Marine turtles of the Maldives

A field identification guide

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Jillian Hudgins
Agnese Mancini
Khadeeja Ali

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Glossary

A

Archipelago – A chain of islands.

Arribada – A Spanish term meaning “arrival”, used to describe the mass nesting behaviour of Olive Ridley sea turtles.

B

Benthic zone – The deepest region of a body of water, not including the sediment surface.

C

Carapace – The upper (back) section of the turtle’s shell, consisting of the animal’s rib cage and spine fused to dermal plates, which interlock.

Cephalopod – Mollusc characterized by bilateral body symmetry, a prominent head, and tentacles. Members of this class include octopus, squid, and cuttlefish.

CITES - the Convention on International Trade in Endangered Species of Wild Fauna and Flora is a multilateral treaty that aims to ensure that international trade of wild animals and plants does not threaten the survival of species in the wild.

CMS – The Convention on Migratory Species (also The Bonn Treaty) is an environmental treaty under the United Nations Environment Programme, that provides a global platform for the conservation and sustainable use of migratory animals and their habitats.

Convergence point – A meeting point or place.

Critically Endangered (CR) – According to the IUCN Red List of Threatened Species ™, a species that is at extremely high risk of becoming extinct in the wild.

D

Data Deficient (DD) – According to the IUCN Red List of Threatened Species ™, a species without sufficient information to make a proper assessment of its conservation status.

E

Ecosystem – A community of living organisms in conjunction with the non-living components of their environment, interacting as a system.

Endangered (EN) – According to the IUCN Red List of Threatened Species ™, a species that is at a very high risk of becoming extinct in the wild.

Erosion – The natural process of removal of rock or sediment from an area by wind, waves, or tides, and its deposition in another area; often accelerated by anthropogenic activities or structures.

F

False crawl – A female turtle's unsuccessful attempt to dig a nest; a crawl resulting from an abandoned nesting attempt.

Foraging area – The area in which an animal searches for food, also known as the feeding ground.

G

Ghost net – A lost, abandoned, or discarded fishing net.

Gyre – A large system of rotating ocean currents, usually involved with wind movement. A vortex.

H

Handline fishing – A traditional fishing technique by which a single line is held in the hands of a fisherman with one or more baited lures or hooks attached.

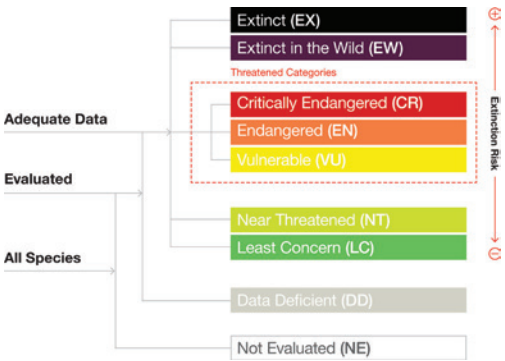
Herbivorous – Feeding on food only of plant origin. Vegetarian.

I

Invertebrate – An animal without a backbone.

IOSEA MoU – The Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia. An intergovernmental agreement that aims to protect, conserve, replenish, and recover marine turtles and their habitats in the Indian Ocean and South-East Asian region.

IUCN Red List - The International Union for Conservation of Nature Red List of Threatened Species™ is widely recognized as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. The IUCN Red List of Threatened Species™ provides taxonomic, conservation status and distribution information on plants, fungi and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction (i.e. those listed as Critically Endangered, Endangered and Vulnerable). The IUCN Red List also includes information on plants, fungi and animals that are categorized as Extinct or Extinct in the Wild; on taxa that cannot be evaluated because of insufficient information (i.e., are Data Deficient); and on plants, fungi and animals that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme (i.e., are Near Threatened). Plants, fungi and animals that have been evaluated to have a low risk of extinction are classified as Least Concern.



L

Longline fishing – A method of commercial fishing by which a long line with baited hooks is towed behind a boat. The line may be 30 km long and have thousands of baited hooks attached.

M

Marine Protected Area – Regions in which human activities are restricted in the interest of protecting the natural environment and its occupants.

Monsoon – A seasonal reversing of winds accompanied by changes in precipitation.

N

Natal beach – The beach on which a female turtle was born and to which it returns to lay its own eggs.

Neritic zone – The shallow part of the ocean above the continental drop–off, which is usually ~200 m in depth. It may also be called the coastal waters or the sub-littoral zone.

O

Oceanic zone – The area offshore beyond the continental shelf, beginning from 200 m depth. Beyond the neritic and pelagic zones.

Omnivorous – Feeding on food of both plant and animal origin.

Opportunistic predator – An animal that hunts when necessary and scavenges when carrion is available.

Opportunistic feeder – An animal that sustains itself from a number of different food sources, depending on what is available.

Over-exploitation – Also called over-harvesting. Harvesting an animal at a rate beyond what is sustainable, maybe leading to the local or global extinction of the species.

P

Pelagic zone – The area of a body of water that is neither close to shore nor close to the bottom; the open sea from the surface to the benthic zone.

Plastron – The underside (ventral) section of the turtle's shell.

Poaching – Illegal hunting, killing, or capturing of wild animals or their eggs with the intention of consuming, selling, transporting or otherwise using the body parts.

Poikilothermic – An organism whose internal temperature is dependent on the ambient temperature. Also called cold-blooded.

Pole and line fishing – A traditional and responsible fishing technique requiring only one person, one hook, and one line.

R

Rookery – A colony of breeding animals.

S

Sargassum – A genus of brown macroalgae and seaweed. Numerous species are distributed throughout temperate and tropical oceans. They generally inhabit shallow seas and coral reefs. Thick masses provide a mini-ecosystem and habitat for a number of marine animals and plants.

Satellite telemetry – a way of remotely tracking animals using Global Positioning System (GPS) tags that transmit information to a satellite.

Scute – A bony external plate on the shell and head of a turtle.

Seagrass – Flowering plants which grow in marine environments. They have long narrow leaves, resemble terrestrial grasses, and grow in extensive beds.

Seawall – A static coastal defence structure intended to protect areas of human habitation from the action of tides and/or waves.

Subspecies – A taxonomic rank below species, usually a separate group within a species that does not interbreed with any other population of that species, but could interbreed if given the chance to do so.

Subpopulation – Geographically or otherwise distinct groups in the population among which there is little demographic or genetic exchange.

T

Trawl fishing – A method of commercial fishing by which a net is dragged behind one or more boats.

Tunicate – A sessile marine invertebrate, filter-feeding animal with a sac-like body structure and two tubular siphons, or openings, through which they draw in and expel water.

V

Vertebrate – An animal with a backbone.

Vulnerable (VU) – According to the IUCN Red List of Threatened Species™, a species that is at a high risk of becoming endangered.

Photo . Green turtle nesting at Komandoo © Rosa Brau

CHAPTER 1

What is a turtle?

"All tortoises are turtles, but not all turtles are tortoises.

All terrapins are turtles, but not all turtles are terrapins.

Some turtles are just turtles."

~The World of Turtles and Crocodiles~

Turtles are long-lived animals that belong to the order Reptilia, a group of animals that also includes snakes, lizards, and crocodilians, all of which share the following characteristics:

+ **Scaly skin:** this helps reptiles conserve moisture as most of them live in dry, sunny, and/or salty environments;
+ **Cold-blooded:** their body temperature depends on the external temperature (e.g. lizards spend time under the sun as they use the heat to regulate their internal temperature and thus their metabolic rate);
+ **Air-breathers:** unlike amphibians, all reptiles, including turtles, are born with lungs and use them to get oxygen from the air;
+ **Oviparous:** they lay eggs (although some snakes give birth to live young).

All reptiles having a shell (either soft or bony) and a backbone are called turtles. There are approximately 263 species of turtles in the world and they can be divided into three major groups: tortoises, freshwater turtles or terrapins, and marine turtles. The term tortoise usually refers to any strictly land-dwelling turtle, while the word terrapin means "small turtle" and is usually used when referring to turtles living in fresh and brackish areas, spending their time both on land (usually basking near the shore) and in water. The word "turtle" usually refers to those species spending most of their lives in water (either fresh or salty).

So, what is a marine turtle? Marine turtles can be defined as reptiles with a shell that have developed some adaptations to live in the oceans. Some of these adaptations can also be found in terrapins and freshwater turtles, while others are specific to marine animals only *(See* Table 1.1*)*.

Table 1.1. Comparison of tortoises, freshwater and marine turtles traits

TORTOISES	FRESHWATER TURTLES	MARINE TURTLES
Dome-shaped shell;	Hydrodynamic shell;	Hydrodynamic shell;
Thick, stumpy limbs and elephant-like feet;	Longer limbs than tortoises, with webbed-feet;	Flipper-like front and rear limbs;
Massive claws;	Long claws;	Loss of most claws;
Regular circulatory and respiratory system;	Adapted circulatory and respiratory system to spend long periods under water;	Adapted circulatory and respiratory system to spend long periods under water;
Able to retract their head and limbs almost fully into the carapace.	Only box turtles are able to retract their head and limbs into the shell.	Unable to retract their head and limbs into the shell;
		Special glands around the eyes that expel salt from the body.

Marine turtles spend 99% of their life in the ocean; only adult females temporarily leave the water to lay eggs on land to incubate and hatch successfully. This is the only time of their life when they leave the marine environment, with some exceptions such as the Hawaiian green turtle population, where both males and females come out of the water to bask along the shore.

HOW OLD ARE MARINE TURTLES?

A well-known scientist (some say it was Bertrand Russell) once gave a public lecture on astronomy. He described how the earth orbits around the sun and how the sun, in turn, orbits around the center of a vast collection of stars called our galaxy. At the end of the lecture, a little old lady at the back of the room got up and said:

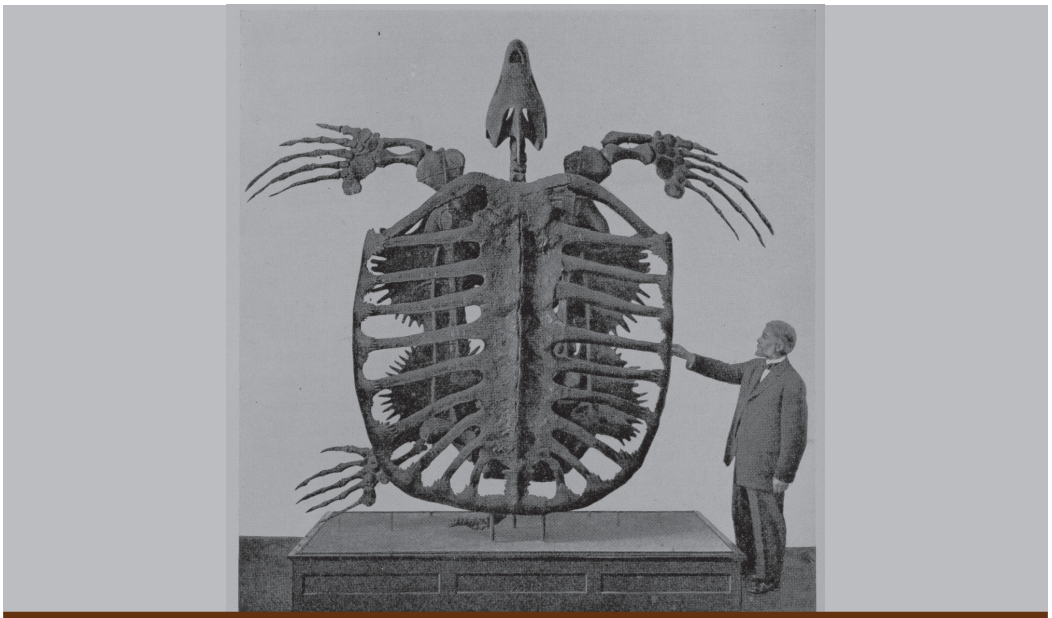
"What you have told us is rubbish. The world is really a flat plate supported on the back of a giant tortoise." The scientist gave a superior smile before replying, "What is the tortoise standing on?" "You're very clever, young man, very clever," said the old lady. "But it's turtles all the way down!"

Hawking, 1988 – A Brief History of Time

The oldest known turtle fossil was found 220 million years ago and was a much larger version of the present day freshwater snapping turtle. Modern marine turtles appeared approximately 120 million years ago during the Cretaceous era, when their limbs evolved into powerful flippers. During the end of the Mesozoic era, some 65 million years ago, a mass extinction brought the end of not only dinosaurs, but also most marine turtle families and species. Only four families of marine turtles survived, two of which subsequently became extinct.

The most famous representative of extinct marine turtles is a fossil belonging to a species of giant turtle called *Archelon ischyros*, found in the 1970s in South Dakota (USA) and dating from around 65 million years ago. The skeleton has a total length (beak to tail) of 4.5 m and it was estimated to weigh approximately 2,200 kg (*See* Figure 1.1). Archelon was a slow mover and found most of its food drifting near the sea surface. It had little need to dive deep except when hibernating on the seabed. It was an omnivorous grazer, sweeping up drifting fish, jellyfish, dead carrion and plants. Its sharp, powerful beak could break open shelled animals such as ammonites. Archelon's huge flippers suggest it was a long distance swimmer that thrived in the open ocean. It was never alone, as its huge size attracted a large group of other animals including fish, barnacles, and parasites. Like modern sea turtle species, Archelon could not withdraw its head or flippers inside its bony shell for protection; thus, despite its size, it was an easy target for larger predators. Resembling modern turtles, it laid its eggs by burying them in sandy beaches under the cover of darkness. Its nearest living relative is the world's largest turtle, the leatherback.

Only two families of marine turtles remain today: the Cheloniidae family including 6 of the 7 marine turtle species, and the Dermochelydae, which consists of only one species: the leatherback turtle.



Giant Cretaceous Sea Turtle (65 million years) Archelon ischyros, a cast Replica

Photo . Courtesy of Black Hills Institute of Geological Research, Inc

INFO BOX

Marine turtles and the origin of the world

For thousands of years, marine turtles have been an integral part of the life and culture of people living along the coasts worldwide. In certain cultures, marine turtles have been linked to the creation of the world:

- In ancient China, it was thought that a turtle's carapace formed the vault of heaven while the plastron represented the Earth;
- In Hindu mythology, after a great flood that occurs every four billion years and dissolves the earth, Vishnu transforms himself into a giant turtle and carries on his back a vessel in which the gods and demons mix the elements necessary to re-create the globe. After a thousand years, when the earth has been reborn, the turtle remains in place, and on his back stands a large elephant, which supports the planet;
- There is a legend in India stating that the world is supported by four elephants standing on a giant turtle;
- According to some Native American legends, a giant turtle swam to the bottom of the sea and brought up some mud that was then used by the creator to make the earth.

A simple explanation for why turtles in general, and marine turtles in particular, are so deeply rooted in the history and culture of many different civilizations around the world is because they were the main food source for many people living along the coast, and their presence was crucial to the survival of many coastal communities.

ADAPTATIONS TO MARINE LIFE

Marine turtles live permanently in a saltwater environment, and thus had to develop adaptations to dive, swim, and excrete salt. As mentioned earlier, marine turtles, unlike tortoises, have a streamlined shell and flippers that allow them to swim quickly, but this is not enough to survive in saltwater. Their breathing and circulatory systems have, therefore, adapted to marine life.

Great Divers

Marine turtles have lungs and need to come to the surface to breathe. They have a respiratory system similar to that of mammals consisting of a mouth, pharynx, glottis, larynx, and trachea that splits into two tubes called bronchi that end up in the lungs. The lungs lie underneath the carapace and are about as long as the carapace itself.

As marine turtles spend 90-95% of their time underwater, they have developed some adaptations that make them excellent divers. First, marine turtles do not have a diaphragm; instead, they use the fused ribs in the carapace for a more efficient inhalation of air into the lungs, which means that short and quick breaths allow them to take in enough air to stay submerged for long periods of time. The lungs are divided into increasingly smaller chambers that, in total, constitute a great volume, meaning that marine turtles can store more oxygen in a smaller space. A second adaptation derives from the presence of higher amounts of haemoglobin and myoglobin in the blood, which allow for faster transportation of oxygen from the lungs to the organs through the circulatory system. Marine turtles can also store high amounts of oxygen in their muscles and blood. They are also known to be tolerant to *hypoxia* (low levels of oxygen). Finally, their lungs are used as buoyancy devices when basking at the surface of the water.

A male green turtle surfaces for air in Lhaviyani Atoll in the Maldives Islands. Male turtles are identified by their longer tails and more prominent foreflipper claws.

Photo . Cara Daneel and Jordan Parett | Naifaru Juvenile.

Keeping Warm in the Water

Like other reptiles, marine turtles are cold-blooded, which means that they can adjust their body temperature according to the ambient temperature of their environment. Furthermore, marine turtles are defined as *poikilothermic*; a term indicating that internal temperature can vary significantly.

In water, heat is lost faster than on land because water has a higher heat conductivity rate compared to air. Furthermore, there are great variations in temperature from one season to another; so, marine turtles have developed special adaptations that allow them to retain heat as needed. The most important of these adaptations is in the circulatory system: marine turtles have the ability to control blood flow to and from their core body, where the temperature is warmest, and flippers, usually the coldest part of the animal. Based on the external temperature, marine turtles can actually dilate or constrict blood vessels to limit the dispersal of heat into the flippers, where insulation is less efficient. This is how the turtle can assure that heat is directed towards the vital organs to keep functioning normally. The circulatory system also includes a counter-current heat exchange mechanism: arteries that allow the flow of blood from the core area to the peripheral organs gradually exchange heat with veins transporting blood in the opposite direction (See Figure 1.3).

Besides physiological adaptations, marine turtles have also developed behaviours that help them maintain a higher body temperature: they can migrate large distances to warmer areas, they can bask at the surface of the water under the sun as lizards do, or, in rare cases, like green turtles in Galapagos, they can bask on the beach.

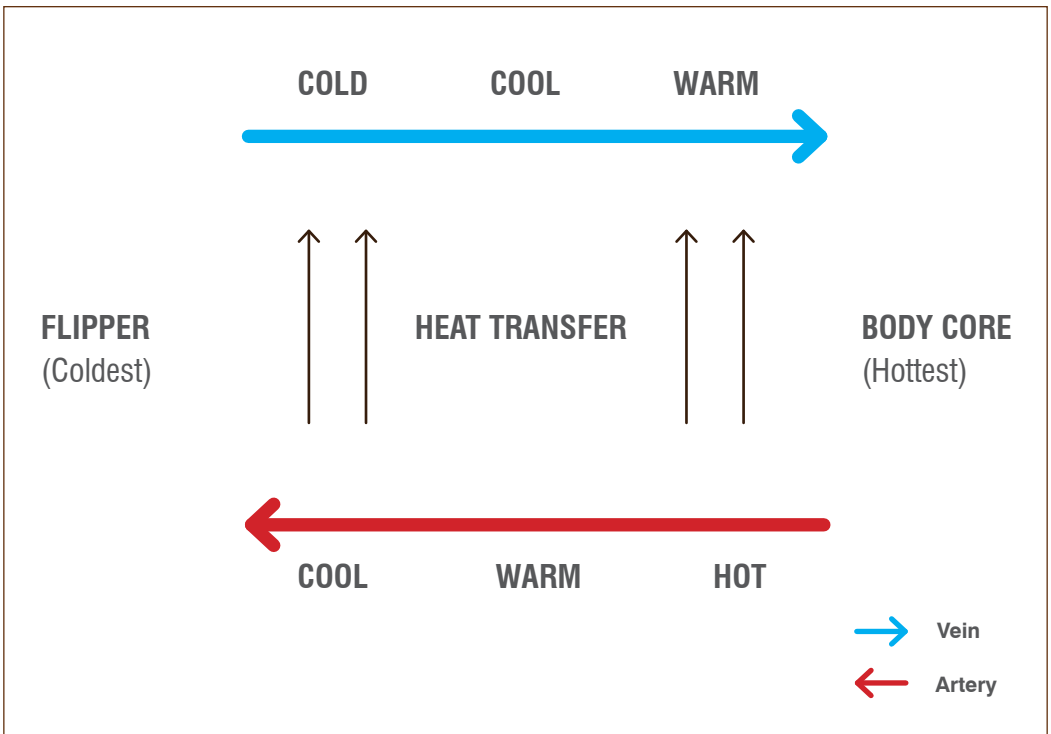


Figure 1.1. Schematic depiction of the circulatory system of a marine turtle: heat is kept in the body core while the peripheral organs are usually colder.

INFO BOX

Cold stunning

Although marine turtles can be found in waters as cold as 13°C, water temperature affects the turtles' metabolic rate. Being cold-blooded animals, marine turtles have to migrate away from cold waters into warmer areas to speed up their metabolism and heart rate. When sea temperatures drop rapidly or unexpectedly, turtles may not have time to move to warmer waters.

Lethargy is induced between 13 and 15°C and turtles become "cold stunned" around 10°C. Juveniles are a bit more resistant to cold temperatures, becoming cold stunned only at around 9°C. Cold stunning results in floating, a decreased heart rate and circulation, shock, stranding, pneumonia, and possibly death. Floating turtles are at risk of boat strikes and are more susceptible to predators. The waters of the Indian Ocean are generally quite warm but turtles may become cold stunned when they enter the Gulf of Oman and the Persian Gulf. Cold stunned green, hawksbill, and loggerheads are often rescued along the coast of the United Arab Emirates between January and April, when temperatures can drop below 16°C. Turtles are given medical care, gradually warmed up, and released back to the ocean.

Surviving in a Salty Environment

Marine turtles spend their life in an environment where the concentration of salt is three times higher than that of their body fluids. The water they drink and the food they eat contains far too much salt that somehow needs to be expelled. While the kidneys usually execute this function in most animals, for marine turtles and other marine reptiles these organs are insufficient to handle the excess salt. Marine turtles have therefore developed a mechanism to solve this problem: the salt glands located behind their eyes collect the excess salt in the blood and expel it in the form of tears. On land, marine turtles are often seen "crying" while laying eggs (which promoted the idea of marine turtles being in pain during the nesting process), but, in reality, these tears are produced by the salt glands and have very high concentrations of salt.

INFO BOX

The five senses of marine turtles

SIGHT: Marine turtles are known to be near-sighted on land but have very advanced vision underwater. Their vision includes light within the ultraviolet range. On land, marine turtles use visual cues to orientate.

HEARING: Marine turtles can hear sounds in the range of 100 to 1000 Hz, although they show a greater sensitivity for sounds between 200 and 400 Hz. The ecological role of hearing in turtles is not clear; marine turtles do not have an external pavilion like humans, but the structure of the internal ear is similar to that of other terrestrial and aquatic turtles. Experiments conducted on these animals both underwater and on land revealed that marine turtles respond to sounds in their hearing range with behavioural or physiological changes.

SMELL: Marine turtles have been observed underwater with their nostrils open while slowly opening and closing their mouths. This behaviour is described as “throat-pumping” and is used by turtles to move water towards the olfaction organs. More than “smelling” the water, marine turtles analyze the chemicals in it to find food or for navigation purposes. This ability is called “chemoreception”.

TOUCH: Marine turtles are particularly sensitive to the touch on the soft parts of their bodies (flippers, neck).

TASTE: Very little is known about the sense of taste in marine turtles.

Did you know?

Turtles have an incredible ability to precisely navigate their way back to the area where they were born every few years. Both males and females have this navigational ability. How do they do it? When they are born and they run from their nest to the water, they imprint a type of magnetic signature of that beach into their minds. This signature stays with them for the rest of their lives. Similar to birds, turtles can sense the magnetic field of the earth, which creates a sort of map for them in their brains. They also are thought to have a sense of time (although the mechanisms are not yet well understood) because some turtles, like the two species of Ridley turtles, nest together around the same time every year. Beyond that, a sea turtle’s navigational ability still remains a mystery to science.

LIFECYCLE

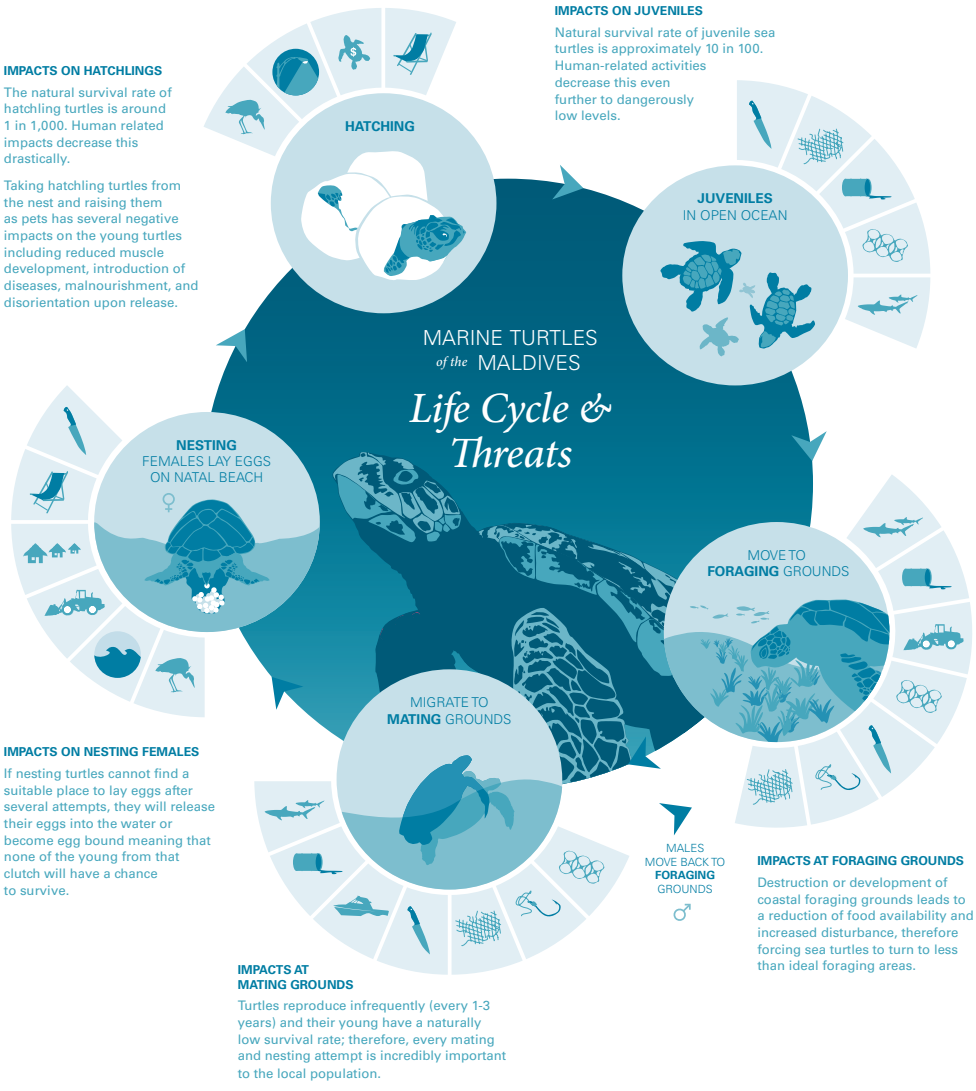


Figure 1.2. Diagram of a marine turtle lifecycle

All marine turtles share the same general lifecycle, although small differences can be found among species. Female turtles come ashore to lay eggs on sandy beaches and nests will hatch around 40 to 60 days later. The hatchlings will be completely alone, as female turtles do not provide any parental care. Af-

ter coming out of the nest, the hatchlings will crawl as fast as possible to the sea and then swim offshore where they will eventually get caught in the closest current, feeding on small, floating animals living within the Sargassum, or floating algal mats. These first few years are often referred to as the "lost years" because there is very little information available on the whereabouts of yearling turtles. After few years, immature turtles will settle in coastal habitats where they will stay until reaching sexual maturity. The time juvenile turtles spend on growing areas varies according to the species but also food availability. Upon reaching maturity, adult turtles will start migrating from their developmental areas to their mating grounds. Females will then swim to the nesting grounds to lay eggs every few years, while males will migrate annually from the mating areas to the feeding grounds (See Figure 1.4).

INFO BOX

The "lost years"

Scientists are still unsure exactly where hatchling turtles spend the first few months or years of their life. Upon leaving their nesting beach, it is thought that hatchlings enter an oceanic phase and find shelter in mats of algae, floating passively in major current systems (or gyres) and feeding at the surface on pelagic vegetation and animals. After one to ten years in the oceanic zone, some species of turtles retreat to coastal areas where they forage and grow until maturity.

Did you know?

Marine turtles may display multiple paternities and a single clutch of eggs may have as many as five fathers. Female turtles have the ability to store sperm in their oviducts until ovulation.

Green turtles mating offshore the Maldives

Photo . Lauren Arthur

Photo . Green turtles mating at Kuredhu Caves © Rosa Brau

CHAPTER 2

Marine turtles in the Maldives

Class Reptilia

Order Testudines

Family Cheloniidae

Species

Chelonia mydas (Green turtle) “Velaa”

Eretmochelys imbricata (Hawksbill turtle) “Kahan’bu”

Caretta caretta (Loggerhead turtle) “Boa bodu velaa or Varvohori”

Lepidochlys olivacea (Olive Ridley turtle) “Vaa voshi velaa”

Family Dermochelydae

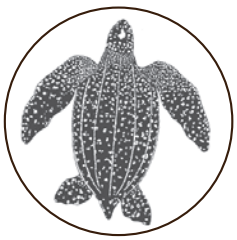
Species

Dermochelys coriacea (Leatherback turtle) “Musimbi”

KEY GUIDE

Flexible with:

- no scutes (plates)
- 5 to 7 ridges
- black with white spots



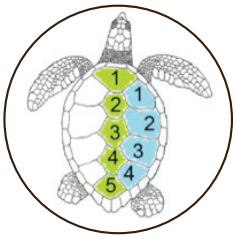
Leathery, flexible carapace
Dark with white spots
Jaw deeply notched

Leatherback Turtle
(Dermochelys coriacea)

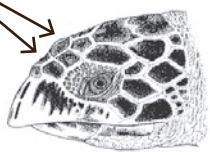
Bony with:

- scutes (plates)
- no ridges

4 pairs of lateral scutes

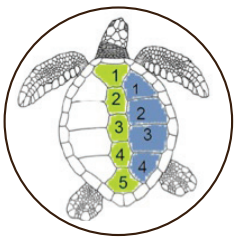


Prefrontal scales

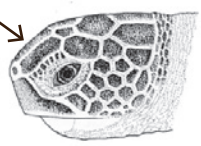


2 pairs of prefrontal scales
Overlapping scutes
Bird-like beak

Hawksbill Turtle
(Eretmochelys imbricata)



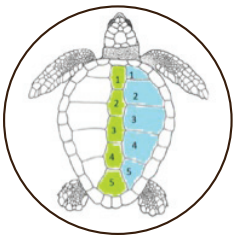
Prefrontal scales



1 pair of prefrontal scales
Non overlapping scutes
Rounded head

Green Turtle
(Chelonia mydas)

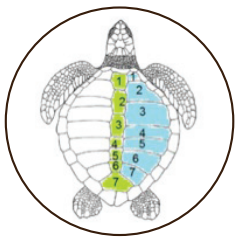
5 pairs of lateral scutes



Ridge at the end of the carapace

Loggerhead Turtle
(Caretta caretta)

6 pairs of lateral scutes
(Sometimes asymmetrical)



Almost circular carapace
Dark grey to dark green
Usually small size

Olive-ridley Turtle
(Lepidochlys olivacea)

Images modified from: Eckert, K. L., Bjorndal, K. A., Abreu-Grobois, F. A. and Donnelly, M. (Eds.) 1999. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4. Washington, DC: 235 pp

CHAPTER 3

Species profiles

GREEN TURTLE

Scientific name: *Chelonia mydas*

Divehi name: Velaa

Key Features

Green turtles are the largest of all the hard-shelled sea turtles, growing to about 120 cm in length and weighing from 135-160 kg. The green turtle has a smooth, sub-circular to heart-shaped carapace with colour varying from greenish-yellow to greyish-brown. The plastron is yellowish-white in colour. In the Maldives, the colouration of adults is darker than that of green turtles in the western Indian Ocean.

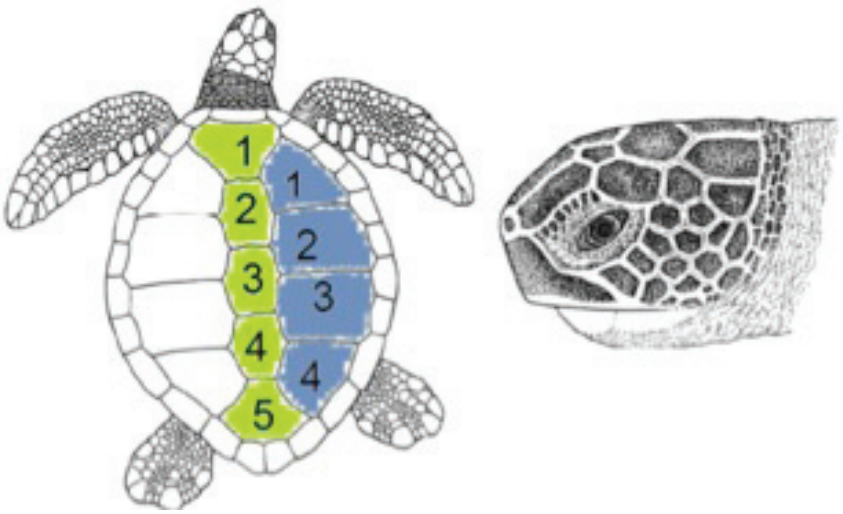


Figure 2.1. Key features of green turtles. Illustrations modified from Pritchard and Mortimer (1999)[1] , used with permission.

[1] Pritchard, P.C.H. and Mortimer, J.A. 1999. Taxonomy, External Morphology, and Species Identification, p.21-38. In: K.L. Eckert, K.A. Bjorndal, F.A. Abreu G. and M.A. Donnelly (Editors), Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publ. No. 4. Washington, D.C.

Biology and Behaviour

The study of growth rates suggests that green turtles mature between 15 and 50 years of age. Turtles that eat a diet rich in nutrients grow and mature faster than those with a poor diet. Mature females return to their nesting beaches once every 2-4 years to nest.

Females migrate huge distances between feeding grounds and nesting areas, but tend to follow coast-lines rather than cross open waters. A female green turtle leaves a symmetrical track with a tail drag down the middle. Tracks are 85-90 cm across. The females lay between 1-6 clutches of between 70 and 125 eggs. Larger females tend to lay larger clutches of eggs. The incubation period lasts between 50 to 70 days. At birth, green turtle hatchlings are around 50 mm long and have black carapaces with a light coloured plastron.

A green turtle swims on Dhonfan reef in Baa Atoll, in the Maldives.

Photo . Lauren Arthur

Green turtle hatchlings await release at Four Seasons Resort Landaa Giraavaru in the Maldives.

Photo . Jillian Hudgins

Diet

Adult green turtles are vegetarians, feeding primarily on seagrasses and algae. Such a diet is thought to give them greenish coloured fat deposits under their carapaces, and it is from this that they get their name. Juvenile green turtles feed on small crustaceans and jellyfish. As they mature, their diet shifts from omnivorous to herbivorous.

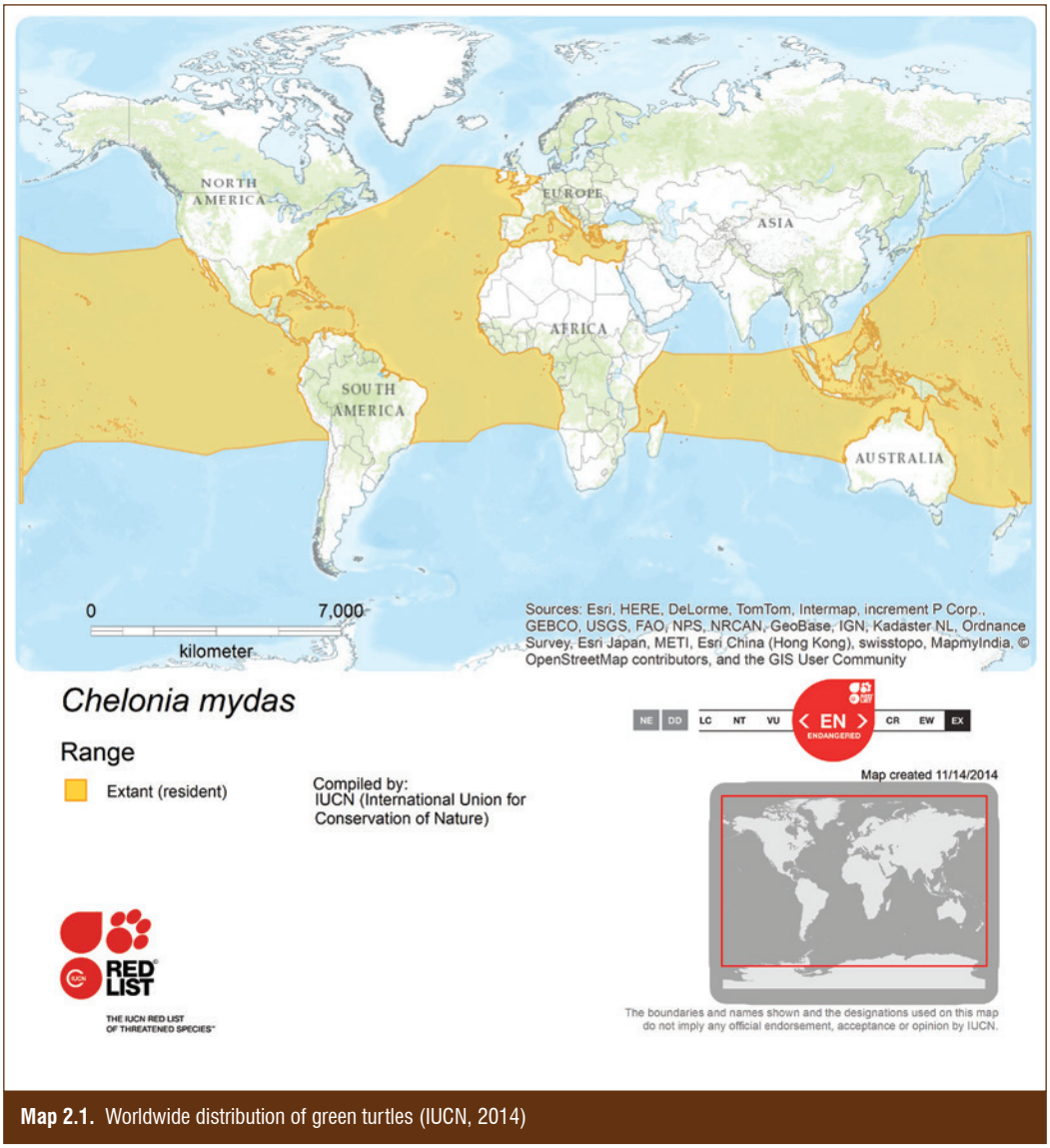
Turtles actively select fresh green growth near the base of the seagrass and there is some evidence that turtles actively farm certain areas of seagrass to ensure a steady supply of younger, protein-rich growth. Where seagrass pastures are absent, as they are in much of the Maldives, other species of red and green algae (e.g. *Caulerpa spp*., *Ulva spp*., *Hypnea spp*.) are eaten.

A green turtle feeding on seagrass near Kuredhu Resort, Lhaviyani Atoll, in the Maldives.

Photo . Cara Daneel and Jordan Parett | Naifaru Juvenile.

Habitat and Distribution

The green turtle has a circumglobal distribution, occurring throughout tropical and sub-tropical waters down to 20°C. They have been recorded as far north as the English Channel and as far south as Polla Island, Chile. Green turtles are highly migratory and they undertake complex migrations through geographically different habitats. Both males and females migrate from benthic foraging areas to mainland or island nesting beaches. The best feeding grounds rarely coincide with the best nesting beaches. Green turtles can travel 20-40 km per day when migrating.



Map 2.1. Worldwide distribution of green turtles (IUCN, 2014)

Photo . Jasmin Pape

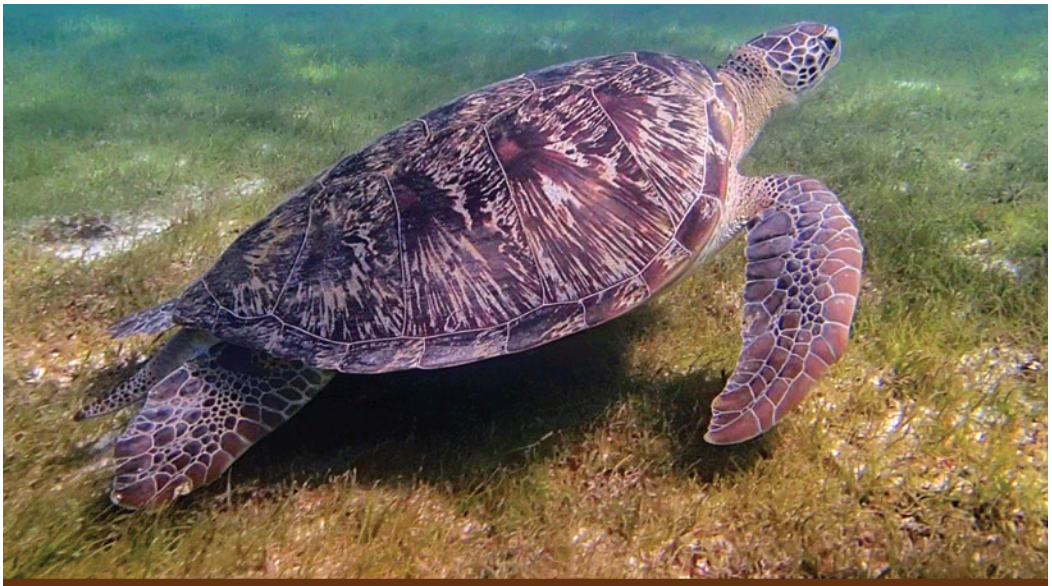
A green turtle resting in Kuredhu Caves, Lhaviyani Atoll, in the Maldives

Did you know?

The longest recorded migration of a green turtle was 3,979 km from the Chagos Islands (Maldives' neighbour to the south) all the way to Somalia.

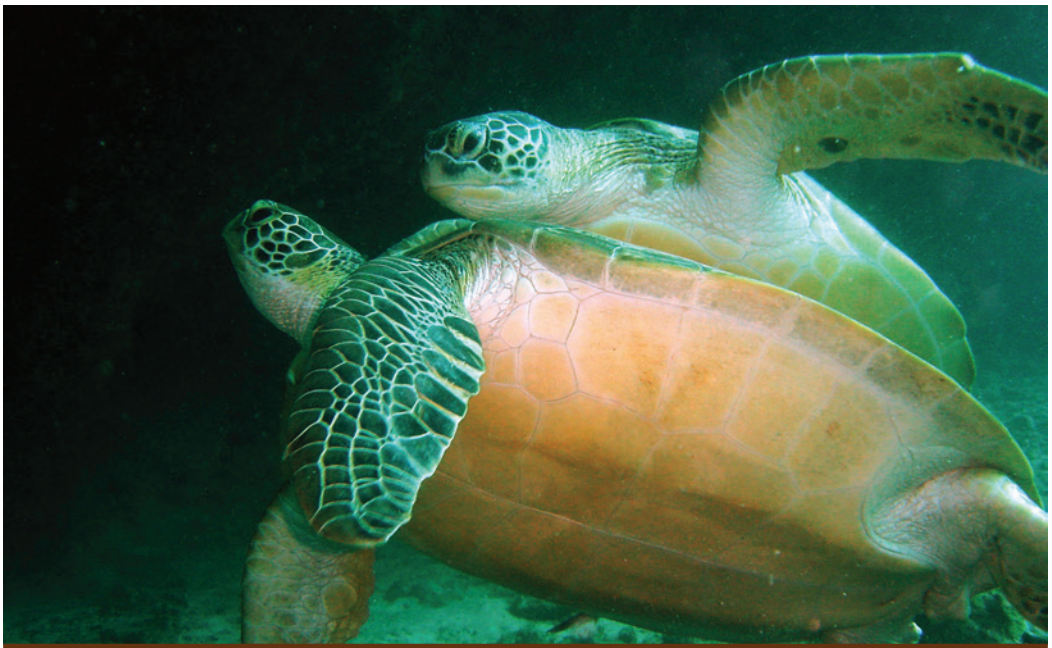
Green turtles are not picky about their nesting beaches. Sand size, composition, and the presence of beach vegetation do not seem to be factors in choosing a nesting site. Mating generally occurs around one kilometre offshore of nesting beaches.

Nesting occurs in more than 80 countries worldwide but only 10-15 populations are of significant size (greater than 2,000 females yearly). The Indian Ocean is home to some of the largest nesting populations of green turtles in the world, particularly Oman and Saudi Arabia. Smaller nesting grounds can be found in Reunion Island, Pakistan and Bangladesh The nesting population of green turtles in the Maldives is currently unknown, but populations in India and Sri Lanka are severely depleted. Nesting appears to happen all year-round.



A large male green turtle swims near Kuredhu Caves, Lhaviyani Atoll, in the Maldives. Male turtles can be idenitifed by their long tails.

Photo . Cara Daneel and Jordan Parett; Naifaru Juvenile.



Green turtles mating at Kuredhu Caves.

Photo . Rosa Brau

Green turtles in the Maldives

The green turtle is known as “velaa” in the Maldive islands, and both juveniles and adults can be seen throughout the archipelago. Turtles with a carapace of about 20 cm have been observed foraging on seagrass beds. Nesting has been confirmed from several atolls, including Baa, North Male, Laamu, Noonu, Addu, and Lhaviyani. Previous reports have noted more nesting on the northern and eastern sides of the archipelago and a peak in nesting between June and December. Marine biologists and citizen scientists have photographed more than 150 individuals throughout the archipelago and green turtles seem to stay on their chosen “home reefs”, being seen year after year in the same spots. Most observed turtles at coastal foraging grounds are juveniles.

INFO BOX

Satellite tagging studies

Tagging data from marine biologists operating out of resorts in the Maldives suggest that Maldivian green turtles are part of a wider Indian Ocean stock. A green turtle tagged in Oman in 1990 was recovered in the Maldives in 1992. A green turtle tagged at Vaadhoo Resort in South Malé Atoll on 9 October 1996 was recovered off Kerala, India, on 14 November 1996.

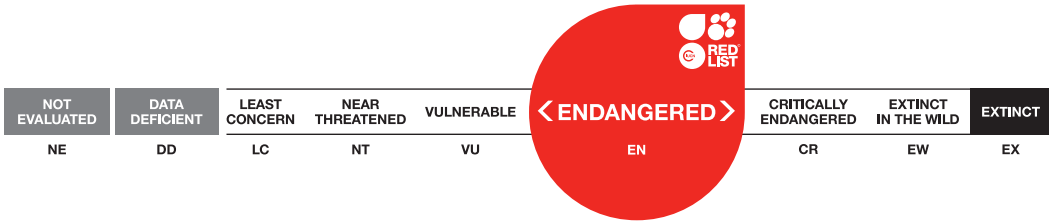
Satellite tagging studies of head-started (captive reared) juvenile green turtles suggest that they travel long distances from the Maldives, many headed east towards Sri Lanka and the Andaman and Nicobar Islands or south-east towards Indonesia and the Cocos Islands. Other tagged juvenile green turtles have travelled north to the Lakhshadweep Islands.

Did you know?

Genetic studies of green turtles in the Chagos Islands showed them to be genetically similar to green turtles from the eastern and western Indian Ocean, but different from turtles in the Arabian Pennisula.

Conservation status

IUCN Red List Status: Endangered (2004)



Current global population estimate: 203,000 breeding females

Protected by: CITES Appendix I, CMS Appendix I, IOSEA Marine Turtle MoU, and Section 10 of the Maldivian Fisheries Law no. 5/87

HAWKSBILL TURTLE

Scientific name: *Eretmochelys imbricata*

Divehi name: Kahan'bu

Key Features or Characteristics

The hawksbill turtle gets its name from its narrow, elongated head that tapers sharply to a V-shaped lower jaw. Its other prominent feature is the saw-like appearance of its shell margins. The hawksbill is one of the smallest species of marine turtles, with adults measuring about 75-90 cm in length and weighing around 70 kg. Indian Ocean turtles tend to be smaller than their Pacific and Atlantic counterparts, with females measuring 70 cm and weighing 44 kg, on average. Males and females tend to be around the same size, but males may have longer claws and brighter colouring. The carapace of the hawksbill is unique amongst the sea turtles as the scutes overlap. It has five central and four pairs of lateral scutes on its carapace. These scutes are streaked and marbled with amber, yellow, black, or brown and the turtle has a yellowish plastron.

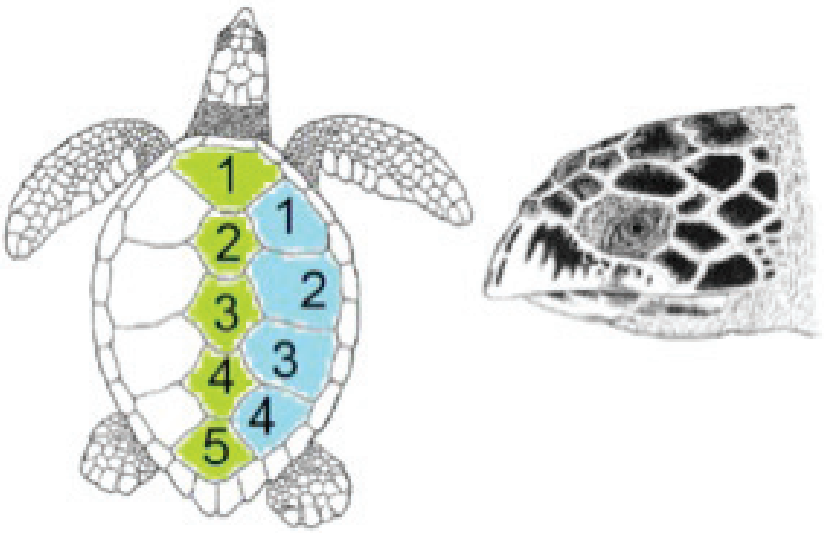


Figure 2.2. Key features of hawksbill turtles. Illustrations modified from Pritchard and Mortimer (1999)[2], used with permission.

[2] Pritchard, P.C.H. and Mortimer, J.A. 1999. Taxonomy, External Morphology, and Species Identification, p.21-38. In: K.L. Eckert, K.A. Bjorndal, F.A. Abreu G. and M.A. Donnelly (Editors), Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publ. No. 4. Washington, D.C.

Biology and Behaviour

Hawksbill turtles reach sexual maturity at around 30 years of age. They mate approximately every 2 years in secluded lagoons off their nesting beaches. Females may nest 2 to 5 times per season. The female lays an average of 160 eggs in each nest that take about 60 days to incubate. Female hawksbills seem to prefer nesting in vegetation at the back of beaches. Track marks are about 70 to 85 cm wide, shallow, and have asymmetrical (alternating) forelimb marks. Tail marks may be present or absent. Hatchlings weigh around 25 g and are 40 mm long at birth. The hatchlings have a light-brown, heart-shaped shell, which elongates with age. Their life span remains unknown. Hawksbills are often observed resting in caves or under ledges around reefs during the day. They are known to return to the same spot night after night to rest.

A hawksbill turtle comes in for a close look at Makunudhoo Reef in North Male Atoll, in the Maldives.

Photo . Zoe Andrews

Did you know?

It has been noted that the colour of the hawksbill's shell can change slightly depending on the water temperature.

Did you know?

Though most turtles nest at night, hawksbill turtles in the Western Indian Ocean are known to nest both day and night. Hawksbills have also been seen nesting during the day in the Seychelles and the Chagos Islands. This behaviour however has not yet been observed in the Maldives.

Diet

Sponges

Corals

The hawksbill's narrow head and beak-like jaw shape allow them to forage in crevices in coral reefs. They feed mainly on sponges, but anemones, soft corals, urchins, jellyfish, squid, and shrimp are also in their diet. Both sessile and mobile animals are eaten and hawksbills appear to be opportunistic predators. Juvenile hawksbills eat Sargassum seaweed as well as prey that can be found within the floating algae mats such as fish eggs, crabs, and other invertebrates.

A hawksbill turtle finds a meal on Mudhdhdoo reef in the Maldives.

Photo . Lauren Arthur

Preying on poison

INFO BOX

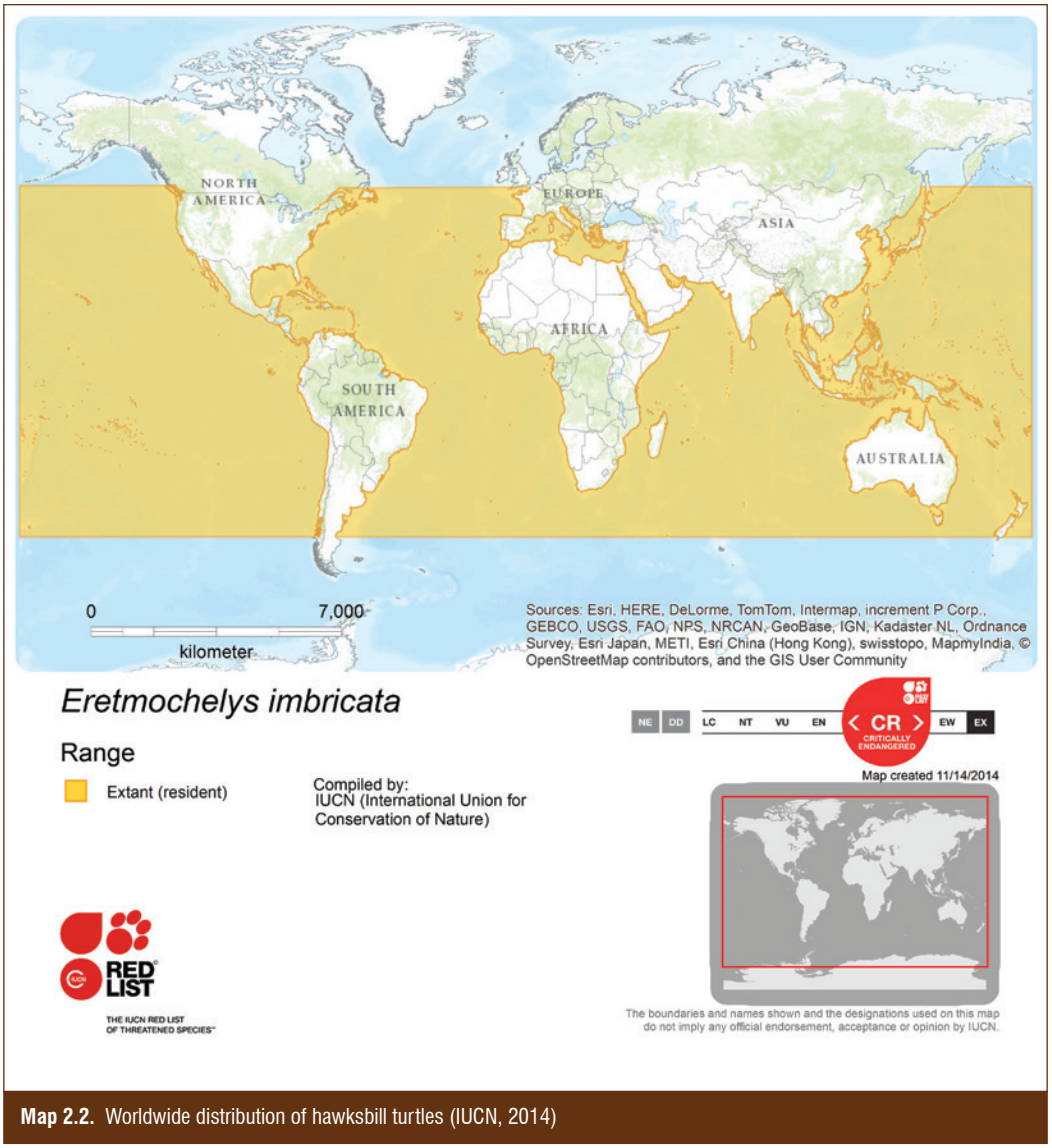
Hawksbill turtles are able to eat dangerous animals, such as the Portuguese man o' war, by simply closing their unprotected eyes. Their hard carapace protects them from the dangerous stinging tentacles. Additionally, many of the sponges that they eat are either highly toxic, even lethal, to other creatures, or contain sharp indigestible siliceous spines. This makes the hawksbill's flesh harmful to humans and and its consumption may cause serious illness or even death.

Habitat and Distribution

This species can be found throughout the central Atlantic and Indo-Pacific regions; in fact, these two populations are sufficiently different to be considered subspecies (*Eretmochelys imbricata imbricata* and *E. i. bissa*, respectively). Post-hatchling hawksbills occupy the pelagic environment, taking shelter under algal mats accumulating at convergence points. Hawksbills recruit to coastal foraging areas when they reach approximately 20-25 cm in length (around 1-4 years of age). This shift in habitat also involves a shift in feeding strategies: from feeding primarily at the surface to feeding on animals associated with coral reef environments below the surface. Adults forage almost exclusively on coral reefs and are seldom seen foraging in waters deeper than 20 metres. Once a convenient feeding area is located, hawksbills remain loyal to that site, moving only when there is increased competition, decreased food availability, or to make their nesting migrations. Marine biologists and divers, stationed around the country, report seeing the same turtles on their house reefs year after year.

Like other marine turtles, the hawksbill makes long nesting migrations and nests on both low- and high-energy beaches. Thanks to their small body size and great agility, they can traverse fringing reefs inaccessible to other species. They often nest on small, isolated islands and sometimes on mainland coasts.

Although generally not found in large concentrations, hawksbills are widely distributed across the Indian Ocean. Nesting density is low throughout their global range and many populations are now severely depleted, though new, previously unknown, nesting populations were recently discovered in the central Pacific. In the Indian Ocean, large nesting populations occur in the Seychelles, Indonesia, and Australia. Smaller nesting populations can be found in the Lakshadweep Islands, the Andaman and Nicobar Islands, Chagos Islands, Oman, Saudi Arabia, the Maldives, and Madagascar.



Map 2.2. Worldwide distribution of hawksbill turtles (IUCN, 2014)

Hawksbill turtles in the Maldives

Hawksbill turtles are known in the Maldives as "kahan'bu" and can be found year-round foraging throughout the archipelago. The Maldives is probably one of the most important feeding areas for hawksbill turtles in the Indian Ocean; marine biologists and citizen scientists have photographed over 1,000 individuals throughout the archipelago. Many of the photographed turtles were juveniles, with a carapace less than 60 cm long, whereas few males and adult females have been photographed. Adult turtles may be foraging in the Maldives and nesting in other Indian Ocean locations such as the Chagos Islands to the south, the Lakshadweeps to the north, or further afield.

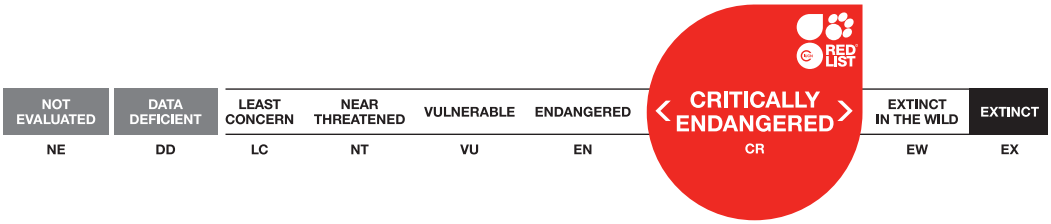
Based on reports from marine biologists and professional divers stationed around the country, the number of confirmed hawksbill sightings is around ten times higher than that of green turtles. However, the number of hawksbill turtles nesting in the Maldives appears to be lower than the number of nesting green turtles. Nesting likely occurs in most atolls on uninhabited islands and sandbanks. In the Indian Ocean, the peak of the nesting season is October to January, which marks the onset of the Northwest Monsoon. The population of nesting hawksbills in the Maldives is currently unknown, though recent nesting activity has been reported in Kaafu, Baa, Thaa, and Laamu atolls.

A hawksbill turtle resting on Dhonfanu reef in Baa Atoll, in the Maldives.

Photo . Lauren Arthur

Conservation status

IUCN Red List Status: Endangered (2008)



Current global population estimate: Approximately 8,000 adult nesting female hawksbill turtles.

Protected by: CITES Appendix I, CMS Appendix I, IOSEA Marine Turtle MoU, and Section 10 of the Maldivian Fisheries Law no. 5/87

OLIVE RIDLEY TURTLE

Scientific name: *Lepidochelys olivacea*

Divehi name: Vaa voshi velaa

Key Features or Characteristics

The Olive Ridley sea turtle is the smallest and most abundant of all sea turtles, growing up to 70 cm and weighing 45 kg, on average. The Olive Ridley gets its name from its olive green coloured carapace, which is heart-shaped. Males and females grow to the same size; however, females have a slightly more rounded carapace. The turtle has 5 to 9 pairs of costal scutes and either one or two claws on each flipper. Indian Ocean Olive Ridley turtles in the Indian Ocean are, on average, smaller than individuals found in the Pacific and Atlantic.

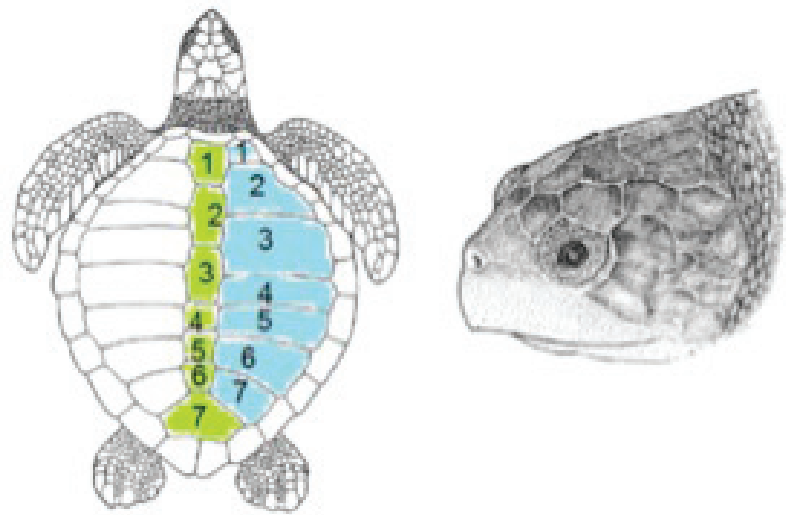


Figure 2.3. Key features of Olive Ridley turtles. Illustrations modified from Pritchard and Mortimer (1999)[3], used with permission.

[3] Pritchard, P.C.H. and Mortimer, J.A. 1999. Taxonomy, External Morphology, and Species Identification, p.21-38. In: K.L. Eckert, K.A. Bjorndal, F.A. Abreu G. and M.A. Donnelly (Editors), Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publ. No. 4. Washington, D.C.

Biology and Behaviour

Olive Ridley turtles reach sexual maturity at approximately 15 years of age, an early age compared to other sea turtles. Many females nest every year, once twice a season, laying clutches of approximately 100-110 eggs, which take from 45 to 65 days to hatch. The nesting female leaves track marks that are 70-80 cm wide and have asymmetrical forelimb marks. Tail drag marks are absent. Olive ridley turtles use three different strategies to nest: arribadas, solitary nests and mixed strategy. An arribada is a mass-nesting event when thousands of turtles come ashore at the same time to lay eggs on the same beach. More commonly, Olive Ridley turtles nest in a dispersed way (individual nesters are not synchronous). In certain places, some females can use both strategies. The time period between nesting events for solitary nesters is approximately 14 days; for arribada nesters it is 28 days. The hatchling Olive Ridley turtles are charcoal grey with a greenish hue along their sides, around 38 mm long and weighing 17 g at birth.

A female Olive Ridley turtle arrives to nest on a beach in Orissa, India.

Photo . Satya Ranjan Behera

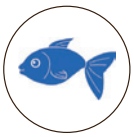
An Olive Ridley turtle hatchling.

Photo . Susie Gibson

Diet


Crustacea


Jellyfish


Fish

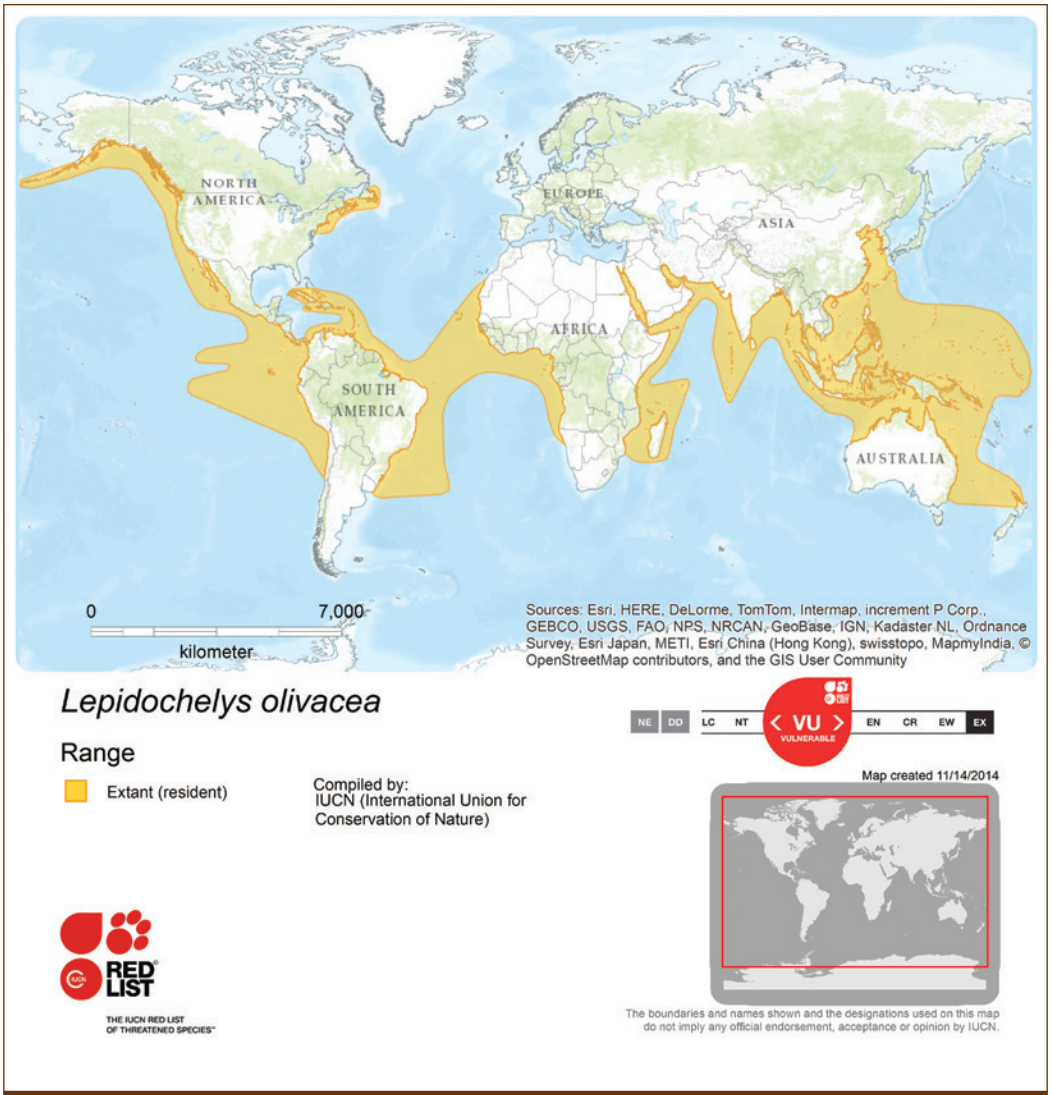

Mollusks

Olive Ridley turtles are omnivorous, feeding on algae, lobsters, crabs, tunicates, jellyfish, molluscs, shrimp, as well as fish and their eggs. These turtles can dive to depths of about 150 metres to forage on benthic invertebrates. In the open ocean, they appear to be opportunistic feeders, eating just about anything they can find.

Habitat and Distribution

The Olive Ridley turtles are globally distributed in the tropical regions of the South Atlantic, Pacific, and Indian Oceans. They are mainly pelagic, but they have been found to inhabit coastal areas, including bays and estuaries. Olive Ridleys often migrate thousands of kilometres between pelagic feeding and coastal breeding grounds. Fishermen have spotted adult Olive Ridleys over 4,000 km from land in the Pacific. Little is known about the juvenile stage of this turtle but it is thought to spend its first few years floating in oceanic currents and foraging for planktonic plants and animals.

Satellite tracking studies of female Olive Ridleys nesting in Bangladesh show that they travel widely in the Bay of Bengal, coming very close to the coasts of India and Sri Lanka. The tracking of rehabilitated turtles released from the Maldives shows that they travel with the predominating currents either east towards Sri Lanka and India or north through the Lakshadweep Islands and into the Arabian Sea. Despite the enormous number of Olive Ridleys that nest in Orissa, India, this species is not commonly seen throughout much of the Indian Ocean.



Map 2.3. Worldwide distribution of Olive Ridley turtles (IUCN, 2014)

The Olive Ridley turtle in the Maldives

Olive ridley turtles have never been recorded nesting in the Maldives, nor have any gravid females been observed. They appear to be most common offshore and most of the recorded turtles were either sub-adults or adult females. Though previous stud-

ies report no particular season for encountering Olive Ridley turtles in the Maldives, more recent data suggest that this species is most often seen entangled in ghost nets between January and April. The turtles are likely on their way to or from their nesting beaches in India and encounter marine debris along the way.

An Olive Ridley turtle photographed in Baa Atoll, in the Maldives.

Photo . Thomas Badstubner

INFO BOX

Arribada nesting

Olive Ridley turtles, along with their cousin the Kemp's Ridley turtle, are best known for their unique and spectacular mass nesting event called arribada (Spanish for "arrival"), where thousands of females come together on the same beach at the same time to lay their eggs. Nesting tends to occur on mainland shores, on wide beaches that are often close to river or estuary mouths. Major arribadas occur in the Pacific coast of Mexico, eastern India, Costa Rica, Nicaragua, and Panama. Solitary nesting occurs in Malaysia, Myanmar, Guatemala, Brazil, Pakistan, Sri Lanka, Oman, and other countries.

It is not known what triggers the start of an arribada event but the timing is thought to be linked to weather events (such as strong winds or cloudy days) and the lunar/tidal cycles.

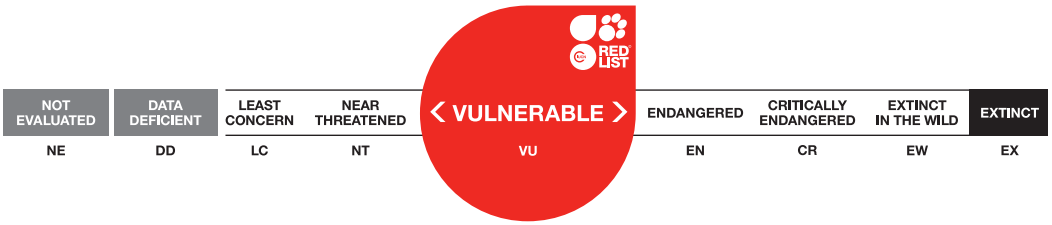
An Olive Ridley *arribada* nesting event in Orissa, India.

Photo . Satya Ranjan Behera

The coast of Orissa, India is home to several Olive Ridley rookeries, where tens of thousands of turtles emerge from the coastal waters to lay their eggs over a period of five to seven days in February or March. The turtles arrive for mating as early as October and large reproductive aggregations, covering an area of 50-60 km^2, can be seen offshore of the nesting beaches. The females laboriously dig conical nests about half a metre deep. After about 45-65 days, the eggs begin to hatch, and the beaches are swamped with hatchlings. Nesting in arribadas is a way for this species to boost the survival rate of the hatchlings by overwhelming predators with sheer numbers. However, survival of eggs at arribada nesting sites is very poor because the eggs from one arribada do not hatch before the second wave of turtles comes to nest and dig them up. Gahirmata beach in Bhitarkanika Wildlife Sanctuary is home to the largest population of nesting Olive Ridleys in the world.

Conservation Status

IUCN Red List Status: Vulnerable (2007)



Current global population estimate: Approximately 800,000 nesting adult females

Protected by: CITES Appendix I, CMS Appendix I, IOSEA Marine Turtle MoU, and Section 10 of the Maldivian Fisheries Law no. 5/87 (expiring in 2015).

An Olive Ridley turtle is cut free from a ghost net in Baa Atoll, in the Maldives.

Photo . Thomas Badstubner

LOGGERHEAD TURTLE

Scientific name: *Caretta caretta*

Divehi name: Boa bodu Velaa

Key Features or Characteristics

Loggerhead turtles are named after their exceptionally large heads. They normally carry many encrusting organisms, such as barnacles, on their head and carapace. Adult loggerhead turtles measure between 75 and 100 cm in length and typically weigh up to 160 kg. The largest recorded loggerhead weighed 545 kg and measured 213 cm in length. Their heart-shaped carapace is orange to reddish-brown with a yellowish-brown plastron. They typically have five vertebral scutes down the carapace's midline and five pairs of costal scutes along the borders.

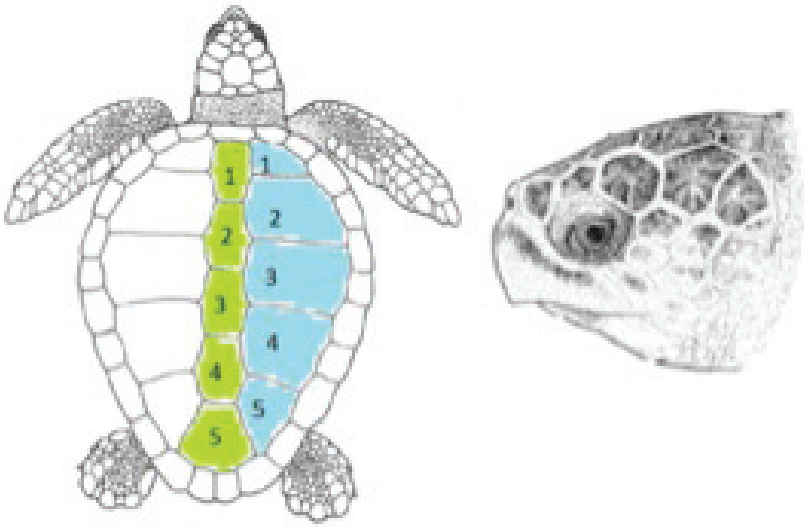


Figure 2.4. Key features of loggerhead turtles. Illustrations modified from Pritchard and Mortimer (1999)[4], used with permission.

[4] Pritchard, P.C.H. and Mortimer, J.A. 1999. Taxonomy, External Morphology, and Species Identification, p.21-38. In: K.L. Eckert, K.A. Bjorndal, F.A. Abreu G. and M.A. Donnelly (Editors), Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publ. No. 4. Washington, D.C.

Biology and Behaviour

The loggerhead reaches sexual maturity at around 30 years of age. There are no external differences between males and females until they reach sexual maturity. Adult males have longer tails and claws, and shorter plastrons. Males also have wider heads and wider and shallower carapaces. Their lifespan is thought to be 47-67 years.

Loggerhead turtles have a low reproductive rate. Females nest every 2 to 3 years at an average of 4 times per season. They lay between 40 and 190 eggs per clutch. Track marks measure 70 to 90 cm wide and have asymmetrical diagonal forelimb marks. The tail drag mark is usually absent. Hatchlings have a light to dark brown carapace and light margins along their flippers. They measure 40-50 mm upon hatching.

A normal dive is between 15 to 30 minutes, but they can stay under for up to four hours. Loggerheads normally rest on the bottom of the sea, remaining

A female loggerhead turtle returns to the sea after nesting on Sarasota Beach in Florida.

Photo . Martin Stelfox

A loggerhead hatchling emerges from a nest on Sarasota Beach, Florida

Photo . Martin Stelfox

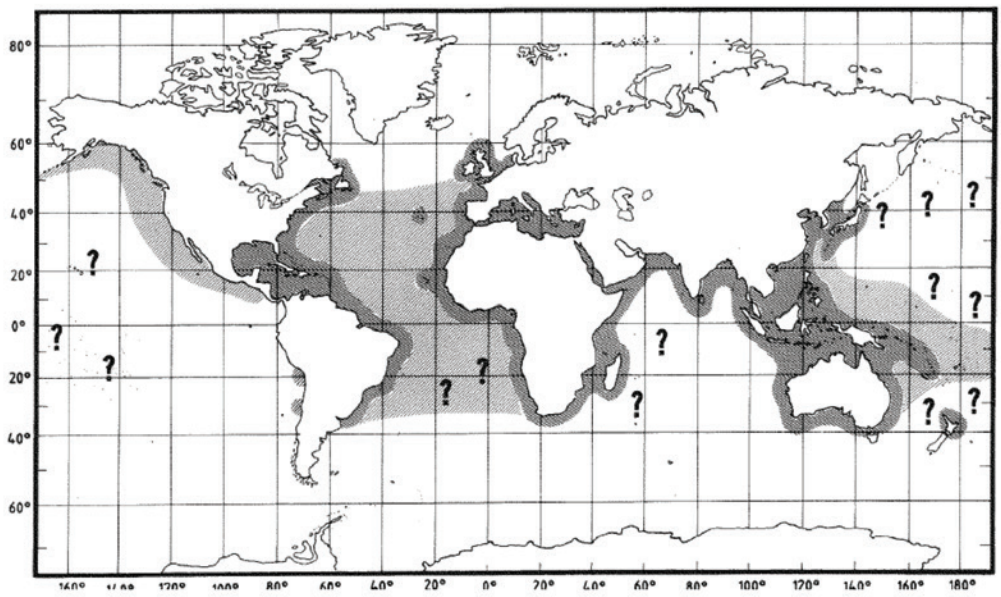
motionless with their eyes half closed so that they are easily alerted. In cold waters, loggerhead turtles have been recorded holding their breath for seven hours at a time. These are among the longest dives of any marine vertebrate.

Diet

The loggerhead's powerful jaws allow it to crush the hard shells of molluscs and crustaceans that inhabit the bottom of the ocean. They feed on crabs, clams, mussels and other invertebrates. They have a more varied diet than any other species of sea turtle. Sponges, corals, sea urchins, squid, starfish, and even insects are on their menu. The loggerhead's jaws are strong enough to crush the shells of giant clams and queen conches. When they are migrating through open seas, loggerhead turtles feed on jellyfish, floating molluscs, fish eggs, and squid. Juvenile loggerheads prey on barnacles, crab larvae, fish eggs, and hydrozoans living in Sargassum seaweed mats and are ambush predators.

Habitat and distribution

Loggerheads are distributed throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans as well as in the Mediterranean Sea. They can live in water as cold as 13°C. This species may be found in pelagic areas as well as in inshore areas such as bays, lagoons, salt marshes, creeks, and the mouths of large rivers. Coral reefs and rocky areas are frequently used for foraging. Like all other marine turtles, they spend their entire lives at sea. Loggerhead hatchlings find their way to mats of flotsam (often Sargassum seaweed) in the open ocean or in shallow estuaries, where they remain for the



Map 2.4. Worldwide distribution of loggerhead turtles (IUCN, 2014)

first 7-12 years of their lives. Recent studies suggest that they spend a lot of time at the surface in their first year. At this stage they will migrate to nearshore coastal areas to forage and grow to maturity. Like other turtles, loggerheads migrate long distances between their foraging and nesting grounds. They appear to migrate along coastlines rather than cross open waters.

Unlike other species of turtles, courtship behaviours do not take place near their nesting beaches but along the way from the foraging grounds to the migration routes. Loggerheads nest on high-energy oceanic beaches and occasionally on estuarine shorelines. Nests are typically made between the high tide line and the dune front. They nest between May and August in the Northern Hemisphere and between October and March in the Southern Hemisphere.

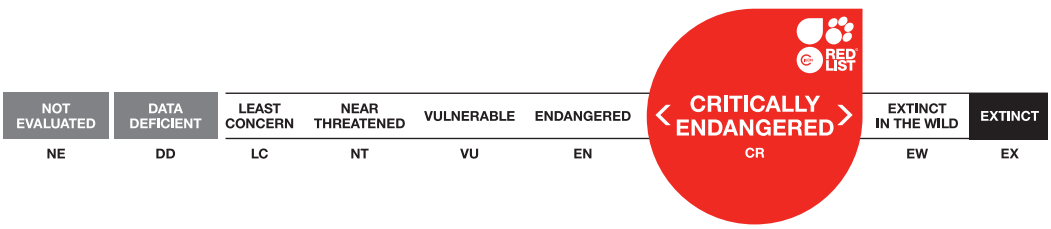
In the Indian Ocean, loggerhead turtles feed along the coasts of Africa, Oman, Yemen, and in the Arabian Sea. Loggerheads nest in few countries in the Indian Ocean, and the number of nesting females is generally small. The exception to this is Masirah Island in Oman, which is one of only two beaches in the world with more than 10,000 loggerhead females nesting yearly, although the population has not been evaluated recently. There are conflicting reports of loggerheads nesting in Sri Lanka and in the Andaman and Nicobar Islands. Loggerheads are rare in the Maldives and nesting has not been reported. Only a few confirmed photographs of loggerheads in the Maldives exist, with the most recent record coming from Dhaalu atoll in 2013.

Loggerhead turtles in the Maldives

Though rarely spotted in Maldivian waters, the loggerhead turtle appears on the national currency, in particular on the 50 laari Maldivian coin. Locally this species is known as “boa bodu Velaa”, which translates into “big-headed turtle”.

Conservation Status

IUCN Red List Status: Critically Endangered (2015



Global population estimate: 36,000 to 67,000 breeding adult females in 2015.

Protected by: CITES Appendix I and II, CMS Appendix I, IOSEA Marine Turtle MoU, and Section 10 of the Maldivian Fisheries Law no. 5/87

LEATHERBACK TURTLE

Scientific name: *Dermochelys coriacea*

Divehi name: Musimbi

Key Features or Characteristics

The largest of all the sea turtle species (and the largest living reptile) - the leatherback turtle - owes its name to its unique shell, which is composed of a layer of tough, rubbery skin strengthened by a matrix of thousands of tiny bone plates that look almost like a jigsaw puzzle. It is the only marine turtle without a hard carapace and without claws on its flippers. The leathery, dark grey to black carapace is mottled with white spots and marked by five ridges; the plastron is cream to black in colour. The leatherback's body is teardrop-shaped and tapers at the hind end to a blunt point. The shape of its shell makes it very hydrodynamic. Mature males and females can grow over 2 metres in length and weigh up to 900 kg, although individuals of this size are rarely seen today. Leatherbacks mature between 8 and 15 years of age and are estimated to have a life span of around 45 years in the wild, but this is not well documented.

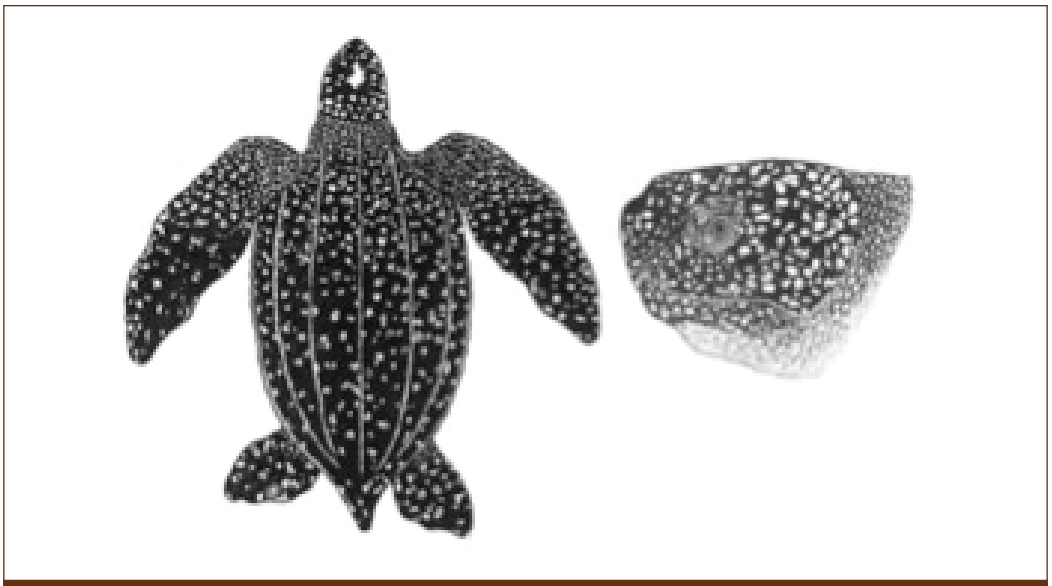


Figure 2.5. Key features of leatherback turtles. Illustrations modified from Pritchard and Mortimer (1999)[5], used with permission.

[5] Pritchard, P.C.H. and Mortimer, J.A. 1999. Taxonomy, External Morphology, and Species Identification, p.21-38. In: K.L. Eckert, K.A. Bjorndal, F.A. Abreu G. and M.A. Donnelly (Editors), Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publ. No. 4. Washington, D.C.

Biology and Behaviour

Leatherbacks have a patch of pink skin on the top of their heads. Each spot, like our fingerprint, is unique. Scientists are not sure about the function of this spot but it might help the turtle sense light or determine where it is geographically.

Like all marine turtles, leatherbacks do not have teeth. Instead, they have two pointed cusps on their upper jaw and one on their lower jaw to help grasp their prey. Additionally, the leatherback's oesophageal tract is lined with sharp, downward pointing spines, which are thought to prevent their prey from escaping once caught and to help shred their food before it reaches their stomach.

Unlike other sea turtle species, female leatherback turtles may use different nesting beaches from year to year (though they tend to stay in the same region). Because of their size, females prefer open-access beaches with a deep-water approach and soft sand, as sharp rocks can easily damage their plastrons. Leatherbacks usually nest once every 2 to 3 years

A leatherback turtle.

Photo . Alejandro Fallabrino | Karumbé

Did you know?

The largest leatherback ever found was a 2.6 metre long male weighing 916 kg that washed up on the west coast of Wales in 1988.

on sandy beaches in the tropics and subtropics and a female may nest from 6 to 9 times per season. Females leave track marks about 150-200 cm wide, with symmetrical flipper marks and a deep median tail groove. Laying a nest takes the female from 1.5 to 2 hours, as she is extremely slow and clumsy on land. A clutch consists of an average of 80-100 fertilised eggs, covered by a layer of about 30 smaller, unfertilised eggs. Scientists are not sure about the function of these yolkless eggs, but they think that they might prevent sand from falling between the fertile eggs, which allows more oxygen to circulate around them. Incubation takes about 65 days. Upon hatching, the baby turtles are around 50-75 mm long and they are black with white along the flipper margins and the ridges down their back.

A nesting leatherback turtle.

Photo . Alejandro Fallabrino | Karumbé

Did you know?

The leatherback turtle is so different to all other species of sea turtles that it is in a taxonomic family of its own (Dermochelyidae). Leatherback turtles have been around since the time of the dinosaurs and have evolved very little in the last 90 million years.

INFO BOX

How do leatherback turtles stay warm in cold water?

Adult leatherback turtles are capable of tolerating water temperatures well below subtropical conditions. They have a number of thermoregulatory adaptations that make this possible: their dark coloured carapace absorbs heat from the sun when they are at the surface; they have a thick layer of fat with a high oil content under their carapace; and also a high volume-to-surface-area ratio (meaning that the turtle has a large body volume in relation to its outside surface area), all of which helps retain heat. Leatherbacks also have a special counter-current heat exchange system where their flippers meet their bodies. Their veins and arteries are located next to one another so that the warm blood coming from the heart in the arteries helps warming the cooler blood returning to the heart in the veins. They are even able to maintain their core body temperature up to 18°C above the ambient water temperature. Some scientists also think that the leatherback turtles may be able to generate heat internally, like a mammal, even though most reptiles are ectotherms, or cold-blooded. Leatherbacks keep their internal body temperature around 25°C and, in hot climates, they can release heat from their outer body layers.

Diet

Jellyfish

Leatherback turtles have delicate, scissor-like jaws, and feed exclusively on soft-bodied animals. A leatherback's diet consists almost entirely of jellyfish but they may also eat salps, gelatinous free-swimming marine invertebrates with transparent barrel-shaped bodies. They rarely feed on tunicates and cephalopods such as squid and octopus.

This type of turtle can eat around 73% of its own body weight in jellyfish every day, packing in around 16,000 calories. That is around 3 to 7 times more than they actually need to survive and allows them to fuel their long migrations.

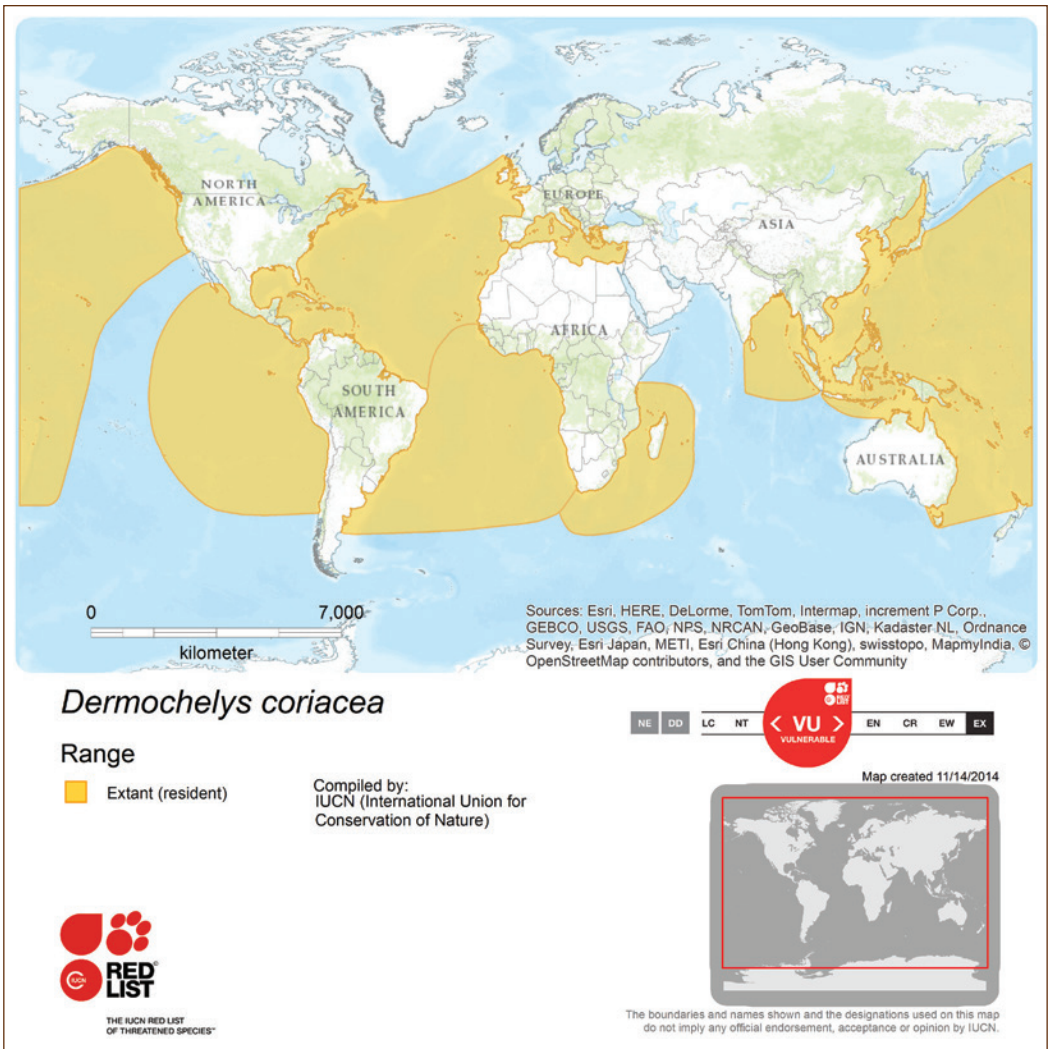
Habitat and distribution

Leatherback turtles are the most migratory and wide-ranging of all marine turtles. They may have the widest global distribution of any vertebrate species on the planet. They are found throughout the Atlantic, Pacific, and Indian Oceans ranging as far north as the Gulf of Alaska and as far south as Tasmania. While the leatherbacks are not as common in the Indian Ocean as other species of marine turtles, important nesting populations are found in and around the Indian Ocean, including in Indonesia, South Africa, Sri Lanka, and India's Andaman and Nicobar Islands. In the Andaman and Nicobar Islands, India, 150 to 520 nests were recorded per nesting season. Sporadic surveys, realized after the 2004 tsunami, showed a reduction in the number of nests, however as these surveys were incomplete, assessing trends is not possible. From 100 to 200 turtles are estimated to nest annually in Sri Lanka.

Leatherbacks are powerful swimmers and regularly travel enormous distances, crossing entire ocean basins, or even moving between them. However,

very little information is available on the movements of leatherbacks in the Indian Ocean. Mostly pelagic in nature, leatherback turtles are also known to forage in temperate coastal waters. They travel from their tropical breeding and nesting grounds to find their favourite prey: jellyfish. The turtles follow their prey, foraging in deeper water in the daytime and shallower water at night, when the jellies rise up in the water column. The distribution and developmental habitats of juvenile leatherbacks are poorly understood but it is thought that they remain in coastal tropical waters (above 26°C) until they are about one metre in length. Sightings of juvenile leatherback turtles are very rare. The leatherback's pelagic habits make it especially at risk of interactions with fisheries, particularly longlines. Additionally, leatherback turtles cannot swim backwards, meaning that once they become entangled in a net or line, they have little chance of escaping from it.

Leatherback turtles can dive to depths of over 1,200 m, much deeper than any other marine turtle, and can stay down for up to 85 minutes, though a typical dive only lasts 3to 8 minutes. The leatherback is one of the deepest diving vertebrate animals.



Map 2.5. Worldwide distribution of leatherback turtles (IUCN, 2014)

Did you know?

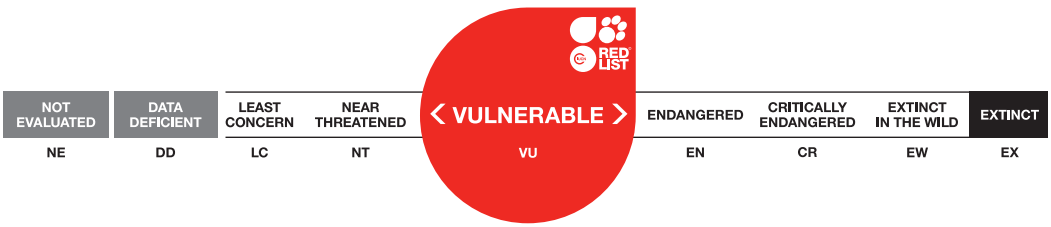
A leatherback turtle was tracked via satellite telemetry 19,000 km from Indonesia to Oregon, USA. This is one of the longest recorded migrations of any vertebrate animal.

Leatherback turtles in the Maldives

In the Maldives, this turtle is known as “musimbi”, which means Mozambique, and sightings are very rare. No nesting events have been confirmed in the last 100 years.

Conservation Status

IUCN Red List Status: Vulnerable (2013)



Global population estimate: 30-40,000 adult females in 1996.

Protected by: CITES Appendix I and II, CMS Appendix I, IOSEA Marine Turtle MoU, and Section 10 of the Maldivian Fisheries Law no. 5/87.

Photo . Large green turtle © Jasmin Pape

CHAPTER 4

Ecological role and importance of marine turtles

Marine turtles play many key roles in the ocean and beach ecosystems that are usually summerised in four main categories:

1. Maintaining healthy seagrass beds and coral reefs,
2. Providing key habitats for other marine life,
3. Balancing the marine food webs, and
4. Facilitating nutrients cycling from water to land.

Green turtles are important for maintaining healthy seagrass beds and coral reefs. Research has shown that seagrass beds cropped by turtles are healthier than those that are not. Without constant grazing, seagrass beds may become overgrown, obstructing currents, shading the bottom, or decomposing. Seagrass beds also act as nurseries for a number of spe-

cies of fish and crustaceans, including commercially valuable species. Juvenile fish feed and hide in the grass until they are big enough to avoid predators on the reef or in the open sea. On the reef, green turtles crop algae that can compete with corals.

Did you know?

The over-exploitation of green turtles in the Gulf of Mexico and the Caribbean has led to a loss of productivity in the entire food chain.

Hawksbill turtles control the population of sponges in coral reefs, which can easily out-compete corals for the same space. Through selective foraging, hawksbill turtles are able to impact the overall reef diversity.

Leatherback turtles can eat enormous amounts of jellyfish, helping to keep their populations under control. Globally, the increase in jellyfish numbers is proving detrimental to the recovery of fish stocks. Further declines in leatherback, loggerhead, and green turtles could shift the species balance even further towards a higher number of jellyfish in the future.

Loggerhead turtles are known to help aerate sediment on the bottom of the ocean and distribute nutrients while they search for, and feed on, crustaceans.

Photo . Susie Gibson

An unburied egg on a beach. Unhatched eggs provide nutrients for beach vegetation, preventing erosion by holding the sand in place.

Furthermore, unhatched eggs, trapped hatchlings, and even egg-shells provide nutrients for beach vegetation, which holds the sand in place. The loss of beach vegetation can lead to erosion. Healthier beach and dune vegetation create a stronger overall beach ecosystem, helping stabilise the turtles' nesting habitat.

Dead and decomposing turtles that wash up on beaches are mini ecosystems, providing food for scavenging birds, mammals and insects. Sea turtle eggs, hatchlings, and adults are also natural prey for a number of terrestrial and marine animals.

Finally, most turtles carry parasites, barnacles, algae, and other organisms on their backs, which represent a source of food for a variety of species at "cleaning stations" around the reef. Additionally, marine turtles help distribute these "hitchhikers" between the reef, seagrass beds, and the open ocean.

Did you know?

Sea turtles are often used as a perching platform by seabirds while they are at sea. The Olive Ridley turtle is most often associated with sea birds as it makes its long oceanic migrations, basking at the surface to warm itself. The birds may even find a meal feeding on the barnacles or crabs hitchhiking on the turtle's back.

Photo . Sea life © IUCN

CHAPTER 5

Global threats to marine turtles

NATURAL THREATS

Due to their size and their protective carapace, adult turtles have few natural predators: sharks, crocodiles, large fish, and occasionally octopuses. The most dangerous time in a turtle's life comes when hatchlings make their journey from their nest to the sea. On the beach, crabs, birds, and mammals prey on the young turtles. Once they are in the water, they face the threat posed by many species of fish on reefs and in deep water.

A hawksbill turtle missing a front flipper swims on a reef in Baa Atoll in the Maldives.

Photo . Chaira Fumagalli

Photo . Emma Doyle

Vultures prey on Olive Ridley turtle eggs as a female nests on a beach in Orissa, India.

ANTHROPOGENIC THREATS

Direct Harvest

The main threat to sea turtles is, of course, humans: all species of sea turtles are captured for their flesh or, in case of hawksbill turtles, for their beautiful carapace. Eggs are also harvested for consumption. Turtle oil may be used in cosmetics, while their skin can be marketed as leather.

Nesting female turtles can be easily captured and green turtles are the most commonly hunted species. Though turtles are legally protected in many countries around the world, large-scale killing still goes on, and turtle meat is sold either openly or through the black market. A lack of enforcement, punishment, and public awareness are particularly problematic.

Did you know?

In many cultures sea turtle eggs are consumed for their supposed aphrodisiac qualities; however, scientific evidence exists that proves that turtle eggs do not have any aphrodisiac property. On the other hand, extensive evidence suggest that sea turtle eggs can contain high levels of pollutants, bacteria and parasites, which may lower fertility.

INFO BOX

The dangers of eating turtle meat

Prized for their taste, presumed therapeutic value and cultural significance, many species of sea turtle are exploited for human consumption around the world. Research and reports published by the World Health Organisation (WHO) have shown that the consumption of hawksbill turtle meat can be fatal. Hawksbill turtles mainly feed on sponges, many of which contain toxins. It is still unclear how hawksbill turtles can even survive on such a diet. The toxins in hawksbill turtle meat exceed international food safety standards and can result in neurotoxicity, kidney disease, liver cancer, developmental effects in foetuses and children, and even death. Hawksbill turtle meat is especially dangerous to pregnant women and children. The poisoning agent in hawksbill turtle meat is called "chelonitoxin" and cases have been reported from many Indian and Pacific Ocean nations. A report from India tells of 12 families who shared the meat of one hawksbill turtle. By the next day, all 130 people who consumed the meat were ill and 18 eventually died.

In addition to chelonitoxin, turtle meat may contain *Salmonella* bacteria, mycobacteria, *Leptospires*, other bacteria and parasites, trematodes, and high levels of heavy metals and pesticides such as DDT. As turtles are near the top of the food chain, these toxins and chemicals bioaccumulate in their flesh making turtle meat a potential source of diseases.

Bycatch in Fisheries

Accidental capture in fishing nets or bycatch remains the most important threat to marine turtles worldwide. Every year hundreds of thousands of turtles are captured, injured or killed in fishing gear. Most of by-caught turtles die in the fishing gears and little is known on the fate of injured turtles caught and released.

Olive ridley turtles accidentally caught in fishing nets next to Orissa.

Photo . Satya Ranjan Behera

INFO BOX

Sustainable fisheries

Bycatch, or the incidental capture of non-target species, is a serious problem in many commercial fisheries worldwide. Most animals caught accidentally are discarded as waste; however, many countries are now starting to consider bycatch in fishery policies.

In an attempt to reduce the number of turtles caught accidentally, several new types of turtle-safe fishing equipment have been developed such as circle hooks in longlines and turtle excluder devices (TEDs) in trawl nets. In addition, certification programmes, such as the Marine Stewardship Council (MSC), exist which evaluate fisheries against a set of environmental standards. Products from certified fisheries get a green label on their packaging, which is meant to encourage consumers to make eco-friendly choices and provides financial benefits to the fisherfolk.

The Maldives' pole-and-line tuna fishery is one of the most sustainable fisheries in the world: it is very species-specific and has a low environmental impact. However, the global pole-and-line tuna fishery only accounts for around 10% of the world's tuna catch.

Did you know?

Turtle Excluder Devices (TEDs) are small gates at the back of a trawl fishing net that allow large animals, such as turtles and sharks, to escape out of the net while still capturing the target species. The implementation of TEDs has succeeded in reducing sea turtle mortality in trawl fisheries; but TEDs are not regulated worldwide. Shrimp trawlers in the USA are now required to use TEDs. TEDs are mandatory in India too, in all mechanized trawlers operating in areas of mass turtle nesting, however little enforcement exists.

Ingestion of Marine Debris

Currently, it is estimated that there are 100 million tons of plastic in the ocean that are responsible for killing 100 million marine animals every year. Most marine turtles are known to ingest variable amounts of plastic during their lives. Due to the downward facing spines in their throats, turtles are unable to regurgitate the plastic. Plastic objects get trapped in the stomach, which prevents them from swallowing their real food. The debris in the stomach or other parts of the gastro-intestinal tract can block the regular mouvements of food, which subsequently decomposes and results in gases that can cause turtles to float, a symptom known as “bubble butt”. If turtles are floating at the surface, they will not be able to feed properly and will be more susceptible to boat strikes and predators. Young turtles usually rely on oceanic currents to feed because of the concentration of Sargassum seaweed; however, oceanic gyres also concentrate marine debris and other pollutants, such as oil and tar balls, which are ingested by young turtles and other animals.

A green turtle that has ingested marine debris.

Photo . Alejandro Fallabrino | Karumbé

Artificial lighting and urban development in nesting beaches

Nesting turtles must now compete with tourists and coastal residents for the use of sandy beaches. Artificial lights on nesting beaches can cause confusion and disorientation of female turtles and hatchlings. Hatchlings normally locate the ocean from the nest using visual clue: they tend to move away from elevated, darker silhuettes and move toward open, lower and brighter horizon. If tricked by the presence of artificial light, sea turtles may inadvertedly head inland and be killed by predators, or die of dehydration and exhaustion.

Night-time human activity can prevent female turtles from emerging on the beach or cause them to stop mid-nesting and return to the ocean. During night-time, beach furniture and recreation equipment left on the beach become obstacles that can reduce nesting success and turtles (adult females and hatchlings) may even become stuck in them. Increases in boating or personal watercraft activity nearshore can result in injuries or fatal collisions when turtles surface to breathe.

A nesting green turtle makes her way around some beach furniture at a resort in the Maldives.

Photo . Chiara Fumagalli

An Olive Ridley turtle with a fractured shell arrives to nest on a beach in Michoacan, Mexico. This turtle may have been accidentally hit by a boat or personal watercraft.

Photo . Enrique Perez

Erosion and Beach Armouring

Development of coastlines often results in erosion, leaving little space for nesting turtles to lay their eggs. On disturbed beaches, they may nest below the high tide line, resulting in the nest becoming flooded at some point during development, and therefore killing the eggs.

Property owners along beaches threatened by erosion often build structures, such as seawalls, to help protect their land. Although they are intended to prevent sand loss, seawalls actually prevent beaches from naturally migrating inland or recovering after storm events. These walls prevent nesting turtles from accessing their preferred beaches or block prime nesting habitats on the upper portion of beaches. Studies have shown that seawalls and other armouring structures result in an increase of false crawls.

Another erosion remedy is beach nourishment: pumping sand on to beaches from deep water. However, this sand can be very different to the native sediment. If it is too compacted, nesting turtles will not be able to dig their nest. If nourishment happens during nesting season, the eggs may be buried too far beneath the surface or nests may be crushed by heavy machinery. Dredging of sand can also negatively affect the nearshore marine habitats of turtles by smothering reefs and seagrass beds with sediment. Nevertheless, when done correctly, beach nourishment can add nesting habitats where erosion has removed it.

Invasive Beach Vegetation and Predators

Planting exotic vegetation on a beach may drastically alter the sand composition or provide shelter for predators. In India, alien vegetation such as Casuaria has rendered many beaches unsuitable for sea turtle nests.

Hatchlings face a huge risk from their natural predators. When human presence encroaches on nesting beaches, additional predators such as domesticated cats and dogs come with them. Rubbish generated by humans attracts other non-native species, such as pigs or rats. With as few as one in 1,000 sea turtle eggs reaching adulthood naturally, the destruction of only a few nests can have a devastating effect on any sea turtle population.

Photo . Enrique Perez

Dogs preying on Olive Ridley turtle eggs in Michoacan, Mexico.

Photo . Baby green turtles at Kuredhu Resort ©

CHAPTER 6

Threats to marine turtles in the Maldivian Archipelago

In the Maldives, the trade of turtles and their products dates back to the 12th century, with international trade probably insignificant until the 20th century. The first biologists' records of sea turtles in the Maldives were made at the end of the 19th century. Exploitation of turtles for their meat by Maldivians remained low until the early 20th century, possibly due to religious scholars preaching that it was "haram", or unclean, to eat turtle meat. However, eggs were consumed, turtles were used as bait for shark fishing, and their oil used to preserve wooden boats.

The ban on eating turtles was lifted in the 1940s and with the rise of tourism in the 1970s, the killing of turtles for meat and for the curio trade flourished. Immature turtles were caught and stuffed to be sold to tourists as souvenirs. Most turtles were caught either while nesting or by jigging them with a hook.

Currently, the biggest threats to turtles in the Maldives are the direct harvesting of meat and eggs, the pet trade, marine debris, and the loss or destruction of nesting habitats. The fisheries in the Maldives pose little threat to turtles as the primary method of fishing is live bait pole-and-line.

INFO BOX

The bekko trade

The hawksbill turtle's shell, also known as "tortoiseshell" or "bekko" in Japanese is highly prized for its beauty and has been traded internationally for centuries. It is used to make eye glasses, jewellery, combs, brushes, and inlay furniture.

A CITES ban on the international trade of tortoiseshell was introduced in 1973. However, up until the early 1980s, the Maldives one of the largest exporter of tortoiseshell in the world. The Maldives did not join CITES until 2013 and legally allowed exports of turtle shells until 1980, though they were still being sold into the mid -1980s. Between 1950 and 1992, the Japanese imported 1.3 million adult hawksbills and 575,000 stuffed juveniles from tropical countries including the Maldives. The Maldives lifted its export ban temporarily in 1995 to allow approximately 2 metric tonnes of stockpiled tortoiseshell to be exported. As long as the ban on international trade is in place, the member countries of CITES, including the Maldives, are obliged to uphold it. However, lack of information in many countries and the availability of tortoiseshell in many tourist shops may lead many to unwillingly support the trade.

Photo . Zoe Andrews

A hawksbill turtle rests on Makunudhoo reef in North Male, Atoll, in the Maldives and shows off its beautiful markings.

DIRECT HARVEST

There are no figures available for the annual capture of turtles in the Maldives. Historical consumption rates are only available for hawksbills that were sold to the bekko or curio industries. Estimates are available for the number of green turtles killed for consumption. Former island chiefs and other citizens reveal that exploitation varied tremendously from island to island.

Though it has been illegal to catch or kill turtles in Maldivian waters since 1995, turtle consumption is still ongoing throughout the country. From 2006-2016, eggs were only protected on 14 islands, and were taken regularly during this period. Egg collecting was probably once an important occupation on remote islands, with eggs being transported to the capital, Male', or being sold between islands. In 1985, turtle eggs sold for Rf 6-8 per egg (about USD 0.50). In 2014 they sold for for Rf 20 per egg (around USD 1.25).

THE PET BUSINESS

Hatchling turtles are regularly taken from nests and kept as pets around the country. These young turtles do not have a chance to run down their natal beaches, and imprint on the beach location, which has unknown effects on future nesting. Hatchlings are often kept in poor conditions: small containers of dirty, fresh or brackish water; fed inappropriate food sources; and handled too often. Being kept in small enclosures reduces muscular development, meaning that if and when they are released to the wild, they will likely tire quickly or be caught by a predator. Crowded enclosures result in disease and bullying among the turtles too. Sick and weak turtles have little chance of surviving in the wild.

A green turtle hatchling takes its first dip in the ocean.

Photo . Chiara Fumagalli

Did you know?

Keeping a turtle for a few days after it hatches will drastically decrease its chances of survival: hatchlings normally go through a 'swimming frenzy' which allows them to move offshore and eventually being taken by the oceanic currents. However, when swimming in tanks, hatchlings exhaust their frenzy and once released in the ocean, they will not swim forward thinking they are already off-shore.

INFO BOX

Ghost nets: the silent killers

Ghost nets are fishing nets that have been lost, abandoned, or discarded at sea. Every year they are responsible for killing millions of marine animals including sharks, rays, bony fish, turtles, dolphins, whales, crustaceans, and birds. They can also become entangled in live coral, smothering a reef or introducing parasites and invasive species into an ecosystem. In the Maldives, the Olive Ridley turtle is the number one victim of ghost net entanglements. Between 2010 and 2014, more than 100 Olive Ridley turtles were rescued from nets in Maldivian waters, many of them being juvenile. Unfortunately, many more entangled turtles go unnoticed, drifting with the currents to their death. Olive Ridley turtles view the nets as a source of food and shelter. For them, it is no different than a floating mat of seaweed, bamboo, or wood. Unfortunately, once tangled in the net, they can rarely escape. If the net floats, the turtle can at least remain on the surface and breathe. However, dragging a large net causes the turtle to become exhausted and dehydrated. It can no longer dive for its food and the net can cut into its skin. Trapped at the surface, the turtle is at risk of sunburn and birds will pick at its eyes and skin. Ghost nets cause pain, distress, infection, starvation, amputation of limbs, and, eventually, a slow and painful death. In Maldives and throughout the Indian Ocean, the Olive Ridley Project collects information on ghost nets and entangled turtles. More information can be found here: www.oliveridleyproject.org

OLIVE RIDLEY PROJECT

Photo . Martin Stelfox

An Olive Ridley turtle trapped in a ghost nett.

Hawksbill turtle and SCUBA diver in South Ari Atoll

Photo . Carl Lundin | IUCN

Hawksbill turtle in South Ari Atoll

Photo . Carl Lundin | IUCN

Photo . Male hawksbill turtle © Zoe Andrews

CHAPTER 7

Turtle conservation efforts and legislation in the Maldives

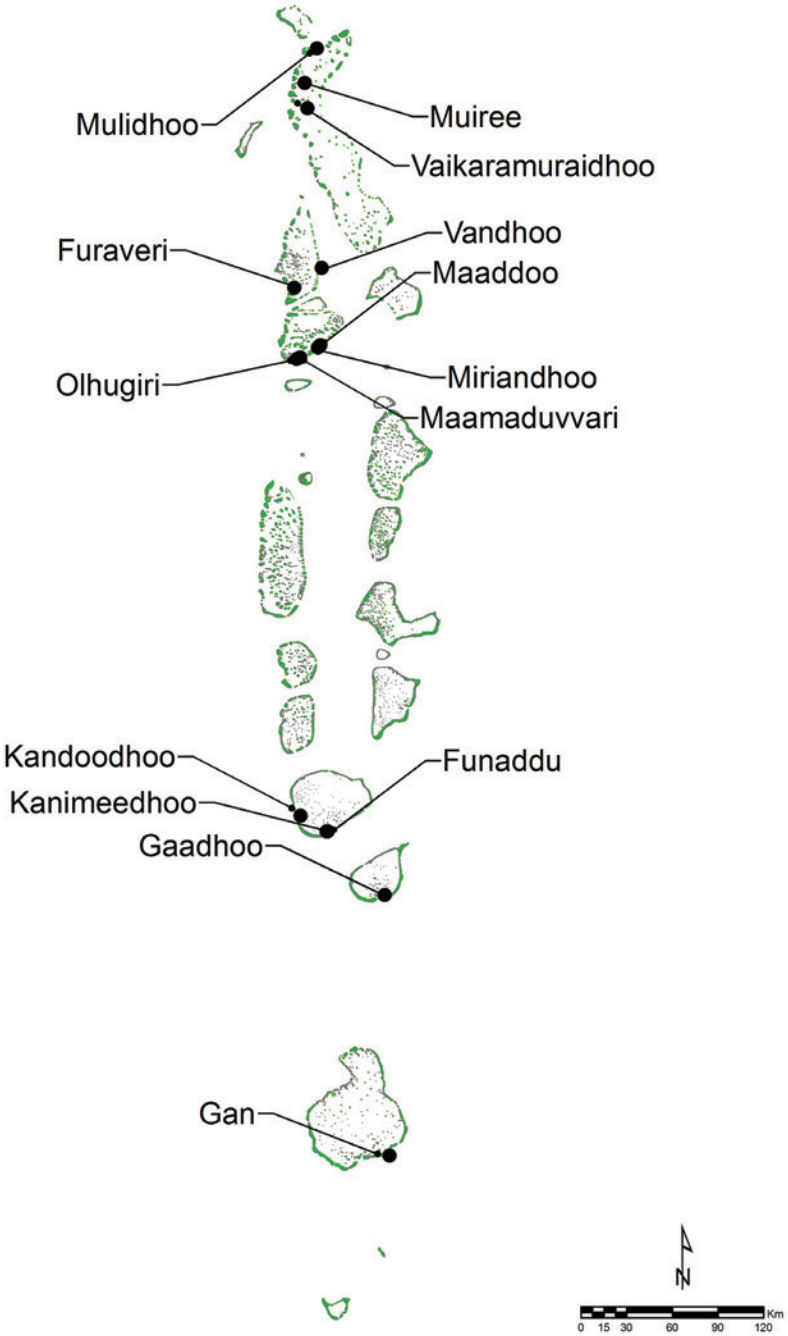
INTERNATIONAL CONVENTIONS

Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)

All species of sea turtles are listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), which forbids selling turtles or turtle products in all signatory countries. Despite this, illegal trade still goes on through the black market. The Maldives became a member of CITES in 2013.

Convention on Migratory Species (CMS)

Sea turtles are also listed in Appendices I and II of the Convention on Migratory Species of Wild Animals (CMS) and are protected under the following auspice of CMS in the Indian Ocean: the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA Marine Turtle MoU). This is an intergovernmental agreement that aims at protecting, conserving, replenishing, and recovering sea turtle populations and their habitats in the Indian Ocean. The memorandum came into effect in 2001 and the Maldives signed in 2010.



Map 6.1. Marine turtle nesting sites where taking of turtle eggs were prohibited by the Ministry of Fisheries and Agriculture from 2006-2016

NATIONAL LEGISLATION

As of April 2016, all species of sea turtles, their eggs, and habitats are legally protected in the Maldives by the Environmental Protection and Preservation Act (4/93). The sale and export of turtles and turtle products is also banned under the Ministry of Fisheries Bill 24/78.

Prior to 2016, sea turtle eggs were only protected on 14 islands considered to be nesting "hotspots". From 2006, a ten-year moratorium on catching and killing of turtles came in to effect. Additionally, there was a Presidential Decree between 1995 and 2015 banning the catching and killing of any species of turtle in Maldivian waters.

CONSERVATION EFFORTS IN THE MALDIVES

Population monitoring

Little historical data exist on marine turtle populations in the Maldives which makes it difficult to study trends or even to estimate the current population size. Surveys carried out by the Ministry of Fishery and Agriculture between 1988 and 2008, although incomplete, revealed that the number of nests (for both hawksbill and green turtles) was declining, while the harvest of eggs remained high.

A hawksbill turtle swimming on a coral reef in Baa Atoll, in the Maldives.

Photo . Chiara Fumagalli

Nest Protection on Resorts and Local Islands

More than 105 islands in Maldives have been developed as tourist resorts. when an island is leased by the Government, the lessee can then set the general policy of how the island and its reefs are to be used and what animals are to be protected. Therefore many resorts cater to scuba divers and snorkellers and have set up rules and put fines in place to protect coral, sharks, turtles, and other animals. Other resorts, however, have no such restrictions.

It is commonplace now for resorts to have a resident marine biologist who may be in charge of surveying the health and diversity of the surrounding reef(s). Many marine biologists record sightings or take photographs of turtles, and if a nest is laid on their island, they often fence it off for protection until it hatches. Often, resort guests are excited to participate in these sighting surveys too - a hatching event is certainly a rare and amazing experience for anyone.

A nest protected at Coco Plam Dhuni Kolhu resort in the Maldives.

Photo . Chiara Fumagalli

Photographic Identification (Photo-ID)

Photo-ID is a method commonly used by scientists to identify individuals within a population based on their natural markings. It has been used for many different animals including tigers, whales, and even octopuses. In the case of the Maldives, scientists are studying manta rays, whale sharks, and now sea turtles using photos collected from marine biologists, professional divers, and 'citizen scientists'.

Photo-ID is an ideal way to help study the populations of endangered species because it is a quick and non-invasive way to estimate population abundance and collect information on the numbers of juveniles, males and females.

Did you know?

All turtles, except the leatherback, can be identified individually based on the pattern of scales on the side of their faces. Each pattern is unique, just like human fingerprints. Individual leatherback turtles, on the other hand, can be identifiedh by the pink patches on the top of their heads.

A hawksbill turtle showing the scutes on the side of its face, the pattern of which can be used to identify individual turtles.

Photo . Lauren Arthur

Photo . Diver with green turtle at Kuredhu Resort © Rosa Brau

CHAPTER 8

What to do if you see...

A TURTLE NESTING

Watching turtles laying eggs at night is one of the most amazing experiences one can witness. However, it is important to respect some basic rules not to disturb the turtles while nesting: marine turtles are very sensitive to light, movement and noise. If they are scared or feel uncomfortable, they will go back to the sea and probably try to lay eggs later or (if repeatedly disturbed) discard the eggs in the water.

1. When a nesting turtle is spotted, you should move away to a distance of at least 15 metres.

2. It is important to keep all lights off; only infrared lights should be allowed on a nesting beach. If you only have a normal torch, try to reduce the light by wrapping the torch in a dark piece of clothing.

3. When the turtle starts laying eggs, she enters a trance. At this moment, and only at this moment, you can get closer to the animal. When there are large groups, it is suggested to form a semicircle behind the turtle, keeping away from its peripheral vision, so that everybody can enjoy the nesting process without disturbing the animal.

4. As soon as the turtle starts to cover the nest, you should step back to your original position and allow the turtle to finish the process and go back to the sea.

5. It is preferable not to use flashlight during the nesting process as it could disturb or disorient the turtle and endanger the nesting process.

A TURTLE

Marine turtles are wild animals and get easily scared by people swimming or diving too close to them, which would provoke a change of behaviour and lead the turtle to swim away.

1. Approach turtles from the side and always keep a distance of 2 or 3 metres. You can follow a turtle by calmly swimming on one side, avoiding chasing behaviour, and not obstructing its front view.

2. When in a group, it is advisable to **form a semi-circle behind the turtle** so that it will always have a free area in front of it for breathing and/or swimming away.

3. When a turtle is going towards the surface to breathe, **do not swim quickly** towards it and do not try to grab it. All of these behaviours can disturb the turtle and even prevent it from going to the surface to take a proper breath of air.

4. If you see a turtle resting under a ledge or in a cave, do not attempt to remove it.

5. Never feed turtles. Marine turtles are wild animals and their ability to procure their own food is fundamental to their survival in the wild.

6. If you are driving a speedboat or a jet ski in an area where marine turtles are known to bask, keep your speed low enough so that you can avoid them. After spending a few minutes at the surface, marine turtles will need some time to dive as they will have to adjust their buoyancy.

A diver carefully swims alongside a hawksbill turtle in Baa Atoll in the Maldives.

Photo . Lauren Arthur

AN INJURED TURTLE

It is becoming more and more frequent to see turtles washing up on beaches (a phenomenon called "stranding") or at sea with injuries due to interactions with marine debris, fisheries, boats, or even from their natural predators. Turtles are wild animals and have incredible strength even when injured. A large injured turtle can be dangerous to handle without equipment or experience. All sightings of sick or injured turtles should be documented and reported.

1. Find help; do not attempt to rescue an injured turtle alone. Inform local wildlife rescue groups, veterinarians, or the coastguard. Always wear protective equipment such as gloves and a face mask as a sick or injured turtle may be carrying a heavy load of bacteria or parasites that could be harmful to you.

2. Assess the situation and the extent of the turtle's injuries. Approach the turtle from the side and always keep a safe distance away especially from the head, to avoid bites. Take photographs or video of the turtle to help scientists document injuries.

3. If you are on a boat and you see an entangled or injured turtle drifting, it can be pulled over to your boat with a long stick to keep it close until help arrives.

4. If the turtle is tangled in a net, fishing line, or other marine debris, it can be carefully cut free from the entangling object with a net or scissors. Beware of flapping flippers as they can deliver quite a slap. Let a professional assess the extent of the turtle's injuries before attempting to release it back to the sea. Remember to remove the marine debris from the sea so it doesn't entangle another marine organism.

5. If you find a sick or injured turtle on a beach, do not attempt to put it back in the sea. Keep the turtle cool by covering it with wet towels and, if possible, shade it. Call for help.

Some marine turtle rescue centers in the Maldives:

Landaa Giraavaru Turtle Rehabilitation Centre
Four Seasons Resort at Landaa Giraavaru
Marine Discovery Centre Manager
mdcmanager.mlg@fourseasons.com
Tel . 660-0888

Coco Palm Dhuni Kolhu Turtle Rescue Centre
Coco Palm Dhuni Kolhu Resort, Baa Atoll
Email . vet@oliveridleyproject.org
info@oliveridleyproject.org
Tel . 955-2205

Kuda Huraa Turtle Centre
Four Seasons Resort at Kuda Huraa
Marine Discovery Centre Manager
Email . mdc.manager@fourseasons.com
Tel . 664-4888

If you are not close to any of the rescue centers reported above, please contact the Marine Research Center (www.mrc.gov.mv)

A LOST HATCHLING TURTLE

Hatchling turtles are easily disoriented after emerging from their nests if there are artificial lights on the beach. They will instinctively head away from the dark silhouettes and towards the brightest light, meaning that they may head in the wrong direction towards a roadway or a residential area, putting them at risk of dehydration, exhaustion, and predation. They may also become trapped in tyre ruts or beach furniture.

1. Bring the hatchling close to the shore. It is best to wear gloves when you are touching the hatchlings.

2. Make sure the hatchling has a chance to run down the beach so that it can imprint the signature of its natal beach into its mind and find its way back in the future.

3. The hatchling can be released from the beach or put in a container with moist sand and immediately driven out to deeper water to be released there. If you can, find some floating Sargassum seaweed for the hatchling to shelter in.

4. If you live on a beach where turtles nest, be sure to turn off all artificial lights and remove beach furniture from your property. Encourage your neighbours to do the same.

FURTHER READING

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- Spotila J.R. (2004) Sea Turtles: A Complete Guide to their Biology, Behaviour, and Conservation. Hopkins Fulfillment Service, USA, 227 p.

INTERNET SOURCES

- www.euroturtle.org
- www.seaturtle.org
- www.seaturtlesociety.org
- **IUCN Red List**
  www.iucnredlist.org
- **NOAA Fisheries**
  http://www.nmfs.noaa.gov/pr/species/turtles/
- **Sea Turtle Conservancy**
  http://www.conserveturtles.org
- **WWF Global: Marine Turtles**
  http://wwf.panda.org/what_we_do/endangered_species/marine_turtles/
- **IUCN Marine Turtle Specialist Group**
  http://iucn-mtsg.org/
- **IUCN Species Survival Commission**
  http://www.iucn.org/about/work/programmes/species/who_we_are/about_the_species_survival_commission_/

IUCN
INTERNATIONAL UNION
FOR CONSERVATION OF NATURE

63 Sukhumvit Road, Soi 39,
Khlonton-Nua, Wattana, Bangkok,
Thailand 10110

T: + 66 (2) 662 4029
F: + 855 (23) 662 4387
E: asia@iucn.org
W: www.iucn.org

MINISTRY OF ENVIRONMENT
AND ENERGY

Green Building, Handhuvaree
Hingun, Maafannu, Male', 20392,
Republic of Maldives

T: + 960 301 8300
F: + 960 301 8301
E: secretariat@environment.gov.mv
W: www.environment.gov.mv

UNITED STATES AGENCY FOR
INTERNATIONAL DEVELOPMENT

No. 44, Galle Road, Colombo 3,
Sri Lanka

T: +94 (11) 249-8000
E: infosl@usaid.gov
W: www.usaid.gov