A critical assessment and gap analysis of existing recovery strategies for the Atlantic leatherback sea turtle (*Dermochelys coriacea*)

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By

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Abstract

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The leatherback sea turtle (*Dermocheyls coriacea*) is the fourth largest and most widely distributed species of reptile. There are three distinct populations in the Atlantic, Pacific, and Indian Oceans. The leatherback is globally categorized as Vulnerable by the ICUN, and faces a number of anthropogenic threats, both in its nesting and foraging habitats, that are causing concern for the conservation and survival of the species. Due to its vast distribution in the Atlantic many countries have created recovery plans to aid in managing the leatherback. Recovery plans from the United States, Barbados, St. Vincent and the Grenadines, the Guianas, Canada, Trinidad and Tobago, and Jamaica were evaluated using a set of indicators to assess implementation mechanisms and management and conservation efforts. Trinidad and Tobago had the most well addressed indicators, followed by Jamaica. However, all recovery plans evaluated had a respectable amount of well-addressed indicators. Threats were generally well addressed, however management gaps were seen in addressing the effects of sea level rise and climate change, and within addressing threats to the critical foraging habitat. Further, persistent challenges were identified in assessing leatherback abundance and identifying critical habitat. Further research could aid in addressing these knowledge gaps and along with the recommendations of this study could strengthen leatherback management for future recovery plan initiatives.

Keywords: Leatherback Sea Turtle, *Dermochelys coriacea,* Recovery Management, Recovery Plans, Gap Analysis, Indicator Evaluation, Highly Migratory Species, Threat Management, Species at Risk

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Abbreviations and Acronyms

CITES   Convention on International Trade in Endangered Species of Wild Flora and Fauna

ENGO   Environmental Non-governmental Organization

MARPOL   The International Convention for the Prevention of Pollution from Ships

NGO   Non-governmental Organization

SARA   Species at Risk Act (Canada)

UNEP   United Nations Environmental Programme

WIDECAST   Wider Caribbean Sea Turtle Conservation Network

WWF   World Wildlife Fund

Chapter 1. Introduction

1.1 Managing Highly Migratory Species

Migration is a behavior that allows an individual to exploit seasonal resources at different locations while simultaneously avoiding seasonal resource deficiencies at other frequented habitats. Migration has evolved independently in a wide diversity of taxa in both the marine and terrestrial environment, and is advantageous for species that are exposed to seasonal variations in the quality and quantity of resources (Shuter et al. 2010). Migratory behavior itself is also diverse, as migrations can be aggregative or solitary and some species exhibit partial migration, meaning that populations could include both migratory and non-migratory individuals. There are also some species that are considered to be highly migratory or long-distance migrants (Shuter et al. 2010). The term "highly migratory" is typically associated animals that are capable of migrating thousands of kilometers, often making transboundary movements across multiple jurisdictions and through the high seas (Maguire et al. 2006). Long-distance migrants that enter multiple jurisdictions are more susceptible to anthropogenic threats and over-exploitation (Shuter et al. 2010). This is partly due to differing natural resource use policies, management capacities, and conservation objectives and priorities (Richardson et al. 2013). Furthermore, highly migratory marine species that enter the high seas become susceptible to international fishing pressures from countries that may not be signatories to international laws (Miller 2007).

Studies have urged proper monitoring and management of highly migratory species (Harris et al. 2009), however doing so has been challenging. Migratory behavior is one of many factors that make management of highly migratory species challenging. In addition, creating management plans for each migratory species within a country's jurisdiction can be time consuming and costly. There are additional challenges associated with managing highly migratory marine vertebrates, as basic understanding of their entire range has been limited due to the extensive time they spend in the open ocean. This has been especially true of sea turtle and whale species (Richardson et al. 2013).

A common management strategy for the conservation of migratory species is the establishment of protected areas (Singh and Milner-Gulland 2011; Shuter et al. 2010).

Protected areas or reserves are geographic areas where harmful anthropogenic activities (i.e. destructive fishing practices or hunting) are limited or prohibited for conservation purposes. The success of protected areas in managing migratory species has been variable (Shuter et al. 2010), as the area would have to be relatively large to effectively protect a long-distance migrant throughout its range. In addition, migratory routes can vary seasonally and yearly, which makes planning and implementing static protected areas very challenging (Shuter et al. 2010; Singh and Milner-Gulland 2011). Examples of using networks of smaller protected areas to effectively manage highly migratory bird species do exist. This has primarily involved establishing protected areas at critical stopover areas along migration routes (Shuter et al. 2010).

Alternative solutions to protected areas are primarily aimed at mitigating anthropogenic threats. These may include broad scale strategies such as banning certain types of fishing and hunting gear. For example, using circle hooks within the Canadian longline fishery has aided in dramatically decreasing the number of leatherback sea turtle (*Dermochelys coriacea*) deaths from incidental catch, as this hook type allows the individual to stay at the surface until it can be manually released (Atlantic Leatherback Recovery Team 2006). Additionally, programs have been established in the Caribbean that compensate fishermen for releasing entangled wildlife from their nets. Due to the financial compensation to fix expensive nets, programs such as this have had relatively high success (Forestry Division of the Government of the Republic of Trinidad and Tobago et al. 2010). Other strategies to mitigate anthropogenic threats include implementing more sustainable management practices such as stricter harvesting restrictions, and the construction of wildlife corridors to reduce the impact of anthropogenic barriers such as highways. These management strategies can be used in conjunction with protected areas or independently when protective areas may not be an appropriate management strategy (Shuter et al. 2010).

1.2 Leatherback Sea Turtle Ecology

Leatherback sea turtles are the fourth largest species of reptile and can be over 2m in length and exceed 500kg (Chen et al. 2015; Hays et al. 2006). The leatherback is

characterized by its soft leather-like shell, and unlike other sea turtle species its shell is composed of bony plates (called osteoderms). The flexibility of the osteoderms allows for compression from hydrostatic pressure during deep dives (up to 1200m) and expansion during air intake (Chen et al. 2015).

Leatherback sea turtles spend the majority of their lifetime in the open sea. They occupy all dimensions of the ocean, diving deeper than 1000m and occasionally venturing to shallower waters on the continental shelf. After the nesting season, leatherbacks will part-take in an ocean-wide migrations in search of food (Hays et al. 2016). The general pattern is moving to high latitudes by the fall before heading south again at the start of winter (Hays et al. 2016), however some individuals tend to disperse to the east and remain in tropical waters (Ferraoli et al. 2004). Turtles nesting in similar areas in the Caribbean can disperse to very different areas post-nesting, travelling between 30 to 80km a day. Most leatherback individuals tend to continuously move through the Atlantic while feeding, however some individuals may remain in feeding hotspots for extended periods of time. Diving behavior in the leatherback has been found to be highly associated with the vertical migrations of jellyfish, their primary prey (Hays et al. 2016; James et al. 2006).

Leatherback sea turtles have the most extensive range of all reptile species (Martin and James 2005), with populations residing in the Atlantic, Pacific and Indian oceans. Further, it has been confirmed that there are three individual sub populations in the Northwest, Southeast and Southwest Atlantic (Wallace et al. 2013). Leatherback sea turtles were once categorized as critically endangered on the IUCN Red List, however the global status has now been revised to Vulnerable. The status of leatherback sea turtles are also categorized by subpopulation due to variations in populations tends (Rivas et al. 2015). The status of the Northwest Atlantic population was recently revised to Least Concern (Wallace et al. 2013) as recent studies (such as Tomilli et al. 2015 and Rivas et al. 2015) have indicated that Atlantic leatherback sea turtle populations are stable and in some cases increasing. A contributing factor to the success of the Atlantic populations may be the intensive beach patrols, which have aided in significantly decreasing the amount of poaching activity (Rivas et al. 2015). 2013). Waters off the coast of Nova Scotia, Canada may support the highest seasonal densities for foraging adults in the Northwest Atlantic. A

14-year opportunistic sighting study conducted by Archibald and James 2016 determined a relative abundance of 564 individuals in one site off of Cape Breton Island, Nova Scotia.

1.3 Threats to Leatherback Sea Turtles

During migration, leatherbacks are exposed to potential threats such as collisions with ocean vessels, pollution, and entanglement in fishing gear (Mrosovsky et al. 2009; Hays et al. 2006). Entanglement is now recognized as one of the primary causes of sea turtle mortality around the globe. Wilcox et al. 2013 reported that 80% of animals found entangled in lost fishing gear were sea turtles. Entanglement can cause long-term suffering through abrasions, limb loss, reduced ability to forage due to drag, starvation, and drowning (Nelms et al. 2016). Further, the leatherback's wide range in the Atlantic means that foraging areas often overlap with the pelagic long-line fishery. Due to this, entanglement within the lines can occur relatively frequently. Establishing protected areas at feeding hotspots has been considered insufficient because individuals often move between foraging grounds, rather than staying in one spot. Therefore, the key to reducing the incidence of entanglements may be to modify human activities such as fishing to ensure practices are sustainable (Hays et al. 2006).

Marine debris is another anthropogenic threat causing detrimental impacts to sea turtles. Plastics are the primary component of marine debris (40-80%), of which massive quantities are floating around in the ocean. The majority of plastic debris found in the ocean originates from land-based sources and is causing harm to many marine species (Barnes et al. 2009; Mrosovsky et al. 2009). Plastic threatens wildlife through the direct and indirect ingestion, entanglement, and by degrading habitat. Mrosovsky et al. 2009 looked at leatherback sea turtle necropsy reports and found a drastic increase in plastic consumption between 1960 and 1980, and it has been estimated that approximately one third of all leatherbacks have ingested plastics within their lifetime (Nelms et al. 2016). Despite this, a review of literature concerning plastic debris and sea turtles conducted by Nelms et al. 2016 found only seven peer reviewed publications investigating the occurrences of plastic ingestion by leatherbacks. Plastic bags are the most common plastic

garbage found in leatherback necropsies, however other plastic items such as fishing line, twine, pieces of balloons, plastic cutlery, and food wrappings have also been found.

Once ingested, debris (microplastics in particular) can leach harmful chemicals into biological tissues that could inevitably impact the turtle's immune system and can cause developmental and reproductive abnormalities (Nelms et al. 2016). Plastic obstruction has also been observed in nesting leatherback females. One documented case found that the female individual's cloaca was blocked, which prevented her from passing her eggs (Plot and Georges 2010). Other sublethal implications of debris ingestion include changes in buoyancy and diving behaviour, reduced growth rates, delayed sexual maturity, decreased physical capabilities, and decreased ability to avoid predators and ship strikes (Nelms et al. 2016).

Sea turtles are also threatened by marine debris on their nesting beaches as it can become buried in the sediment, limiting the acceptable habitat for nesting. Further, large amounts of plastic debris could deter a female from selecting a nesting site, in which case she may return to the ocean without depositing her eggs (Chacon-Chaverri and Eckert 2007). Debris also threatens the success of hatchlings, as plastics and other waste buried near a nest may increase the permeability and temperature of the sediment associated with the nest. Increased permeability may lead to desiccation of the nest, while increased nest temperatures could alter hatchling sex ratios, as warmer nests tend to produce more female hatchlings than male (Carson et al. 2011). Once the hatchlings are ready to emerge from the nest, they could become trapped by debris, wasting valuable energy that would otherwise be used to reach the sea. Debris can also cause the hatchlings to become confused and disoriented while emerging from the nest, making them more susceptible to predators (Nelms et al. 2016).

Nesting beaches are threatened by coastal development projects through increased human traffic, inadequate waste disposal, beach alterations and artificial light pollution. The latter has been identified as one of the most important anthropogenic threats impeding reproductive success of leatherback sea turtles (Rivas et al. 2015b). Artificial light from hotels and other coastal development projects can cause hatchlings to become disoriented upon emerging from the nest. This is because leatherbacks are primarily visual sea-finders and are drawn to the brightest areas within their field of vision once they hatch (Rivas et al.

2015b). This often means that their ability to detect natural cues is reduced in the presence of artificial light (Lorne and Salmon 2007). Rivas et al. 2015 found that leatherbacks are least influenced by long wavelengths of light (i.e. red and orange on the visual spectrum). For this reason, conservationists often use headlamps with red lights when conducting beach patrols. However, when moonlight is scarce all wavelengths (especially blue and white coloured lights) can cause some sort of hatchling disorientation. The same study urged that hotels aid in keeping nesting beaches dark and free of artificial light in order to promote reproductive success.

Along with coastal development, sea level rise as a result of climate change threatens the existence and availability of nesting habitat. If the sea were to rise 0.5m, 32% of the total current Caribbean beach area would be lost. Currently, the impacts of climate change on the leatherbacks, as well as how they will respond, are not well understood. Further, the impacts of climate change could vary over the entirety of their range. One concern regarding climate change is the potential for increased storm events, meaning that a large portion of nesting beaches could be inundated. A secondary concern involves how increased precipitation may impact hatchling success and therefore overall reproductive output. Increased water in nests could lead to mortality or smaller hatchlings due to low oxygen availability to the embryos (Patino-Martinez et al. 2014).

1.4 Management of the Leatherback Sea Turtle

Due to the vast distribution many jurisdictions have created management plans for the leatherback sea turtle. Management strategies vary globally and in some countries the government is the responsible management authority, while in others such tasks are outsources or taken on by environmental non-governmental organizations (ENGOs). Countries may participate in managing the leatherback sea turtle and other at-risk species to fulfill their commitments to international conventions and treaties. One of the most powerful international wildlife conventions is the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Haynes-Sutton et al. 2011). CITES aims to ensure that the international trade of plant and animal species does not impact their survival and recovery and in terms of sea turtle management, CITES strictly prohibits

the import and export of any sea turtle products. To date, there are 183 parties that are signatories to CITES (CITES n.d.). Other international conventions that provide a mechanism for countries to participate in the conservation and management of at-risk species, like the leatherback sea turtle, include: The Convention on Biological Diversity, The International Convention for the Prevention of Pollution from Ships (the MARPOL Convention), The U. N. Convention on the Law of the Sea, The Convention for the Conservation of Migratory Species, and the Convention on the High Seas (Haynes-Sutton et al. 2011).

There are a number of regional conventions and treaties that aid to promote collaborative conservation efforts. For example, the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (the Cartagena Convention) is considered to be one of the most important international agreements for the protection of sea turtles and their habitats in the Caribbean. The Cartagena Convention is coupled with the Caribbean Trust Fund and offers financial services associated with implementing recovery activities and for the development of recovery action plans (Haynes-Sutton et al. 2011). In the Americas, the Inter-American Convention for the Protection and Conservation of Sea Turtles (The Inter-American Convention) is an intergovernmental treaty that provides a legal framework for countries in the Americas and the Caribbean to take actions for the benefit of sea turtles. The Inter-American Convention mandates that the 15 parties "shall take appropriate and necessary measures in accordance with international law and on the basis of the best available scientific evidence for the protection and conservation and recovery of sea turtle populations and their habitats" (National Oceanic and Atmospheric Administration Fisheries 2014).

As mentioned, international and regional conventions are often used to guide and promote countries to take part in management and conservation efforts, however countries typically have national legislations and frameworks that guide specific recovery activities. In Canada, species that are considered endangered, threatened, or at risk for extirpation or extinction are managed using the Species at Risk Act (hereafter referred to as SARA). SARA was first passed in 2002 (Findlay et al. 2009), and aimed to help Canada meet its international conservation requirements (Environment and Climate Change Canada 2016). As SARA states, the purpose is "to prevent wildlife species from being extirpate or

becoming extinct, to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity and manage species of special concern to prevent them from becoming endangered of threatened."

Species listed for protection and management under SARA are placed on Schedule 1, and are then categorized as extirpated, endangered, or threatened. These species then receive a recovery strategy prepared by the competent minister. Recovery strategies are documents that identify threats to the species and its habitat and set population and distribution objectives for the species. In addition, the competent minister and department must also prepare one or more action plans which are based on the recovery strategy. Action plans must include the identification of the species' critical habitat (based on best available information), examples of activities that could result in the destruction of the identified critical habitat and measures to be taken to protect the identified critical habitat. As of December 31, 2015, SARA provides recovery strategies and management plans for 521 unique species. Leatherback sea turtles were first listed under SARA in Schedule 1 in June 2003, however they have been listed as endangered in Canada since April of 1981 (Environment and Climate Change Canada 2016).

The management of leatherback sea turtles in Caribbean nations is widely taken on by ENGOs. The primary ENGO taking on this responsibility is the Wider Caribbean Sea Turtle Conservation Network (WIDECAST). WIDECAST was founded in 1981 and is comprised of a network of biologists, managers, community leaders and educators. It currently operates in over 40 nations and territories in the Caribbean. Within each of these nations, a country coordinator is designated. WIDECAST then works closely with the coordinator to create a sea turtle recovery action plan based on best available science. They also assist in facilitating pilot projects, providing technical assistance, and aiding in building and strengthening community capacity by providing critical knowledge and skills to stakeholders (WIDECAST 2008b). WIDECAST also works in coordination with the United Nations Environmental Programme (UNEP) and other ENGOS, such as the World Wildlife Fund (WWF) to establish sea turtle recovery strategies. To date, WIDECAST has published sea turtle recovery action plans for Antigua and Barbuda, Aruba, Barbados, Belize, the British Virgin Islands, Jamaica, the Netherlands Antilles, Panama, St. Kitts and Nevis, St. Lucia, St. Vincent, Suriname, Trinidad and Tobago, and Venezuela (WIDECAST 2008a).

1.5 Management Problem

Creating recovery plans for at-risk species, such as the leatherback sea turtle, is time consuming and costly. To be successful, they require collaboration, research, and consultation with stakeholders. Once a recovery plan is published, it can remain the primary resource for informing management and conservation decisions for decades. This has seemingly been the case for the leatherback sea turtle, as many nations that participate in managing the species are still basing recovery activities on plans published in the early 1990's. Additionally, because recovery plans remain in effect for extended periods of time, it is possible that management and conservation decisions are being made using outdated practices and data. This could contribute to large gaps within the management of the leatherback sea turtle. This factor alone could be detrimental, as contemporary threats may not be sufficiently addressed in older recovery plans. An example of this is the uncertainty of how leatherbacks, other sea turtle species, and their critical habitats will adapt to the effects of climate change. For these reason, it is important that recovery plans be critically analyzed and evaluated to ensure they are effectively managing the target species. The Atlantic leatherback population has been successfully increasing (Tomillo et al. 2015), therefore keeping this momentum with effective management practices is critical.

1.6 Project Purpose and Objectives

The purpose of this study is to conduct a critical assessment of existing recovery plans for the Atlantic leatherback sea turtle in order to achieve the following four objectives:

1) Determine which countries have published recovery plans to manage the leatherback sea turtle, and determine which countries, if any, haven't yet published recovery plans despite recording the presence of leatherbacks in their jurisdiction

2) Identify any existing gaps within the management of the Atlantic leatherback sea turtle,

3) Determine what needs to be improved to strengthen future recovery plans for the Atlantic leatherback sea turtle

4) Provide recommendations for the upcoming amendment of Canada's Atlantic leatherback sea turtle recovery strategy

Chapter 2. Methodology

2.1 Recovery Plan Selection

In the Atlantic Ocean, three distinct sub-populations of leatherback sea turtles have been identified. These include the Northwest, Southeast, and Southwest populations. Additionally, leatherback individuals take part in ocean wide migrations annually, giving them the most extensive range of any reptile species (Martin and James 2005). Because of their widespread nature, many nations have identified nesting beaches and marine habitats that are regularly occupied by leatherback sea turtles and that require management and conservation efforts. A preliminary online search determined that over 25 nations have published recovery plans guiding management and conservation actions for the leatherback sea turtle. Further, at least six countries that have documented the presence of nesting leatherback sea turtles have either not produced recovery plans or they were not readily available online.

Figure 1.   The seven recovery action plans chosen for indicator analysis are from the following nations: a) Canada, b) Trinidad and Tobago, c) Barbados, d) Jamaica, e) the United States of America, f) St. Vincent and the Grenadines, and g) the Guianas (which includes a regional strategy for Guyana, Suriname, and La Guyane).

As it was not possible to evaluate all of the available recovery plans, plans were chosen for evaluation based on one or more of the following factors: availability of the plan in English, ease of access to the plan online, the date of publication and the abundance of leatherback sea turtles within the jurisdiction. Of the 25 recovery plans that were readily available online, only 18 were available in English. Of the 18 plans available in English, 11 were published in 1993 or earlier. The newest plans were selected first due to the assumption that they were recently amended or updated versions of older recovery plans and would add the most value to the evaluation. Additionally, several countries were eliminated from the selection process if their leatherback sea turtle abundance was small, or if their plans focused primarily on managing other sea turtle species. After these factors were considered, seven recovery plans (Figure 1) in total were chosen for evaluation, which included:

(1) The Sea Turtle Recovery Action Plan for Jamaica (2011)
(2) The Sea Turtle Recovery Action Plan for the Republic of Trinidad and Tobago (2010)
(3) The Recovery Strategy for the Leatherback Turtle (*Dermochelys coricea*) in Atlantic Canada (2006),
(4) The Regional Sea Turtle Conservation Program and Action Plan for the Guianas (2003)
(5) The Sea Turtle Recovery Action Plan for St. Vincent and the Grenadines (1993)
(6) The Recovery Plan for the Leatherback Turtle (*Dermochelys coriacea*) in the U.S. Caribbean, Atlantic and Gulf of Mexico (1992)
(7) The Sea Turtle Recovery Action Plan for Barbados (1992)

The Guiana's regional plan was selected in lieu of the individual plans for Suriname, French Guiana, and Guyane as the date of publication was newer than the Suriname plan, the French Guiana plan was only available in French, and Guyane does not have a national recovery plan readily available. Of the seven plans selected, two are published by federal governments (Canada and the United States), while the remainder were published by the

non-governmental organizations (NGOs) WIDECAST and the World Wildlife Fund for the Guianas (WWF-Guianas).

2.2 Evaluation Indicators

To objectively evaluate the recovery plans, indicators were chosen to measure the favourable/critical component that should be included in an effective recovery plan. These indicators were selected based on reviews of recovery plans for at-risk species, scientific literature, and documents specific to sea turtle management and conservation. The indicators (See Appendix A) were placed in one of two categories: indicators of the effective implementation of the plan, and indicators of successful management and conservation activities. Relevant features of recovery plans that didn't fall within either of these two categories were recorded in a third category, however these were not considered in the overall evaluation (highlighted in yellow in Table 1) for two reasons. First, although ongoing research and monitoring (indicator 3.1) are essential to effectively manage species at risk, not every country can necessarily afford to participate in elaborate research projects. They would equally benefit from utilizing the results of research completed by any nation who have the funding to do so. Second, intervention-based management (indicator 3.2) is not always required, nor necessarily the appropriate solution in all situations. In totally, thirty-seven indicators were selected and each is described in Table 1.

Each indicator was evaluated to determine if it was considered within a recovery plan and how effectively it was implemented. For threats, indicators were automatically considered well addressed if they presented any type of management solution for the threat. This meant that there was no assessment of the actual choice of management solution. The evaluation is displayed in a colour-coded table. Plans marked in green addressed the specific indicator well and provided details of how it was to be implemented or incorporated. Plans marked with red inadequately address the indicator and provided no evidence that it was considered. Plans marked with yellow fell somewhere in between this binary and typically indicated that the indicator was only partially addressed and still required further incorporation. Using these colour codes allowed for trends and patterns to be easily observed when the table was complete.

Table 1.   List and description of evaluation indicators.

Number in table	Indicator	Description and Justification
1.1	Statement of objectives	Clear, concise and measurable objectives are important for guiding recovery activities and achieving goals.
1.2	Description of the plan's scope	Understanding the geographic scope maximizes the understanding of the spatial applicability of the plan. Defining a temporal scope allows deadlines to be defined for implementing conservation activities.
1.3	Presence of a regulatory framework	A description of the framework that supports the plan, including Acts, laws, and regulations that show how the plan legally valid. Additionally, it is important to describe how new recovery activities fit into existing legislation.
1.4	Presence of an implementation schedule	Implementation schedules are critical for organizing recovery activities and for promoting accountability within responsible agencies.
1.5	Identification of responsible jurisdictions	Identifying responsible jurisdictions clarifies where the plan is applicable within the specific country (i.e. which provinces or states the plan is applicable in)
1.6	Identification of responsible enforcement authorities	Identifying responsible enforcement authorities ensures regulatory mechanisms associated with the recovery plan are being enforced.
1.7	Financial resources	Securing financial resources ensures recovery activities will have the budgetary resources to be enacted.
1.8	Responsible agencies for executing the plan	Clarifying who is responsible for various recovery tasks is important to ensure that agencies understand their requirements within the recovery plan.
1.9	Identification of socio-economic conflicts	Identifying socio-economic conflicts is important to understand how the recovery plan will affect industries and various stakeholders.
1.10	Identification of potential ecosystem impacts	Identifying potential ecosystem affects (negative or positive) is important for understanding how recovery activities may affect other elements in the ecosystem. This is often referred to as ecosystem-based management.
1.11	Plan evaluation	An evaluation plan measures how successful the recovery plan has been in terms of completing its objectives. An evaluation plan could also aid in determining areas of weakness that may need more attention.
1.12	Stakeholder consultation	Stakeholder consultations aid in identifying potential socio-economic conflicts that may arise throughout the planning and implementation processes. It also presents the opportunity to receive input from multiple industries to aid in strengthening the plan.
1.13	Participation in	International initiatives may facilitate the pooling of resources

	international initiatives	in order to fund recovery initiatives. For example, collaborating on research efforts aids in creating a better understanding of the species for all those involved. Additionally, managing sea turtles within one jurisdiction does not ensure their safety once they leave, therefore working with other nations could promote recovery outside a single jurisdiction.
2.1.1	Number of sea turtles entering jurisdiction	To effectively manage sea turtles it is important to know how many are within your jurisdiction. This aids in measuring successful population growth as a result of recovery activities, promotes a better understanding sea turtle ecology, and aids in determining population trends.
2.1.2	Population status	Knowing the status of the population is important for better allocating resources towards certain activities. For example, if you know that sea turtles entering your jurisdiction are mostly from population X and the status is critically endangered, you may be more likely to invest in threat prevention for that specific population than if sea turtles in your jurisdiction are from population Y and are described as vulnerable.
2.1.3	Nesting Assessments (i.e. Hatchlings, nesting females, and nests)	Quantifying nesting activity is important for better allocating resources towards certain activities. For example, if you have great nesting success with few false crawls, but hatchling success is low, resources can be allocated towards mitigating threats to hatchlings.
2.1.4	Estimate of Mortality	Estimating and quantifying mortality allows resources to be allocated towards managing the most severe causes of mortality.
2.2.1	Identification of critical habitat	Identifying the critical habitat allows for better managing threats to the area and ensuring protection of the critical habitat.
2.2.2	State of the critical habitat	Understanding the state of the habitat (i.e. is the habitat pristine, deteriorated, over-run with vessel or human traffic, etc.) is important for knowing how resources should be allocated towards improving the quality of the habitat.
2.2.3	Protection of critical habitat	Protecting critical habitats is essential for population recovery.
2.3.1 to 2.3.6	Threats to the critical nesting habitat 2.3.1 Coastal development 2.3.2 Increased human traffic 2.3.3 Inadequate waste disposal on beaches 2.3.4 Beach alterations 2.3.5 Sea level rise 2.3.6 Other changes in habitat suitability due to	Indicators in this section describe threats to the critical nesting habitat. It is important that recovery plans not only recognize threats, but that they also have a strategy to minimize or eliminate the affects from the threat.

	climate change	
2.4.1 to 2.4.3	Threats to the critical foraging habitat 2.4.1 Acoustic disturbance (indirect) 2.4.2 Discharge and run-off (indirect) 2.4.3 Other changes in habitat suitability due to climate change	Indicators in this section describe threats to the critical foraging habitat. It is important that recovery plans not only recognize threats, but that they also have a strategy to minimize or eliminate the affects from the threat.
2.5.1 to 2.5.7	Threats to sea turtles 2.5.1 Marine debris 2.5.2 Vessel interactions 2.5.3 By-catch or entanglement 2.5.4 Artificial light pollution 2.5.5 Discharge and run-off (direct) 2.5.6 Incidental or human caused predation 2.5.7 Illegal/ Clandestine sources of mortality (i.e. poaching)	Indicators in this section describe threats to the individual sea turtle. It is important that recovery plans not only recognize threats, but that they also have a strategy to minimize or eliminate the affects from the threat.
3.1	Monitoring and Research	If a nation is capable of investing or participating in research and monitoring efforts, they are contributing to a better understanding of sea turtles within their jurisdiction and within the wider ecosystem.
3.2	Possible Interventions	Interventions are human activities that help sea turtles survive various threatening situations. These include establishing hatcheries, head-start rearing of hatchlings and disentanglement of trapped sea turtles. Interventions are not always necessary and are highly situation-dependent. However, understanding when they are appropriate and how to properly implement them could aid in effective conservation.

Chapter 3: Results

   Recovery plans were evaluated using 37 indicators in two categories. Trinidad and Tobago evaluated best, with 18 out of the 37 indicators well addressed in the recovery plan (marked as green) (Figure 2). Jamaica was also evaluated as a strong recovery plan with 17 indicators that were well addressed. There were only slight differences between Trinidad and Tobago and Jamaica in terms of which preferred indicators were marked as green. This similarity was expected, as these recovery plans were both published with the help of WIDECAST, and only a year apart. Jamaica (in addition to Canada) also had the least inadequately addressed indicators (marked as red). The three oldest recovery plans had the highest occurrence of inadequately addressed indicators, while the two recovery plans published in the early 2000s had the most indicators moderately addressed (marked as yellow). The justification for each indicator evaluation can be found in Appendix B.

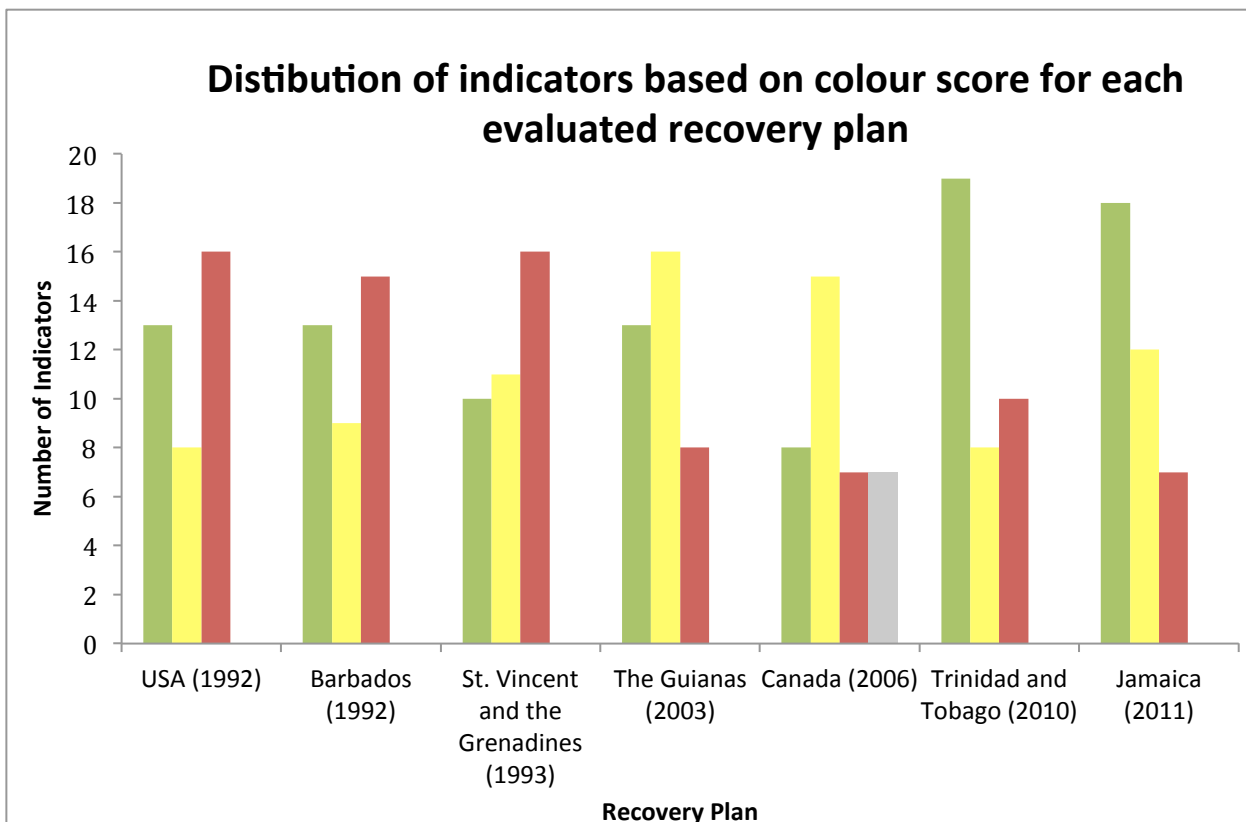**Distibution of indicators based on colour score for each evaluated recovery plan**

Figure 2. Number of indicators scored in each colour category for the seven evaluated recovery plans. Several indicators were removed from Canada's evaluation as they only pertained to nesting beaches. These are represented by the grey bar in the figure.

3.1 Implementation Indicators

Although plans published most recently generally had indicators that were well addressed (Figure 2), the United States, one of the two oldest recovery plans evaluated, included two implementation indicators in their plan that other recovery plans failed to. The U.S. was the only country to include an implementation schedule (indicator 1.4) within their recovery plan for organizing recovery activities, clearly establishing project time lines, identifying responsible agencies, and organizing budgetary requirements. Additionally, the U.S. was the only country to identify the temporal scope of their recovery plan. Other recovery plans only described the geographic boundaries in which their recovery plan operated.

Participation in and the need for international collaborations was the only indicator that was well addressed in all recovery plans. All recovery plans also discussed international conventions to which their countries were signatories, and international agreements their country's governments should ratify in the future. Additionally, all of the recovery plans clearly identifying the presence of socio-economic conflicts, however only a selection of the plans addressed this indicator well by identifying specific conflicts or for offering potential conflict resolutions. Recovery plans showed varying success in terms of addressing the remainder of the implementation indicators. This result did not appear to be influenced by the date of publication, or by the publisher (i.e. government department or NGO) of the recovery plan. For example, financial resources weren't well described by any of the recovery plans, while only two plans presented an intention or method to evaluate their effectiveness.

Table 2.   Evaluation results for implementation indicators for each of the seven recovery plans.

Indicator	Management Plan						
1. Implementation Indicators	United States (1992)	Barbados (1992)	St. Vincent and the Grenadines (1993)	The Guianas (2003)	Canada (2006)	Trinidad and Tobago (2010)	Jamaica (2011)
1.1 Statement of objectives							
1.2 Description of the plan's scope							
1.3 Presence of a Regulatory framework							

Indicator						
1.4 Presence of an implementation schedule						
1.5 Identification of responsible jurisdictions						
1.6 Responsible enforcement authorities						
1.7 Financial resources						
1.8 Responsible agencies for executing the plan						
1.9 Identification of socio-economic conflicts						
1.10 Potential ecosystem impacts						
1.11 Plan evaluation						
1.12 Stakeholder consultation						
1.13 Participation in international initiatives						

3.2 Management and Conservation Indicators

3.2.1 Threat indicators

Threats were generally well discussed throughout most of the recovery plans (Table 3) and threats to individual sea turtles (Section 2.5 of the indicator table) were relatively well addressed by all of the evaluated recovery plans. Trinidad and Tobago and Jamaica each had the most well addressed indicators in this section. All seven plans presented solutions for by-catch and entanglement, while six recovery plans presented solutions for addressing marine debris and artificial light pollution. Vessel interactions and direct acoustic disturbance were the least addressed threats in the category.

Threats to the foraging habitat (Section 2.4 of the indicators table) had the fewest indicators that were well addressed, indicating a deficiency in critical habitat management. Acoustic disturbance was only discussed in one plan, while only four plans mentioned the management of run-off and discharge into the critical foraging habitat. Another clear gap

was the lack of discussion of the potential impacts of climate change. Additionally, none of the recovery plans evaluated discussed sea level rise and its potential impacts to the critical nesting habitat. St. Vincent and the Grenadines was the only country that did not discuss the impacts of run-off and discharge to sea turtles, and received the most inadequately addressed indicators throughout the three sections on threats.

Table 3.	Evaluation results for management and conservation indicators for each of the seven recovery plans.

Indicator	Management Plan						
2. Management and Conservation Indicators	United States (1992)	Barbados (1992)	St. Vincent and the Grenadines (1993)	The Guianas (2003)	Canada (2006)	Trinidad and Tobago (2010)	Jamaica (2011)
2.1.1 Sea turtles entering jurisdiction	red	red	red	yellow	red	red	red
2.1.2 Population status	red	red	red	yellow	red	yellow	yellow
2.1.3 Nesting Assessments	red	red	red	red	gray	green	yellow
2.1.4 Estimate of Mortality	yellow	yellow	yellow	yellow	yellow	yellow	yellow
2.2.1 Identification of critical habitat	red	red	yellow	yellow	red	yellow	yellow
2.2.2 State of the critical habitat	red	yellow	red	red	red	red	green
2.2.3 Protection of critical habitat	red	red	red	yellow	yellow	yellow	yellow
2.3.1 Coastal development	green	green	green	yellow	gray	green	green
2.3.2 Increased human traffic	green	green	yellow	green	gray	green	green
2.3.3 Inadequate waste disposal on nesting beaches	yellow	yellow	green	yellow	gray	green	green
2.3.4 Beach alterations	green	green	green	yellow	gray	green	green
2.3.5 Sea level rise	red	red	red	red	gray	red	red
2.3.6 Other changes in habitat suitability due to climate change	red	red	red	red	gray	yellow	yellow

Indicator								
2.4.1 Acoustic Disturbance (indirect)	red	red	red	red	yellow	red	red	red
2.4.2 Discharge and run-off (indirect)	yellow	green	green	yellow	red	green	green	green
2.4.3 Other changes in habitat suitability due to climate change	red	red	red	red	yellow	yellow	red	yellow
2.5.1 Marine debris	green	green	green	green	yellow	green	green	green
2.5.2 Vessel interactions	yellow	red	yellow	red	yellow	yellow	red	yellow
2.5.3 By-catch or entanglement	green	green	green	green	green	green	green	green
2.5.4 Artificial light pollution	green	green	green	green	yellow	yellow	green	green
2.5.5 Discharge and run-off (direct)	green	yellow	red	yellow	yellow	yellow	green	green
2.5.6 Incidental or human caused predation	yellow	yellow	yellow	green	yellow	yellow	green	green
2.5.7 Acoustic Disturbance (direct)	red	yellow	red	yellow	green	green	red	red
2.5.7 Illegal sources of mortality	green	yellow	green	yellow	green	green	green	green

Although Canada's recovery plan mentions threats to the critical nesting habitat, these indicators were not evaluated because these considerations are outside their jurisdiction. Trinidad and Tobago, and Jamaica had the most indicators that effectively addressed threats to the critical nesting habitat (Section 2.3 in the indicator table). The other recovery plans varied in identifying these threats and in presenting solutions.

3.2.2 Sea turtle population and critical habitat assessment indicators

The Guianas was the only region that had an estimate of the number of sea turtles entering their management jurisdiction. Many of the recovery plans had no accurate or recent data on nesting activity within their jurisdiction, with the exception of Trinidad and Tobago and Jamaica. All recovery plans identified potential causes of mortality, but none quantified these causes. Furthermore, few recovery plans identified important nesting beaches. Important marine habitats (including foraging) weren't identified in any of the

plans, but all plans did recognize the importance of identifying and protecting these critical habitats.

3.3 Indicators for Additional Conservation Investments

Two indicators (research and monitoring and possible interventions) were not considered in the overall evaluation (Table 4). Unsurprisingly, all of the recovery plans for countries with nesting beaches discussed possible interventions, when their use would be appropriate, and, in some instances, preferred methods for their use. Canada discussed interventions used on nesting beaches as the other recovery plans did, and additionally presented intent to addressed entanglement, an intervention to address a threat within Canadian waters. Furthermore, all of the countries discussed research and monitoring projects, but sources of funding for these projects were usually unconfirmed.

Table 4.   Evaluation results for additional indicators that were not included in the overall evaluation.

Indicator	Management Plan						
3. Additional investments in conservation	United States (1992)	Barbados (1992)	St. Vincent and the Grenadines (1993)	The Guianas (2003)	Canada (2006)	Trinidad and Tobago (2010)	Jamaica (2011)
3.1 Research and Monitoring							
3.2 Possible Intervention							

Chapter 4. Discussion

4.1 Economic Influence for Successful Management

An initial hypothesis was formed during this study that the newest recovery plans would be the most effective for management and conservation, and that older plans would have shortcomings in terms of addressing indicators. This was hypothesized because newer plans are informed by modern research and management strategies. However, all recovery plans performed well and had a respectable amount of well-addressed indicators throughout the different categories, suggesting that management of the leatherback sea turtle is being carried out effectively throughout the Atlantic. Additionally, it could suggest that recovery plans have the ability to remain effective as conservation tools for extended periods of time.

Trinidad and Tobago's plan (one of the newest plans) was the most detailed recovery plan, and as a tool for managers it included information that would be critical for decision-making processes. Although Trinidad and Tobago's recovery plan was sometimes difficult to navigate due its length, most of its components work harmoniously to create an effective national strategy. The same amount of detail was also seen in Jamaica's recovery plan. Additionally, these two recovery plans had an apparent focus on conservation that may be heavily influenced by the growing ecotourism industry. Trinidad and Tobago has been named the "Number One Eco-Destination in the Caribbean" by the Caribbean Travel Awards Committee (Simm n.d.) and leatherback sea turtle centric tourism provides much needed income to local communities (Forestry Division of the Government of the Republic of Trinidad and Tobago et al. 2010). In 2014, over 14,000 visitors were recorded at Matura Beach (a critical leatherback nesting beach in Trinidad), resulting in over $45,000 USD in tour fees (Cazabon-Mannette et al. 2017). The importance of protecting sea turtles and preserving their habitat holds importance for the development of the local economy.

Tourism can also cause challenges for the conservation of economically important species. In Jamaica, tourism has contributed to severe habitat degradation, which has negatively impacted the socio-economic environment and local sea turtle populations. It has been observed that the occurrence of sea turtle nesting in Jamaica has declined dramatically as nesting beaches become over populated and degraded from touristic

activities (Haynes-Sutton et al. 2011). As a result, within Jamaica's recovery plan, there is a focus on ecotourism.

Ecotourism may also play a potential role in influencing countries to update their recovery plans. Nations such as the United States, Barbados, and St. Vincent and the Grenadines (and many others that were not included in this evaluation) are likely basing sea turtle conservation decisions on data that was relevant over two decades ago. Concern for this pattern stems from the fact that sea turtle populations and associated habitats have undergone various changes since the publication of these recovery plans. It is possible that the socio-economic environment has also changed within these countries, meaning that they could be currently relying on income from tourism and ecotourism industries more than in the past.

Evaluating specific socio-economic factors was outside the scope of this study because it was believed that a country could produce an effective recovery strategy regardless of their socio-economic status. However, since the ecotourism industry has expanded throughout the Caribbean it may be beneficial to amend recovery plans by placing a heavier focus on conservation in order to ensure the stability of the industry into the future. For example, ecotourism has begun expanding in St. Vincent and the Grenadines. At the time of publishing their current recovery plan, their ecotourism industry was relatively undeveloped compared to other Caribbean countries (Scott and Horrocks 1993). Since then, the national economy has grown to depend on tourism and ecotourism, providing more than 6% of their GDP and 5.5% of their total employment (approximately 2500 jobs) (Lashley et al. 2013). Additionally, their recovery plan proposed a moratorium on sea turtle harvest until more information could be synthesized on sustainable take, and as of January 1st, 2017 the harvest of sea turtle species is officially an illegal activity (IWitness news 2016). Updating the recovery plan to reflect this monumental change in legislation and to reflect the increased importance of the ecotourism industry could likely benefit sea turtle conservation efforts in St. Vincent and the Grenadines.

4.2 Increasing Knowledge for Better Threat Management

By-catch and entanglement are recognized as the largest and most widespread sources of mortality to both sea turtles and other marine species (Nelms et al. 2016; Wilcox et al. 2013). All of the recovery plans evaluated presented management solutions to mitigate this threat. This is likely because all countries evaluated have either a pelagic long-line, gill net, or shrimp trawl fisheries, which all use gears that are particularly harmful to sea turtles. Most of the countries recommended increased monitoring, data collection on the incidence of mortality from entanglement events, and increased education on how to handle entangled sea turtles. Canada, the Guianas, and Trinidad and Tobago were the only recovery plans to mention the implementation of gear restrictions, alternative gear types, and the use of turtle exclusion devices (TEDs). There are several possible reasons for this. First, management strategies altering fishing methods may not have been feasible during the time that the older plans were published. Second, alternative gear types may not have been readily available at the time, as the older plans seem to heavily focus on increasing knowledge on entanglement as the primary management strategy. Third, these plans may have chosen to not focus on alternative gears and TEDs as a management strategy because of the possible conflict it could cause with the fishing industry. Finally, it is possible that entanglement may not be as large of a problem in these countries, as conservation and threat mitigation efforts are heavily concentrated on threats on the nesting beaches in Caribbean nations. However, it is unlikely that neglect is the primary reason for not including these management strategies for by-catch and entanglement. The only country where this may be possible is Barbados who at the time had a long-liner fleet that only consisted of six vessels (Harrocks 1992). This assessment further emphasizes the need to update recovery plans on a more frequent basis.

Marine debris was another well-addressed threat for all of the recovery plans evaluated. This was a positive result, as marine debris is widely distributed throughout the ocean and will require a collaborative effort to effectively manage. Multiple recovery plans presented management solutions that focused on cleaning up debris that washed ashore on nesting beaches, or on educating visitors about the implications of littering on nesting beaches. Very few plans focused on cleaning up debris in the marine habitat or on

identifying point sources of marine debris. The United States was the only country to include identifying point sources of marine debris as a management strategy. This could be due to financial resources, as identifying point sources could potentially be a costly research investment, or it could be that nesting beaches are more of a focus in these areas. Canada also, who doesn't have critical nesting habitat in their jurisdiction, failed to present management solutions for reducing the impacts of debris in the marine habitat.

Threats associated with nesting beaches, which include artificial light pollution, coastal development, and increased human traffic, were also well addressed with many recovery plans suggesting relevant regulatory changes in order to strengthen mitigation and management. This result was expected as conservation efforts for sea turtles are typically focused on nesting beaches due to the ease of access (Mazaris et al. 2014). These threats are also well researched, and therefore awareness of their impacts could be more widely recognized. Regardless, this is a positive result, as anthropogenic influences on the nesting beaches have contributed to dramatic population declines (Patino-Martinez et al. 2014).

Mention of threats associated with climate change was rare. Canada's recovery plan was the only one to recognize climate change explicitly as a threat. Other recovery plans discussed factors associated with climate change such as changes in beach topography from increased storm events, and changes in physical and chemical ocean properties. The effects of increased storm events are still important to consider as they could result in the inundation of a large portion of nesting beaches in the Caribbean, however none of the recovery plans provided management solutions to mitigate these impacts. The discussion of global climate change began several decades prior to the publication of the oldest recovery plan included in this evaluation and these results indicate that climate change may still not be taken seriously as a threat. Papers such as Tomillo et al. (2015) have called for the inclusion of the impacts of climate change in species assessments. Excluding climate change is not only naïve, but could be detrimental to future leatherback sea turtle populations as there is much uncertainty in terms of how they will respond to the effects of climate change. For example, climate fluctuations can dramatically influence leatherback sea turtle nesting outputs. It has been estimated that by 2100 the air temperature in the Caribbean could be too high for successful nesting, influencing a redistribution of nesting to

more temperature climates. Additionally, other marine species have experienced changes in phenology in response to increased sea surface temperatures (Tomillo et al. 2015). The reason for not including climate change (particularly within the newest plans) is not clear, however there should be a push to include climate change in future recovery plans.

A similar issue arose with sea level rise, which was a separate indicator from climate change as there are very distinct impacts to the nesting beach as a result of sea level rise described in the literature (i.e. Tomillo et al. 2015 and Patino-Martinez et al. 2014). There was no discussion of sea level rise or associated affects within any of the recovery plans evaluated. Instead, recovery plans discussed beach erosion from increased storm events. The failure of these recovery plans to recognize sea level rise as a threat is a problem, because increased moisture within nests can cause egg suffocation, while drier nests tend to produce larger and more robust hatchlings (Patino-Martinez et al. 2014).

Threats in and to the foraging habitat were not as well addressed as threats to the nesting habitat. As mentioned, ease of access to nesting beaches may influence the focus of conservation efforts on this habitat, and therefor threats that aren't directly visible may be left unaddressed. Vessel strikes present a relatively significant threat to marine life (Work et al. 2010) and the failure to address this threat effectively could result in increased mortality of leatherback sea turtles and further conservation concerns for the species. There is still much uncertainty on how leatherback sea turtles are affected by acoustic disturbances in the marine habitat as most studies on acoustics focus on marine mammals. Disturbances detectable by sea turtles could originate from oil and gas exploration, shipping, fishing, military activity, underwater detonations and shore based activities. It has been suggested that loggerheads and Kemp's ridley sea turtles are most sensitive to low frequencies, and that increased exposure to noise could cause behavioural disturbances, permanent or temporary hearing impairments, or mortality (Atlantic Leatherback Recovery Team 2006). Evaluated recovery plans discussed noise disturbance as a result of human presence on nesting beaches, while disturbance in the marine habitat was only discussed in Canada's recovery plan. Vessel strikes are identified as a specific information gap in both Canada and the United States, while the other recovery plans only discuss the possibility of strikes from small, motorized jet-skis. This could become a larger problem in Caribbean nations because of the influx in cruise ships as a result of growth

within the tourism industry. These results have further confirmed the need for increased research associated with leatherback sea turtles within their marine habitat.

Threats to mating areas and migratory routes were not considered in this evaluation. This is due to the fact that these areas are not well identified in the literature and are rarely discussed in recovery plans. A paper by James et al. (2005) speculated at a potential mating area after an adult male leatherback sea turtle that was tracked via satellite arrived in Gallera Point, Trinidad, several weeks before the nesting season. This may suggest that Gallera Point is a mating area, however future research would be needed to confirm this speculation. A focus on identifying both important mating areas and migratory routes would further benefit sea turtle conservation by allowing additional implementation of threat mitigation and management strategies.

4.3 Persistent Challenges with Research and Knowledge Gaps

4.3.1 Population and nesting assessments

This evaluation confirmed the persistent challenges in obtaining information on leatherback sea turtle abundance. This evaluation looked for recovery plans to identify the number of leatherback sea turtles entering the given country's jurisdiction. The value of this information is greater for the purpose of national recovery than to understand global population dynamics, as this allows a country to evaluate the effectiveness of its conservation efforts. Of the seven plans evaluated, only the Guianas were able to give an estimate of the population of leatherbacks within their jurisdiction. They estimated that about 50% of all leatherback sea turtles within the Atlantic Ocean nest within the Guianas. The United States and Canada both had data on abundance from opportunistic sightings, but estimates were outdated as the data is from the early 1990s. The evaluated plans span a timeline of almost 20 years, and it could be interpreted as problematic that hardly any progress has been made to estimate the abundance of leatherback sea turtles in the Atlantic. Furthermore, having a population estimate would allow accurate regional population status' to be determined which was another information gap determined by this evaluation.

The lack of progress in obtaining accurate population estimates is likely due to the wider difficulties associated with obtaining information on highly migratory marine species. Most leatherback population assessments are done on land on nesting beaches due to ease of access, however this method has a number of limitations. Nesting assessments done on beaches only directly estimate the number of nesting females within the population, relying on broad assumptions about the population structure to estimate males and juveniles (Archibald and James 2016). Further, to obtain an accurate regional or oceanic population assessment, this method requires a great deal of collaboration to combine the data from multiple nesting beaches An additional challenge is that females typically only nest every 2-5 years, and show low site fidelity. Thus, accurately estimating the number of nesting females potentially requires a long-term study. An alternative method has been suggested thatincludes conducting population assessments at in-water foraging grounds. This method would be more costly (as it would likely involve aerial surveys), but would offer a cross section of the entire population (Archibald and James 2016).

Although nesting assessments may not be the best method for conducting population assessments, they were still included in this evaluation, as they do estimate reproductive output and can aid in evaluating and tailoring conservation efforts. Nesting assessments in this evaluation included number of nesting females, number of nests, and number of hatchlings because knowing one of these could allow you to estimate the others. All of the countries included in the evaluation (except Canada as they were excluded from any nesting beach evaluations) had data on nesting within their jurisdiction, but because some of these plans are almost 20 years old, the information was considered out dated. Out dated information could lead to an inaccurate estimate of the reproductive success of these populations and this an incorrect assessment of conservation status, or, in countries where sea turtle harvest is still legal (i.e. in St Vincent and the Grenadines when their recovery plan was published), a higher harvest quota. These factors emphasize the important of updating recovery plans more frequently to reflect the most recent and accurate information. Trinidad and Tobago's recovery plan was the only one to provide updated nesting assessments. In addition to their plan being relatively new (published within the last 8 years), this is likely because of the active participation of NGO's in sea turtle

conservation activities in Trinidad and Tobago. The Nature Seekers are particularly involved in sea turtle management and conservation, and conducted extensive nesting surveys on both the islands of Trinidad and Tobago in 2007. NGOs in that country are also highly involved in a co-management framework that is used for enforcement activities and beach surveys (Forestry Division of the Government of the Republic of Trinidad and Tobago et al. 2010).

Finally, the last gap identified by this evaluation was knowledge of causes of mortality. All recovery plans identified several key causes of mortality within their jurisdiction, typically based on reports from various stakeholders. However, none of the recovery plans quantified the causes of mortality they listed. This trend is likely again due to the highly migratory nature and elusivity of the leatherback sea turtle. It is especially difficult to monitor the leatherback in the marine habitat, as they part take in deep dives and move continuously throughout the Atlantic Ocean while foraging. However, accurately quantifying mortality will inform proper allocation of resources to manage the threats that are causing the highest rate of mortality to the species.

4.3.2 Critical habitat

The evaluation confirmed that there are persistent challenges with identifying leatherback sea turtle critical habitat. St. Vincent and the Grenadines, and the Guianas were all able to identify "important" and "primary" nesting beaches respectively, while Trinidad and Tobago identified "critical" nesting beaches on both islands. All recovery plans did however recognize the importance of identifying these habitats. A possible explanation for the difficulties associated with identifying critical habitat is that leatherbacks show low site fidelity to both nesting and foraging habitats. Therefore, nesting beaches may show yearly fluctuations in the number of sea turtles present in the habitat, making it difficult to assess its importance to the species. Critical foraging or marine habitats weren't defined within any of the recovery plans. This emphasizes the need for increased research, especially pertaining to leatherback sea turtles within the marine habitat.

It was assumed that if a country couldn't identify critical habitats within their jurisdiction, that they would likely not be able to evaluate its condition or be able to protect it. However, many recovery plans still indicated regulatory mechanisms for, and intent to protect critical habitat once identified. For this reason, indicators for state and protection

of the critical habitat remained a part of this ecalaution regardless of the identification of critical habitat. For example, under Canada's SARA, Critical Habitats are awarded protection within 180 days of the publication of the Action Plan which identifies the Critical Habitat. Unfortunately, in this particular example, Canada has yet to publish an Action Plan for the leatherback sea turtle so the identification and protection of the Critical Habitat have yet to happen. Similarly, some of the recovery plans were able to speculate at the state of the critical habitat, however this area definitely requires further research.

4.3.3 Geographic management gaps

While selecting the recovery plans for this evaluation, it became clear that there were several countries that have reported the presence of nesting Atlantic leatherback sea turtles within their jurisdiction that either haven't produced a recovery plan or that didn't make their recovery plan readily available online. These countries include:

- o In the Caribbean: Dominican Republic, Grenada
- o In Central America: Costa Rica
- o In Africa: Congo, Gabon, Equatorial Guinea

It is possible there are more countries that have nesting or foraging leatherback sea turtles that weren't identified within this study, and thus there could be areas where leatherback sea turtles and their critical habitats are unprotected and therefor vulnerable.

4.4 Limitations

4.4.1 Implementation indicators

The largest differences in how well indicators were addressed were typically seen in the implementation indicators. The most valuable information for achieving the objectives of the study came from the analysis of the management and conservation indicators. This suggests that it may not be as important to evaluate the mechanisms countries are using to perform recovery activities so much as it is to evaluate what a country is doing, as it is these activities that aid in species recovery. Implementation mechanisms are important, but for evaluation purposes these factors didn't contribute to the overall evaluation of the management of the leatherback sea turtle. For example, although implementation schedules were hypothesized to add value to the management process, only one recovery

plan included this tool, so it could be concluded that implementation schedules may not have value to these conservation efforts. Countries may choose not to include an implementation schedule so that their recovery plan has flexibility to implement recovery tasks when the time is most appropriate. Similarly, only one recovery plan defined a temporal scope for their plan. This evaluation couldn't identify how either of these indicators could setback conservation effort, so these are still considered important tools and should be a part of an effective recovery plan.

A description of financial resources within the recovery plan was also hypothesized to aid in carrying out recovery plans. This assumes, however, that if a country has budgeted or secured financial resources for recovery activities that they would state so within their recovery plan. It is also possible that these plans are produced without having secure funding (governmental or otherwise). In addition, this may differ among countries based on the availability of resources and regulatory frameworks. It is almost certain that all of the countries evaluated would prefer to have funding secured, but this may not be realistic. Properly evaluating this indicator would require an examination of how activities were funded, which may not be possible. This observation is also true of another indicator, the identification of socio-economic conflicts, although this indicator was relatively well addressed compared to other implementation indicators. Securing financial resources and identifying socio-economic conflicts are still considered by this evaluation to be important components of recovery planning for species at risk; it just may be that the presence of these indicators within a recovery plan is unnecessary.

There were implementation indicators that added value to recovery plans. For example, all recovery plans expressed the importance of participating in international initiatives. It was a positive result of the evaluation as international collaborations are particularly important in managing highly migratory species. Leatherback sea turtles enter the jurisdiction of multiple nations, and collaborative efforts could increase the chance of successful recovery and population growth.

Another valuable implementation indicator was having an evaluation strategy, which provides a mechanism for measuring success throughout the implementation of recovery activities. Additionally, it can allow for adaptability if strengths and weaknesses can be identified during the implementation of the plan. Unfortunately, this indicator was

not well addressed in any of the recovery plans, and therefore is an area of improvement for future recovery plans.

4.4.2 Other important considerations for recovery planning

The political acceptance and adaptability of a recovery plan are two other factors that were not included in this evaluation, but which may have some importance. Political acceptance of recovery plans will aid by establishing regulatory mechanisms, provide government funding, enforcement of applicable laws and regulations, and may aid in potentially increasing acceptability among citizens. Political acceptance is, however, difficult to evaluate from government plans and political situations change more frequently than do recovery plans. Without interviewing governmental officials or actively seeking out the stances of governments on these types of agendas, political acceptance cannot easily be confirmed, and it is simply not stated within recovery documents. Similarly, the ability of plans to be adaptable (i.e. Adaptive Management) was also considered during the evaluation because of the influence climate change has on species management. Climate change may impact the distribution, availability, and suitability of critical habitat; therefore the ability for a recovery plan to adapt to these potential changes could increase its effectiveness. Ultimately this is most important for plans that are not frequently updated, as it creates a mechanism to allow for changes between amendments. As above, though, it was quickly realized that identifying adaptable components of a management plan was very difficult task. Political acceptance and adaptability are still important considerations for recovery management and should still be considered even though they weren't included directly in the evaluation.

Educational materials and awareness campaigns are important conservation activities that every recovery plan included. Educational materials provide an avenue to communicate with the public and stakeholders to better inform them about the impacts of anthropogenic influences, on-going recovery activities, and other critical information for successful recovery of the species. All of the evaluated plans included the distribution of educational materials or awareness campaigns, such as the placement of posters on nesting beaches to discourage the improper disposal of garbage. Although important, they weren't included in the evaluation because as a result of the varying dates of recovery plans, these activities likely already took place and won't add value to assessing the management of

leatherback sea turtles at the current time. There are several challenges, such as this one, associated with evaluating recovery plans that are written by different countries, organizations, and within different time periods.

Chapter 5. Recommendations

Below are a number of recommendations that should guide the future of leatherback sea turtle management in the Atlantic Ocean. The recommendations are divided into global recommendations (which should be taken into account by all of the countries that have identified the leatherback sea turtle within their jurisdiction) and recommendations that are specific to Canada as they move forward with amending their Atlantic Leatherback recovery strategy.

5.1 Pan-Atlantic Recommendations

5.1.1 Recovery documents

➢ Update leatherback sea turtle recovery plans to include best available information
  o Multiple countries are currently managing leatherback sea turtles with older recovery plans that contain outdated information. Although older recovery plans still performed well in the evaluation, updating recovery plans could further increase population success throughout the Atlantic.
➢ Countries that have reported leatherback sea turtles within their jurisdiction but have not yet implemented their own recovery strategies should do so
  o Existing recovery plans (if any) should be made readily available online for future consideration.
  o The governments of the identified countries should implement recovery strategies; governments should seek partnership and aid of experienced NGOs (such as WIDECAST in the Caribbean) where appropriate to aid in developing recovery plans.
➢ Revise threat management solutions described in recovery plans
  o For older recovery plans, some threats were poorly understood calling for further research. There are likely new solutions that could be implemented that may be more effective and better suited than those currently described in recovery plans.
➢ Consider the impacts of climate change and related concepts in future recovery planning and species assessments

- Recovery plans should allow for adaptability in terms of the impacts of climate change on species distribution, quality and location of critical habitats, and other associated threats because recovery plans are updated relatively infrequently.
- ➢ Countries should implement evaluation strategies within their recovery plans

5.1.2 Research requirements
- ➢ Increase research to determine accurate leatherback sea turtle population abundance within the Atlantic Ocean
  - It has been recommended in the literature that population assessments be done at foraging grounds (Archibald and James 2016).
  - Nesting beach assessments should also be completed regularly to monitor reproductive output.
- ➢ Continue efforts to identify and protect critical foraging and nesting habitats
- ➢ Implement and continue efforts to identity and protect critical mating areas and important migratory routes
  - Identification of critical mating habitats is still in its early stages, identifying these areas is important for better understanding how threats impact leatherbacks within the marine habitat and for aiding in better understanding the species in general.
- ➢ Increase research on threats to the foraging habitat
  - Acoustic disturbance: very little is currently known about how acoustic disturbance affects both leatherback sea turtles and their habitats as most research on disturbance has been focused on marine mammals
  - Discharge and run-off: recovery plans recognize the impacts of discharge and run-off, however management solutions were lacking. This is likely due to how widespread the issue has become.
- ➢ Increase research on threats to leatherback sea turtles in the marine habitat
  - The effects of acoustic disturbance and incidence of vessel interactions are currently not well understood.

- Although every recovery plan within the evaluation included management solutions for mitigating the effects of by-catch and entanglement and marine debris, research should still focus on increasing knowledge on these impacts to create innovative solutions.
- Prey removal (not included in this evaluation) does not currently impact leatherback sea turtles but prey removal has had negative effects on other marine life. Research on this threat could allow for preventative management.

➢ Collaborate with stakeholders to quantify causes of mortality to better allocate resources for threat management
- Stakeholders often report leatherback mortalities and are a valuable resource for quantifying the causes

5.1.3 Recovery related activities

➢ Continue the sustainable development of the ecotourism industry within the Caribbean both as a method for creating alternative livelihoods for sea turtle poachers or in some cases harvesters and to ensure successful population recovery by better educating tourists.

➢ All countries should consider ratifying applicable international and regional conventions and treaties (i.e. CITES, the Cartagena Convention, etc.) that would promote regulatory responsibility for conservation and management.

5.2 Recommendations for Canada

➢ Assist Caribbean countries in developing better and increased enforcement to protect sea turtles

➢ Encourage countries to ratify international and regional conventions to ensure the protection of leatherback sea turtles throughout the Atlantic

➢ Collaborate with countries in nesting beach conservation, particularly those countries whose leatherback sea turtles return to Canadian waters

- ➢ Ensure that the wide ranging effects of climate change are included in the amended recovery strategy to be published in 2017
- ➢ Publish an Atlantic leatherback sea turtle Action Plan
  - o As a part of Canada's regulatory framework pertaining to species at risk, the Action Plans are essential for identifying Critical Habitat and awarding it protection.

Chapter 6. Conclusion

The indicator analysis used in this study revealed that management and conservation concerns for the Atlantic leatherback are being relatively well addressed, at least by the evaluated recovery plans in this study. However, it was also found that there are management gaps in addressing threats from climate change, sea level rise, and in addressing threats to the foraging habitat. Additionally, several countries were identified that should also implement recovery plans, as these countries currently represent geographic gaps in the management of the leatherback. A number of recommendations were made for global consideration that will aid in strengthening the management of the leatherback sea turtle moving forward. Additionally, recommendations were made specifically for Canada, and these should be taken into consideration for their amended recovery strategy for the Atlantic leatherback population in 2017.

Future studies could focus on expanding this evaluation to assess other existing recovery plans for the leatherback. This would aid in further identifying management and conservation gaps that may not have been found in this study, as this research was limited by both time, and availability of plans in English. Additionally, as the methodology used in this study was able to evaluate a wide variety of factors, the indicator analysis could be adapted to assess the conservation and management of other highly migratory or at-risk species, as they face similar challenges to the leatherback sea turtle.

Leatherback sea turtles are highly migratory marine reptiles that are widely dispersed throughout the world's oceans and are exposed to a variety of threats. Recovery planning is used as a tool to manage these threats and provides conservation actions for the species throughout the Atlantic. The Atlantic leatherback population is experiencing successful population growth, and it is important for countries to continue to contribute to this positive momentum.

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Appendix A- Indicators and Assessment Statements

Indicator	Assessment Statements		
1. Implementation Indicators			
1.1 Statement of objectives	Objectives for the plan are not stated	Objectives are stated but lack direction and clarity (i.e. no sub-objectives or strategies)	Objectives are clearly defined and are broken down into clear sub-objectives or strategies
1.2 Description of the plan's scope	The geographic and temporal scopes for the plan are not defined	The geographic scope or temporal scope for the plan is defined, but the reasoning lacks justification or clarity.	The geographic and temporal scopes for the plan are clearly defined and justified.
1.3 Presence of a regulatory framework	The legal context for the plan is not defined	The legal context for the plan is defined, however the regulatory framework is lacking in clarity	The legal context for the plan is defined and is supported by a clear regulatory framework
1.4 Presence of an implementation schedule	An implementation schedule is not present	An implementation schedule is present but lacks clarity or is ambiguous (i.e. not defining hard dates for "long-term" and "short-term" goals)	A clear implementation schedule is present
1.5 Identification of responsible jurisdictions	The responsible jurisdictions within the scope of the plan are not described	The responsible jurisdictions within the scope of the plan are described but applicable responsibilities are not clear	The responsible jurisdictions within the scope of the plan are described and applicable responsibilities are clear
1.6 identification of responsible enforcement authorities	The responsible enforcement authorities within the scope of the plan are not described	The responsible enforcement authorities within the scope of the plan are described but applicable responsibilities are not clear	The responsible enforcement authorities within the scope of the plan are described and applicable responsibilities are clear
1.7 Financial resources	Funding for carrying out various recovery tasks has	Funding has been secured but may be insufficient	Sufficient funding has been secured and obtained

	not been secured		
1.8 Responsible agencies for executing the plan	Responsible agencies (i.e. ad hoc committees, project managers, government departments) for carrying out various recovery tasks have not been identified	Responsible agencies (i.e. ad hoc committees, project managers, government departments) for carrying out various recovery tasks have been identified for some tasks	Responsible agencies (i.e. ad hoc committees, project managers, government departments) for carrying out various recovery tasks have been identified for all tasks
1.9 identification of socio-economic conflicts	The plan does not recognize any potential socio-economic conflicts with recovery activities	The plan states potential socio-economic conflicts but does not identify specific conflicts that will need to be addressed.	The plan states specific socio-economic conflicts and also may give preferred solutions for mitigating and managing them
1.10 Identification of potential ecosystem impacts	Ecosystem impacts from recovery activities are not identified or taken into account	Ecosystem impacts from recovery activities are recognized, however specific impacts are not discussed	Ecosystem impacts from recovery activities are recognized and specific impacts are discussed
1.11 Plan Evaluation	An evaluation strategy to measure the effectiveness of the plan is not present	An evaluation strategy to measure the effectiveness of the plan is present however criteria are not objective or measurable or the strategy lacks feasibility	A clear and feasible evaluation strategy with measurable and objective criteria is included
1.12 Stakeholder Consultation	Stakeholder consultations were not completed	Stakeholder consultations were completed with some stakeholder groups but not all	Stakeholder consultations have been completed with key, primary and secondary stakeholders
1.13 Participation in International Initiatives	There are no international initiatives or collaborations for sea turtle research and management	International collaborations have been formed to increase and strengthen sea turtle research and management initiatives however there is a lack of clarity on how	International collaborations have been formed to increase and strengthen sea turtle research and management initiatives across multiple jurisdictions

		collaborations will move forward	
2. Recovery and Conservation Indicators			
2.1 Leatherback Population			
2.1.1 Population size	There is no indication of the number of sea turtles in the population or the data is outdated	There is a rough estimate (perhaps based on opportunistic sightings data) of the number of sea turtles in the population	There is an exact estimate based on tagging or satellite data of the number of sea turtles in the population
2.1.2 Population status	The population status (i.e. stable, increasing or declining) is not known or stated for any sub-populations or the information is outdated	The population (i.e. stable, increasing or declining) status is known for some sub-populations but not all	The population (i.e. stable, increasing or declining) status is known for all sub-populations
2.1.3 Nesting Assessments (i.e. Hatchlings, nesting females and nest abundance)	Nesting assessments have not been completed and therefor nesting information is unknown or outdated	Some data has been collected (i.e. number of nesting females), however there are still information gaps	Nesting assessments have been completed. Information on nesting females, nests and hatchlings is known and up to date
2.1.4 Estimate of Mortality	Sources of mortality are unknown	Sources of mortality are known, but aren't quantified	Sources of mortality are known and quantified
2.2 Critical Habitat			
2.2.1 Identification of Critical Habitat	Critical habitat has not been identified or defined within the applicable jurisdiction	Some critical habitat have been defined within the jurisdiction to which the recovery plan applies, however work still needs to be done to identify further habitats	All critical habitats to the population have been defined within the jurisdiction
2.2.2 State of the critical	Attributes, functions and	The state of the habitat is	All attributes, functions, and

habitat	features of the critical habitat are not available to the sea turtle	prohibiting access to some attributes, functions, and features of the critical habitat	features of the critical habitat are available to the sea turtle
2.2.3 Protection of critical habitats	Critical nesting and foraging habitats are not protected or are semi-protected	Critical nesting and foraging habitats are protected from existing anthropogenic threats	Critical nesting and foraging habitats are protected from existing and potential future anthropogenic threats
2.3 Threats to Nesting Habitat			
2.3.1 Coastal development	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.3.2 Increased human traffic	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.3.3 Inadequate waste disposal on nesting beaches	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.3.4 Beach alterations	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.3.5 Sea level rise	The threat is not addressed	The threat is addressed in the	The threat is addressed in the plan

	or present in the plan or it states that the threat is outside the scope of the plan	plan but no preferred management solutions or action items are presented	and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.3.6 Other changes in habitat suitability due to climate change	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.4 Threats to Foraging Habitat			
2.4.1 Acoustic Disturbance (indirect)	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.4.2 Discharge and run-off (indirect)	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.4.3 Other changes in habitat suitability due to climate change	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.5 Threats to Sea Turtles			
2.5.1 Marine debris	The threat is not addressed or present in the plan or it	The threat is addressed in the plan but no preferred	The threat is addressed in the plan and preferred management solutions and action items are listed

	states that the threat is outside the scope of the plan	management solutions or action items are presented	**or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.5.2 Vessel interactions	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.5.3 By-catch or entanglement	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.5.4 Artificial light pollution (direct)	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.5.5 Discharge and run-off (direct)	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.5.6 Incidental or human caused predation	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions

2.5.7 Acoustic Disturbance (indirect)	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
2.5.8 Illegal/clandestine sources of mortality (i.e. poaching)	The threat is not addressed or present in the plan or it states that the threat is outside the scope of the plan	The threat is addressed in the plan but no preferred management solutions or action items are presented	The threat is addressed in the plan and preferred management solutions and action items are listed **or** the threat is addressed in the plan and management solutions are coordinated with other jurisdictions
3. Additional investments in conservation			
3.1 Research and Monitoring	There are no plans for on going research and monitoring of the population	Research and on going monitoring of the population is possible pending funding	Research and on going monitoring of the population is already worked into the plan's budget
3.2 Possible Intervention	Possible interventions to increase population numbers (i.e. egg hatcheries, head-start rearing, predator control) are not in the plan	Possible interventions (i.e. egg hatcheries, head-start rearing, predator control) are mentioned, however they may not be thought of as necessary or needed at this time	Possible interventions (i.e. egg hatcheries, head-start rearing, predator control) are mentioned, and plans to implement them are included

Appendix B- Full Indicator Analysis

Indicator	Justification						
1. Implementation Indicators	United States (1992)	Barbados (1992)	St. Vincent and the Grenadines (1993)	The Guianas (2003)	Canada (2006)	Trinidad and Tobago (2010)	Jamaica (2011)
1.1 Statement of objectives	Three recovery objectives are stated with the primary goal of having the leatherback sea turtle delisted from the Endangered Species Act. The objectives are vague, lacking details needed to provide a solid foundation for the recovery plan.	Objectives for the recovery action plan are not stated.	Objectives for the recovery action plan are not stated. However, one of the proposed management solutions of the recovery action plan was to create a foundation for the formation of a National Sea Turtle Conservation Program, of which the goals, objectives and associated activities to achieve the goals and objectives are stated and clearly outlined. These objectives clearly articulate many of the calls for action described throughout the plan.	The overall objective of the plan is stated as "Implement an integrated, comprehensive and long-term sea turtle conservation, monitoring and research program in the Guianas." A number of other specific objectives are also given. Key priority actions and expected outputs and achievements are also listed.	Six objectives for the recovery strategy are clearly outlined and are followed by an individual rationale and several strategies to achieve the objective.	Objectives for the recovery action plan are not stated. However, one of the proposed management solutions of the recovery action plan was to create a foundation for the formation of a National Sea Turtle Conservation Program, of which the goals, objectives and associated activities to achieve the goals and objectives are stated and clearly outlined. These objectives clearly articulate many of the calls for action described throughout the plan.	The primary objective is "to present a strategy for a national effort to ensure sustained recovery of depleted sea turtle stocks." This objective is relatively vague and not able to be quantified to measure success. No sub-objectives are given.

A number of objectives for a National Sea Turtle Conservation Program are stated, with associated activities. These include many of the action items described throughout the document. |
| 1.2 Description of the plan's scope | The recovery plan is aimed towards leatherback sea turtles within U.S. coastal and pelagic waters in the U.S. Caribbean, Atlantic and Gulf of Mexico regardless of nesting beach affiliation. Projects are scheduled for five fiscal years within the implementation schedule. | The recovery action plan articulates management and conservation activities within the beaches and EEZ of Barbados. A timeline for the document is not defined. | The geographic scope for the recovery action plan is not explicitly stated, other than that it is for St. Vincent and the Grenadines. Due to the numerous islands this may create confusion as not all islands have nesting sea turtles. A timeline for the document is not defined. | The document is a collaborative management and conservation tool for Guyana, Suriname, and La Guyane, which are collectively referred to as The Guianas. The plan aims to aid in managing at the local, national, regional, and international level. A timeline for the document is not | Aims to increase the population such that the long-term viability of the leatherback turtles frequenting Atlantic Canadian waters is achieved. A timeline for the document is not defined. | The recovery action plan articulates management and conservation activities within the beaches and EEZ of Trinidad and Tobago. A timeline for the document is not defined. | The recovery action plan articulates management and conservation activities within the beaches and EEZ of Jamaica. A timeline for the document is not defined. |

				defined.			
1.3 Presence of a Regulatory framework	The legal context for the recovery plan is not defined.	The legal context for which conservation and management activities should operate in is described for some recommendations made within the recovery action plan. The legal context for how the plan is supported through international legislation is well described. In some instances recommendations for improving regulatory frameworks are included.	The legal context for which conservation and management activities should operate in is well described for all of the recommendations made within the recovery action plan. In some instances recommendations for improving regulatory frameworks are included.	Because this plan represents sea turtle conservation for three distinct nations, it is difficult to include the regulatory context for each country individually. Rather, the plan suggests the creation of a harmonized regional legislation and regulatory framework for which sea turtle management and conservation activities to operate in.	The recovery strategy describes the legal context (i.e. Acts, and responsible management bodies) in terms of who affords the leatherback sea turtle protection in Canadian waters. A description of protection within the global context is also included.	The legal context for which conservation and management activities should operate in is typically well described for all of the recommendations made within the recovery action plan. The plan also described in detail how current management and conservation activities operate legally and how the regulatory guidelines can be improved.	The legal context is described throughout the plan. As new initiatives and recommendations are made the corresponding Acts are mentioned. Additionally, there is an entire appendices dedicated to laws affecting sea turtles and the conservation of their habitats.
1.4 Presence of an implementation schedule	An implementation schedule is present that includes each task outlined in the Outline and Narrative section. Task timelines are defined as continuing or a yearly duration is given.	An implementation schedule is not present within the document.	An implementation schedule is not present within the document.	An implementation schedule is not present within the document.	An implementation schedule is not present within the recovery strategy. The document states that the Action Plan will outline the schedule for recovery activities, however no such document has been released.	An implementation schedule is not present within the document.	An implementation schedule is not present within the document.
1.5 Identification of responsible jurisdictions	Responsible jurisdictions are not directly stated, however statements simply calling on the responsible State, Commonwealth or Territory to act are included.	The plan applies to the island of Barbados.	The plan applies primarily to St. Vincent while some islands within the Grenadines are also included. For some management objectives it is unclear exactly which islands are responsible because not all islands are home to nesting sea turtles, while for others it is very clear	The plan applies to the three countries that compose the Guianas: Guyana, Suriname, and La Guyane.	Responsible jurisdictions are named and cooperated in the production of the recovery strategy.	Responsibilities and duties are outlined for both the islands of Trinidad and Tobago. The distinction is important as the conservation and management situation is different between the two islands.	The plan applies to the Island of Jamaica and to the shared management areas with Columbia.

			which islands are responsible.				
1.6 Identification of responsible enforcement authorities	Responsible authorities are listed within the implementation schedule under responsible agencies if the task requires law enforcement. Specific enforcement responsibilities are also described.	Enforcement is the responsibility of the Royal Barbados Police Force, the Barbados Coast Guard and the National Conservation Commission. The plan states that these authorities should be responsible for protecting sea turtles and their nesting and foraging habitats.	Enforcement authorities are identified but are severely lacking in St. Vincent and the Grenadines due to lack of financial resources. In addition, police officers have in the past refused to prosecute low-income offenders. The recovery action plan suggests funding several positions that would aid in enforcement activities (i.e. deputies to the Fisheries Officer and the creation of a central authority for managing parks and reserves) .	In Suriname, enforcement is primarily the responsibility of Fisheries Services and other governmental agencies. One of the specific objectives for the recovery plan is to implement effective law enforcement strategies throughout the entire region.	The responsible enforcement authorities are not described.	A co-management strategy is used where multiple community groups actively participate in the protection of sea turtles (leatherbacks in particular). Further, restructuring of the Forestry Division to include a Forestry and Protected Areas Management Authority to take on some of the enforcement and management tasks is recommended.	The Caribbean Coastal Area Management Foundation (C-CAM) is one of the primary enforcement authorities who work with other NGO groups and the government to promote conservation initiatives. Certain government departments are also responsible for enforcement, however like many other Caribbean nations there is a general lack of resources.
1.7 Financial resources	The following statement is made in the recovery plan: "Objectives will only be attained and funds expended contingent upon appropriations, priorities and other budgetary constraints." Cost estimates are noted in the implementation schedule.	Some of the activities will be funded by the Caribbean Trust Fund, which is a regional fund set up by 22 Caribbean nations, including Barbados. Additionally, the Bellairs Research Institute covers some costs.	Obtaining funding appears to be the limiting factor for most management activities. The only source of funding described is a grant application submitted by WIDECAST specifically for a multi-nation tagging program.	WWF-Guianas supplied the initial funding and technical assistance to launch the action plan, however the full implementation rests on the donor community and various other stakeholder groups.	Recovery efforts have previously received funding from the Government of Canada's Habitat Stewardship Program (HSP), Dalhousie University, and the Department of Fisheries and Oceans' (DFO) Species at Risk Fund, however it is unclear whether they will continue to fund recovery efforts in the future.	Multiple funding sources are described throughout the plan for various projects however it is unclear how the current calls to action will be funded. Within the objectives of the Sea Turtle Conservation Program ensuring funding is listed but no further details are given.	Multiple sources are described (i.e. funding for nesting beach surveys was received from the Environment Fund of Jamaica), projects however it is unclear how the current calls to action will be funded.
1.8 Responsible agencies for executing the plan	Responsible agencies for each task are identified within the	A list of NGOs and governmental departments along	St. Vincent and the Grenadines are signatories to the	Due to differing socio-economic and cultural conditions	A team of experts who collaborated on the creation of the	In Trinidad and Tobago conservation and enforcement	In Jamaica the government is primarily

	implementation schedule.	with a list of recommended actions and responsibilities is included in the recovery action plan.	Cartagena Convention, which places the responsibility of sea turtle conservation and management within the governments' responsibility. The government is however, supported by a network of interested citizens and WIDECAST. The plan does lack detail as to which specific departments or agencies should carry out the suggested management activities recommended throughout the plan.	between the three countries that make up the Guianas, agencies and institutions that have taken on implementing sea turtle recovery activities differs. A number of individuals, agencies, communities, and institutions who are primarily responsible for sea turtle conservation activities are described for each country. The recovery plan is available to be used as a tool to guide recovery activities for any of the listed agencies.	recovery strategy is listed, however it is unclear as to what their individual responsibilities in terms of conservation activities might be following the publication of the document.	activities are carried out by a variety of community groups such as Nature Seekers, Fishing Pond Turtle Conservation Group, and the Navira Environmental Trust.	responsible for carrying out management and conservation activities with the help of other organizations such as the Sea Turtle Recovery Network. Some departments are discussed in a general context, however it is unclear as to which departments or organizations should carry out each identified task.
1.9 Identification of socio-economic conflicts	The plan recognizes the existence of socio-economic conflicts (such as fisheries and recreational boating) in section 3, however specific conflicts are not identified.	A number of socio-economic conflicts are discussed throughout the plan, primarily in association with turtle poachers. Mitigation solutions include determining alternative livelihoods for fishers, however there are only a couple of turtle fishers present in Barbados so this is not an urgent issue.	A number of socio-economic conflicts are discussed throughout the plan, primarily in association with turtle poachers. No mitigation solutions are discussed.	Socio-economic conflicts vary throughout the region and are much more prevalent within La Guyane and Guyana than in Suriname, where virtually no sea turtles are slaughtered for meat and other gains. One of the specific objectives of the plan includes assisting indigenous and local communities that rely on sea turtle products in creating sustainable-use guidelines or in finding alternative livelihoods.	The plan recognizes the need to take socio-economic factors into consideration, stating that costs tend to be upfront to impacted industries, while benefits tend to be diffuse across society and may not be realized until later on. A socio-economic analysis would be included in the Action Plan, which does not exist.	A number of socio-economic conflicts are discussed throughout, including industries such as fisheries and tourism. Some mitigation activities that have been implemented in the past.	Socio-economic conflicts are discussed throughout the plan. Specific industry examples are given along with reasoning for their occurrence (i.e. lack of coordination, lack of respect for environmental laws, and lack of enforcement). Mitigation strategies are not discussed.
1.10 Identification	The recovery plan	The recovery plan	The recovery plan	Ensuring the	The impacts of	The recovery action	The recovery action

of Potential Ecosystem Impacts	does not identify any potential ecosystem impacts associated with management activities.	does not identify any potential ecosystem impacts associated with management activities.	does not identify any potential ecosystem impacts associated with management activities.	sustainable use of the ecosystem is discussed as an institutional responsibility. Additionally, one of the main objectives of the recovery plan includes reducing the impact on the surrounding ecosystem from economic activities. The potential ecosystem impacts from various conservation activities are not discussed.	recovery planning on the surrounding ecosystem are considered and the plan aims to ensure that all activities will benefit the environment.	plan considers the value of the wider ecosystem in terms of how it benefits the sea turtles and socio-economic activities, however potential impacts of management activities are not widely discussed.	plan considers the value of the wider ecosystem in terms of how it benefits the sea turtles and socio-economic activities, however potential impacts of management activities are not widely discussed.
1.11 Plan Evaluation	An evaluation strategy to measure the performance of the plan is not present.	An evaluation strategy to measure the performance of the plan is not present.	An evaluation strategy to measure the performance of the plan is not present.	The plan defines important performance indicators for successful research, monitoring, and conservation efforts. Also mentioned is developing mid-course adjustments to recovery activities as needed. No evaluation timeline is given.	Performance indicators are listed in section 4.4 and represent critical components of recovery planning. All indicators are measurable. No distinct timeline for measuring performance is given, simply that it will be performed at regular or scheduled intervals when the recovery strategy is reviewed.	An evaluation strategy to measure the performance of the plan is not present.	An evaluation strategy to measure the performance of the plan is not present.
1.12 Stakeholder Consultation	There is no indication that stakeholder consultations took place.	There is no indication that stakeholder consultations took place.	There is no indication that stakeholder consultations took place.	Key stakeholder groups participated in the development of the regional action plan through various consultations and review processes.	Stakeholder consultations are documented within the recovery strategy in Appendix C and took place with several governmental departments, the US National Marine Fisheries Service, ENGOs, industry groups, the	The introduction states that the recovery action plan has been reviewed by in-country and governmental and non-governmental stakeholders as well as by international collaborators.	A number of stakeholders are identified in Table 5 and it is stated that a consultative process took place.

					international scientific community, provincial governmental departments within the responsible jurisdictions, First Nations Chiefs, and the Atlantic Large Pelagic Advisory Committee.		
1.13 Participation in international initiatives	The recovery plan states that the United States should work in conjunction with other jurisdictions to ensure the stability of the U.S. population of leatherback sea turtles and encourages the formation of international agreements to create a comprehensive leatherback conservation plan. Ratifying the Cartagena Convention, an international convention to protocol to aid in protecting the marine environment of the Wider Caribbean Region, is also encouraged.	The recovery action plan states that Barbados should become a signatory to CITES. Additionally, a number of regional conventions to which Barbados is a signatory of are described. The plan recommends working in collaboration with other Caribbean nations to effectively protect all sea turtle species and participate in regional research initiatives.	It is encouraged by the action plan that St. Vincent and the Grenadines become signatories to CITES, SPAW Protocol, and MARPOL, three international conventions regarding the conservation of sea turtles or at risk species. In addition, WIDECAST proposes collaboration with several other Caribbean nations to perform a tracking program to better understand how sea turtles move between different nations.	The recovery plan discusses collaborating with international universities to bring exchange students in to participate in internship programs and to initiative collaborative research efforts.	Objective 6 calls for international collaborations so that Canada may help strengthen leatherback sea turtle conservation outside their jurisdiction. Strategies involve collaborating with the United States and other range nations and international bodies when possible.	The recovery action plan encourages the Government of Trinidad and Tobago to participate in any international sea turtle conservation initiatives. The country is already a signatory to CITES and the document encourages singing to a number of other international conventions including the Convention on Biological Diversity, the Convention of Migratory Species and the U.N. Convention on the Law of the Sea.	Jamaica is a signatory to a number of international conventions such as CITES, MARPOL, Convention on the High Seas, and CBD. It is recommended that Jamaica accede the Cartagena Convention, the Inter-American Convention, and the Western-Hemisphere Convention. Additionally, it is recommended that Jamaica work with Honduras and Nicaragua to sustain sea turtle populations and with Columbia whom they share jointly managed areas with.
2. Management and Conservation Indicators							
2.1 Knowledge of Leatherbacks within Jurisdiction							
2.1.1 Number of sea turtles	Data from several opportunistic	The number of leatherback sea	The number of leatherback sea	It is estimated that 50% of all	A rough estimate (100-900) of Atlantic	There is no indication of the	Leatherbacks are relatively rare in

entering jurisdiction	sightings studies within U.S. Atlantic and Caribbean waters are included. The data would now be considered outdated as it is from 1979-1987. There is a call for research to determine distribution and abundance to move forward with management.	turtles entering Barbados is thought to be relatively low, however estimates are unknown. The recovery action plan recognizes the importance of obtaining this information.	turtles entering St. Vincent and the Grenadines is unknown. The recovery action plan recognizes the importance of obtaining this information.	leatherback sea turtles in the Atlantic population nest within the Guianas, however an estimate of the number of sea turtles entering the jurisdiction is not given. Population identification and assessment of size and trends are named as a management objective.	leatherback sea turtles is given based on opportunistic sightings data. This information is from 1992 and is therefor outdate.	number of sea turtles within the management jurisdiction	Jamaica with only 6 sightings since 1982. The exact number of leatherbacks within the jurisdiction is not known.
2.1.2 Population status	The global population status is stated as endangered, which is outdated according to the IUCN deceleration. The recovery plan further states that the status of the individuals within the U.S. is unknown.	The global population status is stated as endangered, which is outdated according to the IUCN deceleration. Population details regarding leatherbacks in Barbados are not given.	It is stated that sea turtle species in general are listed as endangered or vulnerable but exact population details regarding leatherbacks in St. Vincent and the Grenadines are not given.	The global population status is stated as critically endangered, which is outdated, however the local population is stated as stable, however volatile. Continued monitoring to determine an accurate overall status is encouraged.	The recovery strategy/ COSEWIC lists Atlantic Leatherback sea turtles as endangered, however according to the IUCN they are to be considered vulnerable and at least one Atlantic sub-population is listed as least concern.	The population status is stated for the general population of leatherbacks nesting in the Caribbean and is stated as stable or slightly increasing. This is consistent with the IUCN deceleration.	The status of the species is given within a global context, stated as Vulnerable, which is consistent with the IUCN. In addition, it is known that the population of leatherbacks within Jamaica is very limited, however the exact status is unknown.
2.1.3 Nesting Assessments (i.e. hatchlings, nesting females, and nest abundance)	Nesting information is outdated (1982-1991).	It is thought that nesting activity in Barbados is relatively rare. Eight nests were recorded between 1984-1987, which is now considered outdated information. No other nesting information is known.	The number of nesting females, nests, and hatchlings are not currently known. The importance of this information for measuring the effectiveness of management and conservation efforts is recognized and it is a recommendation of the recover action plan to begin this data collection	The number of nests in Awala-Yalimapo in 1999 was estimated at about 15,000, which increased to 20,000 by 2002. As many as 50,000 nests have been recorded in this area. Nesting had increased in some regions, while decreasing in others, and nesting data has been better recorded in some areas than in others. Other nesting details such as numbers of nests are discussed, however	Leatherback sea turtles do not nest in Canada.	The Nature Seekers (an NGO group) conducted nest surveys and found 52,797 and 48,240 nests in 2007 and 2008 respectively on three of Trinidad's most prominent nesting beaches. The number of nests on Tobago is much lower at about 250 nests per season. The number of nesting females is not know, however estimates can be derived from knowing the number	Leatherback nesting activity in Jamaica is relatively rare. There have only been 12 reports of nesting activity since 1851. Exact nest and nesting female counts are not known. It is recommended that surveys continue to determine the distribution and success of annual breeding efforts made by all sea turtle species in Jamaica.

				much of the information is outdated.		of nests and false crawls of which the plan calls for further research on.	
2.1.4 Estimate of Mortality	Multiple sources of mortality are discussed and of those mentioned many are quantified. However, the data is outdated.	Multiple sources of mortality within Barbados are discussed, but aren't quantified.	It is stated that natural mortality is higher in younger life stages, however in terms of anthropogenic factors, humans tend to harvest the largest individuals, which is the most detrimental to the population. Other sources of mortality are discussed but are not quantified.	Multiple sources of mortality within The Guianas are discussed. Sea turtle strandings are relatively abundant in Suriname with 10-12 carcasses being found within a single stretch of beach. In addition, it was found that 1300 leatherback, green, and olive ridley sea turtles were killed in shrimp trawls in 1991. Most of the quantifies sources of mortality is outdated, however obtaining updated data is a management objective.	Multiple sources of mortality within Canadian waters are discussed, but aren't quantified.	Multiple sources of mortality within Trinidad and Tobago are discussed, but aren't quantified.	Multiple sources of mortality within Jamaica are discussed. Estimate of mortality from certain sources are given. For example, compacting sand can cause 100% mortality within a nest. The exact number of turtles dying from various threats is not known.
2.2 Critical Habitat							
2.2.1 Identification of critical habitat	Critical nesting beaches and marine habitats are not identified. It is worth mentioning that within the implementation schedule identifying these habitats is identified as a priority one task.	Multiple nesting sites are indicated on a map within the recovery action plan, however critical nesting beaches have not been specifically identified. Additionally, critical foraging habitats have not been identified. The recovery action plan calls upon the Bellairs Research Institute to aid in obtaining this information.	Important nesting beaches in St. Vincent have been identified (i.e. Richmond Beach, Dar View, Clare Valley), while leatherbacks have been reported to nest occasionally on others in the Grenadines. Critical foraging areas (if any) have not yet been identified.	Primary nesting beaches in the Guianas have been identified. In Guyana, Luri Beach and Kamwatta are the most frequented nesting beaches, however nesting occurs across nine distinct beaches. In Suriname, primary nesting beaches include Motkreek Beach and Krofajapasi Beach. Finally, in La Guyane, primary nesting beaches include Awala-Yalimpo	The critical habitat has not yet been identified for the Atlantic leatherback sea turtle, however objective 3 calls for the identification of critical habitat within Atlantic Canadian waters. Further, a Schedule of Studies for the identification of the critical habitat is included in Appendix B.	Critical nesting beaches within Trinidad and Tobago have been identified. The three most important beaches are Matura Bay, Fishing Pond and Grande Riviere, however nesting occurs on beaches all over both Islands. Critical marine habitats (which may include mating areas) within the waters of Trinidad and Tobago have not been identified but the recovery action	The Sea Turtle Recovery Network and WIDECAST completed primary surveys to identify critical nesting and marine habitats in 1992-1995. There were still uncertainties and other surveys have aimed to fill in the gaps. The recovery action plan recommends new regular national surveys to update the information about critical habitats.

				Beach (which has been identified as one of the most important nesting sites worldwide), Kourou, and Cayenne. Critical marine habitats have not been identified. Further identification of critical foraging and nesting habitats is a management objective.		plan calls for the identification and protection of these areas.	
2.2.2 State of the critical habitat	General details on the state of leatherback critical habitats is given within a global context, however because the critical habitat within the United States was not identified within this recovery plan, the state of the habitat can not be described.	Nesting habitats are described as unstressed, however this information could be outdated. Critical foraging habitats have not yet been identified.	It is stated that suitable nesting beaches are numerous and many of them are undeveloped, however it is unclear if they are impacted by other activities.	Many of the critical nesting beaches are experiencing changes due to natural coastal processes that may make the habitat less suitable for nesting sea turtles, however the exact state of the critical habitats is not discussed.	As the critical habitat has not been identified, the state of the habitat cannot be known.	The recovery strategy discusses many nesting beach monitoring initiatives, however none seem to have quantified the quality of the nesting beach habitat to ensure that critical attributes, functions and features of the habitat are available to the sea turtles.	In Jamaica one of the biggest pressures threatening sea turtles is the degradation of the nesting beach and marine habitats. It is known that these areas are subject to deterioration and it has in turn impacted the local fisheries and tourism economies.
2.2.3 Protection of critical habitats	Critical nesting and marine habitats are not awarded protection as of the date of publication of the recovery plan, however ensuring long term protection of these habitats is listed as a priority one task.	Multiple nesting beaches are protected within the Barbados Marine Reserve which extends 1000m off the west coast of Barbados. There are beaches on the south/ south west coast that aren't under protection. Because critical habitats have not yet been identified there could be critical nesting and foraging habitats currently not protected. The plan recognizes the	Some important nesting habitats are coincidentally protected within Fisheries Conservation Zones, however they are not awarded their own protection. The plan calls for a review of multiple existing protected areas and for the future inclusion of critical nesting beaches within protected areas. Similarly, the plan calls for the protection of any	In Suriname, a number of critical nesting beaches are within the Wia-Wia nature reserve and the Galibi nature reserve. Further, nesting beaches are patrolled year-round by permanent field staff. Year round patrolling is recommended throughout the region as nesting is known to occur at all times of year. Protection of all critical nesting and foraging habitats is	Under the Species at Risk Act, critical habitats are awarded protection within 180 days of publication in a recovery strategy or action plan. However critical habitats are not yet identified.	The three most important nesting beaches in Trinidad (Matura, Fishing Pond, and Grande Riviere) have been designated as Prohibited Areas under the Forests Act. The recovery action plan heavily recommends that primary nesting beaches in Tobago be awarded the same protection and that all nesting beaches be further protected under the Environmental	Through the creation of a protected areas network many sea turtle habitats have been placed under protection. Sea turtles are still vulnerable to pressures from poaching and fishing in these protected areas. The recovery action plan recommends extending the network to protect other ecologically important areas to sea turtles and providing incentive

		need for collaborative research to identify these habitats.	important foraging grounds (if any) upon their identification.	encouraged.		Management Act, the Marine Areas Act, the Town and Country Planning Act, and the Forests Act.	to local landowners to assist in protecting beaches. Portland Bright has been identified as an important aggregation area and has been recommended for protection.
2.3 Threats to Nesting Habitat							
2.3.1 Coastal development	Several action items to address the negative impacts of coastal development are listed within the Outline and Narrative section of the recovery plan. These include things such as beach replenishment, softening compacted substrates, and reestablishing dunes and native beach vegetation. Also stated is that coastal construction and related activities should be planned in such a way that avoids disrupting nesting and hatching activities.	Coastal development is recognized as a threat. Management strategies include the development of set-back lines for the construction of new developments, and to consult architects to ensure the use of the precautionary approach in terms of the ecosystem impacts of future developments.	Coastal development is recognized as a threat. Mitigation solutions include requiring Environmental Impact Assessments prior to development, the establishment of set-back lines for construction and the inclusion of sea turtles in future development plans.	Coastal management (along with associated threats such as artificial light and increased human presence) is recognized as a threat, however management strategies are not discussed.	Threats to nesting habitat are not applicable to Canada. It is worth mentioning that Canada's Recovery Strategy does recognizes several threats to nesting habitats and offers to some extent possible management solutions. It is unjust, however, to score Canada on a category outside their jurisdiction.	Coastal development is recognized as a threat in the recovery action plan. Proposed management solutions involve the management of associated activities under the Environmental Management Act and the establishment of set-back lines for construction.	Coastal development is recognized as a threat in the recovery action plan. Proposed management solutions involve the establishment of legally defined set-back lines for construction.
2.3.2 Increased human traffic	Disturbance to nesting females, compacting sand above nests, creating tracks in the sand that interfere with hatchlings reaching the ocean, the presence of recreational beach equipment and the use of vehicles on the beach are	The impact of increased human presence on nesting beaches is not thoroughly discussed. However the importance of sustainably growing the tourism industry is mentioned. Management strategies include creating safe "turtle	The impacts of increased human presence on nesting beaches is not thoroughly discussed as it wasn't a direct issue faced by St. Vincent and the Grenadines at the time of publication. The document states that many of the	Increased human traffic is of particular concern in La Guyane where upwards of 300 tourists could be present on a nesting beach on any particular night without a guide to view nesting and hatching activities. Management		The recovery action plan suggests that developing set-back limits for construction (mentioned above) might also aid in alleviating pressures from increased human presence. It also emphasizes the importance of prohibiting any	The recovery action plan suggests that developing set-back limits for construction (mentioned above) might also aid in alleviating pressures from increased human presence. It also suggests a code of ethics bedrawn up for tourists,

	discussed. Management solutions include ensuring the softening of compacted sand and eliminating vehicular traffic on nesting beaches during nesting season.	watching" programs to ensure the safety of eggs and hatchlings.	management guidelines and activities throughout the document will aid in sustaining the development of the tourism industry.	strategies include improving tour guide and tourist guidelines, improving tourism management, and the implementation of a visitor impact monitoring system.		vehicular traffic on beaches and recommends educational material be distributed to inform the public of the regulations in place to safe guard important sea turtle habitats.	researchers and other turtle watchers to ensure the safety of the nesting and marine habitat. Another issue is the illegal habitation of important cays for sea turtles. It is recommended that enforcement be strengthened to prohibit this activity from continuing.
2.3.3 Inadequate waste disposal on nesting beaches	The negative impacts of inadequate waste disposal of garbage on nesting beaches are described, however the only solution given is to post information signs at public access points to the beach. The plan lacks other response measures to deal with the existing waste and the waste that will inevitably end up on the beach if the signs are ineffective.	Direct waste disposal on nesting beaches ins not discussed, however the broader context of waste washing up on nesting beaches from the ocean and the negative impacts of such waste are discussed. Management solutions include beach clean ups, however no solutions for mitigating inadequate waste disposal on beaches are mentioned.	The government passed an Anti-Litter Act to promote the proper disposal of garbage, however enforcement has been challenging. Recommended management involves continuing beach clean up efforts by the Youth Environment Service (YES club), expanding YES throughout the country and informational hand outs are given to tourists.	Direct waste disposal on nesting beaches ins not discussed, however the broader context of waste washing up on nesting beaches from the ocean and the negative impacts of such waste are discussed. Management solutions include beach clean ups, however no solutions for mitigating inadequate waste disposal on beaches are mentioned.		The recovery action plan recognizes the threats associated with inadequate waste disposal and calls for an overhaul of the country's waste disposal management plan. Further, it also calls for the clean up of waste that has previously been left behind in these environments. It also recommends that sewage treatment facilities that are capable of handling the increasing capacity from tourism be developed in areas of urbanization and high touristic presence.	Most beaches in Jamaica are littered. Recreational beach users are identified as the primary source along with inland dumping sites and ocean-borne debris. The recovery action plan calls for the elimination of waste dumping on beaches, near shore areas, dunes and nearby wetlands. It also calls for the clean up of all trash on the beaches. Additionally the plan calls for the banning of waste dumping into ravines and offshore waters.
2.3.4 Beach alterations	Action items to address beach alterations include evaluating and strengthening applicable laws and removing any failed erosion control	Beach alterations (i.e. sand mining, beach cleaning, beach armouring) are discussed. Sand mining is illegal in Barbados, however illegal removal of	Beach alterations (i.e. sand mining, beach cleaning, stabilization structures) are discussed. Currently sand mining is illegal in St. Vincent and the	The implications of beach cleaning and compacted sand are discussed. There is no mention of beach armouring, beach stabilization or sand mining. Reducing		The recovery action plan suggests that beach alterations such as sand mining and beach armouring be managed under the Environmental	Beach mining is currently prohibited in Jamaica, however there have been enforcement challenges. Mining tools have been confiscated by

	structures. Other threats such as beach nourishment and beach cleaning are also discussed.	sand does occasionally occur. Management strategies include increasing enforcement of sand mining regulations, and that alternatives to beach armouring be considered.	Grenadines, however existing regulations aren't typically enforced. The plan recommends strenuous effort be put forward to ensure enforcement. It also recommends safe use of beach stabilization structures.	sand compaction is mentioned as a management strategy.		Management Act. This would ensure that an Environmental Impact Assessment be completed before any potentially harmful activities take place.	Marine Park Rangers. It is suggested that beach mining be strictly prohibited and beach armoring with hard structures be considered as a last resort only. Threats associated with renourishment are also discussed.
2.3.5 Sea level rise	Erosion from increased storm events in the tropics is discussed. The resulting negative impacts of increased sand moisture and temperature from increased precipitation are not discussed.	The threat is not addressed or present in the recovery action plan.	Threats to eggs from erosion as a result of increased storm events is discussed, however the resulting effects from increased sand moisture and temperature are not discussed.	The threat is not addressed or present in the recovery action plan.		The threat is not addressed or present in the recovery action plan.	Threats to eggs from erosion as a result of increased storm events is discussed, however the resulting effects from increased sand moisture and temperature are not discussed.
2.3.6 Other changes in habitat suitability due to climate change	Other threats to the nesting habitat as a result of climate change are not discussed, however one research action item involves establishing a temperature transect on the nesting beach in case nest relocation projects need to occur.	The plan recognizes that threats associated with erosion and the role removal of native beach vegetation plays in erosion, however no mention is made of climate change as a factor.	Other threats to the nesting habitat as a result of climate change are not discussed.	Threats associated with increased nesting beach erosion are discussed, however erosion seems to be influenced by the construction of spits at the end of near-by rivers. Otherwise, no other changes in habitat suitability due to climate change are discussed.		The recovery action plan calls for the stabilization of native beach vegetation to mitigate the impacts of increased wind and storm events to ensure that the beach remains in tact for sea turtle usage.	Changes in beach topography due to increased storm events, food availability, physical changes to the marine environment and habitat availability are all discussed as potential threats as a result of climate change. No management solutions are presented.
2.4 Threats to Foraging/Marine Habitat							

2.4.1 Acoustic Disturbance (indirect)	The threat is not addressed in the recovery plan.	The threat is recognized as a result of human presence on or near nesting beaches. Acoustic disturbance at sea is not discussed. The implications of acoustic disturbance to the critical foraging habitat are not discussed.	The threat is not addressed or present in the recovery action plan.	The threat is recognized as a result of human presence on or near nesting beaches. Acoustic disturbance at sea is not discussed. The implications of acoustic disturbance to the critical foraging habitat are not discussed.	The threat is recognized and discussed in the plan under the threats section. Several sources of acoustic disturbance and the impacts are discussed, however no management solutions are given.	The threat is not addressed or present in the recovery action plan.	The threat is not addressed or present in the recovery action plan.
2.4.2 Discharge and run-off (indirect)	Discharge and run-off of pollutants and harmful substances is discussed, however the recovery plan places the responsibility within the industry to ensure appropriate measures are taken instead of giving concrete actions to manage the problem.	Point sources of industrial (i.e. a rum refinery and a power station) and agricultural run-off are identified. Discharge of sewage, oil, and other toxic materials are also discussed. The implications of these substances are discussed in terms of their impact on the marine ecosystem. Management strategies include minimizing de-bushing to reduce sediment-loaded run-off, multi-nation planning for potential oil spill clean up, and the construction of two new sewage treatment facilities.	Point sources of Industrial (i.e. a rum distillery, a coconut oil factory, and a diesel power station) and agricultural run-off are identified. Sewage treatment is also an ongoing issue threatening the marine habitat. It is recommended that regular water and habitat quality assessments be conducted.	Pollution from discharge and run-off into rivers, which eventually ends up in the ocean, is discussed. Fisheries are named as a source of pollution in terms of dumping garbage and waste products over board. Specific impacts to the critical habitat are not discussed. No management solutions are discussed.	Threats associated with discharge and run-off are only discussed in terms of the direct threats to individual leatherbacks and not to the broader marine habitat.	The recovery action plan recommends that existing pollution laws be reviewed for completeness and enforceability and that waterways be regularly monitored for the presence of harmful substances. It also recommends that industry activities with the potential for spills and waste discharge be required to undergo an Environmental Impact Assessment before proceeding with any project.	A number of sources of industrial discharge are named in addition to agricultural run-off. Their impacts on the surrounding habitat are discussed. Management solutions involve revising existing pollution laws, monitoring industries to confirm discharging, reviewing Jamaica's capacity to handle an oil spill event, conducting habitat and water quality assessments, and evacuating the effects of agricultural run-off.
2.4.3 Other changes in habitat suitability due to climate change	Threats to the foraging habitat as a result of climate change are not discussed.	Threats to the foraging habitat as a result of climate change are not discussed.	Threats to the foraging habitat as a result of climate change are not discussed.	Threats to the foraging habitat as a result of climate change are not discussed.	Threats associated with climate change are mentioned in the threats section, however no management solutions are given.	Threats to the foraging habitat as a result of climate change are not discussed.	Changes in the marine environment are discussed and include salinity, temperature, current patterns, and food availability. Mitigation solutions are not discussed.

2.5 Threats to Sea Turtles							
2.5.1 Marine debris	The recovery plan recognizes the negative impacts on all life stages of ingestion of and entanglement in marine debris. At the time of publication not much was known regarding the impacts off marine debris on leatherback sea turtles. Management solutions include determining the severity of the of the issue by increasing documentation of such occurrences, researching the effects of ingestion on the health of the leatherback sea turtle, and formulating measures to aid in reducing marine debris in the marine environment by identifying point sources and increasing public awareness.	Dumping of plastic garbage and other debris at sea (particularly from cruise ships) is discussed, while details regarding debris originating from land-based sources is generally lacking. Legislation prohibiting pollution in territorial waters exists, but needs to be better enforced. Management solutions include beach clean ups and the Barbados Environmental Association monitors the type of garbage found on beaches.	Dumping of plastic garbage and other debris at sea (particularly from cruise ships) is discussed, while details regarding debris originating from land-based sources is generally lacking. The nation has a Solid Waste Management project that will be enlisted to aid in clean up and a mitigation strategy recommended is the continuation of yearly beach clean ups by NGOs.	The impacts of marine debris in both the marine habitat and the nesting beach is discussed throughout the recovery plan. In addition, the direct threats from plastic are also discussed. Management solutions include beach clean ups to protect hatchlings and nesting females. No action items are suggested to deal with any already existing debris in the marine habitat.	One of the identified knowledge gaps is the impact of marine debris, however the only action item listed is to determine the level of mortality and injury associated with marine debris.	The recovery action plan calls for the prohibition of dumping solid waste into the water under all circumstances (to be managed under the Environmental Management Act) and recognizes the direct threat this activity poses to sea turtles. It also recommends the implementation of a multi-industry public awareness campaign to promote the proper disposal of garbage and unwanted gear. No action items are suggested to deal with any already existing debris.	Threats associated with marine debris are widely discussed throughout the recovery action plan, identifying multiple at sea sources of garbage dumping and discussing their harmful effects on sea turtles. Management strategies involve increasing beach monitoring and education to eliminate debris at its source and the continued investment into clean up programs.
2.5.2 Vessel interactions	The threat of vessel interactions is discussed. There are no direct management solutions given other than increasing research to better understand the distribution of the species in the pelagic, which could potentially be used	The threat is not addressed or present in the recovery action plan.	The plan mentions strikes from jet-skis, which are banned from the area. Strikes from larger vessels are not discussed.	The threat is not addressed or present in the recovery action plan.	Vessel interactions are identified as a threat within the knowledge gaps, however the recovery strategy simply calls for an evaluation of the vulnerability of leatherback sea turtles to vessel strikes and an assessment of the	The threat is not addressed or present in the recovery action plan.	The plan mentions strikes from jet-skis, which is not a large problem in Jamaica. Strikes from larger vessels are not discussed.

	to identify areas to avoid for vessels. However the use of this research for this purpose is not discussed.				incidence of strikes. No preferred management solutions are given.		
2.5.3 By-catch or entanglement	By-catch and entanglement as a product of the commercial and recreational fisheries industries is addressed (specifically within the shrimping industry). The recovery plan suggests that appropriate agencies identify spatial and temporal conflicts in order to reduce interactions. Further, increased monitoring is encouraged to evaluate the extent of by-catch from certain gear types. Finally, the promotion of enforcement regulations is suggested.	By-catch and entanglement within the long-line fishery is discussed. At the time of publishing, Barbados had six long-liner vessel, however foreign vessels had been known to fish in Barbados' territorial waters. Management strategies involve determining the level of incidental catch as a result of the long-line fishery.	By-catch and entanglement within the long-line fishery is relatively prevalent. Mitigation strategies include requiring the collection of data regarding the incidence of leatherback entanglements, which would become mandatory in order to qualify for a license under the Fisheries Act. In addition, the government is encouraged to support measures outside of the country to ensure the safety of sea turtles that enter local waters.	By-catch or incidental catch is recognized as the main ocean-based threat to sea turtles and is widely discussed throughout the recovery plan. Management strategies include quantifying the impacts and mortality from incidental catch by species and type of fishery, refining conservation efforts for off shore sea turtles, creating a precise list of all fishing vessels in the region, identifying by-catch hot spots, implementing the use of turtle exclusion devices, and the creation of a database for incidental catch reports that will be regularly updated.	By-catch and entanglement within the pelagic longline and other fisheries are addressed under the threats section of the identified knowledge gaps. Management activities include recommending gear adaptations, evaluating the impacts of all fishing gear types, investigating handling procedures when a leatherback is the victim of by-catch, and investigating post-release mortality rates. Finally, a detailed description of the ongoing and completed actions associated with reducing by-catch are included.	By-catch or entanglement is recognized as the single largest source of mortality to leatherback sea turtles both in Trinidad and Tobago and globally. The recovery action plan details the threats and impacts of different gear (gill nets, trawls, etc.) on the survival of the leatherback population. Further, details about a compensation program for fishers who free turtles by cutting their nets are also given. Recommendations include adopting policies that restrict the use of high risk fishing techniques and promoting gear alternatives.	By-catch within gillnet, fish trap, and shrimp fisheries is discussed. Fishers have aided in recording and reporting by-catches. Additionally, the use od turtle excluding devices is discussed. Management strategies include increasing research on the impacts of shrimp trawling, increase research on the impact of all other fisheries (including illegal longline), and revising regulatory measures to ensure adequate protection for sea turtle species.
2.5.4 Artificial light pollution (direct)	The recovery plan calls for further research on the effects of artificial light pollution specifically on leatherback sea turtles. It also calls for an evaluation of lighting regulations in areas with coastal	The impacts of artificial lighting are widely discussed throughout the management plan. At the time of publishing, Barbados had no official regulations to manage lighting on beach front	At the time of publishing the impacts associate with artificial light were not of great concern due to the lack of coastal development. Despite this, the recovery action plan names several	Minimizing the effects of artificial lighting on nesting females and hatchlings is discussed for all three countries. It hasn't been a problem in Suriname as of yet, but with the possibility of	The impacts associated with artificial light on hatchlings and nesting females are described in the threats section. There is no indication of the potential threats associated with	The recovery action plan notes a lack of coastal lighting regulations and suggests they be encompassed into the Town and Country Planning Act or the Environmental Management Act to	Artificial lighting on beaches is regulated under the Beach Control Act. A permit for the use of lighting is needed for developmental projects and other beach activities in areas of nesting. It is recommended that

	development and for the enforcement of the lighting regulations under the Endangered Species Act. Further, it calls for the development of a brochure on recommended lighting modifications or measures to reduce hatchling disorientation.	properties. Other strategies have been used such as educating the public and hotel staff about safe lighting practices and to check for disoriented hatchlings. These methods have produced good results. In terms of new developments, architects have been consulted to alert them of the issues associated with artificial lighting.	mitigation strategies including targeting developers for education and increasing awareness within the Planning Department as to ensure the creation of acceptable regulations concerning artificial lighting.	new-developments, the plan recognizes the need to plan for the future.	artificial light in the open ocean. In general, the impacts of artificial light in the marine habitat are not well understood, however because Canada does not deal with nesting beaches it may be worth investing in research to better understand this threat.	ensure activities that may disrupt sea turtles are managed fairly and consistently enforced.	these permits for sea turtle friendly lighting be actively and consistently enforced.
2.5.5 Discharge and run-off (direct)	Discussion of the threats from discharge and run-off are primarily focused on the oil and gas industry. The recovery plan includes examining the effects of oil spills on leatherback sea turtles, determining geographical areas of interaction between leatherbacks and the industry and finally ensuring that the impacts to leatherbacks are addressed within the planning stages of future oil and gas related activities.	Some physiological effects of contact with oil on sea turtles are discussed, however most of the impacts discussed are focused on the marine environment. Additionally, all management strategies are aimed at reducing the impact on the environment.	The threat is only discussed in terms of how it impacts the marine habitat and not the sea turtles directly.	Pollution from discharge and run-off into rivers, which eventually ends up in the ocean, is discussed. Fisheries are named as a source of pollution in terms of dumping garbage and waste products over board. Specific impacts to the sea turtle are not discussed. No management solutions are discussed.	The impact of discharges and the run off of contaminants and pollutants is identified as a knowledge gap. The recovery strategy calls for increased evaluation of the impacts and offers no management solutions.	A number of sources of industrial discharge are named in addition to agricultural run-off. Their impacts on the surrounding habitat and to sea turtles are discussed. Management solutions include testing fish and other marine life in polluted areas on a regular basis to determine the levels of toxins.	A number of sources of industrial discharge are named in addition to agricultural run-off. Their impacts on the surrounding habitat and to sea turtles are discussed. Management solutions include testing fish and other marine life in polluted areas on a regular basis to determine the levels of toxins.
2.5.6 Incidental or human caused predation	Hatchling management strategies in terms of nest protection to increase hatching success are given, however no solutions in terms of	Predation from domestic dogs is discussed, however no management solutions are given.	Predation from domestic dogs is discussed. The only management solution discussed is increased monitoring of nests, however due to	Monitoring and controlling unsupervised dogs on nesting beaches is mentioned as a management strategy for protecting sea turtle	Nest predation is recognized as a threat, however it is simply mentioned in a list of other potential threats and no management solutions are given.	The plan recognizes a variety of threats to both sea turtle eggs and hatchlings and recommends a policy to impound free roaming dogs found on nesting	Livestock and horse raced often take place on nesting beaches that result in upturned and crushed nests. In addition, exotic animals (i.e.

	managing predation (i.e. stray pets) are given.		financial challenges conducting such monitoring may be difficult.	eggs.		beaches so as to eliminate the threat to sea turtle hatchlings. It also further recommends a release fee charged to the owner of the dog.	mongooses, rats, and cats) are often spread to areas they do not naturally inhabit that threaten sea turtle hatchlings. It is recommended that precautionary measures be taken to eliminate these threats.
2.5.7 Acoustic Disturbance (direct)	The threat is not addressed in the recovery plan.	The threat is recognized as a result of human presence on or near nesting beaches. The direct implication of acoustic disturbance to sea turtles is also not discussed.	The threat is not addressed or present in the recovery action plan.	The threat is recognized as a result of human presence on or near nesting beaches. The direct implication of acoustic disturbance to sea turtles is also not discussed.	The threat is recognized and discussed in the plan and several sources of acoustic disturbance and are discussed. While no management solutions to deal directly with the issue are given, increasing understanding of the threats associated with multiple industries (i.e. Military, offshore development, etc.) is one of the objectives. Many of the industries listed may cause acoustic disturbance in association with other activities.	The threat is not addressed or present in the recovery action plan.	The threat is not addressed or present in the recovery action plan.
2.5.8 Illegal/clandestine sources of mortality (i.e. poaching)	Poaching is described and the responsible management bodies that should ensure adequate law enforcement activities to prevent poaching of hatchlings and harassment of nesting females are identified.	Poaching of adult leatherbacks is not an issue in Barbados, as they are viewed as a rather unusual species and are considered not edible. Eggs are however taken from nesting beaches, which is prohibited by national legislation. It has	Harvesting of sea turtles during an open season, which included the breeding season, was legal at the time this document was published (It wasn't made illegal until January 1st, 2017). The plan recommends a moratorium be	Illegal take of turtles and eggs is discussed in the plan. Eliminating this threat is one of the direct conservation activities for the plan. Daily anti-poaching patrols are suggested.	Poaching of adult nesting females and the collection of leatherback eggs is addressed in the threats section for jurisdictions outside of Canada. The use of hatcheries to protect eggs on nesting beaches is mentioned as a management	The recovery action plan recognizes that current legislation for the legal and illegal harvest of all sea turtle species is inadequate, unsustainable, and difficult to enforce. It therefore recommends a national moratorium on the harvest of sea	Poaching of eggs and adult females is discussed throughout the document. Management strategies primarily involve protecting eggs through the use of hatcheries, however it also states that nocturnal beach patrols and

	been stated that penalties for such activities and enforcement are inadequate. Management strategies include increasing the penalty for egg poaching,	placed on all species until such a time where enough data can be collected to determine sustainable take (which may be challenging due to inadequate law enforcement) and to investigate alternative livelihoods for turtle fishermen.		solution, however no concrete actions are listed. There is no discussion of mitigating any potential illegal activities in the foraging habitat.	turtle species until such a time where the data exists to ensure no further population declines from legal harvesting. *Harvesting leatherback sea turtles in Trinidad and Tobago is however completely illegal.*	public awareness are more effective solutions. Historically, there are no markets recorded for the leatherback, however harvesting of other species is allowed with a license.
3. Additional investments in conservation							
3.1 Research and Monitoring	Nesting surveys are conducted annually on the two most prominent nesting beaches within the United States & calls for the development of a standardized nest survey protocol. Further calls for research include determining natural hatchling sex ratios, determining the genetic relationships of the U.S. Caribbean population to other populations, identifying threats in the migratory habitat, continuing to monitor sea turtle stranding's, the creation of a centralized tagging database. The plan also calls for the development of a public participation research and recovery activity.	Research and monitoring activities are worked into various components of the calls for action and recommendations of the plan. Research and monitoring of nesting beaches is designated to the Barbados Environmental Association. It is unclear how these initiatives will be funded.	Research and monitoring activities are worked into various components of the calls for action and recommendations of the plan, however It is not state how these activities will be funded and funding has presented as the limiting factor for many of the conservation activities outlined in the plan.	The recovery plan states that research and monitoring activities will focus on identifying and filling in knowledge gaps, identifying information on major nesting colonies and foraging assemblages, developing regional standards for data collection, analysis and reporting, and surveying and mapping nesting beaches. Multiple other projects are also mentioned. It is assumed that WWF-Guianas will aid in funding the startup of several of these activities, however it is stated that continued funding will rely on stakeholders and donors.	Objective 2 offers support for continuing research on foraging ecology, diving behaviour, life history, distribution and demographics. The recovery strategy further lists a number of current (as of 2006) knowledge gaps within these categories to further research and monitor.	Research and monitoring activities are worked into various components of the calls for action and recommendations of the plan, however The recovery action plan does not state how these activities will be funded.	Research and monitoring activities are worked into various components of the calls for action and recommendations of the plan. Funding for a select few activities is discussed (primarily through grants that WIDECAST has applied for).

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3.2 Possible Intervention	The recovery plan encourages the designation of rehabilitation facilities within Atlantic and Gulf Coast States and the U.S. Caribbean. It further supports the need for to develop care standards for individuals in captivity.	Hatcheries are discussed as a possible intervention tool if necessary to be implemented by the Town Planning Department or the Bellairs Research Institute. Head start rearing is only discussed for Kemp Ridley sea turtles. No additional information is given on when these tools are appropriate to use.	Interventions and instructions on when interventions are appropriate are discussed. These include the establishment of egg hatcheries, head start programs, and the movement of eggs threatened by erosion or poaching.	Natural hatcheries on nesting beaches have been used in the past. The plan doesn't discuss the future use of hatcheries, however it does suggest nest relocation when needed and appropriate, camouflaging nests, and the use of predator-proof protection cages around nests.	Possible interventions to increase population numbers (i.e. egg hatcheries, head-start rearing, predator control) are not outlined within the recovery strategy; additionally interventions for addressing entanglement are discussed.	Descriptions of possible interventions such as egg hatcheries and in-situ relocations are provided for managers to aid in egg and hatchling management. Information provided includes when these interventions are appropriate, proper techniques, and maintenance information. A further description of hatchling intervention techniques is also provided (i.e. when it is okay to retrieve hatchlings during the day and release them at night, etc.)	Descriptions of possible interventions such as egg hatcheries and in-situ relocations are provided for managers to aid in egg and hatchling management. Information provided includes when these interventions are appropriate, proper techniques, and maintenance information. A further description of hatchling intervention techniques is also provided (i.e. when it is okay to retrieve hatchlings during the day and release them at night, etc.)