Threat Assessment:

Northwest Atlantic Leatherback Sea Turtles, *Dermochelys coriacea*, with Special Emphasis on Trinidad & Tobago and the Guianas

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Disclaimer: The results and recommendations presented in this report do not necessarily represent the official position of WWF-Canada.

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PREFACE AND INTENT

For more than 30 years the Wider Caribbean Sea Turtle Conservation Network (WIDECAST), with Country Coordinators in more than 40 Caribbean nations and territories, has linked scientists, conservationists, natural resource users and managers, policy-makers, industry groups, educators, and other stakeholders together in a collective effort to develop a unified management framework, and to promote a region-wide capacity to design and implement scientifically sound sea turtle conservation programs.

As a Partner Organization of the UNEP Caribbean Environment Programme and its Regional Programme for Specially Protected Areas and Wildlife (SPAW), WIDECAST is designed to address research and management priorities at national and regional levels, both for sea turtles and for the habitats upon which they depend. We focus on bringing the best available science to bear on contemporary management and conservation issues, empowering stakeholders to make effective use of that science in policymaking processes, and providing an operational mechanism and a framework for cooperation at all levels, both within and among nations.

Network participants are committed to working collaboratively to develop their collective capacity to manage shared sea turtle populations. By bringing people together and encouraging inclusive management planning, WIDECAST is helping to ensure that utilization practices, whether consumptive or non-consumptive, do not undermine sea turtle survival over the long term.

This Technical Report asks a deceptively simple question: *"What are the most significant drivers of leatherback* (Dermochelys coriacea) *population decline in the Northwest Atlantic (NWA) Regional Management Unit?"* An accurate answer is critical to the recovery of depleted populations in that it relates directly to the setting of priorities for national and international conservation action, population monitoring and habitat protection, and larger issues of coastal zone management and fisheries policy.

Drawing on the collective expertise of the WIDECAST network, this report summarizes expert knowledge from 33 nations and territories throughout the Wider Caribbean Region where NWA leatherbacks are known to nest. In each case, information was collected related to the frequency and magnitude of survival threats to nests (eggs, hatchlings) and adults (threats to juveniles are assumed to be comparable). The survey differentiates between areas under national jurisdiction (nesting beaches, inter-nesting habitats, Exclusive Economic Zone) and areas beyond national jurisdiction (ABNJ, generally referred to as the high seas).

The results describe a varied landscape of high priority threats ranging from Abiotic Factors (including flooding, beach erosion and accretion, climate-related risks), Pollution, Egg Collection by Humans, Habitat Loss, Harassment, and the Sargassum Influx on the nesting beach to Net Fisheries, Pollution, and Entanglement issues at sea, particularly in nearshore inter-nesting habitats. These insights, and especially when combined with strategic consideration of representative genetic stocks, deepen our understanding of contemporary drivers of decline and meaningfully inform next steps.

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WIDECAST Country Coordinators Katharine Hart (Marine Biologist, Turks and Caicos Islands), Didiher Chacón C. (Latin American Sea Turtles "LAST", Costa Rica), and Nicolas Paranthoën (Coordinateur régional des PNAs Tortues marines et Iguanes des Petites Antilles, ONF International, Guadeloupe) interviewed experts in the English, Spanish and French-speaking Caribbean, respectively. The survey is included as Appendix 1.

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EXECUTIVE SUMMARY

Nest counts for the Northwest Atlantic (NWA) leatherback turtle (*Dermochelys coriacea*) subpopulation have declined significantly at both site and regional levels during the long-term (1990-2017) and during a more recent 10-year period (2008-2017). These declines are particularly alarming in French Guiana, which at the turn of the century hosted the largest nesting assemblage in the region (and an estimated 40% of the world's total) but has recently declined by ~99%. Trinidad, second only to French Guiana in the number of gravid females arriving to nest on an annual basis, has seen a smaller but sustained decline at major nesting grounds. In both countries, fisheries interactions in nearshore waters are implicated.

Given that mortal threats to the Guianas and Trinidad nesting populations include more than fishery bycatch in waters within and beyond national jurisdiction, and that these drivers may be synergistic, this report documents the collection of knowledge from stakeholders throughout the broader Caribbean region on the frequency and magnitude of threats known to reduce survival in leatherback turtles (including gaps in our current understanding), and solutions that stakeholders have employed with varying levels of success. The collection of knowledge focuses on nests (eggs, hatchlings) and adults both on the nesting beach and in nearshore inter-nesting habitats, offshore waters, and the high seas.

In addition to detailed results from a survey distributed to experts in 33 Wider Caribbean countries where NWA leatherbacks nest, this report offers an abridged summary of intergovernmental agreements (and notes that leatherbacks are fully protected by law in all but seven Wider Caribbean nations and territories), an overview of sea turtle life history and demographic vital rates, conservation status of NWA leatherbacks (with a focus on the Guianas and Trinidad), a review of previous threats analyses relevant to NWA leatherbacks, and a discussion of potential drivers of the observed decline in the NWA subpopulation, including life history and demographic factors. The survey highlights a significant level of uncertainty surrounding both the frequency and magnitude of threats in offshore and international waters.

On the nesting beach, Abiotic Factors (including flooding, beach erosion/accretion, and climate-related risks), Pollution, Egg Collection by Humans, and Habitat Loss are both the most prevalent and the most impactful, rising – in as many as one-in-four countries – to the level of threatening the survival of 20% or more of nests laid per annum. With regard to nesting females, Habitat Loss, the Sargassum Influx, and Harassment rank as the most prevalent and impactful threats, in some cases cited as affecting more than 20% of the annual nesting cohort. Smaller numbers of countries reported threats often linked to coastal development (Artificial Lighting, Beach Obstacles, Beach Sand Mining, Killed by Humans, Beach Armoring) as "frequent".

At sea, the threat landscape is dominated, both in frequency and magnitude, by Net Fisheries, Pollution, and Entanglement which in some countries is characterized as threatening the survival of more than 20% (in other cases more than 50%) of the nation's adult population of leatherback turtles. This threat is particularly pronounced in Trinidad and the Guianas, where three of the four countries (75% vs 15% of countries region-wide) cited Net Fisheries as a "frequent" threat, and again, in some cases, affecting more than 20% of gravid females.

Sustained recovery of the NWA leatherback subpopulation (*Endangered* on the IUCN Red List) will require strategic conservation investment integrated with considerations of population size and stock diversity. This report and its conclusions and recommendations will form the basis of a Regional Action Plan based on best practice approaches to priority threats.

INTRODUCTION

According to a recent spatial analysis of sea turtle nesting throughout the Western Central Atlantic region (Eckert and Eckert 2019), only six leatherback (*Dermochelys coriacea*) colonies remain with more than 1,000 crawls (successful and unsuccessful nesting attempts) per year (down from ten such sites in an earlier spatial analysis: Dow Piniak and Eckert 2011). These large colonies, clustered in the southern latitudes of the Caribbean Sea, are located in French Guiana, Panama, and Trinidad. In addition, 12 sites reporting 500-1,000 crawls per year are more broadly distributed in Colombia, Costa Rica, Dominican Republic, French Guiana, Grenada, Panama, Puerto Rico, Suriname, Trinidad, and the USA (Florida). In contrast, more than half (63%) of all known nesting beaches in this region support very small colonies, fewer than 25 crawls per year; 12% have unknown crawl abundances (Eckert and Eckert 2019).

The Northwest Atlantic Leatherback Working Group (2018) reported that regional trends in annual leatherback nest counts declined significantly at site-level and regional scales, during long-term (1990-2017) and recent (2008-2017) time periods. These declines are particularly alarming in French Guiana, which once hosted the largest nesting assemblage in the Northwest Atlantic (NWA) leatherback subpopulation (Fossette et al. 2008) but has recently declined by more than 95% (Northwest Atlantic Leatherback Working Group 2018, 2019). Chevallier et al. (2020) report that nesting females in the French Guiana population represented 40% of the world's total in 2001; today, only 10%. Several potential drivers for these observed declines have been identified, and some, like bycatch resulting from fisheries interactions, have received focused attention (WWF 2019).

Trinidad, second only to French Guiana in the number of gravid females arriving to nest on an annual basis, has seen a smaller but sustained decline at major nesting grounds. Eckert (2013a) opined that decades of community-based vigilance on the nesting beaches suggest "the high level of mortality of leatherbacks in coastal gillnet fisheries of Trinidad are the cause of the decline, and that this mortality threatens to undo all of the successful conservation of the species." Eckert and Mitchell (2018) reviewed nesting data collected between 2006 and 2017 for Matura Beach (which averaged some 8,300 nests per year during this time, with a peak in 2007 of 18,500+ nests) and reported that the index population nesting at this site is declining by 4.7% annually.

Because NWA leatherbacks are widespread across a vast region from breeding and nesting grounds in the Wider Caribbean Region (WCR) to foraging areas on the North American continental shelf and the Atlantic open ocean, there is a need for a cohesive, regional conservation strategy perspective to coordinate conservation and recovery efforts across the region. Such a plan would need to include the conservation status, threats, opportunities, and stakeholders, and should establish priority actions to be taken at various geographic scales to best promote regional population recovery.

A similar information-gathering and consensus approach for the Eastern Pacific leatherback subpopulation led to a regional action plan and a regional network (Red para la Conservación de la Tortuga Laúd del Océano Pacífico Oriental, Red Laúd OPO) to implement the action plan in a regionally integrated, strategic way (Red Laúd OPO 2013). In the WCR, the WIDECAST network is well-established and positioned to spearhead data collection, priority-setting, development and replication of best practices, and strategic integration – within and outside of the network – on behalf of the sustained recovery of the NWA leatherback sub-population.

Background

The Northwest Atlantic Leatherback Working Group (2018) pooled data from across the nesting range of this leatherback population to quantify trends in annual nest counts. The published analysis showed that nest counts have declined significantly both at the site level and the regional level during the long-term (1990-2017) and during a more recent 10-year period (2008-2017). The working group outlined three recommendations to enhance conservation efforts of leatherbacks across their range: 1) characterize and reduce anthropogenic threats, 2) characterize and reduce habitat loss and 3) investigate patterns in life history and demographic parameters. The report notes that there are likely synergistic relationships among drivers of the decline in the nest counts.

In response to the 2018 analysis and its recommendations, as well as evidence in the published literature of the threat of bycatch and entanglement, WWF-Guianas hosted a workshop in March 2019 on bycatch of leatherbacks which nest in the Guianas and T&T. Representatives from French Guiana, Guyana, Suriname, Trinidad & Tobago, the USA and Canada participated in the workshop; the USA and Canada were included because the Guianas nesting population forages in USA and Canadian waters, where the threat of bycatch and entanglement is present. The objectives of the workshop were to share the current state of knowledge among countries about leatherback bycatch across the range of the nesting population and to establish regional and national priorities for addressing bycatch. The workshop report (WWF 2019) outlined a strategic framework for reducing bycatch in the Guianas and Trinidad & Tobago with the highest priorities being identified as: regulations and enforcement, gear improvements, data collection and education and awareness.

Given that the threats to the Guianas and Trinidad & Tobago nesting population include more than bycatch, and that drivers of the decline in nest counts may be synergistic, WWF-Guianas identified a need to develop a more holistic Regional Action Plan (RAP). To facilitate the development of a RAP, WWF-Guianas and WWF-Canada commissioned the writing of a Framework for the Action Plan (Wallace 2019). The Framework proposed two priority first steps: survey regional stakeholders to identify the prevalence of threats affecting NWA leatherbacks; and use this information to identify existing conservation efforts and data gaps as a basis for further discussion.

Objective

This report documents completion of the two priority first steps outlined in the RAP Framework (Wallace 2019); namely, the collection of knowledge from stakeholders throughout the broader Caribbean region on the frequency and magnitude of threats to leatherbacks (including gaps in our current understanding), and solutions which stakeholders have employed with success. The collection of knowledge focuses on nests (eggs, hatchlings) and adults. Threats to juveniles are assumed to be coincident with threats to adults, but data on juveniles are scarce (Eckert 2006). The collection of knowledge differentiated between areas under national jurisdiction (nesting beaches, inter-nesting habitats, offshore waters) and areas beyond national jurisdiction (ABNJ, generally referred to as the high seas) (see Appendix 1).

This report also offers an abridged summary of intergovernmental agreements, an overview of sea turtle life history and demographic vital rates, conservation status of NWA leatherbacks (with a focus on the Guianas and Trinidad & Tobago), a review of previous threats analyses relevant to NWA leatherbacks, potential drivers of the observed decline in the NWA

leatherback sub-population (including life history and demographic factors), and detailed results from our regional survey of stakeholders, including insights into threats affecting leatherback nests and adults on the nesting beach, as well as adults in nearshore, offshore, and high seas habitats.

INTERGOVERNMENTAL AGREEMENTS

There are several international agreements and conventions relevant to sea turtle conservation and management in the WCR (Bräutigam and Eckert 2006, Saladin 2020). Here, three are highlighted; however, others could also be relevant frameworks (e.g., Convention on International Trade in Endangered Species [CITES], Convention on the Conservation of Migratory Species [CMS]) with which an NWA leatherback regional action plan could be aligned for strategic conservation in the region.

Engagement is best done through contracting Parties or member States to each convention. Representatives from Parties to each convention could be involved as reviewers and/or workshop participants so that there is a direct link between the regional action planning process and, inter alia, the SPAW Protocol, InterAmerican Convention for the Protection and Conservation of Sea Turtles, and International Commission for the Conservation of Atlantic Tunas. Then, these representatives could use content generated by the regional action planning process to propose resolutions or conservation measures that would strengthen leatherback conservation and monitoring priorities.

This approach has been successful in aligning the priorities of the Laúd OPO Network with the IAC's activities, including resolutions; in turn, the IAC has used the priorities to successfully lobby the Inter-American Tropical Tuna Commission (the Regional Fisheries Management Organization [RFMO] governing tuna fishing in the Eastern Pacific Ocean region) and member countries to support stronger conservation measures to reduce effects of bycatch on sea turtles (IATTC 2019).

Protocol concerning Specially Protected Areas & Wildlife

The Protocol concerning Specially Protected Areas and Wildlife (SPAW Protocol) to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, or Cartagena Convention, is an important multilateral initiative aimed at providing a basis for collaboration and co-ordination on sea turtle management. The Cartagena Convention is the first and only regionally binding treaty of its kind and it provides the legal framework for the Caribbean Environment Programme. The Convention entered into force in 1986; the SPAW Protocol was adopted in 1990 and entered into force in 2000.

Parties to the SPAW Protocol are to "take the necessary measures to protect, preserve and manage in a sustainable way: 1) areas that require protection to safeguard their special value, and 2) threatened or endangered species of flora or fauna." All six sea turtle species, including leatherbacks, that occur in the Wider Caribbean are listed species under the SPAW Protocol. In particular, Article 10 of the SPAW Protocol specifies that Parties "carry out recovery, management, planning, and other measures to effect the survival of [endangered or threatened] species" and regulate or prohibit activities having "adverse effects on such species or their habitats." Further, Article 11 declares that each Party "shall ensure total protection and recovery to the species of fauna listed in Annex II" (this Annex includes all six Caribbean-occurring species of sea turtle).

In 1990, the United Nations Environmental Programme (UNEP) partnered with WIDECAST to develop national-scale Sea Turtle Recovery Action Plans (STRAPs). The objectives of the recovery action plan series were to assist Caribbean governments to comply with their obligations under the SPAW Protocol, and to promote implementation science-based sea turtle management and conservation programs in the region. Each STRAP summarized the known distribution of sea turtles, discussed major causes of mortality, evaluated the effectiveness of existing conservation laws, and prioritized implementing measures for stock recovery. STRAPs can be accessed on the WIDECAST website.

Inter-American Convention for the Protection and Conservation of Sea Turtles

The Inter-American Convention, or IAC, is an intergovernmental treaty which provides the legal framework for countries in the American Continent to take actions in benefit of these species. The IAC entered into force in 2001 and currently has 16 Contracting Parties. However, very few of the key countries for the Guianas and Trinidad & Tobago leatherback population are Parties to the IAC; only the United States and Venezuela (as well as The Netherlands, including the nearby Caribbean Netherlands territories) have ratified the Convention to date. Thus, a priority should be involving the IAC in the planning process in hopes of attracting new Parties from the region to the Convention so that the IAC could serve as a useful, binding, intergovernmental framework to promote the priorities of an NWA leatherback action plan. Motivated by the declining trends in annual leatherback nest abundance (Northwest Atlantic Leatherback Working Group 2018), the Ninth Meeting of the Conference of Parties approved a Resolution for the conservation of NWA leatherbacks in Santo Domingo in June 2019.

International Commission for the Conservation of Atlantic Tuna

The Commission, known as ICCAT, is the regional fisheries management organization operating throughout international waters in which NWA leatherbacks occur. There are currently 53 contracting parties to ICCAT, including Trinidad & Tobago, Venezuela, USA, Canada, and the European Union (including France, and thus French Guiana). Suriname and Guyana are cooperating, non-contracting Parties. As described below, there are several ways in which this regional action plan can include opportunities to engage the ICCAT through contracting parties involved with NWA leatherback conservation.

LIFE HISTORY OF NWA LEATHERBACKS

Existing resources describe NWA (and particularly Wider Caribbean) leatherback distribution, life history, and threats in detail (e.g., Bräutigam and Eckert 2006, Eckert et al. 2012). We briefly summarize pertinent information here.

Geographic Distribution

The leatherback is well adapted to pelagic life with a streamlined body form (keeled, posteriorly tapered carapace) and long, powerful foreflippers. The species also exhibits a broad thermal tolerance and the most extensive range of any modern reptile (~71° N to 47° S; Eckert et al. 2012), traveling widely and foraging (relying on a specialized diet of medusae and other gelatinous plankton) over an extensive oceanic area. While our understanding of long-distance

movements arises largely from tagging and satellite tracking of post-nesting females, Roden et al. (2017) used genetic analysis to demonstrate that 122 captured or stranded males from Canada, France, Turkey, and USA (collected 1997-2012) all originated from NWA nesting beaches (Trinidad 55%, French Guiana 31%, and Costa Rica 14%).

The NWA leatherback sea turtle regional management unit (RMU; Wallace et al. 2010) or subpopulation ranges throughout the northern Atlantic Ocean, from nesting areas across the Wider Caribbean Region to foraging areas that extend through the Caribbean into the Gulf of Mexico (Horrocks et al. 2016, Aleksa et al. 2018), and from the equator into northern temperate latitudes (James et al. 2005, 2007, Eckert 2006, Eckert et al. 2012) (Figure 1A). Major nesting beaches, in terms of annual nest abundance, are generally concentrated in the Guianas and Trinidad & Tobago, with important nesting also in Costa Rica, Panama, Colombia, and the USA (U.S. Virgin Islands, Puerto Rico, Florida) (Figure 1B).

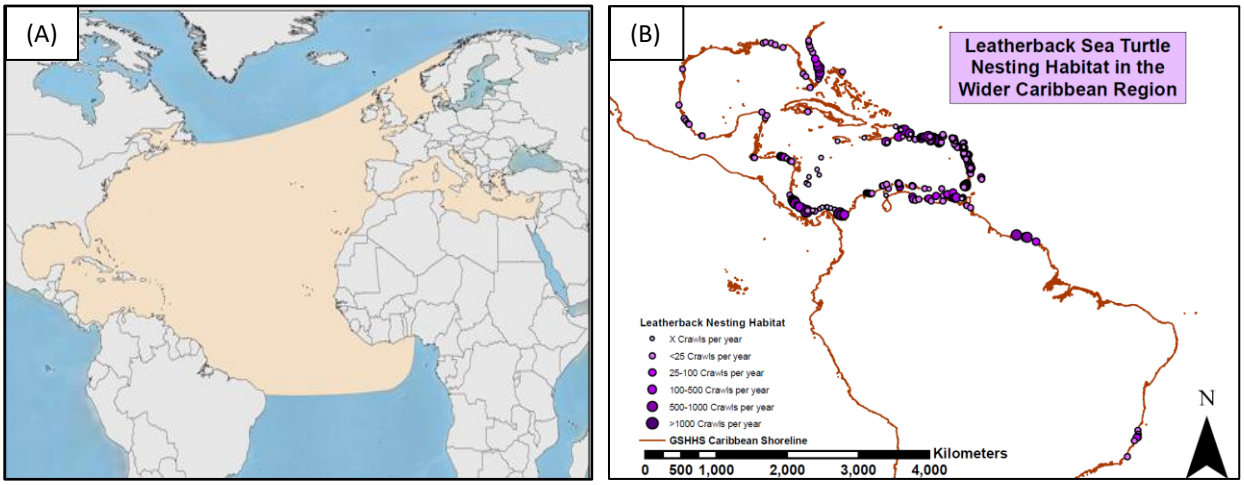


Figure 1. (A) Location and extent of the NWA leatherback turtle regional management unit (RMU). Source: Wallace et al. 2010. (B) Distribution of Wider Caribbean nesting sites for NWA leatherback turtles. Source: Eckert and Eckert 2019.

Life History

Marine turtle life-history strategies, complex but largely known, have not changed over time. These animals are slow-growing, late-maturing and long-lived, with naturally high rates of egg and young juvenile mortality and low rates of adult mortality (Musick 1999). These attributes, coupled with an overlapping iteroparous life cycle – long life-expectancy coupled with discrete multiple breeding seasons and overlapping generations (Chaloupka and Musick 1997) – mean that long-term data collection is vital for the estimation of key demographic parameters and for informing management decisions.

Early attempts to incorporate NWA loggerhead sea turtle (*Caretta caretta*) life-history data into population model simulations revealed that even 100% survival in the first year of life would not reverse population decline, suggesting that protection limited to the egg/hatchling stage was unlikely to be effective and that only by reducing large juvenile and adult mortality could extinction be averted (Crouse et al. 1987). Frazer (1989) used the concept of reproductive value – a measure of the value to the population of an individual female turtle of a particular age

– to emphasize the importance of protecting larger size classes. He urged that any exploitation of marine turtle populations must be restricted on the basis of maximum – not minimum – size limits. More contemporary mathematical treatments (Crowder et al. 1994, Heppell et al. 1999, 2000) have only reinforced the conclusion that protecting large juvenile and adult turtles from exploitation is an essential component of any sustainable marine turtle management regime.

While Caribbean fishery managers have long recognized that "understanding these [life-history] aspects is fundamental to the development of management programs" (*Santo Domingo Declaration*; Eckert and Abreu Grobois 2001), the regulatory framework has been slow to respond. Compounding the management challenges posed by life-history traits are those arising from an elaborate life cycle defined by a broadly predictable but often poorly understood series of changes – so-called ontogenetic shifts in location and habitat (Heppell et al. 2003) – that occur over the course of a turtle's life and often incorporate long-distance migration. At any point in time, a genetically distinct population of marine turtles is spread across several, and perhaps several dozen, geo-political units, evidencing the need for active co-operation and collaboration among range States in the management of shared stocks (Braütigam and Eckert 2006).

Reproduction

Adult female leatherbacks in the NWA return to nesting beaches for reproduction every two to three years (Eckert et al. 2012). During the nesting season, gravid females haul ashore to nest every 8-10 days, on average, to lay 60-90 yolked eggs in each clutch, ultimately laying an average of 4-5 nests total per season (Eckert et al. 2012). Reproductive factors that influence total reproductive output per season are influenced by physiological condition of individual turtles, as well as oceanographic conditions that drive resource (i.e., food) availability (Saba et al. 2015). Further detail – including courtship and mating, nesting behavior, and reproductive cycles – is summarized by Eckert et al. (2012).

Demographic Vital Rates

There are no reliable data on maximum longevity for *Dermochelys*, or any other sea turtle species. Using skeletochronology, Avens et al. (2009) estimated the median age at maturation for NWA leatherbacks to be 24.5-29 years, concluding that an average-sized nesting female (155 cm CCL) may be 31-43 years old. Avens et al. (2020) estimated average reproductive longevity as 8-10 years, "with a total possible range of 3-22 years", which is consistent with most field studies (see Eckert et al. 2012). However, the authors also noted that "recent observations of three turtles from the nesting leatherback population on St. Croix, USVI, have demonstrated that reproductive longevity of 31 years is possible" (K. Stewart and C. Lombard, pers. comm. in Avens et al. 2020).

Mayne et al. (2020) used Sanger sequencing to determine the CpG density in selected promoters, then predicted that the lifespans for marine turtle species ranged from 50.4 years (flatback turtle, *Natator depressus*) to 90.4 years (leatherback turtle, *Dermochelys coriacea*). Girondot et al. (2021) used a combination of reanalysis of the growth trajectories of juveniles maintained in captivity and the age-size relationship of individuals in the field "to demonstrate and quantify the indeterminate growth" of leatherbacks. Their models suggest that "some females may reach maturity at 14 years in natural conditions, while others will take 50 years or more." These findings have profound implications for conservation and management, and not the least being time lags between conservation effort and population recovery.

Demographic vital rates (e.g., annual survivorship) provide useful metrics of population status that can also serve as population-level targets for coordinated conservation actions. Previous studies using long-term mark-recapture histories of nesting adult females have estimated relatively high adult survivorship in NWA leatherback nesting populations in St. Croix, USVI (0.89; Dutton et al. 2005), Florida, USA (0.89; Stewart et al. 2014), and Awala-Yalimapo, French Guiana (0.91; Rivalan et al. 2005). In stable populations of long-lived species such as sea turtles, adult survival is generally 0.90 or higher (Crouse et al. 1987, Congdon et al. 1993, Santidrián Tomillo et al. 2017) with low variability over time (Gaillard et al. 1998).

Earlier estimates of adult survival were made while the individual nesting populations under study all had stable or increasing annual abundance (Dutton et al. 2005; Rivalan et al. 2005; Stewart et al. 2014). However, a current study based on the largest capture-recapture data set (~46,000 individuals) encompassing 28 years (1986-2013) at Awala-Yalimapo, French Guiana, provides a lower estimate of 0.789 ± 0.009 for the average survival of mature females over this time period (Chevallier et al. 2020). Considering the overall declines in annual nest abundance reported (Figure 2), an updated analysis using mark-recapture data from several nesting sites is warranted to estimate current adult survival rates.

CONSERVATION STATUS OF NWA LEATHERBACKS

While the leatherback sea turtle is categorized on the IUCN Red List of Threatened Species as *Vulnerable* on a global scale (Wallace et al. 2013a), the NWA subpopulation was recently reassessed and re-categorized from *Least Concern* (Tiwari et al. 2013a) to *Endangered* (Northwest Atlantic Leatherback Working Group 2019) due to precipitous declines in major nesting assemblages in the southern latitudes of the Caribbean Sea. The species is protected by several international conventions (see *Intergovernmental Agreements*) and enjoys full protection under law in all but seven[1] (see Eckert and Eckert 2019) Wider Caribbean countries.

According to the latest analyses (Northwest Atlantic Leatherback Working Group 2018, 2019), the subpopulation-level Red List trend is mostly driven by the trend estimated for the stock with the highest relative abundance: Guianas and Trinidad & Tobago. The ~99% decline in Awala-Yalimapo, French Guiana, from an average of more than 28,000 nests/yr between 1986 and 1990 to fewer than 600 nests/yr between 2013 and 2017 featured prominently in the documented regional decline. “Evaluation of Red List Criterion A showed an approximate 60% decline (-7.9% per year) between past (~58,000 nests/yr) and present (~23,000 nests/yr) estimates of leatherback nest abundance, [corresponding to] a Red List Category of Endangered (IUCN 2014). These results were similar to those derived from Bayesian regression trend analyses of count data – rather than a simple calculation of change between past vs. present averages – that yielded mean geometric annual trend estimates of -4.2% per year (95% CI: -6.7% to -2.2%).” (Northwest Atlantic Leatherback Working Group 2019).

Conservation Status: Guianas-Trinidad Population

In recent years, community-based monitoring efforts throughout the Wider Caribbean have noted with concern that annual counts of nests or nesting females appeared to be in decline. Members of the Wider Caribbean Sea Turtle Conservation Network (WIDECAST) began informal discussions about collaborating on an updated regional assessment to determine whether a decline is occurring and, if so, how pervasive it might be. Dataholders met

[1] Dominica, Grenada, Haiti, St. Lucia, St. Kitts & Nevis, and the UK Overseas Territories of Montserrat and Turks & Caicos Islands.

in Matura, Trinidad, during the 2018 WIDECAST Annual Meeting to discuss the regional trends seen on their respective beaches. Guyana, French Guiana, and Suriname confirmed an observed decline in their nesting numbers, and were interested to see if their nesting females were moving to other nesting beaches in the region. However, representatives from other countries had not observed tagged females appearing on their beaches, and also indicated seeing a decline in nests laid in their jurisdictions. Given this widely reported observation, WIDECAST members decided that a regional assessment of trends was warranted.

In response to this and to parallel management needs and grant-making opportunities that emerged at the same time, dataholders from across the Wider Caribbean convened as a "NWA Leatherback Working Group" to contribute existing nesting data to a region-wide trend analysis. The objectives of this effort were to: 1) compile available time-series datasets on leatherback nesting abundance, 2) analyze regional trends, and 3) in response to results of the trend analyses, provide recommendations for priority conservation actions and research. This effort coincided with the US Fish and Wildlife Service's and U.S. National Marine Fisheries Service's review of NWA leatherback status in response to a petition from the Bluewater Fishermen's Association to downlist the leatherback from 'endangered' to 'threatened' on the US Endangered Species List (82 FR 57565, 2018).

The NWA Leatherback Working Group's assessment revealed that regional, abundance-weighted trends were negative both for long-term (1990-2017) and recent (2008-2017) temporal scenarios, and at different geographic scales: sites, genetic stocks, and regional (Northwest Atlantic Leatherback Working Group 2018) (Figure 2). The significant decline observed in the Guianas and Trinidad & Tobago stock, particularly at Awala-Yalimapo, French Guiana – and mirrored elsewhere (e.g., Suriname; Tortuguero, Costa Rica; St. Kitts) – essentially drives the regional results, particularly in the long-term scenario (Figure 2).

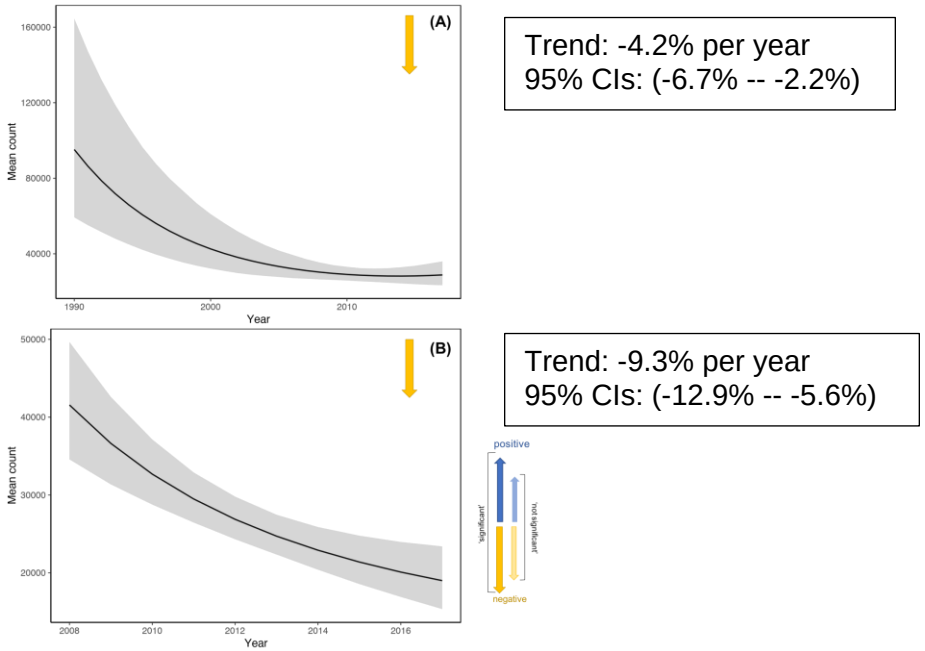


Figure 2. Regional-level trends (annual geometric mean change in nest counts) for (A) 1990-2017 and (B) 2008-2017 (results for intermediate scenario not shown). Line is geometric annual mean trend (weighted by relative site-level abundance) and shaded area is 95% Credible Intervals. Blue up arrows = positive trends, yellow down arrows = negative trends; large arrows = 'significant' trends; small arrows = 'non-significant' trends. Source: Northwest Atlantic Leatherback Working Group (2018).

According to the Northwest Atlantic Leatherback Working Group (2018), the largest stock in the NWA Atlantic – "Guianas-Trinidad" – declined significantly across temporal scenarios (Table 1; Figure 3). These declines, particularly the long-term decline, were driven principally by the exponential decline in abundance observed at Awala-Yalimapo, western French Guiana (Table 2). The recent trend also reflects continued declines in Guyana, Suriname, Cayenne (eastern French Guiana), and smaller but sustained declines at Matura Beach on the east coast of Trinidad (Table 2).

Given these results, the Working Group discussed and identified anthropogenic factors, habitat losses, and changes in life history parameters as potential drivers for the observed declines, while recognizing that synergistic relationships among drivers is likely occurring (see *Potential Drivers of NWA Leatherback Decline*).

Table 1. Stock-level trends in annual abundance (annual geometric mean percent changes [+/- 95% Credible Intervals]) for the Guianas-Trinidad stock in three different time period scenarios. 95% Credible Intervals around all trends do not include zero (i.e., denoting 'significant' trends). Source: Northwest Atlantic Leatherback Working Group (2018).

Stock (n = # sites)	1990-present	1998-present	2008-present
Guianas-Trinidad (n = 8)	-5.04 (-7.88 - -2.69)	-6.53 (-9.83 - -3.31)	-10.43 (-14.91 - -5.68)

Table 2. Site-level trends in annual abundance (annual geometric mean percent changes [+/- 95% Credible Intervals]) for the Guianas-Trinidad (TT) stock in three different time period scenarios. Shading indicates positive (blue) or negative (yellow) trends, with darker colors indicating trends whose 95% CIs do not include zero (i.e., 'significant' trends) and lighter colors indicating trends whose 95% CIs include zero (i.e., 'not significant'). Source: Northwest Atlantic Leatherback Working Group (2018).

Stock	Site	1990-present (n = 23)	1998-present (n = 23)	2008-present (n = 19)
Guianas-Trinidad	Levera (GD)	6.1 (0.27 - 12.29)	6.62 (0.49 - 13.07)	-2.05 (-10.64 - 7.08)
	Querepare (VZ)	2.62 (-3.70 - 9.47)	2.59 (-3.61 - 9.45)	-5.62 (-13.94 - 2.84)
	Cipara (VZ)	-2.06 (-7.75 - 3.62)	-2.74 (-8.08 - 2.76)	
	Guyana	3.86 (0.59 - 7.28)	-5.49 (-9.98 - -0.84)	-19.86 (-26.99 - -12.72)
	Suriname	-5.14 (-7.98 - -1.96)	-9.36 (-12.91 - -5.84)	-12.36 (-20.54 - -4.05)
	Awala-Yalimapo, GF (FR) (including remote beaches)	-12.95 (-15.87 - -10.20)	-19.05 (-24.27 – -13.52)	-31.26 (-38.11 – -23.6.0)
	Cayenne, GF (FR)	7.44 (2.21 - 13.03)	8.19 (2.81 - 13.81)	-14.21 (-22.17 - -6.03)
	Matura (TT)	-2.84 (-10.02 - 4.55)	-3.51 (-10.85 - 4.17)	-1.60 (-10.21 – 7.00)

The Working Group recognized bycatch as likely to be an important driver of declines in the Guianas-Trinidad region; however, insufficient monitoring and reporting have prevented identification of priority conservation measures at a regional scale. In response, a regional bycatch prioritization workshop for the Guianas and Trinidad & Tobago was held from 17-18 March 2019 in Suriname, with the objectives to share knowledge, information and data and identify regional and national data gaps and priorities for leatherback bycatch reduction in these countries (WWF 2019).

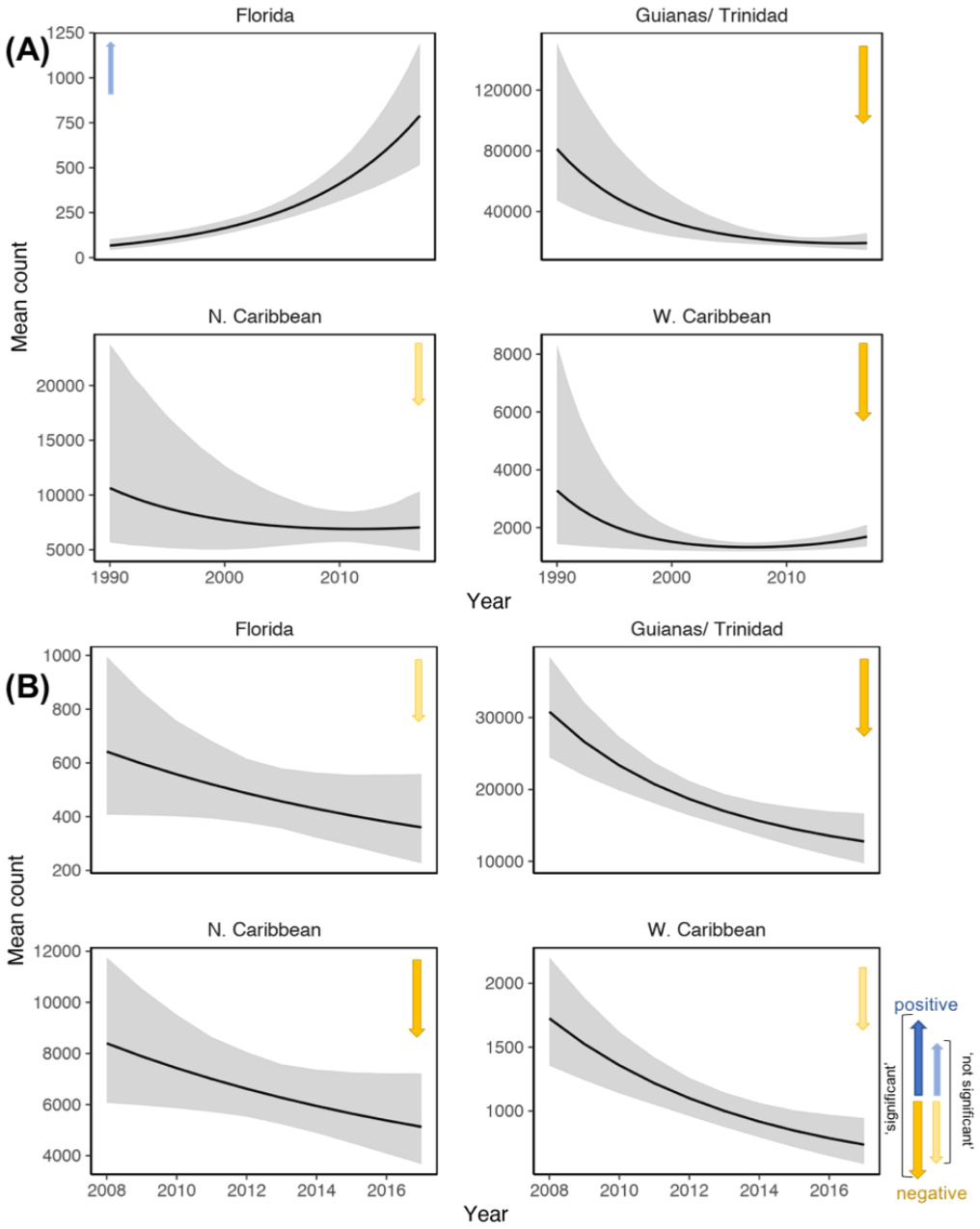


Figure 3. Stock-level trends (annual geometric mean change in nest counts) for the Guianas-Trinidad stock during (A) 1990-2017 and (B) 2008-2017 (results for intermediate scenario not shown). Line is geometric annual mean trend (weighted by relative site-level abundance) and shaded area is 95% Credible Intervals. Blue up arrows = positive trends, yellow down arrows = negative trends; large arrows = 'significant' trends; small arrows = 'non-significant' trends. Source: Northwest Atlantic Leatherback Working Group (2018).

PREVIOUS ASSESSMENTS OF THREATS TO NWA LEATHERBACKS

No effort of this scope and scale proceeds in isolation; rather, it builds upon and is informed by the assessments that have gone before. Among the most relevant of these are the published reports summarized below.[2]

TRAFFIC Report on Trade in NWA Sea Turtles

In recognition of the patchwork of national management regimes governing the exploitation, trade, and management of sea turtles in the Northern Caribbean region that existed in 2001, the CITES Secretariat commissioned a comprehensive review of management regimes to improve regional co-operation. In the resulting report, Braütigam and Eckert (2006) highlighted that the legal framework for management of marine turtles was hindered by confusion about the rules, conflict between laws, and insufficient application of principles of sustainable use in cases where exploitation was legally permitted. Illegal trade in sea turtles is poorly quantified, but extensive and clandestine regional trade persisted mainly in Central America at the time of their writing (see CITES Secretariat 2019 and Nahill et al. 2020 for updates).

Braütigam and Eckert (2006) concluded that available scientific knowledge about sea turtle biology and life history was not typically incorporated in the development or implementation of laws governing exploitation of sea turtles, and critical information (e.g., estimates of population sizes and trends, location of critical nesting and foraging habitats) was often lacking, reducing the potential efficacy of existing marine turtle management. The report also highlighted the incongruence between the transboundary, international nature of sea turtle distributions and habitat use and the variation in sea turtle management regimes and resources from country to country as a serious challenge.

Priority recommendations included conducting comprehensive assessments on marine turtle catch and use, establishing systematic monitoring programs, developing a compliance strategy, and increasing government participation in regional agreements.

IUCN Red List Assessments

TWEG (2007) collated data on various demographic parameters and abundance metrics (e.g., number of nesting females, number of nests) to estimate the overall adult population size and trend and concluded that the NWA leatherback adult female population was relatively stable, with some inter-annual fluctuations related to demographic and environmental factors. The authors estimated 28,000 to 46,000 nests and 4,800 to 11,000 nesting females in 2004-2005, and increasing trends region-wide, except the Western Caribbean.

The NWA leatherback 'subpopulation' (in Red List parlance) qualified for the official category of "Least Concern" on the IUCN Red List of Threatened Species[3] because long-term trends in annual nest abundance were generally increasing through 2010 (Tiwari et al. 2013a). Despite this official category listing, the assessors highlighted the importance of continued conservation efforts to prevent collapses such as those documented for leatherback RMUs in

[2] This summary is adapted from Wallace (2019).

[3] The purpose of the Red List is to provide a triage for those species in imminent risk of global extinction. Thus, the terminology "Least Concern" is intended to reflect the relative risk of such species in that context; species can still be declining, experiencing significant threats, etc., and be classified as "Least Concern" based on evaluation of Red List criteria.

the Pacific Ocean (Tiwari et al. 2013a,b, Wallace et al. 2013b).[4] This warning was based on the presence of significant, continued threats to leatherbacks in the region, particularly the large numbers of adult leatherbacks taken as bycatch in small-scale fisheries near major nesting beaches, particularly in Trinidad (Lee Lum 2006, Eckert 2013a,b).

Tiwari et al. (2013a) used historical data that were collected inconsistently across years and estimates of total annual nest counts based on a statistical correction to account for incomplete monitoring coverage. In contrast, the Northwest Atlantic Leatherback Working Group (2019) used observed counts associated with consistent monitoring methodology and coverage level over time. These changes in approach caused significant divergence in results, with the updated assessment being the more accurate picture of long-term trend in annual nest abundance. Based on the 2019 analysis, the NWA leatherback subpopulation is categorized by the IUCN Red List of Threatened Species as "Endangered".

WIDECAST Regional Nesting Beach Atlas and Threats Assessment

Dow et al. (2007) produced a comprehensive atlas of sea turtle nesting in the Wider Caribbean region that also included an assessment of the presence and prevalence of threats to sea turtles. Local experts were interviewed either by telephone or via a standardized survey form to ascertain which threats were present in their country and their relative frequency at national and local scales. The assessment did not attempt to quantify relative magnitude nor relative population-level effects of threats.

According to Dow et al. (2007), the most prevalent threats to sea turtles[5] on nesting beaches at that time were beach erosion/ accretion and nest loss to abiotic factors, while the most prevalent threats to sea turtles at sea were pollution, fisheries bycatch, and entanglement (Table 3). Where cited as present and significant, threats that were most often characterized as "frequent"[6] (either on a national scale or in some areas within a nation) were artificial lighting, exotic (or loss of native) vegetation, recreational beach equipment and/or other obstacles, beach vehicular use, egg collection by humans, and sand mining on nesting beaches, and marina and dock development, fisheries bycatch, and hunting/poaching in water (Table 3).

Although this earlier assessment of threats was not quantitative in terms of population-level effects, and the survey related to all sea turtle species (not only leatherbacks), it produced a holistic regional perspective of the prevalence and relative frequency of a multitude of possible threats to sea turtles across Wider Caribbean nations and territories.

More than a decade later, we find that results specific to leatherbacks do not differ appreciably from that of Dow et al. (2007). Abiotic Factors, Pollution, Egg Collection, and Habitat Loss continue to rank most highly on nesting beaches, and Net Fisheries, Pollution, and Entanglement are most consistently reported as causing "frequent" threat to leatherbacks in nearshore waters off nesting beaches. Threat magnitude (vs frequency) is another way to define conservation priorities – and in that case we find, for example, that one-in-four countries reports Abiotic Factors affect more than 20% of all nests laid. In some countries, Abiotic Factors (and, equally, Egg Collection by Humans, Artificial Lighting, and Predators) pose a survival threat to more than 50% of all nests laid (see *Survey Results: Frequency and Magnitude of Threats*).

[4] An updated Red List assessment now describes leatherbacks as Endangered (Northwest Atlantic Working Group 2019).
[5] Here, we refer to the 'most prevalent' threats as those for which respondents from more than 90% of nations and territories cited the factor as both present and constituting a threat to sea turtles.
[6] Here, we refer to 'most often cited' as threats that respondents from at least one-third of nations characterized as 'frequent.'

Table 3. The proportion of Wider Caribbean nations and territories (n=41 in the case of nesting beaches, nesting being insignificant in Bermuda and Saba; n=43 in the case of foraging grounds) citing the factor as both present and constituting a threat to sea turtles. Data were assembled 15 years ago from responses to a standardized survey completed by local experts in each jurisdiction. The proportion of nations and territories characterizing the threat as "Frequent" appears in parentheses; this proportion does not differentiate between "Frequent" (F) on a national scale and "Frequent in Some Areas" (FA). Source: Dow et al. (2007).

Threats to sea turtles on the beach (nesting/hatching) in the Wider Caribbean Region	
Beach Erosion/Accretion	.95 (.21)
Nest Loss to Abiotic Factors	.95 (.18)
Artificial Lighting	.85 (.46)
Egg Collection by Humans	.85 (.37)
Killing of Nesting Females by Humans	.83 (.24)
Pollution	.83 (.21)
Nest Loss to Predators	.78 (.19)
Exotic (or Loss of Native) Vegetation	.68 (.43)
Recreational Beach Equipment and/or Other Obstacles	.68 (.39)
Beach Vehicular Use	.68 (.39)
Sand Mining	.68 (.36)
Harassment Due to Increased Human Presence	.66 (.19)
Beach Armouring/Stabilization Structures	.59 (.17)
Livestock Presence on the Beach	.56 (.13)
Mechanized Beach Cleaning	.39 (.31)
Beach Nourishment	.34 (.07)
Killing of Nesting Females by Predators	.32 (.15)
Threats to sea turtles in water (foraging/migration) in the Wider Caribbean Region	
Pollution	.93 (.13)
Fisheries Bycatch	.91 (.38)
Entanglement	.91 (.26)
Coral Reef Degradation	.88 (.13)
Killing of Turtles by Humans	.79 (.38)
Predators	.77 (.03)
Seagrass Degradation	.77 (.09)
Boat/Personal Watercraft Collisions	.67 (.07)
Disease/Parasites	.67 (.03)
Harassment Due to Increased Human Presence	.65 (.14)
Marina and Dock Development	.56 (.42)
Dredging	.42 (.11)
Oil and Gas Exploration, Development, Transportation	.40 (.00)
Offshore Artificial Lighting	.21 (.00)
Power Plant Entrapment	.14 (.00)

NWA Leatherback Bycatch Working Group Report

The NWA Leatherback Working Group (2018) recognized that bycatch is likely a primary driver of estimated declines in abundance, specifically leatherback bycatch near key nesting beaches during the nesting season and the potential for overlaps between industrial long-line fisheries and leatherback migratory and foraging areas in the high seas. The Working Group noted that, in general, bycatch in the region is poorly monitored and significantly underreported, and enforcement of existing regulations is generally weak or non-existent.

A Regional Leatherback Bycatch Prioritization workshop convened by WWF-Guianas in March 2019 identified major gaps in information, highlighted opportunities for immediate action, and facilitated an exchange of knowledge. The workshop resulted in the development of national and regional priorities for bycatch monitoring and reduction measures for the Northwest Atlantic leatherback population – with a particular focus on nearshore waters near nesting sites, offshore foraging grounds, and migratory routes (WWF 2019).

Participants in the 2019 bycatch prioritization workshop developed an overarching strategic framework for bycatch reduction initiatives in the Guianas and Trinidad that consist of an inter-connected set of five components: Regulations and Enforcement; Gear Modifications; Data Collection and Reporting (involving fishing communities); Education and Awareness (in a multi-stakeholder setting); and formation of an Overarching Committee to facilitate and monitor bycatch reduction activities (WWF 2019). The priorities and country-level information generated by this Working Group effort are an important resource for a regional action planning exercise.

POTENTIAL DRIVERS OF NWA LEATHERBACK DECLINE

The NWA Leatherback Working Group discussed potential drivers of observed population trends, and other workshops (e.g., Illegal, Unreported, and Unregulated [IUU] fisheries workshop [WWF 2018], Bycatch Prioritization Working Group [WWF 2019]) discussed specific drivers in greater detail, including identification of potential priorities for enhanced conservation and monitoring measures. Here, we briefly summarize the current state of knowledge about important drivers of NWA leatherback conservation status and highlight recommendations and opportunities to address those drivers or related information gaps.

Threats on Land: Nests and Nesting Females

Human activities on or near nesting beaches can affect leatherbacks directly (e.g., harvest of nesting females or eggs for consumption) or indirectly (e.g., alteration of habitat for coastal development). Unquantifiable legal harvest of sea turtles, including leatherbacks, occurs in seven Caribbean countries (including two overseas territories of the United Kingdom), generally resulting from unmonitored open access seasonal fisheries (Eckert and Eckert 2019). Illegal harvest of nesting females and their eggs is now relatively uncommon where consistent beach patrolling efforts occur, but is likely more prevalent at remote, unmonitored beaches and in some cases threatens a significant proportion of the population (see *Survey Results: Frequency and Magnitude of Threats*).

Eckert et al. (2012: Table 18), in their comprehensive *Synopsis of the Biological Data on the Leatherback Sea Turtle*, offer a literature review of predators to leatherback nests, including invertebrates (e.g., ants, flies, crabs, mole crickets), birds (e.g., herons, vultures, frigate birds), and mammals (e.g., mongoose, coatis, raccoons, dogs, jaguars) common to the Wider

Caribbean Region. Adults are injured or killed (e.g., dogs, jaguars) in unquantifiable numbers throughout the region whilst attempting to lay eggs. Internal parasites include mainly Platyhelminthes (flatworms, tapeworms, flukes) and more rarely Annelida (segmented worms) and Nematoda (roundworms), while external parasites include at least six genera of barnacle (Eckert et al. 2012: Table 19; Mashkour et al. 2020: Appendix S4); none are known to be fatal.

For an overview of other threats to nesting females (e.g., beach obstacles, coastal lighting, habitat loss, harassment), see *Abiotic Factors: Climate, Pollution, Habitat Loss* below.

Threats At-Sea: Fisheries Interactions

Leatherback bycatch, whether in artisanal or commercial gear, is of special conservation concern because interactions involve mainly adults, and mainly gravid females in waters off nesting beaches. The associated mortality disproportionately removes animals with the highest reproductive value, and these are the most difficult life stages for a population to replace (e.g., see Crouse et al. 1987, Heppell 1998). The effects of unmitigated bycatch were seen in the swift and dramatic demise of the Eastern Pacific leatherback subpopulation, where commercial gillnet fisheries in Chile and Peru were implicated (Sarti et al. 1996, Eckert and Sarti 1997, Spotila et al. 2000).

According to Eckert et al. (2012), "Leatherbacks are vulnerable to injury and death as bycatch in artisanal and commercial fisheries. They are ensnared by a wide variety of active and abandoned fishing gear and may bruise or bleed from the face and mouth after being dropped on the deck of a fishing vessel from a trawl net or purse seine. Nesting turtles are sometimes observed entangled in discarded fishing line and with embedded hooks, presumably from accidental interactions with fishers. For example, between 2002 and 2005, 9.0-16.9% of females nesting in Suriname '…had injuries that showed evidence of being fisheries related…' (Hilterman and Goverse 2007), including holes in their carapace '…where wooden sticks had been used to force [the turtles] from fishing nets…' (Crossland 2003)."

In Suriname, bycatch in artisanal coastal fisheries (not the Njawarie fisheries) is estimated from interview data at landing sites to have included 829 leatherbacks in 2006, 461 in 2010, 461 in 2012, and 521 in 2016 with an overall mortality rate of 7-14% (Suriname Representatives *in* WWF 2019). In the most recent summary (2015-2016), based on fisher interviews and monitored catches and/or landings and with a focus on bycatch of predominantly slow-growing, late-maturing and long-lived species "most vulnerable to over-exploitation and slow to recover," Sys (2019) characterized as "alarming" the finding that, annually, "more than 4,000 [4,496] sea turtles, over 130,000 sharks and almost 130,000 rays are being entangled by the Surinamese coastal artisanal fleet" and that these are under-estimates. Thirty-seven percent of entanglements were of leatherbacks; 7% (~116 turtles) were reported as dead.

Kiszka (2014) reported on interview-based data collected from nearly 900 fishers in Belize, Colombia, Dominican Republic, Haiti, and Mexico in an attempt to assess bycatch affecting the West Indian manatee (*Trichechus manatus*) and other "vulnerable megafauna", including sea turtles, in WCR artisanal fisheries. No catches of leatherbacks were reported (reports were restricted to green, *Chelonia mydas*, and hawksbill, *Eretmochelys imbricata*, turtles), but the study highlighted the fact that bycatch in artisanal fisheries is widespread throughout the region and while it likely occurs at relatively low levels, "captures may not be sustainable" when sea turtle populations are already depleted.

Despite fisheries interactions – longlines, gillnets, trawls, and traps (Bjorkland 2011) and evidence of same in studies of visible injury (Archibald and James 2018) – being well-documented as a threat to leatherbacks throughout the NWA, the NWA Leatherback Working Group (2018) and Bycatch Prioritization Workshop (WWF 2019) noted that monitoring and reporting of bycatch and enforcement of existing regulations are often lacking, both regionally and nationally. There has been comparatively little attention in the peer-reviewed literature to bycatch in artisanal fisheries, even though these fisheries account for more than 95% of fishers in the world, especially in developing countries (Pauly 2006). Their impact on vulnerable megafauna may thus be significant, either as bycatch or as target species (Moore et al. 2010).

A recent assessment of bycatch in the artisanal longline fishery in Barbados (Blades et al. 2019) highlighted a growing concern related to "overlap of small-scale fisheries with sea turtle high-use areas." Based on structured interviews with 22 longline vessel captains, the authors estimated a sea turtle bycatch per unit effort (BPUE) of 0.15, which extrapolates to 374 turtles caught per year, fleetwide. The majority (86%) of captains reported leatherbacks to be the predominant species and that they were released alive. The longline fleet operates in sea areas through which leatherbacks pass on their way to and from important nesting beaches in Trinidad & Tobago, Grenada, and the Guianas, and in which they reside during the pre-nesting period as well as throughout the nesting season (Blades et al. 2019).

Leatherback turtles dominate the gillnet bycatch in Trinidad and the Guianas. Lee Lum (2006) used fisher interviews to determine that drift gillnets on the northeast coast of Trinidad entangle 3,000 leatherbacks annually with 27-30% mortality. In 2007 and 2008, Eckert and Gearhart (unpubl. data) used controlled experiments of drift gillnets in the same area to determine a BPUE per square meter net per hour, which translated to three leatherbacks caught per net (1,000 x 10 m) per night (6-hr soak time), largely confirming Lee Lum's interview-based findings. Other studies report the capture of leatherbacks by coastal gillnets in the Guianas, but do not estimate BPUE (Laurent et al. 1999, Chevalier 2001, Hiltermann and Goverse 2004, Delamare 2005, Madarie 2006).

Quantitative research in Trinidad and the Guianas suggest that coastal artisanal drift gillnets may affect >20% of the adult female population in Trinidad's nearshore water per annum, with nearly one-third reported dead. In Suriname, Madarie (2006) reported that in 2006, 1435 vessels using gillnets captured 584 leatherbacks (March-August) with a mortality of 14%. In French Guiana, Fossette et al. (2008) summarized BPUE in coastal gillnets as ranging from one turtle per day per fisher (citing Chevalier et al. 1998, Chevalier 2001) to 10% of the population (citing Georges et al. 2007), and that leatherback turtles constituted 75% of the sea turtle bycatch (Delamare 2005). Updating these studies is a conservation imperative.

Leatherbacks that nest in Trinidad and the Guianas have been identified while foraging in temperate latitudes, on the continental shelf of Nova Scotia, Canada, and New England, USA (James et al. 2005, 2007, Eckert 2006, Stewart et al. 2013, 2016, Dodge et al. 2014, Chambault et al. 2017, Archibald and James 2018). Leatherback entanglements in vertical line fisheries (e.g., pot gear targeting crab, lobster, conch, fish) in continental shelf waters off New England, USA, and Nova Scotia, Canada, are potentially important mortality sinks that require continued monitoring and bycatch reduction efforts (DFO Canada 2012, Dodge et al. 2014, Hamelin et al. 2017). For example, from 2008 to 2017, 267 leatherback entanglements were reported in vertical fishing line (U.S. Sea Turtle Disentanglement Network, unpubl. data), which, based on estimates of post-release mortality, could translate to as many as 163 dead leatherbacks (Upite et al. 2018). Government agencies and NGOs in Canada and the USA have collaborated in recent years on monitoring of leatherback movements and entanglements in vertical line

fisheries on the shared continental shelf where bycatch interactions occur in the two countries. There are many opportunities to enhance and increase monitoring efforts and to continue exploring and implementing bycatch reduction measures in these countries.

Bycatch in the longline gear of industrial fleets operating throughout the North Atlantic and Gulf of Mexico is also a threat to leatherbacks originating from nesting beaches in Guianas and in Trinidad & Tobago (Laurent et al. 1999, DFO Canada 2012, Fossette et al. 2014, Stewart et al. 2016). For example, the on-board observer program associated with the US Atlantic pelagic longline fishery, which operates in the Wider Caribbean, Gulf of Mexico, and US and international waters of the Atlantic, had an estimated 200-600 leatherback interactions annually between 2005-2015, though few turtles were observed to have died as a result (~1% of observed interactions) (Stokes and Garrison *in press*). In Canada, 138 leatherback interactions were observed in longline fishing operations between 2001-2010 with an estimate of 13 to 44 mortalities per year (DFO Canada 2012).

ICCAT does not collect nor analyze sea turtle bycatch data collected in its tuna fisheries operating in areas beyond national jurisdiction, despite a resolution that calls for reporting of such data by member countries (ICCAT 2010). ICCAT is in the process of developing approaches to assess bycatch impacts, but it is hindered by lack of consistent reporting of relevant information from member country fishing operations, with the exceptions of the US and Canada (Hanke 2018). Review is necessary to determine the magnitude of longline bycatch within exclusive economic zones and international waters, and whether it has increased in recent years. Threats from bycatch in coastal foraging areas off western Europe and western Africa (Witt et al. 2007, Fossette et al. 2014) – including commercial longlines as well as small-scale net fisheries – merit further attention, as well.

Less well-documented is entanglement in pot fisheries. Summarizing a decade (1977-1987) of data, Prescott (1988) implicated entanglement (primarily in lobster pot lines) in 89% (n = 51) of adult leatherback strandings in Cape Cod Bay, Massachusetts. Similarly, from 1990-2000, 92 leatherbacks were reported entangled in pot lines from New York through Maine, suggesting that with the "…proliferation of pot gear in Massachusetts shelf waters, where leatherbacks are known to forage, [the] potential for interaction is high…" (Dwyer et al. 2003). In Florida, 8% (n = 44) of leatherback strandings between 1980 and 2007 were found entangled in the buoy line of a crab trap or lobster pot (A. Foley, pers. comm. *in* Eckert et al. 2012).

Reviewing data from sea turtles stranded on Florida beaches (1986-2014), Foley et al. (2019) identified those with vessel strike injury (VSI). Of 620 stranded leatherbacks, 34.4% showed evidence of VSI (either definitively, with ≥1 linear or curvilinear chop wounds or probably, with a blunt force injury resulting in fractures), reproductively active individuals appeared to be particularly vulnerable to these injuries, and, across all species, necropsy data (n=194 turtles) implicated the strike as the probable cause of death in 92.8% or more of cases. By coastal county, the proportion of stranded sea turtles with a vessel-strike injury was positively related to the mean annual number of registered vessels. Fretey (1977) commented on increased cargo ship traffic in the waters of French Guiana, noting that only ship propellers could inflict the deep wounds observed on some nesting females.

Finally, adults are injured or killed at sea in unquantifiable numbers throughout the region by native predators (e.g., orcas ["killer whales"], sharks). In a typical account, a 305.5 kg female leatherback washed ashore alive in 1989 on the Atlantic coast of Barbados after her right front flipper had been severed at the shoulder by a shark (Horrocks 1989).

Abiotic Factors: Climate, Pollution, Habitat Loss

There have been several studies of effects of environmental factors (e.g., increased sand temperatures, increased precipitation, rising sea levels) on sea turtle biology (e.g., decreased hatching success, feminized sex ratios) in the Wider Caribbean region (Caut et al. 2010, Santos et al. 2017, Dudley et al. 2016, Caesar et al. 2018). These studies typically attempt to estimate potential changes in these environmental factors given future climate change projections. However, most studies project potential environmentally driven alterations in sea turtle biological traits (e.g., hatchling production, resource acquisition) at a single site, and effects linked holistically to climate change have not quantified.[7]

An earlier threats assessment relating to all sea turtle species (Dow et al. 2007) found that pollution in the marine environment was the most prevalent threat to sea turtles in the region, followed closely by fisheries bycatch and entanglement (see Table 3, above). Effects of other threats such as pollution from hydrocarbon extraction and spills and marine debris have not been quantified for leatherbacks (e.g., DWH NRDA Trustees 2016), but national recovery planning documents, including for Trinidad and the Guianas (e.g., Reichart et al. 2003, Forestry Division et al. 2010, Entraygues 2014), highlight these as deserving of priority attention. The pollution category can also include exposure to harmful chemical pollution and ingestion or entanglement in marine debris.

Drowning or debilitation resulting from ingestion of persistent marine debris (e.g., plastic bags presumably mistaken for jellyfish) and entanglement in persistent marine debris (e.g., fishing line, fishing nets, cargo netting) pose serious and pervasive threats to sea turtles on a global scale. Reviewing data available at the time, Mrosovsky (1981) concluded that "…44% of adult non-breeding leatherbacks have plastic in their stomachs." Mrosovsky et al. (2009) analyzed autopsy records of 408 leatherback turtles, spanning 123 years (1885-2007), and found that plastic (such as "blockage of the gut by plastic") was reported in 34% of these cases. In French Guiana, 51 of 101 leatherbacks necropsied had "floating debris" (mainly plastic bags) in their stomachs (Kelle and Feuillet 2008). Macali et al. (2018) further associate plastic ingestion with "potential toxicity due to persistent, bioaccumulative and toxic (PBT) substances adsorbed onto the plastic surface or those leached from the polymer matrix, such as phthalates and flame retardants, known also as endocrine disruptors."

Studies and summaries of the pervasive threat to sea turtles posed by marine debris, including debris originating with the fishing industry, are often found in the peer-reviewed *Marine Pollution Bulletin* (e.g., Carr 1987, Bjorndal et al. 1994, Bugoni et al. 2001, Tomás et al. 2002, Lazar and Gračan 2011) or in anecdotal notes, such as Plot and Georges' (2010) account of a leatherback "expulsing 2.6 kg of plastic debris from her cloaca while nesting in French Guiana." Schuyler et al. (2016) opined that, "Plastic marine debris pollution is rapidly becoming one of the critical environmental concerns facing wildlife in the 21st century [with] initial calculations indicat[ing] that up to 52% of sea turtles may have ingested debris." The authors' risk analysis for plastic ingestion by sea turtles concluded that life history stage is the best predictor of debris ingestion, with oceanic-stage turtles at highest risk.

[7] Not insignificantly, human communities in the region are also threatened. Williams and Kalamandeen (2013) reflect on climate change impacts in Guyana, where high levels of poverty, particularly in indigenous communities, create potential risks like damages to ecosystems, water resources and coastlines, and impacts on food resources. Shah et al. (2013) developed and tested the application of a Livelihood Vulnerability Index (LVI) for agricultural and natural resource-dependent communities in developing countries, applying the model to a comparative study of two wetland communities in Trinidad & Tobago, "a country that is expected to bear some of the most severe impacts of climate change."

Regarding land-based hazards, an earlier threats assessment (Dow et al. 2007) found that beach erosion/accretion and nest loss to abiotic factors to be the most prevalent threats, followed closely by artificial lighting and egg collection by humans (see Table 3, above). Leatherback nesting sites in the Wider Caribbean are often high-energy coastlines where sand erosion-transport-deposition processes are dynamic (e.g., Darsan et al. 2016) and loss of nesting habitat – apparently without concomitant increases elsewhere – has contributed to some extent to the observed declines in annual nest abundance. Beach sand mining can exacerbate natural processes of sand loss (Anthony 2016). Geomorphology and hydrology in leatherback nesting areas require further study (Darsan et al. 2016). Ideally, habitat availability (i.e., how much nesting habitat exists) should be included as a covariate in the trends models to better quantify variation in site-level trends that is due to habitat loss.

Beach erosion across the Guianas has significantly diminished available leatherback nesting habitat. For example, Awala-Yalimapo, the area in western French Guiana that has been monitored consistently since the 1990s (and inconsistently since the 1960s), undergoes dramatic fluctuations in beach length, width, and location within and across seasons. This site has decreased in the past eight years from 2.8 km of beaches that were used by leatherback for nesting in 2010 to 1.8 km in 2018 (D. Chevallier, CNRS-IPHC, pers. comm. *in* Wallace 2019). Beach erosion and accretion combined were responsible of the loss of 40% of sea turtle nests each year at Awala-Yalimapo from 2012 to 2017 (D. Chevallier, pers. comm. *in* Wallace 2019). Similarly, beaches in Suriname have eroded over the past decade, partly because of sand mining for construction projects (Anthony 2016, Gersie et al. 2017, Anthony et al. 2019). Leatherback nesting has declined ~99% at Awala-Yalimapo and ~74% in Suriname since the 1990s and a portion of this decline appears related to loss of nesting habitat (NWA Leatherback Working Group 2018, Wijntuin 2021).

Finally, coastal development introduces a variety of survival threats to turtles, eggs and young. These include beachfront lighting (Choi and Eckert 2009, Knowles et al. 2009, Lake and Eckert 2009, Rivas et al. 2015, Colman et al. 2020), beach obstacles (Choi and Eckert 2009), loss/conversion of critical nesting habitat (Hernández et al. 2007, Roe et al. 2013), and harassment of nesting females. Lighting disrupts the orientation of hatchlings, which can lead to exhaustion, dehydration, increased risk of predation, and increased risk to roadway collisions (Salmon 2003, Zheleva 2012, Rivas et al. 2015). Harassment is difficult to document but may be associated with unregulated tourism (bright lights, camera flashes, excessive touching, loud noises, riding of turtles), domestic animals (such as feral dogs), or vehicle traffic on the beach.

Life History and Demographic Factors

The NWA Leatherback Working Group (2018) analyzed the number of leatherback nests observed on individual nesting sites each year, which is a relatively poor index of the overall dynamics of sea turtle populations (see NRC 2010 for review). Inter-annual variation in sea turtle annual nest counts reflects non-annual breeding typical of sea turtle females, which itself is affected by environmentally driven resource availability and individual-level physiological processes that determine whether a turtle will reproduce in a given year and the magnitude of her reproductive output (e.g., number of clutches, number of eggs per clutch) that year. In addition to these biological factors, the number of nest counts documented at monitored sites can also vary if nesting shifts away from the places and/or times being monitored. There is some evidence to suggest that leatherbacks may display relatively weak nest site fidelity compared to other sea turtle species (e.g., Stewart et al. 2014).

While leatherback mortality caused by anthropogenic factors certainly would influence the observed abundance trends, changes in life history and demographic parameters, such as increases in remigration intervals (already documented in St. Kitts: Kimberly Stewart, unpubl. data) and/or decreased clutch frequency could be causes of decreased nest abundance over time. Changes in remigration intervals and clutch frequency could indicate fluctuations in oceanographic conditions that drive prey availability and distribution (e.g., Doney et al. 2012), but not necessarily in mortality. In addition, possible extreme female biases in sex ratio and decreased hatching success caused by increased nest temperatures possibly due to climate change (e.g., Hamann et al. 2013) could have cryptic effects on observed nest abundance.

There is also a possibility that sea turtle population abundance – or any index of abundance – can fluctuate over time, potentially on longer, multi-decadal timescales than is typically monitored by conservation groups or resource managers. For example, the NWA loggerhead population declined over a decade through the late 2000s, invoking significant concern in the conservation community (Witherington et al. 2009). However, in subsequent years, loggerhead nesting increased, and has maintained this trajectory since (FWC/FWRI Core Index Nesting Beach Survey Program Database as of 21 October 2017). This case study provides a cautionary tale about understanding sea turtle population dynamics in order to calibrate conservation response to apparent declines in NWA leatherbacks.

On the other hand, Pacific leatherbacks illustrate the relevance of the precautionary principle when long-term declines in abundance occur. Both the West and East Pacific RMUs are Critically Endangered according to the IUCN Red List (Tiwari et al. 2013b, Wallace et al. 2013b) because annual nest abundance has declined > 90% since the 1980s in both cases. While annual abundance has fluctuated, largely due to environmental drivers of adult female remigration (Saba et al. 2015), the overall negative population trends for both RMUs have continued. These persistent trends have not responded to decades of sustained conservation efforts on nesting beaches, and a decade of bycatch reduction efforts in foraging areas (Laúd OPO 2013). This example demonstrates the importance of responding promptly to signs of population reduction to increase the chance of successful long-term recovery.

SURVEY RESULTS: FREQUENCY AND MAGNITUDE OF THREATS

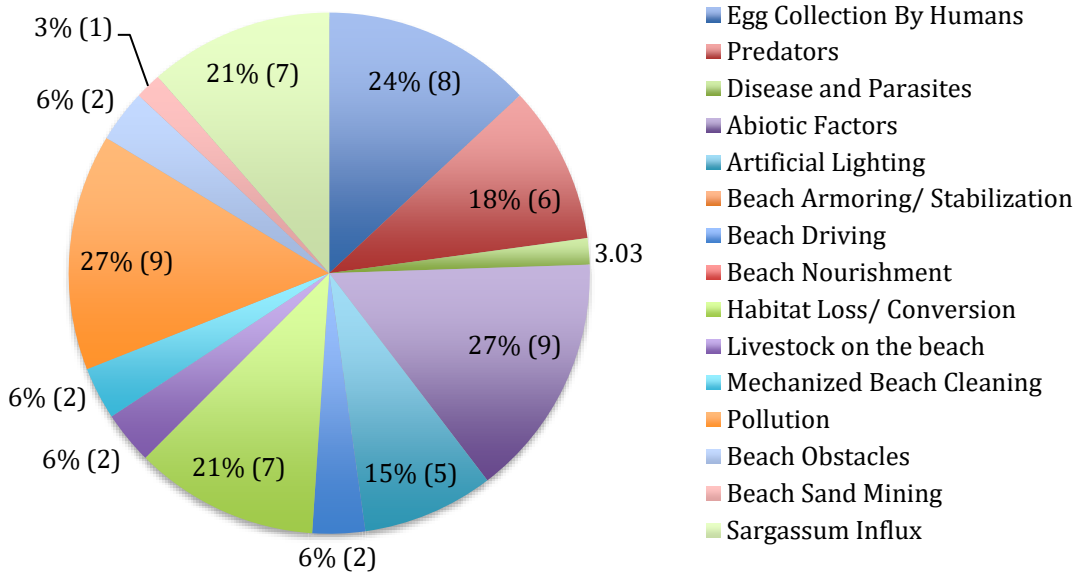
NWA leatherbacks are declining in annual abundance, their nesting, migratory, and feeding areas are connected across this vast region, and a suite of anthropogenic and non-anthropogenic factors affect the population at multiple scales (e.g., James et al. 2005, 2007, Eckert 2006, Dodge et al. 2014, Northwest Atlantic Leatherback Working Group 2018, 2019). These factors warrant a regionally cohesive strategic conservation plan. Development of such a plan requires coordination, communication, and collaboration among individuals, projects, organizations, and agencies to bring together available information and expertise and form a regionally applicable strategy to guide conservation across range States.

In this section, we summarize the findings of a stakeholder survey (see Appendix 1) designed to inform our understanding of the frequency and magnitude of threats to the NWA leatherback subpopulation, and to describe solutions which stakeholders have employed with some measure of success. The collection of knowledge focuses on nests (eggs, hatchlings) and adults. Threats to juveniles are assumed to be coincident with threats to adults, but data related to juvenile life stages are scarce (cf. Eckert 2006). The survey differentiated between areas under national jurisdiction (nesting beaches, inter-nesting habitats, Exclusive Economic Zone) and areas beyond national jurisdiction (ABNJ, generally referred to as the high seas).

Threats on Land: Nests and Nesting Females

Nests – Survey respondents had the option of describing a suite of potential threats to eggs and hatchlings as None, Rare, Occasional, Frequent, or Unknown. Experts in 27% of countries ranked Abiotic Factors[8] and Pollution[9] as "frequently" posing a survival threat to eggs and/or hatchlings, followed by Egg Collection by Humans (24%), Habitat Loss/Conversion and the Sargassum Influx (21% each), Predators (18%), and Artificial Beachfront Lighting (15%). See Figure 4.

Figure 4. Percentage of Wider Caribbean countries (#countries in parentheses) that ranked specific hazards as "frequently" posing a survival threat to leatherback nests.



In addition to frequency, survey respondents were asked to estimate the number of nests (not the number of individual eggs or hatchlings) that were directly affected by a particular threat. Response categories were: None, 1-10, 11-100, 101-500, 501-1,000, >1,000 nests or Unknown. Then, based on the number of nests estimated to be laid, nation-wide, in an average year (estimated from data provided to Eckert and Eckert 2019), the relative magnitude of the threat was determined to be None/Sublethal, <20% of Nests, >20% of Nests, >50% of Nests, or Unknown.

Some of the same threats described most often by experts as "frequently" posing a threat to leatherback nests (see Figure 4) were identified in some countries as affecting more than 20% of nests laid each year. Specifically, 24% of countries reported that Abiotic Factors reached the level of posting a threat to more than one in five nests laid, 9% of countries reported the same for Predators, 6% reported Egg Collection by Humans, Artificial Beachfront Lighting, Beach Obstacles, Pollution, and Disease and Parasites, and 3% reported Habitat Loss/Conversion, Beach Driving, an/or the Sargassum Influx. See Figure 5a.

[8] The survey defined Abiotic Factors to include, inter alia, climate change (stronger storms, rising seas, feminizing sand temperatures), flooding, erosion, or sediment deposits that constitute a survival threat to eggs or hatchlings.
[9] The survey defined Pollution to include, inter alia, beach litter/debris, petroleum/tar, sewage, or municipal waste discharged to the beach or washed ashore.

In 6% of countries, Egg Collection by Humans, Artificial Lighting, Predators, and Abiotic Factors were identified as posing a threat to more than 50% of nests laid each year; 3% of countries reported the same for Beach Obstacles, Mechanized Beach Cleaning, and/or the Sargassum Influx. See Figure 5b.

Figure 5a. Percentage of Wider Caribbean countries (#countries in parentheses) reporting specific threats that affect more than 20% of leatherback nests per annum.

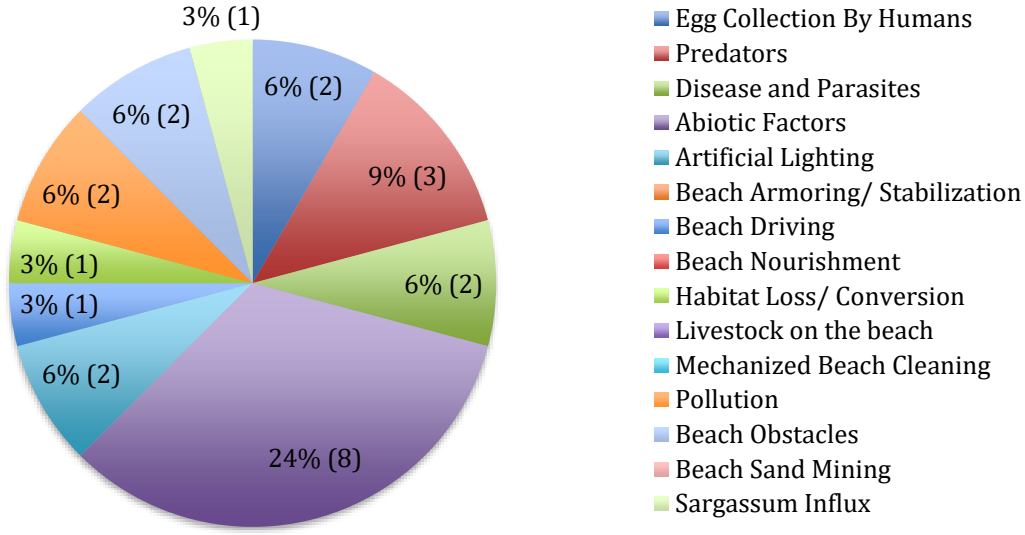
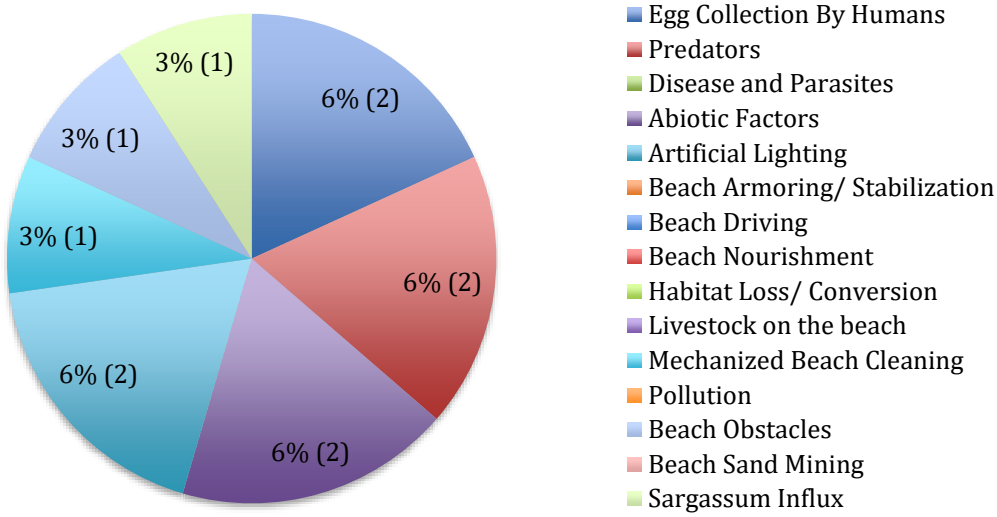
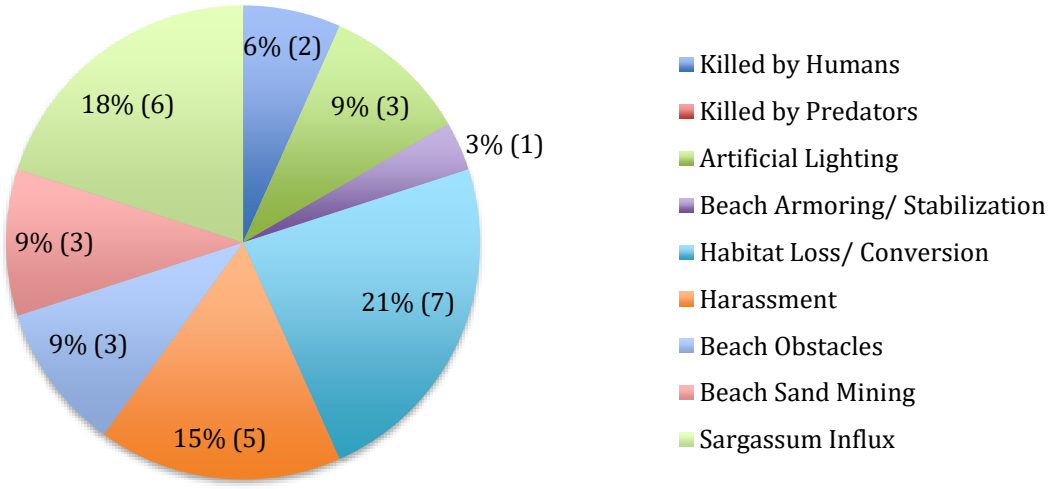


Figure 5b. Percentage of Wider Caribbean countries (#countries in parentheses) reporting specific threats that affect more than 50% of leatherback nests per annum.



Adults – Nesting Females – Survey respondents had the option of describing a suite of potential threats to nesting females as None, Rare, Occasional, Frequent, or Unknown. Experts in roughly one in five (21%) countries ranked Habitat Loss/Conversion as the most serious threat to nesting females, followed by the Sargassum Influx (18%), Harassment (15%), and Artificial Lighting, Beach Obstacles, and Sand Mining at 9% of countries each. See Figure 6.

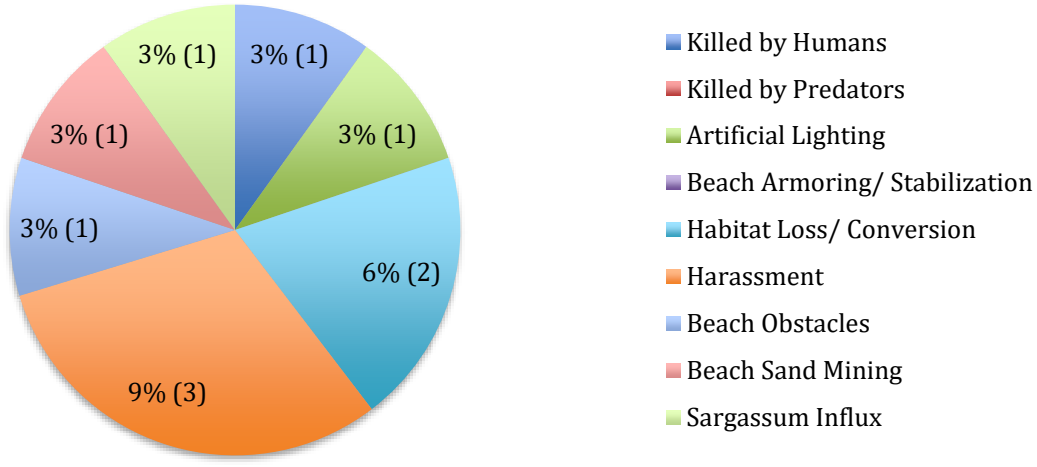
Figure 6. Percentage of Wider Caribbean countries (#countries in parentheses) that ranked specific hazards as "frequently" posing a survival threat to gravid females on the nesting beach.



In addition to frequency, survey respondents were asked to estimate the number of nesting females directly affected by a particular threat. Response categories were: None, 1-10, 11-100, 101-500, 501-1,000, >1,000 females or Unknown. Then, based on the number of females estimated to nest, nation-wide, in an average year (estimated from data provided to Eckert and Eckert 2019), the relative magnitude of the threat was determined to be None/ Sublethal, <20% of Females, >20% of Females, >50% of Females, or Unknown.

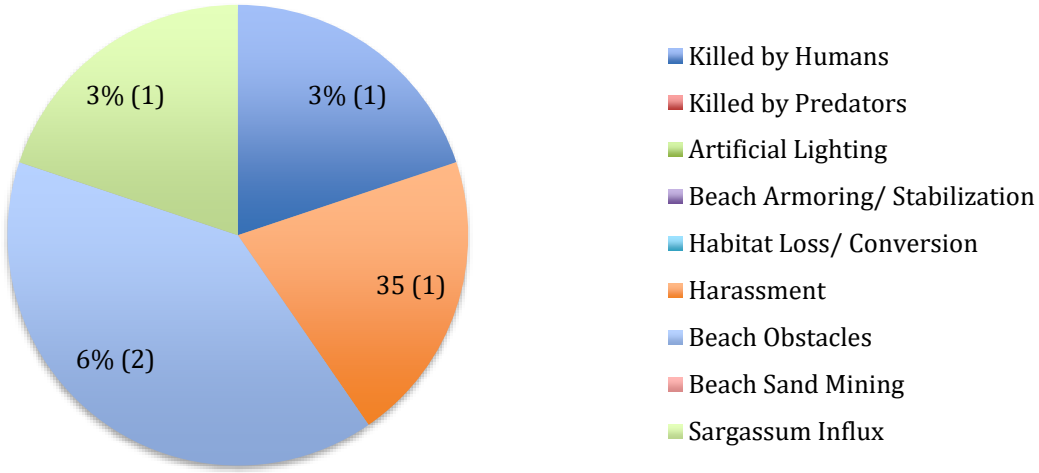
The same five threats described most often by experts as “frequently” posing a threat to nesting females (see Figure 6) were identified in some countries as affecting more than 20% of the reproductive cohort each year. Specifically, 9% of countries reported that Harassment reached the level of posing a threat to more than one in five nesting turtles, 6% of countries reported the same for Habitat Loss/Conversion, and 3% for Artificial Lighting, Beach Obstacles, Sand Mining, Killed by Humans, and the Sargassum Influx. See Figure 7a.

Figure 7a. Percentage of Wider Caribbean countries (#countries in parentheses) reporting specific threats that affect more than 20% of nesting females per annum.



Two countries identified Beach Obstacles as posing a threat to more than 50% of nesting females each year; others (one country in each case) reported the same for Killed by Humans, Harassment, and the Sargassum Influx. See Figure 7b.

Figure 7b. Percentage of Wider Caribbean countries (#countries in parentheses) reporting specific threats that affect more than 50% of nesting females per annum.



Threats at Sea: Nearshore, Offshore, and High Seas Habitats

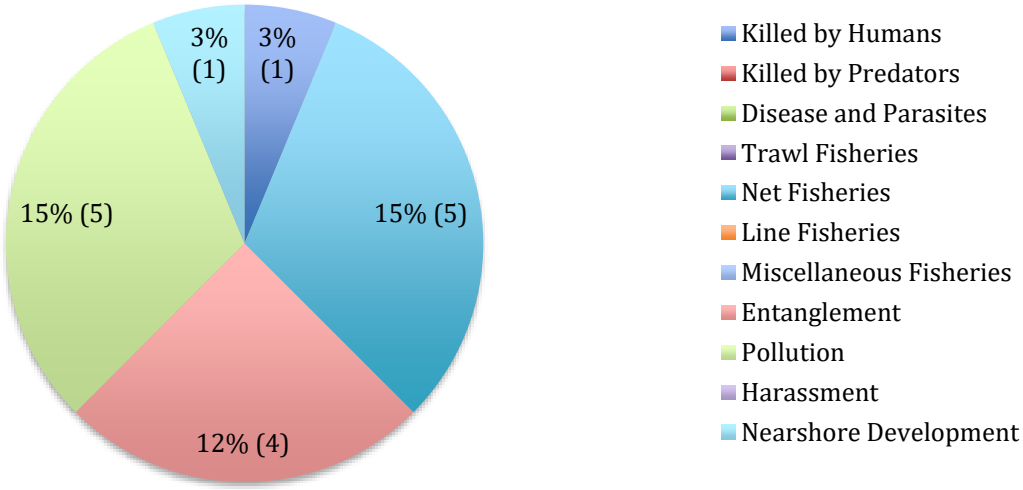
Adults – Nearshore (Inter-nesting) Habitat – Survey respondents had the option of describing a suite of potential threats to adult leatherbacks in the inter-nesting habitat (nearshore waters) as None, Rare, Occasional, Frequent, or Unknown. Five threats – Net Fisheries and Pollution (15% of countries each), Entanglement (12%), and Killed by Humans and Nearshore Development (3% each) – were described as a "frequent" cause of mortality to adults nearshore (Figure 8).

Survival threats to leatherbacks at sea are less well-known than those associated with nesting beaches, and the percentage of countries indicating "unknown" for these potential nearshore threats ranged from 24% to 52%. Roughly the same percentage of countries responded that these various threats affected zero turtles in their nearshore, inter-nesting range.

In addition to frequency, survey respondents were asked to estimate the number of adults (typically these would be gravid females) directly affected by a particular threat in nearshore waters. Response categories were: None, 1-10, 11-100, 101-500, 501-1,000, >1,000 turtles or Unknown. Then, based on the number of females estimated to nest, nation-wide, in an average year (estimated from data provided to Eckert and Eckert 2019), the relative magnitude of the threat was determined to be None/Sublethal, <20% of Females, >20% of Females, >50% of Females, or Unknown.

One country (Haiti) indicated Killed by Humans in nearshore waters as constituting a known survival threat to more than 20% of the nesting population. Experts in 30% to nearly 70% of countries could not estimate the number (within these broadly binned categories) of turtles impacted by these various threats (Figure 8) in nearshore waters, highlighting a significant knowledge gap.

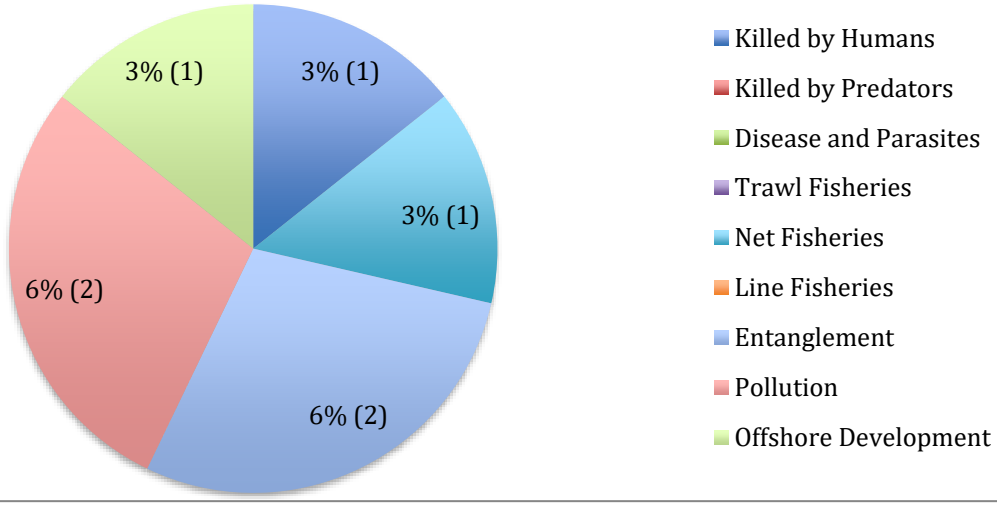
Figure 8. Percentage of Wider Caribbean countries (#countries in parentheses) that ranked specific hazards as "frequently" posing a survival threat to adult leatherbacks in inter-nesting (nearshore) habitats.



Adults – Offshore (Exclusive Economic Zone) Habitat – Survey respondents had the option of describing a suite of potential threats to adult leatherbacks in the Exclusive Economic Zone (waters beyond nearshore, inter-nesting zones) as None, Rare, Occasional, Frequent, or Unknown. Only five threats rose to the level of "frequent", with two countries (6%) describing Entanglement or Pollution, and one additional country (in each case) describing Net Fisheries, Killed by Humans, or Offshore Development as a frequent cause of mortality to adults offshore (Figure 9).

Survival threats to leatherbacks at sea are less well-known than those associated with nesting beaches, and the percentage of countries indicating "unknown" for these potential offshore threats ranged from 55% to 88%.

Figure 9. Percentage of Wider Caribbean countries (#countries in parentheses) that ranked specific hazards as "frequently" posing a survival threat to adult leatherbacks in waters beyond nearshore inter-nesting habitats (EEZ, or offshore waters).

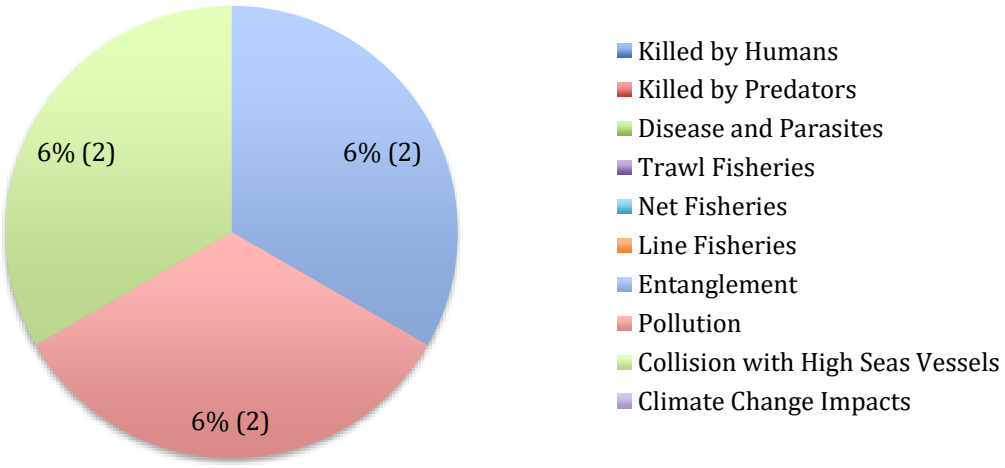


No country reported any potential hazard in offshore waters as constituting a known survival threat to more than 20% (or more than 50%) of the nesting population. Experts from only three countries had access to data that empowered them to broadly estimate the magnitude (number) of turtles impacted by these various threats (cf. Figure 9) in offshore waters (i.e., beyond inter-nesting habitat), highlighting a significant knowledge gap.

Adults – Areas Beyond National Jurisdiction (High Seas) – Survey respondents had the option of describing a suite of potential threats to adult leatherbacks in Areas Beyond National Jurisdiction (high seas) as None, Rare, Occasional, Frequent, or Unknown. Only three threats rose to the level of "frequent", with two countries (6%) describing Entanglement, Pollution or Vessel Collision as a frequent cause of mortality to adults on the high seas (Figure 10).

Survival threats to leatherbacks at sea are less well-known than those associated with nesting beaches, and the percentage of countries indicating "unknown" for these potential high seas threats ranged from 88-97%. This significant knowledge gap hampers the strategic prioritization and allocation of resources on behalf of effective conservation in international waters.

Figure 10. Percentage of Wider Caribbean countries (#countries in parentheses) that ranked specific hazards as "frequently" posing a survival threat to adult leatherbacks in Areas Beyond National Jurisdiction (ABNJ, or high seas).



No country reported any potential hazard in areas beyond national jurisdiction as constituting a known survival threat to more than 20% (or more than 50%) of the nesting population. Not a single expert from any country could estimate the number of turtles impacted by these various threats (cf. Figure 10) on the high seas, once again highlighting a significant knowledge gap.

Threats to NWA Leatherbacks Nesting in the Guianas and Trinidad

Threats to leatherbacks nesting in the southern latitudes of the Caribbean Sea are of special interest because declines in the Guianas – and French Guiana in particular – appear to be driving the declining trend within the NWA leatherback subpopulation (Northwest Atlantic Leatherback Working Group 2018, 2019).

In broader regional responses (summarized above), Net Fishing rose to the top as a "frequent" threat to NWA leatherbacks in both nearshore (inter-nesting) and offshore waters. However, the percentage of countries within the Guianas and Trinidad & Tobago citing Net Fishing as a "frequent" threat was much higher; specifically, 15.6% (regional, including the Guianas and Trinidad) vs 75% (Guianas and Trinidad alone) in nearshore waters and, similarly, 3% vs 50% in offshore waters.

Nests – Survey respondents had the option of describing a suite of potential threats to eggs and hatchlings as None, Rare, Occasional, Frequent, or Unknown. For the Trinidad-Guianas subpopulation, experts in three of the four countries (75%) ranked Predators as "frequently" posing a survival threat to eggs or hatchlings; two of the four (50%) ranked Egg Collection by Humans and Abiotic Factors, and one (25%) ranked Habitat Loss/Conversion and/or Artificial Beachfront Lighting as frequent threats.

In addition to frequency, survey respondents were asked to estimate the number of nests (not the number of individual eggs or hatchlings) directly affected by a particular threat. Response categories were: None, 1-10, 11-100, 101-500, 501-1,000, >1,000 nests or Unknown. Based on the number of nests estimated to be laid, nation-wide, in an average year (estimated from data provided to Eckert and Eckert 2019), the relative magnitude of the threat was determined to be None/Sublethal, <20% of Nests, >20% of Nests, >50% of Nests, or Unknown.

Some of the same threats described most often by experts in Trinidad & Tobago and the Guianas as "frequently" posing a threat to leatherback nests (see Figure 11) were also identified as affecting more than 20% of nests laid each year. These were Predators (50% of countries), and Habitat Loss/Conversion and Abiotic Factors (25% of countries in each case). None of these four countries identified threats believed to affect more than 50% of leatherback nests laid each year.

Adults – Nesting Females – Survey respondents had the option of describing a suite of potential threats to nesting females as None, Rare, Occasional, Frequent, or Unknown. Only one country (25%) identified a threat as "frequently" affecting gravid females, that was Habitat Loss/Conversion. None of these four countries could identify threats believed to "frequently" affect more than 20% (or more than 50%) of leatherbacks nesting on the shores of Trinidad & Tobago or the Guianas.

Adults – Nearshore (Inter-nesting) Habitat – Survey respondents had the option of describing a suite of potential threats to adult leatherbacks in the inter-nesting habitat (nearshore waters) as None, Rare, Occasional, Frequent, or Unknown. Only one threat rose to the top – i.e., three countries (75%) identified Net Fisheries as a "frequent" threat to adults in nearshore waters. None of those interviewed in these four countries could identify threats believed to "frequently" affected more than 20% (or more than 50%) of adult leatherbacks in offshore waters; however, published studies confirm that artisanal Net Fisheries in Trinidad capture more than 20% of gravid females per annum and the data suggest significant capture rates in Suriname and French Guiana, as well (see *Potential Drivers of NWA Leatherback Decline – Threats At-Sea: Fisheries Interactions* for details).

Adults – Offshore (Exclusive Economic Zone) Habitat – Survey respondents had the option of describing a suite of potential threats to adult leatherbacks in offshore waters as None, Rare, Occasional, Frequent, or Unknown. Two countries (50%) identified Net Fisheries as a "frequent" threat to adults in offshore waters; one country (25%) identified Offshore Development as a "frequent" threat to adults in offshore waters. None of those interviewed in

these four countries could identify threats believed to "frequently" affect more than 20% (or more than 50%) of adult leatherbacks in offshore waters.

Adults – Areas Beyond National Jurisdiction (High Seas) Habitat – Survey respondents had the option of describing a suite of potential threats to adult leatherbacks on the high seas as None, Rare, Occasional, Frequent, or Unknown. None of those interviewed in these four countries had sufficient information to rank any of the potential threats as "frequently" affecting leatherbacks on the high seas that return to nest in Trinidad & Tobago or the Guianas. The lack of data regarding the fate of this subpopulation in international waters mirrors a general dearth of information available to stakeholders region-wide, highlighting a significant knowledge gap.

SURVEY RESULTS: SUMMARY OF FINDINGS

As noted above (see *Previous Assessments of Threats to NWA Leatherbacks*), Dow et al. (2007), as part of a geospatial atlas of sea turtle nesting beaches in the Wider Caribbean, relied on expert input to rank threats to sea turtles region-wide (see Table 3). While the 2007 assessment did not attempt to quantify relative magnitude nor relative population-level effects, it provides useful insight into which threats were, at that time, deemed most prevalent. The present study, based on a more comprehensive stakeholder survey (see Appendix 1), is similar in its findings but provides more detail in focusing on a single species and in differentiating between life stages (nests, adults) and habitats (beach, nearshore, offshore, high seas).

On the nesting beach, the present study provides clear evidence that Abiotic Factors (including flooding, beach erosion and accretion, rising sand temperatures, and other climate-related risks), Pollution, Egg Collection by Humans, and Habitat Loss are both the most prevalent and the most impactful, rising – in as many as one-in-four countries – to the level of threatening the survival of 20% or more of nests laid per annum (Table 4). Mounting concern over Abiotic Factors may reflect a growing awareness that modern climate change is implicated in stronger storms (beach loss, nest flooding), reduced hatch success, and shifting thermal regimes believed to be feminizing hatchling ratios (e.g., IUCN Red List 2009, Fuentes et al. 2012, Santidrian-Tomillo et al. 2012, Fuentes and Porter 2013).

With regard to gravid females on the nesting beach, the present study reports Habitat Loss/Conversion, the Sargassum Influx, and Harassment as both the most prevalent threats to nesting females and, in some cases, as affecting more than 20% (in other cases more than 50%) of the annual nesting cohort (Table 4). Smaller numbers of countries report as "frequent" the threats posed by Artificial Lighting, Beach Obstacles, Beach Sand Mining, Killed by Humans, and Beach Armoring. These were surveyed as distinct threats because solutions differ among them, but the underlying threat in each case is ill-planned coastal development.

At sea, the threat landscape is dominated, both in frequency and magnitude, by Net Fisheries, Pollution, and Entanglement which in some countries is characterized as threatening the survival of more than 20% (in other cases more than 50%) of the nation's adult population of leatherback turtles (Table 4). This threat is particularly pronounced in Trinidad and the Guianas, where three of the four countries (75% vs 15% of countries region-wide) cited Net Fisheries as a "frequent" threat. For more detail on fisheries interactions involving the NWA leatherback subpopulation, see *Potential Drivers of NWA Leatherback Decline – Threats At-Sea: Fisheries Interactions*. Only one country (Haiti) noted that direct take ("Killed by Humans") remained a threat; others noted that direct take, such as by harpoon, ended with legislation protecting the leatherback in national waters (e.g., Cuba: Moncada Gavilán 2014).

Table 4. Summary of the frequency and magnitude of threats to leatherback turtles (*Dermochelys coriacea*) in all 33[10] Wider Caribbean countries that participated in the survey (see Appendix 1). The table indicates the percentage (absolute number appears in parentheses) of countries that identify a particular factor as a "frequent" threat to leatherback survival, and the percentage (and number) of countries reporting the magnitude of the threat as affecting more than 20% (or more than 50%) of turtles or nests per year. For comparison, responses from Trinidad & Tobago and the Guianas (Suriname, Guyana, French Guiana) (n=4) are shown in red. See Appendix 1 for a definition of each threat.

Threat (Life Stage, Habitat)	"Frequent"	Affects >20%	Affects >50%
Nests			
Abiotic Factors	27(9) 50(2)	24(8) 25(1)	6(2)
Pollution	27(9)	6(2)	
Egg Collection	24(8) 50(2)	6(2)	6(2)
Habitat Loss/Conversion	21(7) 25(1)	3(1) 25(1)	
Sargassum Influx	21(7)	3(1)	3(1)
Predators	18(3) 75(3)	9(3) 50(2)	6(2)
Artificial Lighting	15(5) 25(1)	6(2)	6(2)
Beach Obstacles	6(2)	6(2)	3(1)
Mechanized Beach Clean	6(2)		3(1)
Beach Driving	6(2)	3(1)	
Livestock on the Beach	6(2)		
Disease/Parasites	3(1)	6(2)	
Beach Sand Mining	3(1)		
Beach Nourishment			
Beach Armoring			
Adults: Nesting			
Habitat Loss/Conversion	21(7) 25(1)	6(2)	
Sargassum Influx	18(6)	3(1)	3(1)
Harassment	15(5)	9(3)	3(1)
Beach Obstacles	9(3)	3(1)	6(2)
Beach Sand Mining	9(3)	3(1)	
Artificial Lighting	9(3)	3(1)	
Killed by Humans	6(2)	3(1)	3(1)
Beach Armoring	3(1)		
Killed by Predators			
Adults: Nearshore			
Net Fisheries	15(5) 75(3)	25(1)[11]	
Marine Pollution	15(5)		
Entanglement	12(4)		
Killed by Humans	3(1)	3(1)	
Nearshore Development	3(1)		
Killed by Predators			
Disease/Parasites			
Trawl Fisheries			
Line Fisheries			
Misc Fisheries (pots, blasting)			
Harassment			

[10] Thirty-four NWA nations and territories host leatherback turtle nesting, but data were unavailable from Honduras.

[11] While experts interviewed on behalf of Trinidad & Tobago did not identify artisanal Net Fisheries operating in inter-nesting habitat as posing a threat to 20% or more of the annual nesting cohort, published literature confirms this to be the case (see *Potential Drivers of NWA Leatherback Decline – Threats At-Sea: Fisheries Interactions* for details).

Threat (Life Stage, Habitat)	"Frequent"	Affects >20%	Affects >50%
Adults: EEZ			
Offshore Development	3(1) 25(1)		
Net Fisheries	3(1) 25(1)		
Entanglement	6(2)		
Marine Pollution	6(2)		
Killed by Humans	3(1)		
Killed by Predators			
Disease/Parasites			
Trawl Fisheries			
Line Fisheries			
Adults: ABNJ			
Entanglement	6(2)		
Marine Pollution	6(2)		
Vessel Collision	6(2)		
Killed by Humans			
Killed by Predators			
Disease/Parasites			
Trawl Fisheries			
Net Fisheries			
Line Fisheries			
Climate Change			

Gaps in our Understanding of Threats to NWA Leatherbacks

Uncertainty about the distribution and abundance of nesting has declined in the last decade. Eckert and Eckert (2019) report that 12% of NWA leatherback nesting beaches have unknown crawl abundances; a decade ago, that percentage was nearly double (21%; Dow Piniak and Eckert 2011). The same cannot be said about our knowledge of at-sea distribution and abundance, which remains in a nascent stage despite the reality that some of the most serious threats (entanglement, pollution, fisheries interactions, offshore development) facing the NWA subpopulation are offshore.

Uncertainty regarding threat regimes, both in frequency and magnitude, increases with distance from the shoreline. The percentage of "Unknown" responses to survey questions rose from less than 10% of countries unable to identify whether a particular threat was Absent, Rare, Occasional, or Frequent on the nesting beach to 25-50% of countries unable to make this determination for nearshore waters, to 55-85% and 90-100% in offshore and international waters, respectively. Similarly, it was rare for country experts to feel that they have sufficient data to estimate the number of turtles affected by various threats in offshore or international waters.

Gaps and uncertainty surrounding threat regimes and their individual and synergistic effects on the NWA leatherback subpopulation present a significant challenge to conservation planning. In order to achieve sustained population recovery, primary threats must be identified and mitigated using best practice, and successful programs replicated throughout the species' range. Successful mitigation of threat is particularly vital for large juveniles and adults, which carry the highest reproductive value and are the most problematic for a population to replace (e.g., see Crouse et al. 1987, Frazer 1989, Crowder et al. 1994, Heppell et al. 1999, 2000).

SURVEY RESULTS: SOLUTIONS IN PRACTICE

A comprehensive survey (Appendix 1) completed in late 2021 by all Wider Caribbean countries (with the exception of Honduras) where NWA leatherbacks are known to nest, has provided insight into successful conservation programming currently in practice. Seeking to avoid a roster of all possible conservation intervention, interviewees were asked to provide examples of solutions designed to mitigate threats affecting >20% of the nesting population.

To address egg collection and/or the killing of gravid females on the nesting beach, regularly scheduled anti-poaching patrols are broadly employed (e.g., best practices are described for Dominica: Stapleton and Eckert 2008). These are described by interviewees as having low to high cost (depending on the remoteness of location, whether patrollers are paid, and so on) with generally medium effectiveness and a high degree of uncertainty regarding their sustainability and effectiveness in the long term.

Legal protection of nesting beaches (e.g., Prohibited Areas Orders for Matura, Fishing Pond, and Grande Riviere: Trinidad; Sandy Point National Wildlife Refuge: St. Croix USVI; Gandoca/Manzanillo, Pacuare Reserve, Tortuguero and Cahuita National Parks: Costa Rica, among many others), often with the requirement that visitors be accompanied by trained guides (e.g., Clovis 2005, Sammy and Baptiste 2008), is a broadly applied policy-driven approach described as having medium cost and ease of implementation, with effectiveness closely related to monitoring and enforcement, infrastructure, and trained staff (Leverington et al. 2010, OECD 2017, Giakoumi et al. 2018).

To mitigate fisheries interactions, interviewees highlighted Turtle Excluder Device (TED) implementation and controls (cf. Senko and Nalovic 2021); fisheries control for subsistence, artisanal and IUU fishing; legal requirements, including mesh size and distance from shore; various gear-technology approaches for artisanal coastal gillnets (e.g., Gilman et al. 2010); prohibitions on blast or chemical fishing; and incentivizing traps set without ropes (removing the threat of entanglement). The first two were described as high cost, low/medium ease of implementation, and medium/high effectiveness. The others were described as low cost with low/medium effectiveness depending on the consistency of monitoring and enforcement.

To address pollution and entanglement issues, current programming includes regular beach and in-water cleaning by NGOs and volunteers; implementation of a ghost gear program; and adoption of an Oil Spill Contingency Plan. Coastal clean-ups are described as having medium cost, high ease of implementation, and high effectiveness, whereas the ghost gear program is high cost with low ease and low effectiveness.

Offshore development, typically associated with seismic exploration, can be mitigated through agreements to operate only when leatherbacks are not present, requiring onboard observers, monitoring turtle movements through satellite tracking (practical only with very small populations; van der Wal et al. 2016), and raising awareness among Safety, Health and Environmental staff employed by the energy company. With the exception of satellite tracking (high cost), these initiatives are described as low cost with generally medium ease of implementation (e.g., requiring training, compliance monitoring), and a high degree of uncertainty regarding their sustainability and effectiveness in the long term.

Legal protection (all times, all locations) to leatherback turtles and their eggs is a policy-based approach seen in all but seven[12] of the constituent nations and territories of the NWA leatherback regional management unit. This approach has the advantage of providing a solution framework (e.g., as a deterrent) to a variety of on- and offshore threats summarized in Table 4. The material cost is low, but "ease" and effectiveness are mixed and largely dependent on public awareness, the capacity to monitor compliance, the reliability of law enforcement action, and the resources allocated to prosecution (reviewed by Bräutigam and Eckert 2006).

Finally, public awareness and community engagement, including the education of fishers, is broadly applied in support of all other conservation intervention. It is typically characterized as incurring medium cost and low/medium ease of implementation, but with a typically low degree of effectiveness.

CONCLUDING REMARKS

When several drivers synergistically influence population status, it can be difficult to optimize investments of limited conservation resources for maximum effectiveness. Approaches that facilitate direct comparison of quantified impacts of various threats in terms of overall population dynamics can provide valuable guidance for these important conservation decisions. By evaluating impacts of individual threats in a common population-level context, threats can be ranked in terms of their relative importance to population status. This ranking of threats can inform development and prioritization of proposed conservation actions in a regional action plan.

To conduct such a population-level approach to priority-setting, different types of information are required, including the magnitude (estimates of the number of individuals affected) and extent (distribution of the occurrence of a threat relative to distribution of the population) of impact, reproductive values (or a proxy, such as body sizes), and an indication of the availability and quality of data used to estimate impacts of threats. Describing data quality and availability – or uncertainty – highlights important information gaps that themselves can become priorities for data collection and reporting (Wallace et al. 2011, Wallace 2019).

In this study, we have taken the first steps toward "a population-level approach" by interviewing stakeholders (see Appendix 1) in 33 range States to gather information on both the frequency and magnitude of contemporary threats to NWA leatherbacks, recently classified as Endangered on the IUCN *Red List of Threatened Species* (Northwest Atlantic Leatherback Working Group 2019) due, in large part, to a steep decline in what was, until recently, the largest nesting assemblage for this species in the world (Fossette et al. 2008). We have focused on threats to various life stages (eggs, hatchlings, adults; threats to juveniles are assumed to be similar) on nesting beaches, as well as in waters within and beyond national jurisdiction.

Results indicate high levels of bycatch near key nesting beaches during the nesting season, implying that fisheries interactions may be a primary driver of estimated declines in abundance, including in Trinidad and the Guianas. Previous efforts to test and introduce gear modification designed to reduce leatherback bycatch and maintain target catch in Trinidad made important progress, but bycatch reduction measures (cf. Eckert and Eckert 2005, Eckert 2013b) were ultimately not implemented. Thus, there is great potential to revive – and to replicate – these efforts to conservation benefit elsewhere (see Gilman et al. 2010 for additional detail).

[12] Dominica, Grenada, Haiti, St. Lucia, St. Kitts & Nevis, UK Overseas Territories of Montserrat and Turks & Caicos Islands.

Net Fisheries, Marine Pollution, and Entanglement are not the only "frequent" threat to NWA leatherbacks but, like Habitat Loss, Harassment, and the Sargassum Influx, which similarly ranked as "frequent" threats onshore (see *Survey Results: Frequency and Magnitude of Threats*; Table 4), they directly affect reproductively active adults and thus demand immediate and sustained conservation attention (cf. Frazer 1989).

Finally, integrating conservation investment with considerations of population size and stock diversity is vital to the restoration of the NWA leatherback subpopulation. Using data provided to Eckert and Eckert (2019)[13] and stock identification by Dutton et al. (2013), we find that four nesting colonies (Costa Rica, Panama, Trinidad, French Guiana) representing two of the region's three (known) genetic stocks support slightly more than 60% of all nesting by NWA leatherbacks (Figure 11). Prioritizing investment in these countries – with strategic attention to the northern Caribbean stock (Puerto Rico, USVI, BVI) to retain genetic diversity – is one approach to priority-setting for a geographically widespread species with distinct populations subject to multiple threats operating at different spatial and temporal scales.

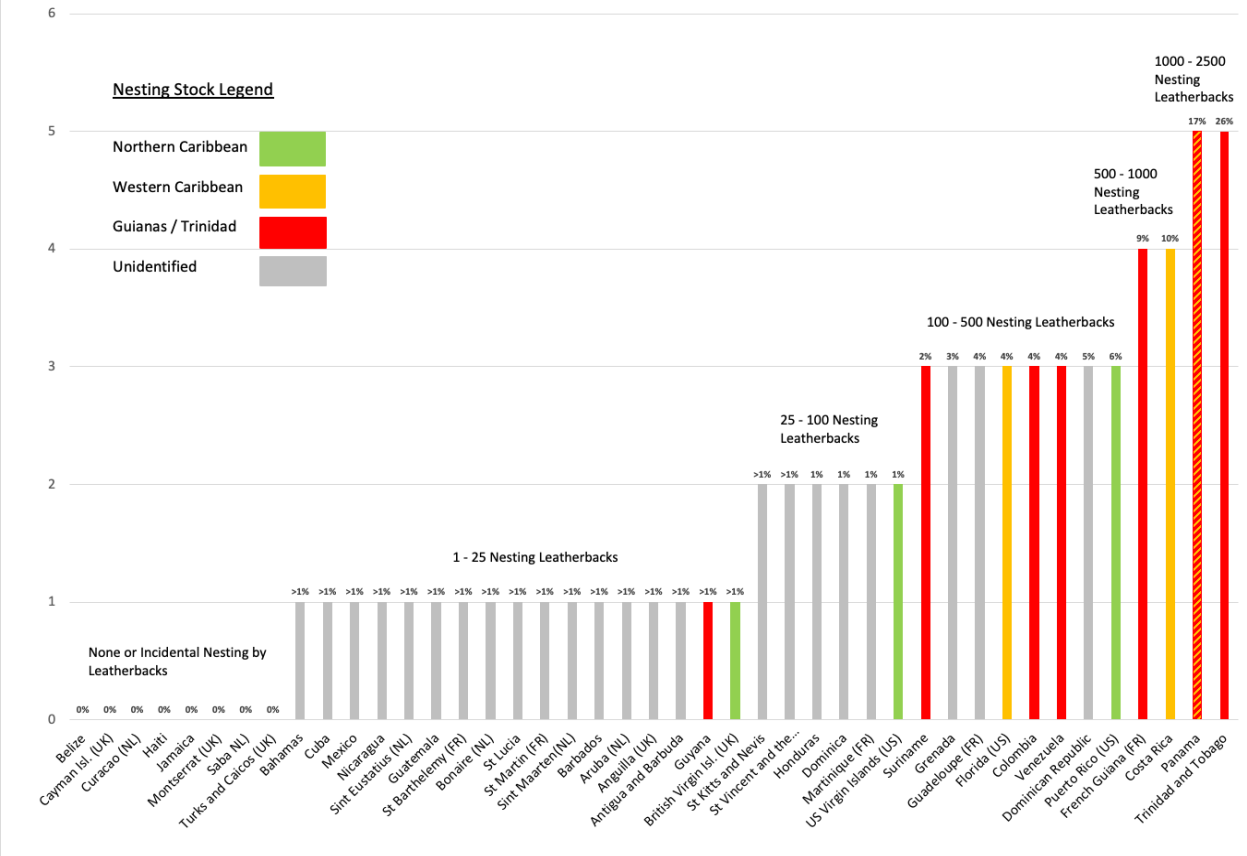


Figure 11. Geographic distribution of average annual nesting by leatherbacks (*Dermochelys coriacea*) in the NWA subpopulation, estimated from data provided to Eckert and Eckert (2019)[13]. Populations are color-coded by stock identity as defined by Dutton et al. (2013), who concluded that Costa Rica/Florida and Guianas/Venezuela/Trinidad stocks were genetically distinct, but that Panama may represent nesting by both. An estimate of the average proportion (%) of the annual NWA nesting cohort hosted by each range State appears above the histogram bar.

[13] Eckert and Eckert (2019) reported binned estimates of average annual crawl counts (successful + unsuccessful nesting attempts). For our purposes (present study), these were converted to binned estimates of average annual numbers of nesting females by assuming that 70% of crawls resulted in the deposition of eggs, and a clutch frequency of five (cf. Eckert et al. 2012).

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Photo credit: Leatherback turtle hatchlings and a post-nesting female returning to the sea in French Guiana. © Guillaume Feuillet, KWATA

APPENDIX 1

Threats to NWA Leatherback Sea Turtles: Regional Survey of Knowledge Providers

PART 1 (BEACH) Threats #1 - #24
PART 2 (AT-SEA) Threats #25 - #54

WIDECAST
Wider Caribbean Sea Turtle Conservation Network

Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Administrative Questions

* 1. Country (please select one from the dropdown menu)

* 2. Data Providers (please enter name + affiliation for each person interviewed for this survey)

* 3. Interview Date

Date

Date

MM/DD/YYYY

4. Gravid Leatherbacks/ Year (estimated from 2019 Atlas)

Other: Keep the bin score above, but if the number of nesting females is known with greater precision, enter that number (or range) here.

5. Leatherback Nests/ Year (estimated from 2019 Atlas)

Other: Keep the bin score above, but if the number of nests is known with greater precision, enter that number (or range) here.

WIDECAST
Wider Caribbean Sea Turtle Conservation Network

Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Adults): THREAT #1 Nesting Females Killed by Humans

In this "Nesting Beach Threats" section we discuss nine threats (Threat #1 - Threat #9) to nesting females. In each case the interviewee will be asked to assess the threat at a national scale in terms of Frequency, Magnitude, Relative Magnitude, and, IF appropriate, Solutions. Solutions must already be implemented (not planned) and included only if the particular threat is thought to affect >20% of nesting females per year.

6. THREAT #1: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

7. THREAT #1: MAGNITUDE (i.e., number of turtles killed per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

8. THREAT #1: RELATIVE MAGNITUDE (i.e., percentage of turtles killed per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

9. THREAT #1: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nesting turtles are killed by humans each year legally or illegally, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Anti-poaching patrols; Extend the closed season; Public awareness/media campaigns.

10. THREAT #1: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Anti-poaching patrols; Extend the closed season; Public awareness/media campaigns.

11. THREAT #1: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Anti-poaching patrols; Extend the closed season; Public awareness/media campaigns.

WIDECAST
Wider Caribbean Sea Turtle Conservation Network

Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Adults): THREAT #2 Nesting Females Killed by Predators (ex. jaguar, dog)

12. THREAT #2: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

13. THREAT #2: MAGNITUDE (i.e., number of turtles killed per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

14. THREAT #2: RELATIVE MAGNITUDE (i.e., percentage of turtles killed per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

15. THREAT #2: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nesting turtles are killed by predators, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Enforce leash-your-dog laws; Increase human presence on the beach to discourage jaguars

16. THREAT #2: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Enforce leash-your-dog laws; Increase human presence on the beach to discourage jaguars

17. STHREAT #2: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Enforce leash-your-dog laws; Increase human presence on the beach to discourage jaguars

WIDECAST
Wider Caribbean Sea Turtle Conservation Network

Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Adults): THREAT #3 Artificial Lighting

For this threat we're looking for "significant" disorientation - in other words, lighting that constitutes a survival threat. Examples might include nesting females disoriented into built structures, swimming pools, parking lots or roadways - or simply led inland to perish in the heat of the day. NOTE: We are only concerned about nesting females for Threats #1 - #9, hatchlings will come later.

18. THREAT #3: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

19. THREAT #3: MAGNITUDE (i.e., number of turtles significantly disoriented per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

20. THREAT #3: RELATIVE MAGNITUDE (i.e., percentage of turtles significantly disoriented per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

21. THREAT #3: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nesting turtles are significantly disoriented by coastal lighting, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Lighting Ordinance adopted (law/policy); Program to encourage hoteliers and other coastal landowners to implement turtle-friendly lighting voluntarily; Public awareness/media campaigns.

22. THREAT #3: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Lighting Ordinance adopted (law/policy); Program to encourage hoteliers and other coastal landowners to implement turtle-friendly lighting voluntarily; Public awareness/media campaigns.

23. THREAT #3: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Lighting Ordinance adopted (law/policy); Program to encourage hoteliers and other coastal landowners to implement turtle-friendly lighting voluntarily; Public awareness/media campaigns.

WIDECAST
Wider Caribbean Sea Turtle Conservation Network

Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Adults): THREAT #4 Beach Armoring/Stabilization

For this threat we're looking for "significant" effects - in other words, coastal armoring that constitutes a survival threat. Examples might include seawalls, breakwaters, jetties, or groynes that prevent gravid females from nesting in preferred habitat.

24. THREAT #4: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

25. THREAT #4: MAGNITUDE (i.e., number of turtles significantly affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

26. THREAT #4: RELATIVE MAGNITUDE (i.e., percentage of turtles significantly affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

27. THREAT #4: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nesting turtles are prevented from nesting by coastal armoring, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations to prevent armoring of nesting beaches; Public awareness/media campaigns.

28. THREAT #4: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations to prevent armoring of nesting beaches; Public awareness/media campaigns.

29. THREAT #4: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations to prevent armoring of nesting beaches; Public awareness/media campaigns.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Adults): THREAT #5 Habitat Loss/Conversion

For this threat we're looking for "significant" effects - in other words, habitat loss or conversion that constitutes a survival threat. Examples might include coastal development (commercial, agricultural) that eliminates habitat or prevents gravid females from nesting in preferred areas. NOTE: Beachfront lighting and obstacles left on the beach are covered separately.

30. THREAT #5: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

31. THREAT #5: MAGNITUDE (i.e., number of turtles significantly affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

32. THREAT #5: RELATIVE MAGNITUDE (i.e., percentage of turtles significantly affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

33. THREAT #5: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nesting turtles are prevented from nesting by habitat loss or conversion, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations to prevent development on or near nesting habitat, such as by requiring a buffer zone; Regulations that require independent Environmental Impact Assessments; Active enforcement of coastal zone management laws.

34. THREAT #5: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations to prevent development on or near nesting habitat, such as by requiring a buffer zone; Regulations that require independent Environmental Impact Assessments; Active enforcement of coastal zone management laws.

35. THREAT #5: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations to prevent development on or near nesting habitat, such as by requiring a buffer zone; Regulations that require independent Environmental Impact Assessments; Active enforcement of coastal zone management laws.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Adults): THREAT #6 Harassment

For this threat we're looking for "significant" effects - in other words, harassment that constitutes a survival threat. Examples might include "ecotourism" (such as turtle watching without a trained guide, involving lights, noise, riding of turtles, etc.) or recreation (fishing, camping, commercial events) that prevents gravid females from completing the nesting process.

36. THREAT #6: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

37. THREAT #6: MAGNITUDE (i.e., number of turtles significantly affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

38. THREAT #6: RELATIVE MAGNITUDE (i.e., percentage of turtles significantly affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

39. THREAT #6: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nesting turtles are prevented from successfully nesting by harassment, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations to prevent harassment of nesting turtles; Regulations that require visitors to be accompanied by a trained guide; Regulations that close nesting beaches to the public during the nesting season; Implementation of public awareness/media campaigns.

40. THREAT #6: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations to prevent harassment of nesting turtles; Regulations that require visitors to be accompanied by a trained guide; Regulations that close nesting beaches to the public during the nesting season; Implementation of public awareness/media campaigns.

41. THREAT #6: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations to prevent harassment of nesting turtles; Regulations that require visitors to be accompanied by a trained guide; Regulations that close nesting beaches to the public during the nesting season; Implementation of public awareness/media campaigns.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Adults): THREAT #7 Beach Obstacles

For this threat we're looking for "significant" effects - in other words, beach obstacles that constitute a survival threat. Examples might include sunbeds, chairs/tables, or watercraft left on the beach at night that prevents gravid females from completing the nesting process or results in the turtle's injury or death.

42. THREAT #7: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

43. THREAT #7: MAGNITUDE (i.e., number of turtles significantly affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

44. THREAT #7: RELATIVE MAGNITUDE (i.e., percentage of turtles significantly affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

45. THREAT #7: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nesting turtles are prevented from successfully nesting by beach obstacles, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations requiring that obstacles be removed from the beach at night; Outreach campaigns to remind hoteliers of the importance of clearing the beach at night.

46. THREAT #7: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations requiring that obstacles be removed from the beach at night; Outreach campaigns to remind hoteliers of the importance of clearing the beach at night.

47. THREAT #7: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations requiring that obstacles be removed from the beach at night; Outreach campaigns to remind hoteliers of the importance of clearing the beach at night.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Adults): THREAT #8 Beach Sand Mining

For this threat we're looking for "significant" effects - in other words, beach or river mouth mining that constitute a survival threat. Examples might include disorientation, entrapment, or injury due to mining operations or the pits left behind.

48. THREAT #8: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

49. THREAT #8: MAGNITUDE (i.e., number of turtles significantly affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

50. THREAT #8: RELATIVE MAGNITUDE (i.e., percentage of turtles significantly affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

51. THREAT #8: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nesting turtles are prevented from successfully nesting - or are injured or killed - by beach sand mining, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations to prevent mining on or proximal to nesting beaches; Regulations requiring that construction sand be mined from inland quarries; Campaign to encourage successful prosecution of violators.

52. THREAT #8: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations to prevent mining on or proximal to nesting beaches; Regulations requiring that construction sand be mined from inland quarries; Campaign to encourage successful prosecution of violators.

53. THREAT #8: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations to prevent mining on or proximal to nesting beaches; Regulations requiring that construction sand be mined from inland quarries; Campaign to encourage successful prosecution of violators.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Adults): THREAT #9 Sargassum Influx

For this threat we're looking for "significant" effects - in other words, Sargassum influx that constitute a survival threat. Examples might include reduced access to nesting beach(es), disorientation, entrapment, or injury to nesting females due to large accumulations of seagrass or related cleanup operations.

54. THREAT #9: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

55. THREAT #9: MAGNITUDE (i.e., number of turtles significantly affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

56. THREAT #9: RELATIVE MAGNITUDE (i.e., percentage of turtles significantly affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

57. THREAT #9: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nesting turtles are prevented from successfully nesting by Sargassum, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations requiring that Sargassum by removed by hand (vs heavy machinery); Conservation teams are organized to rescue adult females.

58. THREAT #9: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations requiring that Sargassum by removed by hand (vs heavy machinery); Conservation teams are organized to rescue adult females.

59. THREAT #9: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations requiring that Sargassum by removed by hand (vs heavy machinery); Conservation teams are organized to rescue adult females.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #10 Egg Collection by Humans

In this "Nesting Beach Threats" section we discuss 15 threats (Threat #10 - Threat #24) to NESTS. In each case the interviewee will be asked to assess the threat at a national scale in terms of Frequency, Magnitude, Relative Magnitude, and, IF appropriate, Solutions. Solutions must already be implemented (not planned) and included only if the particular threat is thought to affect >20% of nests per year.

60. THREAT #10: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

61. THREAT #10: MAGNITUDE (i.e., number of nests collected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

62. THREAT #10: RELATIVE MAGNITUDE (i.e., percentage of nests collected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

63. THREAT #10: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests are collected by humans, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Anti-poaching patrols; Extended the closed season; Public awareness/media campaigns.

64. THREAT #10: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Anti-poaching patrols; Extended the closed season; Public awareness/media campaigns.

65. THREAT #10: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Anti-poaching patrols; Extended the closed season; Public awareness/media campaigns.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #11 Predators

66. THREAT #11: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

67. THREAT #11: MAGNITUDE (i.e., number of nests depredated per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

68. THREAT #11: RELATIVE MAGNITUDE (i.e., percentage of nests depredated per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

69. THREAT #11: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are taken on the beach by predators (mammals, birds, crabs) each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Enforce leash-your-dog laws; Increase human presence on the beach to discourage predators; nests are caged or moved to a hatchery.

70. THREAT #11: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Enforce leash-your-dog laws; Increase human presence on the beach to discourage predators; nests are caged or moved to a hatchery.

71. THREAT #11: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Enforce leash-your-dog laws; Increase human presence on the beach to discourage predators; nests are caged or moved to a hatchery.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #12 Disease or Parasites

For this threat we're looking for "significant" effects - in other words, disease or parasites that constitute a survival threat to eggs or hatchlings. This might include fungal or maggot infestations in the nest.

72. THREAT #12: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

73. THREAT #12: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

74. THREAT #12: RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

75. THREAT #12: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are destroyed or debilitated by disease or parasites each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Nests are excavated to define the extent of this threat; Veterinary care is provided to sick hatchlings.

76. THREAT #12: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Nests are excavated to define the extent of this threat; Veterinary care is provided to sick hatchlings.

77. THREAT #12: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Nests are excavated to define the extent of this threat; Veterinary care is provided to sick hatchlings.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #13 Abiotic Factors

For this threat we're looking for "significant" effects - in other words, abiotic factors such as climate change (stronger storms, rising seas, feminizing sand temperatures), flooding, erosion, or sediment deposits that constitute a survival threat to eggs or hatchlings.

78. THREAT #13: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

79. THREAT #13: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

80. THREAT #13: RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

81. THREAT #13: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are lost to abiotic factors each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Eggs are moved out of high risk zones; Beach patrols rescue hatchlings following best practices.

82. THREAT #13: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Eggs are moved out of high risk zones; Beach patrols rescue hatchlings following best practices.

83. THREAT #13: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Eggs are moved out of high risk zones; Beach patrols rescue hatchlings following best practices.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #14 Artificial Lighting

For this threat we're looking for "significant" disorientation - in other words, lighting that constitutes a survival threat. Examples might include hatchlings disoriented into built structures, swimming pools, parking lots or roadways - or led inland to perish in the heat of the day.

84. THREAT #14: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

85. THREAT #14: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

86. THREAT #14: RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

87. THREAT #14: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are lost to coastal lighting each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Lighting Ordinance adopted (law/policy); Program to encourage hoteliers and other coastal landowners to implement turtle-friendly lighting voluntarily; Public awareness/media campaigns.

88. THREAT #14: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Lighting Ordinance adopted (law/policy); Program to encourage hoteliers and other coastal landowners to implement turtle-friendly lighting voluntarily; Public awareness/media campaigns.

89. THREAT #14: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Lighting Ordinance adopted (law/policy); Program to encourage hoteliers and other coastal landowners to implement turtle-friendly lighting voluntarily; Public awareness/media campaigns.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #15 Beach Armoring/ Stabilization

For this threat we're looking for "significant" effects - in other words, coastal armoring that constitutes a survival threat. Examples might include seawalls, breakwaters, jetties, or groynes that result in nest loss or prevent hatchlings from reaching the sea.

90. THREAT #15: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

91. THREAT #15: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

92. THREAT #15: RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

93. THREAT #15: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are lost to coastal armoring each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations to prevent armoring of nesting beaches; Public awareness/media campaigns.

94. THREAT #15: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations to prevent armoring of nesting beaches; Public awareness/media campaigns.

95. THREAT #15: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations to prevent armoring of nesting beaches; Public awareness/media campaigns.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #16 Beach Driving

For this threat we're looking for "significant" effects - in other words, beach driving that constitutes a survival threat. Examples might include nest compaction (embryo or hatchling death) or hatchlings trapped in tire ruts that prevent them from reaching the sea and/or expose them to mortal threat from predators.

96. THREAT #16: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

97. THREAT #16: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

98. THREAT #16: RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

99. THREAT #16: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are lost to vehicle traffic on the beach each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations to prevent beach driving during nesting and hatching seasons; Regular beach patrol to rescue hatchlings; Public awareness/media campaigns.

100. THREAT #16: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations to prevent beach driving during nesting and hatching seasons; Regular beach patrol to rescue hatchlings; Public awareness/media campaigns.

101. THREAT #16: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations to prevent beach driving during nesting and hatching seasons; Regular beach patrol to rescue hatchlings; Public awareness/media campaigns.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #17 Beach Nourishment

For this threat we're looking for "significant" effects - in other words, "nourishment" or restoration projects that constitute a survival threat. Examples might include sand compaction, unsuitable replacement sand, or use of heavy machinery that results in known nest loss or reduced hatch or emergence success.

102. THREAT #17: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

103. THREAT #17: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

104. THREAT #17: RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

105. THREAT #17: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are lost to beach nourishment projects each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations to prevent "nourishment" or restoration projects during nesting and hatching seasons; Requirements that replacement sand mimic natural beach sand characteristics; Mandate that hatch success be monitored for signs of impact from nourishment projects.

106. THREAT #17: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations to prevent "nourishment" or restoration projects during nesting and hatching seasons; Requirements that replacement sand mimic natural beach sand characteristics; Mandate that hatch success be monitored for signs of impact from nourishment projects.

107. THREAT #17: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations to prevent "nourishment" or restoration projects during nesting and hatching seasons; Requirements that replacement sand mimic natural beach sand characteristics; Mandate that hatch success be monitored for signs of impact from nourishment projects.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #18 Habitat Loss/Conversion

For this threat we're looking for "significant" effects - in other words, habitat loss or conversion that constitutes a survival threat. Examples might include coastal development (commercial, agricultural) or the removal of stabilizing vegetation that eliminates habitat and results in nest loss. NOTE: Beachfront lighting and obstacles left on the beach are covered separately.

108. THREAT #18: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

109. THREAT #18: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

110. THREAT #18: RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

111. THREAT #18: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are lost to beach development each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations to prevent development on or near nesting habitat, such as by requiring a buffer zone; Regulations that require independent Environmental Impact Assessments; Active enforcement of coastal zone management laws.

112. THREAT #18: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations to prevent development on or near nesting habitat, such as by requiring a buffer zone; Regulations that require independent Environmental Impact Assessments; Active enforcement of coastal zone management laws.

113. THREAT #18: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations to prevent development on or near nesting habitat, such as by requiring a buffer zone; Regulations that require independent Environmental Impact Assessments; Active enforcement of coastal zone management laws.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #19 Livestock on the Beach

For this threat we're looking for "significant" effects - in other words, livestock issues that constitute a survival threat. Examples might include nest compaction or collapse, and/or predatory flies associated with dung.

114. THREAT #19: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

115. THREAT #19: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

116. THREAT #19: RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

117. THREAT #19: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are lost to livestock issues each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations to prevent livestock from accessing nesting habitat; Public awareness/media campaigns emphasizing the danger to embryos developing unseen beneath the beach surface.

118. THREAT #19: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations to prevent livestock from accessing nesting habitat; Public awareness/media campaigns emphasizing the danger to embryos developing unseen beneath the beach surface.

119. THREAT #19: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations to prevent livestock from accessing nesting habitat; Public awareness/media campaigns emphasizing the danger to embryos developing unseen beneath the beach surface.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #20 Mechanized Beach Cleaning

For this threat we're looking for "significant" effects - in other words, beach cleaning that constitutes a survival threat. Examples might include nest compaction or collapse, or nest exposure.

120. THREAT #20: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

121. THREAT #20: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

122. THREAT #20 RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

123. THREAT #20: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are lost to mechanized beach cleaning each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations to prevent mechanized beach cleaning in nesting habitat; Public awareness/media campaigns emphasizing the danger to embryos developing unseen beneath the beach surface.

124. THREAT #20: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations to prevent mechanized beach cleaning in nesting habitat; Public awareness/media campaigns emphasizing the danger to embryos developing unseen beneath the beach surface.

125. THREAT #20: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations to prevent mechanized beach cleaning in nesting habitat; Public awareness/media campaigns emphasizing the danger to embryos developing unseen beneath the beach surface.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #21 Pollution

For this threat we're looking for "significant" effects - in other words, pollution that constitutes a survival threat. Examples might include beach litter/debris, petroleum/tar, sewage, or municipal waste discharged to the beach or washed ashore.

126. THREAT #21: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

127. THREAT #21: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

128. THREAT #21 RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

129. THREAT #21: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are lost to pollution each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations requiring the proper disposal of waste; Public awareness/media campaigns to reduce litter; Requirements (and inspection) for proper treatment of sewage and other effluents (industrial, agricultural).

130. THREAT #21: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations requiring the proper disposal of waste; Public awareness/media campaigns to reduce litter; Requirements (and inspection) for proper treatment of sewage and other effluents (industrial, agricultural).

131. THREAT #21: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations requiring the proper disposal of waste; Public awareness/media campaigns to reduce litter; Requirements (and inspection) for proper treatment of sewage and other effluents (industrial, agricultural).

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #22 Beach Obstacles

For this threat we're looking for "significant" effects - in other words, beach obstacles that constitute a survival threat. Examples might include sunbeds, chairs/tables, or watercraft left on the beach at night that prevents hatchlings from emerging successfully and/or reaching the sea.

132. THREAT #22: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

133. THREAT #22: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

134. THREAT #22 RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

135. THREAT #22: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are lost to beach obstacles each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations requiring that obstacles be removed from the beach at night; Outreach campaigns to remind hoteliers of the importance of clearing the beach at night.

136. THREAT #22: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations requiring that obstacles be removed from the beach at night; Outreach campaigns to remind hoteliers of the importance of clearing the beach at night.

137. THREAT #22: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations requiring that obstacles be removed from the beach at night; Outreach campaigns to remind hoteliers of the importance of clearing the beach at night.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #23 Beach Sand Mining

For this threat we're looking for "significant" effects - in other words, beach or river mouth mining that constitute a survival threat. Examples might include nests lost to erosion or hatchling entrapment and/or injury due to mining operations or the pits left behind.

138. THREAT #23: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

139. THREAT #23: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

140. THREAT #23 RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

141. THREAT #23: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are lost to beach sand mining each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations to prevent mining on or proximal to nesting beaches; Regulations requiring that construction sand be mined from inland quarries; Campaign to encourage successful prosecution of violators.

142. THREAT #23: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations to prevent mining on or proximal to nesting beaches; Regulations requiring that construction sand be mined from inland quarries; Campaign to encourage successful prosecution of violators.

143. THREAT #23: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations to prevent mining on or proximal to nesting beaches; Regulations requiring that construction sand be mined from inland quarries; Campaign to encourage successful prosecution of violators.

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Threats to Leatherbacks: PART 1 (BEACH) Threat #1 - #24

Nesting Beach Threats (Eggs & Hatchlings): THREAT #24 Sargassum Influx

For this threat we're looking for "significant" effects - in other words, Sargassum influx that constitute a survival threat. Examples might include hatchling entrapment or injury due to large accumulations of seagrass or related cleanup operations.

144. THREAT #24: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

145. THREAT #24: MAGNITUDE (i.e., number of nests affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

146. THREAT #24 RELATIVE MAGNITUDE (i.e., percentage of nests affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

147. THREAT #24: SOLUTION #1 (Remember, this is ONLY answered if: >20% of nests or hatchlings are lost to Sargassum influx events each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations requiring that Sargassum by removed by hand (vs heavy machinery); Conservation teams are organized to rescue hatchlings.

148. THREAT #24: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations requiring that Sargassum by removed by hand (vs heavy machinery); Conservation teams are organized to rescue hatchlings.

149. THREAT #24: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations requiring that Sargassum by removed by hand (vs heavy machinery); Conservation teams are organized to rescue hatchlings.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

Administrative Questions

* 1. Country (please select one from the dropdown menu)

* 2. Data Providers (please enter name + affiliation for each person interviewed for this survey)

* 3. Interview Date

Date

Date

MM/DD/YYYY

4. Gravid Leatherbacks/ Year (estimated from 2019 Atlas)

Other: Keep the bin score above, but if the number of nesting females is known with greater precision, enter that number (or range) here.

5. Leatherback Nests/ Year (estimated from 2019 Atlas)

Other: Keep the bin score above, but if the number of nests is known with greater precision, enter that number (or range) here.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Near Nesting Beaches (Adults): THREAT #25 Killed by Humans

In this section we discuss 11 threats (Threat #25 - Threat #35) AT SEA to adult turtles in inter-nesting habitat. In each case the interviewee will be asked to assess the threat at a national scale in terms of Frequency, Magnitude, Relative Magnitude, and, IF appropriate, Solutions. Solutions must already be implemented (not planned) and included only if the threat is likely to affect >20% of turtles per year. NOTE: This threat (#25) is direct take, bycatch is addressed separately.

6. THREAT #25: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

7. THREAT #25: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

8. THREAT #25 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

9. THREAT #25: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed by humans in the internesting habitat each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Fisheries or other enforcement staff patrol inter-nesting habitat with an aim to apprehend poachers; Extend the closed season to include the entire nesting season; Public awareness/media campaigns.

10. THREAT #25: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Fisheries or other enforcement staff patrol inter-nesting habitat with an aim to apprehend poachers; Extend the closed season to include the entire nesting season; Public awareness/media campaigns.

11. THREAT #25: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Fisheries or other enforcement staff patrol inter-nesting habitat with an aim to apprehend poachers; Extend the closed season to include the entire nesting season; Public awareness/media campaigns.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Near Nesting Beaches (Adults): THREAT #26 Killed by Predators (ex. orca, shark)

12. THREAT #26: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

13. THREAT #26: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

14. THREAT #26 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

15. THREAT #26: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed by predators in the internesting habitat each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Hotlines or other communication options are well-advertised and used to report injuries; Trained veterinary staff are available to care for injured turtles

16. THREAT #26: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Hotlines or other communication options are well-advertised and used to report injuries; Trained veterinary staff are available to care for injured turtles

17. THREAT #26: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Hotlines or other communication options are well-advertised and used to report injuries; Trained veterinary staff are available to care for injured turtles

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Near Nesting Beaches (Adults): THREAT #27 Disease or Parasites

For this threat we're looking for "significant" effects - in other words, disease or parasites that constitute a survival threat to adult turtles. This might include debilitating tumors, or a heavy leech, fluke or barnacle load.

18. THREAT #27: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

19. THREAT #27: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

20. THREAT #27 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

21. THREAT #27: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by disease or parasites each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Trained veterinary staff are available to care for sick turtles; Research is underway to identify disease vectors.

22. THREAT #27: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Trained veterinary staff are available to care for sick turtles; Research is underway to identify disease vectors.

23. THREAT #27: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Trained veterinary staff are available to care for sick turtles; Research is underway to identify disease vectors.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Near Nesting Beaches (Adults): THREAT #28 Trawl Fisheries

There are four bycatch sections - trawl fisheries, net fisheries, line fisheries, and miscellaneous fisheries (ex. pot/trap, blast, chemical). In each case, "bycatch" refers to any incidental capture, it does not have to be fatal. Remember, here we're only talking about leatherbacks in inter-nesting habitat (nearshore). NOTE: Later sections will address pelagic fisheries.

24. THREAT #28: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

25. THREAT #28: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

26. THREAT #28 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

27. THREAT #28: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by TRAWL fishery interactions each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Trawling is excluded from inter-nesting habitat; TEDs (Turtle Excluder Devices) designed and approved for leatherbacks are mandatory; Research is underway to define the extent of the bycatch problem.

28. THREAT #28: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Trawling is excluded from inter-nesting habitat; TEDs (Turtle Excluder Devices) designed and approved for leatherbacks are mandatory; Research is underway to define the extent of the bycatch problem.

29. THREAT #28: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Trawling is excluded from inter-nesting habitat; TEDs (Turtle Excluder Devices) designed and approved for leatherbacks are mandatory; Research is underway to define the extent of the bycatch problem.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Near Nesting Beaches (Adults): THREAT #29 Net Fisheries (ex. seine, gillnet)

There are four bycatch sections - trawl fisheries, net fisheries, line fisheries, and miscellaneous fisheries (ex. pot/trap, blast, chemical). In each case, "bycatch" refers to any incidental capture, it does not have to be fatal. Remember, here we're only talking about leatherbacks in inter-nesting habitat (nearshore). NOTE: Later sections will address pelagic fisheries.

30. THREAT #29: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

31. THREAT #29: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

32. THREAT #29 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

33. THREAT #29: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by NET fishery interactions each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Net fisheries are excluded from inter-nesting habitat; Nets must be monitored so entangled turtles can be released without harm; Research is underway to define the extent of the bycatch problem.

34. THREAT #29: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Net fisheries are excluded from inter-nesting habitat; Nets must be monitored so entangled turtles can be released without harm; Research is underway to define the extent of the bycatch problem.

35. THREAT #29: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Net fisheries are excluded from inter-nesting habitat; Nets must be monitored so entangled turtles can be released without harm; Research is underway to define the extent of the bycatch problem.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Near Nesting Beaches (Adults): THREAT #30 Line Fisheries (ex. longlines, handlines)

There are four bycatch sections - trawl fisheries, net fisheries, line fisheries, and miscellaneous fisheries (ex. pot/trap, blast, chemical). In each case, "bycatch" refers to any incidental capture, it does not have to be fatal. Remember, here we're only talking about leatherbacks in inter-nesting habitat (nearshore). NOTE: Later sections will address pelagic fisheries.

36. THREAT #30: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

37. THREAT #30: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

38. THREAT #30 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

39. THREAT #30: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by LINE fishery interactions each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Line fisheries are excluded from inter-nesting habitat; Lines must be monitored so entangled turtles can be released without harm; Research is underway to define the extent of the bycatch problem.

40. THREAT #30: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Line fisheries are excluded from inter-nesting habitat; Lines must be monitored so entangled turtles can be released without harm; Research is underway to define the extent of the bycatch problem.

41. THREAT #30: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Line fisheries are excluded from inter-nesting habitat; Lines must be monitored so entangled turtles can be released without harm; Research is underway to define the extent of the bycatch problem.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Near Nesting Beaches (Adults): THREAT #31 Misc Fisheries (ex. weir, pot/trap, blast)

There are four bycatch sections - trawl fisheries, net fisheries, line fisheries, and miscellaneous fisheries (ex. pot/trap, blast, chemical). In each case, "bycatch" refers to any incidental capture, it does not have to be fatal. Remember, here we're only talking about leatherbacks in inter-nesting habitat (nearshore). NOTE: Later sections will address pelagic fisheries.

42. THREAT #31: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

43. THREAT #31: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

44. THREAT #31 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

45. THREAT #31: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by fishery interactions other than with trawls, nets or lines each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Chemical and blast fishing is prohibited; Research is underway to define the extent of leatherback interactions with fish pots, traps, and other miscellaneous fisheries.

46. THREAT #31: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Chemical and blast fishing is prohibited; Research is underway to define the extent of leatherback interactions with fish pots, traps, and other miscellaneous fisheries.

47. THREAT #31: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Chemical and blast fishing is prohibited; Research is underway to define the extent of leatherback interactions with fish pots, traps, and other miscellaneous fisheries.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Near Nesting Beaches (Adults): THREAT #32 Entanglement

For this threat we're looking for "significant" effects - in other words, entanglement that constitutes a survival threat. Examples might involve marine debris; abandoned lines, nets, or other commercial gear; or FAD, buoy or anchor lines.

48. THREAT #32: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

49. THREAT #32: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

50. THREAT #32 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

51. THREAT #32: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by entanglement in nearshore waters each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations require the proper disposal of fishing gear no longer in use; Programs are in place to collect marine debris; Research is underway to define the extent of the entanglement threat.

52. THREAT #32: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations require the proper disposal of fishing gear no longer in use; Programs are in place to collect marine debris; Research is underway to define the extent of the entanglement threat.

53. THREAT #32: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations require the proper disposal of fishing gear no longer in use; Programs are in place to collect marine debris; Research is underway to define the extent of the entanglement threat.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Near Nesting Beaches (Adults): THREAT #33 Pollution

For this threat we're looking for "significant" effects - in other words, pollution that constitutes a survival threat. Examples might include marine debris; agricultural, municipal, or sewage effluent; or the presence of oil, petroleum, or tar.

54. THREAT #33: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

55. THREAT #33: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

56. THREAT #33 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

57. THREAT #33: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by pollution in nearshore waters each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations prohibit industrial, agricultural, and sewage disposal into nearshore wasters; Oil spill response protocols are in place; Ratified MARPOL with government committed to enforcement.

58. THREAT #33: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations prohibit industrial, agricultural, and sewage disposal into nearshore wasters; Oil spill response protocols are in place; Ratified MARPOL with government committed to enforcement.

59. THREAT #33: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations prohibit industrial, agricultural, and sewage disposal into nearshore wasters; Oil spill response protocols are in place; Ratified MARPOL with government committed to enforcement.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Near Nesting Beaches (Adults): THREAT #34 Harassment

For this threat we're looking for "significant" effects - in other words, harassment that constitutes a survival threat. Examples might include interaction with yachters, SCUBA divers, fishers, or increased boat traffic.

60. THREAT #34: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

61. THREAT #34: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

62. THREAT #34 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

63. THREAT #34: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by harassment in nearshore waters each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations prohibit harassment; "Hotlines" and other reporting mechanisms are well advertised; Research is underway to define the extent of the threat.

64. THREAT #34: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations prohibit harassment; "Hotlines" and other reporting mechanisms are well advertised; Research is underway to define the extent of the threat.

65. THREAT #34: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations prohibit harassment; "Hotlines" and other reporting mechanisms are well advertised; Research is underway to define the extent of the threat.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Near Nesting Beaches (Adults): THREAT #35 Nearshore Development

For this threat we're looking for "significant" effects - in other words, nearshore development that constitutes a survival threat. Examples might include collision with personal watercraft, encounters with dredges, or threats posed by pier or marina development.

66. THREAT #35: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

67. THREAT #35: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

68. THREAT #35 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

69. THREAT #35: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by nearshore development each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Regulations to prevent nearshore development on or near nesting habitat; Regulations that require independent Environmental Impact Assessments; Active enforcement of coastal zone management laws.

70. THREAT #35: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Regulations to prevent nearshore development on or near nesting habitat; Regulations that require independent Environmental Impact Assessments; Active enforcement of coastal zone management laws.

71. THREAT #35: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Regulations to prevent nearshore development on or near nesting habitat; Regulations that require independent Environmental Impact Assessments; Active enforcement of coastal zone management laws.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Beyond the Nearshore (Adults): THREAT #36 Killed by Humans

In this section we discuss nine threats (Threat #36 - Threat #44) to adult turtles in national waters (the Exclusive Economic Zone, EEZ), seaward of inter-nesting habitat. In each case the interviewee will be asked to assess the threat at a national scale in terms of Frequency, Magnitude, Relative Magnitude, and, IF appropriate, Solutions. Solutions must already be implemented (not planned) and included only if the threat is likely to affect >20% of turtles per year. NOTE: This threat (#36) is direct take, bycatch is addressed separately.

72. THREAT #36: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

73. THREAT #36: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

74. THREAT #36 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

75. THREAT #36: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is intentionally killed in offshore waters each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Coast Guard or other enforcement staff patrol EEZ waters with an aim to apprehend poachers; Regulations protect leatherbacks in migratory corridors.

76. THREAT #36: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Coast Guard or other enforcement staff patrol EEZ waters with an aim to apprehend poachers; Regulations protect leatherbacks in migratory corridors.

77. THREAT #36: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Coast Guard or other enforcement staff patrol EEZ waters with an aim to apprehend poachers; Regulations protect leatherbacks in migratory corridors.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Beyond the Nearshore (Adults): THREAT #37 Killed by Predators (ex. orca, shark)

78. THREAT #37: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

79. THREAT #37: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

80. THREAT #37 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

81. THREAT #37: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed by a predator in offshore waters each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

82. THREAT #37: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

83. THREAT #37: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Wider Caribbean Sea Turtle Conservation Network

Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Beyond the Nearshore (Adults): THREAT #38 Disease or Parasites

For this threat we're looking for "significant" effects - in other words, disease or parasites that constitute a survival threat to adult turtles. This might include debilitating tumors, or a heavy leech, fluke or barnacle load.

84. THREAT #38: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

85. THREAT #38: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

86. THREAT #38 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

87. THREAT #38: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by disease or parasites in offshore waters each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

88. THREAT #38: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

89. THREAT #38: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Beyond the Nearshore (Adults): THREAT #39 Trawl Fisheries

There are three bycatch sections - trawl fisheries, net fisheries, and line fisheries. In each case, "bycatch" refers to any incidental capture, it does not have to be fatal. Remember, here we're only talking about leatherbacks in the Exclusive Economic Zone (EEZ), meaning waters under national jurisdiction beyond inter-nesting habitat.

90. THREAT #39: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

91. THREAT #39: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

92. THREAT #39 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

93. THREAT #39: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by TRAWL fishery interactions in offshore waters each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Trawling is banned in all national waters; If trawling is allowed, TEDs (Turtle Excluder Devices) designed and approved for leatherbacks are mandatory; Research is underway to define the extent of the bycatch problem.

94. THREAT #39: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Trawling is banned in all national waters; If trawling is allowed, TEDs (Turtle Excluder Devices) designed and approved for leatherbacks are mandatory; Research is underway to define the extent of the bycatch problem.

95. THREAT #39: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Trawling is banned in all national waters; If trawling is allowed, TEDs (Turtle Excluder Devices) designed and approved for leatherbacks are mandatory; Research is underway to define the extent of the bycatch problem.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Beyond the Nearshore (Adults): THREAT #40 Net Fisheries (ex. seine, gillnet)

There are three bycatch sections - trawl fisheries, net fisheries, and line fisheries. In each case, "bycatch" refers to any incidental capture, it does not have to be fatal. Remember, here we're only talking about leatherbacks in the Exclusive Economic Zone (EEZ), meaning waters under national jurisdiction beyond inter-nesting habitat.

96. THREAT #40: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

97. THREAT #40: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

98. THREAT #40 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

99. THREAT #40: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by NET fishery interactions in offshore waters each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Gillnets are banned in all national waters; Research is underway to define the extent of the bycatch problem.

100. THREAT #40: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Gillnets are banned in all national waters; Research is underway to define the extent of the bycatch problem.

101. THREAT #40: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Gillnets are banned in all national waters; Research is underway to define the extent of the bycatch problem.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Beyond the Nearshore (Adults): THREAT #41 Line Fisheries (ex. longlines)

There are three bycatch sections - trawl fisheries, net fisheries, and line fisheries. In each case, "bycatch" refers to any incidental capture, it does not have to be fatal. Remember, here we're only talking about leatherbacks in the Exclusive Economic Zone (EEZ), meaning waters under national jurisdiction beyond inter-nesting habitat.

102. THREAT #41: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

103. THREAT #41: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

104. THREAT #41 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

105. THREAT #41: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by LINE fishery interactions in offshore waters each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1. Examples: Longlining is banned in all national waters; Research is underway to define the extent of the bycatch problem.

106. THREAT #41: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2. Examples: Longlining is banned in all national waters; Research is underway to define the extent of the bycatch problem.

107. THREAT #41: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3. Examples: Longlining is banned in all national waters; Research is underway to define the extent of the bycatch problem.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Beyond the Nearshore (Adults): THREAT #42 Entanglement

For this threat we're looking for "significant" effects - in other words, entanglement that constitutes a survival threat. Examples might involve marine debris or abandoned lines, nets, or other commercial gear.

108. THREAT #42: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

109. THREAT #42: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

110. THREAT #42 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

111. THREAT #42: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by entanglement issues in offshore waters each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

112. THREAT #42: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

113. THREAT #42: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Beyond the Nearshore (Adults): THREAT #43 Pollution

For this threat we're looking for "significant" effects - in other words, pollution that constitutes a survival threat. Examples might involve marine debris, shipping waste or discharge, or the presence of oil, petroleum, or tar.

114. THREAT #43: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

115. THREAT #43: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

116. THREAT #43 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

117. THREAT #43: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated by pollution in offshore waters each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

118. THREAT #43: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

119. THREAT #43: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

At-sea Threats Beyond the Nearshore (Adults): THREAT #44 Offshore Development

For this threat we're looking for "significant" effects - in other words, offshore development that constitutes a survival threat. Examples might include collisions, hearing damage, or other harm from offshore drilling operations or seismic exploration.

120. THREAT #44: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

121. THREAT #44: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

122. THREAT #44 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

123. THREAT #44: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting cohort is killed or debilitated each year by infrastructure development in offshore waters, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

124. THREAT #44: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

125. THREAT #44: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

ABNJ (Adults): THREAT #45 Killed by Humans

In this section we discuss ten threats (Threat #45 - Threat #54) to adult turtles in ABNJ (=Areas Beyond National Jurisdiction, or "high seas"). These are turtles that would be expected to return to nest in the country. In each case the interviewee will be asked to assess the threat to this population in terms of Frequency, Magnitude, Relative Magnitude, and, IF appropriate, Solutions. Solutions must already be implemented (not planned) and included only if the threat is likely to affect >20% of turtles per year. NOTE: This threat (#45) is direct take, bycatch is addressed separately.

126. THREAT #45: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

127. THREAT #45: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

128. THREAT #45 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

129. THREAT #45: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting population is killed by humans on the high seas each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

130. THREAT #45: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

131. THREAT #45: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

ABNJ (Adults): THREAT #46 Killed by Predators (ex. orca, shark)

132. THREAT #46: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

133. THREAT #46: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

134. THREAT #46 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

135. THREAT #46: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting population is killed by predators on the high seas each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

136. THREAT #46: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

137. THREAT #46: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

ABNJ (Adults): THREAT #47 Disease or Parasites

For this threat we're looking for "significant" effects - in other words, disease or parasites that constitute a survival threat to adult turtles. This might include debilitating tumors, or a heavy leech, fluke or barnacle load.

138. THREAT #47: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

139. THREAT #47: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

140. THREAT #47 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

141. THREAT #47: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting population is killed or debilitated by disease or parasites on the high seas each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

142. THREAT #47: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

143. THREAT #47: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

ABNJ (Adults): THREAT #48 Trawl Fisheries (ex. pelagic, deep water)

There are three bycatch sections - trawl fisheries, net fisheries, and line fisheries. In each case, "bycatch" refers to any incidental capture, it does not have to be fatal. Remember, here we're only talking about leatherbacks in Areas Beyond National Jurisdiction (high seas).

144. THREAT #48: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

145. THREAT #48: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

146. THREAT #48 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

147. THREAT #48: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting population is killed or debilitated by TRAWL fishery interactions on the high seas each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

148. THREAT #48: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

149. THREAT #48: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

ABNJ (Adults): THREAT #49 Net Fisheries (ex. pelagic gillnet, driftnet, purse seine)

There are three bycatch sections - trawl fisheries, net fisheries, and line fisheries. In each case, "bycatch" refers to any incidental capture, it does not have to be fatal. Remember, here we're only talking about leatherbacks in Areas Beyond National Jurisdiction (high seas).

150. THREAT #49: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

151. THREAT #49: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

152. THREAT #49 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

153. THREAT #49: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting population is killed or debilitated by NET fishery interactions on the high seas each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

154. THREAT #49: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

155. THREAT #49: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Wider Caribbean Sea Turtle Conservation Network

Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

ABNJ (Adults): THREAT #50 Line Fisheries (ex. pelagic longlines)

There are three bycatch sections - trawl fisheries, net fisheries, and line fisheries. In each case, "bycatch" refers to any incidental capture, it does not have to be fatal. Remember, here we're only talking about leatherbacks in Areas Beyond National Jurisdiction (high seas).

156. THREAT #50: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

157. THREAT #50: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

158. THREAT #50 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

159. THREAT #50: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting population is killed or debilitated by LINE fishery interactions on the high seas each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

160. THREAT #50: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

161. THREAT #50: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

ABNJ (Adults): THREAT #51 Entanglement

For this threat we're looking for "significant" effects - in other words, entanglement that constitutes a survival threat. Examples might involve high seas marine debris or abandoned lines, nets, or other commercial gear.

162. THREAT #51: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

163. THREAT #51: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

164. THREAT #51 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

165. THREAT #51: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting population is killed or debilitated by entanglement on the high seas each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

166. THREAT #51: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

167. THREAT #51: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

ABNJ (Adults): THREAT #52 Pollution

For this threat we're looking for "significant" effects - in other words, pollution that constitutes a survival threat. Examples might involve marine debris, shipping waste or discharge, or the presence of oil, petroleum, or tar.

168. THREAT #52: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

169. THREAT #52: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

170. THREAT #52 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

171. THREAT #52: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting population is killed or debilitated by pollution on the high seas each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

172. THREAT #52: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

173. THREAT #52: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

ABNJ (Adults): THREAT #53 Collision with High Seas Vessels

174. THREAT #53: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

175. THREAT #53: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

176. THREAT #53 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

177. THREAT #53: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting population is killed or debilitated by high seas collisions each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

178. THREAT #53: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

179. THREAT #53: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

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Threats to Leatherbacks: PART 2 (AT-SEA) Threat #25 - #54

ABNJ (Adults): THREAT #54 Climate Change (ex. shifts in currents, food chain disruption)

NOTE: This is the last question! Yippeeeee!

180. THREAT #54: FREQUENCY

None/Sublethal	Rare	Occasional	Frequent	Unknown
○	○	○	○	○

181. THREAT #54: MAGNITUDE (i.e., number of adult turtles affected per year)

None/Sublethal	1 – 10	11 – 100	101 – 500	501 – 1,000	> 1,000	Unknown
○	○	○	○	○	○	○

182. THREAT #54 RELATIVE MAGNITUDE (i.e., percentage of adult turtles affected per year)

None/Sublethal	< 20%	> 20%	> 50%	Unknown
○	○	○	○	○

183. THREAT #54: SOLUTION #1 (Remember, this is ONLY answered if: >20% of your nesting population is killed or debilitated by issues related to climate change each year, the solution is designed to reduce that threat, and the solution has already been implemented)

	Low	Medium	High	Unknown
Solution #1: Cost	○	○	○	○
Solution #1: Ease of Implementation	○	○	○	○
Solution #1: Effectiveness	○	○	○	○

Please briefly describe Solution #1.

184. THREAT #54: SOLUTION #2

	Low	Medium	High	Unknown
Solution #2: Cost	○	○	○	○
Solution #2: Ease of Implementation	○	○	○	○
Solution #2: Effectiveness	○	○	○	○

Please briefly describe Solution #2.

185. THREAT #54: SOLUTION #3

	Low	Medium	High	Unknown
Solution #3: Cost	○	○	○	○
Solution #3: Ease of Implementation	○	○	○	○
Solution #3: Effectiveness	○	○	○	○

Please briefly describe Solution #3.

WIDECAST

Wider Caribbean Sea Turtle Conservation Network

"Working together to build a future where all inhabitants of the Wider Caribbean Region, human and sea turtle alike, can live together in balance."

The Wider Caribbean Sea Turtle Conservation Network (WIDECAST) is a regional coalition of experts and a Partner Organization to the U.N. Environment Programme's Caribbean Environment Programme. WIDECAST was founded in 1981 in response to a recommendation by the IUCN/CCA *Meeting of Non-Governmental Caribbean Organizations on Living Resources Conservation for Sustainable Development in the Wider Caribbean* (Santo Domingo, 26-29 August 1981) that a "Wider Caribbean Sea Turtle Recovery Action Plan should be prepared ... consistent with the Action Plan for the Caribbean Environment Programme."

WIDECAST's vision for achieving sea turtle recovery on a regional scale has focused on bringing the best available science to bear on sea turtle management and conservation, empowering people to make effective use of that science in the policy-making process, and providing a mechanism and a framework for cooperation within and among nations. By involving stakeholders at all levels and encouraging policy-oriented research, WIDECAST puts science to practical use in conserving biodiversity and advocates for grassroots involvement in decision-making and project leadership.

Emphasizing initiatives that strengthen capacity within participating countries and institutions, the network develops and replicates pilot projects, provides technical assistance, enables coordination in the collection, sharing and use of information and data, and promotes strong linkages between science, policy, and public participation in the design and implementation of conservation actions. Working closely with local communities and resource managers, the network has also developed standard management guidelines and criteria that emphasize best practices and sustainability, ensuring that current utilization practices, whether consumptive or non-consumptive, do not undermine sea turtle survival over the long term.

With Country Coordinators in more than 40 Caribbean nations and territories, WIDECAST is uniquely able to facilitate complementary conservation action across range States, including strengthening legislation, encouraging community involvement, and raising public awareness of the endangered status of the region's six species of migratory sea turtles. As a result, most Caribbean nations have adopted a national sea turtle management plan, poaching and illegal product sales have been dramatically reduced or eliminated at key sites, major nesting beaches are protected, many of our largest breeding colonies are monitored on an annual basis, alternative livelihood models are increasingly available for rural areas, and citizens are mobilized in support of conservation action. You can join us! Visit www.widecast.org for more information.

WWW.WIDECAST.ORG