

Merging socio-cultural and economic requirements in West Indian Manatee's habitat management: A holistic approach

Jenieki Young

Grenfell Campus, Memorial University of Newfoundland

Abstract

*The West Indian manatees are considered a sentinel species occupying a unique niche in tropical and sub-tropical waters. The West Indian Manatees (*Trichechus manatus*) roams in fresh, marine or salt waters throughout Florida, the Greater Antilles, Central America, and South America. Manatee habitat and populations have plummeted over the last two hundred years due primarily to anthropogenic stressors (habitat loss, hunting and pollution). The aim is to gather in-depth overview of the ecological management objectives in different regions based on the anthropogenic threats, and possible management techniques that addresses aspects of societal, economic and biodiversity management. By comparing the Floridian population with the Belizean populations of manatees, the researcher reviewed the similarities and differences to gain substantial awareness of the threats through socio-cultural, and economical inputs between the different regions. Additional literature research was utilized to see if the three component demands could be met while maintaining habitat preservation. My argument concludes that management plans that incorporates societal, economic and ecological management techniques can have a longer-lasting impact on positive habitat preservation.*

Introduction

Manatees are referred to as sea cows, because of their slow movements, shape and size. According to the National Geographic Society (2015) despite their massive bulk, they are graceful swimmers powering themselves with their strong tails. Manatees typically glide along at 5 miles (8 kilometers) an hour, but can swim 15 miles (24 kilometers) an hour in short bursts. Manatees are usually seen alone, in pairs, or in small groups of a half dozen or fewer animals. The scientific name *trichechus* is Latin for hair, and refers to the small hairs that are found all over the manatee's body. From above the water's surface, the animal's nose and nostrils are often the only thing visible. (Odell, 1981). Manatees never leave the water but, like other marine mammals, they must breathe air at the surface. A resting manatee can remain submerged for up to 15 minutes, but while swimming it must surface every three or four minutes. The average adult manatee is 3.5 m long and weighs 1,000 kg, male and female manatees lack sexual dimorphism, which means they are similar in size and appearance. Newborn calves are, on average, 1.2 to 1.4 m long and weigh an average of 30 kg (Odell, 1981).

There are three species of manatee, distinguished primarily by where they live. One manatee population ranges along the North American east coast from Florida to Brazil, while other species inhabit the Amazon River and the west coast and rivers of Africa (Odell, 1981). The researcher's focus is on the West Indian manatee *Trichechus manatus*, which roams in both fresh and salt,

marine waters throughout Florida, the Greater Antilles, Central America, and South America. This unusual marine mammal has adapted well to its marine environment. Manatees migrate seasonally to adapt to changing water temperatures since they cannot swim in waters below 20 degrees Celsius, therefore they reside in warm shallow waters in the tropic and sub tropic areas. Manatees became endangered after intensive hunting pressures between the 1500s to 1800s that reduced the manatee population. Currently new developments are built along the waterways. As stated by the Fish and Wildlife Research Institute red tide is a naturally-occurring event that begins offshore in the Gulf of Mexico. Florida's Defenders of Wildlife (2017) introduced other threats that explained how large amounts of certain species of algae blooms contain natural neurotoxins, which can be dangerous to humans and local wildlife. Once the blooms move closer to shore, nutrient pollutants in agricultural or urban runoff can make the problem worse by fueling larger and more persistent blooms. Manatees can inhale red tide neurotoxins when they surface to breathe, and ingest them when they eat seagrass coated by the algae. The toxins cause seizures that, if severe enough, can prevent manatees from lifting their snouts above the water to breathe, which causes them to drown (Florida's Defenders of Wildlife, 2017). If this pollution continues, manatees' death rate would increase since they are primarily herbivores and their habitat would be degraded.

Common deaths of manatees occur due to their size and slow moving swimming speed; it is difficult for them to swim away from oncoming boats without colliding into them. Occasionally, seasonal cold waters cause the manatees to stress which makes them susceptible to diseases. However, the manatees, specifically the Floridian manatees must either migrate prior to cold seasons or stay near warm spots such as industrial areas near rivers. The UNEP reports that manatees in Belize number fewer than 1,000, but the population's birth rate and cub survival rate is relatively stable and comparable to the population of Florida's Crystal River area. Furthermore, they are referred to as "sentinel species," which means they are early warning indicators of environmental change since these mammals are highly susceptible to different environmental stressors. Manatees can indicate a severe environmental change in the ecosystem before other species or humans are affected (Bonde & Aguirre & Powell 2004). Therefore, this study is comparing the anthropogenic threats and management objectives of Florida and Belize by examining the West Indian manatee's ecological, cultural, and socioeconomic contributions.

There is a challenge when it comes to wildlife managers providing visitors with opportunities to observe rare and endangered wildlife, while simultaneously protecting the target species from harmful impacts (Sorice & Shafer & Ditton, 2006). Human-wildlife interactions are important in a tourism context, since there is the potential for accrual of benefits to local, regional, and national economies, and there is awareness presented to the participant and target species. At the base level, participants in marine wildlife encounters can derive cognitive benefits including increase in knowledge, awareness, and pleasure. According to Sorice, Shafer and Ditton (2006), up- close encounters with wildlife found that emotional affinity for, and interest in, wildlife is equally based on direct experiences in nature. The benefits derived from tourism can translate into benefits for wildlife, as people adopt more pro-environmental behaviours or contribute to wildlife conservation efforts. Benefits to wildlife and habitat also accrue as demand for these types of experiences increase, encouraging local, regional, and national governments to weigh the opportunity costs of wildlife consumption and habitat destruction (Sorice & Shafer & Ditton, 2006). Yet, conservationists are not pleased with this initiative as they are more concerned with the habitat and well-being of the endangered mammal.

The West Indian manatee is divided into two species, Florida and Antillean. North of South American, the Caribbean including Belize is the home of the Antillean manatee, where the waters are warm all year around, therefore this subspecies does not migrate as the Floridian manatee (Hunter et al., 2012). Subspecies are a geographical subunit that are genetically different from other populations of species. The two West Indian subspecies have been designated by differences in skull measurements and genetic changes. Our recent genetic studies, using highly informative microsatellite DNA, have shown that the manatees populations from both regions are very different from another, and in fact do not travel or mix together. (Hunter et al., 2012).

Historically, manatees of Belize have been hunted for food, hides, and bones. This hunting continues in many South and Central American countries. In Guyana, a country in northeastern South America, people have used manatees to keep waterways free of weeds (“Caribbean Critters,” n. d., para 11). Manatees living in the Belizean coastal waters are not as affected by human activity as they are in other locations such as Florida. Furthermore, in the US, the West Indian manatees are protected under federal law by the Marine Mammal Protection Act of 1972, and the Endangered Species Act of 1973. (“Caribbean Critters” n. d.) describes Florida species specifically have suffered human-related injury or death due to pollution, boating accidents, and ingestion of fish hooks, litter and monofilament line. The Antillean manatee found in Belize has suffered less due to lesser population of watercraft, however, it is listed as endangered under Belize’s Wildlife Protection Act of 1981.

Methodology

Study design and aim

This research is to gather an in-depth cognizance of how the anthropogenic threats and management objectives of the West Indian manatee in Florida and Belize vary; using documentation analysis throughout the study to examine decision-making and techniques of humans on whether their interactions conflict or influence the manatees. The aim is to seek similarities and differences to gain substantial awareness of the threats of these aquatic mammals through social, ecological, and economical inputs in the different regional contexts.

Comparative Data Analysis

A detailed review of current management plans, laws and socio-economic circumstances in Belize and Florida was done. The Belize Manatee Recovery Plan (Auil, 1998) and the Florida Manatees Management Plan (U.S. Fish and Wildlife Service, 2007) were used to determine policy similarities and difference between Belize and Florida respectively. The additional peer review articles will elevate our knowledge on the West Indian Manatees, and assist in possible solutions for revising a recovery plan. Since Florida has more experience when it comes to conservation of the manatees, their Manatee Recovery Plan (2001) was revised to a further refined and more ideally- suited manatee management plan. This in terms will allow the researcher to extrapolate from Florida’s plan to accommodate Belize, as the notion that presents developing countries moving forward through the adoption of a modern system without going through intermediary steps.

The knowledge gained by additional documents will allow the researcher to raise discussions on whether the sentinel mammal (West Indian manatee) can be used as an indicator species to assess

the state of the ecosystem, and determine if ecosystem processes are being compromised by human-caused environmental disturbances. The researcher will also provide more information on the subspecies phenomenon, and determine whether this contributes to the ecosystem barriers. Understanding the West Manatee's ecology and biology will in terms assist the researcher to examine the socio-cultural and economic aspects of both regions; factors are appealing to review, especially since Belize and Florida have the same species, but the people who are affected or benefit from the sentinel mammal vary. The economic, societal and cultural concerns are vital factors that establishes majority implications when it come to developing projects to protect the manatees and their habitat. This intervention leads to political differences, where it has been mentioned that Florida, as part of a developed country, has revised their Manatee Recovery Plan (2001) to a Manatee Management Plan (2007), while Belize, as a developing country, has a Manatee Recovery Plan (1998), but there are no updates on any actions taken place. The researcher will consider an alternative for Belize to utilize but reviews both documents and develop discussions on how Belize may address their problem and examine how Florida's reactive jurisdiction has allowed a solid manatee population.

Interview Overview

An interview was conducted with a marine biologist in Belize, Mr. Jamal Galves who has been involved with the Manatee Research Program for 30 years; which is primarily in Belize, responsible for the Antillean manatee's population and their challenges information on the manatee's population threats, contributions, and enforced laws. Also, the interview will allow the researcher to present recent information on the progression of the project, and give insights on the new efforts being prepared into revising the recovery plan.

Literature Review

West Indian Manatees - Humans

Besides manatee specialists, the public is often ignorant of the significance and do not understand the impact^[06] of manatees and their interactions with humans. It is often overlooked and deemed as unimportant. However, this review presents the impacts and threats faced by these sentinel species, and how they have evolved over the years. Florida has manifested their proposed ideas to limit the threats and management regulations that have significant intervention with manatee protection. The Florida Manatee Management Plan (2007) delivered discussions pertaining to their regularity efforts and the human conflict and benefit from these aquatic mammals. The researcher wishes to use Florida's Manatee Management Plan (2007) as a guide when revising the recovery plan for Belize. O'Shea and Salisbury (1991) initiated on protection of Belize's manatee habitat mainly since it is their prime habitat in the Caribbean, like Florida being the leading region for protection of the West Indian manatees.

Sentinel Species - Habitat and Ecosystem's Health

Manatees have occupied a unique niche in both North, and Central America, coastal estuaries, mangroves and river habitats since they are the only herbivorous marine mammal (Bonde & Aguirre & Powell 2004). Being the only herbivorous marine mammal, their feces is rich in

nutrients, which contributes to the growth and health of aquatic plant life, since the seagrass already provides overall nutrients that relates to the mangrove ecosystems. West Indian Manatee grazing has allowed for seagrass beds to have a greater diversity and improve the composition of their nutrients. Having a vast number of sea grass beds allows for healthier and more diverse flora and faunal species. Also, conservation geneticist, Margaret Hunter (U.S. Geological Survey), who led a molecular DNA study of genetic diversity in the Antillean subspecies in Belize, the genetic diversity of Belize's manatees is lower than classic examples of critically low diversity.

Anthropogenic threats to the West Indian Manatee include:

- i) Pollution – Dredging and Harmful Algal Blooms
- ii.) watercrafts collisions
- iii.) tourism
- iv.) illegal poaching/hunting

Pollution – Dredging and Harmful Algal Blooms

As mentioned above, the threats to manatees and influences on their seagrass beds includes poor water quality and dredge-and-fill operations, which relates to fluctuations in salinity and excessive nutrient enrichment. Also, pollution in the form of domestic waste, as well as agricultural and industrial runoff have the capacity to enter waterways used by manatees. Once in the water, suspended toxic ions and those attached to aquatic vegetation are readily consumed. This consumption may prove fatal if the heavy metals accumulate substantially in animals' systems over time, but this fatality has not been proven for manatees. Additionally, solid waste such as plastics, paper, and sponges can also be ingested, causing almost immediate death (Auil 1998). As these types of waste are found washed-up on coasts and quays, they indeed pose a risk for free-ranging manatee in our waters. On the positive side, manatees are not called sentinel beings for no reason, as the ecological impacts of industrial warmth have allowed them to adapt and protect themselves from extreme cold winters. However, in the summers the manatees, as well as other fish species, tend to lose their resilience in the water, and die off frequently due to chronic exposure to thermal pollution causing an unbalanced marine ecosystem.



Figure 1. Pollution in Lake Okeechobee, Florida <http://www.chicagonow.com/commit-to-get-fit/files/2016/07/admin-ajax.png>

Watercrafts Speed Zones

It is necessary to monitor watercraft and implement protection zones to maintain seagrass beds, since they are the significant area where the manatees live. Boat speed zones that have been established, and the impacts to the size and placement of boat facilities in Florida, are the most visible manatee conservation efforts that have the potential for social impact (U.S. Fish and Wildlife Service, 2001). Manatee speed zones can create longer transit times, may eliminate certain types of water sports, and can affect traffic patterns and boat distribution. While impacts on individuals' ability to engage in specific activities at specific sites may be significant, the degree to which each waterway user is impacted varies. For speed zone areas, they may be viewed negatively by some water sport enthusiasts, such as water skiers, and viewed positively by other users, such as canoeists and kayakers. Due to the low availability of unregulated waters, some users may adapt their use patterns, but effects on other users may be more detrimental (U.S. Fish and Wildlife Service, 2001) Many of the slow-speed or non-motorized zones are in areas where fishing occurs, and these restrictions can have both negative and positive effects on the fishing experience. Negative effects include longer times to reach the areas and the inability to fish in as many areas within a certain amount of time. Positive impacts include less frequent disturbance from other boaters in these sites, resulting in a higher-quality fishing experience.

Whereas, Belize mariners do not respect the precautionary slow boat speed zone. Local fishermen rely heavily on fishing for subsistence and primary income for a significant section of the population (Auil, 1998). Furthermore, marine based tourism is a rapidly growing and nationally an important industry, and both tourism and fishing depend on healthy and productive marine environments.

Tourism

Manatees have now become tourist, yet ironically, have become accidental victims of water-based recreation and tourism activities. Florida's marine mammals now cause problems for themselves because they will often voluntarily interact with humans, making it difficult to avoid physical encounters; harassment by divers and photographers is often noted, prompted by the docility of the animals. They are also attracted to marinas and popular boating areas because they receive food, in defiance of published codes of conduct (Shackley, 1992). In Florida, guidelines have been produced to maximize visitors' chances of seeing a manatee and to provide a measure of protection for the animals. These include advice to wear polarized sunglasses (enabling a person to see a manatee underwater), to approach slowly and quietly, preferably in a canoe or dinghy, to increase the chances of an encounter and to avoid excessive noise. Divers are advised to snorkel and avoid using scuba gear, but this recommendation is frequently ignored because of the differential profit margins of dive shops. An additional threat is provided by a new fashion for manatee watching by helicopter over the Crystal River area (Shackley, 1992).

Increasing coastal development have had some negative effects on Belize's manatee populations. The main issues surround tourism, sport fishing, the use of gill fishing net entrapment that cause destruction of mangrove beds for housing construction. Collisions with manatees also occur more frequently as tour operators switch from traditional low power canoes to increasingly larger craft with high power motors. The Belize government, community-based organizations and the US Fish

and Wildlife service have joined forces to conduct education campaigns to increase awareness of these stressors (Luther, 2007, para 6).

Illegal Hunting - Poaching

Auil (1998), reports of declining manatee populations due to hunting date back to the 19th century. Despite the Manatee Protection Ordinance of 1935, and the more recent protection under the Wildlife Protection Act, illegal hunting has persisted. Poaching and hunting was initially practiced in Southern Belize by the indigenous people that resided in traditional villages (Auil 1998). Other reports of manatee bones at butcher sites is evidence that manatees are still taken for local consumption, but currently the primary threat is the exportation of meat to neighboring countries, such as Honduras and Guatemala. Cases of poaching and hunting were rather rare in the Florida region.



Figure 2: Poaching in Southern Belize – Toledo
http://www.tidebelize.org/sites/default/files/public/users/user1/manatee_03.jpg

Discussion

The researcher developed a comparative analysis table that considered the main differences and similarities of Florida's Manatee Management Plan and Belize's Manatee Recovery Plan.

Chart 1. A comparative analysis table of current West Indian manatee population and the management plan highlights - Belize (right) and Florida (left)

Belize	Florida
<ul style="list-style-type: none"> • Population of Manatees – approximately 1,000 • Increasing demand on coastal tourism • Current Policy: Manatee recovery plan (1998) • Precautionary measures for protected areas by: <ul style="list-style-type: none"> ○ establishing manatee sanctuaries with slow boating speed zones ○ introduce poaching education and appropriate fishing gear ○ restoration of habitat degradation 	<ul style="list-style-type: none"> • Population of Manatees – around 6,300 • High demand on coastal tourism • Current Policy: Manatee management plan (2007) • protection zones (federal and state level) such as: <ul style="list-style-type: none"> ○ waterway marker posting and maintenance schedule ○ boater education ○ manatee harassment decline ○ future habitat restoration/development restrictions

Socio- Economic and Policy Impacts on Watercraft

Marine fisheries are important as they are providers of food and economic resources to fishing communities around the world, however they are declining globally. Florida’s Manatees Management Plan (2007) presents several instruments that’s displayed potential in providing both conservation and sustainable use of marine resources, including Marine Protected Areas (MPAs) and no-take zones. The success of such management systems that limit or restrict access to marine resources depends on the extent to which fishers are willing to participate. For instance, in Florida manatee deaths and injuries entrapment in water-culvert pipes, crushing (in flood-control structures, in canal locks, or between large ships and wharfs), entanglement in fishing gear or debris, and incidental ingestion of debris accounted for approximately 6% of all documented manatee deaths over the past two decades (Ackerman & Wright, 1997). Their manatee population seem to be stable, since they have been implementing strict regulatory. As a leading marine based tourism zone their sustainable practices need to be monitored to keep these animals around longer. It states in Florida’s Management Plan (2007); studies were done regarding boater’s opinions of speed zone regulations which the majority agreed on. Boaters supported the protection of marine life and the manatees. In Florida, these protection zones can be configured in a few ways with various restrictions. Examples of manatee protection zones include idle- and slow-speed areas, higher speed travel corridors (usually 25 or 30 MPH) within slow-speed zones, shoreline buffer zones, seasonal zones, no motorized areas, and no-entry areas (Florida Fish and Wildlife Conservation Commission, 2007).

Although in Belize there is only a fraction of boats compared to Florida, the several deaths classified as “unidentified” due to lack of proper necropsy training, resulted to only surmise the

deaths. In Belize, under the Belize Port Authority Act, the limits for ports are controlled. As marina siting is an important land use planning issue, they should be placed where the least possible impact to manatees and any other endangered species will occur. Regulating marina numbers and sizes also regulates, to an extent, the number of boats, and consequently the number of boat-related manatee mortalities (Reynolds, 1988). According to the Fish and Wildlife research institute, boat advocacy groups say that Florida has focused too much attention on the boating regulations and not enough on water pollution and habitat loss.

On the other hand, recovery plans are designed with little regard for marginal economic benefits relative to costs, nor with much regard for ecological-economic interactions. Recovery plans exclude the value of information that allows the government/ policy makers to make decisions. Recovery plans tend to take long to develop, since approval is a separate matter plus funding does not seem to be available. According to Jamal Galves, Belize's manatee recovery plan has been outdated (1998), while Florida has an updated manatee management plan. The researcher establishes that as the main difference in examining both document orientations.

Jamal Galves continues, "these policies are well out dated and dates all the way back to 1981. We have been lobbying for the revision of the policies." These recommendations should be achieving some level of expansion in the near future, however, he believes that the financing is distributed where the economy benefits such as ecotourism projects. Galves mentions, in the interview that he doesn't have any issue with utilizing the manatees as an ecotourism component but he wants the government to consider the manatees when establishing any project. He understands the importance of having innovation but he is concern when it comes to financial mechanisms.

Socio-Cultural Impacts and Tourism

In Belize, since manatee ecology is not adequately studied in this region, local ecological knowledge can be used to fill the baseline information gaps. Unwanted human disturbance can be minimized by encouraging community participation. This can be ensured and sustained by facilitating the livelihood of the coastal community. Jamal Galves, a local biologist who has been working on this project says "starting 1997 and the interest from the community has grown drastically due to the increase in threats to an already fragile and endangered population." However, he mentions "the policies are outdated and has been lobbying for revision," and therefore, the Manatees project's major concern is to spread awareness. Galves continues, "working in collaboration between US NGO Sea to Shore Alliance in Florida and the Coastal Zone Management Authority and Institute in Belize I developed biology and conservation skills that include the following: coordinate the Belize Maine Mammal Stranding Network, and working group, track manatees and study their behavior and activities (occupy a vital role in the Belize Manatee Capture and Tagging), provide assistance to dead and stranded manatees and rehabilitation efforts, conduct manatees and marine ecosystem awareness in schools along with sea grass and environmental monitoring. I assist in communications with rehabilitation partners, states and local authorities and other groups as directed. Finally, assisted with the sustainable livelihood and awareness campaign in small, poverty-stricken stakeholder communities of a protected area."

Galves assisted, in the launch of the website www.galespointbelize.com, and highlighted natural treasures of protected areas and cultural uniqueness. Interviewee Galves, grew up in a local community in Belize, Gales Point Manatee Village; he explained how the village was initially the target development for a community- based rural ecotourism project. Belsky (2000) introduced the community- based conservation (CBC) was established to correct human injustices and social impacts together with a protected area management that subordinated resident peoples' welfare and rights together with local economic development to environmental preservation. It was simply a local beneficial way to use rural landscapes and cultures (Belsky 2000). However, the distribution of members to perform certain tasks were biased because work was done mainly by foreigners. The only locals that were hired were the tour guides that benefited from this project. Other villagers were not considered.

Together, the attention was never devoted to analyzing community, or how community history and social processes might affect outcomes on the ground. Bengtson and Magor (1979) described the foreign conservationist's image of Gales Point community not acknowledging differences within the community, nor how these differences could affect ecotourism and use of natural resources, local politics and strategies for pursuing multiple interests beyond the local community. International conservationists, other interest groups, and funders should be more aware of the political and economic context which includes not only them but local people and communities. Locals eventually started putting their own input by developing surveys and produced feedback on the abundance and distribution of manatees. Although manatees continue to be hunted near some coasts in Belize it seems to not be the main threat (Bengtson & Magor 1979).

Economic Benefits from the Manatee's Habitat

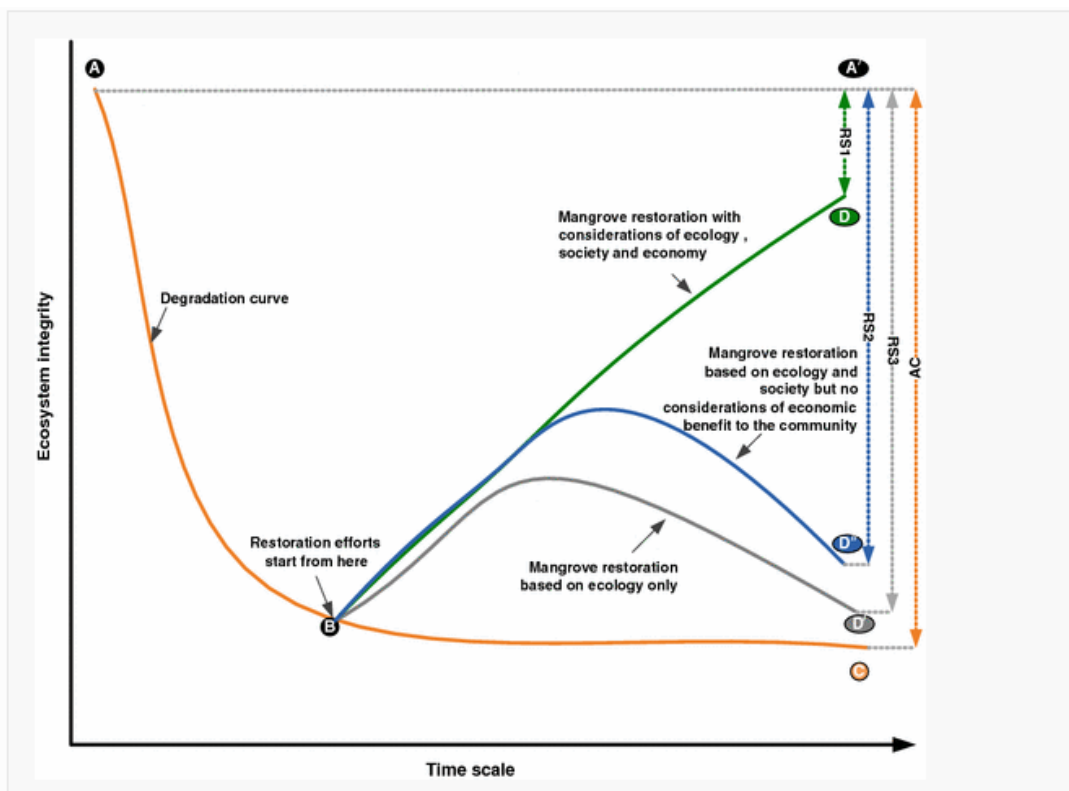
The United State Endangered Species Act (1973) is probably the most comprehensive of all environmental laws. An act benefits the entire nation when protecting endangered species and is portrayed as the exemplar of the most extreme policy of government intervention. However, most of the cost imposed by the act are borne by private landowners. Economists, on the other hand want to debate on whether the cost is exceeding the social benefits, since the price of the act seems to be too high. The primary intention is to save all species and their habitats because of their intrinsic value rather than relative costs and benefits (Brown & Shogren 1998). Therefore, a species with a high economic cost of recovery and possibly low economic benefits has the same standing as a species with greater benefits and less cost.

Seagrass beds provide more of some indirect economic benefits through their function as fish nurseries by providing food and habitat for adult fisheries species, and through erosion control; while mangroves provide a series of direct economic benefits (Brown & Shogren 1998). The government, private sector, and communities are responsible to restore them, but it all depends on the decision-making criterion. A cost-benefit analysis would be significant to examine if the cost to plant mangroves or seagrass is feasible considering the benefits (Brown & Shogren 1998). There is a primary direct benefit of seagrass habitat in sediment stabilization. The benefit of seagrasses depends on the nursery and other adult fisheries. When restoration occurs, it is difficult because the places are polluted, sometimes due to high currents and heavy storm events. However, it is essential to act right away or establish a small initiative that will be beneficial to the ecosystem in the longer-run.

Mangrove Restoration Impacts on Manatee's Habitat

Mangrove restoration is a much younger technology than an upland reforestation, especially in Belize where temperature zones receive far less attention, funding, and research. Belize is known to be a small coastal developing state which is recognized as having a particularly vulnerable economy, while bearing responsibility for a 'significant portion of the world's oceans and seas and their resources' (LaCommare & Self-Sullivan & Braul 2008). Another example of a small coastal developing state is South East Asia, which developed a theorem that initially laid out the differences when referring to guidelines in restoring their mangroves. Restoration of mangroves following anthropogenic degradation is complicated since it requires a holistic approach, which involves integrating socio-cultural and economic issues of coastal communities along with the ecological issues of the mangrove habitat (Biswas & Mallik & Choudhury, 2018). Uncertainty is presented on whether the ecosystem will be restored to its actual pre-degraded state. Nevertheless, the following graph presents a gap between the disturbed and the restored ecosystem states, thus defining the best initiative.

Chart 2. A conceptual graph that illustrates the restoration of mangrove in South-East Asia (Biswas & Mallik & Choudhury, 2018)



Above is a conceptual graph which examines the restoration of Southeast Asian mangroves. A gap between disturbed (C) and restored (A) ecosystem levels. Restoration initiatives start from (B). The first, BD' displays restoration including only the ecological factor. The second, BD'' displays consideration of society and ecological, excluding the economic benefits to the community. The final slope, BD displays a smooth upward curve with considerations of the economical, societal and ecological factors.

Clearly, the graph reflects the status quo scenario, only utilizing an ecological restoration management plan (grey plot line D) when implementing a framework, however society and economy are potentially greatly inter-related with ecological restoration. Society cannot stand alone without having any economic impact, so considering both factors contributes to a positive mangrove restoration. The case of economic value on ecosystem services and the development of mangrove areas benefit society in the long term, but may not be enough to attract the working-class people that inhabit the coastline areas in South-East Asia (Biswas & Mallik & Choudhury, 2018). However, the third slope does present an alternative that Belize could utilize since it encompasses all three factors of sustainability, social, economic and ecological.

Although manatees are not found in South-East Asia, both their economies are vulnerable, therefore, Belize should adopt South-East Asia framework to restore their mangrove forests. Another challenging factor when protecting mangrove swamps in the Caribbean is the lack of adequate legislation for coastal conservation (remove measure). However, actions may include conversion of the newly accreted lands where mangroves develop naturally into land use for humans or conversion of productive mangrove forests into other land management. It is only fair to protect the habitat by implementing management plans, but cultural and/or natural capital should be considered in any management approach. Developing societies such as Belize can more readily accept the role and relationship of nature with human activities before development is out of control. Yet it is true that in Belize the problems faced with the manatee protection is difficult for various other reasons. Developed countries like Florida are more concerned about coastal developments for tourism but neglect initiatives to restore the ecosystem and manatee habitat. If coastal development continues latter consequences will occur, therefore, the both regions will learn from each other, but focus on the ability to manage a system that responds to feedbacks not only from the ecological principles.

Delisting- Endangered to Threaten

On January 7, 2016, the U.S. Fish and Wildlife Service (UWS) announced that the West Indian manatee is to be reclassified from endangered to threatened status under the Endangered Species Act (ESA) (Platt 2016). Given its review of the best scientific efforts and analyses of threats and demographics, the Service believes the West Indian manatee no longer fits the Endangered Species Act (ESA) definition of “endangered” (Platt 2016). Scientific efforts and analyses included the Castel Blanco-Martinez’s Population Viability Analysis model for the Antillean manatee that describes a met population with growth and Runge et al.’s Core Biological Model predicts that it is unlikely (less than 2.5 percent chance) the southeastern U.S. population will fall below 4,000 total individuals over the next 100 years, assuming current threats remain constant. Another factor that prompted the UWS to act in reclassifying is the 2007 five-year review recommendation that addressed several priority recovery actions, such as additional protections for wintering manatees, which are being considered by Crystal River National Wildlife Refuge for its Three Sisters Spring unit. The Service continues to work with other partners to restore warm water springs, and there is also collaboration with Florida’s power industry to address warm water habitat needs.

Although this is true, there are nearly 200 species for which enough data warrants endangered or threatened status, but the budgets for listing are inadequate. The budget only caters from around 100 species, so the rest are eliminated from the list and causes confusion about the conservation

status. (Gardner & Brown & Shogen 1998) Additionally, there are no specific priorities for listing species as endangered, so economists are not surprised that delisting the species that they like best despite the prescription against ranking in the Endangered Species Act. It is difficult to avoid the correlation between an endangered species and the expected net economic benefit of its preservation. Although their corresponding levels of biological diversity are not priced by the market, economists are seeking the least cost solution to achieve the ecological based standard. Resources are scarce and some attempt should set balance so that the policymakers allocate funds to their highest value use (Gardner & Brown & Shogen 1998). By comparing the cost and benefits of endangered species protection, it allows for plausible adjustments for uncertainty in ecosystem functions and irreversibility.

Recommendation - Conclusion

A conflict situation has evolved in regards to West Indian manatees, the headlines in the beginning of this year, where the U.S. Fish and Wildlife Service proposed the Florida manatee and its relative the Antillean manatee delisted to “threatened” (Waymer 2016). A population viability analysis (PVA) was utilized in Florida and scientists recommend PVA to be used in other areas in the Caribbean, including Belize for the entire Antillean manatee meta population. The PVA is to identify the way in which fragmentation, environmental uncertainty, and reproductive factors are interrelated and contribute to the extinction process (Marmontel & Humphrey & O’Shea 1997). The results of the model can then be used to provide recommendations to policy and decision makers that could help develop appropriate management plans for the subspecies. The researcher argues that an analysis should not focus on scientific findings but also serve as social facilitators, and communities will develop regularities that are inclusive of social, cultural and economic entities.

Also, some conservationists from Florida and other regions including Belize are not pleased with this since it leads to a further serious issue where the populations of Antillean manatee may eventually go extinct. Jamal mentioned in his interview, “their assessment (Florida) doesn’t consider what is happening in Belize.” He has worked ten years with the program, and is certain that the Antillean sub-specie is not ready to be delisted. Galvez continues, “The increase in the mortality has lead me to think that there is most definitely a decline as most animals being killed are younger and would likely live some 30 more years.” To conclude, the anthropogenic stressors provided each region with information on how to mitigate and enhance managerial objectives. For, example how will implementations benefit not only the manatee’s habitat but humans that utilize the area. A recovery plan should be revised despite its low support given, therefore it must strive to form a proactive management strategy. The strategy will have a sustainable impact on habitat restoration by incorporates societal, economic and ecological management entities. Belize is at an advantage since restoration efforts are steadily rising, especially in tourism the coastal development keeps increasing but there is still time to initiate action.

References

- Ackerman, B. and Wright, S. et al. (1997). Trends and Patterns in Mortality of Manatees in Florida 1974-1992 retrieved from:
https://www.researchgate.net/profile/Robert_Bonde/publication/285637681_Trends_and_patterns_in_mortality_of_manatees_in_Florida_1974-1992/links/56b205df08ae56d7b06c9a49.pdf
- Auil, N. (1998). Belize Manatee Recovery Plan: UNDP/GEF Coastal Zone Management Project. First edition. Belize: *The Angelus Press*. 1–67.
http://eprints.uberibz.org/3/1/Belize_Manatee_Recovery_Plan.pdf
- Belsky, J.M. (2000). The Meaning of the Manatee: An Examination of Community-Based Ecotourism Discourse and Practice in Gales Point, Belize. *People, Plants, and Justice: The Politics of Nature Conservation. - Law*. Retrieved from https://books.google.ca/books?id=inCap0H1wyEC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
- Bengtson, L.J. and Magor, D. (1979). A Survey of Manatees in Belize. *Journal of Mammalogy*, Vol. 60, No. 1 pp. 230-232
retrieved from: <https://www.jstor.org/stable/pdf/1379785.pdf>
- Biswas, S.R., Mallik, A.U., and Choudhury, J.K. et al. (2008, August 09). A unified framework for the restoration of Southeast Asian mangroves—bridging ecology, society and economics. *Wetlands Ecology and Management*. doi:10.1007/s11273-008-9113-7
- Bonde, R.K., Aguirre, A.A. and Powell, J. Eco Health (2004, September). Manatees as Sentinels of Marine Ecosystem Health: Are They the 2000-pound Canaries? Volume 1, Issue 3, pp 255–262 retrieved from: <http://link.springer.com/article/10.1007/s10393-004-0095-5>
- Brown, M.G. and Shogren, F.J. (1998). Economics of the Endangered Species Act. *The Journal of Economic Perspectives*. Vol. 12, No. 3 Summer, 1998, pp. 3-20
Retrieved from <http://www.jstor.org/stable/2647029>
- Castel blanco-Martinez et al. (2012). Potential effects of human pressure and habitat fragmentation on population viability of the Antillean manatee *Trichechus manatus manatus*: a predictive model. *Endangered Species Research*. Vol. 18: 129–145 doi: 10.3354/esr00439
- Caribbean Critters. (n. d.). retrieved from
<https://ambergriscaye.com/critters/manatee.html>
- Defenders of Wildlife (2017). Threats to Florida Manatees.

Retrieved from <http://www.defenders.org/florida-manatee/threats>

Florida Fish and Wildlife Conservation Commission. (2007, December). Florida Manatee Management Plan. Retrieved from: <http://myfwc.com/media/415297/manateemgmtplan.pdf>

Figure 1. Pollution in Lake Okeechobee, Florida. retrieved from <http://www.chicagonow.com/commit-to-get-fit/files/2016/07/admin-ajax.png>

Figure 2. retrieved from http://www.tidebelize.org/sites/default/files/public/users/user1/manatee_03.jpg

Hunter, E. M. et al. (2012 October 10). Puerto Rico and Florida manatees represent genetically distinct groups. Retrieved from DOI 10.1007/s10592-012-0414-2

LaCommare, K. Self-Sullivan, C and Braul, S. (2008). Distribution and Habitat Use of Antillean Manatees in Belize. Retrieved from file:///F:/LaCommare%20et%20al%202008%20Dist%20&%20habitat%20use%20of%20Tmm%20in%20Belize.pdf

Luther, C. (2007). Manatee Tours in Belize. *USA Today* retrieved from <http://traveltips.usatoday.com/manatee-tours-belize-11347.html>

Marmontel, M., Humphrey, S.R., O'Shea, T.J. (1997). Population viability analysis of the Florida manatee (*Trichechus manatus latirostris*), 1976-1991. *Conservation biology*. Retrieved from <http://onlinelibrary.wiley.com/doi/10.1046/j.1523-1739.1997.96019.x/full>

National Geographic Society. Manatees. (n. d.) retrieved from <http://www.nationalgeographic.com>

Odell, D.K. (1981). Growth of a West Indian manatee, *Trichechus manatus*, born in captivity. Pages 131-140 in R.L. Brownell, Jr. and K. Ralls, eds. *The West Indian manatee in Florida. Proceedings of a workshop held in Orlando, Florida 27-29 March 1978*. Florida Department of Natural Resources; Tallahassee, Florida. ORYX VOL 25 NO 3 July 1991 Retrieved from file:///F:/O'Shea%20&%20Salisbury%201991%20Belize%20manatees.pdf

O'Shea J. T.; Salisbury A, C.; (1991, July) Belize- a last stronghold for manatees in the Caribbean. Volume 25, Issue 3, pp. 156-164 retrieved from <https://doi.org/10.1017/S0030605300034189>

Platt, R.J. (2016, January 27) Manatees in Belize face increasing threats from

development—and potentially from the U.S. Think Manatees Are Recovered? Look Farther South. *Scientific American*. retrieved from <https://blogs.scientificamerican.com/extinction-countdown/manatees-belize/>

Reynolds, J. E. and C. J. Gluckman. (1988). Protection of the West Indian manatees (*Trichechus manatus*) in Florida. Final Report to U.S. Marine Mammal Commission in Fulfillment of Contract MM4465868-3 and MM3309741-7. 84pp.

Shackley, M. (1992). Manatees and Tourism in Southern Florida: Opportunity or Threat? *Journal of Environmental Management* 34, 257-265 retrieved from www.sciencedirect.com/science/article/pii/S0301479711800022

Sorice, M.G., Shafer, C.S. & Ditton, R.B. (2006). Managing Endangered Species Within the Use-Preservation Paradox: The Florida Manatee (*Trichechus manatus latirostris*) *Environmental Management* 37: 69. doi:10.1007/s00267-004-0125-7

Sorice, M. (2001. November 28) Minimizing Harassment of the West Indian Manatee (*Trichechus manatus*) in Crystal River, Florida. *Viewing Marine Mammals in the Wild: A Workshop to Discuss Responsible Guidelines and Regulations for Minimizing Disturbance*. pp. 109. retrieved from http://www.nmfs.noaa.gov/pr/pdfs/education/viewing_workshop.pdf

Sulzner, K. Johnson, K. C. Bonde R. K., Gomez A. N. et al. (2012) Health Assessment and Seroepidemiologic Survey of Potential Pathogens in Wild Antillean Manatees (*Trichechus manatus manatus*) retrieved from <file:///F:/Sulzner%20et%20al%202012%20HA%20&%20seroepidemiologic%20survey%20of%20Tmm.pdf>

U.S. Fish and Wildlife Service. (2001). Florida Manatee Recovery Plan, (*Trichechus manatus latirostris*), Third Revision. U.S. Fish and Wildlife Service. Atlanta, Georgia. 144 pp. + appendices. Retrieved from https://www.fws.gov/northflorida/Manatee/Recovery%20Plan/2001_FWS_Florida_Manatee_Recovery_Plan.pdf

U.S. Fish and Wildlife Service. (2016, November) North Florida Ecological Services Office. Retrieved from https://www.fws.gov/northflorida/manatee/2016_Reclas_Proposal/20160107_faq_12-mo_Proposal_FAQs.htm

Waymer, J.; (2016, January 07) Feds to reclassify manatees from 'endangered' to 'threatened'. *Florida today*. Retrieved from <http://www.floridatoday.com/story/news/local/environment/2016/01/07/feds-reclassify-manatees-endangered-threatened/78415242>