying potential conservation areas. Shell Beach was identified as one such area due to its importance as a nesting beach for sea turtles, its wealth in avian fauna and its extensive tracts of intact mangroves. The latter have been shown in recent research (e.g. Daniel et al., 2011) to sequester more atmospheric carbon in the long-term than any other tropical forest type. With financial assistance from the German Ministry of Economic Cooperation and Development (BMZ) through the German Development Bank (KfW), the delineation process of the proposed Shell Beach protected area began in fall 2009. In 2011, Guyana established a Ministry of Natural Resources and the Environment and under this umbrella also formed a Protected Areas Commission (PAC). During the same year the Protected Areas Act (PAA) was passed by parliament and signed into law and Shell Beach became officially recognized as a national protected area, encompassing ca. 1,500 km² of coastal habitat (PAC, pers. comm.). Under the PAA, sea turtles are now protected on Shell Beach. However, traditional Amerindian subsistence use is being recognized as an exemption (PAA, § 117, 2011). In 2013 the Environmental Protection Act of 1996, which provided the legal basis for the competencies of the Guyana Environmental Protection Agency (EPA), was refined by the passing of the arguably overdue Wildlife Management an Conservation Regulations, which now protects all sea turtles in Guyana, even outside of protected areas. Poaching of sea turtles or their eggs is now punishable by a fine of 2,500 USD and 6 months imprisonment (WMCR, 3rd schedule, sct. E, 2013). Again, traditional Amerindian subsistence rights are exempted.

STAKEHOLDERS

Table 1 provides an overview of the major stakeholders involved in the project, followed by a short profile.

Tab. 1 Stakeholders of the Shell Beach (Almond Beach) turtle conservation project

Stakeholder	**Type of Organisation**	**Origin**
Guyana Marine Turtle Conservation Society (GMTCS)	NGO	Guyana
Almond Beach Community	Amerindian village	Guyana
Protected Areas Commission (PAC)	Government	Guyana
Environmental Protection Agency (EPA)	Governmnet	Guyana
Ministry of Natural Resources and the Environment (MoNRE)	Government	Guyana
Ministry of Amerindian Affairs (MoAA)	Government	Guyana
Office of the Prime Minister (OPM)	Government	Guyana

World Wide Fund for Nature (WWF)	NGO	Guyana
Chelonian Resarch Institute	Private Research Institute	USA
Repsol	Private Donor Company	Guyana
EEREPAMI Regenwaldstiftung	NGO	Germany

The **Guyana Marine Turtle Conservation Society** (GMTCS) is a local organization which formed around Audley James, a former turtle hunter, Amerindian and research assistant to the British-American zoologist Dr. Peter Pritchard. Audley and his family started working in turtle conservation on Almond Beach in 1988. GMTCS was formally registered as an NGO under the Guyana Friendly Society Constitution in 2000. Volunteers from different fields of society joined and the scope of the organization's work extended to five main objectives:

1. Marine Turtle Conservation
2. Community development and Capacity Building
3. Education and Awareness
4. Promotion of Protected Areas
5. Scientific Research

Every year during the nesting period from February until August, members of GMTCS are present on Almond Beach, patrolling the beach to deter poachers, collect scientific data on nesting turtles and relocate threatened clutches of eggs to a hatchery. GMTCS also organizes environmental education camps for local school groups on the beach and throughout local communities and has been trying to establish eco-tourism as a source of income. The organization has also been very actively involved in the establishment of the Shell Beach Protected Area, having been designated as the lead agency by the EPA during the delineation phase. Currently the organization's marine turtle work is headed by Audley's son, Romeo DeFreitas who is also the country coordinator for the programme.

The **Almond Beach Community** consists of approximately 180 inhabitants, living in scattered houses along a 5km section of Almond Beach. Most locals engage in fishing and coconut farming. The population size fluctuates throughout the year as a number on inhabitants also pursue part-time economic activities in the hinterland like gold-mining. Since almost all villagers are Amerindian, Almond Beach is scheduled to become officially

recognized as an Amerindian Village and is already being treated "pro forma" as such by the Ministry of Amerindian Affairs.

The **Protected Areas Commission** (PAC) was established in 2011and is mandated to manage, maintain, promote and expand the national protected areas system in Guyana

The **Environmental Protection Agency** (EPA) is governed by the Environmental Protection Act (No 11, 1996) which "…*mandates the Agency to oversee the effective management, conservation, protection and improvement of the environment. It also requires that the Agency takes the necessary measures to ensure the prevention and control of pollution, assessment of the impact of economic development on the environment and the sustainable use of natural resources*". (www.epaguyana.org, 2014)

The **Ministry of Natural Resources and the Environment** (MoNRE) is the superordinate body for the EPA, PAC and other administrative organizations in the environmental/ natural resource sector like the Guyana Forestry Commission.

The **Ministry of Amerindian Affairs** (MoAA) is mandated to manage all matters pertaining to Amerindians in Guyana as detailed in the Amerindian Act (2006).

The current incumbent at the **Office of the Prime Minister** (OPM), the Honourable Minister Samuel Hinds, is the patron of the GMTCS turtle conservation work on Shell Beach.

The **World Wide Fund for Nature** (WWF) is one of the world's leading conservation NGO's. The WWF Guianas has been providing major funding and expertise to the GMTCS sea turtle conservation work for numerous years.

The **Chelonian Research Institute** is a private, non-profit corporation which was established in 1998 by zoologist and internationally renowned turtle expert Dr. Peter Pritchard in Oviedo, Florida. The institute is dedicated to research and conservation of turtles and tortoises throughout the world. Dr. Pritchard currently functions as the official scientific advisor to GMTCS and has also been a regular provider of funding, especially towards the environmental education work.

Repsol is an international oil corporation, headquartered in Madrid, Spain. Its Guyana branch is currently entering into a MOU with GMTCS about providing financial support to the educational work as part of the company's "Repsol Guyana Environment & Biodiversity

Support Plan". Repsol Guyana and its predecessor Simpson Oil Limited have also been contributing fuel for the GMTCS ranger boats over a number of years.

The **EEREPAMI Regenwaldstiftung** is a Dresden, Germany-based non-profit charitable foundation. Its work encompasses supporting remote area development, biodiversity conservation, as well as the exchange of science, culture and education between Germany and Guyana. EEREPAMI formally partnered with GMTCS by entering a MOU in December 2009. The organization has since been providing funding and technical expertise towards infrastructure improvement, GMTCS labor costs and educational work. EEREPAMI has also been placing German volunteers with GMTCS on Almond Beach over a period of three years from 2011-2013.

Figure 2 shows an overview of how the different stakeholders are interconnected in the sea turtle conservation efforts and provides a starting point for a problem analysis.

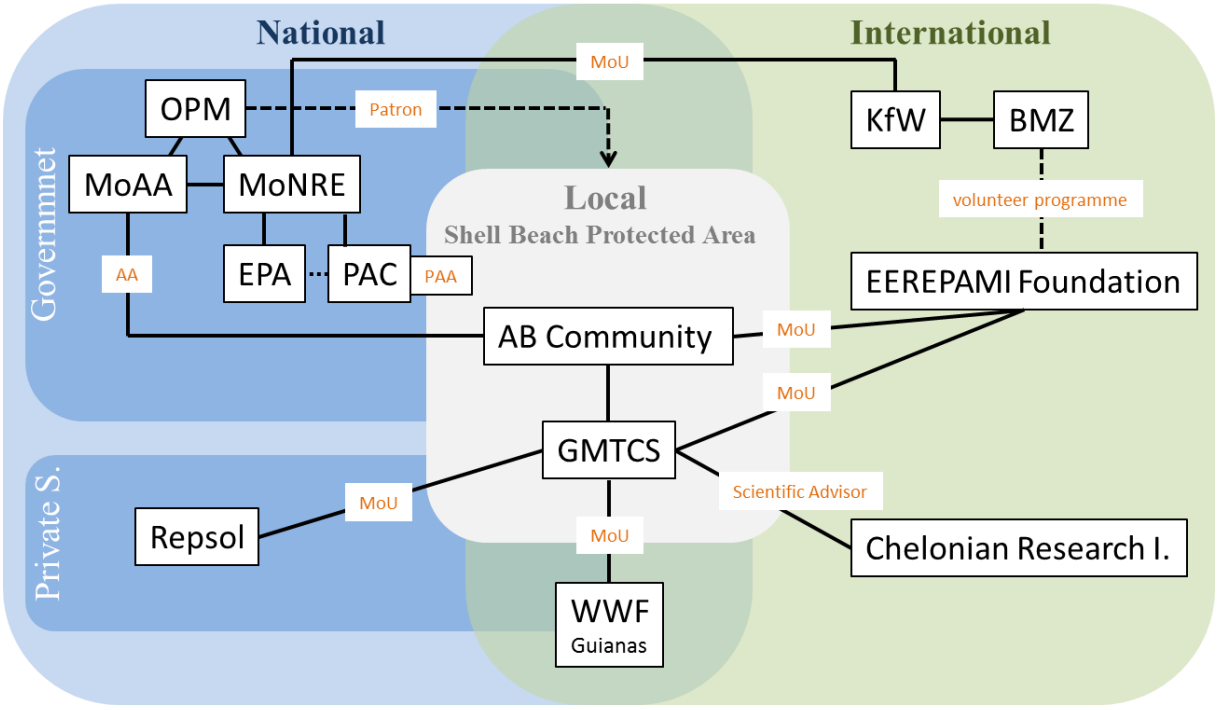

Fig. 2 Stakeholders and their interconnections in the Almond Beach sea turtle conservation project

Despite good intentions by all stakeholders and the expenditure of substantial amounts of funding, sea turtle conservation on Almond Beach has been and remains to this day challenged by stakeholder conflicts. Most notably, the project has largely failed at building strong community support towards sea turtle conservation among local community members. In the following section, I will analyze whether the situation constitutes the characteristic of a

"wicked problem". According to Balint et al. (2011) a wicked problem is characterized by a high degree of uncertainty and profound disagreement on values. In an adaptation of Rittel and Webber (1973), Balint et al. (2011) developed a 9-point "checklist" of conditions associated with wicked problems. Table 2 provides my analysis of how and which extent these conditions apply to the situation on Almond Beach.

Tab. 2 Analysis of conditions associated with wicked problems on Almond Beach

Condition	Applicable to Almond Beach?	Explanation
1. Lack of unique problem statement	partially	Although all stakeholders agree "per se" that sea turtle conservation is important, there is a lack of clarity and a multitude of perspectives on the matter. For example, the dogs of local villagers destroy numerous nests but the owners are protective of their pets. Fishery by-catch of turtles is generally perceived as unfortunate but fishing as a livelihood has priority, and what is still considered to be traditional subsistence use by some is already being perceived as poaching by others.
2. Conflicting objectives	yes	Objectives of community development (e.g. improved income, housing, fishing and farming) can clash with conservation objectives of minimizing disturbance, restoring and maintaining wilderness characteristics of the area.
3. Conflicting values	yes	Values like Personal Freedom (traditional rights and way of life) and Family Security (e.g. via farming, fishing and hunting) on the part of the community members sometimes cause friction with values of National Security (government) and A World of Beauty (conservation NGO).
4. Dynamic context	partially	Having been the first and largely the only one "on-site" turtle conservation actor, GMTCS over the years has grown complacent to some degree and reluctant to change "their" ways of management although the situation on Almond Beach has become increasingly complex.
5. Scientific complexity and uncertainty	yes	Although an immense amount of research has been conducted on sea turtles over the last decades there are still many uncertainties about their biology and the effects of disturbance, e.g. artificial light sources on their nesting beaches, changes in beach stratum and temperature regime, the best way of re-locating eggs etc. Studies pertaining specifically to Guyana are especially rare. For example, a Web of Science search (01.03.2014) for "Guyana*Sea Turtles" yielded only 5 hits compared to 478 for "Mexico*Sea Turtles".
6. Political complexity and uncertainty	yes	With the recently gained status as a National Protected Area and the Almond Beach community's impending official status as a titled Amerindian Village, there is a high degree of political complexity.
7. Administrative complexity and uncertainty	yes	There has traditionally always been uncertainty about funding, severely impeding GMTCS's ability for long term planning and implementing ideas.

8. Multiple tactics to address problems	yes	With multiple stakeholders involved, especially with different cultural backgrounds, there is an inherent risk of encountering uncertainty and differences with regard to evaluating project success, on how to prioritize problems and the appropriate responses.
9. Multiple stakeholders with power to assert their values	yes	With at least 11 different stakeholders involved in the project, all with strong means to assert their values, e.g. community members (traditional rights, permanent presence), government (legislation), NGOs (supporter base and funding), GMTCS (project implementation), criterion (9) is definitely fulfilled on Almond Beach.

With 7 criteria being fully applicable and 2 partially so, sea turtle conservation management on Almond Beach certainly "fits the bill" for a wicked problem. Before delving deeper into the analysis of underlying values and attitudes, which metaphorically speaking form the "roots" of the problems, I shall first briefly describe the main "branches", which can be summarized into 5 commonly encountered conflict situations.

(1) Traditional subsistence use of sea turtles vs. conservation

Sea turtles and their eggs have been a food source for local Amerindians for a long time. Although nowadays only very few families still live fully traditional, subsistence hunting and fishing continue to be indispensable for the provision of nourishment to most families on Almond Beach. Sea turtles and eggs are easily harvested at virtually no risk of harm to the hunter. The right to use natural resources for subsistence also has a strong cultural (and legal) foundation and as long as there is a genuine need for food, subsistence hunting is generally accepted amongst the public even on a global scale (see Fischer et al., 2012). However, some sea turtle populations have declined so severely that even subsistence use can become detrimental. Although conservationists like GMTCS have realized that sacrificing the food income from sea turtles has to be compensated for by other means of income (e.g. farming, employment in eco-tourism), instigating change is difficult and slow. In addition, asking people to refrain from using turtles or even actively preventing them from doing so, can be perceived as an infringement on traditional rights and foster resentment towards conservationists and sea turtles.

(2) Local fishing and farming vs. sea turtle conservation

Fishing is the most important source of income for the villagers on Almond Beach and is largely practiced via seine nets. If these are set close to the nesting beach female turtles often become entangled and either drown, suffer injuries from strangulation or are killed by

fisherman. The latter usually happens more in an attempt to save the expensive net (it is very difficult to entangle a live and panicked turtle without cutting the net to pieces) rather than out of a desire for turtle meat. Coconut farming can be problematic as well because the tough roots of the palm permeate the beach, making it difficult for turtles to dig their nests into the sand.

(3) Poaching

This usually concerns the taking of eggs, which are easy to hide by reburying them. Although some villagers are opposed to restrictions on the use of turtles, practically no one would openly slaughter a nesting turtle; not out of concern for the species but rather because several GMTCS staff are also community members. Openly destroying something a neighbor values carries strong social sanctions and violates values like Social Recognition and Politeness. A special case of "poaching" occurs from semi-feral dogs which have exploded in numbers on the beach. In 2012 the author once counted 70 dogs along a 10km stretch of beach. Dogs smell out nests, dig up the eggs and also feed on hatchlings.

(4) Stakeholder interests and conflicts

These comprise the most complex aspect of the project. Apart from the conflicts already described, further examples include: concern by the government over the influence of NGOs, research interests can collide with efforts of development (e.g. eco-tourism), foreign actors (e.g. volunteers) can be overly idealistic and culturally insensitive, NGOs might have different priorities (e.g. building up infrastructure vs. conducting educational work) and must show results to their funders which in turn might occasionally be beyond the implementation capacities of local actors, communication can be difficult and lead to misunderstandings etc.

(5) Alternative income opportunities

While there is consensus that local people must be offered alternative means of income to render the harvest of turtles and eggs unnecessary and to compensate for losses in fishing through restriction of practices during nesting season, there is debate on which alternatives work best. For example, farming and eco-tourism can be viable options but there is also the risk that both could conceivably become more detrimental to nesting turtles than the occasional harvest for subsistence use by a few individuals.

As demonstrated, it is comparatively easy to spot and define problems and conflicts associated with behaviors (e.g. poaching, using seine nets etc.) simply because behaviors are

observable. However, the obvious solution, getting people to change their behavior, frequently proves to be very difficult to achieve. More often than not, managers at best succeed only at "trimming the branches" of a wicked problem -ultimately a frustrating exercise- instead of striking at the (invisible) root. Fortunately, sociologists have been "digging deep" in their search of what underlies behaviors. What they discovered is that people worldwide apparently share a common set of only 36 basic values, which were first identified by Polish-American social psychologist Milton Rokeach in 1973. Building upon the foundation of these Rokeach Values, Heberlein (2012) explains that while values don't have an object, they give rise to attitudes which do. With regard to the conservation project on Almond Beach, it is the attitudes towards sea turtles and the resulting behaviors which are of crucial importance. In between values and attitudes there are beliefs. Like attitudes they are also tied to the object and can actually be viewed as the "components" of attitudes. Using 3 different stakeholders as an example, Table 3 illustrates how the analysis of values, beliefs and attitudes can help to explain why people behave the way they do.

Tab. 3 Different values, beliefs, attitudes and behaviors of 3 selected stakeholders in relation to sea turtles

	Community Member	**GMTCS Employee**	**EEREPAMI Activist**
Behavior	Uses seine nets for fishing during nesting season, harvests turtle eggs, lets his dogs run free	Patrols nesting beaches, relocates turtle nests to safe hatchery, shoots poaching dogs	Fundraises for turtle conservation, volunteers for work on Almond Beach, participates in public awareness campaigns
Attitude	Turtles are a nuisance.	I love turtles.	I love turtles.
Evaluative Belief	Turtle conservation restricts my way of life and lowers my income.	Turtles are more important than people's convenience.	Turtles are invaluable for ecological, economic and spiritual reasons.
Belief	I have a traditional right to use turtles. Turtles destroy fishing nets. There are enough turtles elsewhere. Providing for my family comes first. Only GMTCS members benefit from conservation. No foreigner can tell me what to do.	Turtle conservation provides me with a job and income. Turtles need my help. With some adjustments fishing and farming can co-exists with nesting turtles. Poachers destroy the fruits of my labor.	Turtles are endangered. Turtles have important functions in the ecosystem. Turtles are beautiful. Everybody can benefit from turtles. Turtles create sympathy and help raise funds.
Value	Freedom / Family Security/ Social recognition	Family Security / A Sense of Accomplishment	A World of Beauty / Equality / Family Security

Interestingly, the same values (e.g. family security) and even similar beliefs (e.g. everybody can benefit from sea turtles) can lead to different attitudes. In addition, even having the same attitude ("I love turtles") can lead to different behaviors. In one memorable example, the

project experienced severe conflict between an EEREPAMI volunteer and GMTCS rangers, when the latter shot poaching dogs. Although both actors loved turtles, there was a profound disagreement of what constitutes appropriate measures for their protection. Conflict can also arise if proposed or real actions (e.g. the establishment of no-netting zones along nesting beaches or restrictions on farming) collide with key beliefs and values. For example, a villager who actually likes turtles and even voluntarily tries to avoid harming them might still come to resent the turtle conservation work if he feels that this negatively impacts his basic values like Freedom or Family Security. Attitudes and behavior can be very fickle, especially if the underlying horizontal structure of values and beliefs is not very broad. For example, GMTCS provides employment as trainee rangers to local youths every year during the 7-months nesting season. Some of them might have been indifferent towards turtles or even have hunted them prior to employment. If asked about their attitudes towards sea turtles once they have started working, most would express positive attitudes or even concede that their attitudes have changed towards favoring conservation. Generally this would even be true but their newly gained positive attitude towards sea turtles would usually have only little horizontal structure, e.g. it might be tied to only one basic value like Social Recognition ("having a job"). In other words, the new attitude could be weak and might not persist. For example, in one extreme case there was indication that a disgruntled employee, who had been fired because of matters unrelated to turtles, actually went and killed a critically endangered leatherback turtle out of spite and frustration. Losing his job had likely violated his values of Social Recognition and Family Security and the resulting angry behavior completely overruled the weak positive attitude towards turtles he had previously developed.

4. Potential solutions from a human dimensions perspective

In the previous chapter I showed that sea turtle management on Almond Beach faces a highly dynamic setting resulting from structural and political uncertainty, stakeholder conflicts and a paucity of reliable data. On top of these mostly human dimension aspects, managers are also confronted by a highly dynamic environment, which is characterized by frequent storms, floods and a highly volatile coastline which can shift several meters within a few months. During the 2013 turtle nesting season for example, the Almond Beach area was subjected to severe flooding which drowned many turtle nests but also necessitated the relocation of several families and their houses. Adaptive management has often been suggested as a response to uncertainty as it involves learning as part of the management process (e.g. Decker et al., 2012, Balint et al., 2011). Learning increases knowledge and thereby reduces

uncertainty. The idea appears to be so sensible and straightforward that adaptive management, at least in name, has been readily embraced by many natural resource managers and has become almost equally as popular as the much overused term "sustainability". Prosaic social scientists however, have been less enthusiastic. For example, Allen et al. (2011) positively caution against treating adaptive management as a "panacea" in responding to wicked problems. Allen and Gunderson (2011) went further and identified a list of 9 pathologies which can derail even the most well-intended adaptive management process. Because most stakeholders of the turtle conservation project have referred to their work as "adaptive management" in one way or another, I attempted to assess to which extent the 9 pathologies apply to the situation on Almond Beach. The findings are summarized in Table 4.

Tab. 4 The 9 pathologies of adaptive management in reference to the Almond Beach sea turtle adaptive management process

Pathology	Assessment
1. Lack of stakeholder engagement	This is partially applicable to the involvement of community members. Although some individuals actively participate in the turtle conservation and some more participate in meetings, the project has largely failed to really engage the majority.
2. Experiments are difficult	The way GMTCS operates has become rather fixed over the years. Active on-site involvement of stakeholder other than community members has been a fairly recent phenomenon. There is willingness to experiment with new ideas (e.g. the inclusion of foreign volunteers) but the hierarchical framework has been rather strongly established and the fear of losing control sometimes limits the willingness to experiment.
3. Surprises are suppressed	No –surprises, whether environmental or social are a common occurrence and are usually being addressed with either pragmatism or even enthusiasm about "something new".
4. Prescriptions are followed	If "prescriptions" are interpreted as the "traditional way of running things" then this is applicable to GMTCS.
5. Action procrastination: learning and discussing remain the only ingredients	No –rather the opposite is true. A typical on-site approach is to take action, often via "trial and error". On several occasions a bit more restraint and discussion prior to action would actually have been preferable.
6. Learning is not used to modify policy and management	No-all stakeholders are involved in a constant learning process about environmental, economic and cultural aspects and try to implement findings into improving policy and management. The main problem with this is that the latter two are only fairly vaguely and informally defined.
7. Avoiding hard truths: decision makers are risk averse	No –when it comes to protecting turtles GMTCS staff are not timid; for example they confront villagers, involve the police or the coast guard if necessary and shoot dogs that are found poaching.
8. The process lacks leadership and direction	Partially true -due to the many stakeholders and a shifting legislative environment, the project's leadership structure and the guiding objectives were sometimes unclear.
9. Focus on planning, not action	No –similar to the observations mentioned under (5), there has generally been more focus on action than planning.

With 5 out of the 9 pathologies not being applicable and 2 more being only partially so, adaptive management appears to be a viable management approach on Shell Beach. However, as shown in Figure 3, adaptive management works best if controllability and uncertainty are high, which is conducive to learning and if risk is low, which allows for experiments. These conditions are not fully given on Almond Beach. For one, working with endangered species always "stacks the stakes" and makes experiments risky because mistakes can have dire consequences for the species. Secondly, due to the many sources of uncertainty, controllability is also only medium at best. As a consequence, the management on Almond Beach has been more characteristic of scenario planning. However, adaptive management and scenario planning can complement one another (Allen and Gunderson, 2011) and the current situation is best described as scenario planning evolving into adaptive management. Since a well-working adaptive management system is preferable in the long term, what does it take for the evolution to succeed?

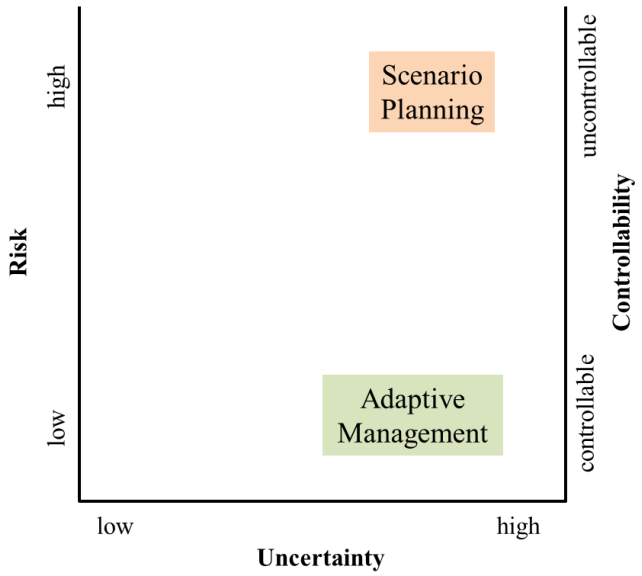

Fig. 3 Conditions in which adaptive management and scenario planning are appropriate (modified from (Allen and Gunderson, 2011).

For adaptive management to work, three basic conditions have to be fulfilled (Camilla Sandström, pers. commun.):

- Bridging organizations

- Adaptive governance

- Enabling laws

There is a high potential for the establishment of *bridging organizations* between stakeholders; to some degree they are actually already in effect. For example, NGOs like the WWF and EEREPAMI have often already inadvertently functioned as bridging organizations between GMTCS and the community because they are also involved in community projects not directly linked to turtle conservation, for example in assisting agriculture and education. GMTCS has often functioned as a link between the community and the government, like during the Shell Beach Protected Area delineation. The village council also consists of turtle conservationists and villagers less in favor of the conservation work. It will gain even more influence once Almond Beach becomes an officially titled Amerindian village. The importance of assuring equal participation of stakeholders in the management process should not be underestimated. Chase et al. (2004) found the aspect of "equal participation" to be more relevant to stakeholders than for example weighing their input based on some seemingly reasonable criteria (e.g. size of the group, level of expertise).

Adaptive governance is also already in effect to a large degree. There are some formal institutions (laws of Guyana, bylaws of the stakeholder organizations, MoU's between the actors) and numerous informal and voluntary ones. This situation, also sometimes referred to as "soft governance", holds the potential for innovation and voluntary institutions can gradually be steered into formal regulations. There is also potential for the establishment of new norms in favor of sea turtle conservation.

Enabling laws have for many years been the most serious shortcoming. The recent establishment of the National Protected Areas system, accompanied by new laws, can be expected to strongly clarify and improve the situation. With clear regulations in place, adaptive management can be expected to succeed.

After having "diagnosed" 5 of the most severe ailments (see "conflict situations") associated with sea turtle management and having identified the most promising type of "treatment" (adaptive management), this leaves the questions of the best "medicines" to cure them. In human dimension problems such "cures" are commonly referred to as "fixes". Heberlein (2012) identifies three types:

- Technological Fix

- Cognitive Fix

- Structural Fix

Table 5 list the 5 conflicts and challenges and the 3 fixes that have either been attempted or at least been considered.

Tab. 5 Conflicts and challenges in sea turtle conservation management on Almond Beach and the three fixes

Problem	Technological Fix	Cognitive Fix	Structural Fix
1. Traditional subsistence use of sea turtles vs. conservation	Establish more intensive farming, provide financial compensation for non-use of turtles	Education about the importance of sea turtles	Designate traditional-use and fully protected zones, establish clear quotas for subsistence use
2. Local fishing and farming vs. sea turtle conservation	Bottom-line fishing instead of seine nets, turtle excluder devices, sea turtle safe hooks	Capacity building, signs and information materials, e.g. maps with important nesting areas	Make sea turtle safe fishing and farming practices mandatory by law, establish designated activity zones
3. Poaching	Monitor and patrol beaches to deter poachers	Provide information about the importance of sea turtles	Prosecute poachers
4. Stakeholder interests and conflicts	Build a meeting place, set up communication technology (e.g. satellite phone, internet)	Communication (meetings, newsletters, online forums etc.)	Clearly define the roles, functions and competences of all stakeholders, establish a clear hierarchy
5. Alternative income opportunities	Establish farms (fruits, coconuts), build guesthouse for eco-tourism	Capacity building, training and information about alternative income options	Provide actual employment in alternative fields (e.g. eco-tourism, turtle conservation and research)

All three fixes can be useful in improving management and in most cases, including the Almond Beach turtle conservation project, a mix of them is being used. There are, however, some misconceptions among stakeholders about the effectiveness of them. While there is in general reasonably good awareness about the fact that purely technological fixes rarely work (building a guest house does not automatically bring tourists), many managers still put a lot of hope and faith into cognitive fixes. “Educating the public” is often viewed as a “cure-all” for changing undesirable behavior. However, numerous studies (see Heberlein (2012) for examples) have found the opposite to be the case. Education works very poorly or not at all in changing behavior. Applied to the situation on Almond Beach, betting on education as a means of changing the behavior of poachers would –in a slightly sarcastic exaggeration- most likely only lead to having educated poachers rather than fewer instances of poaching. This is not to say that education per se is unimportant; on the contrary, education opens up opportunities and broadens the range of choices people have to sustain themselves. Its

limitation lies mostly in changing already existing attitudes and behaviors, especially in the short-term. Fortunately there is a way out of this dilemma. According to Ericsson and Heberlein (2003), direct experience has been demonstrated to lead to stronger attitudes and has the potential to instigate behavioral change. This is confirmed by the experiences on Almond Beach. Especially youths but also adults who have participated in the annual educational turtle camps showed better attitudes towards sea turtles but even more importantly improved *behavior*. The turtle camps include classic "classroom teaching" sessions but also many active experience components like beach cleanups, relocating threatened nests, running the hatchery or nursing injured turtles. Although the changes in attitudes and behavior have not yet been scientifically verified but there is good indication that they exist. Examples are observations of youths voluntarily picking up garbage from the beach, fishermen calling for assistance when discovering entangled turtles or villagers offering to establish hatcheries close to their homes so that they can assist in "watching over them" during temporary absence of GMTCS staff.

5. Conclusions and further research

The management of sea turtle conservation on Almond Beach has a strong human dimension component and shows many characteristics of a so-called wicked problem. Currently management takes places with the involvement of many stakeholders who sometimes have different values and attitudes, leading to conflict-causing behaviors. Policies, guidelines and management structures have often been vague and subject to changes and uncertainty. From a managerial point of view, the project appears to be in a transition stage from scenario planning towards adaptive management. With the recently gained clarity about enabling laws through the passing of the Protected Area Act (2011) and the establishment of the Shell Beach National Protected Area, both measures being structural fixes, adaptive management can be expected to succeed. The greatest challenge remains building a strong support base for sea turtle conservation among villagers. Education as a cognitive fix alone has to be considered as insufficient to achieve this. Emphasis should be placed on direct experiences and tangible benefits, like employment within the project or through the emerging eco-tourism. It is important to allow for the building of a broad horizontal structure of positive beliefs and attitudes towards sea turtle conservation. Changing attitudes, behavior and norms takes time, so managers should focus on assuring long-term (at least 10 years) continuity of resources and measures. In closing, Table 6 provides a priority ranking of aspects which should be

addressed and suggests measures to be taken. Recommendations for further research are also included.

Tab. 6 Priority ranking of key aspects to be addressed as well as suggested measures and further research

Aspect	Suggested measures	Suggested research
1. Clarify management structure and stakeholder roles under the new PA regulations.	Stakeholder meetings and conference, development of a management plan	- Conduct stakeholder expectations survey
2. Establish a permanent presence of PAC representatives on Shell Beach	Build and staff a field station in Almond Beach	n.a.
3. Build community support for turtle conservation	Train and employ local people as staff for the Protected Area, develop eco-tourism, establish clearly defined usage zones, develop a compensation system for economic losses (e.g. from reduced fishing) associated with turtle conservation, focus on "direct experience" educational work	- Conduct study on value, beliefs and attitudes towards sea turtles - Do a feasibility study on eco-tourism
4. Build national and international awareness	Feature Shell Beach on national TV and other media, establish partnerships with local and foreign research and eco-tourism organizations	- (promote biological, ecological and socio-economic research on Shell Beach)

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