Leatherback turtle

Dermochelys coriacea

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DESCRIPTION

Taxonomy

The leatherback (*Dermochelys coriacea*) is the largest and most migratory of the living turtles, with the most extensive geographic range (Eckert et al. 2012). It is so distinctive that it is placed in a separate family, Dermochelyidae and is the only extant species remaining in this family. Blainville introduced the generic name *Dermochelys* in 1816. The binomial refers to the distinctive leathery, scaleless skin of the adult turtle. The specific name, *coriacea,* was first used by Vandelli in 1761 and adopted by Linneaus in 1766 (NMFS & USFWS 1992).

Basic Description

The carapace of the leatherback is distinguished by a rubber-like texture unlike hard-shell sea turtles. It is black with white spots and has seven prominent longitudinal ridges, which taper posteriorly to a blunt point. No sharp angle is formed between the carapace and the plastron, resulting in the animal being somewhat barrel-shaped; hence one common name was "trunkback". Adult leatherbacks possess a pink spot on the top of their heads (Eckert et al. 2012), associated with the pineal gland (Wyneken 2001). The undersurface is mottled, pinkish-white and black and is highly variable. They have long clawless front flippers, pointed tooth-like cusps for foraging on soft body prey, and keratinized spines in the mouth and throat to retain prey as water is expelled from their mouths (Pritchard 2015). Mean curved carapace length for adult

females nesting in the United States Caribbean is 155 cm (61 in.) with weights of 262 to 506 kg (578 to 1274 lbs.) (NMFS & USFWS 1992). Leatherback hatchlings are dorsally mostly black and covered with bead-like scales appearing as stripes along the length of the back. Their long flippers, reaching lengths as long as the carapace, are margined in white.

Conservation Status

The United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) share jurisdiction for sea turtles under the Endangered Species Act (ESA) with the USFWS's responsibility for turtles on the beach and NMFS's jurisdiction in the marine environment. The leatherback sea turtle was listed as Endangered throughout its global range on June 2, 1970, under the Endangered Species Conservation Act of 1969 (35 FR 8491), the precursor to the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 *et seq*). The leatherback is included on Appendix I of CITES (Convention on International Trade in Endangered Species) that recognizes the species is threatened with extinction and in need of the greatest level of protection. The leatherback is listed as Vulnerable globally under the IUCN (International Union for Conservation of Nature) Red List though separate subpopulations (also called populations in ESA reviews) have different listings. Leatherback subpopulations in the Pacific have declined and, overall, the Pacific subpopulations are listed as Critically Endangered (Wallace et al. 2013). The Northwest Atlantic Ocean subpopulation is listed as Endangered (Wallace et al. 2013, the Northwest Atlantic Working Leatherback Group 2019).

Critical habitat for the leatherback was designated by USFWS for a small area in US Virgin Islands on September 26, 1978 (43 FR 43688) and by NMFS in marine waters adjacent to Sandy Point Beach on March 23, 1979 (44 FR 17710). On January 5, 2010, the National Marine Fisheries Service proposed regulation to revise the critical habitat designation for the endangered leatherback sea turtle by designating additional areas of protection within the Pacific Ocean. The proposed addition measures approximately 70.6 $mi.^2$ and was designated in January 2012 (77 FR 4170).

Status review of the leatherback has determined there are seven leatherback populations that meet the requirements of discreteness for consideration as distinct population segments (DPSs). Discreteness determination is based on genetics, tagging, satellite telemetry data, and physical factors such as land masses, oceanographic features, and currents. Leatherbacks observed in South Carolina fall within the Northwest (NW) Atlantic DPS (NMFS and USFWS 2020).

POPULATION SIZE AND DISTRIBUTION

The estimated worldwide nesting population of leatherbacks in 1995 was about 34,500 females on 28 major surveyed beaches, with a lower limit of about 26,200 and an upper limit of about 42,900 (Spotila et al. 1996). This is less than one third of the 1980 estimate of 115,000 (Spotila et al. 1996). The largest female nesting aggregation was once located in Gabon (Southeast Atlantic DPS) (Witt *et al.* 2009) but recent analysis shows a steep decline in numbers (NMFS & USFWS 2020). The Northwest Atlantic DPS population now hosts the largest number of female leatherbacks with the largest nesting aggregations occurring in Trinidad, French Guiana, and Panama

(NMFS & USFWS 2020). Leatherback nesting beaches are distributed circumglobally on tropical or subtropical beaches but also on some temperate beaches (Pritchard and Mortimer 1999, NMFS & USFWS 2020). In North America, the northeast coast of Florida was considered the northern limit for leatherback nesting. Nesting in Florida was once considered extremely rare, but now nests number in the hundreds annually (Stewart et al. 2011). Leatherback nesting has been confirmed in South Carolina but is considered a rare occurrence as the state lies beyond the northern edge of nesting range and nests laid in South Carolina typically are not successful. Since 1996, 36 leatherback nests have been documented in South Carolina (SCDNR unpublished data, 2024). Despite expansion of nesting occurring north of historical beaches, evidence of a decreasing nest trend has been observed at nesting beaches with greatest known female abundance in the NW Atlantic DPS (NMFS & USFWS 2020).

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

Leatherbacks' highly migratory nature, with extensive geographic range, ensures they are rarely encountered except females during nesting and because of such less is known about their overall life history. They are unique among sea turtles in the ability to thermoregulate (maintain their core temperature) utilizing countercurrent heat exchange and due to large size can avoid overheating while nesting (Friar et al. 1972, Greer et al. 1973). Leatherback adaptations such as low metabolic rate, large oxygen storage capacity, ability to withstand crushing hydrostatic pressures at depth, and tolerate cold water temperatures allow them to reach deep depths in the water column over 1 km (Doyle et al. 2008, Robinson and Paladino, 2015)

Mating between adult males and females is thought to occur prior to or during migration from foraging areas before females arrive in waters off nesting beaches. On occasion mating has occurred just off nesting beaches before commencement of actual nesting (Rostal 2015).

Nesting females prefer high-energy beaches with deep, unobstructed access to nesting sites from soft-bottom, deep-water approaches (Pritchard and Mortimer 1999; Eckert et al. 2012, 2015) that occur most frequently along continental shorelines. Foraging areas are typically where zones of upwelling occur including where major currents converge such as continental edges. (Saba 2013).

Leatherback movements are likely in response to seasonal abundance of macroplanktonic prey, jellyfish, their major food item. An annual migration of adult and sub-adult leatherbacks from the

wider Caribbean to the northwestern Atlantic results in spring and fall concentrations of leatherbacks in South Carolina waters. Nearshore concentrations of leatherbacks can occur from April to June during the northward migration when cannonball jellyfish (*Stomolophus meleagris*) are abundant. Based on strandings reported and live in-water observations, there is a second, less apparent peak, during the southward migration in October and November. (Murphy et al. 2006, SCDNR unpublished data).

Information on habitat requirements for post-hatchling and juvenile leatherbacks is limited, with individuals smaller than 100 cm (39 in.) in carapace length confined to waters > 26°C (79°F) Eckert et al. 2012).

CHALLENGES

Loss or degradation of nesting habitat from coastal development and beach armoring results in adverse impacts to leatherbacks. Even if a suitable sandy beach is available, nesting can be aborted because of beach furniture and equipment blocking access to nest sites.

Artificial light pollution along the coast is disruptive to both nesting adult females and emerging hatchlings. The presence of humans using flashlights or cell phone lights at night can also disrupt nesting females. Artificial lighting that illuminates the beach causes females to avoid certain areas to nest and disorients hatchlings when direct and timely migration to the ocean is critical to their survival. (NMFS & USFWS 1992).

Climate change is a potential threat to sea turtles as it may affect these species in three ways: loss of dry sand beaches to sea level rise or inundation of existing nests (Daniels et al. 1993; Fish et al. 2005; Baker et al. 2006); lethal high temperatures within the nest that would cause egg/hatchling mortality or decreased hatchling fitness; or a female-biased sex ratio of hatchlings due to increased nest temperatures (Glen and Mrosovsky 2004, Binckley and Spotila, 2015, Seaman and Milton 2023). Sea turtles, like some other reptiles, have temperature-dependent sex determination (TDSD), with higher temperatures favoring the development of female offspring and lower temperatures favoring males (Spotila 2004). Foraging grounds in the marine environment may also be affected as increased sea water temperatures alter prey species availability, foraging success and reproductive success (Goudarzi, F et al 2024, Spotila, Saba et al. 2015).

Egg clutches on beaches are subject to expected natural predators such as raccoons, coyotes, ghost crabs (*Ocypode quadratus*) (SCDNR, unpublished data, NMFS & USFWS 1992) and yellow crown night herons (*Nyctanassa violacea*) on the beach at night (NMFS & USFWS 1992).

Because of their very large front flippers, leatherbacks become entangled often in longlines, float lines of crab and lobster pots, buoy anchor lines, and other vertical ropes and cables existing in the water column. This can lead to serious injuries and/or death by drowning (NMFS & USFWS 1992; SCDNR unpublished data). Leatherbacks apparently mistake floating plastic bags and sheets for jellyfish and consume these materials. This can cause direct obstruction of the gut or absorption of toxic byproducts and reduced absorption of nutrients across the gut wall.

Mrosovsky (1981) reviewed data from leatherback stomach content studies worldwide and concluded that approximately 44% of the adults examined had plastic in their stomachs.

The shrimp trawl fishery also captured leatherbacks until Turtle Excluder Devices (TEDs) were enlarged to allow their escape. They are also vulnerable to boat and ship collisions, particularly when inhabiting shallow, near-shore waters. Lewison et al. (2004) integrated catch data from over 40 nations and by-catch data from 13 international observer programs. They estimate that 50,000 leatherbacks were likely taken as pelagic longline by-catch in 2000. Eckert and Sarti (1997) reported that, "mortality associated with the swordfish gillnet fisheries in Peru and Chile represents the single largest source of mortality for Eastern Pacific leatherbacks." Incidental mortality in fisheries, implicated in the collapse of the Eastern Pacific population, is a largely unaddressed problem worldwide (Eckert et al. 2012).

Vessel strikes continue to be a threat (NMFS & USFWS 2020). In South Carolina, leatherbacks are vulnerable to vessel strikes where interaction with large propellers lead to direct mortality (SCDNR, unpublished data).

Leatherbacks are still occasionally killed for meat and oil in the Caribbean (NMFS & USFWS 1992). The theft of eggs for local consumption was once a problem in the US Virgin Islands but has been all but eliminated because of nightly patrols and nest protection programs (NMFS & USFWS 1992).

CONSERVATION ACCOMPLISHMENTS

Since 1981, intensive nest survey and protection efforts have been implemented at Sandy Point, St. Croix, US Virgin Islands. In 1984, the US Fish and Wildlife Service purchased the 2.4 km (1.49 mi.) long nesting beach at Sandy Point, which became a National Wildlife Refuge and designated as Critical Habitat under the Endangered Species Act of 1973. In South Carolina, nearshore aerial surveys have documented the spatial and temporal distribution of leatherbacks since 1993. The leatherback Conservation Zone was established as part of the Contingency Plan in 1995 (60 FR 25260, May 12, 1995; 60 FR 25663, May 12, 1995). Additionally, leatherback-sized TEDs were required in all shrimp trawls by the National Marine Fishery Service in 2003.

On January 5, 2010, the National Marine Fisheries Service proposed regulation to revise the critical habitat designation for the endangered leatherback sea turtle by designating additional areas of protection within the Pacific Ocean. The proposed addition measures approximately 70.6 $mi.^2$ and was designated in January 2012 (77 FR 4170).

SCDNR continues to partner with and permit the South Carolina Aquarium Sea Turtle Care Center™, which opened in 2000, to provide medical care for sea turtles in need from both South Carolina waters and surrounding states. To date only one leatherback has been successfully rescued off a barrier island by SCDNR staff and rehabilitated in South Carolina. Leatherbacks do not normally respond well to captivity, even brief stints for rehabilitation. SCDNR partners with the South Carolina Aquarium staff on educational outreach.

In 2020 changes were made to the NMFS South Atlantic Regional Biological Opinion for dredging

activities because of multiple entanglement events associated with a dredging project in South Carolina waters. Gear modification requirements ensured leatherback would not get flipper caught in cable loops of vertical lines used to mark submerged pipelines.

CONSERVATION RECOMMENDATIONS

- Protect areas of high leatherback concentration in water from activities that can have a negative impact on leatherbacks such as longlines, set nets and trawl fisheries that do not require effective TEDs.
- Continue to monitor use of vertical lines for fisheries, dredging projects and other projects that may present a possibility of interaction.
- Continue to monitor presence of leatherbacks in South Carolina waters or just offshore to learn more about migratory paths and ensure protection against vessel interactions.
- Conduct education programs that inform the public about the detrimental impacts of litter on aquatic organisms like the leatherback to assist in reducing the volume of plastics in the marine environment.
- Provide protection from predators and erosion for any nests that are laid on the beaches.
- Continue to work with partners to model sea level rise with leatherback nesting beaches in South Carolina.
- Increase education of boaters to raise awareness of sea turtles in our coastal waters.
- Ensure a continued food source for leatherbacks by protecting the cannonball jellyfish from commercial over-harvest.
- Monitor stranded leatherbacks to determine the number, size, and distribution of mortalities and the source of tagged individuals.
- Perform post-mortem examinations of stranded leatherbacks to document cause of death, food habits, sex ratio, reproductive condition, and extent of ingestion of plastics.
- Continue to gain more information on leatherback distribution from the public through the Marine Turtle Conservation Program web site.

MEASURES OF SUCCESS

While Pacific populations of leatherbacks are in sharp decline, nesting populations in the Atlantic appear to be either declining or stable though nesting areas have expanded. South Carolina research and monitoring efforts will be an important component to document future population trends in this endangered and unique animal. An increase in the number of nests and nesting females may be considered a sign of successful management actions.

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