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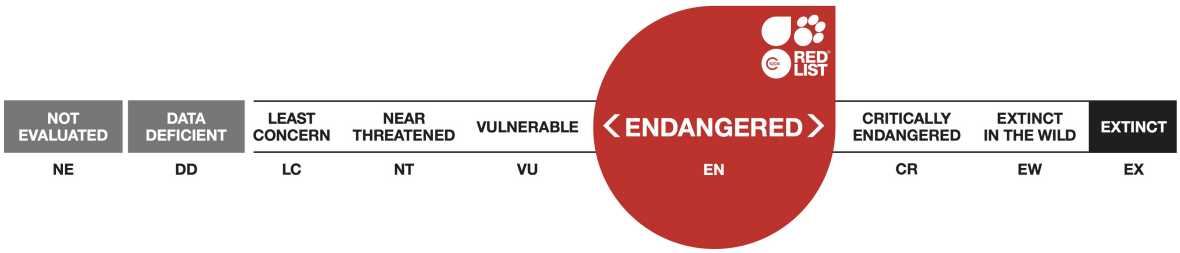
Dermochelys coriacea (Northwest Atlantic Ocean subpopulation), Leatherback

Assessment by: The Northwest Atlantic Leatherback Working Group



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Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Reptilia	Testudines	Dermochelyidae

Taxon Name: *Dermochelys coriacea (Northwest Atlantic Ocean subpopulation)* (Vandelli, 1761)

Parent Species: See *Dermochelys coriacea*

Common Name(s):

- English: Leatherback

Assessment Information

Red List Category & Criteria: Endangered A2b ver 3.1

Year Published: 2019

Date Assessed: January 18, 2019

Justification:

This subpopulation exceeds thresholds for all range and population size criteria (B, C, D), therefore we compiled time series datasets from across the range of the Northwest Atlantic Ocean Leatherback subpopulation to evaluate the long-term trend in annual nest abundance under criterion A. **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 (Table 1** *in the Supplementary Information*). **This result corresponds to a threatened 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%) (Figure 2 in the Supplementary Information) (NWA Leatherback Working Group 2018).

Approach

To evaluate available data under Red List Criterion A, the Red List Guidelines require calculation of the per cent decline (i.e. per cent change) from past to present estimates. As with previous Red List assessments for long-lived species (e.g., African Elephants; Blanc 2008), including sea turtle species (e.g. Wallace *et al*. 2013b, Casale and Tucker 2015), we assumed that the abundance at the beginning of an available time series dataset had not changed significantly in three generations, and therefore used the same abundance value in trend calculations (Tables 1 and 2 in the Supplementary Information).

The most recent Red List assessment result (Tiwari *et al*. 2013) used Leatherback nesting data up to 2010 as the index of abundance under criterion A. The result of this assessment listed Northwest Atlantic Leatherbacks as 'Least Concern,' indicating that this subpopulation was extremely unlikely to go extinct in the near future. The previous Red List assessment relied heavily on data provided in the TEWG (2007) report, particularly for historical data (i.e., prior to the 1990s). However, the NWA Leatherback

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Working Group (2018) performed a comprehensive, updated assessment of Northwest Atlantic Leatherback status that closely involved valuable information from country project leaders with knowledge of historical and recent data. This exercise found that most of those older nest counts were not collected using consistent or comprehensive effort within or across years, a fact also noted in earlier country-specific accounts (TEWG 2007).

Therefore, we limited this updated Red List assessment to datasets employed in trend analyses performed by the NWA Leatherback Working Group (2018) i.e. at least 10 years of data per dataset, collected using consistent methodology over time. We acknowledge that this change in approach affected the final result because many of the early counts provided by TEWG (2007) were quite low (in the tens of nests), especially when compared to counts in the 1990s (in the thousands or tens of thousands of nests at major rookeries such as French Guiana, Suriname, and Guyana), which produced several increasing trends that might have actually been artifacts of the inconsistent monitoring efforts in early years (Tiwari *et al*. 2013).

Thus, we calculated five-year averages of annual nest counts for a past time point and a recent time point that included 2017. For example, if a dataset began in 1986 and continued to 2017, we calculated a 'past' estimate by averaging annual nest counts from 1986–1990 (five years) and calculated a 'present' estimate by averaging annual nest counts from 2013–2017 (five years). The multi-year average is intended to account for inter-annual variation in nesting typical of non-annual breeders like sea turtles (TEWG 2007). We repeated this calculation for all sites with >10 yr of data (n=23 sites across 14 countries and territories; Table 1 in the Supplementary Information). Next, in accordance with Red List Guidelines, we calculated stock-level trends by averaging site-level trends within stocks, but weighting those site-level trends by initial abundance. We then repeated this calculation to estimate an abundance-weighted subpopulation-level trend. Based on our updated datasets that restricted annual count data to those collected with consistent methodology within nesting sites, evaluation of Red List Criterion A resulted in an approximate 60% decline from past to present estimates of Leatherback nest abundance (Tables 1 and 3 in the Supplementary Information).

We also calculated trends to 2010 using these more refined datasets to illustrate how our methodological approach might produce different results compared to the previous Red List assessment. Calculating overall trends between past estimates and 2010—the same year through which the official Red List assessment evaluated Leatherback data—results in a 52% decline (Tables 2 and 3 in the Supplementary Information). Thus, our updated datasets that adhere to more stringent standards of monitoring consistency significantly influenced the divergence in results from the current Endangered Red List assessment and the previous Least Concern assessment (Tiwari *et al*. 2013).

As in the trend analyses described above, the subpopulation-level Red List trend is mostly driven by the trend estimated for the stock with the highest relative abundance: Guianas-Trinidad (Tables 1 and 3 in the Supplementary Information). The ~99% decline in Awala-Yalimapo, French Guiana, from an average of more than 28,000 nests/yr between 1986–1990 to fewer than 600/yr between 2013–2017 accounted for this decline. Likewise, the divergence between the Red List assessment results through 2010 and our results through 2010 can be attributed largely to French Guiana (88% decline since 2010) (Tables 2 and 3 in the Supplementary Information). As described briefly above, the previous Red List assessment (Tiwari *et al*. 2013) used historical data from the late 1960s through the 1970s. However, these data were

collected inconsistently across years, whereas data were collected at Awala-Yalimapo using essentially consistent methods starting in 1986. In addition, the previous Red List assessment (Tiwari *et al*. 2013) used estimates of total nest counts per year based on a statistical correction accounting for incomplete (<100%) monitoring coverage (Girondot *et al*. 2007, TEWG 2007), and the Tiwari *et al*. (2013) Red List assessment had to use estimated nest counts between 2006–2010 because the raw data could not be modeled using the same approach. However, in the present assessment, we used observed counts, as long as the counts could be attributed to a consistent monitoring methodology and coverage level over time. These changes in approach compared to the 2013 Red List assessment (Tiwari *et al*. 2013) caused significant divergence in results. Because we used reliable datasets collected with consistent methodologies, this updated assessment should be considered to be a more appropriate assessment of the long-term change in annual nest abundance in the Northwest Atlantic Leatherback subpopulation.

Sources of Uncertainty

Although monitoring of nesting activities by adult female sea turtles is the most common metric recorded and reported across sites and species, globally, there are several disadvantages to using it as a proxy for overall population dynamics, some methodological, some interpretive (NRC 2010). Because nesting females are a very small proportion of a sea turtle population, using abundance of nesting females and their activities as proxies for overall population abundance and trends requires knowledge of other key demographic parameters, and how those are affected by environmental and anthropogenic factors (NRC 2010, Seminoff and Shanker 2008, Kendall *et al.* 2019, NWA Leatherback Working Group 2018). For further reading on sources of uncertainty in marine turtle Red List assessments, see Seminoff and Shanker (2008).

Potential Drivers

Considering that recent status assessments determined that this subpopulation was generally abundant and stable (TEWG 2007, Tiwari *et al*. 2013), the NWA Leatherback Working Group (2018) discussed drivers of the updated trends in the context of what factors might have changed or have not been sufficiently addressed to cause a divergence between previous findings and the current analysis. In addition to the methodological differences—i.e. the current assessment used more rigorous data standards for inclusion of datasets in analysis—anthropogenic sources of mortality (particularly bycatch in small-scale fishing gears near high-density nesting beaches in Trinidad and the Guianas), habitat losses, and changes in life history parameters were identified as potential drivers for the observed declines in nesting abundance (NWA Leatherback Working Group 2018). It is likely that synergistic relationships exist among various drivers and types of drivers.

For further information about this species, see Supplementary Material.

Previously Published Red List Assessments

2013 – Least Concern (LC)
http://dx.doi.org/10.2305/IUCN.UK.2013-2.RLTS.T46967827A46967830.en

Geographic Range

Range Description:

Leatherbacks are distributed circumglobally, with nesting sites on subtropical and tropical sandy

beaches and foraging ranges that extend into temperate and sub-polar latitudes; see Eckert *et al*. (2012) for review. The Northwest Atlantic Ocean Leatherback subpopulation nests in the southeastern U.S.A., throughout the mainland and insular Wider Caribbean, including Latin America and the Guiana Shield, and marine habitats extend throughout the North Atlantic, including the Gulf of Mexico, north beyond 50°N, into the Mediterranean, and across the equator to northwestern Africa (Figure 1 in the Supplementary Information; Wallace *et al*. 2010).

For further information about this species, see Supplementary Material.

Country Occurrence:

Native: Albania; Anguilla; Antigua and Barbuda; Aruba; Bahamas; Barbados; Belize; Benin; Bermuda; Bonaire, Sint Eustatius and Saba (Saba, Sint Eustatius); Bosnia and Herzegovina; Brazil; Canada; Colombia; Costa Rica; Côte d'Ivoire; Croatia; Cuba; Curaçao; Cyprus; Dominica; Dominican Republic; Egypt; France (France (mainland)); French Guiana; Gambia; Ghana; Greece; Grenada; Guadeloupe; Guatemala; Guinea; Guinea-Bissau; Haiti; Honduras; Ireland; Israel; Italy; Jamaica; Lebanon; Liberia; Libya; Martinique; Mauritania; Mexico; Montenegro; Montserrat; Morocco; Nicaragua; Nigeria; Panama; Portugal; Puerto Rico; Saint Kitts and Nevis; Saint Lucia; Saint Martin (French part); Saint Vincent and the Grenadines; Senegal; Sierra Leone; Sint Maarten (Dutch part); Slovenia; Spain; Suriname; Syrian Arab Republic; Togo; Trinidad and Tobago; Tunisia; Turkey; Turks and Caicos Islands; United Kingdom; United States; Venezuela, Bolivarian Republic of; Virgin Islands, British; Virgin Islands, U.S.

FAO Marine Fishing Areas:

Native: Atlantic - western central, Atlantic - southwest, Atlantic - northwest, Atlantic - northeast, Atlantic - eastern central, Mediterranean and Black Sea -

Population

Leatherbacks are a single species globally comprising biologically described regional management units (RMUs; Wallace *et al*. 2010), which describe biologically and geographically explicit population segments by integrating information from nesting sites, mitochondrial and nuclear DNA studies, movements and habitat use by all life stages (RMU shapefiles can be viewed and downloaded at: http://seamap.env.duke.edu/swot). RMUs are functionally equivalent to IUCN subpopulations, thus providing the appropriate demographic unit for Red List assessments. There are seven Leatherback subpopulations, including the Northwest Atlantic Ocean (NWA).

Multiple genetic stocks have been defined within the Northwest Atlantic subpopulation—Florida (U.S.A.), the northern Caribbean (St. Croix, USVI; British Virgin Islands, Puerto Rico), Costa Rica (and likely including Panama and Colombia), the Guianas (Guyana, Suriname, French Guiana), and Trinidad (Dutton *et al*. 2013)—that overlap significantly in migratory and feeding areas throughout the North Atlantic (TEWG 2007, Wallace *et al*. 2010, Eckert *et al*. 2012).

There are only ten Leatherback nesting beaches (2% of the total) in the Wider Caribbean Region that receive more than 1,000 nesting crawls per year. In contrast, 92% of all known nesting beaches host relatively small nesting populations (<100 crawls per year, the equivalent of <20 gravid females) (Dow *et al*. 2007, Dow Piniak and Eckert 2011). Details can be viewed and downloaded at: http://seamap.env.duke.edu/widecast/).

A recent report by the NWA Leatherback Working Group summarized trend analyses from recent, intermediate, and long-term temporal windows using existing time series datasets of annual nest counts from beaches throughout the Wider Caribbean region. Results demonstrated negative long-term trends at site-, genetic stock-, and regionwide (i.e. subpopulation) scales (NWA Leatherback Working Group 2018). Details are provided below, and form the basis of the current assessment.

For further information about this species, see Supplementary Material.

Current Population Trend: Decreasing

Habitat and Ecology **(see Appendix for additional information)**

See the species-level account for details. For a thorough review of Leatherback biology, please see Eckert *et al*. (2012).

Systems: Terrestrial, Marine

Use and Trade

Egg harvest persists in some rookeries in the Wider Caribbean region, particularly Costa Rica and Panama (LAST 2015). However, this is not a pervasive problem across the region (Bräutigam and Eckert 2006). Retention of bycaught Leatherbacks does not appear to occur.

Threats **(see Appendix for additional information)**

Threats to Leatherbacks—and other marine turtle species—vary in time and space, and in relative

impact to populations. Threat categories were described by Wallace *et al*. (2011) as:
1) Fisheries bycatch: incidental capture of marine turtles in fishing gear targeting other species;
2) Take: direct utilization of turtles or eggs for human use (i.e. consumption, commercial products);
3) Coastal Development: human-induced alteration of coastal environments due to construction, dredging, beach modification, etc., resulting in loss/degradation of nesting habitat;
4) Pollution and Pathogens: marine pollution and debris that affect marine turtles (i.e. through ingestion or entanglement, disorientation caused by artificial lights), as well as impacts of pervasive pathogens (e.g. fibropapilloma virus) on turtle health; and
5) Climate change: current and future impacts from climate change on marine turtles and their habitats (e.g. increasing sand temperatures on nesting beaches affecting hatchling sex ratios, sea level rise, storm frequency and intensity affecting nesting habitats, etc.).

The relative impacts of individual threats to all Leatherback subpopulations were assessed by Wallace *et al*. (2011). Fisheries bycatch was classified as the highest threat to Leatherbacks globally and for the Northwest Atlantic subpopulation (Wallace *et al*. 2011, 2013), followed by human consumption of Leatherback eggs, meat, or other products, and coastal development. Due to lack of information, pollution and pathogens was only scored in three subpopulations and climate change was only scored in two subpopulations. Enhanced efforts to assess and reduce the impacts of these threats on Leatherbacks—and other marine turtle species—should be a high priority for future conservation efforts.

Continued threats from fisheries bycatch in small- and large-scale fishing operations (Wallace *et al*. 2011, 2013a), particularly those near nesting beaches (e.g. Lee Lum 2006, Eckert 2013) and in distant foraging areas (e.g. James *et al*. 2005, Stewart *et al*. 2013, Hamelin *et al*. 2017), appear to have caused declines in this subpopulation's long-term trend (Tables 1–3, Figure 2 in the Supplementary Information). The NWA Leatherback Working Group (2018) highlighted several potential drivers of these observed trends, and recommended continued, effective efforts to mitigate bycatch impacts and reduce threats on nesting beaches as absolutely necessary to stabilize and recover the Northwest Atlantic Leatherback subpopulation.

For further information about this species, see Supplementary Material.

Conservation Actions **(see Appendix for additional information)**

Leatherbacks are protected under various national and international laws, treaties, agreements, and memoranda of understanding. A partial list of international conservation instruments that provide legislative protection for leatherbacks are: Annex II of the Protocol concerning Specially Protected Areas and Wildlife (SPAW) to the UNEP Cartagena Convention; Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora CITES); Appendices I and II of the Convention on Migratory Species (CMS); the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC), the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA), the Memorandum of Understanding on ASEAN Sea Turtle Conservation and Protection, and the Memorandum of Understanding Concerning Conservation Measures for Marine Turtles of the Atlantic Coast of Africa.

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A previous assessment of Atlantic Leatherback status reported increasing population trends for most rookeries (TEWG 2007). Long-term efforts to reduce or eliminate threats to Leatherbacks on nesting beaches have been successful in some locations (e.g. St. Croix, USVI, Dutton *et al*. 2005), but continue in others (e.g. Costa Rica; Chacón-Chaverri and Eckert, 2007). However, continued threats from fisheries bycatch in small- and large-scale fishing operations, especially adjoining some of the region's largest rookeries (Trinidad: Lee Lum 2006, Eckert 2013) and in high use foraging areas (e.g., James *et al*. 2005, Hamelin *et al*. 2017), as well as egg harvest for human consumption (Revuelta *et al*. 2012) appear to have caused declines in the NWA subpopulation (Tables 1–3, Figure 2 in the Supplementary Information). Reducing Leatherback bycatch has become a primary focus for many conservation projects around the world, and some mitigation efforts are showing promise (Eckert and Eckert 2005; Watson *et al*. 2005; Gilman *et al*. 2006, 2011). However, threats to Leatherbacks—bycatch and egg consumption, in particular—persist, and in some places continue to hinder population recovery (Alfaro-Shigueto *et al*. 2011, 2012; Tapilatu *et al*. 2013; Wallace *et al*. 2013a).

In addition to direct anthropogenic mortality, habitat loss due to beach erosion has significantly reduced Leatherback nesting habitat, particularly in French Guiana and Suriname (NWA Leatherback Working Group 2018). While Leatherback nesting sites in the Wider Caribbean are often high-energy coastlines where sand erosion-transport-deposition processes are very dynamic, loss of Leatherback nesting habitat—apparently without concomitant increases elsewhere—has contributed to some extent to the observed declines in annual nest abundance (NWA Leatherback Working Group 2018). Finally, habitat loss and degradation due to coastal development is a persistent threat throughout the Wider Caribbean Region (Bräutigam and Eckert 2006).

To ensure successful Leatherback conservation, the most prevalent and impactful threats must be reduced wherever they occur, whether on nesting beaches or in feeding, migratory, or other habitats (Bräutigam and Eckert 2006; Bellagio Report 2007; Wallace *et al*. 2011, 2013); a holistic approach that addresses threats at all life history stages is essential (Dutton and Squires 2011). Therefore, current conservation efforts, legal protections, and resources supporting those mechanisms must be maintained—and augmented, wherever possible—to reverse downward trends for the Northwest Atlantic Leatherback subpopulation. Regional and local efforts to protect Leatherbacks, their offspring, and their habitats should be designed to address threats at appropriate scales, and implemented with participation of appropriate stakeholders.

For further information about this species, see Supplementary Material.

Credits

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Reviewer(s): Pilcher, N.J. & Casale, P.

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External Resources

For Supplementary Material, and for Images and External Links to Additional Information, please see the Red List website.

Appendix

Habitats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
9. Marine Neritic -> 9.1. Marine Neritic - Pelagic	Resident	Suitable	Yes
10. Marine Oceanic -> 10.1. Marine Oceanic - Epipelagic (0-200m)	-	Suitable	Yes
12. Marine Intertidal -> 12.1. Marine Intertidal - Rocky Shoreline	-	Suitable	Yes
13. Marine Coastal/Supratidal -> 13.3. Marine Coastal/Supratidal - Coastal Sand Dunes	-	Suitable	Yes

Threats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score
1. Residential & commercial development -> 1.3. Tourism & recreation areas	Ongoing	Minority (50%)	Negligible declines	Low impact: 4
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 2. Species Stresses -> 2.2. Species disturbance		
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.1. Intentional use: (subsistence/small scale) [harvest]	Ongoing	Minority (50%)	Negligible declines	Low impact: 4
	Stresses:	2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.3. Indirect species effects -> 2.3.7. Reduced reproductive success		
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.3. Unintentional effects: (subsistence/small scale) [harvest]	Ongoing	Majority (50-90%)	Slow, significant declines	Medium impact: 6
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.4. Unintentional effects: (large scale) [harvest]	Ongoing	Majority (50-90%)	Slow, significant declines	Medium impact: 6
	Stresses:	2. Species Stresses -> 2.1. Species mortality		

Conservation Actions in Place

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions in Place
In-Place Research, Monitoring and Planning
Systematic monitoring scheme: Yes
In-Place Land/Water Protection and Management

Conservation Actions in Place
Conservation sites identified: Yes, over entire range
Occur in at least one PA: Yes
In-Place Education
Subject to recent education and awareness programmes: Yes
Included in international legislation: Yes
Subject to any international management/trade controls: Yes

Conservation Actions Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions Needed
1. Land/water protection -> 1.1. Site/area protection
2. Land/water management -> 2.1. Site/area management
3. Species management -> 3.1. Species management -> 3.1.1. Harvest management
4. Education & awareness -> 4.3. Awareness & communications
5. Law & policy -> 5.1. Legislation -> 5.1.1. International level
5. Law & policy -> 5.1. Legislation -> 5.1.2. National level
5. Law & policy -> 5.1. Legislation -> 5.1.3. Sub-national level

Additional Data Fields

Distribution
Estimated area of occupancy (AOO) (km²): 2000
Estimated extent of occurrence (EOO) (km²): 68997470
Lower elevation limit (m): 0
Upper elevation limit (m): 1
Lower depth limit (m): 1300
Upper depth limit (m): 0
Population
Number of mature individuals: 20000
Habitats and Ecology
Generation Length (years): 30
Movement patterns: Full Migrant

Habitats and Ecology
Congregatory: Congregatory (and dispersive)

The IUCN Red List Partnership

The IUCN Red List of Threatened Species™ is produced and managed by the IUCN Global Species Programme, the IUCN Species Survival Commission (SSC) and The IUCN Red List Partnership.

The IUCN Red List Partners are: Arizona State University; BirdLife International; Botanic Gardens Conservation International; Conservation International; NatureServe; Royal Botanic Gardens, Kew; Sapienza University of Rome; Texas A&M University; and Zoological Society of London.