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Status and Distribution of the Leatherback Turtle, *Dermochelys coriacea*, in the Wider Caribbean Region

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Identity and Description

The generic name *Dermochelys* was introduced by Blainville (1816). The specific name *coriacea* was first used by Vandelli (1761) and adopted by Linneaus (1766) (Rhodin and Smith, 1982). The binomial refers to the distinctive leathery, scaleless skin of the adult turtle. The people of the Wider Caribbean know *Dermochelys* by a variety of common names, the most prevalent being leatherback in English, laúd (or tora) in Spanish, tortue luth in French, and tartaruga de couro in Portuguese.

The leatherback turtle is the sole member of the monophyletic family Dermochelyidae. It is further unique in being the largest (Morgan, 1989), deepest diving (Eckert et al., 1989) and most widely distributed (71ºN to 47ºS; Pritchard and Trebbau, 1984) sea turtle. Caribbean-nesting females typically weigh 250-500 kg. A record male specimen, weighing nearly 1,000 kg, died from net-entanglement in Wales, U.K., a decade ago (Morgan, 1989). Leatherbacks lack a bony shell. The smooth black skin is spotted with white; the proportion of light to dark pigment is variable. The somewhat flexible carapace is strongly tapered, typically measures 130–175 cm (along the curve), and is raised into seven prominent ridges. Deep cusps form tooth-like projections on the upper jaw.

Hatchlings are covered with small polygonal scales and are predominately black with mottled undersides. Flippers are margined in white, with the forelimbs extending nearly the length of the body. There are no claws. Rows of white scales appear as stripes along the length of the back. Typical carapace length is 60 mm. Typical (yolked) egg diameter ranges from 51-55 mm.

For additional information, the reader is referred to Pritchard and Trebbau (1984), NMFS/ FWS (1992), Eckert (1995), Boulon et al. (1996), Girondot and Fretey (1996), and Pritchard and Mortimer (1999).

Ecology and Reproduction

Adult leatherbacks exhibit broad thermal tolerances. They are commonly reported in New England waters and northward into eastern Canada. Core body temperature in cold water has been shown to be several degrees C above ambient. This may be due to several features, including the thermal inertia of a large body mass, an insulating layer of subepidermal fat, counter-current heat exchangers in the flippers, potentially heat-generating brown adipose tissue, and a relatively low freezing point for lipids.

Stomach contents from animals killed in various parts of the world indicate that the diet is mostly cnidarians (jellyfish, siphonophores) and tunicates (salps, pyrosomas). Surface feeding on jellyfish has been observed at several locales around the world. Foraging on vertically migrating zooplankton in the water column has been proposed based on the diving behavior of Caribbean-nesting females (Eckert et al., 1986). The specialized medusae diet places the leatherback atop a distinctive marine food chain based on nannoplankton, and largely independent of the more commonly recognized trophic systems supporting whales or tuna, for example (Hendrickson, 1980).

Nesting grounds are distributed circumglobally (approximately 40ºN to 35ºS). Gravid females are seasonal visitors to the Wider Caribbean region (males are rarely encountered) and observations are largely confined to peak breeding months of March to July. Mating is believed to occur prior to or during migration to the nesting ground (Eckert and Eckert, 1988). Females generally nest at 9-10 days intervals, deposit an average of 5-7 nests per year,

and remigrate at 2-3+ year intervals. As many as 11 nests per year have been observed to be deposited by a single female in the Caribbean Sea (St. Croix: Boulon et al., 1996) and as many as 13 per year in the Eastern Pacific (Costa Rica: R. Reina, pers. comm. *in* Frazier, this volume). Because relatively large numbers of nests are made by each turtle, and not all crawls result in a nest (that is, not all crawls result in the successful deposition of eggs), a tally of 100 crawls may translate into 70-80 nests – or the sum reproductive effort of only 10-15 females.

Females prefer to nest on beaches with deep, unobstructed access; contact with abrasive coral and rock is avoided. Nesting typically occurs at night. Approximately 70-90 yolked eggs are laid in each nest, along with a variable number of smaller yolkless eggs. Sex determination in leatherback hatchlings is temperature dependent and the "pivotal temperature" (approximately 1:1 sex ratio) has been estimated to be 29.25°-29.50°C in Suriname and French Guiana (Mrosovsky et al., 1984; Rimblot-Baly et al., 1986-1987). As is the case with all sea turtle species, warmer incubations favor females.

Research has shown that females engage in virtually continuous deep diving in the general vicinity of the nesting ground, traversing inshore waters only to and from the beach. Dives become progressively deeper as dawn approaches. Typical dives are 12-15 minutes in duration and rarely extend beyond 200 m in depth, but dives exceeding 1,000 m have been documented in the Caribbean Sea (Eckert et al., 1986, 1989). Leatherbacks swim constantly, traveling 45-65 km per day during internesting intervals and 30-50 km per day during long distance post-nesting migration (S. Eckert, HSWRI, pers. comm.). After nesting, females leave the Caribbean basin. This is known from tag returns (e.g., leatherbacks tagged whilst nesting in French Guiana have been recaptured in North America, Europe and Africa: Pritchard, 1973; Girondot and Fretey, 1996), post-nesting satellite-tracking studies from Trinidad (Eckert, 1998) and French Guiana (Ferraroli et al., in press), and studies of barnacle colonization on females nesting in St. Croix (Eckert and Eckert, 1988).

Neither the dispersal patterns of hatchlings nor the behavior and movements of juveniles are known. Preliminary evidence, based on a global assessment of sightings records, suggests that juveniles may remain in tropical latitudes until they reach approximately 100 cm in carapace length (Eckert, 1999). Survivability, growth rate, age at maturity and longevity in the wild have not been determined for this species.

Distribution and Trends

The largest colony in the Wider Caribbean Region is at Ya:lima:po, French Guiana, near the border with Suriname. As is typical of long-term databases at well-studied nesting beaches, the French Guiana database demonstrates strong fluctuations in the number of nests laid each year, ranging (since 1978) from more than 50,000 nests to fewer than 10,000 (Girondot and Fretey, 1996). The number of nests laid at Ya:lima:po since 1992 has been steadily declining (Chevalier and Girondot, 2000). While the nature and extent of the decline is difficult to interpret (due to the highly dynamic nature of the beaches and the shifting pattern of nesting that results), the trend is clear. By averaging data across years (reducing the effects of annual fluctuations), we can see that the mean number of nests laid per year between 1987 and 1992 was 40,950 and the mean number of nests laid per year between 1993 and 1998 was 18,100, a decline of more than 50%. Drift/gillnet fishing in the Marconi Estuary is implicated in the population's demise (J. Chevalier, DIREN, pers. comm.).

As erosion has degraded nesting beaches in French Guiana, the colony there has spilled over into Suriname where sandy beach habitat is expanding due to coastal processes. There were fewer than 100 leatherback nests laid in Suriname in 1967, but annual numbers have risen steadily to a peak of 12,401 nests in 1985 and have fluctuated widely since (Reichart and Fretey, 1993). A minimum of 4,000 nests were laid in Suriname in 1999, of which about 50% were lost to poaching (STINASU, unpubl. data).

Nesting on a more moderate scale is reported from Guyana, Venezuela, and Colombia. Sea turtles have been heavily utilized on the nesting beaches in Guyana for many generations. The most important nesting area is the North-West District, especially Almond Beach. Aerial surveys in 1982 indicated

that "most of the turtles nesting on this beach are being slaughtered by fishermen and probably all eggs are harvested" (Hart, 1984). Pritchard (1986) estimated that 80% of females were killed each year as they attempted to nest. In 1989 an intensive tagging program began in collaboration with local communities, and rates of mortality have since declined. The number of nests laid at Almond Beach fluctuates among years and ranged from 90-247 between 1989-1994; the populations appears to be stable (P. Pritchard, Chelonian Research Inst., unpubl. data). There are no historical data for Venezuela, but the Paria Peninsula appears to be the most important nesting site at the present time. Current information suggests that Querepare and Cipara (believed to be the most important of the Paria Peninsula's seven known nesting beaches), are each visited by perhaps 20-40 females per year (H. Guada, WIDECAST-Venezuela, pers. comm.).

The Acandí region (Gulf of Urabá), specifically Playona Beach, is the most important nesting site (for leatherbacks) in Colombia. During 11 weeks of monitoring 3 km of nesting beach at Playona in 1998, 71 females were tagged and 162 nests confirmed (Duque et al., 1998). In 1999, 180 females were tagged and 193 nests confirmed (Higuita and Páez, 1999). The status of the colony is unknown, but these tagging records roughly confirm previous estimates of 100 (Ross, 1982) and 200-250 (USFWS, 1981) females nesting per year. Current threats to the colony are considered serious, and include direct harvest, incidental catch by fisheries, pollution, upland deforestation, and coastal development (D. Amorocho, WIDECAST-Colombia, pers. comm.).

In Panama, "concentrated nesting" [nests/yr was not reported] occurs both in the western sector in Bocas del Toro Province (principally on Playa Chiriquí and Changuinola) and also in eastern Panama at Playa Pito and Bahía Aglatomate (Meylan et al., 1985; Pritchard, 1989). More recent surveys have confirmed 150-180 nests per year on Colon Island (D. Chacón, Asoc. ANAI, pers. comm.). Local experts characterize leatherback nesting in Panama as declining; surveys are needed to confirm the speculation. Between Costa Rica and Escudo de Veraguas (Bocas del Toro Province), some 35-100 gravid females are killed each year and egg poaching is estimated at 85%. Most of the leatherbacks are killed in the vicinity of the Changuinola River, where the meat is later sold in Changuinola and the banana plantations for US$ 0.25 per lb (D. Chacón, pers. comm.).

Costa Rica has seen dramatic declines in some areas (Hirth and Ogren, 1987) due largely to egg poaching, which still approaches 100% outside of protected areas. An estimated 70% of all leatherback nesting in Caribbean Costa Rica occurs within the protected areas of Gandoca-Manzanillo Wildlife Refuge, Pacuare Nature Reserve, and Tortuguero National Park, where the combined number of nesting females per year is 500-1,000, making it the third largest known breeding assemblage in the Wider Caribbean Region. The population at Gandoca-Manzanillo Wildlife Refuge is increasing, with the number of nests per year ranging from 200 to more than 1,100 between 1990-1999 (D. Chacón, unpubl. data). Similar increases are not reported from Tortuguero, however, where nesting continues to decline (Campbell et al., 1996).

In Honduras there is a small rookery (25-75 nests/yr) at Plapaya Beach which has been protected by MOPAWI and the Garifuna community since 1995 (D. Chacón, pers. comm.). Nesting is not known to occur in Belize (Smith et al., 1992). Nesting is described as "rare" in Mexico, where perhaps fewer than 20 nests are laid along the entire Caribbean and Gulf of Mexico coastline each year (L. Sarti, INP, pers. comm.).

With the exception of Trinidad (and perhaps the Dominican Republic, for which I have no data), nesting in the insular Caribbean is predictable but occurs nowhere in large numbers, by which I mean more than 1,000 nests (or approximately 150 females) per year. There is considerable anecdotal evidence that nesting has dramatically declined throughout the eastern Caribbean. In the British Virgin Islands, for example, six or more females nested *per night* on beaches on the northeast coast of Tortola in the 1920's. The turtles were harvested primarily for oil, which was (and is) used medicinally. In 1988 a single nest was recorded in Tortola; in 1989 there were none (Cambers and Lima, 1990). Recently nesting appears to be on the rise, presumably benefiting from a local moratorium enacted in 1993 and long-standing protection in the

neighboring U. S. Virgin Islands. There were 28 crawls (successful and unsuccessful nesting events, combined) on Tortola in 1997, 10 in 1998 and 39 in 1999, suggesting a local nesting assemblage of 2–6 turtles per year (M. Hastings, BVI Ministry of Natural Resources, pers. comm.).

Where there is little protection, declining trends persist. The theft of eggs and the killing of egg-bearing females have combined to diminish once thriving colonies in St. Kitts and Nevis (Eckert and Honebrink, 1992), St. Lucia (d'Auvergne and Eckert, 1993), Tobago (W. Herron, Environment Tobago, pers. comm.) and elsewhere in the insular Caribbean. In Grenada, for example, despite a closed season that embraces most of the nesting season, information dating back nearly two decades documents the killing of a significant number of nesting females each year and an illegal egg harvest that local observers describe as near 100% (Finlay, 1984, 1987; Eckert and Eckert 1990). On islands where nesting appears to have been historically rare or occasional (e.g., Anguilla, Antigua, Barbados, Jamaica, the Netherlands Antilles), present trends are impossible to estimate.

The news is better in some areas where protection measures have been strong. Nesting at the Sandy Point National Wildlife Refuge, USVI, where leatherbacks have been protected for nearly three decades, is showing a clearly upward trend. An average of 26 females nested (with an average of 133 nests laid) each year between 1982-1986 [1982 being the first year of full beach coverage and tagging] and an average of 70 females nested (with an average of 423 nests laid) each year between 1995-1999, a near tripling over the course of two decades (R. Boulon, USNPS, pers. comm.). Similar trends are seen at Culebra National Wildlife Refuge (Playa Resaca and Playa Brava), Puerto Rico, where an average of 19 females nested (with an average of 142 nests laid) each year between 1984-1986 and an average of 76 females nested (with an average of 375 nests laid) each year between 1997-1999 (M. Rivera and T. Tallevast, USFWS, pers. comm.).

The two primary nesting sites in Trinidad, Matura Beach (east coast) and Grande Riviere (north coast), were declared protected areas in 1990 and 1997, respectively. Systematic tagging began at Matura in 1999 and 862 females were tagged, but beach coverage was incomplete and it is likely that somewhat more than 1,000 females nested on nearly 10 km of beach that year (Sammy, 1999). A similar number of females (800-1,000 per year) are believed to nest at Grande Riviere (S. Eckert, HSWRI, pers. comm.). The status of the nesting colony in Trinidad is unknown. Community-based beach patrols have reduced the number of females killed each year to near zero (down from an estimated 30-50% per year on the east coast and near 100% on the north coast in the 1960's and 1970's), but high levels of incidental catch offshore have the potential to decimate the colony (see Conclusions).

Threats

In some Wider Caribbean countries, gravid leatherbacks are killed for meat, oil, and/or eggs during nesting. In some cases (e.g., Tortola [BVI], Grenada, Guyana), long-term local harvests have had dire population consequences for local nesting assemblages. In other cases the harvest occurs in a range state, as is the case between Costa Rica and Panama. Since only adult females are encountered, there is no harvest of juveniles. The oily meat is not widely favored and is typically prepared by sun-drying or stewing. The oil is used for medicinal purposes, generally in cases of respiratory congestion, and is believed by some to have aphrodisiac qualities. The harvest of eggs seems nearly ubiquitous in unprotected colonies.

A serious threat to this species in the Wider Caribbean region and greater Atlantic ecosystem is incidental capture and mortality at sea. The fisheries most likely to unintentionally ensnare leatherback turtles are longlines and tangle nets (setnets, gillnets, driftnets). Published accounts are scarce, but the capture of leatherbacks by longlines, for example, is documented in the northeastern Caribbean Sea (Cambers and Lima, 1990; Tobias, 1991; Fuller et al., 1992), Gulf of Mexico (Hildebrand, 1987), and the eastern U.S. and Canada (NMFS, 2000; Witzell, 1984). In the southern latitudes of the Wider Caribbean Region the world's largest leatherback colonies are clearly threatened by incidental capture in gillnets. Eckert and Lien (1999) estimate that more than a 1,000 leatherbacks are captured each year (logically including multiple captures of the same individual) offshore the nest-

ing beaches in Trinidad; all indications are that mortality rates are high. Drift/gillnets are also considered a serious threat in the Guianas.

The ingestion of persistent ocean debris, notably plastic bags which are often mistaken for jellyfish and ingested, is a pervasive threat throughout the species' global range (Balazs, 1985; Witzell and Teas, 1994). As is the case with other sea turtle species, habitat loss in the form of increasingly developed coastal areas (particularly sandy beaches which would otherwise contribute important nesting habitat) is also a threat to species survival.

Conservation Status

The leatherback is classified as Endangered by the World Conservation Union (Baillie and Groombridge, 1996). They are included in Annex II of the Protocol to the Cartagena Convention concerning Specially Protected Areas and Wildlife (SPAW); 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 the Conservation of Migratory Species (Bonn Convention); and Appendix II of the Convention on European Wildlife and Natural Habitats (Bern Convention) (Hykle, 1999). The species is also listed in the annexes to the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere, a designation intended to convey that their protection is of "special urgency and importance". Only one Wider Caribbean country, Suriname, maintains a CITES reservation on *Dermochelys*, but "the exemption is mostly a matter of principle", there being no international trade in leatherback turtles or their products (Reichart and Fretey, 1993).

Conclusions

Based on information compiled for this presentation it is clear that leatherbacks nesting in the Eastern Caribbean have, on balance, experienced dramatic declines since World War II (WWII). The situation in Central and South America is less clear; some populations are rising, some are declining. Potentially important sites in Colombia, Panama and the Dominican Republic have not been adequately surveyed. The largest colony in the region (Ya:lima:po, French Guiana) is widely characterized as declining (high levels of incidental catch offshore have been implicated); however, it is not possible to accurately assess this population until nesting trends from related colonies in eastern French Guiana and Suriname are taken into account. The status of the nesting colony in Trinidad is unknown; tagging for the purpose of population assessment has only just begun. It is obvious that killings on the nesting beach have dramatically declined (in Trinidad) in recent years, but, again, high levels of incidental catch offshore are a serious concern. In Costa Rica the trends are mixed, with the most serious threats being egg poaching and the illegal killing of adult females in neighboring Panama.

What is very clear is that the Western Tropical Atlantic, including the Caribbean Sea, is the primary nursery ground for this species in the greater Atlantic ecosystem. The pivotal role that the Wider Caribbean Region plays in reproduction emphasizes the urgency with which Caribbean governments should approach the challenges of management and conservation. Hunting of this species in Caribbean waters is perilous to its long-term survival since by definition only egg-bearing females are killed (males and juveniles apparently being so rare in the region that they are virtually never encountered). Uncontrolled egg poaching on shore and undocumented but almost surely unsustainable levels of incidental capture at sea combine to warn us that while rising trends are a welcome sign in some areas, historical declines are still the norm in most countries. With fewer than five known "large" colonies (>1,000 nests/ yr), and the two largest colonies experiencing high levels of mortality at sea, it is not unimaginable that we could loose this species in the Caribbean basin.

Why such grave concern? We need only look at the rookeries that, until recently, were among the largest leatherback nesting colonies in the world. Terengganu Beach, Malaysia, incubated more than 10,000 nests in 1956, in contrast to fewer than 100 nests per year, on average, during the decade of the 1990's. Major causes of decline are mortality associated with fisheries operations in the high seas as well as within the territorial waters of Malaysia, and a long history of sanctioned egg collection involving nearly 100% of all eggs laid (Chan and Liew, 1996).

The rookery now supports less than .05% of post-WWII nesting levels.

Eastern Pacific rookeries have experienced devastation on a comparable scale, but over a much shorter time. In the early 1980's, the beaches of Pacific Mexico were visited by more than 50,000 gravid females per year, laying uncounted hundreds of thousands of nests. Mexico was assumed to support more than half of all leatherback nesting on Earth. By 1999, in less than 20 years, the population was reduced to 250 turtles nesting per year (Sarti et al., 1996). What happened, and why so quickly? In an effort to support a dwindling fishing industry, Chile, and later Peru, instituted an artisanal gillnet fleet which grew exponentially until the early 1990's. One estimate suggests that this fishery killed as many as 3,000 large juvenile and adult leatherbacks each year on their southeastern Pacific foraging grounds (Eckert and Sarti, 1997). As a result, nesting in the Mexico (and other Eastern Pacific sites) declined at a staggering rate of some 20% per year during the 1990's (Sarti et al., 1996; Spotila et al., 2000).

The lessons of Mexico are that (i) what seem to be almost infinitely large populations can be destroyed so quickly as to preclude intervention by the relevant resource agencies and (ii) such threats can take place so far away that they are unknown to local resource managers. Mexico invested millions of Pesos in protecting leatherback sea turtles at their nesting beaches, and it was all for naught because of the management decisions of a distant Range State. Recognizing these essential linkages is what this meeting is all about. I consider it a great privilege to be here.

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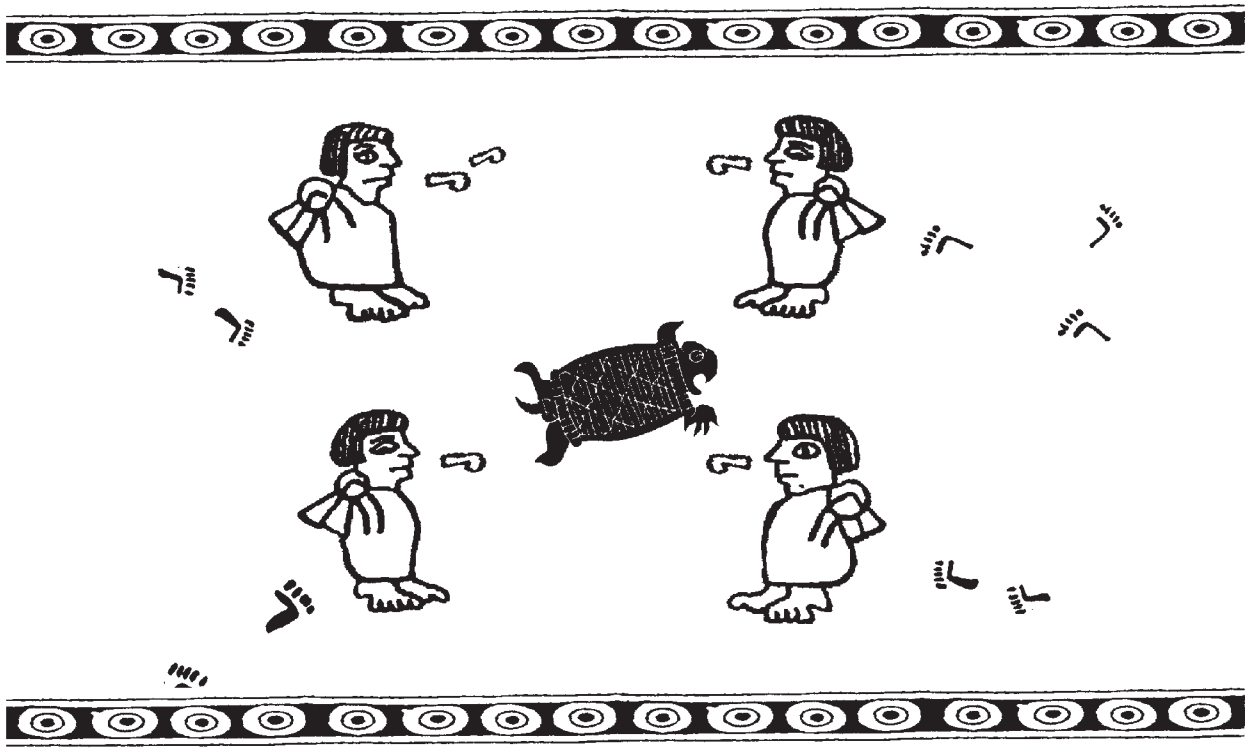
Marine Turtle Conservation in the Wider Caribbean Region: A Dialogue for Effective Regional Management

Santo Domingo, Dominican Republic
16-18 November 1999

PROCEEDINGS



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About the cover

The designs for the cover were extracted from various Mexican pre-Columbian codices. The human figures, footprints, and the speech symbols were taken from the *Códice Boturini*, also known as *Tira de la Peregrinación*, which depicts the migration of the Mexicas (ancient Aztecs) towards the Valley of Mexico. The turtle figure in the center comes from an ancient Mayan codex. We felt that this symbolism, taken from pre-Colombian art, well reflected the nature and purposes of the people attending the workshop — bringing together many people, traveling from far and wide, to dialogue about marine turtles.