Sea Turtle Tagging and Information Handbook

Developed for the National Sea Turtle Conservation Project

Partners in Sustainable Community Development

Atlantic

Moving a generation ahead

TURTLE VILLAGE TRUST

TRINIDAD & TOBAGO W.I.

THE GREEN FUND

Introduction and Intent

Turtle Village Trust (TVT) is an umbrella non-profit organisation for sea turtle conservation in Trinidad & Tobago. TVT works to foster and strengthen strategic partnerships with turtle conservation groups and the wider coastal communities, to protect the natural resources and thus to achieve sustainable community growth. Our major activities are research and conservation, ecotourism and capacity building, and public awareness.

Since its inception in 2006, TVT has worked with its partner community organisations to conduct nesting beach monitoring in a project designed to protect marine turtle nesting populations on our beaches and foster partnerships between community groups, corporate entities and government. As part of the National Sea Turtle Conservation Project (NSTCP), TVT gathers information about the population of nesting sea turtles to provide the most accurate assessment of the nesting population that will inform management decisions.

Currently the NSTCP surveys 42 beaches nightly along the North and East Coasts of Trinidad and around Tobago. Peak sea turtle nesting in Trinidad & Tobago is observed in May and June.

This ***Sea Turtle Tagging and Information Handbook*** is designed to complement the training workshops hosted periodically by TVT and its Community-based partners for community and volunteers to become participants of the NSTCP and to contribute to a unified code for tagging practice in Trinidad & Tobago.

The NSTCP benefits from public and private sector support from Wildlife Section, Forestry Division, the Green Fund, Ministry of Planning and Sustainable Development, and Atlantic LNG. Contributions to early development of this Handbook were provided by Dennis Sammy (Nature Seekers) and Scott Eckert (WIDECAST). Thanks as well to colleagues who provided input and insight in this Handbook including Sherron Barker, Kerron Marson, Kevin Muhammad, Michelle Cazabon-Mannette and Reia Guppy.

Kathryn Audroing
Research Manager
Turtle Village Trust
March 2017

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1 Overview

In 2011 the Sea Turtle Recovery Action Plan (STRAP) for Trinidad and Tobago was approved by the Government of the Republic of Trinidad and Tobago. This recovery action plan summarises the known distribution of sea turtles, discusses major causes of mortality, evaluates the effectiveness of existing conservation laws, and prioritises implementing measures for stock recovery.

To manage and protect important habitat, the STRAP recommends that The National Sea Turtle Monitoring Programme initiated by TVT in 2008, be strengthened to lend impetus to training personnel, collecting long-term data on nesting and foraging assemblages, protecting critical habitat, encouraging participation by rural communities and the general public in sea turtle conservation actions, strengthening the regulatory framework, and evaluating sustainable alternatives to consumptive use.

The National Sea Turtle Conservation Project (NSTCP) which commenced in 2013, reinforces the STRAP's recommendation with respect to the National Monitoring Programme. The objectives of the NSTCP are:

1. To protect and monitor our marine turtle nesting populations on our index beaches and high nesting beaches, and gather information about our population of nesting Leatherbacks, Hawksbills and Greens, and strengthen the National Sea Turtle Database that will inform management, policy and legislative decisions.
2. To conduct a comprehensive survey to identify conclusively those beaches that support the most sea turtle nesting and provide the most accurate assessment of the nesting population size and eventually, population status, for Trinidad's Leatherbacks, Hawksbills and Greens that will inform management decisions.
3. To gather information about the resident population of Hawksbills and Greens foraging on the reefs and sea grass beds around Tobago that will inform management decisions.
4. To develop the capacity of the community organisations to continue the conservation of sea turtles.
5. To ensure Public Awareness
    i. Community Tourism will be promoted as a tool for conservation of natural ecosystems and species by using the spectacular ecological behaviour of the nesting Leatherback turtles as the principle focus for this activity.
    ii. Nesting habitat of marine turtles and other natural resources will be safeguarded from negative human activities through awareness activities.
6. To encourage livelihood opportunities through ecotourism centred on sea turtles as the product.
7. To develop Beach Management Plans that will direct the use of the resource, identify responsibilities of stakeholders, highlight research priorities and make recommendations to mitigate threats.

This Handbook is designed to complement a Turtle Tagging and Handling training workshop. Both are directed at improving the capacity of community persons and citizen scientists to assist in sea turtle conservation particularly on nesting beach monitoring, tagging and data collection conducted for the NSTCP.

1.1 The training objectives

The training objectives are as follows:

1. To increase the capacity for sea turtle conservation in Trinidad and Tobago.
2. To outline a standard operating procedure for sea turtle tagging in the National Sea Turtle Conservation Programme:
    - To build and review turtle tagging skills and data collection methodology.
    - To demonstrate the reasonable expectations of personnel requirements for the National Sea Turtle Conservation Programme.

1.2 Topics to be covered in training

Within this manual, the topics that will be covered in training are as follows:

1. Background:
    a. What is conservation? The need for conservation.
    b. Historical and current turtle conservation initiatives.
    c. Personal and collective responsibility to our environment.
2. Sea turtles:
    a. Life history.
    b. Biology and behaviours.
    c. Identification.
    d. Endangered status and ethical treatment of animals.
3. Turtle Village Trust and the NSTCP.
4. Data collection:
    a. The critical nature of timely and accurate data.
    b. Data security and privacy.
    c. Methods.
5. Tagging techniques.
6. Health and Safety of turtles and people.
7. Public and community interaction.
8. Work ethic and personal responsibility.

1.3 Recommended additional reading

- Forestry Division (Government of the Republic of Trinidad and Tobago), Save our Sea turtles-Tobago, and Nature Seekers. 2010. WIDECAST Sea Turtle Recovery Action Plan for Trinidad & Tobago (Karen L. Eckert, Editor). CEP Technical Report No. 49.
- Eckert, Karen L. and Jennifer Beggs. 2006. Marine Turtle Tagging: A Manual of Recommended Practices. WIDECAST Technical Report No. 2. Revised Edition.
- Phelan, Shana M. and Karen L. Eckert. 2006. Marine Turtle Trauma Response Procedures: A Field Guide. WIDECAST Technical Report No. 4.

2 What is conservation?

Conservation is the maintenance and restoration of populations and ecosystem health. Conservation describes all the actions taken to ensure a species can survive in the future, for their preservation or for sustainably managed utilisation. All of the 6 sea turtle species that inhabit the Caribbean Sea are classified on the IUCN Red List of Threatened Species. Population declines are due to exploitive harvesting, accidental capture, damaged feeding grounds with coral reef and seagrass degradation, marine pollutants and nesting beach destruction by coastal developments. Threats to sea turtles are numerous and most are human-caused so to truly protect sea turtles many countries must cooperate and share responsibility, the dedication of organisations and individuals is essential.

Conservation works to promote the survival of sea turtle populations through sustained recovery of depleted stocks and safeguarding of critical habitats. Successful conservation strategies are built on the foundations of solid science (SWOT 2011). The first step is to assess the numbers of individuals that exist in a population and any current (and future) trends. Monitoring programmes aim to develop and maintain long-term capture-mark-recapture studies of sea turtle populations on nesting beaches and in offshore foraging (feeding and aggregation) areas to get the most accurate estimate of population numbers.

Long-term protection of sea turtles also means developing solutions that reduce reliance on management methods requiring direct human involvement. If sea turtles cannot survive and reproduce on their own without human intervention, then their existence is doomed.

3 The History of Tagging Efforts and Sea Turtle Conservation in T&T

The Republic of Trinidad and Tobago supports the second largest nesting assemblage of Leatherback sea turtles (*Dermochelys coriacea*) in the Western Hemisphere and the largest island-nesting population of Leatherbacks on Earth. Trinidad and French Guiana are largely responsible for maintaining the Greater Atlantic Leatherback assemblage, which during non-nesting periods distributes from the Canadian Arctic to the tropical west coast of Africa. Trinidad is one of the five most valuable nesting sites on earth for Vulnerable (IUCN 2017) Leatherbacks (Eckert, 2001).

The island of Trinidad supports more than 80% of all Leatherback sea turtle (*D. coriacea*) nesting in the insular Caribbean Sea and is the 2nd largest nesting colony in the world with an estimated 6,000 Leatherbacks nesting annually (Fournillier and Eckert, 1999). The majority of this nesting is concentrated on the North and East coasts of Trinidad and Southern Tobago, with occasional nests laid along the South coast in Trinidad and Northern Tobago. Leatherbacks nesting on Trinidad distribute throughout the North Atlantic as demonstrated by both flipper tag returns and satellite telemetry and reside for part of the year in virtually every North Atlantic coastal nation (Eckert, 1998; Eckert, 2005; James et al., 2005).

Management responsibility for this vital nesting colony is the responsibility of the Government of Trinidad and Tobago's Wildlife Section, Forestry Division. Active management of the colony began in the late 1980's and early 1990's with efforts from the Trinidad & Tobago Field Naturalist Club and the Point-a-Pierre Wildfowl Trust to stop rampant killing of adult females on the nesting beaches for sport and meat.

Source: Nature Seekers

However, limited financial and personnel resources meant that such efforts were incomplete and many hundreds of females were slaughtered each year. In response, the Wildlife Section initiated the formation of local non-governmental conservation groups, and established co-management of the nesting beaches with those local NGO's with initial support for training and scientific oversight provided by the regional conservation organisation WIDECAST. Success in reducing poaching has been almost complete, particularly at the 3 primary nesting colonies of Fishing Pond, Matura and Grande Riviere beaches. This came from conducting nocturnal beach patrols, tagging of nesting turtles, collection of morphometric information, documentation of mortality sources, assessment of population trends and behavioural patterns, supervision of ecotourism, and education of the public. These 3 beaches are legally protected as Prohibited Areas which restricts public access during the main sea turtle nesting

period, March to August every year, to persons who have gained a permit from the Wildlife Section, Forestry Division.

The success in reducing poaching in Trinidad through the establishment of a local co-management program has been a major achievement in preserving the nesting colonies. Furthermore, the environmental outreach activities conducted by these village organisations have been extraordinarily successful in elevating the status of sea turtles among Trinbagonians. As a result of dedicated community-led efforts that span many years, Leatherback populations have stabilised in our country. In contrast, some of the largest Leatherback populations in the world are now nearly extinct because such care has not been taken. The most dramatic declines have occurred in Pacific Mexico and Costa Rica, as well as in Malaysia and other Asian countries. Except for French Guiana-Suriname, most Caribbean populations are also very small.

In Trinidad and Tobago, we will better understand the global nature of the threats the population faces by tagging all Leatherbacks. A Satellite-tracking project by Dr Scott Eckert revealed that Leatherbacks travel to two areas of the world after nesting in Trinidad: Canadian waters off Nova Scotia and to the Cape Verde islands off the West Coast of Africa. Researchers are currently collaborating in both of those areas and will utilize that relationship to contact fisherman in those areas to advise them of our project and to be on the lookout for turtles tagged in Trinidad and Tobago.

Up to 2012, most resources had been dedicated to addressing the immediate threats to the Leatherback population. The result indicates that the status of the nesting stock is still unclear, and there isn't a quantified assessment of population size. Both of these values are vital to the sustained management of this important nesting aggregation.

Over the past 10 years, the Turtle Village Trust has been supporting a National Monitoring Programme through the sponsorship of BHP Billiton Trinidad & Tobago and more recently and consistently Atlantic LNG. This support saw the involvement of groups in Grande Riviere, Matura, Fishing Pond and Southwest Tobago in consistent monitoring efforts and increased efforts with lesser studied species.

As an approach to sea turtle protection and rehabilitation the Forestry Division and local NGO groups-Nature Seekers and Save our Seaturtles-Tobago, WIDECAST and the UNEP Caribbean Environment Programme designed a National Sea Turtle Recovery Action Plan. One of the recommendations of this document was to implement a full scale national sea turtle tagging and monitoring programme. As such, in 2013 TVT acquired resources from the Green Fund to establish the National Sea Turtle Conservation Project and increase patrol coverage, equipment acquisition and enhance public education of the conservation efforts expanding the programme to a national level on beaches of Trinidad and Tobago.

Research conducted on our local beaches informs sea turtle conservation and management and awareness which in turn promotes sea turtle conservation throughout the world. The 5 species of sea turtles nesting and foraging in Trinidad and Tobago were designated Environmentally Sensitive Species in 2014 (EMA 2014).

4 Personal and collective responsibility to our environment

"Everyday choices and acts by individuals play an important role for the future of political, social and economic life. In short, every person is part of global responsibility-taking" (Michele Micheletti 2003)

Destructive changes to the environment have increased significantly in recent decades due to increased industrial development and under-managed resource use. While a lot of this devastation can be attributed to large corporations and wealthy nations, this does not exonerate small-scale or even individual acts which have contributed to environmental damage. The actions performed by individuals have aggregate negative consequences on the environment.

Rather than focus on the blame and backward-looking responsibility for actions which have caused detriment to the environment, it is crucial that each individual and institution; with increased awareness of the environmental consequences of their actions, increased alternatives, capacity and resources, accrue moral responsibility in a forward-sense for future actions. Future generations are relying on the actions we take today for their benefit and for the environment in which they will live.

If sea turtles go extinct, many other plants and animals in marine ecosystems will be negatively impacted and the environment will be irreparably altered. Sea turtles are also an economic resource, particularly to local communities, providing a potential food source, a tourism attraction and ecosystem services- benefits such as seagrass maintenance, coral reef management, beach stabilisation and climate regulation. Conservation and sustainability decisions are fundamentally ethical decisions. Conservation is therefore a personal choice for each individual.

A conservation ethic helps narrow any gaps in government regulations, persons make the choice to preserve without a law or penalty. Individuals and private corporations can withstand pressure from private interests and changes in the political climate.

Community persons play a central role in conserving local sea turtle populations and in documenting the abundance and distribution of nesting females and turtles in offshore areas. Beach patrollers, tour guides, fisherfolk and other citizens help provide a better understanding of the biology of sea turtles. Local communities must manage their natural resources and ensure a future with healthy wildlife, including sea turtle populations, and sustainable economic growth. Communities thrive in healthy ecosystems.

5 Ethical treatment of Sea Turtles

Taggers must always have an ethical attitude with full respect for the turtle. They are sensitive animals and can be stressed by human interaction.

AVOID:

- long periods of immobilisation, keeping the turtle cool and moist should it need to be restrained
- direct artificial lighting on the eyes or at the shoreline with approaching turtles,
- use of excessive force,
- excessive, sudden noises
- multiple taggings

DO:

- Every turtle should be assessed to determine their general state of health and suitability for research procedures.
- Nesting females should be allowed to emerge from the water, nest and return to the sea unhindered.
- Occasionally issues arise where intervention is required for their safety and the animal should always be treated with care.
- Turtles should be protected from temperature extremes and kept moist with a wet towel or periodical spray with water.

Additional important notes:

- Leatherbacks should not be turned on their backs.
- Comatose or unresponsive sea turtles should be transported as quickly as possible to a rehabilitation facility or veterinary hospital whenever possible.
- All equipment that comes into contact with sea turtle body fluids, cuts, lesions must be disinfected before use with other turtles. Any equipment or materials that comes in contact with animals displaying disease, particularly Fibropapilloma tumours, should be destroyed or disinfected using bleach.

6 Sea Turtle Biology

6.1 Reptiles

This includes sea turtles, snakes, lizards, crocodiles, and dinosaurs. Reptiles have the following characteristics:

1. A **vertebral (spinal) column** supports the body. Mammals, birds, fish, and amphibians also have a vertebral column.

2. **Epidermal scales** decrease water loss while protecting muscles and internal organs.

3. **Lungs** to breathe air (unlike fish that have gills). Sea turtles must come to the water's surface to breathe; they are capable of drowning.

4. **Ectothermic,** or "cold-blooded," meaning the environment determines a reptile's body temperature. However, the term "poikilothermic" is more accurate because reptiles regulate their body temperature through behaviour (movement, basking, hibernation, etc).

5. **Internal fertilisation** of eggs; males deposit sperm inside the female (unlike fish that release their eggs or sperm into the water).

6.2 Sea turtles are DIFFERENT than land tortoises.

	Sea turtles	Land tortoises
Shell	• hydro-dynamic shape increases swimming efficiency, but leaves no room for pulling head or limbs inside shell	• high-domed, provides room for pulling head and limbs inside shell
Locomotion (movement)	• long front flippers to paddle and swim, hind flippers are used to steer (as rudders) and dig nests	• legs and feet for walking on land
Predator avoidance or protection	• use swim speed, deep diving, hiding, or hard shell (however, cannot pull head or limbs into the shell for protection)	• pull head and limbs into the shell
Adaptations for the marine environment	• salt glands (similar to tear ducts) near the eyes pump excess salt out of the body in thick "tears" • store large amounts of oxygen in the blood and muscle tissue for swimming and diving • shell (see above)	• none

Note: Freshwater turtles have webbed feet and flattened shells.

6.3 BOTH sea turtles AND humans have the following:

System	Structure(s)	Function(s)
Circulatory	heart, blood vessels, blood	gas, waste, and nutrient transportation throughout the body, temperature regulation
Digestive	mouth, oesophagus, stomach, small intestine, colon	food breakdown and absorption
Excretory	kidneys, ureter, urinary bladder	filters wastes from the blood
Nervous	brain, eyes, ears, nose, spinal cord, nerves	controls the body, processes information
Osmoregulatory	kidney	regulates water balance
Reproductive	testes or ovaries	produce sperm or eggs
Respiratory	nose/mouth, trachea, lungs	breathing air, gas exchange

6.4 Identification of Sea Turtles in Trinidad and Tobago

There are five species of marine turtle that come ashore to nest in Trinidad and Tobago:

- Leatherback Turtle: *Dermochelys coriacea*
- Hawksbill Turtle: *Eretmochelys imbricata*
- Green Turtle: *Chelonia mydas*
- Loggerhead Turtle: *Caretta caretta*
- Olive Ridley Turtle: *Lepidochelys olivacea*

Simple Identification key

1. (a) Flexible shell with 5 distinct ridges; no scutes..... **Leatherback**
   (b) Bony shell with scutes…… 2
2. (a) Four pairs of costal (lateral) scutes…… 3
   (b) Five or more pairs of costal (lateral) scutes……. 4
3. (a) Two pairs of prefrontal scales…….. **Hawksbill**
   (b) Single pair of prefrontal scales…….. **Green**
4. (a) Five pairs of costal (lateral) scutes…….. **Loggerhead**
   (b) Six or more pairs of costal (lateral) scutes…… **Olive Ridley**

6.5 Terminology

1. **Carapace**-upper half of the shell. For Leatherbacks, usually black or dark brown with pink, white or bluish splotches (Gulko and Eckert 2003). Seven ridges run the entire length of the Leatherback carapace. Green and Hawkbill turtles have a hard carapace, usually brown, reddish-brown, green, with large shell plates (scutes). Hawkbills have overlapping scutes while Green turtles have non-overlapping scutes.

2. **Plastron**-lower half of the shell. The lighter or whitish colour in provides counter-shading effect. In Leatherbacks, six ridges on the plastron, plus those on the carapace, increase swimming efficiency.

3. **Cloaca**-area beneath the tail where the reproductive, urinary, and excretory systems empty. Internal fertilisation occurs here.

4. **Pineal gland**-light pink spot on the Leatherback turtle's head allows outside light to reach this gland inside the brain. The Leatherback probably uses this information to navigate.

5. **Prefrontal scale**- scale between the eyes, on top of the snout, of hardshell sea turtles. Green turtles have one pair (2 scales) of prefrontal scales while the Hawksbill turtle has two pairs (4 scales) of prefrontal scales.

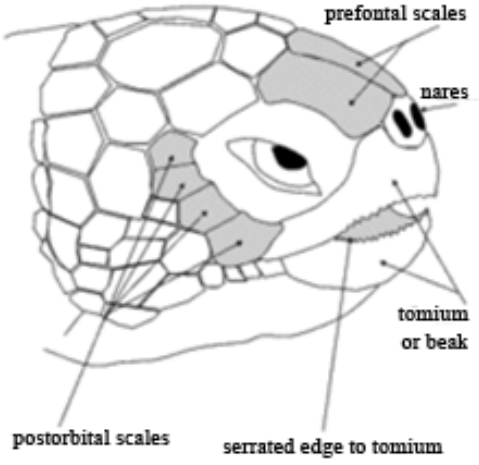


Image credit/source: EuroTurtle/FAO Species Catalogue Vol.11

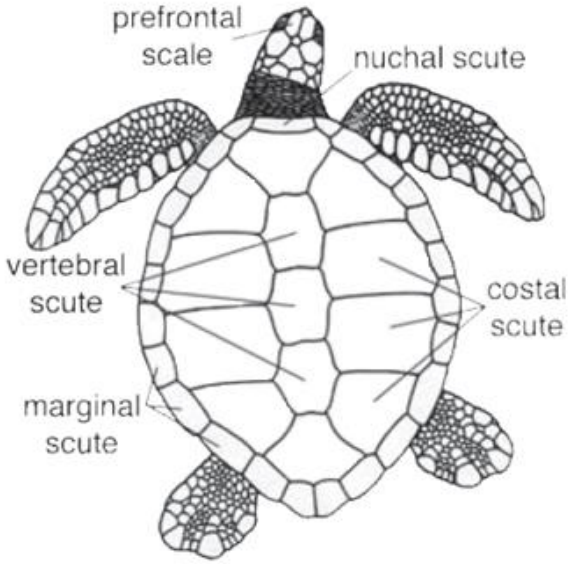


Image credit/Source: turtlesandtides.wordpress.com

7 Leatherback Sea Turtle

In Trinidad, the critically endangered Leatherback turtle (*Dermochelys coriacea*) is commonly called "caldong" or "coffinback." Leatherbacks are the largest marine turtle and one of the largest reptiles in the world. Adults can exceed 9 feet in length and weigh 2000 pounds or more (Gulko and Eckert 2003). These turtles are the most dominant nesting species on Trinidad's beaches. They are generally black with white spots (can also be a pink colouration). Unlike other marine turtles they do not have a hard shell but a leathery carapace which is relatively soft and has longitudinal ridges. Their large flippers and unique, ridged carapace allows them to swim long distances and dive to deep depths which is necessary for them to swim to their foraging areas in colder waters in the Northern Hemisphere and also aids in escaping predators. Adults lack head and flipper scales, while both adults and hatchlings lack flipper claws. Leatherback front flippers are longer and more paddle-like than the other sea turtle species.

The record largest Leatherback, a male, found stranded on the West Coast of Wales in 1988, had a curved carapace length (the length of the carapace from notch to tip, excluding the head and tail) over 3 metres (10 feet) and weighed 916 kilogrammes (almost 2020 pounds).

Based on current knowledge, it is impossible to determine the exact age of a living Leatherback. However, they are long-lived; needing 25-30 years just to reach sexual maturity. Some experts suggest Leatherbacks cannot live more than 100 years in the ocean due to the number of threats that exist. Others believe they can live much longer based on their size and growth rates. Bones, near the turtle's eyes, have "rings" much like a tree does; scientists are researching whether or not the number of rings indicates a turtle's age. Unfortunately, this procedure can only be performed on dead Leatherbacks.

8 Green Sea Turtle

Locally known as "green turtle" and "greenback", Green sea turtles are recognised by their round, blunt beak with one pair of scales between the eyes. Greens are variably coloured with light to dark brown, shades of green including olive and four pairs of non-overlapping lateral carapace scutes.

Adults attain weights of 230 kilogrammes (500lb) and grow to 95-120 centimetres in length.

Green sea turtles reach sexual maturity at estimated 18-36 years of age. While juvenile Greens may stay resident within local waters for extended periods, upon reaching sexual maturity they may migrate for mating and nesting. Sexually mature breeding individuals from other rookeries visit our waters for reproducing.

Young greens may feed on a diverse diet of crustaceans, worms, molluscs, tunicates and coelenterates which are also harbouring in Sargassum seaweed rafts in the open sea. Adult Green sea turtles are exclusively herbivorous feeding on seagrasses typically *Thalassia testudinum* known as "turtle grass".

9 Hawksbill Sea Turtle

Hawksbills are known as “oxbill” and “chicken turtle”. The species is distinguished by a narrow, pointed, bird-like shaped beak. The carapace is often posteriorly serrated and the four pairs of lateral carapace scutes overlap, like shingles on a roof. There are 2 pairs of prefrontal scales between the eyes, exposing a cross or ‘+’ of skin just above the breathing nares (nostrils).

Adults can weigh 90 kilogrammes (198lbs) and have a carapace length of 90 centimetres from nuchal notch to posterior tip of marginal scute. The carapace has been prized for is “tortoise shell” brown, orange, gold colouration for use in craft and jewellery.

Available evidence demonstrates that hawksbills reach sexual maturity between 15- 40 years. During a normal life cycle individual turtles disperse and migrate over long distances to about 1,000 kilometres, however, these turtles may be sedentary and resident for long periods in feeding areas, between reproductive migrations. Aggregations of Hawkbills at foraging grounds and other non-reproductive areas are a mix from distinct genetic stocks, populations. Each nesting population forms a discrete genetically isolated entity.

10 Loggerhead Sea Turtle

Loggerhead turtles can be distinguished by their relatively large heads. Adults are approximately 80-100cm CCL and 120-200kg. Their hard shells are generally a reddish brown. They have more than one pair of prefrontal scales and five or six costal scutes, the first of which touches the nuchal scute. Each flipper has two claws. These turtles are found less frequently in T&T than the other three species.

11 Olive Ridley Sea Turtle

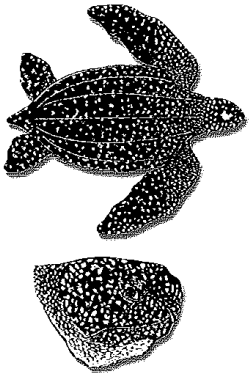
The Olive Ridley is very rare to our islands. They have a dome shaped carapace and are olive or greyish-green in colour. These turtles are relatively small at approximately 55-80cm CCL and 45-50kg. Their carapace can be divided into 6 or more costal scutes, the first of which touches the nuchal scute. They have more than one pair of prefrontal scales and one or two claws on each flipper. Olive Ridleys perform a most unique nesting habit whereby large numbers, hundreds or thousands, of these turtles come ashore to nest at the same time. This is called “arribada”. This arribada nesting occurs only on a few beaches worldwide and does not include Trinidad and Tobago; solitary nesting events have occurred locally.

All sea turtle species have historically been prized for human consumption- meat and eggs. Legal protection of these species has made the sale and consumption of turtle eggs, meat and other products illegal.

12 How to identify sea turtles of Trinidad and Tobago

How to Identify Sea Turtles of Trinidad and Tobago

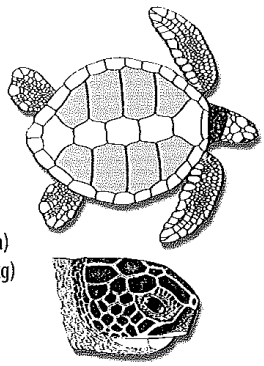
5 Species are found in Trinidad and Tobago



Leatherback
(Dermochelys coriacea)

Critically Endangered

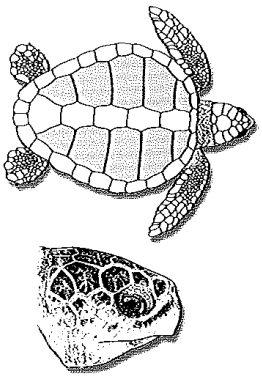
- Carapace (upper shell) leathery, with prominent ridges
- Carapace dark gray/black with white spots
- Plastron (belly) lightly coloured
- Length of adult females 4.5-6 feet (180 cm)
- Weight of females 550-1400 lb (250-650 kg) [males to 2000 lb (920 kg)]
- Adult head covered with unscaled skin



Green Turtle
(Chelonia mydas)

Endangered

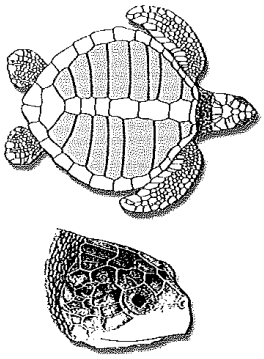
- Carapace brown with radiating streaks
- Plastron pale yellow
- 4 pairs of lateral scutes (shell plates)
- Length of adult females 3-4 feet (120 cm)
- Weight of adults 400 lb (120-180 kg)
- 1 pair of prefrontal scales (between the eyes)



Loggerhead Turtle
(Caretta caretta)

Endangered

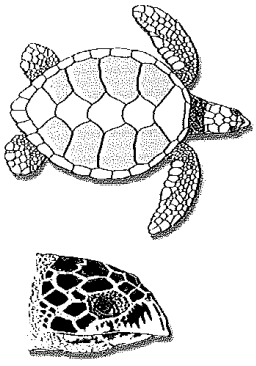
- Carapace broad and reddish-brown
- Plastron light yellow to light brown
- 5 pairs of lateral scutes
- Length of adult females 3-4 feet (120 cm)
- Weight of adults 400 lb (100-180 kg)
- Broad, large head
- 2 pairs of prefrontal scales



Olive Ridley Turtle
(Lepidochelys olivacea)

Endangered

- Carapace dark green/gray, nearly circular
- Plastron pale yellow
- Usually 6 pairs of lateral scutes or more
- Length of adult females 2-2.5 feet (60-75 cm)
- Weight of adults 70-110 lb (35-50 kg)
- Triangular-shaped head
- 2 pairs of prefrontal scales



Hawksbill
(Eretmochelys imbricata)

Critically Endangered

- Carapace brown, black and amber with over-lapping scutes
- Plastron yellow
- 4 pairs of lateral shell scutes
- Length of adult females 2-3 feet (90 cm)
- Weight of adults 132-176 lb (60-80 kg)
- Pointed face and distinct over-bite
- 2 pairs of prefrontal scales

Illustrations by Tom McFarland
Photography by Caroline Rogers and Grande Riviere Nature Tour Guide Association

13 Sea turtles of the World

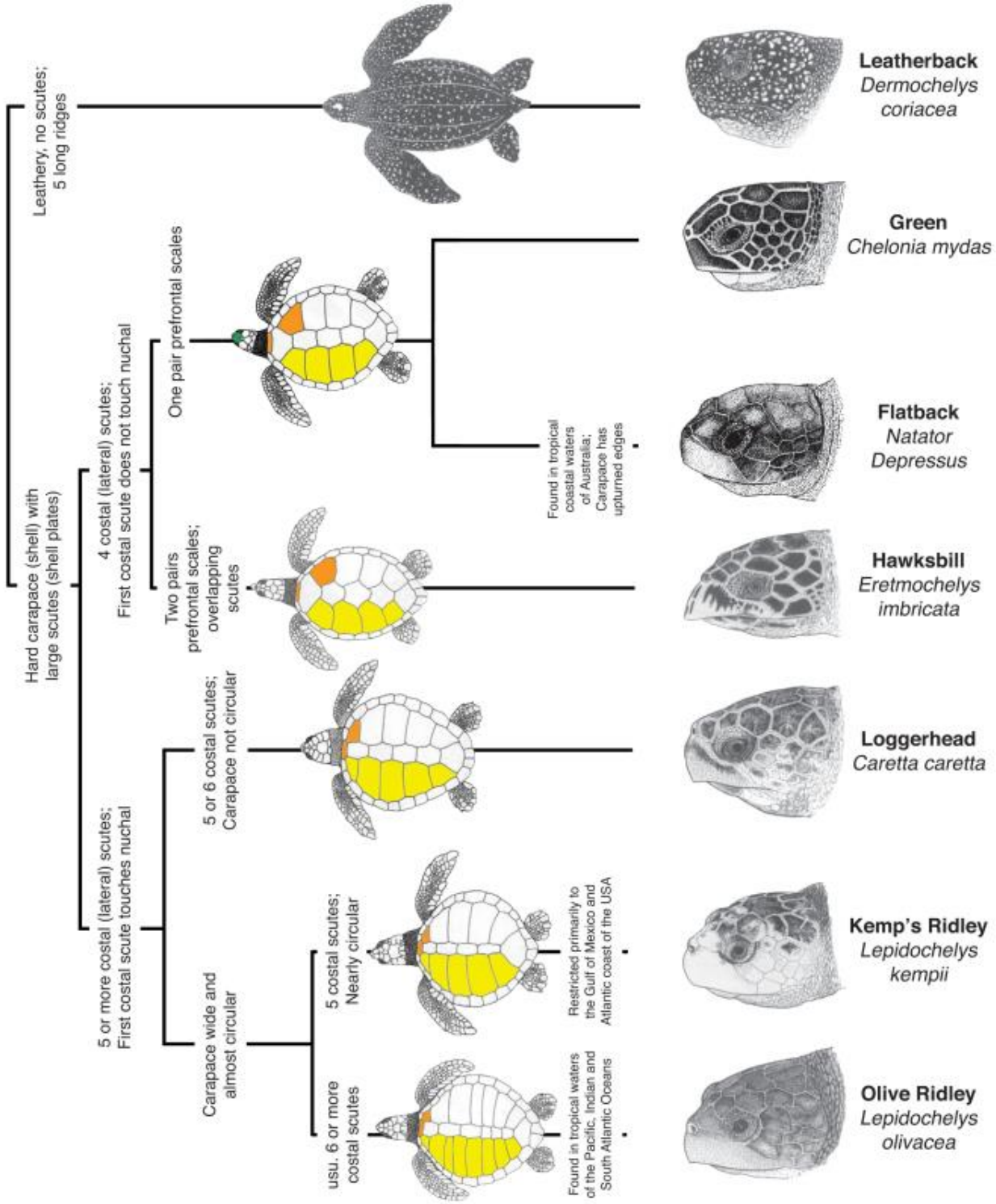


Image Credit/Source: NMFS/SEFC diagram modified from seaturtle.org

13.1 Common Characteristics of Sea Turtles

Biology and Behaviours	Leatherbacks	Hardshells (Green and Hawksbill)
Predator Avoidance and Turtle Migration	Leatherbacks avoid predators by swimming fast (up to 1.5 metres per second), and generally stay under water for 12-15 minute intervals. The dive depth record is 1.3 km (4265 feet); however, the dive recorder imploded under the pressure so the turtle may actually have gone deeper. Leatherbacks have the widest range of any sea turtle species, migrating between foraging and nesting areas. They are found as far north as Nova Scotia and Newfoundland (Canada), and as far south as South Africa. On average, Leatherbacks travel 10,000 km (6,200 miles) per nesting migration, and probably use current, magnetic field (magnetite inside the turtle's brain may serve as an internal compass), and seasonal changes in ambient light (detected by the pineal gland) and temperature to navigate. Leatherbacks migrate and forage alone, however, several may gather in the same area if prey density is high. Leatherbacks do not stop moving in tropical waters.	In their open sea existence, young hardshell turtles will converge in floating seaweed mats. Adult turtles shelter on reef shelves and rocky crevices. Individual turtles may disperse and migrate over long distances moving into the high seas and territorial waters of different countries while moving between feeding areas and nesting beaches. The same turtles may be sedentary and resident for long periods between reproductive migrations. Genetic analysis indicates that turtles from distinct genetic stocks coexist on feeding grounds and other non-reproductive areas.
Eating	Adult Leatherbacks feed on Portuguese Man-of-Wars and Lion's Mane sea jellies. The jellies, pierced by the turtle's three pointed jaw cusps, are guided toward the stomach by backward pointing spines in the mouth and oesophagus. Foraging grounds in the North Atlantic contain the largest jellies, and adults need to consume one to two times their weight in jellies daily. Hatchlings depend on their absorbed yolk sacs while swimming to foraging grounds.	Hawksbill juveniles and adults are "spongivores" feeding primarily on reef-associated sponges in the Caribbean. Their pointed beaks yank sponges and soft-bodied organisms from the reef. Hawksbills are observed foraging offshore coincident with the distribution of coral reefs and other hard bottom habitat in Trinidad and Tobago. Greens are exclusively herbivorous, beyond post-hatchling stage.
Mating	Sea turtles (like all reptiles) have internal fertilisation, and mating may take several hours (Gulko and Eckert 2003). To facilitate the male mounting the female from behind, males have longer tails and a slightly concave plastron. Male sea turtles spend their entire life at sea, while females return to the general location of their birth to nest. Females, 25-30 years of age, mate and nest on average every 2-3 years. They store sperm from multiple males to fertilize eggs throughout the nesting season. During off years (when they are not nesting), females eat to increase their body mass in preparation for the nesting year.	

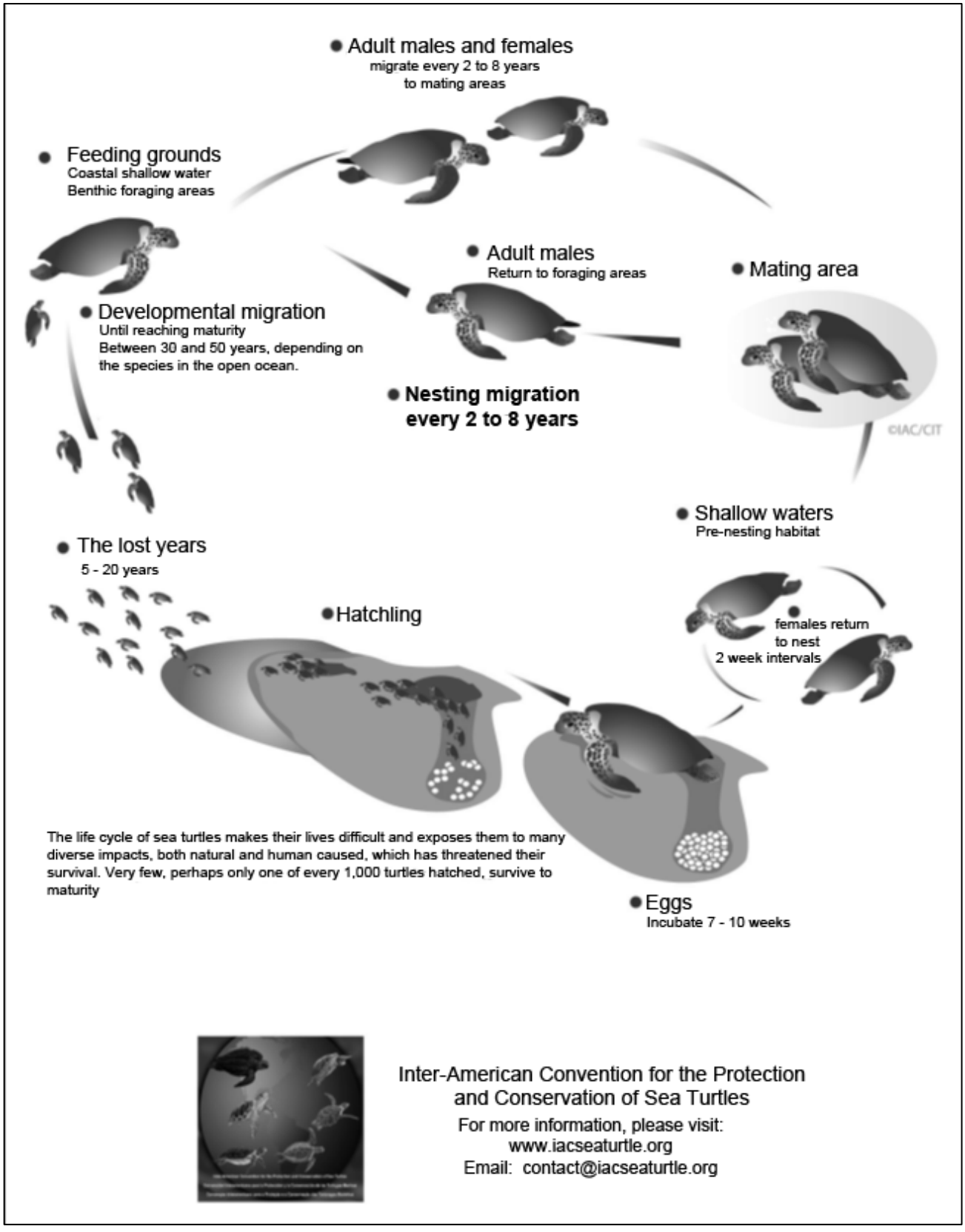
<table>
<tr><td></td><td colspan="2"></td></tr>
<tr><td rowspan="4">Nesting</td><td colspan="2">Nesting at night reduces the probability of predation on turtles and eggs; females are sensitive to light and avoid brightly lighted beaches (due to development, flashlights, or vehicle headlights). Turtle tracks can be used to determine the type of turtle, the stages of nesting, and whether or not eggs were successfully laid.</td></tr>
<tr><td>Leatherbacks prefer to nest on isolated beaches next to deep water without reefs.

The season generally begins in March and ends in August or September.</td><td>Female Green and Hawksbill sea turtles often lay their eggs in the shelter of the beach vegetation and on isolated beaches and coves flanked by exposed coral and rock. Hawksbills commonly nest on pebble beaches digging below the rock surface to nest in the sand below.</td></tr>
<tr><td>Leatherback clutches contain 80-120 eggs.</td><td>Hawksbill and Green clutches contain 60-200 eggs.</td></tr>
<tr><td colspan="2">Clutches have odd-shaped yolkless eggs in addition to the perfectly round, fertilised eggs. The yolkless eggs dry out and collapse, probably to allow space for gas exchange and movement of emerging hatchlings. Warm and/or dry months are best for incubating eggs, which take 50-70 days to hatch.</td></tr>
<tr><td>Senses</td><td colspan="2">1. Hearing: Sea turtles lack external ears, but have skin-covered ear canals that are sensitive to low frequency sounds (Gulko and Eckert 2003).

2. Vision: All sea turtles are sensitive to light. They may not see very far when they are on land.

3. Smell: A good sense of smell may help sea turtles find their prey in the water.</td></tr>
<tr><td>Temperature-dependent Sex Determination (TSD)</td><td colspan="2">Incubation temperatures determine the sex of hatchlings. Warmer temperatures produce females, cooler temperatures produce males (hot chicks, cool dudes). Not only is sand temperature important, but so is an egg's position within a nest. Eggs at the centre of a nest tend to be warmer than eggs along the outside of the nest. Vegetation shades sand, thereby reducing the temperature, while proximity to cool ocean water does the same.</td></tr>
</table>

13.2 Sea Turtle Life Cycle



Inter-American Convention for the Protection and Conservation of Sea Turtles

For more information, please visit:
www.iacseaturtle.org
Email: contact@iacseaturtle.org

Image Credit/Source: unknown

Leatherback open jaw and a diving Leatherback sea turtle.

13.3 Nesting Process

1. A female turtle **emerges** from the water (usually at high tide) and selects a nest site based on sand temperature, moisture content (damp enough not to collapse during digging), grain size (porous enough to allow gas exchange), and vegetation.

2. The turtle **body pits**, using front and rear flippers, to remove dry surface sand. This keeps the sand from falling back into the nest during digging.

3. Using rear flippers to dig, the turtle **excavates** the flask-shaped nest (narrow at the top, wider at the bottom). The wider, bottom area is the "egg chamber."

4. Once the nest is excavated, the female **lays** a clutch of eggs (80-120, including yolked and yolkless). The soft shell allows the eggs to drop 3 feet into the nest without breaking. During this phase, the female is less aware of her surroundings; some consider this a trance or semi-trance.

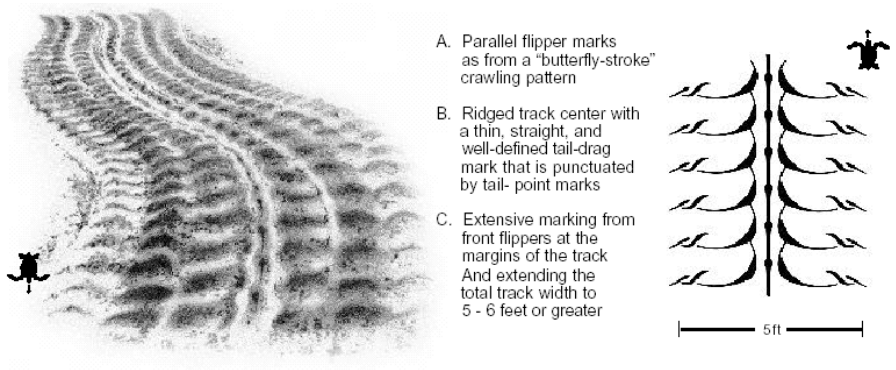
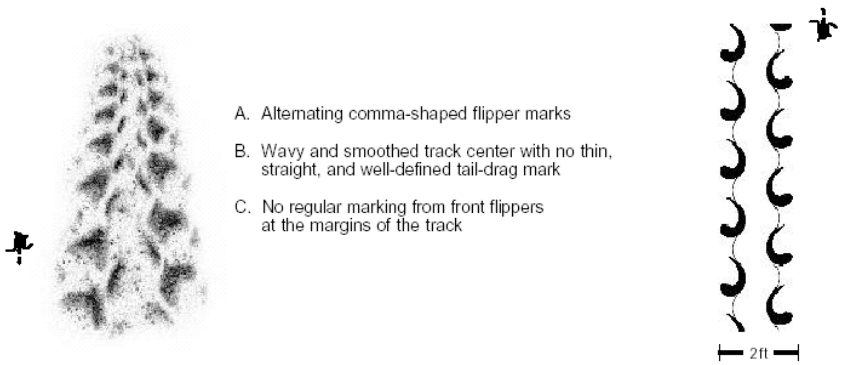
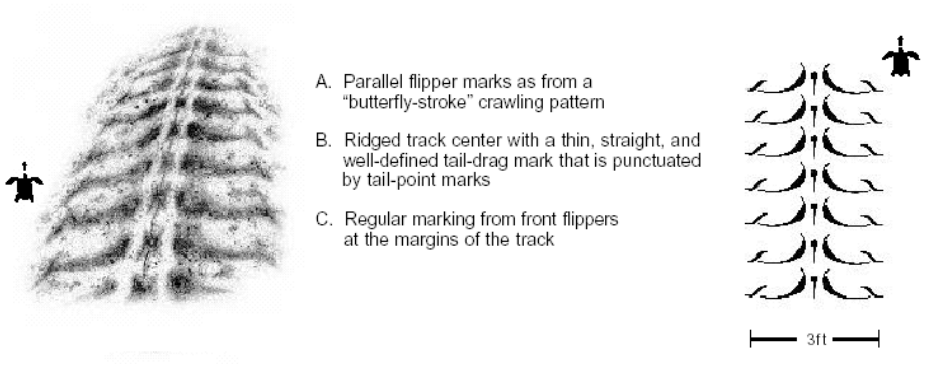
5. Once the female is done laying eggs, she **covers** the nest by filling it with sand and packing it down with her rear flippers.

6. Next, the female **camouflages** the nest to hide it from predators. She uses both her front and rear flippers to distribute sand.

7. Finally, she **returns** to the water never to see or care for her hatchlings.

13.4 Crawl identification

The best count for determining population abundance and trends is the actual number of nesting females. Due to logistical and financial constraints, the count of uniquely identified females is not always possible so a crawl count is used to estimate nesting abundance. These are best conducted in the early morning when the shadows on the sand are longer. Tracks should be distinguished as "fresh" or "old". Species can be identified by their crawl pattern. A **symmetrical** track is formed when the front flippers move together synchronously to pull the turtle over the surface of the sand, resulting in a track in which the right and left halves are almost mirror images. An **asymmetrical** track is formed when the front flippers move alternately (right, left, right, left, etc.) to carry the turtle forward.

Leatherback *Track width:* 150-230 cm *Type of track:* very deep and broad, with symmetrical diagonal marks made by the forelimbs, and usually with a deep incised median groove formed by dragging the relatively long tail.	
Hawksbill *Track width:* typically 70-85 cm. *Type of track:* shallow, with alternating (asymmetrical), oblique marks made by the forelimbs. Tail drag mark may be present or absent.	
Green Sea Turtle *Track width:* typically about 100-130 cm but variable. *Type of track:* deeply cut, with symmetrical diagonal markings made by the forelimbs. Straight, central tail drag marks present, either as a solid or a broken line.	
(Pritchard & Mortimer 1999)	(Harold & Eckert 2005)

13.5 Hatchlings

Image Credit/Source: Nature Seeker Leatherback hatchling

After incubating for 60-70 days, 2-3 inch long hatchlings use an "egg tooth" to break out of the shell (the egg tooth breaks off shortly thereafter). Movement of one hatchling stimulates the others to hatch.

To emerge from the nest, they must use "**protocooperation**," meaning the hatchlings crawl out of the nest as a group, which may take several days. They alternate digging and resting (until oxygen decreases or increases, respectively), stopping just below the surface of the sand until it cools, which usually occurs in the late afternoon or early evening.

Hatchlings **MUST** crawl on the sand before entering the water; this provides an opportunity for imprinting on the smell of the sand, the magnetic location, and any other factors hatchlings use to later identify the beach where they were born.

Obstacles to reaching the ocean include: footprints, vehicle tracks, driftwood, litter, predators, and humans. One in a thousand hatchlings will survive to become a reproducing adult, which is why females lay so many eggs (to compensate for high hatchling and juvenile mortality). Hatchlings are very sensitive to light, and look for the lightest horizon (which should be the moonlit ocean surf) to determine which way to go. Artificial lighting will disorient hatchlings, and may even be lethal if the hatchling reaches roadways or spends too much time crawling on the beach. Once a hatchling reaches the ocean, it swims to its juvenile foraging grounds where it will finally rest, eat, grow, and try to survive predators until it becomes a reproducing adult.

13.6 Threats to Sea Turtles

Natural Threats:

1. Erosion (caused by rain or tide) or accretion (sand deposited on the nest)
2. Unusual temperature fluctuations
3. Bacterial invasions (especially from decomposing nests nearby)
4. Root growth from nearby vegetation
5. Driftwood (a problem on Matura Beach)
6. Predators at different stages:
    a. Eggs and hatchlings - crabs, birds (night herons and vultures), insects, dogs, and opossum
    b. Juveniles - fish, birds, and sharks
    c. Adults - Killer whales and sharks (adults have few predators due to their large size)

Human Threats:

1. Boat propeller strikes
2. Recreational equipment and furniture (ex. umbrellas, chairs, fishing poles, or volleyball nets)
3. Bonfires
4. Vehicles
5. Pedestrian traffic
6. Litter and pollution
7. Mistreatment (riding, chasing, capturing or otherwise disturbing turtles)
8. Fisheries by catch
9. Coastal development and artificial lighting
10. Vegetation removal or beach nourishment
11. Inadequate laws or enforcement

14 Nest monitoring and Data collection

14.1 Physical requirements of personnel in the field

Please keep in mind that conditions may change and the project activities could potentially be more or less strenuous:

Physical Activity	**Workload Intensity**
Bending	Regular bending for gathering data, typically 50 times per night depending on the number of turtles nesting.
Walking	Quickly and on soft sand. Walking for up to 8 hours per night for tagging, 3-4 hours for morning crawl counts, nest excavations, beach profiling. Distance will depend on the number of turtles nesting and the length of the beach.
Carrying	Field equipment, approximately 10lbs, can be shared among the data collection team. Each person will carry their personal belongings- water, snacks, raincoat/umbrella, etc.
Digging	Excavating by hand burrows 3-5ft deep in sand. This daylight activity means heat and humidity also influence intensity.

Appropriate wear and gear:

- Dark coloured, lightweight and full-length shirts and pants are advised at night.
- Comfortable, lightweight, full-coverage, quick drying boots, sneakers or shoes.
- Small waterproof bag for storage
- Writing materials
- Watch
- Adequate drinking water and food
- Raincoat/ umbrella and hat or sunscreen
- Insect repellent if desired – liquid pump sprays, creams/gels, bands/bracelets preferred to aerosol cans

Data accuracy

The accurate collecting and recording of data is of utmost importance to uphold the scientific validity of the Project. If you are unsure, please recheck or ask for clarification.

Ethical treatment of animals

In compliance with Special Game License, Wildlife Section.

Attitude to visitors

Please be polite to visitors. Do not get involved in discussions regarding controversial subjects with beachgoers. Do not be impolite, if they have comments they want to make, practice good listening skills or direct them to a TVT or Forestry staff member. It is always better to say too little than too much. Volunteers are seen by the public as part of the NSTCP and therefore represent the Project and its sponsors. Please behave in a respectable manner that displays professionalism.

Personal Belongings

Do not bring large sums of money with you and make sure your personal belongings are either out of sight or secured in your possession. TVT is not responsible for any lost items.

Lighting

No white light is allowed on the beach without approval by TVT staff and only in very special circumstances. Please use a red filtered light or allow your eyes to adjust to the ambient light.

Adhere to Safety Tips

- **Never wander off alone**. Always inform your team of your whereabouts and never be out of viewing or hearing distance.
- **Never turn your back to the ocean or enter the water**.
- **Walk quickly, do not run on the beach**.
- **Always wear appropriate apparel and footwear**.

Should you or someone on the beach require medical assistance please inform the other Project members present and alert the nearest First Responders.

There is an element of risk to the researcher when tagging large turtles on a nesting beach, as powerful, fast and unexpected swings of the front flippers can inflict painful blows. Tag applicators not gripped firmly may be turned into hazardous projectiles as a result of violent flipper movements. A flipper can fling sand into a researchers' eyes and durable shoes are advisable to protect against foot injury from a nesting turtle that suddenly decides to crawl while being tagged. The sharp point of a metal tag and the injector needle of a PIT tag are also hazardous and can easily puncture a hand if care is not taken.

Media

Volunteers are not permitted to give the media any information regarding TVT. Please refer all media to the Project Manager.

Return TVT equipment and materials

Replacement or repayment will be required for any damage or loss incurred.

Separation

A volunteer may be separated for any of the following reasons:

- Failing to observe TVT policies
- Abusing drugs or alcohol while on duty
- Behaving inappropriately

DUTIES WILL BE CONDUCTED RAIN OR SHINE,

DURING THE NIGHT HOURS AND EARLY MORNING HOURS.

14.2 Conducting the survey

Journey to and Arrival at the beach

Aim to reach the beach before complete darkness. This makes it easier for you to assess your surroundings and prepare yourself before the start of patrol. On your way to the beach and once you arrive at the beach, please scope out your surroundings carefully. Make note of entrances and exits from the beach, the location of the nearest health centre, police station or security personnel/post, toilet and waste facilities if available, check for cellular phone reception and note the number of persons on site and types of activities.

Identify yourself to any home owners and the lifeguard or security officer if present.

Once the survey team is assembled at the designated area begin your surveillance of the beach by traversing the beach walking along the latest high tide line. Look for signs of "old" crawls or nesting activity. Any event occurring before the initial survey should be identifiable as "marked" - a line drawn through the crawl with a stick or a sweeping of the sand with feet or branch. These crawls and nests are not to be included in further counts. It's useful to record the time taken to cross the entire beach. This will help you plan the intervals for patrols.

The walking survey technique

Surveyors should move along the beach at the level of the latest high tide. Upon discovery of a crawl, confirm that it is "fresh". There should be no "marking" as yet. Visually determine the crawl type and the species of sea turtle that made the crawl. Check for evidence that the turtle may still be on the beach. For Hawksbill turtles this will likely involve checking at the vegetation line.

Record any information including species, crawl type, GPS coordinates. This data is written on the ***CENSUS DATA SHEET***. Once the crawl has been recorded it should be "marked" to prevent double counting. This can be done by drawing a line through the crawl with a stick or sweeping/raking over the crawl with feet or with a branch.

In the event that the turtle is in the nesting process, follow the protocol for recording a nesting event.

If the turtle has already returned to sea, proceed with the patrol along the beach noting any other nesting activity.

On each patrol you must cover the length of the beach as far as the tide allows. The patrols should be carried out at a maximum of 2 hour intervals.

Nesting Event Recording

If you encounter a turtle actively nesting you should determine the stage of nesting she is in:

1. Approaching 2.Body pitting 3.Digging 4.Laying

5. Covering 6.Camouflaging 7.Leaving

A ***NESTING EVENT DATA SHEET*** must be filled out for all sea turtles encountered on the beach.

In the early stages of nesting, before laying, sea turtles are easily deterred by movement, sound and light so keep a distance and approach from behind.

Once the turtle is encountered in the early nesting stages she can be recorded on the census and the patrol can proceed to see if any other nesting events are taking place. If the number of surveyors allows or circumstances advise, the patrol can remain with the turtle throughout the nesting to ensure her safety.

Tag placement or tag return data should be conducted during laying.

Triangulation

At a confirmed laying, the GPS coordinates of the nest should be taken. A triangulation of the nest requires a measuring tape to be pulled from the nest site to 2 fixed points- this could be a tree, post, or any immovable marker- to create a triangle with the nest site at the apex. The GPS coordinates, distance measurements and description of the markers are recorded on the **TRIANGULATION DATA SHEET**. A triangulated nest should be identified in the Notes box on the Nesting Event Data Sheet.

Morning counts

The significant difference between the surveys conducted at night and those in the early morning are that there will likely be no nesting events during daylight hours. The beach needs to be walked only once. All the data can be collected in one patrol. The data recording remains the same.

Between Patrols and Leaving the site

It is advisable that you conserve as much energy between patrols, always keeping alert for sea turtles nesting as well as for your own safety.

At the end of a survey period, secure the datasheets and any other equipment used, remember to collect all your belongings and do a final head count before saying goodbye and driving away.

Please do not leave your waste behind.

NESTING EVENT DATA SHEET- HOW TO GUIDE

NESTING EVENT DATA SHEET

★Minimum data which must be collected for each nesting

★**Date:** ___/___/___ (D M Y) ★**Time:** _____

★**Tagger(s)** _____

★**Location:** _____ **Zone** _____

N __ __/__ __/__ __ __

W __ __/__ __/__ __ __

GPS # _____

 # Tourist/persons around turtle ____

Turtle disturbed by: People Lights Animal

Tag Scars | **Flipper Tag #**

Y NEW/ RET LEFT/ RIGHT _____

Y NEW/ RET LEFT/ RIGHT _____

Y NEW/ RET LEFT/ RIGHT _____

Scanner # _____

PIT Tag _____

PIT Tag _____

Does carapace damage affect measurement? Y N

CCL: _____ (cm) CCW: _____ (cm) N -- N _____ (cm)

Nest disturbance Y / N Viable/ Non-viable

Nest relocated to:

Location: _____ **Zone** ____

N __ __/__ __/__ __ __

W __ __/__ __/__ __ __

Egg count _____

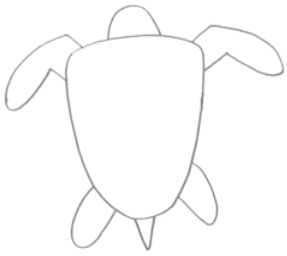
Species
LBT
HWK
GRN
other

Weather
Clear Overcast
Rain Stormy

Activity
Approach
Body pitting
Digging
Laying
Covering
Camouflaging
Leaving
Gone
Dead
Unknown

★**Outcome**
Confirmed lay
Estimated lay
False crawl (FC)
FC w/ body pit
Poaching
Dead
Stranding
Unknown

NOTES



Names of all taggers/ data collectors at the

Circle whether there are tag scars and circle which flipper

Circle whether the tag is New or Return

Used to identify the Scanner unit being used

CCL- Curved Carapace length (Notch to tip)
CCW- Curved Carapace Width
N-N – Curved Carapace Length (Notch to Notch)

State whether turtle disturbed another nest while excavating nest. Viable= some disturbance but nest may survive Non-viable= all or most eggs were lost

Used when nest is relocated

Circle ONLY ONE option of each- Weather, Activity and

Used to identify the GPS unit being used

If you see eggs being laid, the Outcome is Confirmed Lay

Give detailed descriptions of any additional information or observations. Try to be specific. Use the turtle outline drawing to indicate injuries or abnormalities

15 The Importance and Reasons for Tagging

Input from Scott Eckert & Dennis Sammy

Historically tagging has been the single most valuable activity in advancing our understanding of sea turtles and their conservation needs in relation to complex life cycles, reproductive migrations, growth rates and sexual maturation. In many cases a commitment to years of systematic tagging of even a few turtles, particularly at nesting beaches where tagging had never been conducted, can yield valuable insight into migrations and the locations of resident feeding grounds.

The first goal of a tagging program must be to minimize tag loss to ensure that recognition is retained, while not causing any lasting harm to the turtle from the tagging process. The second critical goal is to measure the extent of tag loss in order to correctly interpret resulting data and to adjust tagging techniques accordingly.

There are two main types of tagging equipment used on turtles – external flipper tags and internal Passive Integrated Transponder tags. In addition, some researchers paint the individuals and take photos of their frontal pink spots or scutes as identification guides.

15.1 Flipper tags

The tags used in Trinidad & Tobago are #49 Monel external flipper tags and PIT tags for Leatherbacks, the #681 Inconel external flipper tags for Greens and Hawksbills. Each has their benefits and disadvantages, but used together they provide a good system for identification.

Metal tags require a special applicator for proper attachment. When the applicator is squeezed the sharp point of the tag pierces through the flipper and passes under a bridge on the opposite end of the tag where it bends over and locks into place. The resulting shape of the tag is oval with no parts that can easily entangle in a net. Difficulties in applying metal tags are sometimes experienced. Incomplete sealing of the tag's point or the point prematurely bending over can occur. Malfunctions applying metal tags can also result from the use of applicators that are rusted, clogged with sand or other debris or are worn from heavy use. All tag applicators must be inspected and cleaned on a routine basis and discarded when they cease to function properly.

Each TVT tag has an ID number of five digits and a letter, e.g. T14068. In addition to the number on the tag, there is a space for a message, a concise mailing address or other means of notification. For tags issued by other projects, this information should be noted on the datasheet.

The main disadvantage of external flipper tags is the factor of loss over time. Sea turtles shed flipper tags for a variety of reasons including tissue necrosis, abrasion, corrosion, tearing and improper application. Tags secured to the fore flipper of a Leatherback turtle can carve furrows in the carapace as a result of contact during swimming and nesting and can pinch the skin on the body, leaving the

animal bleeding and vulnerable to infection. Barnacles, algae and other fouling organisms can cover the number and increase drag producing tearing which can lead to loss.

The placement of 2 tags, referred to as “double tagging”, means that 1 tag operates as an insurance policy against losses and increases the likelihood that a turtle will retain her unique identification over several years.

Here are a few notes about flipper tagging:

a) Turtles emerging to nest should be allowed to start laying their eggs before tagging takes place, for two reasons: one is that during this stage the turtle will be unlikely to abandon the nest if any discomfort occurs and the second is that this is the time when the turtle remains still and tagging is therefore much easier than when there is flipper movement.
b) Tags that fail to lock should be removed from the turtle, recorded as destroyed and replaced. Old tags present on recaptured turtles that are unreadable due to corrosion or being embedded with tissue should be removed and replaced with a new tag if possible.
c) When applying metal tags squeeze the applicator until the tag pierces the flipper. After this apply a greater force to make sure the point bends over properly. The handles of the applicator should always be gripped as far back as possible to gain maximum leverage. Using both hands can help.

If tag loss is high, returns will only tell you what turtles are capable of, not what the average turtle does. It may be that an individual female can nest 8 times in a season, but to calculate the population for a given beach from the number of nests laid there in a season, it is necessary to know how many times on average an individual lays. If turtles are found to grow slowly, how can you be sure that fast growing animals have not shed their tags? If most turtles are never seen again after tagging does that mean few ever return to breed again or that their tags dropped off?

Double tagging helps with the assessment of the frequency of tag loss - from the number of turtles returning with only one tag an estimate can be made of the minimum tag loss. The real figure will be slightly higher as some turtles will lose both their tags and go unrecognised. Scars do not give a good idea of previous tags as the tag holes are found to heal over and scars could also be due to other injuries. Tag scars have been used in the past to assume previous tagging, however this is being phased out due to inaccuracy. Tagging is as yet a crude approach, but the process is improving over time.

It is easy to learn about the number of days between successive nestings by a turtle (inter-nesting interval) because the tag only has to stay on for 10 days or so. To find out how many eggs an individual lays in a season, the tags must remain intact throughout the season.

The question of total output of eggs by an average turtle is an important one for conservation. In a stable population, to replace itself each female has to produce one female and one male, assuming a 1:1 sex ratio. Knowing the number of eggs a female lays naturally to ensure 2 surviving to maturity helps assess the levels of exploitation and the scope of measures designed to protect the eggs. To tackle the

question of how rapidly old turtles are replaced by new ones, how dynamic the population is, we need tags that stay on many years or, failing that, estimates of tag loss.

15.2 PIT tags

There are only three places in the Western Atlantic Basin where PIT tags are currently being placed on nesting Leatherback turtles – the U.S. Virgin Islands, French Guiana and Trinidad & Tobago. This elite group will hopefully increase in size in the future and this long-term research project will provide the global research and conservation community with highly accurate and vital information on the status of this highly endangered animal.

The application of PIT tags will help to determine more accurately: population size (how many turtles nest in Trinidad?), recruitment (how many babies grow up and return to the nesting beach?), remigration (how many years does a turtle stay away before she returns to lay her eggs again?), clutch frequency (how often does a turtle nest and at what intervals?), tag loss (how many of the external markers stay on long enough to enable you to identify an individual 5 or 10 years later?) and other questions important to conservation and management.

Passive integrated transponder or PIT tags are small inert microprocessors sealed in glass that can transmit a unique identification number to a handheld reader when the reader activates the tag with a low frequency radio signal at close range. PIT tags can be inserted into the shoulder muscle of Leatherback sea turtles.

The disadvantages of PIT tags included their high cost, the cost of the readers and the inability of someone without a reader to detect that the turtle has been tagged. In addition, PIT tags can sometimes migrate within body tissue making it necessary to carefully scan the entire area where implantation occurred. Several brands of PIT tags and scanners are operating at different frequencies. Some are cross-compatible, but others only read their own tags. There needs to be standardisation between countries if identification of turtles visiting beaches in different countries is to become possible.

However, there are many advantages of the PIT tags over external flipper tags such as loss or damage over time from abrasion, breakage, corrosion or tearing being virtually non-existent. These PIT tags could retain the identification of an individual for decades if the tagging program is conducted thoroughly and PIT tags are placed correctly. Due to high retention rates this technology will allow the determination of population size, remigration rates, survivorship, rates of flipper loss and other important aspects with much higher levels of certainty then would be possible with flipper tagging alone.

As PIT tags are thought to have nearly 100% retention over many years, it has been discovered that even more flipper tags were being lost than previously thought. Low flipper tag retention helps to explain why the majority of turtles tagged on nesting beaches are only seen in one season and even if they are returning every 3 years they will no longer have their tags in place. There has been a great deal

of misidentification. It can be reasonably assumed that the influx of untagged turtles to the beach represents recruitment of new individuals. As PIT tags are very expensive, information gained from using them in some countries (for example % flipper tag loss) can be passed on to other regions where the external flipper tag results can be adjusted to increase their accuracy.

A standard injection procedure implants the identity tag quickly and safely into the turtle's muscle. No anesthesia is needed. Accident or injury to the animal will not prevent reading of the tag (flipper loss or damage can remove flipper tags from the turtle). Each tag is manufactured and programmed under computer control to insure against duplication of identification codes. The number can never be altered. The tag number is displayed on the LCD of the reader in an easy to read format.

15.3 Tagging event recording

The tag numbers, tag type, date and place of tagging and all data collected at the tagging event should be accurately and clearly recorded for future retrieval. The main value of tagging results from the recovery and recognition of a turtle at some later date.

The best option overall is to PIT tag in conjunction with two flipper tags per turtle to make the most of the advantages of each system.

In summary tags can reveal many things including:

1. Migratory paths and geographical range when tags are sent back from a distance.
2. Breeding frequency, does a female return every year, 2 years or 3 years?
3. How often she lays within a season.
4. How accurately she returns to a particular beach or stretch of beach, i.e. nest site fixity.
5. Longevity beyond the time when first tagged.
6. Growth rates, if turtles are also measured on tagging and capture.
7. Population size, if certain assumptions are made.

Overall tagging is a very important tool in sea turtle conservation and biology and with the use of both external flipper tags and PIT tags, we hope to gain important knowledge about these creatures in the future. The most important and most critical components in any sea turtle conservation project are the men and women who walk the beach each night. Without these people maintaining consistent patrol schedules, tagging and measuring turtles carefully and precisely and recording data accurately and legibly via strict protocol, there would be no database to provide the conservation and policy-making community with information.

16 Tagging Procedure

Input from Scott Eckert & Dennis Sammy

16.1 Tagging Kit

A tagging kit comprises:

1. One box of Flipper Tags
2. PIT Scanner
3. Clipboard holding:
    a. Pliers
    b. Flipper tags
    c. PIT tags and applicator
    d. Data Sheets
    e. Pencils
    f. Measuring Tape
    g. GPS unit

16.2 Check turtle

Check turtle to determine what to do:

a) Always approach a turtle from behind.
b) Make sure that the light used is not shined on the head of the turtle.
c) Check for tags to determine whether you can record immediately or if you need to come back when she is laying, or return after you check the rest of your zone.

16.3 If the turtle has tags

If the turtle has tags you may attempt to record the turtle during the digging, laying, covering or camouflaging stage. Avoid as much as possible trying to record a turtle with tags during the body pitting stage. This will help to reduce the chances of the turtle returning to the ocean as a result of disturbance.

Green and Hawksbill sea turtles are particularly sensitive and should only be approached at laying.

16.4 Determine if turtle is ready to be tagged

A turtle is ready to be tagged when she has started her egg-laying process.

Tagging a new turtle must only be done during the laying process whether you need to apply all 3 tags or just 1 tag. However, you should allow about 5 eggs to be deposited before you actually tag the turtles.

If a turtle arrives on a nesting beach with <u>two</u> well-placed and readable tags, even if they are not from T&T ***do not apply additional tags***. Record the tag number and the project name or address on your data sheet.

Every Leatherback turtle that needs 2 flipper tags must be scanned with a PIT tag scanner. This is to ensure that the existing PIT tag in the turtle is linked with the flipper tags on the data sheet (without this we might count one turtle twice in the database).

Always test the scanner by reading a new PIT tag before scanning the turtle to make sure the scanner is working.

16.5 Effective Scanning

The areas to scan are the upper front flippers, the right and left shoulders and behind the neck. Pass the antenna of the scanner as close to the above areas as possible. The scanner has a few inches read distance, so the closer to the turtle skin the more effective the reading will be.

Once it is determined there is no PIT tag, open the tagging kit on the sand and scan a new PIT tag. If the scanner reads give your partner a PIT tag and the applicator. If the scanner is not working, flipper tag the turtle and indicate the scanner number and brief remark of what was the problem with the scanner.

16.6 Preparing a PIT tag

To prepare a PIT tag:

1. Remove tag from pack and lay the tag in the holster of the tag implanter.
2. Lock the needle in place with the flat white shaft.
3. Remove cover tube (watch sharp edge of needle)

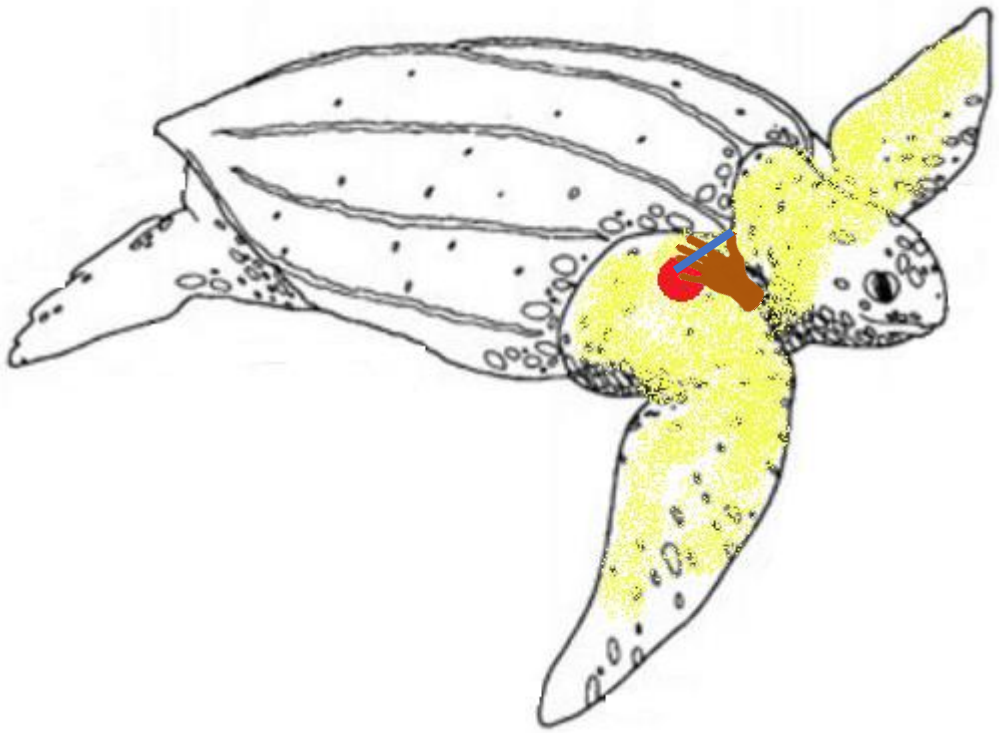


Image Credit/Source: Kathryn Audroing

PIT tagging location (red) on the right shoulder at a handspan width from the 2nd ridge. Scanning area to detect PIT tags (highlighted in yellow).

PIT Tag Procedure: ONLY LEATHERBACKS

1) Inserting PIT Tag:

   Tag Placement- Ensure that the PIT tag is placed half of the scanner width from the carapace aligned with the second ridge on the right shoulder.

   (i) Test for Response from turtle (prod with finger)- Be sure to position yourselves comfortably in case she reacts negatively.
   (ii) Insert needle straight in as gently as possible. The full depth of the needle should be inserted perpendicular to the flesh, a 90^{o} angle.
   (iii) Push trigger and hold down as you withdraw the needle, while your fingers are pressing on the tagging spot.
   (iv) Keep your finger over the tag spot for about 10 second to reduce blood flow and to make sure the microchip does not come back out.
   (v) Then scan turtle for tag number (to make sure it is in the turtle).

2) Record by sticking 1 PIT tag sticker on data sheet and one on container or tube.

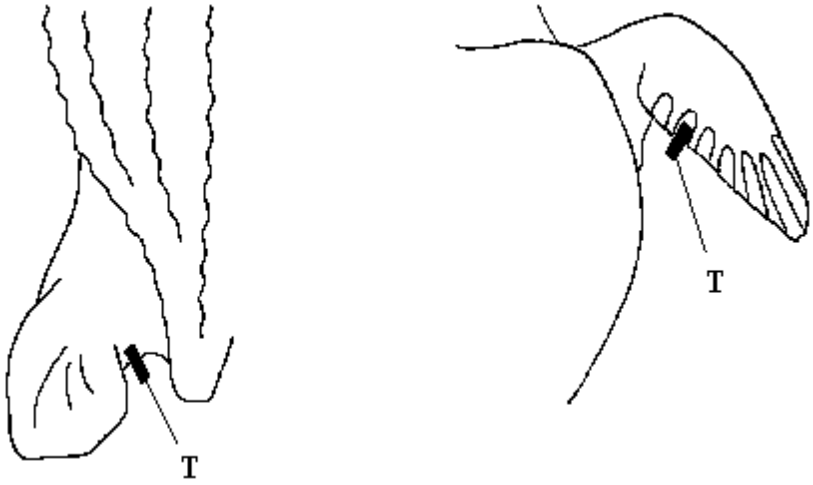
3) Apply flipper tags.

16.7 Flipper tag placement

Flipper Tag Placement:

Leatherback turtles are flipper tagged with Monel tags on **rear flippers**. The flipper tags are placed where the skin is thinnest, in the fold of the skin that connects the tail to the rear flipper.

Hardshell turtles are tagged on **front flippers** with Inconel tags, through the 2nd scale closest to the body (armpit) or between the 1st and 2nd scale.

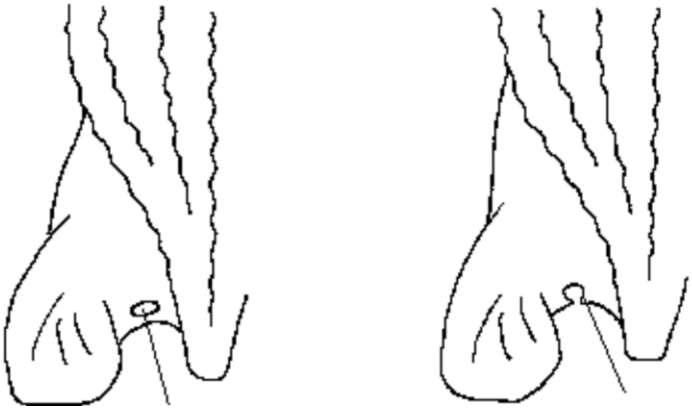


(A) (B)

Flipper tagging location (T) on (A) the rear flipper of the Leatherback and (B) the front flipper of the hardshell turtle

Image Credit/Source: IAC Nesting Beach Manual 2011

Before tagging look for evidence of previous tagging on all flippers. Record any information on other tags and tag scars on the data sheet.



(A) (B)

A turtle with Fibropapilloma or suspected tumours should not be tagged or measured. Any equipment exposed to these turtles should be thoroughly sterilised before being used with other turtles.

Scars considered as possible evidence of previous tagging of Leatherback.

A) Complete hole tag scar- usually caused by incorrectly closed tag.
B) Tear-type tag scar- usually caused by tag placed too tightly without space between the tag curve and the margin of the flipper.

Image Credit/Source: IAC Nesting Beach Manual 2011

Image Credit/Source: NMFS/SEFSC

Correct placement of flipper tag in tagging pliers.

Image Credit/Source: Kathryn Audroin

Placement of a flipper tag in a nesting Hawksbil.

16.8 Applying Flipper Tags

When applying flipper tags:

1. Write tag number on data sheet and check the “new tag” box on sheet.
2. Base of the tag must rest flat on the pliers (button on tag fits in groove on pliers).
3. Before you attempt to tag clear the loose sand from around the nest to prevent caving when you attempt to tag Leatherback rear flippers.
4. When positioning the pliers with the tag on the turtle, make sure that there is a pencil size space (~1 cm) between the curve of the tag and the edge of the flipper. This is to facilitate flipper growth.
5. Lightly tug at the closure of the tag to ensure the tag is properly cinched.

17 Morphometrics and Other Data Collection

17.1 Juveniles

Juvenile sea turtles of Hawksbill and Green sea turtles remain resident in their developmental habitat for years before migrating when close to attaining sexual maturity. These individuals may make small daily movements for foraging but are relatively stationary. Apart from distinguishing individuals in the population, tags will not supply much information on these juvenile animals which can be identified daily in their resident location. Tagging targets sexually mature individuals in our foraging habitats and nesting beaches since the return tag information will show longer and larger migrations of these individuals.

The average guideline for size at maturity for Hawksbill and Greens is 60 cm Straight Carapace Length (SCL).

Leatherbacks seen in our waters are hatchlings and sexually mature migrants.

17.2 Measuring Turtle – Morphometrics

Always record measurements in centimetres.

1. Clean sand off the back of the turtle before you measure.
2. Record any obstruction (barnacles or carapace damage) which may affect accuracy of the measurements.
3. Length- **C**urved **C**arapace **L**ength (CCL): lay tape flat along the middle ridge of the carapace, from behind the neck to over the tail.

   For Green and Hawksbill turtles, there are 2 length measurements: (see diagrams below)

Image Credit/Source: Bolten in Eckert et al. 1999

Carapace length measurements for hardshell sea turtles- a) CCL n-n (notch-notch), b) CCL n-t (notch-tip).

CCL minimum/ CCL n-n (notch-notch) from the notch at the anterior of the carapace (behind the neck) to the notch where the last two marginal scutes (supracaudals) meet.

CCL n-t (notch-tip) from the notch behind the neck to tip of the last marginal scute. Measure to the longer scute.

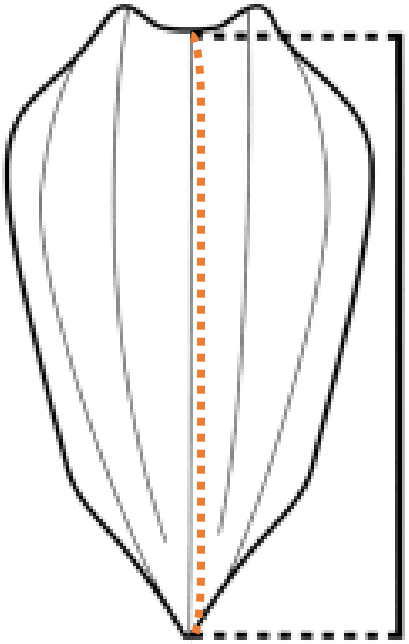


Image Credit/Source: Bolten in Eckert et al. 1999

Curved carapace length in Leatherback turtles.

4. Width- **C**urved **C**arapace **W**idth (CCW): this represents the widest part of the turtle which is the upper half of the carapace.

If barnacles, deformities or injuries affect these measurements, record this on the datasheet.

17.3 Data Sheets

Record the following information carefully:

- Name of Taggers
- Date – Use the dd/mm/yy.
- ACTIVITY- Record the activity of the turtle at the time of tagging e.g. 10:30pm the turtle is laying- the ACTIVITY is laying and time you put is when she is laying.
- WEATHER- use codes on data sheet
- Time- when tagged/recorded
- CCL- length in centimetres
- CCW- width in centimetres
- Outcome- **Once you see eggs the OUTCOME is always Confirmed Lay)**
    - False crawl without Body Pit (crawls up, crawls back to sea)
    - False Crawl with Body Pit (area disturbed is less disturbed than would be with actual nest)
- Tourist- (number of observers including Taggers). If tourists are present around the turtle, asked the guide for the number of persons.
- In a return turtle, if tag has information that is not from Trinidad, write down the address in the data sheet.
- Record injuries (large scars, missing flippers)

17.4 Skin Biopsy

Tissue collection should be carried out after a nesting female has completed nesting and only after tags have been applied.

<u>It is not recommended to flip turtles onto their backs for tissue collection.</u>

The sample site is along the posterior edge of the rear flipper in soft tissue, not the scale. The area must be sterilised by wiping with pure ethanol (isopropyl alcohol).

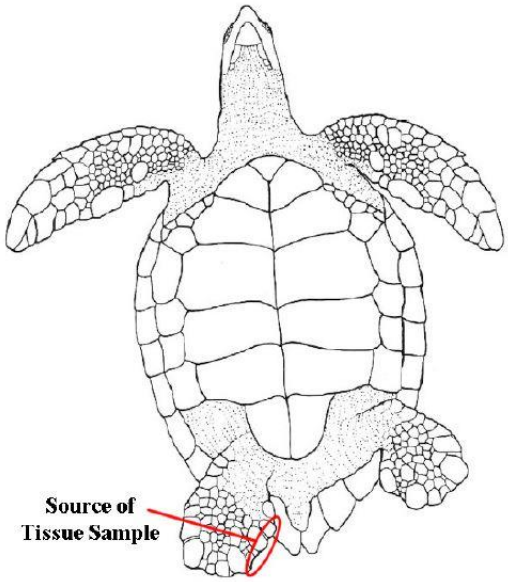


Image Credit/Source: Darren Browne
View of t*issue sample location from underside of sea turtle.*

A new biopsy tool (punch) should be used for each individual turtle to prevent cross-contamination of samples and possible disease transference. Gloves should be worn to protect the researcher and the sampling site.

A hard plastic surface (a tagging kit clipboard is a great option) cleaned with isopropyl alcohol should be placed beneath the sampling site as a hard surface to press against. Press the biopsy punch firmly into the flesh just along the flipper edge, so as not to create a complete hole but to leave an indented flipper margin. Make one full turn of the biopsy punch while pressing firmly, then release and lift off.

A scissors sterilised with alcohol can be used in place of the biopsy punch. It must be carefully sterilised between use.

Using the scissors, cut a small piece of tissue (1cm by 0.5cm) from edge of the flipper.

Swab the sampled area with iodine solution (10% povidone-iodine solution eg. Betadine) after tissue removal.

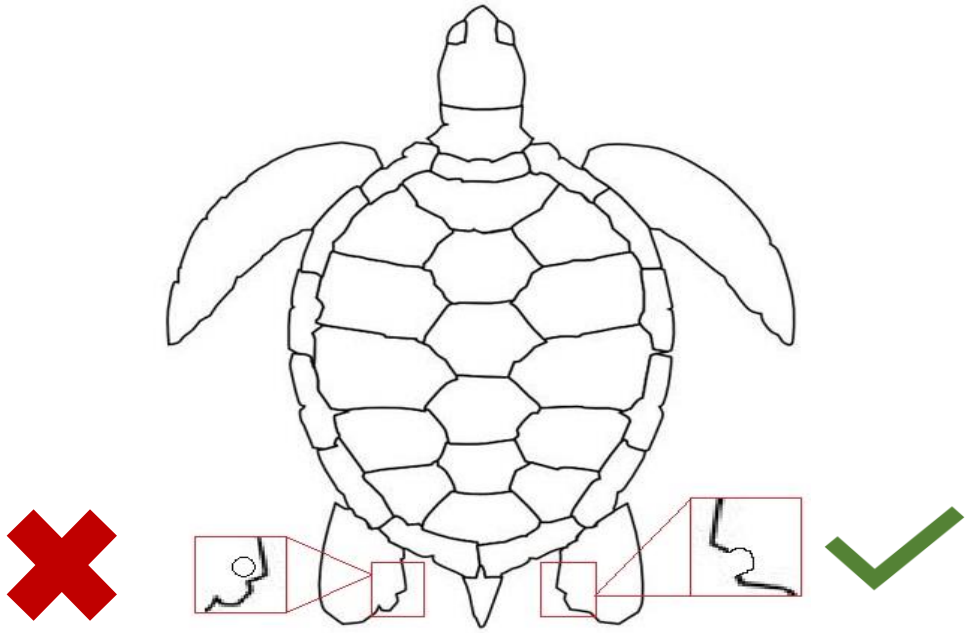


Image Credit/Source: Kathryn Audroing

Preferred technique for skin biopsy from margin of flipper.

<u>Only one biopsy sample is needed per turtle.</u>

Dead hatchling biopsy (not too badly decomposed) is sampled in a similar manner. An entire flipper can be cut off and placed in preservative.

The 2nd marginal scute from the supracaudal scute is removed with a scalpel from live hardshell hatchlings.

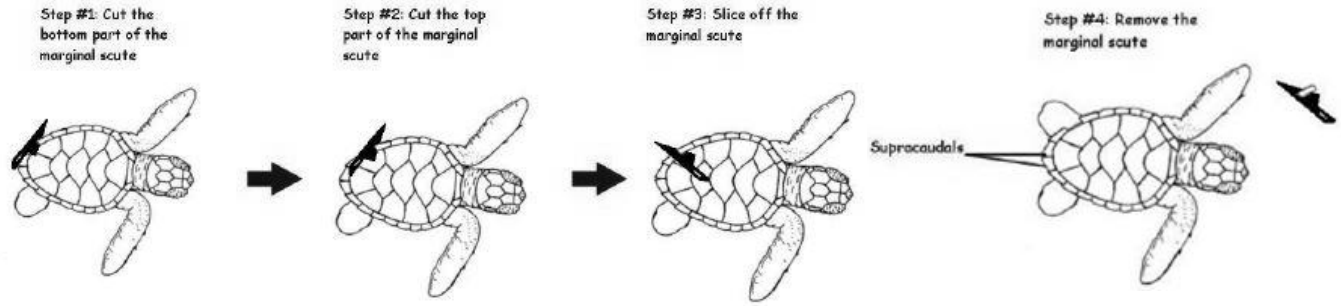


Image Credit/Source: Darren Browne

Procedure for marginal scute excision with a scalpel for sample collection from a hatchling Hawksbill.

<u>Only one biopsy sample is needed per nest.</u>

Samples must be placed in sample vials with preservative and labelled with:

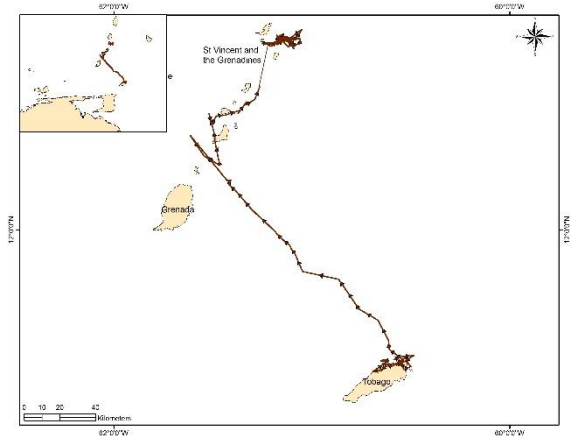
- Date of sampling
- Tag numbers, if available
- (J) for Juvenile, (A) for Adult, (H) for Hatchling

18 Satellite tagging of Sea Turtles

There is a paucity of knowledge of the ecology of Green, Loggerhead and Hawksbill turtles in Trinidad and Tobago with only few records annually on nesting beaches and little to no information on their activity away from the nesting grounds identified. In addition to previously surveyed sites in Tobago, sea turtles have been observed foraging on seagrass, coral reef, hard bottom and estuarine habitats in the nearshore North Coast of Trinidad. The purpose of the current study is to survey these ecosystems with the aim to identify and appropriately manage the fragile marine communities which are important to the nation's sea turtles' survival.

Satellite telemetry although more costly has become a prolific technique for gathering data on the movements of sea turtles and to confirm results of other surveys using conventional tagging methods. Satellites offer high-precision, real-time data on the activity of the tagged animals, insight into previously overlooked movements of short distances and has the benefit of not requiring recapture of individuals thereby reducing the effort expended in searching for the tagged individuals and the stress to the animal from being handled. Telemetry studies of Leatherback sea turtle have been done by international researchers in conjunction with TVT partner groups Nature Seekers and Grande Riviere Nature Tour Guide Association from 1995 to present, with some tags applied in T&T, primarily at Matura. Satellite transmitter selection is based on a trade-off between small footprint and long battery life.

Pre-attachment procedure will involve the removal of epibionts (algae, barnacles), sanding the attachment site and cleaning it with isopropanol. A marine epoxy blend will be used to attach the PTT to the carapace just behind the head. The PTT plus epoxy will be less than 5% of the turtle's body weight and the attachment will be streamlined so that buoyancy and drag will not affect swimming ability of the turtle.



A satellite tagged Hawksbill sea turtle on Grande Riviere beach (left) and tracking maps from a Hawksbill tagged in Charlotteville (right).

Image Credit/Source: Kevin Muhammad

The research from this project hopes to give insight to some questions including what these sea turtles do in the inter-nesting interval, how far do they move from T&T after the nesting season, where do they frequent within our waters, where are their migratory routes, are there several discreet populations of each species around our islands and do they integrate for mating, feeding, long migrations?

19 Examining nests

Excavating nests at the end of incubation is a valuable method to determine how well a beach is producing hatchlings.

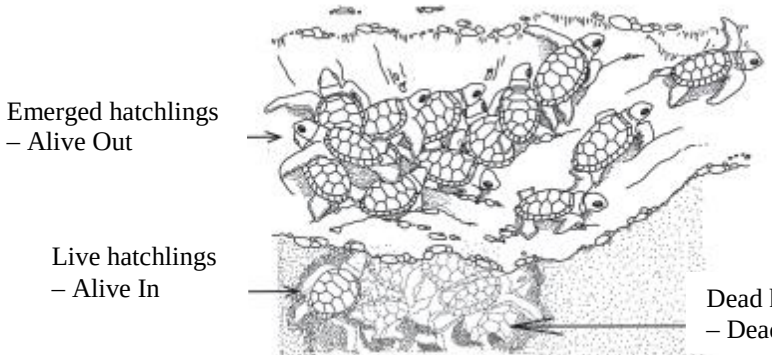
Nests are excavated 70 days after incubation or up to 5 days after emergence. Nests which are marked or triangulated at nesting are monitored 45 to 70 days after nesting for emergence activity. If no emergence occurs, the contents of the nest are exhumed 70 days later by re-locating the nest using triangulation markers and measurements. A count of eggs deposited at the time of laying is needed to evaluate these nests properly.

Once determined that a nest has emerged, by seeing hatchlings or finding the hatchling tracks, the emergence location has to be identified. Tracing the tracks back to their source, being careful not to walk on any of the tracks which will disguise them, is the easiest was to locate the nest. This nest can be marked for future exhumation in the daylight hours, if emergence occurs at night.

The emergence location is usually a bowl-shaped depression, approximately 8 inches in diameter that usually has all tracks departing in a fan-shaped pattern away from the depression and generally toward the sea. It is not always possible to detect individual tracks but the depression will remain. The sand around the depression is usually more firm so probing with fingers or digging in the depression can help determine if it is the emergence location.

Digging up nests of Leatherbacks is often more challenging than other species, since the average depth of a Leatherback nest is 70 cm. Leatherback beaches are often quite uneven due to the large body pit left by the turtle after nesting and such beach disturbance often makes finding the emergence site difficult.

A nest cavity with a full clutch



An emerging nest

Image Credit/Source: Adapted from Shanker et al. 2003 UNDP-GOI Research Manual

19.1 Egg content examination

			
Live hatchling- Alive in/ Alive out of nest	Dead hatchling- Dead in/ Dead out of nest	Live hatchling in pipped egg- Pipped Alive	Dead hatchling in pipped egg- Pipped Dead
			
Unhatched with small discernible embryo- Mid Developed	Unhatched full-term embryo- Full Developed	Small, misshapen and desiccated, no embryo development, transparent fluid- Yolkless	No embryo development, opaque fluid- Undeveloped embryo

Pipping- the breaking or opening of the egg shell by the hatchling

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www.turtlevillagetrust.org
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