Dermochelys coriacea (Leatherback Turtle)

Family: Dermochelyidae (Leatherback Turtle)
Order: Testudines (Turtles and Tortoises)
Class: Reptilia (Reptiles)

Fig. 1. Leatherback turtle, *Dermochelys coriacea.*

[http://www.itsnature.org/sea/other/leatherback-turtle/, Downloaded 20 September 2011]

TRAITS. The leatherback turtle (Fig. 1), the largest marine turtle, is possibly the most extraordinary as its structure is unique compared to other sea turtles. Adult females range in length from 130-165 cm (55-71 in.) and weigh 260-500 kg (573-1103 lbs), while adult males can weigh as much as 916 kg (2015 lbs.) (Morgan, 1989). The major distinction from other species is the leatherback's carapace or shell. Unlike other sea turtles, the carapace of the leatherback is soft and not fused to the vertebrate and ribs. The shell is made up of numerous small polygonal plates and a leathery skin is stretched over these to form the shape of the shell which is somewhat barrel-shaped and tapered at the caudal end (Rebel, 1974). There are seven prominent ridges or keels which run along the length of the shell (Scott & Horrocks, 1993). The leatherback's entire body, including the carapace, is black in colour and splattered with varying degrees of white spots. There is also a prominent pink spot on the dorsal surface of the head in adults. The upper jaw of adults contains two tooth-like peaks on the jaw. The limbs are clawless and paddle-like; with forelimbs that span to almost the turtle's body length (Scott & Horrocks, 1993). Adult males can be differentiated from adult females by the length of the tail, which in males, extends beyond the hind limbs when lined up edge to edge (Rebel, 1974). Hatchlings (Fig. 2) are predominantly black and both body and shell are covered with tiny polygonal scales with white margins on their flippers and white stripes on their keels, which are actually scales that eventually drop off (Eckert et al. 1984).

ECOLOGY. Leatherbacks are distributed globally, and are known to tolerate warm and cold to subarctic climates (Spotila, 2004), which allows these sea turtles to be scattered far and wide, ranging from 47^{o} N to 71^{o} S (Pritchard and Trebbau, 1984). In 1995, female leatherbacks were projected worldwide to total 34,500, which is less than one third Pritchard's (1982) approximation of 115,000 (Spotila et al. 1996). Recently, the projection for North Atlantic leatherbacks alone has been 34000 – 94000 (Turtle Expert Working Group, 2007). Currently, there are three major nesting colonies worldwide, supporting nesting by more than 5,000 female leatherbacks each year, all of which are located in the Atlantic Ocean. Included are a colony spreading along 400 km of West African coastline (centred in Gabon) and a nesting colony covering the border between French Guiana, Suriname and Trinidad (Sammy and Eckert, 2010). Trinidad now supports an estimated population of 6000 females, making the Trinidad colony one of the largest in the Atlantic and signifying a percentage greater than 80, for females in the Insular Caribbean (Fournillier and Eckert, 1999).

FORAGING BEHAVIOUR. Leatherbacks feed on invertebrates such as cnidarians (jellyfish, siphonophores) and tunicates (salps, pyrosomas), as indicated upon analysis of the digested matter of slaughtered leatherback turtles (Eckert and Grobois, 2001). Foraging occurs mainly in surface waters, however, organisms belonging in deep waters such as siphonophores have been found in digested matter of some leatherback turtles suggesting that foraging also occurs at depth (Hartog, 1980). In Trinidad and Tobago it has been reported by fishermen along the north coast that the turtles are found in proximity to areas where jellyfish are found, suggesting that feeding occurs during the reproductive season. In the early nesting season in 2004 and 2005, an adult male was satellite tracked navigating from Canada to Trinidad's Galera point, signifying it may be an area for foraging (James et al. 2005). Eckert found that gravid females kept in the vicinity of nesting beaches and as far as 30 km from the coastline and were significantly concentrated around Galera Point, perhaps because their jellyfish prey were abundant here. Speculation was made about the arrival of leatherbacks and the corresponding seasonal influx of jellyfish (Forestry Division, 2010). In gravid leatherback turtles, it was thought that they were capital breeders and did not forage when in proximity to nesting beaches but rather depended on stored energy for reproduction. Studies have shown, however, that they carry out longer, deeper dives during the day and shorter, more frequent dives during the night associated with diel vertical migration of its prey (Eckert et al. 1986). Eckert et al. (1989) suggested that nocturnal foraging of zooplankton in upwellings occurred, based on noted inter-nesting dive behavior for leatherback turtles. However, gravid leatherback turtles have also shown a preference to foraging at daytime which may be an energy conservation strategy, as at night there is low light availability and it is more difficult to detect and capture prey (Casey et al. 2010).

REPRODUCTIVE BEHAVIOUR. According to Pritchard (1982), it was believed that leatherback mating did not occur in the surrounding areas of nesting beaches and has been suggested that mating may occur in foraging areas, or throughout the journey, en route to nesting beaches (Eckert and Eckert, 1988). However recent studies done by James et al. (2005) suggest that male leatherbacks migrate to areas suitable for reproduction directly from foraging in colder regions. Therefore it seems that proximity to nesting beaches is essential for mating. This was confirmed by interviewing fishermen, who observed mating while fishing off the northern and eastern coasts of Trinidad (James et al. 2005). There were two recorded accounts of mating, one occurred off Blanchissuese in April in the late 1970s and another, approximated to 1983. Both accounts were similar, where a pair of turtles consisting of a female mounted by a larger male was observed at the sea surface. The male's fore flippers were "grasping" the female's shoulders

in what was termed "piggyback" style. The animals, however, became distressed and panicked as the boat got closer, but were unable to flee or dive (Forestry Division, 2010). Female leatherbacks embark on reproductive migration to tropical waters several weeks before the nesting season, to the nesting beaches on or around where they were born. Nesting in the Trinidad colony begins in early March, and continues until August (Sammy and Eckert, 2010). This event takes place every 2-3 plus years, where they lay an estimated 5-7 clutches of eggs during a period of 9-10 days. Clutch sizes for these nests range from 70 – 90 yolk eggs per nest, including a few yolkless eggs (Eckert and Grobois, 2001). Nesting leatherbacks prefer sandy beaches with deep waters and easy access as opposed to beaches with abrasive coral and rock, as this can be damaging to their soft plastron and flippers (Eckert, 1987). The female crawls out of the water and locates an area beyond the tide mark, then using its flippers, creates a body pit. It then uses its rear flippers to dig a nest about 3 feet deep and proceeds to lay eggs. The nest is covered with care and sand is thrown over the area in an attempt to disguise the nest (Spotila, 2004).

ACTIVITY. Evolution has adjusted their digestive tract in order to feed on jellyfish by having an extra long oesophagus and oesophageal papillae (Fig. 3). The papillae are made of cartilage, cone-shaped and pointed and possibly protect the turtle from getting stung by its prey. As the leatherback feeds, its throat contracts to expel excess water taken in with prey. The papillae prevent the prey from escaping with the expelled water and keep it moving down the digestive tract. Leatherbacks are able to extract nutrients from this seemingly nutrient-less diet by means of their long oesophagus, which acts as to hold the food as it is continually digested (Spotila, 2004). Leatherbacks can maintain a core body temperature as high as 15^{o} C above ambient environmental temperature, enabling foraging in waters 0-15^{o}C (Spotila et al. 1997). This may be attributable to adaptations such as thermal inertia of a large body mass (Neill and Stevens 1974), an insulating layer of sub-epidermal fat (Mrosovsky and Pritchard 1971, Frair et al. 1972), countercurrent heat exchanging mechanism in the flippers (Greer et al. 1973) and the abundance of energy high brown adipose tissue (Goff and Stenson 1988). Leatherbacks are also great divers, reaching maximum depths up to 1300 m, however 95% of all dives are < 20 mins in length and < 200 m in depth. The ability of these turtles to dive to such depths could explain why evolution has favoured such a soft carapace. At such depths a hard shell might snap or crush under the pressure, however the soft shell compresses, enabling deep diving (Spotila, 2004). It has been proposed that these remarkably deep dives represent a mode of escaping predators such as killer whales and may also explain the rarity of sightings of these animals offshore (Eckert et al. 1989).

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Fig. 2. Leatherback turtle hatchling.

[http://www.superstock.com/stock-photos-images/1566-0186056, downloaded 25 September 2011]

Fig. 3. Leatherback showing oesophageal papillae.

[http://museumvictoria.com.au/about/mv-blog/categories/melbourne-museum/, downloaded 25 September 2011]