

Leatherback Turtle (*Dermochelys coriacea*)

Description:

The Leatherback Turtle is the largest sea turtle and the largest living reptile found on Earth. These turtles can be as long as 6.5 feet (2 m) and weigh up to a ton (900 kg). These turtles are the only sea turtle that does not have a hard shell. The shell is a leathery, oil saturated connective tissue overlaying loosely interlocking dermal bones. The top shell or carapace has seven ridges that taper to a point. The shell is mostly black. Its head has pink and white spotting. Their flippers do not have claws and are usually longer than other turtles. The make of the shell is what gives the Leatherback its name.

When mature, females lay nest on sandy, tropical beaches. Females nest several times during the nesting season. Each nest has an average of 100 eggs. Hatchlings emerge after around 60 days.

Habitat:

As hatchlings they go away from the land into the ocean which they feed on the surface of the ocean in order to get away from most of their predators. These turtles have adapted to a heat exchange system from the uniqueness of their shell in order to tolerate colder temperatures. Leatherback Turtles are mostly migratory and can be found in a vast range of beaches.

Threats:

The primary threat to Leatherbacks are the harvest of these animals and the incidental capturing of them in fishing gear. Another threat is the harvest of eggs during nesting and harvesting mature turtles on feeding grounds. These turtles are protected under the Convention on International Trade in Endangered Species of Wild Flora and Fauna and in other various treaties and agreements. These turtles are endangered everywhere they are found.

Resource:

NOAA Fisheries, Office of Protected Resources
<http://www.nmfs.noaa.gov/pr/species/turtles/leatherback.htm>

Green Turtle (*Chelonia mydas*)

Description:

The Green Sea Turtle is the largest of all the hard-shelled turtles. These turtles grow up to be more than 3 feet (0.91 m) long and weigh up to 300-350 pounds (136-159 kg). However these turtles have a small head compare to the other turtles with such massive size. These turtles begin as small as 2 inches while they are hatchlings.

The Green Sea Turtles are herbivorous, feeding primarily on sea grasses and algae. The eating of these greenish plants gives them the green color that we know them from. The sea turtle's shell or carapace is very smooth and can have different shades of black, gray, green, brown, and yellow. Their bottom of the shell or plastron is usually yellow or white.

The Green Sea Turtle becomes an adult between 20 – 50 years of age. When female se turtles become adults, they start to lay eggs on beaches where they were born every 2 - 4 years. The Turtles nest mostly during the summer months of the hemisphere where they are located. Females usually have 5 nests which they lay an average of 135 eggs.

Habitat:

Since the sea turtles are herbivores, they do not move much. As hatchlings they go away from the land into the ocean which they feed on the surface of the ocean in order to get away from most of their predators. Once they become a certain size, they go back near the shore to find bigger and better food. These turtles are usually found between 30o North and 30o South. These turtles are sighted in as many as 80 countries throughout the year. These turtles are thought to inhabit in coastal areas of 140 countries.

Threats:

The most common threat to these turtles is human and predator harvest of eggs and adult turtles on nesting beaches. Another threat is the harvesting juveniles and adults on feeding grounds when they are near the shore. Also some human accidents such as capture in fishing gear such as traps, trawls, and dredges. These turtles are protected under the Convention on International Trade in Endangered Species of Wild Flora and Fauna and in other various treaties and agreements. These turtles are endangered in Florida and the Pacific coast of Mexico. They are threatened in all other populations in the world.

Resource:

NOAA Fisheries, Office of Protected Resources
<http://www.nmfs.noaa.gov/pr/species/turtles/green.htm>

Hawksbill Turtle (*Eretmochelys imbricata*)

Description:

The Hawksbill Turtle is a small to medium sized turtle compared to the other species. They grow up to weigh around 100 – 120 pounds (45 – 68 kg) on average but can be as big as 200 pounds (91 kg). Their shell is 25 to 35 inches (63 – 90 cm) in length and has a “tortoiseshell” coloring which ranges from dark to golden brown with streaks of orange, red, and sometimes black. The hatchlings shells are 1-2 inches (42 mm) long. The bottom of the shell is usually yellow. One feature is that the rear edge of the carapace or the top shell is almost always serrated.

Their head is very long and tapers to a point where a beak like mouth is located. This mouth is what gives this species its name. This mouth allows the turtle to reach into holes to find food to eat. Some things unique about this turtle is that they have two pairs of prefrontal scales on the top of its head and each of the flippers have two claws.

When mature, the female turtles return to the beaches where they were nest and lay eggs at the same beach every 2 – 3 years. They nest during the night and usually lay 3 – 5 nests every season which each nest have an average of 130 eggs. These turtles commonly nest on beaches that have little or no sand.

Habitat:

As hatchlings these turtles go away from the land into the ocean which they feed on the surface of the ocean in order to get away from most of their predators. Once they become a certain size, they go back near the shore to find bigger and better food. They usually feed on animals associated with coral reef environments which they are able to use their unique mouth. The corals which they feed also house them while they rest. These turtles are usually found between 30o North and 30o South.

Threats:

The main threat to Hawksbill Turtles are the loss of coral reef communities. Without these structures, these turtles do not have food or shelter. Also these turtles are harvested for their unique shell which is used for much decorative jewelry. These turtles are protected under the Convention on International Trade in Endangered Species of Wild Flora and Fauna and in other various treaties and agreements. These turtles are endangered everywhere they are found.

Resource:

NOAA Fisheries, Office of Protected Resources
<http://www.nmfs.noaa.gov/pr/species/turtles/hawksbill.htm>

Loggerhead Turtle (*Caretta caretta*)

Description:

The Loggerhead Turtle is named from the large heads and powerful jaws they have to feed on prey. The carapace or top shell is heart shaped and reddish brown. The bottom shell or plastron is mostly yellow. Their neck and flippers are also reddish brown on top and yellow on the sides and bottom. Their shell reaches a length of 3 feet (92 cm) and they weigh around 250 pounds (113 kg).

Loggerheads mature around 35 years of age. When mature, females lay eggs on beaches from April to September. They lay around 3 – 5 nests every season. The eggs incubate for 2 months before hatching. Hatchlings are dark grey and do not have the reddish brown pigment that adults have.

Habitat:

As hatchlings these turtles go away from the land into the ocean which they feed on the surface of the ocean in order to get away from most of their predators. Once they become a certain size, they go back near the shore to find bigger and better food. Because of their powerful jaws, they feed on hard shell prey. The Loggerheads migrate from foraging areas to nesting beaches. The Loggerheads are found in a vast range of places. They usually nest in subtropical regions.

Threats:

The greatest threat of these turtles are from the incidental capture in fishing gear. Mostly from long lines and gillnets, but also trawls and dredges contribute to their decline. Also harvesting of these turtle contributes to their threat. These turtles are protected under the Convention on International Trade in Endangered Species of Wild Flora and Fauna and in other various treaties and agreements. These turtles are endangered everywhere they are found.

Resource:

NOAA Fisheries, Office of Protected Resources
<http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.htm>

Sea Turtle Metabolism

This learning module focuses on the metabolic activities of sea turtles. One of the major differences between humans and sea turtles, in term of metabolic activities, is their heart rate. We have a fairly constant heart rate during normal activity and increasing heart rates during exercise. For sea turtles, they adjust their heart rates according to their metabolic needs. Sea turtles have slower heart rates while diving than while floating on the surface. According to Southwood (1999), turtles' diving heart rate is about 17.4 ± 0.9 beat/min and surface heart rate is about 24.9 ± 1.3 beat/min.¹ The slower heart rate helps to conserve the oxygen level within their bodies. This behavior is different from us because our heart rate would increase during diving.

The heart beat difference can be explained by the storage of oxygen. In humans, most of our oxygen is stored in our lungs. As we inhale oxygen, the oxygen is transferred to blood and hemoglobin and will bring the oxygen to our organs or tissues as needed. Therefore, when we exercise (time that we need more oxygen), our heart will pump faster to ensure that adequate amounts of oxygen will reach our organs to perform metabolic activities aerobically. For sea turtles, the majority of oxygen is stored in their blood. This will overcome the possibility of lung collapse due to oceanic pressure while diving deep.² In terms of energy, sea turtles do not need to spend extra energy to pump blood to different organs. This explains why sea turtles have a much lower heart rate than humans.

References:

1. Southwood, A. L., et al. "Heart rates and diving behavior of leatherback sea turtles in the eastern Pacific Ocean." *J. Exp. Biol.* **202** (1999) 1115–1125.
2. Lutcavage, M.E., Lutz, P.L. "Voluntary diving metabolism and ventilation in the loggerhead sea turtle." *J. Exp. Mar. Biol. Ecol.* **147** (1991) 287.

Threats in the Marine Environment

Threats directly toward Turtles:

There are many threats in the world for sea turtles. Turtles can become entangled in fishing gear such as gillnets, pound nets, and long lines. This gear entangles the turtles which may cause them to drown or suffer serious injuries to their appendages from the ropes or lines that the nets have. Also long lines may hook a turtle in which may damage their jaw, esophagus, or flippers. Fishing dredges now have a “back door” which turtles are able to escape which declined turtles mortality because of many turtles caught in them. Also garbage or marine debris is a problem for the turtles. Turtles may ingest or become entangled in many plastics that are found in the open ocean. Especially when the sea turtles are young, they may accidentally feed on this debris which may either kill them or kill the prey which they need to survive. Pollution from coastal runoff and other situations also makes problems for the marine turtles. Boat traffic and discharge of oil and gas makes the sensitive turtles change their way of life in which they may also lack things in which they really need to survive. Disease is also a major threat to the marine turtles. Some diseases found in some areas of the world such as fibropapillomatosis may kill the turtles. Fibropapillomatosis makes tumorous growths on the turtle which inhibits their feeding and swimming behaviors which usually leads up to death. How marine turtles function within the marine ecosystem is still poorly understood so that there could be more threats toward the turtles than it is known.

Indirect threat to marine turtles:

The majority of indirect threats are threats toward the nesting habitat of the marine turtles. The loss or degradation of this habitat threatens the turtles. From armoring beaches to artificial lighting, the result of the threats toward the habitat results in lower populations of the sea turtles. Beach armoring hurts the turtles in that it blocks turtles for coming onto the beach in order to nest. People use armoring such as seawalls in order to maintain the sea level or tidal level the ocean has. These structures also impact on what kind of sand is being deposited. Some turtles need different kind of sand in order to nest and if they can not find that particular type at the beach they are at, then the turtle will not nest. Artificial lighting and non-native vegetation also poses a threat on the marine turtles. Hatchlings have a tendency to orient themselves towards the brightest light in order to find the sea when on the beach. If there is artificial light, then they hatchlings would be going more on land than out to sea where they are safe from predators. Also non-native plants hurt the turtle as if the new plant out competes the native species in which the turtles may need to eat in order to survive. Also new plants may entangle hatchlings when leaving the beach or have an ill effect on turtles that digest the new plant. These are some of the threats found against marine turtles.

Resource:

NOAA Fisheries, Office of Protected Resources
<http://www.nmfs.noaa.gov/pr/species/turtles/threats.htm>

Nesting and Predators



I. Nesting

Sea or Marine Turtles (*Chelonioidae*) are turtles found in all of the world's oceans except the Arctic Ocean. Some species travel between oceans. The Leatherback Sea Turtle is the largest sea turtle and reptile, measuring six or seven feet (2 m) in length at maturity, and three to five feet (1 to 1.5 m) in width, weighing up to 1300 pounds (600 kg). Most other species are smaller, being two to four feet in length (0.5 to 1 m) and proportionally less wide. There are seven types of sea turtles: Kemp's Ridley, Flatback, Green, Olive Ridley, Loggerhead, Hawksbill and the Leatherback.

Different species are distinguished by varying anatomical characteristics: for example: the prefrontal scales on the head, the number of and shape of scutes on the carapace, and the type of inframarginal scutes on the plastron. The Leatherback is the only sea turtle that does not have a hard shell, instead it carries a mosaic of bony plates beneath its leathery skin. Each species also has a different behavior in which they nest to produce offspring. Most species of sea turtles nest by themselves at night during the summer and fall months. Also, some species have a unique way of nesting.

An arribada is a unique nesting phenomenon common to both the Olive Ridley and the Kemp's Ridley sea turtle. The Olive Ridley is endemic to the Pacific coasts of Mexico, Central America, and India. It is known to be a nocturnal nester. The Kemp's Ridley is endemic to the Gulf of Mexico. It ranges from Galveston, Texas to Tampico, Mexico.

As the sea turtles evolved, Ridley sea turtles adopted a unique nesting behavior that increases their offspring's chance of survival. They deposit more eggs in the sand than predators can consume. No other species of marine turtle mimics this type of nesting behavior. Both species of Ridley practice the phenomenon known as "predator swamping." "Predator swamping" can also be observed as hatchlings emerge from their nests in large numbers. This behavior overwhelms the predators that wait to eat them on the beach. The odds are very good that at least one offspring from any one female will survive to reach adulthood and thus, introduce that parent's genetic information into the gene pool.

On unprotected beaches it is estimated that, for some species of marine turtles, only one out of one thousand or one in ten thousand hatchlings survive to adulthood.

With current conservation efforts in place on nesting beaches, the current mathematical model now suggests that the survival rate is one out of three hundred.

In 1947 the first images of a Kemp's Ridley arribada were captured on film by Andres Herrera, a young Mexican engineer. It was estimated by some who have viewed the black and white footage that there were over 40,000 nesting Kemp's Ridley sea turtles on the beach that day. Unfortunately for the Kemp's Ridley, this footage was put away and forgotten for over a decade. At that time the scientific community only knew of the Kemp's Ridley arribadas from rumors. It wasn't until 1960 that Dr Henry Hildebrand from the University of Corpus Christi viewed the film. Then, in 1961, he presented that film at the annual meeting of the American Society of Ichthyologists and Herpetologist. As you can imagine, this film was an incredible discovery. Two years later, Dr. Hildebrand visited Rancho Nuevo, the site of the mass Kemp's arribadas. When he arrived in Rancho Nuevo the massive arribadas captured in Herrera's film were no more. The Ridley nesting population had dwindled down to only 2000 nesting Kemps. By the early 1980's, due to the continued illegal harvest of both females and their eggs, the Kemp's Ridley was on the verge of extinction. The remaining nesting Ridley population had reached an all time low, only 300 nesting females. In 1986, a joint bi-national recovery program by the governments of Mexico and the United States was created to save the Kemp's Ridley in the Gulf of Mexico.

Thanks to continued efforts by many caring individuals, the population of Kemp's Ridley in the Gulf of Mexico is on the rise. As of 2006, 12,000 Kemp's nests have been protected along the Mexican coast and 100 recorded nests along the Texas coast.

II. Predators

There are many predators of sea turtle and their hatchlings. Some common predators are raccoons, sand crabs, and sea birds. Predators hunt hatchlings when they are moving toward the ocean, where it is easier for sea turtles to survive. Raccoons disturb the nest of sea turtles' eggs, while other predators eat the hatchlings during the migrating process of the hatchlings. However, the biggest predators of the sea turtle are humans.

Humans disturb many processes that the sea turtles take for granted. Disturbances that we are guilty of are poaching, artificial lighting, beach armoring, and simply being a tourist who encroaches upon nests. Humans still poach sea turtle eggs for their dietary worth and desirability. This problem continues everywhere around the world. The artificial lighting hurts the hatchlings because they use the reflection off the water to see where the ocean is located. If they start moving toward artificial lighting, the sea turtles will travel the wrong way and then easily become prey for the other predators. Beach armoring hurts the sea turtles, for they are not able to come to a beach to lay their eggs. Sea turtles usually return to where they were hatched. If sea turtles are not able to get to a beach, then no eggs will be laid. Finally, being tourist is a problem because we can disturb nests accidentally. These are some of the reasons why humans are the biggest predator of sea turtle populations.

Global Positioning System (GPS) in Sea Turtles

Humans greatly depend on their sense of vision for navigation. However, sea turtles use different senses to navigate in their marine environment. Hatchling turtles use light sources to guide them toward the sea during the daytime. This is because water surfaces reflect more light from the sun than land surfaces. In the darkness, strong light sources may not be available. The way sea turtles navigate is to sense the orientation of waves. Turtles swim into the approaching waves to travel toward the open sea.¹ The use of light and sensation help them to swim offshore.

During migration, sea turtles need another sense to guide them because the wave direction becomes a less dependable source for guiding. Once the turtles reach open sea, they begin to sense the intensity and direction of the Earth's magnetic field.² Experiments conducted by Lohmann conclude that sea turtles can orient themselves to their destination even after they have been relocated intentionally by researchers. However, the major biological mechanism for sensing the magnetic field remains unclear.

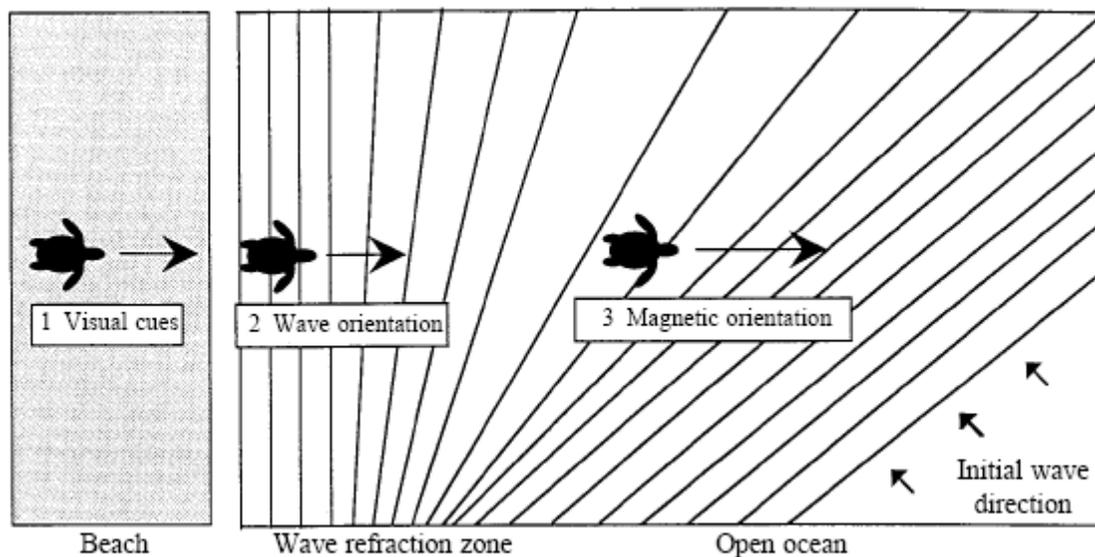


Figure 1. This pictures shows how a sea turtle uses different senses while it travels offshore from the beach. [Figure taken from ref. 2]

References

1. Lohmann K.J., Lohmann, C.M.F. "Orientation and Open-Sea Navigation in Sea Turtle." *J. Exp. Biol.* **199** (1996) 73-81.
2. Lohmann, K.J., *et al.* "Geomagnetic map used in sea-turtle navigation." *Nature.* **428** (2004) 909.

Sea Turtle Fun Facts

- Sea Turtles Predate Dinosaurs and have existed for over 200 million years.
- Sea Turtles have lived to be over 100 years old in captivity.
- Sea Turtles love to eat jellyfish, sponges, algae, sea grasses and crustaceans.
- A mature female turtle (20-30 years) will return to her natal beach every 2-3 years to lay 1 to 7 nests with an average of 4 nests.
- The temperature of the sand determines the sex of the hatchlings (hotter sand-more females-cooler sand-more males).
- Bright house lights that face the ocean will confuse nesting mothers and hatchlings.
- Sea turtle populations are threatened by pollution, poaching, and habitat loss.
- There are 8 species of Sea Turtles. 5 visit North Carolina: The Loggerhead, Green, Kemp's, Ridley, and Leatherback.
- Mature Loggerhead Turtles weigh up to 400 pounds.
- A Fine of up to \$100,000 and or 1 year in prison is the penalty for harassing a Sea Turtle or disturbing its nest.

Source:

"Turtle Watch Program," Holden Beach,
<<http://www.hbturtlewatch.org/turtletalk/>>