

LEATHERBACK

Dermochelys coriacea Vandelli, 1761
(Dermochelyidae)

Global rank G2 (06Sep2001)

State rank S2 (16May2006)

State rank reasons

Considered rare; only 19 documented occurrences in Alaskan waters since 1960. Trends are unknown. Potential threats include injury and mortality associated with entanglement in fishing gear and fixed lines, and collision with marine vessels.

Taxonomy

Two described subspecies, *D. c. coriacea* (Atlantic Ocean) and *D. c. schlegelii* (Pacific and Indian oceans), seem to be poorly differentiated and are not currently recognized (Pritchard 1980). Should the populations in the Pacific prove to be a valid subspecies, the proper name would be *D. c. angusta* (Pritchard and Trebbau 1984). Brongersma (1996) determined that the source of the type material for the name *schlegelii* is likely Japan and not Guaymas, Mexico.

General description

Carapace has seven prominent longitudinal ridges; plastron has five ridges; no scutes on skin-covered carapace and plastron; carapace blackish or dark bluish, often with irregular whitish or pink blotches; plastron mainly whitish. Largest living turtle species, with adults usually 135-178 cm in carapace length, 295-544 kg; young are black and white, covered with numerous small beady scales (later shed), carapace about 6-7.5 cm at hatching (Conant and Collins 1991). No other sea turtle lacks scutes on the shell or has prominent dorsal longitudinal ridges.

Length (cm) range 135-178, max. 189

Weight (kg) 295-544, max. 916

Reproduction

Lays up to 10+ (average 5 in Virgin Islands, 5-7 in Puerto Rico) clutches of 50-170 eggs (typically 70-90 normal eggs in the Atlantic, usually fewer than 60 in the eastern Pacific) at intervals of about 1-2 weeks; most individuals nest every 2-3 years. Females nest at night between March and August in the western hemisphere. Eggs hatch in 8-10 weeks. Reportedly sexually mature in 6-10 years, or possibly less, or perhaps 20-50 years; females in the Atlantic mature at a carapace length of 137-145 cm, Pacific females mature at



slightly smaller size (Eckert 1992). Zug and Parham (1996) conducted a skeletochronological analysis and concluded that "for conservation management purposes, 9 years is a likely minimum age for maturity based on the youngest adult in the sample." Limited data indicate a post-maturation longevity of up to about two decades (Pritchard 1996).

Ecology

Eggs and hatchlings incur high rates of mortality from predation; humans are significant egg predators. Eggs are harvested for human consumption in many areas. Other predators of eggs and hatchlings include raccoons (*Procyon lotor*) and armadillos (*Dasyus novemcinctus*) in Florida, as well as crabs, dogs, pigs, monitor lizards, other small mammals and sharks (UNEP 2003). In Malaysia, egg survivorship to hatching was 0.63 (Iverson 1991).

Adults often die from entanglement and drowning in commercial and recreational fishing gear (trawls, gillnets, longlines and fixed pot gear), vessel strikes, and from eating floating debris, especially plastic, which often resembles jellyfish, their primary food source. Adults generally are not exploited for food or commercial products in most areas, though sometimes the oil is rendered and used for caulking boats and for medicinal purposes (Van Meter 1983). Suarez and Starbird (1996) documented subsistence hunting of leatherbacks in Indonesia. Killer whales (*Orcinus orca*) have been observed eating adult leatherbacks offshore in Mexico, California, and the Caribbean. Predation of leatherbacks by killer whales was attributed to lower levels of predatory specializations due to lower concentrations of any one type of prey (Pitman and Dutton 2004).

Leatherbacks exhibit a mammal-like ability to maintain high body temperature (usually several degrees C above ambient) and are therefore more tolerant of low water temperatures at extreme latitudes (NMFS and USFWS 1998).

Migration

Moves hundreds or thousands of km between nesting beaches and distant marine waters; transequatorial migrations have been documented. Pattern of epibiont colonization in the Caribbean suggests that gravid turtles do not arrive from temperate latitudes until just prior to nesting and individuals go directly to a preferred nesting beach; nesters apparently arrive asynchronously (Eckert and Eckert 1988). Individual females may nest on multiple islands within a region; within 18 days a female nested on St. Croix, Isla Vieques, and Isla Culebra, Virgin Islands (Keinath and Musick 1993); see also Boulon et al. (1996). Caribbean nesters apparently move north along Atlantic coast after nesting (appear at least as far north as the northeastern U.S. in late summer). A leatherback tagged in Chesapeake Bay in late May 1985 was captured off southern Cuba in late July 1986. A nesting female tagged in Suriname was captured off Ghana, West Africa, less than 1 year later (Eckert 1992).

Morreale et al. (1996) documented a migration corridor extending from the Pacific coast of Costa Rica to the vicinity of the Galapagos Islands. Based on results of satellite tracking data, leatherbacks in the Atlantic are more widely dispersed throughout the ocean and do not follow specific migration corridors (Ferraro et al. 2004, Hays et al. 2004).

Food

Invertivore; principal food is jellyfish, though other invertebrates, fishes, and seaweed are sometimes eaten. Pelagic foraging may focus on jellyfish in the deep scattering layer (Eckert 1992); foraging may also occur at the surface. Food habits known primarily from stomach samples of stranded individuals; consist largely of cnidarian and tunicate species found in temperate and boreal latitudes, including *Cyanea capillata*, *Rhizostoma cuvieri*, *Stomolophus meleagris*, and the Portuguese Man o' War *Physalia utriculus* (NMFS and USFWS 1998, sources in UNEP 2003).

Phenology

Nesting occurs at night; females nest every 2-3 years.

Habitat

Marine; open ocean, often near edge of continental shelf; also seas, gulfs, bays, and estuaries. Mainly pelagic, seldom approaches land except for nesting (Eckert 1992). Dives almost continuously to depths of up to at least several thousand meters; may linger at the surface at midday but spends most of time submerged. In the northeastern Pacific, leatherbacks generally occur at depths of 50-100 m; have been recorded as deep as 8,000 m (Stinson 1984).

Nests on high energy, sloping sandy beaches bordered by vegetation, often near deep water and rough seas. Largest colonies use continental, rather than insular, beaches (CSTC 1990). Absence of a fringing reef appears to be important. Females deposit eggs in moist sand. Individuals sometimes change to different nesting beach between nestings during a single year; females changed to sites 30-110 km away in West Indies (Eckert et al. 1989; see also Keinath and Musick 1993). May rapidly occupy newly formed nesting habitat (Pritchard 1992).

Global range

Circumglobal species. Generally forages in temperate waters. Nests on beaches of the Atlantic, Indian, and Pacific Oceans, in tropical and subtropical latitudes. Nonbreeders often occur in high latitude waters in summer (e.g., see Goff and Lien 1988) and occur occasionally in inshore waters. Significant nesting areas include Malaysia (at least formerly), Pacific coast of Mexico and Central America, and Atlantic shore of northern South America. Largest population worldwide is in the western Atlantic (Spotila et al. 1996). In the Western Hemisphere, nests also in Florida (very rarely north to Georgia), along the shores of the Gulf of Mexico, in the West Indies, and along the Atlantic shore of Central America and the Pacific shore of northern South America. In the western Caribbean, nesting is frequent from northern Costa Rica to Colombia and in eastern French Guiana and western Surinam. Some nesting occurs along the central Brazilian coast; important colonies are in northwestern Guyana and in Trinidad. In the Antilles, most nesting occurs in the Dominican Republic and on islands close to Puerto Rico, including Culebra

and St. Croix (the largest, best-studied population in U.S. waters).

A general aggregation of leatherbacks is known to occur in the Pacific north of the Hawaiian Islands year-round, and in the Atlantic seasonal concentrations occur during the summer and fall months in the northeastern U.S. and Canada in areas such as Cape Cod Bay, the Gulf of Maine, the Scotian Shelf and Cape Breton. Appear to spend the first portion of their lives entirely in tropical waters; those less than 100 cm in carapace length occur only in waters warmer than 26°C, whereas adults may venture to extreme latitudes (Eckert 2002).

State range

At least 19 sightings recorded in Alaska between 1960 and 2001; all generally clustered near centers of human population and nearshore. Current information about the distribution of leatherbacks in Alaskan waters is biased by reporting of strandings that occur only where they were most likely to be observed by humans (Stinson 1984, Hodge and Wing 2000, Wing and Hodge 2002). Most sightings are from Southeast Alaska (including near Craig and Yakutat), but some have been reported as far north as off the Copper River Flats in south-central Alaska and as far west as near Perryville in the Aleutian chain (Hodge and Wing 2000). Leatherbacks probably reach Alaska via the Japan and North Pacific currents which reach the Alexander Archipelago, arc northwestward across the Gulf of Alaska, and then flow southwestward along the Aleutian chain (Hodge 2001).

Global abundance

Pritchard (1982) estimated 115,000 breeding females worldwide, though his estimates may have been too high, especially for Mexico. Estimated world population in the early 1990s was reported as 136,000 breeding females by Pritchard (1992). In contrast, Spotila et al. (1996) estimated the worldwide population of nesting females at 34,500, with the majority of animals occurring in the Atlantic Ocean and Caribbean Sea where the population is estimated at 27,608. Spotila et al. (2000) estimated total adult (breeding) population at 1,690 females in the eastern Pacific (down from an estimated 4,600-6,500 in 1996) and concluded leatherbacks are on the verge of extinction in the Pacific. Another estimate suggests a total of 2,300 adult females in the entire Pacific (Crowder 2000). An estimated 100-900 leatherbacks occur in summer

in waters off the northeastern U.S. (Shoop and Kenney 1992).

In Florida, between 1988 and 1992, annual reported leatherback nests varied between 98 and 188 (USFWS 1998). In the 1980s and early 1990s, about 18-55 females nested each year on St. Croix in the U.S. Virgin Islands (Boulon et al. 1996); increased to 100+ in 1997. In 1997, more than 80 females nested at Culebra Island, Puerto Rico. Nest counts at the largest nesting colony in Mexico reported less than 250 in 1998-1999 (Eckert unpubl. results in Spotila et al. 2000). Spotila et al. (2000) predicted that without protection the population breeding at Playa Grande, Costa Rica (once the 4th largest nesting colony in the world) would be reduced to ~50 nesting females by 2003-2004. See Cook (1981) for information on status in Canada.

In the mid-1990s, few beaches had more than a few hundred nesting females (Spotila et al. 1996). Only four nesting areas presently support more than 1000 breeding females: the Pacific coast of Mexico probably fewer than 5000 though formerly many more; Pacific coast of French Guiana, 4500-6500; peninsular Malaysia, 1000-2000; and the Kepala Burung region of Indonesia (UNEP 2003).

State abundance

Rare. Only 19 documented occurrences between 1960 and 2001 (comprising 58% of all marine turtle occurrences reported in Alaska for that time period; Hodge and Wing 2000, Wing and Hodge 2002). Presence is likely related to food availability and oceanographic correlates in the Gulf of Alaska, particularly during late summer and fall (Hodge and Wing 2000).

Global trend

Spotila et al. (1996) summarized recent information indicating that a major decline has occurred in recent decades; this was questioned by Pritchard (1996). Declines in the number of nesting females have been documented in Malaysia, India, Thailand, and the West Indies (USFWS 1998). Current trend of populations under U.S. jurisdiction is uncertain (USFWS 1998). Small nesting populations in Florida and on St. Croix, U.S. Virgin Islands, and Culebra Island, Puerto Rico, have increased significantly since early 1980's, but magnitude of nesting in these areas is much less than at other breeding sites (NMFS Southeast Fisheries Science Center 2001).

The eastern Pacific leatherback population, in particular, appears to have declined dramatically. In the early 1980's the total Pacific population estimate was 87,000-91,000 breeding females, with 12,000 occurring in the East Pacific outside of Mexico (Pritchard 1982, Spotila et al. 1996). In 2000, Spotila et al. (2000) estimated only 1,690 breeding females in the eastern Pacific. The population nesting along Mexico's Pacific coast, which once supported as much as half of all global nesting, experienced a drastic decline in the 1980's and 1990's, with fewer than 1,000 females believed to have nested there during the 1995-1996 season; a decline of 22-55% annually over 12 years (Sarti et al. 1996). On a beach on the Pacific coast of Costa Rica, the number of nesting females fell from 1,367 in 1988/1989 to 231 in 1999/2000, a decline of almost 85% in 11 years (Reina et al. 2002). The decline reflects excessive adult mortality likely related to fishing industry practices (Spotila et al. 2000).

A major population in Rantau Abang, Malaysia, declined from over 10,000 nests per year in 1956 to 3100 in 1968 to fewer than 100 in the early to mid-1990s (Chan and Liew 1996). The largest known nesting aggregation of leatherbacks in the western North Atlantic occurs in French Guiana and has been declining by about 15% annually since 1987 (NMFS Southeast Fisheries Science Center 2001).

State trend

Trends are unknown. The last recorded sighting in Alaskan waters was near Sitka at Vitskari Rocks in August 1993 (Hodge and Wing 2000, Wing and Hodge 2002).

Global protection

The Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC) is the only treaty devoted exclusively to sea turtles and aims to "promote the protection, conservation and recovery of sea turtle populations and of the habitats on which they depend, based on the best available scientific evidence, taking into account the environmental, socioeconomic and cultural characteristics of the Parties." This treaty involves 21 nations, including the U.S., in preserving sea turtles as an internationally shared resource (seaturtle.org 2003, C. Ryder, pers. comm.).

Critical Habitat designated at St. Croix, Virgin Islands; Santa Rosa N.P., Costa Rica; and sites in Mexico. NMFS (Federal Register, 12 May

1995) established a leatherback conservation zone extending from Cape Canaveral to the Virginia-North Carolina border and including all inshore and offshore waters; this zone is subject to shrimping closures when high abundances of leatherbacks are documented. For example, on 19 December 2001, NOAA Fisheries issued an emergency rule that required shrimp trawlers operating in Atlantic waters from the shoreline out to 10 nautical miles between 28 degrees north latitude, approximately Melbourne, Florida and the Florida/ Georgia border, to use Turtle Excluder Devices (TEDs) with escape openings modified to exclude leatherback turtles. This emergency rule, effective through 13 January 2002, was based on a number of factors including the presence of an extraordinarily high number of leatherbacks stranded along northeast Florida beaches in November and early December. According to state authorities, 15 dead leatherbacks washed ashore from St. Johns through Brevard counties in shrimp zones 28 and 29 between November 4 and December 10, 2001 (NMFS 2000). TED programs have been initiated in several other countries as well.

There are now also requirements in certain areas during specified times for larger TEDs that are more effective in excluding larger hard shell and leatherback turtles. Use of TEDs with openings large enough to accommodate leatherbacks is required of U.S. shrimp trawlers in the Atlantic and Gulf of Mexico. In 1989, a law was passed (Section 609 of U.S. Public Law 101-162) prohibiting U.S. importation of shrimp harvested in ways that are harmful to sea turtles; only nations certified by the Department of State as having a sea turtle protection program similar to that in the U.S. (i.e. requiring and enforcing TED use) may avoid this trade embargo. Time length of individual shrimp trawls is also limited to reduce drowning risk to trapped sea turtles, and fisheries observers are required on a certain percentage of U.S. vessels fishing the North Pacific, Atlantic and Gulf of Mexico. Nest beaches are protected in most parts of the species' range, but outside of U.S. jurisdiction law enforcement is often insufficient (Showalter 2003).

U.S. Endangered Species Act:

Endangered (02Jun1970).

Committee on the Status of Endangered Wildlife in Canada (COSEWIC):

Endangered (01May2001).

IUCN Red List Category:

CR - Critically endangered.

Convention on International Trade in Endangered Species Protection Status (CITES): Appendix I.

State protection

Protected under the Endangered Species Act (ESA) and internationally recognized as a critically endangered species. TEDs are not required of Alaskan fishing fleets.

Global threats

Major threats include egg collecting and mortality associated with bycatch in longline, trawl and gillnet fisheries throughout range (Spotila et al. 2000, Ferraroli et al. 2004, Lewison et al. 2004). Other concerns include harvest of adult females at nest beaches for meat and oil, nesting habitat loss, pollution, and adult ingestion of floating plastics and trash (Lewison et al. 2004).

Egg poaching: Most nest beaches are now protected in Mexico and in other parts of range, but egg exploitation continues. A long history of egg collection contributed to population declines in Malaysia (Chan and Liew 1996), and in the 1980s, cash value of leatherback eggs was still so high that the Trengganu Fisheries Department could only afford to buy back a small percentage of poached eggs for incubation and release (Pritchard 1982).

Fisheries bycatch: Especially threatened by longline swordfish and tuna fisheries of the United States, Europe, Asia and South America, shrimp trawl fisheries, gillnet fisheries and pot fisheries throughout the world. Even with the use of larger TED's developed to exclude leatherbacks, the U.S. offshore commercial shrimp fishery captures an estimated 640/year (NOAA/NMFS 2005). Eckert and Sarti (1997) report that "mortality associated with the swordfish gillnet fisheries in Peru and Chile represents the single largest source of mortality for East Pacific leatherbacks". Gillnet fisheries in these countries may kill an estimated 2,000 leatherbacks annually (this estimate does not include animals taken in the longline fishery; Eckert and Sarti 1997). During 2000, an estimated 20,000 leatherbacks were caught and 1,000-3,200 killed as bycatch in Pacific longline fisheries (Lewison et al. 2004). U.S. contribution to total pelagic longline bycatch is only around 2% of global take, so most of the threat of capture exists outside the U.S. (Lewison et al. 2004). From 1978-1981, 126 turtles were reported captured in the Japanese tuna longline

fishery in the Atlantic/Gulf of Mexico, of which around 25% were leatherbacks (Spotila et al. 1996).

Other threats: Adults were taken for meat and oil on nest beaches and poaching still occurs in some locations. Erosion, development and disturbance of nest beaches threatens nest success and reduces available nesting habitat (Pritchard 1982, NOAA/NMFS 2005). Where space is limited, females have been observed constructing nests on occupied sites and destroying eggs already present. Nesting beaches throughout their range are subject to human-related impacts including: coastal development, beach armoring, dredging, and beachfront lighting. Ingestion of floating plastic trash mistaken for jellyfish is often fatal to leatherbacks; vessel dumping of discarded fishing gear and petroleum products is also of concern (Bolten and Bjorndal 1992, NOAA/NMFS 2005).

State threats

Of the 19 reported leatherback occurrences in Alaska, six were entangled in fishing gear: 3 were captured in purse seiner nets; 1 in a gillnet; three of the six were killed (Stinson 1984, Hodge and Wing 2000, Wing and Hodge 2002). Since leatherbacks do not nest in Alaska, general concerns include incidental bycatch in fisheries, entanglement in other lines, vessel collisions, ingestion of floating plastics, and exposure to oil spills.

Global research needs

Information needed on ecology, demographics, and migratory movements. Determine nest site tenacity. Perform stock assessment, determine bycatch and survivorship rates.

State research needs

Determine abundance of primary food sources and investigate movement patterns in Alaska waters.

Global inventory needs

Monitor occurrences and number of breeding females.

State inventory needs

Conduct aerial surveys to better understand distribution in nearshore and offshore waters. Consolidate all existing occurrence information for this species from various reporting mechanisms and databases (e.g. state of Alaska,

NMFS, U.S. Coast Guard, community, tribal and fishermen's organizations). Establish a framework to standardize the reporting of fisheries interactions and determine bycatch associated with different gear types that operate in Alaskan waters (C. Ryder, pers. comm.).

Global conservation and management needs

Basic needs are to: monitor occurrences; enforce protective regulations including TED programs, regulate artisanal gillnet and other fisheries, international trade restrictions and nest beach protection; conduct educational programs regarding sea turtles, particularly in Mexico, South America, and Malaysia and also in the western Pacific (Papua New Guinea, Papua Indonesia, Solomon Islands and Vanuatu); enact beach lighting ordinances; keep traffic off beaches; remove nest predators (e.g., raccoons, canids, coatis) if needed.

Incidental catch in worldwide pelagic gillnet, longline and trawl fisheries is the most important conservation goal. Areas where conservation efforts should be focused include the Pacific migration corridor from the coast of Costa Rica to the Galapagos Islands and the offshore area near the Maroni river estuary heavily fished by French Guiana and Suriname fleets (Ferraroli et al. 2004). While TED programs are required in the U.S. and encouraged in many other countries, they are hard to enforce and easy to ignore without established fisheries observer programs. Bycatch is a crucial problem limiting population recovery, however, and it has been suggested that changes in survivorship of adults and large juveniles would have a greater effect on future population growth than changes at the egg/hatchling stage (see sources in Spotila et al. 1996). Current bycatch mortality levels are far above the 1% maximum adult mortality level models predict can be sustained by such a long-lived species (Spotila et al. 1996). The unaddressed problem of entanglement in fixed pot gear lines in the northwest Atlantic needs to be focused on.

Frazer (1992) emphasized the primary need for clean and productive marine and coastal environments; installation of TED's in shrimp trawl nets and use of low pressure sodium lighting on beaches were suggested as appropriate sea turtle conservation technologies, whereas headstarting, captive breeding, and hatcheries were regarded as ineffective at best.

At Sandy Point National Wildlife Refuge, U.S. Virgin Islands, where beach erosion causes losses of 45-60% to egg production, nest relocations and protection from poaching have possibly resulted in a doubling of the number of emerging hatchlings (Boulon et al. 1996).

See Chan (1989) for information on handling eggs and artificial incubation.

A recovery plan is available for marine turtles: see Marine Turtle Recovery Team (1984). For detailed information on management and recovery, see also the recovery plans for the St. Croix population (Baker 1981), U.S. Pacific populations (NMFS and USFWS 1998), South Florida population (USFWS 1998), and Canadian Pacific populations (PLTRT 2003).

Protect all nesting beach habitat, nesting adult females, clutches of eggs and emergent hatchlings. Important developmental and foraging habitats and migratory corridors also need to be protected, and ocean dumping of plastics and other debris and pollutants restricted.

State conservation and management needs

The prevention of incidental capture in fisheries and education of fishermen is the most important conservation goal. Conduct public outreach to inform fishermen and the public of the presence of leatherbacks in Alaskan state waters (an example of a successful community-based information campaign in northern Canada is described in Martin and James 2005). Ensure that leatherback concerns are addressed in oil spill response plans. Train a network to respond to entangled animals.

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