Turtles in Trouble

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A Close-up Look at Turtles

Looking at the table of contents of *Turtles in Trouble*, you will see that we have divided this issue into five sections. Each section deals with a different aspect related to turtles and their conservation, and includes background information and activities on that theme.

**Background Information:** Each section begins with a note which explains the main concepts that are part of the theme. The note could serve as a good introduction to the theme. It also provides supplementary information that can be used in several ways to fill in gaps and to generate discussion on the theme. Most of the activities also begin with a brief note which gives the background and basic information related to the activity or its theme. You can use this either as an introduction to the activity or the discussions following it.

**Activities:** Activities are designed to better demonstrate or explain concepts, and to encourage maximum participation by the students. Each activity stands by itself and includes a step-by-step explanation of how to carry it out.

Each activity also indicates the levels for which it may be suited. The levels indicated are elementary (standards 3 to 5), intermediate (standards 6 to 8), and advanced (standards 9 to 10).

You need not feel bound by the suggested levels. You would be the best judge of which activities are best suited to your students and the topics that you are teaching.

The teaching objectives, suggested levels, a list of materials needed, and subjects, are highlighted in a tinted box just under the title of the activity.

**Fact Finder:** These sections give information which is necessary to carry out some of the activities, and also, in many cases, provide extra information which relates to the requirements of the activity. This may be used to support and enrich the basic information.

You may teach each chapter as a unit or choose a single activity to demonstrate the concept that you are teaching in your regular classroom session.
What
Makes a Turtle a Turtle?

When one hears the word "turtle", the first image that comes to mind is that of a shell; a head and four legs that disappear into a rigid box-like shell; a creature that carries its home on its back.

Turtles are frequently cited as examples of slowness. But their adaptations for heavy protection at the expense of quick movement have stood the test of time. These are among the most ancient of the existing four-legged animals (tetrapods). Turtles, along with crocodilians, have managed to survive the mass extinction of dinosaurs some 65 million years ago. They have walked the earth for about 200 million years.

Turtles are direct descendants of Cotylosaurs, considered as the first or stem reptiles and primitive members of the class. Externally they were large and lizard-like, and structurally they were very close to primitive amphibians. The earliest true turtles were the Proganochelyidae that appeared around 200 million years ago, and differed little in essentials from those surviving today.

The description of a four-legged creature with its body encased in a shell covers a range that includes freshwater turtles, amphibious terrapins or freshwater tortoises, marine turtles, and land tortoises. All these encase their body parts in a shell consisting of two main pieces, the carapace above and the plastron below.

All these are closely related, and belong to the large group of animals with backbones called vertebrates, and are part of one group of vertebrates called Reptiles. Within this group, they belong to an order called Testudine. (For more, see 'Classification' on page 5).
Members of this order are easily differentiated from all other animals by their characteristic bony shell, with the carapace above and the plastron below. They also share other characteristics including jaws which lack teeth, sexes which are difficult to distinguish in the young, long life spans, and the fact that they all bury their eggs in soil for incubation.

A reptile is a vertebrate (an animal with a backbone). It has scales, breathes air, characteristically lays shelled eggs, and depends on outside sources for body heat. There are five main groups of animals that fit this definition of reptiles: turtles and tortoises; lizards; snakes; crocodilians; and a little-seen creature called tuatara.

**Turtles and Tortoises**

Everyone has heard the story of the tortoise and the hare, as also the story of the *Kurma* avatar. The star of the first is a tortoise, and of the second, a turtle. There are several significant differences between turtles and tortoises.

One basic difference between turtles and tortoises is that turtles are completely aquatic, whereas tortoises are terrestrial. Turtles have paddle-like feet or flippers that are adapted to suit the aquatic environment. Tortoises have short thick legs with clawed feet, that are suited for walking on land.

There are variations among turtles themselves. The turtle group includes freshwater turtles (mud turtles), amphibious terrapins, and marine turtles. (See Fact Finder on page 5).

In this book we will be taking a closer look at one of these groups—the Marine Turtles. So let us begin all over again and try to find out more about these.

**What Makes a Marine Turtle?**

All turtles belong to the order Testudines. Within this, all Marine Turtles except Leatherbacks belong to the family *Cheloniidae*. Leatherbacks belong to the family *Dermochelidae*.

Marine turtles are found in the tropical oceans. There are seven species of marine turtles. These are: Olive Ridley, Kemp’s Ridley, Green, Hawksbill, Leatherback, Loggerhead and Flatback turtles.

The largest of the sea turtles are the Leatherbacks, reaching a total length of up to 2 m. They are also the heaviest—an adult can weigh up to 800 kg. The smallest of the sea turtles are the Ridleys, reaching a size of 80 cm.

Of all the marine turtles, five species are found in the coastal waters of India. They are the Olive Ridley, Green, Hawksbill, Leatherback, and Loggerhead. (See Fact Finder on page 5)
Classifying the Turtle

There are millions of plants and animals. If living things were not classified, it would be almost impossible to study them or conserve them. Biological classification is the arrangement of living organisms into groups with similar characteristics. Animals and plants are classified into units called taxa, based on factors common to each group.

The system of classification—known as Taxonomy—not only shows how organisms are related to each other, but it also conveys information about the animals themselves. For example, when a biologist is told that "Y" is a reptile, he/she will immediately know that "Y" is cold blooded, has a scaly body and lays eggs on land.

The purpose of biological classification is to provide a clear and practical way to organize and communicate information about organisms. Classification can show relationships between different ancient and modern groups, indicate the evolutionary pathways along which present day animals may have developed, and provide a basis for comparing experimental data about different plant and animal groups.

A taxonomic key is a device by which each type in a group of types may be identified. For making such a key, we have to identify the distinguishing features of each member of the group. Next we have to ask questions about them in such a way that only one of the two answers i.e. "yes" or "no" is possible.

The taxonomic key for turtles would be as under:

- **KINGDOM** - Animalia
- **PHYLUM** - Chordata
- **CLASS** - Reptilia
- **ORDER** - Testudines
- **SUBORDER** - Cryptodira
- **FAMILY** - Cheloniidae or Dermochelyidae

**Class Reptilia**

- Reptilia is a class of ectothermic (cold-blooded) vertebrates that includes snakes, lizards, crocodiles, and turtles.
- Reptiles have scaly skins, use their lungs for breathing, and have a three-chambered heart.
- Most reptiles lay eggs, although some produce eggs that hatch internally.

**Order Testudines**

This order includes all turtles and tortoises. It is divided into three sub-orders: Pleurodira (side-necked turtles), Cryptodira (all other living species), and Amphicheleydia (extinct species).

**Suborder Cryptodira**

This suborder includes freshwater turtles, snapping turtles, tortoises, soft-shelled turtles, and sea turtles.

**Families**

Most scientists recognize two families of sea turtles:

- **Family Cheloniidae** are sea turtles with shells covered with scutes (horny plates).
- **Family Dermochelyidae** are scuteless turtles with only one modern species, the leatherback turtle. Leatherbacks are covered with leathery skin. They are the only marine turtles whose backbone is not attached to the inside of the shell.

**Genus, Species**

Most scientists recognize seven species of sea turtles.

1. Green: Chelonia mydas
2. Loggerhead: Caretta caretta
3. Kemp's Ridley: Lepidochelys kempii
4. Olive Ridley: Lepidochelys olivacea
5. Hawksbill: Eretmochelys imbricata
6. Flatback: Natator depressus
7. Leatherback: Dermochelys coriacea

Some biologists consider that there are eight species. Others believe that the Black and Green Turtles belong to the same species. Another school of biologists point out that there is very little difference between the two species of Riddles. Genetic studies are underway on some of these issues.
Physical Characteristics

All marine turtles have some basic characteristics in common.

Body Shape

Marine turtles are characterized by a large, streamlined shell, with the carapace (upper shell) gently domed. Depending on the species, the shell of the adult ranges in shape from oval to heart-shaped. They have non-retractile head and limbs (those which cannot be pulled into the shell). Their limbs are paddle-shaped, front feet longer than hind feet.

Bony Shell

The turtle is characterized by its armour—a shell made up of a top part (carapace), and a belly part (plastron). The two parts are generally joined on each side by a bony bridge.

The shell has two layers: an outer one made up of broad horny scales with strong joints, and an inner thicker layer of lightly jointed bones. These two layers form a strong casing for the turtle. The ventral (bottom) side of the shell over the belly is called the plastron. In all species except the leatherback, the backbone is attached to the carapace.

Like all reptiles, turtles too have scales. The shell is made up of large scales, known as “scutes”. Each species has a particular number, pattern and arrangement of scutes, by which one can identify the species of turtle. These scutes are firm but flexible, not brittle.

There are three basic kinds of scutes (scales) on the dorsal side of the shell. The ‘Vertebrals’ or ‘Centrals’ which run down the middle of the shell, from the head to tail, over the vertebrae; ‘Costals’ or ‘Lateralis’, which form the row of scutes on either side of the vertebrals; the ‘Marginals’ scutes which are along the margins, all around the carapace.

The plastron (ventral side) generally has six pairs of scutes. Occasionally there is an additional scute in the center in the front, under the neck, and one in the center at the back, under the tail.

The hard bony shell protects the turtle from predation and abrasion. Algae are frequently seen growing on the shells of marine turtles. This attracts fishes which feed on algae, which helps in maintaining the shell.

Skeletal System

It is the shell that has led to an unique internal arrangement of the skeleton. Most of the bony parts of the turtle such as the vertebral column, ribs, shoulder and hip girdles, are fused with the shell. The backbone too is fused to the shell. The ribs are flattened and widened so that there is maximum support within the shell. The ribs particularly, are broad and flattened, merging with the inside of the carapace. The vertebral column in turtles has undergone drastic modifications down the ages. In contrast to most other reptiles, the number of vertebrae has reduced rather than increased.

Head

The marine turtle cannot retract its head under its shell as a freshwater turtle or land tortoise can.

Marine turtles have large upper eyelids that provide protection for their eyes against sand particles and objects floating in water.

The mouth lacks teeth; turtles crush food with their jaws (which are called beaks). The beaks are shaped according to the diet and vary from species to species. (See also Page 14)

There are no external ear openings but marine turtles have a fairly good sense of hearing.

Flippers

Both fore and hind limbs are adapted as flippers for swimming.

The fore-flippers are long and paddle-like. Long digits are fused along the length of the flipper. Only one or two claws are present on each fore-flipper. A sea turtle swims with powerful wing-like beats of its fore-flippers.

The hind limbs are shorter, with a membrane joining all five toes. Hind-flippers work like the rudders of a ship that stabilize and direct the animal as it swims. The females of all species use the hind-flippers for digging nests in the sand.
Senses

Hearing

Although turtles are generally believed to be hard of hearing, marine turtles have a good sense of hearing, both on land and in water. Probably it is best under water, since sound waves travel faster in water than in air. Like other reptiles, the sea turtle ear has a single bone in the middle ear (unlike mammals and birds which have three bones). This transmits vibrations to the inner ear. Researchers have found that sea turtles hear and respond well to low frequency sounds and vibrations. They also pick up vibrations from the water through their skin and shell.

Sight

Marine turtles have fairly good eyesight but do not see in colour. They can see only in black and white and shades of grey. They are highly sensitive to visual cues. This is especially true of hatchlings which use light to find the sea after they emerge from the nest. It is possible that adults and hatchlings are able to detect infrared radiation, and it is this ability which helps in finding direction.

The retina of the marine turtle is especially adapted for vision in cloudy (underwater) surroundings. They can see well under water, but cannot see clearly outside it. Many semi-aquatic species alter the curvature of the lens for vision under water, but the eyes of sea turtles are fully adapted for underwater vision.

Touch

Sea turtles are sensitive to touch on the soft parts of the flippers and on the shell.

Smell

Most researchers believe that sea turtles have a very good sense of smell in the water. This adaptation allows sea turtles to locate food in murky water. The sense of smell comes into use for the purpose of detecting familiar shotes for nesting, and for detecting food sources such as algal material, jelly fish and shell fish. For example, experiments show that hatchlings react to the scent of shrimp. Pulsating movements of the throat are thought to be associated with smelling.

Taste

Little is known about a sea turtle’s sense of taste.

Internal Organs

Nervous system

In turtles, the central nervous system (brain and spinal cord) is more highly developed as compared to amphibians. The cerebrum is enlarged and the other parts like the cerebellum, parietal organ and hypophysis, are well developed. The optic lobe is somewhat reduced.

Digestive system

The digestive system consists of an alimentary canal which is the main food tract, and associated digestive glands. The food passes from the mouth → pharynx → oesophagus → stomach → small intestine → large intestine → cloaca (external opening of the digestive tract).

Since turtles do not have teeth, there is no chewing. Hard-bodied animals such as crabs and snails are caught by the mouth, snapped and swallowed.

Circulatory system

It consists of the heart, arterial system (which takes blood away from the heart) and the venous system (which takes blood to the heart). The heart has three chambers—two auricles and one ventricle. The ventricle has a septum or partial wall called the intraventricular septum, which divides the chamber partially into two. The blood flow is from various parts of the body to the veins → sinus venous (another chamber attached to the heart) → right auricle → ventricle → lungs → left auricle → ventricle (partially mixed with impure blood from right auricle) → aorta (main artery distributing blood to the different parts of the body).

Respiratory system

Although completely aquatic, marine turtles come to the surface to breathe. But one breath can last a long time, even up to one hour in some species. This ability to suspend breathing varies from species to species. For instance, it is estimated that leatherbacks and loggerheads can store enough oxygen for dives lasting up to 70 and 33 minutes, respectively. When they come up to breathe, they can empty their lungs of stale air within 2-3 seconds and take in fresh air.

A pair of external nares (nostrils) are situated at the anterior end of the head. The trachea (wind pipe from the nares) bifurcates into two bronchi which enter one into each lung. Lungs are spongy structures which lie directly below the carapace.

Turtles have immovable ribs, so they cannot expand their chest. The task of chest expansion has been transferred to the abdominal muscles. Two muscles at the back (near the flanks) contract and increase the volume of space around the lungs, and the air rushes in. Another set of muscles contract and press the internal organs against the lungs to force the air out.

Excretory system

The excretory system consists of two flattened and lobed kidneys, ureters (tubes which carry waste from the kidneys to bladder) and a urinary bladder. The urinary bladder has two lobes (it is bilobed). There may also be an additional urinary bladder on either side of the cloaca.
Since sea turtles live in salty seawater there has to be a mechanism to remove excess salts from the body. This is done by a gland, variously known as tear or salt gland. This gland empties into the sea turtles’ eyes. The secretion of salt and fluids makes the turtles look as if they are “crying” when they come ashore. This gland assists the kidneys, which would be unable to cope with the digestion of so much salt from food and seawater. These tears also protect the eyes when the turtle is on land. The fluids help to keep the eyes free of sand when the females dig their nests on the beach.

Sea turtles can live in seawater and have no need for a freshwater source. They obtain sufficient water from their diet and from metabolizing (chemically breaking down) seawater.

**Identification of Male and Female**

It is almost impossible to look at marine turtle hatchlings, (young ones that have just hatched out), juveniles (slightly older turtles), or subadults (turtles that are yet to reach maturity), and say whether they are male or female. Differentiating between the sexes in young turtles is not possible without internal examination of the turtle. However, adult males are different externally from adult females. In other words, in marine turtles, males can be distinguished from females only when the animals are adults or nearly adults.

Some visual clues for distinguishing the sexes are:

(i) The adult male has a long, thick tail protecting the male reproductive organ located at the base of the tail. The tail may extend beyond the hind-flippers. Adult females have short tails that do not extend appreciably behind the hind margin of the carapace.

(ii) Males have claws on the foreflippers. These are elongated and curved, and help in grasping the females’ shells during mating. Females have shorter, thinner claws than males.

(iii) The female carapace tends to be more highly domed than the male’s, but the plastron is less concave and harder. The male carapace tends to be more elongated, tapering in the tail region.

(iv) The plastron is often more flexible and concave in the male than in the female.

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**Who is a Reptile?**

There is more to being a reptile than having a dry scaly skin. Reptiles were the first organisms to lay eggs on land rather than in water. This differentiates them from their close amphibian relatives from which they have evolved. Reptiles are able to lay eggs on land as their eggs have an additional layer called amnion, which keeps the embryo in a watery medium within the egg. The egg shell is tough enough to protect the contents of the egg, yet porous enough to allow passage of oxygen into the egg and carbon dioxide out. Reptiles are similar to amphibians in that they are cold-blooded (poikilothermic or ectothermic), i.e. their body temperature depends on the temperature of their surroundings.
Evolution of Turtles

The oldest turtles made their appearance by the middle or late part of the Triassic era (approximately 225 million years ago). These were the Proganochelyidae, the fossil remains of which have been found in Germany. Teeth were absent from the margins of the jaws and the body was covered by a heavy shell having numerous marginal and supra-marginal scutes on their carapace. The bones of the skull were less in number than their large lizard-like ancestor. Scientists believe that these lived in marshy areas. Gradually some adapted to an aquatic environment, others to a terrestrial habitat. Biologists speculate that the slower moving ancestors, to avoid predatory pressures, took refuge in water. Fully aquatic existence is thus only a secondary adaptation. At the same time, the ones on land evolved to have tougher and sturdier shells.

The later turtles were completely toothless and developed the power to retract the head, legs and the tail into the shell, which may not have been possible in Proganochelids. The jaws became covered with a horny beak. This made possible strong tearing or shearing mechanisms, effective for eating meat and plants.

The turtles have plodded a steady course through evolutionary time, changing very little in basic structure.

In Trouble

Much can be learned about the condition of the planet’s environment by looking at sea turtles. They have existed for over 200 million years, and they travel throughout the world’s oceans. Suddenly however, they are struggling to survive—largely because of things people are doing to the planet’s oceans and beaches. But what does this mean for the human species? It is possible that a world in which sea turtles cannot survive may soon become a world in which humans struggle to survive.
Tell the children to visualize a turtle. Discuss the different parts of the body of a turtle: the shell, the head, flippers, tail, etc. Discuss the form and function of each of these. (See details on page 6-7)

The carapace or upper shell of each species of marine turtles has a different shape and pattern. (Show students the shell pattern of the five main Indian marine turtles. You could also draw these on the board or a chart paper.)

<table>
<thead>
<tr>
<th>Objective</th>
<th>To help students to learn about the different parts of the turtle's body and understand the functions of each part.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Elementary</td>
</tr>
<tr>
<td>Subjects</td>
<td>Science, Art and craft</td>
</tr>
<tr>
<td>Group Size</td>
<td>Groups of 5 students</td>
</tr>
<tr>
<td>Place</td>
<td>Inside the classroom</td>
</tr>
<tr>
<td>Duration</td>
<td>45 minutes</td>
</tr>
<tr>
<td>Materials</td>
<td>Chart paper, tapes, pins, scissors, paint brushes, marker pens, turtle picture, glue.</td>
</tr>
</tbody>
</table>

Begin with the most characteristic feature of a turtle—the shell. Discuss the unique skeletal structure of the turtle, that has evolved so as to be accommodated within the shell. (See Page 9).

The shell has helped ensure the survival of the turtle for nearly 200 million years. Today it still encapsulates all turtles, although it has been modified to suit a variety of environments. The marine turtle's shell is modified to help rapid movement through water—making them among the fastest moving of modern reptiles. The shell of the tortoise that lives on land is designed to help support the huge body on tiptoe locomotion. Freshwater turtles have shells which allow them to bury themselves in mud.

A land turtle can retract its head and limbs into its shell. The head and limbs of marine turtles are non-retractile. They cannot be pulled back into the shell.

The marine turtle's limbs are in the form of paddle-shaped flippers. The flippers have to beat endlessly as they swim the wide expanses of oceans—whether the creatures are diving, or migrating, or just searching for food. They only briefly rest on the sea bottom.

Turtles come to the surface regularly to breathe, but are capable of suspending their breathing for considerable lengths of time.

Depending on the species, marine turtles are of different colours. They may be olive-green, yellow, greenish-brown, or black.

Olive Ridley

Green

Hawksbill

Leatherback

Loggerhead

10 Turtles in Trouble
Activity

Play a game of pin the parts on the turtle.

- On a large chart paper, trace the outline of the turtle as shown.
- Pin up the chart paper.
- Draw and cut out the parts of the turtle (flippers, head and tail). This should be in proportion to the size of the shell (see diagram).
- Keep these parts near the chart with the outline.
- Ask one student at a time to come up. Blindfold the student.
- Ask the student to pin the different parts of the turtle to the outline.
- You may allow the other students to give oral clues to guide the blindfolded students, and also to keep the time.
- Remove the blindfold, let everyone see how accurately the parts were pinned.
- Take down the parts.
- Let the next student attempt the same; until all or several students have tried.

- Let some students keep score of students which were most accurate, and pinned the parts in the shortest time.
- If there are too many students the activity could be done in groups.
- Alternately there could be five outlines, each with shape and pattern of the carapaces of different species as given on page 10.

Variation

Another way to make a turtle is to use a coconut shell or walnut shell as the turtle shell, and make flippers and head of paper or clay. A domed shell could be used to make a tortoise, and a flatter shell to make a turtle.

Let students use their imagination and make turtles out of other materials also, eg. from cloth, mud or clay, wood, etc.
Turtles and tortoises are easily distinguished from all other animals by their bony shells. Although superficially similar, they are different in terms of morphology (in external characteristics), as well as in anatomy (internal organs). They also have specific habitats as well as food preferences.

The Order Testudinidae includes marine turtles, fresh water turtles, fresh water terrapins and land tortoises. Each of these has distinct characteristics.

**Marine Turtles:** These lead a completely aquatic existence. Normally only females ever come ashore on land, that too only to lay eggs. All marine turtles have paddle-shaped limbs, with longer front limbs which move though the water in a way similar to birds moving their wings. Marine turtles cannot retract (pull back) their heads and limbs into the shell. The upper shell is gently domed and curved from back to front. They are mainly tropical in distribution, though some species enter temperate seas. Some species of marine turtles are herbivores, some carnivores and other omnivores. The marine turtles found in Indian waters are Olive Ridley, Leatherback, Hawksbill, Green and Loggerhead. All marine turtles belong to the family Chelonidae, except the Leatherback which belongs to the family Dermochelyidae.

**Freshwater Terrapins:** These are hard-shelled and closely resemble land tortoises in appearance. They have a short snout and tail. Most terrapins are herbivores. They lay small clusters of eggs. In India, the majority of terrapins occur in the larger river systems of the Indo-Gangetic plains. Many are semi-terrestrial. The Indian species are: Indian Pond Terrapin or Black Turtle; Indian Sawback or Roofed Terrapin; Deccan Sawback or Indian Tent Terrapin; Chapati or Brown Roofed Terrapin; Dhooor or Three-striped Roofed Terrapin; Red Crowned Terrapin; Assam Roofed Terrapin; Brahminy Terrapin; Spotted Black Terrapin; Eastern Hill Terrapin; Kerala Foresti Terrapin; River Terrapin; Mayan Box Turtle; Indian Eyed Turtle; Asian Leaf Turtle; and Keeled Box Turtle. All Indian Terrapins belong to the families Bataguridae and Emydidae.

**Freshwater Turtles:** These have flattened disc-like shells, covered with soft skin; semi-circular, paddle-like limbs with three claws; tubular nostrils; completely retractable head and neck; and flexible and extendible neck. They are usually carnivorous. All freshwater turtles are aquatic and most Indian species are found in the large river systems of the Indo-Gangetic plain. They are often found in shallow water, half-buried in the mud or aquatic vegetation. The Indian species include: Indian Mud or Flapshell Turtle; Chitra Turtle; Ganges or Indian soft-shelled turtle; Deccan soft-shell and Peacock soft-shell. All Indian freshwater turtles belong to the family Trionychidae.

**Land Tortoises:** All land tortoises belong to the family Testudinidae. They have heavy shells covered with horned shells and the heads and neck are completely retractile. Their hind limbs are columnar and club-shaped and tails are short. They are mostly herbivores and lay hard-shelled eggs which are more or less spherical. The species found in India are: Starred Tortoise; East Asian or Elongated Tortoise; Travancore Tortoise; and Eastern Hill Tortoise.
Procedure

- Make cards as indicated below. The Name Cards and Feature Cards should be of identical shape and size and large enough to shuffle. You will need 40 cards (20+20) per group of four students.
- Explain the distinct features of marine turtles, freshwater turtles, freshwater terrapins and land tortoises. Highlight how they differ from one another.
- Ask the students to list the similarities and differences between marine turtles, land tortoises, terrapins and fresh water turtles.
- Ensure that all the distinct features listed in the background table are covered. You may have to give clues or ask questions to get all of them.
- Divide the class into groups of four students each. Give one set of name cards and feature cards to each group.
- Ask one of the students in each group to shuffle the cards and deal one card at a time to each of the four players, until all the cards have been distributed.
- After the cards are dealt, each player will have ten cards.
- Tell them that the objective of the game is to make matching hands. Inform them that a name card paired with a feature card giving a characteristic of the animal mentioned in the name card would constitute a match.
- Give some time to players to make matches within their cards. Ask the players to place the matching pairs, face down, in front of them.
- When all the players are ready, ask the dealer to begin the game. He/she turns to the player on his/her right, chooses and pulls a card (Cards should not be shown.)
- Game continues clockwise around the circle. Whenever the selected card creates a match in a player's hand, that match should be put down on the table.
- Play continues until all possible matches have been made.
- Ask the players to check their matches against the answer grid.
  a. Each card that is paired correctly is worth two points. (+2)
  b. Each card left remaining in a player's hand without a match is worth minus one (-1).
  c. Incorrect matches count heavily against a player, and he/she is penalized by (-5) for every wrong match.
- Ask the students to compare their scores.

### Name Cards (4 x 5 per set)

<table>
<thead>
<tr>
<th>Marine turtle</th>
<th>Fresh water turtle</th>
<th>Fresh water terrapin</th>
<th>Land tortoise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine turtle</td>
<td>Fresh water turtle</td>
<td>Fresh water terrapin</td>
<td>Land tortoise</td>
</tr>
<tr>
<td>Marine turtle</td>
<td>Fresh water turtle</td>
<td>Fresh water terrapin</td>
<td>Land tortoise</td>
</tr>
<tr>
<td>Marine turtle</td>
<td>Fresh water turtle</td>
<td>Fresh water terrapin</td>
<td>Land tortoise</td>
</tr>
<tr>
<td>Marine turtle</td>
<td>Fresh water turtle</td>
<td>Fresh water terrapin</td>
<td>Land tortoise</td>
</tr>
</tbody>
</table>

### Feature Cards (4 x 5 per set)

<table>
<thead>
<tr>
<th>We are completely aquatic and live in seas and oceans</th>
<th>We are completely aquatic and live in fresh waters</th>
<th>We are semi-terrestrial</th>
<th>We all have stumpy feet to help us walk on any surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our head and neck are not retractile</td>
<td>We all are largely carnivorous</td>
<td>We are mainly herbivorous</td>
<td>We are all herbivorous</td>
</tr>
<tr>
<td>Only adult females amongst us come to land to lay eggs</td>
<td>We have flattened disc-like carapace, with soft skin on it</td>
<td>Some of us have very colourful carapaces</td>
<td>We live only on land</td>
</tr>
<tr>
<td>We have long paddle shaped fore-legs that help us swim</td>
<td>We aestivate* in mud and live in non-perennial waters  *Aestivation is the act of becoming inactive and having a reduced metabolic rate during hot, dry conditions.</td>
<td>We have flattened limbs with webbed digits having 4–5 claws</td>
<td>We all have a highly domed shells</td>
</tr>
<tr>
<td>There are five species of our kind found around India</td>
<td>Our forelimbs are paddle-like, with three claws</td>
<td>We possess scent glands</td>
<td>Some of us are crepuscular (active at twilight)</td>
</tr>
<tr>
<td></td>
<td>Marine turtles</td>
<td>Freshwater turtles</td>
<td>Freshwater terrapins</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td>----------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Habitat</strong></td>
<td>Completely aquatic, live in seas and oceans. Only females of the species come to shore to lay eggs</td>
<td>Completely aquatic, live in shallow fresh waters. Some aestivate in mud</td>
<td>Semi-terrestrial</td>
</tr>
<tr>
<td><strong>Head and neck</strong></td>
<td>Cannot be pulled into the shell or carapace, hence not retractile</td>
<td>Completely retractile; neck flexible and extensile</td>
<td>Completely retractile</td>
</tr>
<tr>
<td><strong>Limbs</strong></td>
<td>Paddle shaped long forelimbs help in swimming</td>
<td>Semi-circular, paddle-like, with three claws</td>
<td>Flattened limbs and almost fully webbed digits with 4-5 claws</td>
</tr>
<tr>
<td><strong>Food habits</strong></td>
<td>Herbivorous, carnivorous or omnivorous depending on the species</td>
<td>Largely carnivorous, Voracious feeders</td>
<td>Mainly herbivorous</td>
</tr>
<tr>
<td><strong>Carapace or shell</strong></td>
<td>Streamlined shell with bony scutes</td>
<td>Flattened and disc-like, covered with soft skin</td>
<td>Hard shelled, not very convex</td>
</tr>
<tr>
<td><strong>Habits</strong></td>
<td>Spend their entire life in the sea, except in the case of adult females which come ashore for brief periods to lay eggs, once or twice annually</td>
<td>Aestivate [spend the summer in a state of sluggishness] in mud, in dried up water bodies</td>
<td></td>
</tr>
<tr>
<td><strong>Special features</strong></td>
<td>Migrate between foraging areas and breeding and nesting areas</td>
<td>Model of Indian iconography. Often kept by religious establishments and are fed by devotees</td>
<td>Have scent glands and colourful shells</td>
</tr>
<tr>
<td><strong>Reproduction</strong></td>
<td>Annually or at longer intervals. Lay one or more clutches of 100-120 eggs on sea shore</td>
<td>Annually females come ashore to lay a clutch of leathery eggs ranging from 10 and upto 80-90 eggs</td>
<td>Annually females come ashore to lay upto 25 eggs, usually hard shelled</td>
</tr>
</tbody>
</table>
Turtle Statistics

**Objective**
To learn about turtle sizes and other statistics and try to visualize them.

**Level**
Intermediate

**Subjects**
Mathematics, Science

**Group Size**
Individual

**Place**
Outside the classroom

**Duration**
30 minutes

**Materials**
Chart papers, measuring tape, chalk, weighing machine

In the shallow seas in North America, 144 to 65 million years ago, there lived a giant turtle called *Archelon isochryos*. This was one of the largest turtles that ever lived. Its shell length was over 3 m and overall length about 5 m. An extinct land turtle of Asia (*Colosochelys atlas*) had a shell 2.1 meters long. The largest tortoise lived in northern India about 7.2 million years ago. This was the Geochelone atlas, and was as big as a small car!

Today, turtles run an entire gamut in size. The Atlantic Leatherback (Dermochelys coriacea), is the largest of the living turtles. It may attain a total length of 2.1 m. It may weigh more than 540 kilograms and measure 2.7 m from the tip of one front flipper to that of the other. The largest living tortoises may weigh more than 225 kilograms.

The smallest is the Musk terrapin of South America which reaches only 10 cm in length. The adults of some species weigh less than half a kilo and have a shell about 12 cms long.

The shell length of most adult turtles ranges between 10 and 40 cm.

**Procedure**
Ask the students to make a chart which clearly shows the size of each species as well as the weight.

On the playground or in a space which has a clear floor area, ask the students to measure and draw lines which indicate the length of each species, with the name of the species indicated alongside. (Take an average of the range given, e.g., Green Sea Turtles measure between 78 to 112 cms. Students could draw a line about 85 or 90 cms long).

Ask students to compare these lengths with lengths of different familiar objects—e.g., a classroom table, or a book, as the case may be, from the largest to the smallest.

Draw attention to the weight of the different species. Tell each student to find out her/his own weight. Now tell them to note the weight of each species and calculate how many of them would add up to the weight of the turtle [here again you may take an average weight], e.g., a Green Sea Turtle has an average weight 120 kg. This will equal 3 students weighing on an average 40 kg each. Leatherbacks average 400 kg, which is equal to 10 students of 40 kg each.

Students can also put up a chart of record breakers and Turtle Eye Openers and use this as reference while discussing any turtle topic.

**Record Breakers**

- **Leatherbacks**: Largest and heaviest sea turtles
- **Leatherbacks**: Deepest diving sea turtle—can dive down to 1,200 meters depth
- **Loggerheads**: Swimming speed record—94 m/s
- **Loggerheads**: Longest breeding migration—over 12,000 km across the Pacific
- **Loggerheads**: Hibernation underwater
- **Olive Ridley**: Largest mass nesting—over 100,000 turtles nest simultaneously
- **Green Turtles**: Precision of natal homing

What Makes a Turtle a Turtle? 15
Size

Turtle size is expressed as the straight-line distance from the anterior (front edge) to the posterior edge of the shell. Different species of marine turtles are of different sizes, but in most species, adult female marine turtles are larger in size than the males.

1. Green sea turtles reach about 78 to 112 cm in length, and 68 to 186 kg in weight. The largest individual collected was 1.5 m in length, and 395 kg in weight.
2. Black sea turtles reach about 59 to 117 cm in length, and 42 to 126 kg in weight.
3. Kemp’s Ridley and Olive Ridley are the smallest species, and reach about 55 to 65 cm in length, and 30 to 50 kg in weight.
4. Loggerheads reach about 82 to 105 cm in length, and 66 to 101 kg in weight.
5. Hawksbills reach about 53 to 114 cm in length, and 27 to 86 kg in weight.
6. Flatbacks reach about 81 to 97 cm in length, and 60 to 84 kg in weight.
7. The leatherback is the largest of all living sea turtles. Mature leatherbacks reach about 1.2 to 1.9 m in length, and 200 to 506 kg in weight. The heaviest leatherback ever recorded weighed 916 kg.

Source: Sea Turtle and Coastal Habitat Education Programme: An Educators Guide prepared by Sea Turtle Survival League and www.seaturtle.org

Turtle Eye Openers

- The female Hawksbill turtle can climb over reefs, rocks and vegetation to nest on beaches that would be inaccessible to larger, less agile sea turtles.
- Green sea turtles are so called because their body fat is green in colour.
- Though turtles do not have the power to communicate through vocal sounds, it has been observed in the case of Leatherbacks that they are able to emit wails, groans, roars and bellows when attacked.
- Active Leatherbacks have been recorded at water temperatures below 6° C. No other reptile is known to remain active at such low temperatures. Leatherbacks can live in cold waters because, unlike most other reptiles, their body temperature can be as much as 18°C higher than that of their environment. In addition to retaining heat produced by muscular activity, Leatherbacks may be able to actively regulate their temperature.
- A marine Green Turtle (Chelonia mydas) has been known to swim 480 kilometers in 10 days. It must have swum at an appreciable rate, since it scarcely could have swum steadily ahead without taking time to eat, sleep or rest.
Activity

Where Do I Belong?

Play a game to learn about the differences among the different species of sea turtles

<table>
<thead>
<tr>
<th>Objective</th>
<th>To help students differentiate among the various species of sea turtles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Elementary and Intermediate</td>
</tr>
<tr>
<td>Subject</td>
<td>Science</td>
</tr>
<tr>
<td>Group Size</td>
<td>Two groups of equal number of students</td>
</tr>
<tr>
<td>Place</td>
<td>Outside the classroom</td>
</tr>
<tr>
<td>Duration</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Materials</td>
<td>Turtle cards, Table “Differences between Sea Turtle Species”, five placards, blackboard for score keeping</td>
</tr>
</tbody>
</table>

There are seven species of turtles in the world today belonging to six genera. Out of these, five species are known to occur in Indian coastal waters. The Andaman and Nicobar Islands harbour some of India’s best Leatherback, Green and Hawksbill nesting beaches. Nesting of the Olive Ridley and Green turtles has been recorded on the west coast, in the states of Gujarat, Maharashtra, Goa, Karnataka, and Kerala. All along the east-coast of India, Olive Riedleys nest in high concentration—the world’s largest concentration being along the Gahirmatha coast in Orissa.

Each species is distinct. The Leatherback is the largest and Olive Ridley, the smallest of all sea turtles.

Before you begin

Before you begin the activity, make turtle cards, each having one or two distinguishing characters of the five species of our turtles (refer Table ‘The Turtles of Our Waters’ on Page 19). One card should be made per student. Several students can have cards with the same points.

The Activity

Part A

Begin the activity by discussing with students the various differences that exist among different species of turtles. For convenience, Fact Finder on Page 19 can be made into a chart and put up when the students play the game.

Part B

This part of the activity is better carried out outside the classroom in an open space. Designate five areas as the areas for the five types of turtles. You may place a placard with the name of the turtle in its designated area.

Divide the class into two equal groups, Group A and Group B. Tell the students that both the groups will be doing the activity one after the other. It is a competition whose outcome depends on both speed and getting answers right. On the blackboard, make two columns—one marked as Group A and the other as Group B.

Place all the turtle cards in a bowl. Tell each student to pick up a card, read it and decide which species he/she belongs to, by referring to the chart. The student should then go to the area marked for that turtle. The time for Group A to complete this exercise is noted and each of the student’s cards is checked to see if he/she has selected the correct species. The time and the number of mistakes made by the group are noted on the blackboard.

The same game is played with Group B and the time and mistakes are noted. The group taking the least time and making the least number of mistakes is the winner.

What Makes a Turtle a Turtle? 17
Sample turtle cards

**Olive Ridley**
Card 1 - I have 5 - 9 pairs of costal scutes
Card 2 - My length is 63 - 75 cm and I have two claws on each limb
Card 3 - I eat squid and jelly fish and my mouth is shaped like a parrot’s beak

**Green turtle**
Card 1 - I have one claw on each limb and have a beak with serrated edges
Card 2 - I have four pairs of costal scutes and a heart shaped carapace
Card 3 - I am herbivorous.

**Loggerhead**
Card 1 - I have two claws on each limb
Card 2 - I have nesting populations in Australia and Japan
Card 3 - I have a large and broad head

**Leatherback**
Card 1 - I do not have claws on my limbs
Card 2 - I feed exclusively on jelly fish
Card 3 - I do not have scutes on my carapace

**Hawksbill**
Card 1 - I have an oval or elongated shell, with the rear portion sharply serrated
Card 2 - I have four pairs of costal scutes and just one claw in each limb
Card 3 - I have a narrow and sharp beak and feed on sponges, anemones and squid.

---

**Sea Turtle Names**

Each sea turtle has both a scientific name and a common name. The scientific name identifies the genus and species, and the common name typically describes some characteristic of the turtle’s physical appearance. The Loggerhead, for example, gets its name from its exceptionally large head. The Hawksbill turtle gets its name because of its narrow head and large beak which looks like a hawk. The Australian Flatback gets its name from its shell which is very flat. The Leatherback is the only sea turtle without a hard shell. It is called ‘leatherback’ because its shell is made of a layer of thin, tough, rubbery skin that looks like leather.

Other turtles are named for colors on their bodies. The shell of the Black Turtle is dark gray or black, and the shell of the Olive Ridley is olive green. The Green, turtle is a little bit trickier. You might think the shell of a green turtle would be green, but it is not. It can have a black, gray, or brown shell. The green turtle is actually named for the green colour of the fat under its shell.

Last but not least is the Kemp’s Ridley. This turtle’s first name, “Kemp’s”, was given to it because a man named Richard Kemp helped discover and study the turtle. The second part of its name is a mystery. No one is sure why it is called “Ridley”. Some think turtle researcher Dr. Archie Carr was the one who named it “Ridley”. The name “Ridley” might be short for the word “riddle” or “Riddiler”. The Ridley may have got that name because it was a riddle to researchers. It was hard for them to figure out where the turtle came from and what its breeding habits were.
## The Turtles of Our Waters

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Olive Ridley Turtle</th>
<th>Hawksbill Turtle</th>
<th>Loggerhead Turtle</th>
<th>Green Turtle</th>
<th>Leatherback Turtle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appearance</strong></td>
<td><img src="image" alt="Olive Ridley Turtle" /></td>
<td><img src="image" alt="Hawksbill Turtle" /></td>
<td><img src="image" alt="Loggerhead Turtle" /></td>
<td><img src="image" alt="Green Turtle" /></td>
<td><img src="image" alt="Leatherback Turtle" /></td>
</tr>
<tr>
<td><strong>Carapace</strong></td>
<td>Round, highly domed, uniform olive green in adults. Curved carapace length 63–75 cm</td>
<td>Oval or elongated, sides and rear portions are sharply serrated. Curved carapace length 66–86 cm</td>
<td>Carapace is broad. Males have comparatively narrower shells. Curved carapace length 95–100 cm</td>
<td>Smooth, relatively broad and low, more or less heart-shaped. Curved carapace length 80–120 cm</td>
<td>Carapace is long with 7 prominent longitudinal ridges and black in colour with varying degree of pale spots. Curved carapace length 150–180 cm</td>
</tr>
<tr>
<td><strong>Costal scutes</strong></td>
<td>5 – 9 pairs</td>
<td>4 pairs</td>
<td>5 pairs</td>
<td>4 pairs</td>
<td>—</td>
</tr>
<tr>
<td><strong>Plastron</strong></td>
<td>Greenish white to yellow</td>
<td>Clear yellow with little or no dark pigmentation</td>
<td>Yellow to cream colored</td>
<td>Whitish to light yellow</td>
<td>Black or gray with mottled, pinkish-white spots</td>
</tr>
<tr>
<td><strong>Head</strong></td>
<td>Triangular, medium-sized, with a parrot-like beak</td>
<td>Narrow. Beak resembles a hawk’s bill. Maxilla (upper jaw) projects slightly above the mandible (lower jaw)</td>
<td>Large and broad, and varies from reddish or yellow chestnut to olive brown</td>
<td>Relatively small and blunt. Lower beak with serrated edge</td>
<td>Large, each side of the upper jaw bears a tooth-like projection</td>
</tr>
<tr>
<td><strong>Claws</strong></td>
<td>Two claws on each limb</td>
<td>One claw on each limb</td>
<td>Two claws on each limb</td>
<td>One claw on each limb</td>
<td>No claws on any of the limbs</td>
</tr>
<tr>
<td><strong>Food</strong></td>
<td>Shellfish like clams, mussel, crabs and other invertebrates. Also sea urchin, squid and jellyfish</td>
<td>Sponges, anemones, squids and shrimps</td>
<td>Shellfish like clams, mussel, crabs and other invertebrates</td>
<td>Young eat worms, crustaceans, insects, grasses and algae. Adults are herbivorous, mostly feeding on grasses and algae</td>
<td>Jellyfish and other soft fish</td>
</tr>
<tr>
<td><strong>No. of clutches in one season</strong></td>
<td>2 to 3</td>
<td>2 to 4</td>
<td>4 to 7</td>
<td>3 to 5</td>
<td>6 to 9</td>
</tr>
<tr>
<td><strong>Clutch size (average)</strong></td>
<td>110 eggs</td>
<td>160 eggs</td>
<td>100 – 126 eggs</td>
<td>115 eggs</td>
<td>80 fertilized eggs (these are larger) + 30 unfertilized eggs (these are smaller)</td>
</tr>
<tr>
<td><strong>Incubation</strong></td>
<td>52 – 58 days</td>
<td>60 days</td>
<td>60 days</td>
<td>60 days</td>
<td>65 days</td>
</tr>
</tbody>
</table>
Sea turtles are found in all the seas, except in the frigid zones, (i.e., the Arctic and the Antarctic Oceans), although Leatherback turtles are known to inhabit seas with temperatures as low as 6°C.

Precise distribution of sea turtles is difficult to map. A general idea of the distribution of sea turtles is possible from sightings of turtles in the particular area. All five Indian species, that is, the Olive Ridley, loggerhead, Hawksbill, Green turtle and Leatherback, are found in the tropical and subtropical Atlantic, Pacific and Indian Oceans. While nesting beaches can easily be located, it is difficult to say where these turtles go after nesting. Now, with the use of satellite telemetry it is becoming possible to trace their movements. For example, tagged turtles from Gahirmatha have been located in the waters around Andhra Pradesh and Sri Lanka. The turtles may migrate even further. No one can say for sure where they go.

Temperate Regions

Temperate climate is experienced in the region between the Tropic of Cancer and the Arctic Circle, and the Tropic of Capricorn and the Antarctic Circle. This region receives slanting rays from the sun and hence the temperature is moderate in these zones. This region includes the parts of the Atlantic and Pacific Oceans in this region, and spans over the continents of America, Asia, Europe, Africa and Australia.

Turtles being cold-blooded, have to limit their movements to the warmer climates. Most turtles do not venture into colder climates. Leatherbacks and loggerheads, being more hearty species and able to adapt to colder climes, may be found in temperate climate.

Leatherbacks are able to regulate their body temperature and thus easily survive even in regions beyond the temperate regions, i.e., the frigid zone. The Leatherback turtle also has a thick and oil-sulfured skin, which is an excellent insulator. This allows this species to be able to go into colder waters.

Tropical and sub-tropical regions

Tropical climate is the climate that is experienced between the Tropic of Cancer in the northern hemisphere and the Tropic of Capricorn in the southern hemisphere. In this region, the rays of the sun fall almost vertically throughout the year. Thus, the temperature is high throughout. This is also known as the Torrid Zone.

This zone includes parts of Africa, Central America, South America, South, and Southeast Asia including India, and the northern part of Australia. The islands in this region include Madagascar, New Zealand, Sri Lanka, Philippines, Andaman and Nicobar, Maldives, West Indies, etc.

The Tropical seas are the Atlantic, Pacific and Indian Oceans on either side of the equator, upto the Tropic of Cancer in the northern hemisphere and the Tropic of Capricorn in the southern hemisphere.

Most of the species are limited to this region, as the warm climate here is favourable. Olive Ridley, Loggerheads, Hawksbill and Green Turtles are found in this zone.
and places on their list. Once every group finishes filling in their map with the distribution of the species, a composite map of all the species can be made on a large world map, showing distribution of all the species. Different colours can be used to identify different species. This can be put on the notice board for the benefit of other students.

**Fact Finder**

**Nesting distribution of species**

Source: Sea Turtle Manuals — A GORI-UNDP Project Manual, Centre for Herpetology/ Madras Crocodile Bank Trust, Mambakkam, Tamil Nadu, India.

**Turtles in Indian Offshore Waters**

<table>
<thead>
<tr>
<th>Coast of Seas</th>
<th>Olive Ridley turtle</th>
<th>Hawksbill turtle</th>
<th>Loggerhead turtle</th>
<th>Green turtle</th>
<th>Leatherback turtle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orissa</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Karnataka</td>
<td>●</td>
<td>●</td>
<td>**</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Goa</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Gujarat</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Andaman &amp; Nicobar</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>**</td>
</tr>
<tr>
<td>Lakshadweep</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

* Sporadic sighting
** The best and largest population of Leatherback in South Asia.

What Makes a Turtle a Turtle? 21
Where do they live?

Adults of most species of sea turtles are found in shallow, coastal waters, bays, lagoons, and estuaries. Some also venture into the open sea. Juveniles of some species may be found in bays and estuaries, as well as at sea.

Olive Ridley's typically forage offshore in surface waters or dive to depths of 1.50 m to feed on the bottom-dwelling crustaceans and mollusks.

The deepest diving sea turtle, i.e. the leatherback, can dive to depths of over 1,200 m. They are also capable of active life in waters with temperatures down to about 6°C, being the only reptile known to remain active at such low temperatures. Due to this, they can inhabit the open oceans as far north as Alaska and as far south as the southern tip of Africa.

Loggerheads, on the other hand, prefer to feed in coastal bays and estuaries, as well as in the shallow water along the continental shelves.

Hawksbills are found around coastal reefs, rocky areas, estuaries and lagoons, whereas Greens are found near the coastlines and around islands where there is sufficient green vegetation like sea grass.

Major Nesting Sites

- Flatback
- Green
- Hawksbill

Map adapted from The Worldwide Distribution of Sea Turtle Nesting Beaches, Center for Marine Conservation, 1987.
Marine turtles are generally solitary creatures that remain submerged in water for much of the time they are at sea, which makes them extremely difficult to study. Decades of research has produced some insights into the daily activities of marine turtles and their behaviour, such as courtship, mating and nesting. Because of the difficulties in studying sea turtles in the open ocean, there are a great many things still unknown about their behaviour.

Sea turtles rarely interact with one another outside of courtship and mating. Ridleys, however, do come together in massive groups during Arribada (mass nestings). But even when large numbers of turtles gather on feeding grounds or during migration, there is little behavioral exchange among individuals. Green sea turtles are considered solitary, but occasionally feed collectively in shallow waters abundant in sea grass or algae.

Daily Activities

Marine turtles are known to feed and rest, off and on, during a typical day. Research conducted in the southeast United States has revealed that during nesting season, loggerheads follow regular patterns between the nesting beach itself, offshore reefs, and other rocky structures. It is presumed that mating and/or feeding occurs at these offshore areas.

Hawksbill Turtles spend some time resting or sleeping hidden under coral or rock ledges. It is not unusual to see thousands of Olive Ridleys floating in front of their nesting beaches.

Leatherback Turtles tend to dive in a cycle that follows the daily rising and sinking of the dense layer of plankton and jellyfish. The turtles probably feed on the upper layers of water at night. As dawn approaches, their dives become deeper, as the plankton and jellyfish retreat to deeper water, away from the light of day. The turtles bask at the surface at midday when the plankton layer sinks beyond their typical diving range. As dusk approaches, the turtles' dives become more shallow, as the layer of plankton rises.

Sea turtles can sleep at the surface, while in deep water, or on the ledges under rocks in near-shore waters. Many
Service Stations

A turtle cleaning station is a place where sea turtles congregate in order to get their shells cleaned by various algae-eating fish, and to have their skin picked clean of parasites. Turtles will lie on the reef or sea bottom and assume ‘cleaning postures’ to allow the fish to scrape away the algae or get at the parasites.

The Saddleback wrasse is a common reef fish in the Hawaiian Islands. It is unmistakable, having a green body with a large orange band just behind the head. The saddleback reaches lengths of up to 30 cm in adulthood. It has often been observed that this wrasse bites at the tumors and other white spots on the skin of turtles, probably in an effort to feed upon parasites.

The Whitespotted Toby, also known as the Whitespotted Pufferfish, is a common fish around the Hawaiian Reels. It has a pointed snout, a round spotted body, and measures about 5 to 7 cm when fully grown. Often, when a resting turtle gets up, the action reveals a Whitespotted Toby. Many times it has been observed that this fish also bites at Fibropapilloma tumors (a type of tumor commonly affecting turtles), probably to feed off the parasites found there.

Divers have seen Green Turtles sleeping under ledges in reefs and rocks. Hatchlings typically sleep floating on the surface, and they usually have their front flippers folded back over the top of their backs.

Swimming

Sea turtles are good swimmers. The swimming speed of Green turtles is about 1.5 to 2.3 kmph. Leatherbacks have been recorded at speeds of 1.5 to 9.3 kmph.

Forelimbs of all sea turtles are modified into long, paddle-like flippers for swimming. Their neck and limbs are non-retractile. The shell adaptations necessary for having a retractile head and limbs would impede rapid swimming.

Diving

Sea turtles are excellent divers. Leatherbacks routinely dive more than 300 m, and they may reach depths of more than 1,200 m, seeking jellyfish.

Sea turtles are ectothermic or cold-blooded, that is, their body temperature depends on the temperature of the surroundings. They thus have a slow metabolic rate. This slow metabolism allows them to stay submerged for long periods of time. Hawksbill turtles are known to remain submerged for 35 to 45 minutes. Green sea turtles can stay under water for as long as five hours. Their heart rate slows to conserve oxygen—nine minutes may elapse between heartbeats. During long dives, blood is directed away from tissues that are tolerant of low oxygen levels, toward the heart, brain, and central nervous system.

Leatherbacks have high concentrations of red blood cells; therefore, they can retain more oxygen. The muscles of Leatherbacks have a high content of the oxygen-binding protein, myoglobin. Myoglobin transports and stores oxygen in muscle tissue. This helps them stay underwater for long periods.

Feeding

Diet varies with species. Sea turtles may be carnivorous (meat eating), herbivorous (plant eating), or omnivorous (eating both meat and plants). The jaw structure of many species indicates their diet.

Green and Black sea turtles have finely serrated jaws adapted for a vegetarian diet of sea grasses and algae. In adulthood, Greens are the only herbivorous sea turtles. The diet of Green turtles changes significantly during their lives. Young Green turtles eat a variety of fish. Their diet includes worms, young crustaceans (crabs and crab-like organisms) and insects, as well as grasses and algae. When Green turtles reach 20-25 cm in length, their diet changes and they become herbivorous.

Loggerheads' and Ridleys' jaws are adapted for crushing and grinding. Their diet consists primarily of crabs, mollusks, shrimps, jellyfish, and vegetation. The powerful jaw muscles of Loggerheads help them to easily crush shellfish. Ridleys also eat fish, sea urchins and squid.

A Hawksbill has a narrow head with jaws meeting at an acute angle, adapted for getting food from crevices in coral reefs. They eat sponges, tunicates, shrimps and squids.

Leatherbacks have delicate scissor-like jaws that would be damaged by anything other than their normal diet of jellyfish, tunicates, and other soft-bodied animals. The mouth cavity and throat are lined with spine-like projections (papillae), pointed backward to help them swallow soft foods. Leatherbacks feed almost exclusively on jellyfish.

Researchers continue to study the feeding habits of Flatbacks. There is evidence that they are opportunistic feeders and eat seaweeds, cuttlefish, and sea cucumbers.

Horseshoe crab
Water requirement

Sea turtles do not need to drink freshwater. They obtain enough water from their food and from metabolizing sea water.

Feeding Grounds

These are areas usually far away from the nesting beaches, where food is in abundance. Some turtles like Hawksbills, which feed mostly on sponges, live near coral reefs (coral reefs are an ecosystem including sponges, coelenterates, echinoderms, and various fishes and organisms that depend on them). Other turtles like Green Turtles live near sea beds rich in sea grass, which they feed on exclusively. Olive Ridley’s and Loggerheads feed on molluscs and crustaceans, while Leatherbacks spend their adult life diving deep in the open ocean looking for jellyfish, which is their main food.

Turtles reach these feeding habitats as subadults (before they mature) and spend their life here until maturity, when they would take on the migration to their breeding grounds. The males return to these places after mating, whereas the females would return after nesting.

Migration to Breeding Grounds

Some sea turtle populations nest and feed in the same general areas; others migrate great distances during the breeding season—even up to several thousand kilometers, to nest. They leave the place where there is a sufficient abundance of food i.e., their feeding ground, and undertake these long migrations to their breeding grounds—the offshore waters of their nesting beaches. Most females return to the same nesting beach each year.

Males and females migrate to the breeding grounds after they have accumulated enough fat (pre-migratory fattening) for their long migration. (For more on migration, see “Page 39”)

Turtles usually do not feed in the breeding grounds but they may do so while preparing for their return migration back to their feeding grounds.

Green Sea Turtle populations migrate primarily along the coasts from nesting to feeding grounds. However, some populations will travel 2,100 km across the Atlantic Ocean from the Ascension Island nesting grounds just 8 km wide, to the Brazilian coast feeding grounds. We can only speculate as to why turtles would make such a difficult journey, or how they can find this island in the vastness of the Atlantic Ocean.

Black Sea Turtles migrate along the coast from breeding areas to feeding grounds between the northern and southern extremes of their distribution range.

Loggerheads leave foraging areas and travel on breeding migrations that range from a few kilometers to thousands of kilometers.

Kemp’s Ridley Turtles follow two major routes in the Gulf of Mexico: one northward to the Mississippi area, the other southward to the Campeche Bank, near the Yucatan Peninsula.

Populations of olive ridleys have been observed in large flotillas travelling between feeding and nesting grounds in the Eastern Pacific and Indian Oceans.

Hawksbill migration studies have been limited. Evidence suggests that some Hawksbill populations show cyclic nesting migrations. Other researchers have documented non-migratory and short-distance migratory populations.

Flatbacks move from their nesting grounds on the northern coast of Australia and adjoining islands, to feeding grounds in shallow waters of northeastern Australia. The distance covered ranges from 215 to 1,300 km.

Leatherbacks have the longest migration of all sea turtles. They have been found more than 4,800 km away from their nesting beaches.

In the north-central Gulf of California, Black Sea Turtles return each year to specific areas. They bury themselves under water in sand or mud, and may remain dormant from November to March.

Reproduction

Sexual maturity

Researchers are still studying sexual maturity in sea turtles. Estimates of the age when sea turtles attain maturity varies not only among species, but also among different populations of the same species. Maturity age may range from as early as three years in Hawksbills, to 12 to 30 years in Loggerheads, to 20 to 50 years in Green Sea Turtles.

Sexual maturity is often related to carapace size. Studies have shown that Hawksbills reach sexual maturity at a carapace size of 60 to 95 cm; Loggerheads reach maturity at a carapace size of 79 cm; and Green Sea Turtles reach maturity at 69 to 79 cm. Evidence suggests that some turtles continue to
grow after reaching sexual maturity, while some stop growing after reaching maturity.

**Mating**

Adult turtles migrate long distances to mate in offshore waters. Mating takes place in the offshore waters of the nesting beaches. Males have enlarged claws on their front flippers. These aid them in grasping the shells of the females during mating. The male mounts the female, holding her with the claws on his fore-flippers, and proceeds to mate. Fertilization is internal, that is, the male transfers the sperm into the female.

One female may mate with many males, and one male may mate with many females.

A female turtle may nest more than once in a season but since females are capable of storing sperm in their oviducts for up to several months, they do not need to mate during the inter-nesting period (period between two nestings in the same season). Thus it is possible that all clutches of one nesting season may be fertilized without repeated mating.

They do not break when they fall into the egg cavity.

After laying the eggs, she uses her hind-flipper to cover the pit with sand and uses her body weight to compress and pack the sand tightly. Burying the eggs serves three purposes: it helps protect the eggs from surface predators; it helps keep the soft, porous shells moist, thus protecting them from drying out; and it helps the eggs maintain proper temperature.

She then throws sand around the nest to camouflage it, and returns to the sea. Experts can identify the species of turtle by the type of mound left by the nesting female and by her flipper tracks in the sand when she comes up to nest.

Females may spend two or more hours out of the water during the entire nesting process.

Most turtles nest more than once during a season. Some (like Ridleys) may nest only once or twice, while others (like Greens and loggerheads) may nest 5-8 times.

Nesting is exhausting, but females will undertake several breeding migrations in their lives, generally returning to nest on the same beach at intervals of one to two years, depending on food availability and other factors. Sometimes the gap may be up to eight years.

**Incubation**

Incubation is the time between the laying and the hatching of the egg. During this period, the young one develops within the egg.

Marine turtle eggs incubate for about 7 to 10 weeks (45 to 70 days) before hatching. Incubation time varies with species, clutch size (number of eggs laid in one nest), and temperature and humidity in the nest. Heat is derived from the sun and also the metabolic
heat of the developing embryos. The temperature and moisture of the nest influence the development of the embryos. The greater the temperature of the nest, the less the time taken by eggs to hatch. However, above a certain temperature, the embryos may die due to desiccation.

**Male or Female?**

The incubation temperature of the nest determines the sex of the hatchlings (whether it becomes a male or a female). In case of sea turtles, there is a critical temperature (usually about 29°C) above which females develop, and below which, males develop. Different species (and even different populations) have different critical temperatures.

Sea turtles maintain a balance of males and females in the population by nesting at different times in the season. In India for example, Ridleys nesting in the early part of the season in December and January will produce male offspring, while those nesting in February and March will produce female offspring. In some turtles like Greens, which nest on islands, it has been found that turtles nest on different islands, because black sand beaches (which absorb heat) produce females, while white sand beaches produce males.

**Hatching**

The eggs hatch over a period of a couple of days. To break open their shells, hatchlings use a sharp, temporary egg tooth at the tip of their snouts, called the “caruncle”. This falls off soon after hatching. The caruncle is an extension of the upper jaw. Hatchlings are about 3.5 cm in length and weigh about 10-20 gm, depending on the species.

Hatchlings usually remain in their nest for two to three days after hatching, until most of the eggs in the nest have hatched, and then emerge all together. Newly-hatched turtles wriggle from time to time in their nest. The wriggling motion initiates hatching of other eggs. As darkness sets in, the wriggling becomes more intense, freeing some hatchlings from the eggshells.

While eggs usually hatch in the night, at times, this may happen during daylight hours. If this is the case, the hatchlings instinctively remain under the sand and wait until night to emerge from the nest. Hatchlings can detect the temperature of the sand, which is much cooler during the night, and thus decide when to emerge. Emerging at night reduces exposure to daytime predators.

About this time, when the hatchlings are ready to emerge, the nest begins to collapse, that is, the sides begin to cave in, bringing the hatchlings up to the surface.

**Imprinted for Life**

When the hatchling emerges from the nest, it moves towards the brighter horizon, that is, the sea. There are several theories as to how hatchlings find the sea after they emerge from the nest. Hatchlings may be able to differentiate light intensities, and head for the greater light intensity of the open horizon i.e., the reflection of light and stars on the water. In case there are brighter lights on the land side, they may be misdirected away from the sea by lights on the land.

During their crawl on the shore towards the sea, and also during offshore swimming, the geomagnetic field of that area gets imprinted on the hatchlings. This is thought to be the mechanism by which, as adults, they return to the same nesting beaches where they were born. This phenomenon is called “natal homing”. Besides geomagnetic cues, they may also be imprinted by scent and visual cues of that area.

Some researchers hypothesize that during the crawl to the sea, the hatchling may set an internal magnetic compass, which it uses for navigation away from the beach.

**On-route Dangers**

If they do not make it to the ocean quickly, many hatchlings will die of dehydration in the sun, or may be caught by predators like birds or crabs.

**Hatchlings at Sea**

Hatchlings do not feed or take up residence in the vicinity of where they were born. They depend on the reserve yolk
that is still present in their bodies for the first few days. Once they reach the sea, hatchlings continue swimming rapidly away from the land, against wave direction. This "swim frenzy" (also known as "juvenile frenzy"), or continuous swimming, takes place for about 24 to 48 hours after the hatchling enters the water. During this time, the hatchling is very active. This frantic activity gets the young turtle into deeper water, where it is less vulnerable to predators.

However, hatchlings in water still face many risks. They may be predated on by fish, or by birds from the air. In fact there are reports of swimming hatchlings diving straight down when birds and even airplanes appear overhead. This diving may be a behavioural adaptation for avoiding predation by birds.

Only one in a thousand hatchlings is believed to survive till adulthood.

The First Few Years

During their first few years, many species of sea turtles are rarely seen. These years are thus known as the "lost years." Researchers generally agree that most hatchlings spend these years leading an oceanic existence, before appearing in coastal areas. Although the migratory patterns of young turtles during the first years has long been a puzzle, most researchers believe that they ride prevailing surface currents, situating themselves in floating seaweed where they are camouflaged and where they can find food.

In this phase, they presumably feed on organisms that float with the tides, for example jelly fish and crustaceans, algae, woody plant material, or sponges, depending on the species of turtle. They typically swim several miles into the sea, where they are caught in currents and seaweed rafts that may carry them around the oceans for years, before returning to the near-shore waters of feeding grounds.
Activity

Food and Feeding

Play a game to match the food habits with the physical adaptations of various types of turtles.

Objective: To help students understand how different turtles' mouths are adapted to their different feeding habits.
Level: Intermediate
Subjects: Science, Language
Group Size: Individual
Place: Outside the classroom
Duration: 30 minutes
Material: Chart paper, paper, and writing materials

Food is the fundamental requirement for every organism to survive. The modification of the jaws and teeth are important adaptations which are related to the food and feeding habits of the organism. For example, grazing animals have well-developed grinders (molars) and well-developed middle incisors (four front teeth in each jaw), which help them eat their particular food. Canine teeth of rodents are adapted for gnawing at food. Cats and dogs have well-developed canines for tearing. Turtles do not have teeth but the horny projection of the mouth called the beak is certainly specialized to handle the specific food that they eat.

Procedure
Before you begin, prepare cards which represent the food of turtles. The cards may be 6 cm x 6 cm in size. A picture of one food item from the list below and its name should be put on each card. Make as many cards as there are students in the class, repeating the items if required.

Turtle foods
- Clams (mussels)
- Gastropods
- Echinus (Sea urchins)
- Tunicates
- Corals
- Fish
- Shrimp
- Jellyfish
- Crabs
- Sponges
- Sea grass
- Squid
- Sea anemone
- Squilla

Another set of chits is to be made such that student gets one chit. These chits will have the type of jaw, as mentioned below.
- My beak is shaped like the beak of a parrot
- My beak has serrated edges
- My beak is like a hawk's beak
- I have a soft delicate bill

Begin the activity by telling the students that this exercise will help them understand the relationship between the food
preferred by a turtle, and the structure of its beak. Share the information given below to explain this.

1. Green Sea Turtles have finely serrated jaws adapted for a vegetarian diet of sea grasses and algae. In adulthood, they are the only herbivorous sea turtles.

2. Loggerheads' and Olive Ridleys' jaws are adapted for crushing and grinding. Their diet consists primarily of crabs, mollusks, shrimps, jellyfish, and vegetation.

3. A Hawksbill has a narrow head with jaws meeting at an acute angle, adapted for getting food from crevices in coral reefs. They eat sponges, tunicates, shrimps, and squids.

4. Leatherbacks have delicate scissor-like jaws that would be damaged by anything other than their normal diet of jellyfish, tunicates, and other soft-bodied animals. The mouth cavity and throat are lined with papillae (spinelike projections) pointed backward, to help them swallow soft foods.

5. Some species change eating habits as they age. For instance, Green Sea Turtles are initially carnivorous up to the juvenile stage. They feed on marine snails, jellyfish, fish eggs and crustaceans as they float along with the currents. They then progressively shift to a herbivorous diet including algal material, seagrasses and seaweeds.

The activity can be done in the classroom or a hall where there is place to run around. Make a circle on the ground in the centre of the room. Spread out all the food item cards in that area, face up. Mark the four corners of the room with the following tags:

Corner 1 - Green Turtle
Corner 2 - Loggerhead and Olive Ridley
Corner 3 - Hawksbill
Corner 4 - Leatherback

Let the students stand around the circle of food items, at a distance from it. Put a box with chits of the types of beak on the edge of the circle. Ask the students to come one by one and pick up a chit from this box. They should read the chit aloud and go to the circle and pick up the food item that they think will be preferred by them with their type of beak, and then carrying that item, run to the corner reserved for the turtle who they think they are.

After all the students have finished, you can discuss the reasons why a certain food has been selected. Let the students analyze their answers.

The students now know the food that they have to eat for a certain kind of beak. The game can now be made more interesting by making two groups. Keep the beak chits in a box. Let one group at a time play. Each of the students from the group picks a chit, reads it aloud, runs to the circle, picks a food item, and goes to the corner where she thinks she belongs. Note the time for the whole group to finish and then take the second group.

The group finishing in the least time, and making the least mistakes, wins the game.
Food and Feeding

Feeding or foraging behaviour is unique in case of each species of sea turtle.

The young of Greens, particularly hatchlings, are carnivorous. As they float along with the currents on sargassum (a kind of seaweed found floating in masses) rafts, they feed on marine snails, jellyfish, crustaceans, and fish eggs. Adults of Greens are totally vegetarian, preferring to feed on algal material, sea grasses and seaweeds. Grazing grounds of the Greens are found near the shores of the coast. Green Sea Turtles graze on seagrass beds, often going back to the grazed plot for cropping. Biologists have determined that this behaviour helps Greens in obtaining a diet rich in nitrogen.

Hatchlings of Hawksbills mainly feed on a mixed diet ranging from algae and woody plant material, to sponges and marine snails. The adults feed on sponges, sea anemones, crustaceans and soft corals. Besides such a diet, the Hawksbill at times will also feed on algae and seagrass.

Olive Ridley's consume smaller forms of fish, fish eggs, marine snails, crustaceans and, at times, jellyfish. Algal material is also consumed. In one case, this species of turtle has been observed feeding on pearl oysters and sea urchins.

Leatherbacks feed mainly on jellyfish. Sometimes they also capture octopuses, crabs, sea snails and slugs. They dive to great depths to feed on jellyfish.

Since turtles do not have teeth, there is no chewing. Hard-bodied animals such as crabs and snails are caught by the mouth, snapped and swallowed.
Activity

A Turtle Tale

Be an editor and learn about the family life of Marine Turtles.

Objective
- To help students
- To identify correct and incorrect information related to turtles
- To understand why accuracy in journalism is important

Level
Intermediate

Subjects
Science, Language

Group Size
Individual

Place
Inside the classroom

Duration
30 minutes

Material
Copy of "Turtles: A First-hand Report"

Marine turtles are large, air-breathing reptiles that inhabit tropical and subtropical seas throughout the world. All sea turtles begin their lives as tiny hatchlings on land. Unlike most other animals, turtles do not have a social life. They are solitary, and individuals seldom interact with each other except for courting and mating. Even in the case of species which feed, migrate or nest together, there is little interaction.

Sea turtles are migratory species and some may migrate over 1000 km from their feeding ground to their mating ground and the nesting sites.

Researchers do not yet know how long baby turtles spend in the open sea, or exactly where they go. It is theorized that they spend their earliest, most vulnerable years, floating around the sea in giant beds of sargasso weeds, where they do little more than eat and grow. Once turtles reach dinner-plate size, they appear at feeding grounds in near-shore waters. They grow slowly and take between 15 and 30 years to reach reproductive maturity, depending on the species. It is difficult to determine the age of a sea turtle from its physical appearance. It is theorized that some species can live for over 100 years.

Before You Begin

Discuss various facts about turtles. Tell the students that this activity is to test their level of understanding about turtles by identifying incorrect information about them.

Tell the students that they are going to be editors of a popular science and nature magazine. Magazines have to print information that is well written and accurate. Editors receive many articles and stories each week from writers. As editors, they have to decide which of the articles and stories can be printed in their magazine.

Tell them that to check whether the article in hand is accurate, editors need to do research on the subject of that article. At times this involves digging up information from reference books and looking up other articles on the subject. Discuss with students why it is important for editors of magazines to make sure that articles are accurate.

Procedure

Dictate to the students the article "Turtles: A First-hand Report". Tell them that they have received this article from an author. They have to go through the article to decide whether or not the article can be printed in their magazine.

Tell the students to read the passage carefully and underline any words, phrases or sentences that they feel are inaccurate.
Turtles: A First-hand Report

After our reports on the beautiful beaches and churches of Goa, in this week's piece, I would like to introduce you to another of Goa's wonders—the sea turtles which come to Goa's beaches. One of the ten marine turtles of the world, the Olive Ridley turtles are the only ones which come to India's west coast. And I have been lucky enough to see them!

A group of Olive Ridley turtles lives permanently in the coastal waters of Goa. They often come ashore in groups of five to six to bask in the sun.

Today there was great excitement on the beach. One female Olive Ridley was seen nesting this afternoon. After digging out the nest, she laid about 10-20 eggs and returned to the sea.

As in Orissa, females in Goa too are known to come in huge numbers to the shore to lay eggs (called Arribada) But this being May, it is not the time for mass nesting.

After two weeks, the eggs will hatch. The mother turtle will come to the coastal waters and whistle. On hearing this sound, the hatchlings will run towards the sea and then follow the mother everywhere for the next few years, during which time the mother will teach them survival skills.

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Fact Finder

1. There are seven species of marine turtles in the world.
2. Five species of marine turtles are known to occur in Indian coastal waters.
3. Turtles do not live permanently in the off-shore waters of Goa. They come in the months of November to March to breed. Turtles migrate thousands of kilometres between feeding and breeding grounds.
4. Turtles have to come to the water surface to breathe, but they never come to the land to bask. Females come to land to nest but only very rarely do males come on to the land.
5. Olive Rileaks usually nest at night.
6. Olive Ridley females lay about 100 to 150 eggs at a time.
7. In Goa, only sporadic nesting takes place and no Arribada. Morjim, Golgibaga and Agonda are the turtle nesting places.
8. The eggs take about 52-60 days to hatch.
9. The mother turtle goes back to the sea after she lays the eggs. She never sees the hatchlings.
10. The hatchlings detect the sea because of its brighter horizon. It is a myth that the females whistle from the sea to call their hatchlings.
11. Like most reptiles, turtles do not show parental care. The hatchlings are independent once they hatch, and have to fend for themselves.

A Life at Sea 35
Hatchling Cards

Design a card that announces the birth of a baby turtle.

**Objective**
To help students to learn about the characteristics of baby turtles.

**Level**
Intermediate

**Subjects**
Science, Language, and Craft

**Group Size**
Group of two to three students each

**Place**
Inside the classroom

**Duration**
30 minutes

**Materials**
Writing materials

Turtles usually come ashore at night to lay eggs on the beach. The female digs a nest, up to one metre deep, and lays about 100 – 150 eggs, covers the nest, and leaves the eggs to the mercy of nature. Within each egg, a little turtle is growing and taking shape. The eggs hatch in about 7 – 10 weeks. This period varies from species to species. And finally, after the incubation time lapses, the little ones break open their shells and struggle to climb up to the sand.

Unlike baby crocodiles and alligators which are liberated from their nest by their mother, sea turtle hatchlings must do it all by themselves. To break open their shells, hatchlings use a temporary, sharp egg-tooth at the tip of their snout called a caruncle. This falls off soon after birth. The caruncle is an extension of the upper jaw. Digging out of the nest is a group effort that can take several days. Hatchlings usually emerge from their nest at night or during a rainstorm when temperatures are cooler. Once it is time to burst out, they erupt from the nest cavity as a group. The little turtle hatchlings orient themselves to the brightest horizon (usually the sea), and then dash towards it.

Emphasize that while all the facts should be correct, students can use their imagination to present the information in an interesting manner.

**Filling the Card**

Ask the students to imagine that they are in the place of the hatchlings. In the first blank, let the students fill a name for the hatchling, which should be followed by the 'surname', i.e. the species they want to be, e.g. Ravi Olive Ridley or Roni Hawksbill.

In the second blank space, they must fill a date between December and May—the months when the sea turtle hatchlings hatch, since the females lay the eggs during November to March. The third blank space must give the incubation time of the species of turtle that they imagine themselves to be. The fourth space must tell which beach they were born on. The fifth blank space must have information on the depth at which they were in the nest. Usually females dig nests up to one metre in depth. The sixth blank must give the temperature of the ground. The temperature determines the sex of the baby turtle. The seventh blank can be used to write the year in which a female turtle from the clutch will become an adult and come to the shore to lay the eggs. Usually it takes about 20 to 30 years. Remember, the card will read differently depending on whether they choose to be a male or female hatchling. They will have to fill in blanks accordingly e.g., if the hatchling is a male, it will not return to the beach to nest.

Activity

Discuss with the students about the nesting of turtles, incubation and hatching. (See Pages 28–30)

Tell the students that they have to design cards that would announce the hatching of a baby turtle. Since there is no parental care in turtles, a baby turtle has to announce its own arrival to the world!

Start this activity by putting a copy of the hatching announcement card on the board. Information about the hatchlings can also be put up. You can use the Fact Finder on Page 37.

Divide the class into groups of two to three students each, and tell each group that they have to prepare hatchling cards.

36 Turtles in Trouble
In the space "About Me", they can fill in details about the species of turtle they are, how they look, how they find their way to the sea, what they eat, or any other fact related to the hatchlings. The Fact Finder box can be used as a source of information.

In the space for the picture, they can draw a baby turtle.

The cards may be put up in the class or on the notice board for display.

### Hatchling Announcement Card

I _____________, am proud to announce that I have hatched on ___________. I was in this nest for ____ days. Since the incubation temperature in my nest was _____,I am a baby girl/boy. I/my sister will be returning to nest here in ____ years. I/my brother will never return to my birth beach again.

Do take care of my coast so that my sisters can return here to nest.

About me

---

### Fact Finder

#### Hatchling Facts

1. Hatchlings break open the eggshell with the help of an egg tooth, which is present on the beak.
2. They respond to light and move towards it.
3. As soon as they emerge, they proceed towards the sea, which they locate by its brighter horizon. They then orient to the wave direction, swim off-shore, and gradually get imprinted on by the Earth’s magnetic field, which they probably use later in life to return to their natal shore to nest.
4. For the first few days, hatchlings do not need to feed, and depend upon the yolk stored in their stomachs.
5. The parents do not see the hatchlings after hatching.
6. Many predators like jackals, birds, dogs etc. feed on them as they move towards the sea.

#### Incubation Times of Different Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Incubation time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Green</td>
<td>60 days</td>
</tr>
<tr>
<td>2. Hawksbill</td>
<td>60 days</td>
</tr>
<tr>
<td>3. Olive Ridley</td>
<td>45 – 62 days</td>
</tr>
<tr>
<td>4. Loggerhead</td>
<td>60 days</td>
</tr>
<tr>
<td>5. Leatherback</td>
<td>65 days</td>
</tr>
</tbody>
</table>

A Life at Sea 37
Migration Mysteries

Read two passages on migration written by well known naturalists.

**Objective**
To learn more about sea turtle migration.

**Level**
Intermediate, Advanced

**Subjects**
Language

**Group Size**
Individual

**Place**
Inside the classroom

**Duration**
30 minutes

**Material**
Writing material

Every animal, at some time during its life, leaves its place and travels to another. This journey could cover a few centimeters, or it may span the globe. A migratory animal is one that undertakes regular movements between two habitats, thereby exploiting the availability of resources in two different places.

Migratory animals can be divided into three basic categories. There are those that travel over land, including mammals such as elephants and wildebeest. Several birds, some bats, and some insects travel by air. And aquatic species (some fishes, whales, dolphins, seals, and marine turtles) migrate through water.

Different species follow different types of cycles of migration. In some, cycles are seasonal. For example, on the grassy African plains, many animals migrate with the rainy season. In some birds, butterflies and turtles, the to-and-fro journeys are well defined. In eels and salmon, the overall cycle can take more than a year. Some monkey species migrate once a month from one part of the forest to another and back. African elephants are known to take ten years to complete their migratory cycle. Elephants move over large areas to meet their requirements for food and water. Their migrations are governed by vegetation and climatic conditions of the region. Marine animals migrate to find areas of better food supply or suitable breeding conditions. These movements follow a seasonal pattern.

The mass migration of the large antelopes called wildebeest or gnus in grasslands of eastern Africa are linked with the dry and wet season. From December to January, during the rainy season, the wildebeest live in small scattered groups. As soon as the dry season begins, they gather to form huge herds and start moving in search of fresh grazing lands. They are joined by other antelopes, deer and zebra—all forming an enormous moving sea of animals.

Many migrating animals return to exactly the same place, year after year. Whatever the nature of the migration, the migrating animal needs some kind of sensory apparatus to help it move in the correct direction and reach the correct place. However, the various mechanisms whereby different animals do this is not well understood.

The ability of marine animals to orient themselves in an environment which is almost totally lacking in landmarks remains largely a mystery. Scientists are trying to learn more about this by using metal tags, radio transmitters and satellite transmitters (See page 70), but many mysteries remain unresolved.

The migration of marine turtles is one such mystery. In the case of Olive Ridleys, the coming ashore of the female Ridleys, in tens of thousands, after the long migration journey, is a phenomenon in itself.

The mass migratory movements of several animals have been vividly described by many authors, and some have become unforgettable parts of literature.

**Activity**

Given below are two short passages describing the movement of the wildebeest and the Arribada of the Ridleys. Students can enjoy the vivid use and flow of language and answer some questions on the pieces.
Ask students to read both passages and answer the questions given.

A. Soon there was no room to stand. The air was full of the leathery squeak of turtle skin against hard turtle shell and soft beach sand. This was punctuated by the blowing of air by the gravity-bound female turtles as they forged up to the nesting grounds.

A female turtle shuffles forward up the sloped beach, stops, digs her snout into the soft sand, almost like a dog on a new scent, and continues until the nesting ground is reached. Once she has covered the 100 to 50 m from the surf to the second plateau of the beach, after blundering into other females returning to the sea after nesting, she starts the mysterious and fascinating final act in the art of procreation.

We were on Gahirmatha beach in the Bhitarkanika Wildlife Sanctuary in Orissa, witnessing a phenomenon that was comparable to the hordes of game on the African plains, schools of tuna and whales, and other such astounding congregations in nature.

This was one of the planet’s ultimate extravaganzas, the mass nesting of the Olive Ridley sea turtle.


B. We came to the wildebeest migration soon after 7 o’clock and were driving slowly through the glistening army for about four hours. These pewter coloured, white bearded creatures move in long close-packed columns at a steady pace and in a constant direction and when the time comes to graze, spread out as far as the eye can see for about twenty miles, like great hordes of ants speckling the plain. All the time, when on the move, they emit harsh grunts, something like the sound of frogs, something like that of old men clearing their throats. People have called them ungainly because of their high shoulders and sloping hindquarters, and also clowns because of their sometimes playfulness, leaping and cavorting with apparent joie de vivre. Their heads go down, their tails go up, they bounce like balls, kicking up eddies of dust. When disturbed they gallop off together and make curious junking swerves, at the same time lashing their tails.

Every year hundreds of thousands of wildebeest migrate across the Serengeti plains and Masai Mara in East Africa in search of fresh pasture within an area of about 15,000 square miles. When rain falls, they come to the open plains, from the bush to enjoy the grass which sprouts immediately.

Last Days In Eden, Elspeth Huxley & Hugo Von Lawick, Harvil Press London 1984

Questions

1. Where are the Serengeti plains? Where is Bhitarkanika?

2. Find two adjectives each that describe the wildebeest and the turtles.

3. What kind of sounds do the wildebeest make while on the move? What are the sounds heard when the beach is covered with turtles?

4. How does the turtle move along the beach? How do the wildebeest move across the plains?

5. Why do the wildebeest migrate? Why do the turtles come on to the beach?

6. What is the “final act in the art of procreation”?
   (a) coming ashore  (b) laying eggs  (c) digging a nest

7. Give a title to each of the two passages.
in Our Lives

Down the ages, turtles have been nesting at various points along the Indian coastline. This has led to a connection between turtles and people. The habit of marine turtles of coming ashore to bury their eggs under the sands of the seashore has been recorded as early as the 4th century A.D. in Tamil literature.

In India, as well as other parts of Asia, turtles have been part of life and mythology through the ages. They are believed to be symbols of longevity and perseverance. They are worshipped in some places. Freshwater turtles are often kept by religious establishments and fed by devotees. The Ganges softshell is kept in a bathing tank of a small Vishnu temple at Puri, Orissa; the Burmese softshell in a pool at a Pagoda at Mandalay in Myanmar. In neighbouring Bangladesh too, turtles are worshipped. The Chittagong softshell is kept in a large tank in the mausoleum of the Saint Sultan Bayazed near Chittagong.

Turtles have been part of people's lives also as a food source for people along the coasts, and the shells as a material for crafts. Sometimes shells are also used to store grains and other household articles.

In Indian Mythology, the turtle is believed to be the second among the ten 'Avatars' of Lord Vishnu. Some communities revere the turtle as a God, and if incidentally caught, it is released after a brief puja.

**Kurma Avatar**

According to Hindu mythology, all the Gods and demons together decided to churn the ocean, *kshirsagar*, the ocean of milk, to get the *amrit* (ambrosia or holy nectar). This was known as the great churning.

The Meru mountain was used as the hub, and Vasuki, the king of snakes, was chosen as the rope to churn the ocean with. Twining the divine snake around the mountain, the ocean was to be churned in a manner in which traditionally butter is churned—twirling the mountain by pulling the snake.

The gods and demons tried to churn the ocean but could not do so, as the mountain was sinking into the sea and was unstable. All the gods and demons went to Lord Vishnu and asked Him for help. The Lord accepted their plea and took the incarnation of Kurma, the giant turtle. He dived into the ocean and took Mount Meru on his back, and then the churning proceeded. In this way the *amrit* was churned out of the ocean along with various other treasures including the Goddess Lakshmi.
Worship

Mud turtles were a part of Vedic sacrifices. A deep depression was made in the centre of the ved (altar) and a live turtle kept there with sufficient food to keep it alive. If, at the end of the sacrifice and destruction of the altar, the turtle was alive, the sacrifice was considered auspicious.

On the Andhra Pradesh coast there is a temple devoted to the Kurma Avtar.

On the Bangladesh coast, at the grave of a certain holy man, turtles do not fear humans. The turtles are revered and fed. The story goes that the turtles were once evil spirits that were rescued from the path of evil by the holy man. There is a belief that you can wash away your sins if you wash and feed these turtles.

Turtles in Art

Turtles carved out of marble are often seen in temples. These are placed facing the deity.

The Chittra turtle (Chithra India) is the model for tortoises in Indian iconography. It is easily distinguished from other Indian species by the peculiar shape of its head and the proximity of the eyes to the tip of the snout.

The Kurma Avatar of Vishnu is also expressed in many dance forms.

Turtle Shells

The turtle carapace or upper shell is known for its beauty, and was used as a showpiece and to make artifacts. The demand for this has to an extent, led to the poaching of turtles. There is an illegal market in "tortoise shell", which is in fact the shell of the Hawksbill Turtle. The carapace of this species was used for making curio items such as lampshades, photo frames, combs, cigarette cases etc.

Turtles Today

Turtles On Our Coast

Turtles nest in India both on the Eastern and Western coasts. The major nesting areas in India are the Gahirmatha beach stretch in Bhitarankika Sanctuary, Rushikulya and Devi river estuaries in Orissa, Point Calimere region in Tamilnadu and Bhaidar Island near Okha in the Gujarat coast, and several areas along the south-east coast and areas in the Andaman - Nicobar Islands, Lakshadweep Islands.

Goa: There are three main nesting sites of the Olive Ridley here—at Morjim in North Goa and Garibagoa and Agonda in South Goa. All sites are protected by the Forest Department with the help of local people. Thirty per cent (about 65 km) of Goa’s coastline is sandy beach, inherently suitable for sea turtles to nest on. The remaining coast is mostly rocky.

It is known that Olive Ridley often favours beaches near river-mouths for nesting. Six major rivers including Zuari and Mandovi flow into the Arabian Sea. It therefore appears very likely that Goa’s beaches once hosted large nesting populations of this species, but human intervention has put an end to that.

Gujarat: Gujarat is a well known nesting site for Green turtles as well as Olive Ridleys. Green Turtles require nesting beaches where sand above high tide level is deeper and covers greater expanses. On an average, nesting is denser on the State’s western coast, roughly between Okha and Veraval, than on the southern coast (Veraval to Gogha). Sea grass beds and coral reefs in Gujarat—especially in the vicinity of Karumbhar island, provide food for a considerable population of Green Turtles whose numbers and nesting migration routes are yet to be ascertained.

Much of this nesting habitat is today being destroyed for construction purposes and for the manufacture of cement. Ports and jetties, petrochemicals and oil refineries, salt works, mining, ship breaking etc. are activities that are threatening the ecosystem along Gujarat’s coast.

Kerala: Historical data shows that turtles used to nest in the coast. Nowadays nesting is sporadic. Olive Ridleys nest in moderate numbers along the coast of Kerala.

Illegal sand mining, dumping of solid and liquid waste, violation of the Coastal Regulation Zone (CRZ) stipulations, tourism etc., are threats to the sea turtles along the Kerala coast.

Maharashtra: Out of the five species of sea turtles found in India, four are known to occur in Maharashtra waters. Olive Ridleys are found in the waters along the entire coast. Green Turtle population is greater near Malvan. Nesting has been on the decline in the last ten years. A few sites near Malvan are visited by Olive Ridleys and Greens for nesting.

Sea turtle eggs are consumed by people along the entire coast and nests are poached to collect eggs. Sea turtle meat is also eaten, but some communities believe the turtles to be sacred and
they are released immediately if caught in a net.

**Orissa:** Four species of sea turtles—Olive Ridley, Green, Hawksbill and Leatherback—are reported to occur in the coastal waters off Orissa. But only the Olive Ridley is known to nest along Orissa's coast. Moreover, it is on three of Orissa's beaches—Gahirmatha, Rushikulya and Devi Mouth—that Olive Ridiys exhibit the unique behaviour of mass nesting or Arribada. There are only a few places in the world where Arribada takes place.

**Tamil Nadu:** About 65 per cent of the coast of Tamil Nadu has dry sandy stretches which are suitable for turtle nesting. There is sporadic nesting of Olive Ridiys here, usually between December and March.

The waters along the Tamil Nadu coast are important migratory corridors for the Olive Ridiys on their way to Gahirmatha for the Arribada and on their return migration to the Indian Ocean. The Gulf of Mannar is an important feeding ground for sea turtles.

**West Bengal:** Olive Ridiys are known to nest along the Sundarbans coast and on nearby islands which have luxuriant mangroves, lagoons, vegetation, suitable organisms for food and sandy beaches.

Indiscriminate fishing, pollution of sea water, over-fishing, growth of townships and human populations close to the shore, as well as tourism, are some of the threats to the sea turtles. Selling of turtle meat as a delicacy is a big factor. Although this is now banned, some illegal sale continues.

**Andaman Islands:** The four species of marine turtles that occur in the Andaman and Nicobar islands are the Leatherbacks, the Hawksbills, the Green Sea Turtles and the Olive Ridiys. In the late 1970s and up to the early '80s, there were several reported Loggerhead nestings on the islands. However there is no evidence of this species nesting in the Andaman and Nicobar islands today.

The highest concentrations of nests occur on islands where water monitor lizards (Varanus salvator) which eats the eggs, are absent, for example South Reef and Snark Islands. Here human disturbance is also minimal. The Hawksbills' peak nesting period in Andamans is believed to be from April to January, with some nesting taking place round the year. The peak nesting period for Green Turtles is the south-west monsoon season, from June to September. Sporadic year-round nesting may also occur. Feeding habitats of turtles occur in many areas in the Andamans.

**Nicobar Islands:** Most islands are uninhabited. Meroe island is favoured by nesting Green Turtles.

Great Nicobar Island is part of the island group of Andaman and Nicobar. The southernmost part of India—Indira Point—only 150 km from Sumatra in Indonesia, is located on this island. At Indira Point, the beach is less than half a kilometre in length. The intensity of turtle nesting is low here. Great Nicobar has a significant population of Leatherback Turtles. Galathea on the east coast of Great Nicobar is the most accessible Leatherback nesting beach on the island. The other beaches on the west coast are mostly uninhabited. It is estimated that about a thousand Leatherbacks nest on the Nicobar Islands every season.

Here one of the main threats to the turtles is from predation of eggs by wild boar, monitor lizards and feral dogs. Saltwater crocodiles are also known to grab turtles while they are nesting.

**Lakshadweep:** Four species of sea turtles occur and nest in the Lakshadweep Islands. The largest numbers are of Green Turtles, followed by Olive Ridley, Hawksbill and Leatherback.

Green Turtles are caught and killed when they come ashore to the nest for their oil, which is of commercial value. This oil is considered to be a very good waterproofing agent and is used in painting boats.

Here turtles are not threatened by fishing, as fishing is done using pole and line in the waters surrounding the islands, rather than through mechanized trawlers. Turtle meat and eggs are not eaten due to religious restrictions.
Mass nesting beaches of the Olive Ridleys in Orissa

Devi River Mouth (Orissa): The beach is wide, flat (small sand dunes about 1-2 meter high are present on the northern side) and without forests, except recently planted casuarina. The colour and texture of the sand and beach topography resemble those of the Gahirmatha beach to some extent.

Gahirmatha beach: Mass nesting by the Olive Ridleys used to take place along 10 km of coastline from Habalikhati northward up to a place called Ekakulnasi. However, at present, nesting takes place in Ekakulnasi island which was separated from the mainland some years ago.

At the Gahirmatha rookery, the nesting beach is wide, flat and consists of sand which may contain rare earths such as titanium ores. The colour varies from brownish-white to blackish-white or completely black. The texture of the sand varies from medium to fine hard-packed particles. Often half of the beach near the high water mark looks black in colour. The nest site selection may be related to the texture and quality of the beach sand which in turn is related to the turtles being able to dig a successful nest cavity there; and thereafter providing conditions of temperature, moisture and aeration necessary, throughout the incubation period for the developing embryos.

The average width of the main nesting beach remains almost constant during an Arribada, although it undergoes cyclical seasonal erosion throughout its entire length. The Arribada coincides with the period when the width of the rookery is at its maximum, that is, in the winter months where the width of the rookery is about 50 to 60 meters.

Possibly the Ridleys are capable of viewing the beach topography while swimming. Prior to the commencement of an Arribada, masses of Ridleys are observed swimming parallel to the coast just beyond the third breaker line in the shallow coastal waters off Gahirmatha. They intermittently raise their heads out of water as if carefully scanning the beach. Nesting usually does not occur in eroded areas having vertical walls, whereas adjacent stretches having gentle slopes will host large numbers of nesters, thus supporting the contention that Ridleys can see the beach topography while swimming. The capacity of Ridleys to find their bearings with reference to any direction appears to be greater (more accurate) in water than on land.

Gahirmatha Calender

The coastal waters along Gahirmatha welcome the first Olive Ridleys around November. It is observed that the males arrive first, followed by the females. Mating takes place in the shallow coastal waters, and by mid-December the males return to their deep-sea foraging grounds. For about a month after mating, the females congregate in the offshore waters, in huge groups called "reproductive patches". It is at this time that they are in greatest danger of injury or death from mechanized fishing trawlers.

Then it is time for them to come ashore to lay eggs. At some time between January and March, there is a short period (7 to 10 days) marked by a huge surge of nesting by large numbers of females. This is the well-known arribada.

At Gahirmatha, the first Arribada occurs in the period from late December to February and the second Arribada may commence from mid-February and continue till April. The first Arribada is usually very big as compared to the second Arribada, or subsequent mini-Arribadas during the months of April and May. The occurrence of Arribada is known to be highly correlated with the phases of the moon, and usually takes place two or three days before and after the moon enters its last quarter. Observations made over a period of seven years at the Gahirmatha rookery strongly suggest that the arribadas usually take place coinciding with, or within one or two days after the neap tidal days along with increasing tide. Another interesting observation made at Gahirmatha is that immediately following an arribada, the number of nesters abruptly declines and for about a week, practically no turtles emerge to lay their eggs.

It has been observed that this peak, which takes place at night, coincides with neap tides. It is preceded by a strong wind blowing onshore southward. The phases of the moon and wind speed also influence the exact timing of the event.

For the last 27 years this astonishing phenomenon has been recorded. In only four years in this period has Arribada not taken place.
Shifting Sands: The Story of Gahirmatha

Today the name Gahirmatha is known the world over as the place where several hundred thousands of Olive Ridleys nest every year. It is the world’s largest known sea turtle rookery.

Till the early 1970s, perhaps the only awareness about sea turtles in Orissa was their identity as a commercial commodity. Live turtles and turtle eggs by the boat-load often headed from here for the markets of Kolkata.

In 1973, two researchers of the Bombay Natural History Society were conducting a survey of saltwater crocodiles in the mangrove forests of Bhitaranika, located in the delta of the Brahmani and Baitaran rivers on the coast of Orissa. They reported that large numbers of turtles were nesting on one of the beaches along the eastern part of the area—Gahirmatha. It was perhaps the first report of this nature, but it did not receive much attention. In 1974, a consultant to the Indian Government, Dr. H.R. Bustard, who was also carrying out a survey on crocodiles, confirmed the mass nesting on the Gahirmatha beach, and reported that it could be the world’s largest nesting population of Olive Ridleys.

The government then declared Bhitaranika as a wildlife sanctuary. Gahirmatha was included as a part of this Protected Area. Collection of turtle eggs from this area was banned. The Forest Department initiated measures to control poaching of sea turtles. These were the first measures in a programme for the conservation of sea turtles which is now in its third decade.

Along the Gahirmatha stretch of coast, there has been a periodic shifting of the preferred spots for nesting. In the early 1970s, mass nesting took place in a 1.5 km stretch between Ekakula and Satkshaya village. In the mid-70s, the stretch between Ekakula and Gahirmatha was favoured. At that time the beach was very wide, and had high sand dunes.

Following a devastating cyclone in 1977, the sand dunes were planted with casuarina—a fast growing tree species from Australia, with the idea of protecting the coastal villages from the cyclonic winds. As a result of the change in the beach’s original profile characteristic, the turtles stopped coming to this stretch.

By the early 1980s, the highest concentration of nesting turtles was on the Ekakula sand spit near the mouth of the Maipura river.

Another cyclone in 1989 split this nesting beach. The sand spit separated from the main beach, and formed a longish island which was surrounded on three sides by the Maipura river, and the Bay of Bengal on the fourth. The 4 km long island did not have any vegetation. The newly formed island became known as Ekakula Nani Island (‘Nani’ means a sand spit near a river mouth).

It is this site which has seen the mass nesting of Olive Ridleys since 1990.

In 1998, the Ekakula Nani Island once again got broken up into two islands, about a kilometre apart. The average width of the two islands is less than 50 m. This severely constrains the space available for nesting. Turtles come ashore in batches, and the newer egg-laying batches tend to destroy large numbers of eggs laid by recent predecessors. Also, being small and low lying, the sandy beach gets eroded and the nests and eggs are exposed, hampering the successful hatching of eggs. One of the problems confronting Ekakula Nani is the bright illumination from the nearby defence establishment that disorients the hatchlings.

In early 1981, another rookery was discovered at the mouth of the Devi river. Recent surveys have indicated that not much nesting takes place at this site now, due to the beach being overpopulated by casuarina trees.

Another rookery near the mouth of the Rushikulya river was discovered in 1994. This site is now well protected. However, bright lights from nearby establishments disorient both adults coming into nests as well as hatchlings trying to reach the sea.

Orissa is the only state in India which has three large turtle nesting sites or rookeries. It is vital that these be protected and maintained in a condition which attracts the Ridleys to nest, and safeguards their eggs and hatchlings till they reach the safety of the seas, so they can return one day in the future, to spawn a new generation of Olive Ridleys.
## Table 1: Our Turtles in International Waters

<table>
<thead>
<tr>
<th>Species</th>
<th>Habitat Preference</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green turtle</td>
<td>Tropical and subtropical areas near continental coasts and around islands</td>
<td>Atlantic Ocean, Gulf of Mexico, along Argentine coast, in the Mediterranean Sea, Australia and Indo-Pacific.</td>
</tr>
<tr>
<td>(Chelonia mydas)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loggerhead turtle</td>
<td>Coastal tropical and subtropical waters; will venture into temperate waters, to boundaries of warm currents; prefer coastal bays, but have been found in streams, creeks, and in the open ocean</td>
<td>Australia, Japan, Atlantic coast of North and South America.</td>
</tr>
<tr>
<td>(Caretta caretta)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olive Ridley turtle</td>
<td>Mostly coastal, travelling or resting in surface waters in spite of their wide range. Nearly unknown around oceanic islands.</td>
<td>Tropical regions of Pacific, Indian, and Atlantic Oceans.</td>
</tr>
<tr>
<td>(Lepidochelys olivacea)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hawksbill turtle</td>
<td>Near coral reefs and rocky outcappings in shallow coastal areas, estuaries and lagoons</td>
<td>Throughout central Atlantic and Indo-Pacific regions. Most tropical of all sea turtles.</td>
</tr>
<tr>
<td>(Eretmochelys imbricata)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leatherback turtle</td>
<td>Highly oceanic; approach coastal waters only during breeding season</td>
<td>Most widely distributed of all sea turtles; found in the Gulf of Alaska and south of the Bering Sea in the northern Pacific; to Chile in the southeastern Pacific; in the Barents Sea, Newfoundland and Labrador in the North Atlantic; throughout the Indian Ocean; Andaman and Nicobar; and to Tasmania and New Zealand, Surinam in the southwestern Pacific. This species is found farther north than any other reptile, marine or terrestrial</td>
</tr>
<tr>
<td>(Dermochelys coriacea)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Table 2: Worldwide Distribution of Sea Turtles Nesting Beaches

<table>
<thead>
<tr>
<th>Turtle</th>
<th>Olive Ridley Turtle</th>
<th>Hawksbill Turtle</th>
<th>Loggerhead Turtle</th>
<th>Green Turtle</th>
<th>Leatherback Turtle</th>
<th>Kemp's Ridley</th>
<th>Flatback *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nesting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Primary nesting ground is on the beach near Rancho Nuevo, Tamaulipas, Mexico. A second nesting site at Padre Islands National Seashore</td>
<td>Nest on inshore Islands and mainland from Nio Repos in the South to around Mackay in the North (in Australia). Other major nesting areas occur in the Kimberley region of Western Australia and extend to the Torres Strait. The inner shelf area of the Southern Great Barrier Reef includes 4 major rockeries on Peak, Wild Duck, Aviod and Curtis Islands</td>
</tr>
<tr>
<td>Largest nesting populations are in Mexico, Costa Rica and India</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Globally significant nesting populations are in the Caribbean and Seychelles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large nesting populations in Australia, Japan, Atlantic coast of North and South America</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Globally significant nesting populations in Central and South America, Mediterranean, Australia, South East Asia</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large nesting populations in Atlantic coast of South America (Surinam etc.) and probably Indonesia and Nicobar Islands. Atlantic populations in decline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Test Your TQ (Turtle Quotient)

| Objective | To help students:  
|------------|------------------|
|            | • Rate themselves on their knowledge regarding turtles  
|            | • Correct some commonly prevalent misconceptions related to sea turtles  
| Level      | Intermediate  
| Subjects   | Science, Language  
| Group Size | Individual  
| Place      | Inside the classroom  
| Duration   | 30 minutes  
| Material   | Writing material  

Turtles have a fascinating and complex life cycle. It is very difficult to find out about some parts of their life history. Since little is known, myths and false beliefs abound.

This activity will help the students know the turtle better. It will help in correcting false beliefs, if any.

### Activity

Tell the students that as you read out the 'Do you know Sea Turtles?' quiz, they should note down whether according to them, each statement is True or False. Alternatively, you can dictate the questions to them and then ask them to indicate whether the statements are True or False. These can also be converted to 'Tick the right answer' type questions by giving four choices of answers to each question.

Once you have finished with all the statements, give the answers to the students and discuss correct answers with them. Tell them that based on the scoring sheet, they can rate themselves on their awareness related to sea turtles.

### Variation

A Mock Turtle Quiz may be organized. Divide the class into two groups and ask them the questions. This will bring an element of competition into the game.

### Scoring Sheet

Check your answers and evaluate yourself on the basis of the following scoring sheet.

<p>| | | | | | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11–13 Arribada! Welcome to your natal shore and congratulations on successful nesting. Well done!</td>
<td>7–10 Good! You have matured into a nice turtle. Just a few more miles to go for Arribada.</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>4–6 Still surviving on yolk! Search for more sargasso and grow up.</td>
<td>1–3 You have just hatched! Orient yourself towards the sea for the long journey ahead.</td>
<td></td>
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### Do You Know Your Sea Turtles?

1. Turtles evolved from the ancestral proganochelid.
2. There are ten species of sea turtles in the world.
3. Sea turtles are aquatic and lay eggs in the water.
4. Female turtles return to the same coast that they were born on, to make nests and lay eggs.
5. Leatherback is the largest of the sea turtles.
6. Green Turtle is the smallest of the sea turtles.
7. Leatherbacks are among the deepest diving sea turtles. They can dive to depths of over 1200 m.
8. Hawksbill Turtles can climb over reefs, rocks and vegetation to nest on beaches that would be inaccessible to larger, less agile sea turtles.
9. Green Sea Turtles are so called because they are green in colour.
10. Leatherback females come to nest in large groups.
11. Olive Ridleys usually nest at night.
12. The hatchlings cannot detect light when emerging from the nest.
13. Eggs hatch in approximately seven weeks.

**Answers**

1. True. Turtles evolved from Proganochelid ancestor, which was a marsh dwelling creature with a bony shell. Teeth were absent from the margins of their jaws.

2. False. There are 7 species of sea turtles in the world, namely Olive Ridley, Kemp’s Ridley, loggerhead, Hawksbill, Flatback, Green and Leatherback.

3. False. Sea turtles do not lay eggs in the water though they are completely aquatic. Females come on to the shore to nest.

4. True. Evidence overwhelmingly suggests that females return to the same beaches or within 1 to 10 km of the beaches on which they were born.

5. True. Leatherback is the largest turtle. It can reach a total length of 2 m.

6. False. Ridley’s (Olive and Kemp’s) are the smallest sea turtles, with lengths up to only 80 cm.

7. True. Leatherbacks dive up to a depth of 1,200 m in search of jellyfish, their preferred food.

8. True. Hawksbill Turtles can climb over reefs, rocks and vegetation to nest on beaches that would be inaccessible to larger, less agile sea turtles, since they have a very hard plastron (lower shell).

9. False. Green Sea Turtles vary from light tan to grayish black in colour above, often with radiant or spotted markings and with a yellow underside. The fat under the shell is green in colour and hence the name.

10. False. Leatherback females are not known to come in great numbers to nest. This mass nesting is known only in Olive Ridleys.

11. True. Olive Ridleys usually nest under the cover of dark to avoid predation.

12. False. The hatchlings are very sensitive to light. They find their way to the sea by guided by the brighter horizon i.e. the reflections of the moon in the sea.

13. True. Eggs hatch in 7 to 10 weeks depending on the species of turtle and also on the temperature of incubation.
A Turtle's Quest

Far away, near another sea,
Lies the coast, that I long to see,
Where years ago, my mother dug a nest.
My siblings and I faced our first test.

I must return to that coast,
So that in future I can boast.
That I too made my own nest.
Oh! When can I end this long quest?

My hatchlings I will never see,
Even when they scurry to reach the sea.
Their future is theirs to find.
The shore imprints they’ll keep in mind.

It’s a long swim to get to that shore;
But for sure this long trip is not a bore,
With the fishes below and the birds above,
This is the trip I love.

Migration is not my hobby, you know!
We have to keep that genetic flow.
200 million years, we have changed only little.
Doesn’t my life seem like a puzzling riddle?

After I rest I will come back here,
Where shortage of food is something I don’t fear.
Abundance is the key word,
This is totally my kind of world.

— Swati Kittur
Staying Alive

If all the hundreds of thousands of turtle eggs laid every year were to successfully hatch, and if the hundreds of thousands of hatchlings were to reach adulthood, the world would probably be overrun by turtles. The reality is that only one in a thousand hatchlings is likely to reach adulthood.

In nature, sea turtles face a host of obstacles to their survival. Turtles are in danger at all stages of their lives—from the time eggs are laid to when they hatch; during their journey as hatchlings from sand to sea; and as adults in the seas.

The nature of danger at every stage is different. Predators such as crabs, ants, monitor lizards, dogs, etc., raid eggs and hatchlings still in the nest. Once they emerge, hatchlings make bite-sized meals for birds, crabs and a host of predators in the ocean. After reaching adulthood, sea turtles are relatively immune to predation, except for the occasional shark attack. However adult turtles face many threats from humans. A combination of factors such as trade, habitat change and violation of the law, are responsible for the decline in their population.

Turtles, like many other reptiles have been a part of business from time immemorial. Some turtles and tortoises are captured for the pet trade and are smuggled out of the country. Another major problem is that nesting beaches may not be adequately protected. This is sometimes due to the absence of adequate laws and more often inadequate implementation of those laws.

Poaching

Poaching of sea turtles is mainly carried out for their meat. Though all five Indian species are given legal protection, poaching of turtles continues. The meat of Olive Ridleys and Green Turtles is illegally sold at some fish landing sites along the Eastern coast. Turtle soup is a delicacy and is an expensive item of food in many countries. Calipee is a vital ingredient in turtle soup. This is the cartilage cut from the bones of the bottom shell. Poachers often follow a gruesome procedure to get this. Green Sea Turtles are turned over, their calipee is cut, and the turtle is left to die. The eggs of turtles are also poached. They are believed to have curative properties and are considered a delicacy.
The meat of Hawksbills is thought to be poisonous. Many deaths have been reported due to consumption of this meat. The symptoms are usually seen 24 hours after consumption of the meat. These include nausea, vomiting, stomach pain and diarrhea.

There is also an illegal market for the "tortoise shell," which is in reality the shell of Hawksbill Turtles. The carapace of this species is used for making curio items such as lampshades, photo frames, combs, cigarette cases etc.

**Fishing**

Fishing activities along the coasts during the breeding season take a great toll on turtles that come to nest. Thousands of turtles are found trapped in fishing nets. They are caught up in the net and are injured or suffocated, and die. During the breeding season, thousands of turtles are seen stranded on the beach. Dead turtles are often washed up on the shore.

**Incidental Catch**

Earlier, upto the 1970s, sea fishing activities involved traditional fishermen fishing from traditional non-mechanized boats, that too with cotton yarn nets and only in very selected sites. Since then however, there has been a proliferation of mechanized fishing vessels using new gear and nets including nylon nets, trawl nets, gill nets etc. Fisherman do not go out to catch turtles, but turtles do get caught in the nets along with the fish. And once caught, sea turtles cannot escape from these new types of nets. This is referred to as 'incidental catch'. The sea turtles ultimately die due to suffocation and asphyxia. Due to unregulated fishing by trawlers and non-use of turtle excluder devices (TEDs) (see Page 69) in fishing trawlers, a number of casualties of turtles have been reported in the last two decades.

When a turtle is caught accidentally, to save their fishing nets, the crew of fishing vessels often plunge sharp-edged iron forceps into the eyes of the still living turtle, drag it forcibly from the net and throw it away into the open sea. They may also injure the head and carapace with iron rods. The sea waves then carry the dead or nearly-dead turtle to the shoreline.

Between 1000 to 5000 turtles have died in Gahirmatha area alone every season due to 'incidental catch' in fishing-related activities during this period. Mortality of adults (males and females, including females carrying eggs) due to sea fishing activities has reached a record high in recent years. In the last 20 years, fishing activities have resulted in the death of over 75,000 adult Olive Ridleys of both sexes along the Orissa coast alone. This is a serious cause for concern.

**Threats to Habitat**

**Development:** Various large-scale development projects taking place on the coasts, e.g., development of marinas (small ports that are used for pleasure rather than trade, often with hotels, restaurants and bars), ports, jetties, and industries etc. have major environmental impacts, such as changes in the landscape or habitat. These affect turtle nesting adversely.

On some parts of the coast, the land near beaches is being converted for agricultural use, often commercial tree plantations. Plantations extend right up to the nesting areas. Such plantations are seen in Orissa, Andhra Pradesh and Tamil Nadu. All this destroys and changes the traditional nesting areas. Prawn farms along the coast too have affected nesting beaches.

**Pollution:** Urban agglomerations near the coast, as well as industries, dump their waste directly into the sea. Some of this floating waste is deposited on nesting beaches, making it unsuitable for sea turtles to nest.

Oil spills from harbours, refinery waste and toxic chemicals from industries also have an impact on the health of sea turtles. Studies conducted in the United States of America and elsewhere prove that oil spills in the seas can have serious effect on the health of turtles. Sea turtles exposed to oil and chemical pollution may develop skin lesions, fibropapillomas and other kinds of diseases.

Human land-based activities result in hundreds of plastic bags landing up in oceans. These, in the eyes of a turtle, bear a resemblance to jelly fish, their staple diet. Once ingested, the plastic blocks the digestive tract, causing starvation and resulting in death.

**Sea walls:** In many coastal areas, sea walls are constructed for protecting built-up areas such as residential buildings, factories etc. against sea erosion. Iron tetrapods or blocks of iron are also put up along the coast to help prevent coastal erosion by breaking waves. Such structures prevent sea turtles from coming to nest.

Sea turtle nesting beaches in Kerala and Lakshadweep have been fenced off by granite blocks and embankments as protection against sea erosion, thereby preventing sea turtles from nesting on
about 200 km of Kerala’s 590 km coastline.

**Beach mining:** Sand is a raw material for construction. Demand for sand is met by mining of beaches. Sand is physically trucked off from some beaches for the extraction of titanium. Such activities bring about drastic changes to nesting beaches.

**Non-native beach vegetation:** Turtles are known to avoid beaches with casuarina plantations. The entrenched root system and the leaf litter of the casuarina make it difficult for female turtles to nest. The shade of such a plantation could also change the nest temperatures, altering the natural sex ratio of hatchlings.

**Large scale destruction of mangroves:** The mangrove ecosystem is a rich source of food for the turtles. Also, turtle nesting has been known to be concentrated on beaches which are at river mouths and populated with mangroves. Destruction of mangroves therefore adversely affects both the food chain of sea turtles and their nesting areas.

The mangroves, which were once abundant all along the coastal belt of Cuttack district, Orissa, have now totally disappeared from this region due to human encroachment and felling for firewood and other household purposes.

**Destruction of nests due to beach erosion:** If for anthropogenic causes, nesting is late in the season and the peak hatching emergence period (especially on the Orissa coast) coincides with the coastal southwest winds, the strong wind and wave action result in beach erosion, which destroys a considerable proportion of the eggs laid.

**Threats to Eggs**

**Predation:** Almost all sporadic nests along the coast are predated on by mammalian beach predators viz.; jackals, hyenas, fishing cats etc. This is true for most other nesting beaches too, where feral dogs abound in large numbers.

Dogs were introduced on the Andaman and Nicobar islands by the British in the 1850s. Since then, their numbers have exploded. The dogs dig up turtle nests and destroy the eggs. They have even been known to attack turtles tired and exhausted after nesting on the beaches. On Great Nicobar, one of the important Leatherback nesting sites of the world, dogs have been found to be the cause of the loss of almost 70 per cent of eggs and hatchlings.

**Destruction of eggs due to subsequently emerging nesting females:** On mass nesting beaches, during Arribadas, a number of nests laid during the first few nights are usually destroyed by nesting turtles arriving later. In Gahirmatha too, many nests laid earlier in the season are destroyed by the turtles nesting later, as they dig up the original nest unknowingly, to make a new nest. Thousands of nests are lost in this way.

Large numbers of eggs are buried under the sand, and after the peak hatching period, a proportion remain as unfertilized, unhatched or rotten eggs. It is possible that the presence of decaying remains of unhatched or rotten eggs and dead hatchlings which remain buried underneath the sand could have an adverse effect on the success of hatching in the following nesting season.

**Natural threats to Adults**

**Predation:** The only threats to adult sea turtles in their natural environment are from sharks and large marine mammals in the open ocean. But turtles have a mechanism by which they avoid being eaten by sharks. They turn their upper hard shell towards the mouth of the attacking shark. The shark cannot get a hold on the turtle shell, and the turtle thus gets a chance to escape.

The Sundarban is a mangrove forest, where the Olive Ridley is known to visit. Wild boars are a major threat in the coastal regions of Sundarban in West Bengal. These boars kill and eat up turtles, as well as damage their nests and eat the eggs.

In the Sundarban Tiger Reserve, pug marks of tigers have been found around the carapace and skull remains of Olive Ridley Turtles indicating that the turtles may have been eaten by the tiger.

**Disease:** Fibropapilloma tumors (FP) are lobe-shaped tumors that infect soft portions of the turtle’s body. Tumors grow primarily on the skin, but they can appear on scales and scutes, in the mouth, on the eyes and on internal organs. These tumors increase in size and number until the turtle is seriously debilitated. Death is the common outcome. FP began affecting Green Turtles in large numbers simultaneously in several geographically separated areas such as Hawaii, Florida and Australia in the 1980s. More than 50 per cent of certain populations were found to be affected.

**Danger!**

Sea turtles are mercilessly killed for their blood, in the belief that sea turtle blood taken before sunrise is a cure for asthma.

“Bekko” is a Japanese word for the shell of the Hawksbill turtle. “Bekko” has been turned into anything from cabinets to door posts and handles for mirrors.
Turtle Maths

Solve some mathematical problems related to turtle numbers.

**Objective**
To help students understand the survival percentage of sea turtles

**Level**
Intermediate

**Subjects**
Mathematics, Science

**Group Size**
Individual

**Place**
Inside the classroom

**Duration**
15 minutes

**Materials**
Paper, pen, calculator

Only one in a thousand turtle hatchlings reaches adulthood. Dangers beset turtles at every stage in their lives.

**Before You Begin**

In this activity, students get a rough idea about the number of turtles that come to nest, and how many hatchlings may survive finally, based on example of nesting of the Olive Ridleys along India’s Eastern coast.

During the 1999 nesting season, the Wildlife Institute of India (WII) estimated that, 200,000 females nested on the Gahirmatha beach in Orissa.

Adult female Olive Ridley turtles come in large numbers over long stretches of the Indian Coast to lay their eggs. Each female Olive Ridley lays about 100-150 eggs in a nest, which is a hole dug in the soft beach sand 50 to 75 meters from the high tide line. However, not all the females that come to nest are successful. Some of them return without nesting due to unsuitable nesting conditions. Some are so distracted by humans, or disoriented by the coastal illumination and other disturbances that they may leave the coast without nesting at all. A few of them accidentally destroy the nests of those turtles that have nested previously.

Since the nest is not guarded and the female returns to the sea immediately after depositing the eggs, a large number of the nests are destroyed by wild and domesticated animals such as jackals, dogs etc.

1. Total number of females that come ashore and successfully nested is 2,00,000
2. Assume that 1.5 per cent of the nests are destroyed by subsequent nesters (30,000)
3. Assume that 15 per cent of the nests are destroyed by predators during 8 weeks of incubation (32,000)
4. Assume that 3 per cent of the nests are washed away by the tides (6,000):
   - How many nests stay intact till the end of incubation?
     {200,000-30,000-32,000-6,000} = 132000
   - Say each turtle lays an average of 120 eggs. How many eggs does that make? (1,58,40,000)
   - Assume that only 80 per cent of these eggs hatch. How many hatchlings will there be? (1,26,72,000)
   - If only one in every thousand hatchlings survive till adulthood. How many hatchlings survive till adulthood? (12,672)

After all the students have worked out the problems, you can ask for the answers. Check them. The following points can then be discussed.

**Activity**

You can write the following information on the board. Do not write down the correct answers given in parentheses. Tell students that these figures are rough estimates, not accurate figures. Based on the statements, let the students work out a mathematics problem.
Points for Discussion

• According to the problem, is the number of hatchlings which survive till adulthood more than the females coming to nest?
• What are the other threats that the turtles face, that are not included in the problem?
• How will all these threats affect the population of sea turtles?
• What can be done to increase the number of hatchlings that survive?

Nest Loss

1.5 per cent of 200,000 due to destruction — 30000 - A
16 per cent of 200,000 due to predation — 32000 - B
3 per cent of 200,000 are washed by the tides — 6000 - C

Therefore, total loss is
A (30000) + B (32000) + C (6000) = 68000
The natural obstacles faced by young sea turtles are staggering, but it is the increasing threats caused by humans that are driving them to extinction. Today, all sea turtles are listed as endangered.

Humans pose serious threats. Sea turtles' eggs are still consumed. Eggs can often be found for sale in local markets. In these same areas, adult sea turtles are killed for their meat. Turtle products, such as jewellery made from Hawksbill shells, also are a direct reason for killing of sea turtles. Commercial fishing in the offshore waters during the nesting season kills hundreds of sea turtles entangled in trawler nets.

Thousands of sea turtles die from eating or becoming entangled in non-degradable debris, including packing bands, balloons, pellets, bottles, vinyl films, tar balls, and styrofoam. Trash, particularly plastic bags, thrown overboard from boats or dumped near the beaches and swept out to sea, is swallowed by turtles and causes fatalities.

Various 'developmental' activities such as construction of hotels and houses along the beaches and artificial lights from such sources, discourage females from nesting and cause hatchlings to become disoriented and wander inland, where they often die due to dehydration or predation. (See page 52)

When they reach adulthood, female and male turtles migrate a great distance from the feeding ground to the breeding ground to mate. Several risks threaten them on their way to the breeding grounds. Once they mate, the males return to the deep sea.

In order to propagate the species, female turtles have to come ashore from the sea where they are comfortable and relatively safe. While approaching the coast, female turtles face many hurdles like fishing boats and polluted water. Once on the beach, they may get disoriented by artificial lights or be poached upon.

There are threats not only in the sea but also on the land. Not all females are successful in nesting. And even after they lay eggs and return to the sea, the risks to the eggs and to the hatchlings before they reach the safety of the sea, are enormous.

In this activity students will learn about the different factors that threaten the safety of turtles.

Before you begin

Before the activity, draw a large square on the ground and divide this into 25 small squares. Each of the 25 squares should be about 36cm x 36cm (See page 57).

Also design instruction cards for the game. For this, you can use pieces of chart paper, each one the size of an A4 sheet. Write one statement on each sheet. You can make your own set of seven or eight instruction cards based on the list of threats and conservation issues given.

Place these instruction cards on the ground in the squares as shown on Page 57.

Activity

Discuss with students the various threats faced by sea turtles (See Fact Finder on Page 58). As you discuss these, list them down on the black board. Also, list the conservation measures that are taken up by institutions, NGOs, people and government organizations for conservation of sea turtles (See pages 65–73).
Tell the students that during the game, all of them should imagine that they are sea turtles and are moving about in the coastal waters of the nesting beach in search of a safe place to nest. They will face different threats in the water and on the beach.

The game is played with a die numbered 1 to 6 on its sides. The sequence of the players can be decided by asking all the players to roll the die once. The one with the maximum number will play first, then the second, and so on in decreasing order.

After you have explained the game to the players, and after the sequence of the players has been decided, ask the first player to roll the die. He/she should move as many spaces as indicated by the die. If he/she comes to a square that has an instruction card; explain the instruction to the player and tell him/her to act accordingly. The chance then passes to the next player and thus the game continues. The game will end when one of the players is successful in nesting. The player who wins the game should be asked what he/she learnt from the game and how he or she will help conserve sea turtles.

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<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start here</td>
<td></td>
<td>Trawl nets are being used by fishermen. Hold your breath and stay deep. Miss 2 chances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Nice quiet water with plenty of food. Throw the die again.</td>
<td></td>
<td>Caught in a net but thankfully released soon and unhurt. Move one space forward</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Caught in a gill net. Back to square one (literally)</td>
<td></td>
<td></td>
<td>Effluents in the sea make you sick. Miss one chance</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>19</td>
<td>18</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>Lighting and noise on the beach do not allow you to nest. Move two steps back.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>The beach you want to nest on has eroded. Miss one chance</td>
<td></td>
<td></td>
<td>You can nest at last</td>
<td></td>
</tr>
</tbody>
</table>

Staying Alive 57
**Threatened Beaches**

1. Erosion of nesting beaches can lead to loss of nesting habitat.
2. Development of the beachfront may include fortification to protect property from erosion, resulting in loss of a nesting beach. It may also prevent females from getting to nesting sites.
3. Beach nourishment is a technique used to restore an eroding or lost beach or to create a new sandy shoreline, involving placement of sand fill with or without supporting structures to widen the beach. This is supposed to be the only management tool which serves the dual purpose of protecting coastal lands and preserving beach resources. But beach nourishment impacts turtles by burial of nests, disturbance to nesting turtles, and changes in sand compaction and temperature which may affect embryo development.
4. Artificial lighting can cause disorientation to both adults and hatchlings. Turtles are attracted to light. Hatchlings go towards light sources, rather than the ocean, when there are bright lights inland, thereby increasing their chances of dehydration and death. In addition, as nesting females avoid areas with intense lighting, highly developed areas may cause problems for turtles trying to nest.
5. A serious threat emanating from night time use of a beach is the disturbance caused to nesting females. Heavy use of nesting beaches by humans may also result in lower rate of success of hatching of eggs due to sand compaction.
6. The placement of physical obstacles on a beach can hamper or deter nesting attempts, as well as interfere with incubation of eggs and the seaward approach of hatchlings.
7. The use of off-road vehicles on beaches is a serious problem in many areas. It may result in decreased hatching success (rate of successful hatching of infant survival of birth) due to sand compaction, or directly kill hatchlings. Tyre ruts may also interfere with the movement of hatchlings to get to the ocean.
8. The invasion of a nesting site by non-native beach vegetation can lead to increased erosion and destruction of a nesting habitat. Trees shading a beach can also change nest temperatures, altering the natural sex ratio of the hatchlings.

**Threats at Sea**

1. Dredging can destroy nesting or foraging habitats. The use of hopper dredges can also kill turtles caught in dragheads. (Hopper dredge is a dredge which sucks sediment from the sea bottom with giant vacuum cleaner-type skids, called dragheads).
2. Loggerhead Turtles eat a wide variety of marine debris such as plastic bags, plastic and styrofoam pieces, tar balls, balloons and raw plastic pellets. Effects of consumption of these include interference in metabolism or gut function, even at low levels of ingestion, as well as absorption of toxic byproducts.
3. Today’s commercial fishers use vast “factory” trawlers the size of football fields, and advanced electronic equipment and satellite communication to track fish etc. Huge nets, sometimes miles long, stretch across the ocean swallowing up everything and everyone including turtles. Factory trawlers are vacuuming the oceans clean of sea life at an alarming pace.
4. In areas where recreational motor boating and ship traffic is intense, propeller and collision injuries are not uncommon.
5. Sea turtles are at risk when they encounter an oil spill. Respiration, skin, blood chemistry and salt gland functions are affected.
6. Pesticides, heavy metals and PCBs (polychlorinated biphenyls), a toxic substance, have been detected in turtles and eggs. The effects are not known, but are likely to be deleterious.
7. Marina and dock development can cause foraging habitat to be destroyed or damaged. They also lead to increased boat traffic, increasing the risk of turtle-vessel collisions.
8. Underwater explosives are being increasingly used in fishing. This can kill or injure turtles, and may destroy or damage habitat.
9. Turtles get caught in discarded fishing gear. The number affected is unknown, but probably significant.
Once the female turtle lays her eggs in the nest, she goes back to the sea, and will not return to the sea shore. The eggs are left to the mercy of nature. The eggs lie buried in the sand as they incubate. Some eggs may not hatch at all, some may be damaged or the embryo may not develop fully, and die.

The embryo inside develops day by day, acquiring new characteristics and resembling a turtle more and more. After about 50 to 60 days, depending on the species, the baby turtle is ready to hatch. Once the turtle hatches and comes out of the egg and the sand pit, the struggle for survival begins. To reach the sea is not easy for the babies, as many predators are waiting for the babies to crawl to the sea.

At night, artificial light sources on the beach appear bright and emanate light that appears intense. As a result, light from an artificial source appears many times brighter than light from any other source including the ocean. The glaring light of artificial sources leads hatchlings astray. This leads, or rather misleads, them away from the ocean and towards the land. Hatchlings crawl towards artificial light sources following the same instinctive response that leads them seaward on naturally lighted beaches. The artificial light does not allow hatchlings to correctly assess the visual cues (natural light reflected on the water) that lead them to the sea.

Activity

Tell the students about the problems/obstacles baby turtles face before reaching the sea. Tell the students that they are going to be turtle hatchlings that have just hatched out. The hatchlings will have to race from their nest to the sea, facing obstacles and experiencing difficulties en route. (see pages 51–53).

Identify a large open area (this activity would be most effective if carried out on a beach) and mark two lines about 20 metres apart. Name two opposite ends as 'Nest' and 'Sea'. Within the two lines, draw six circles on the ground to represent obstacles.

Select six students to become "obstacles". Let each ‘obstacle’ stand in an obstacle circle. Each one should also wear a label indicating the nature of the obstacle. Some obstacles could be: beach vehicle, birds, dogs, poachers, pits on the beach, mounds on the beach, people collecting eggs, people collecting hatchlings to show tourists, etc. The other students represent hatchlings rushing towards the sea. The hatchlings should move from the nest to the sea without being caught by any obstacle.
Tell the students that once you whistle, all the turtle hatchlings should start moving simultaneously towards the sea. You could make the experience more realistic by asking the students to crawl on the ground, as baby turtles would. The obstacles standing in the circles should try and catch the baby turtles as they move. However, they cannot move out of their circles. Once a baby turtle is ‘caught’, it is out of the game.

At the end of each round, count how many baby turtles have reached the sea and how many of them have died. Compare this with the total number that started out. Tell the students that it is believed that only one in a thousand turtle hatchlings survive till adulthood.

### Fact Finder

#### Threats to Eggs

**Poaching:** The main threat to turtle eggs is the exploitation of eggs for food. In many coastal areas, turtle eggs are regularly sold in local markets as a delicacy.

**Dogs:** Wherever human populations settle, they bring along with them dogs. Towns and villages near nesting beaches have a number of stray dogs which have been known to raid turtle nests.

#### Natural Threats to the Hatchlings

**Avian predators:** Hatchlings which cannot move out to the sea in the night are usually predated on by thousands of seagulls and crows during the morning.

Predation of hatchlings in the sea: Predatory fishes feed on large numbers of hatchlings when they reach the sea. Shore crabs and Hermit crabs also kill a large number of hatchlings.

#### Human Threats to Hatchlings

**Death of hatchlings due to trampling of nesting beaches:** At places where there is movement of human beings and domesticated animals such as cattle and buffaloes on the nesting beaches, significant number of hatchlings die inside the nests by being trampled on prior to their emergence.

**Death of hatchlings due to entanglement in fishing nets:** In many places, after reaching the sea, hatchlings get entangled in gill nets of small mesh size in near-shore coastal waters. In Orissa, the major mass nesting sites are located near river mouths, and a large proportion of hatchlings enter estuaries and tidal rivers and creeks, where they get entangled in gill nets.

**Death of hatchlings due to disorientation:** Hatchlings of all species of sea turtles are known to get greatly disoriented when there are strong light sources in the landward side of their nesting sites. Such hatchlings, after emerging from their nests, instead of moving in the seaward direction, move in the opposite direction, towards the land. After having moved a considerable distance, they cannot return to the sea, and ultimately die. Often they get entangled in the beach vegetation zone. Large numbers of such hatchlings are also predated on by avian predators during the day.
Who Has a Solution?

<table>
<thead>
<tr>
<th>Objective</th>
<th>To help students understand some issues involved in Sea Turtle Conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Subject</td>
<td>Science</td>
</tr>
<tr>
<td>Group Size</td>
<td>12 individuals or 12 small groups</td>
</tr>
<tr>
<td>Place</td>
<td>Classroom</td>
</tr>
<tr>
<td>Duration</td>
<td>45 minutes</td>
</tr>
<tr>
<td>Material</td>
<td>Writing material</td>
</tr>
</tbody>
</table>

A role play is based on a real life situation and helps explore issues that have various dimensions which are open to different interpretations. A role play has no predetermined outcome. It is designed to raise awareness and to develop an understanding of specific issues.

A role play helps to develop problem solving and conflict resolution skills in the students. It helps the participants to develop empathy and see different points of view.

Before You Begin

Select a group of 12 students and assign roles to each of them. (If there are more than 12 students, make 12 small groups and assign one role per group)

Photocopy or write down each role on different slips of paper. Assign roles to every student and distribute role cards.

Read out the enclosed scenario or photocopy and give to each group. Tell the students that they have 10 minutes for preparation and 30 minutes for the discussion. In case you are working with groups, they should use the preparation time to discuss their role and select a spokesperson.

The objective of the role play is to arrive at a decision regarding the steps that should be taken to protect sea turtles and their habitats in a given area.

If necessary, you can individually brief the students about their roles. Tell the students to 'get into' the roles and tell them that a role play is a serious activity. Ask the observers (other students) to report their observations on the process.

During the Role Play

As far as possible, you should not participate in the role play. But in case the discussion stretches for too long, or gets too heated, or if the students are going off track, or they have nothing more to say, you can tactfully intervene and help the students reach a decision.

After the discussion is over, ask the group about the decision they arrived at. Also ask the students to give reasons for the decision they have taken.

After the Role Play

Once the role play is over, give some time to the students to come back to being themselves. You can now discuss with the students—the actors as well as the observers—about their feelings, observations and experiences during the session. You can also discuss with the students if there are other ways of handling the role play.

The Scenario

Borja is a small sandy beach spread over 2 km on the west coast. Borja is a major nesting habitat for Olive Ridley turtles. Thousands of Olive Ridley turtles come here every year between November and March to lay their eggs. Borja is also an important fishing area, especially for shrimp fishing. This place, because of its scenic beauty and fame as a turtle-nesting site, has become a tourist spot. To cater to the needs of the tourists, many hotels and establishments have come up in the area, causing destruction to the sand dunes and the beach ecology. Many streetlights have been installed.

Because of the high demand of shrimps from this area for export, fishermen have started using mechanized trawlers to
catch them. Many a time, they end up with sea turtles in their
nets.

The population of sea turtles coming to this beach has
dramatically reduced because of fishing activities during the
nesting season. Destruction of their habitat and poaching for
their meat and eggs is another reason for the decline of sea
turtle population in the area. Many hatchlings are disoriented
because of harsh lights from the land and get killed.

The Forest and Wildlife Department has protected the nesting
sites and imposed a ban on fishing activities during the nesting
season in the offshore waters. The US has placed a ban on
the import of shrimp from this area, as the fishermen do not use
the Turtle Excluder Device (TED) (See pg. 69) in their trawl nets.
This ban will have adverse effects on the fishermen, as they will
not be able to export their catch. Many NGOs and the
government have suggested the use of TED in the trawl nets.
However, the fishermen are of the opinion that the TED will
reduce their catch of fish, and that will in turn reduce their
income.

The Ministry of Environment and Forests has been receiving
requests from Forest officials and NGOs to take steps in order
to solve the problem and ensure the protection of the habitat
of the turtles and their nesting sites.

In this regard, the Ministry, with the State Forest and Wildlife
Department, has set up a participatory process in which the
problem of various parties would be taken into account in
finding a solution to the problem. A meeting has been called
to discuss the steps that should be taken to conserve the sea
turtle nesting site. Those attending the meeting are:

- Chairperson of the concerned Committee from the Minis-
try of Environment and Forests
- Director, Wildlife and Ecotourism, State Government
- Sarpanch, Borja
- Post Graduate students, Department of Zoology
- Raju and Vikram, Volunteers of the Forest Department
- Naresh, Local Fisherman
- Forest & Wildlife Guard
- Director, Department of Fisheries
- Director, Tourism
- Representative, Coast Guard
- Savita, old lady of the Borja village
- Reporter, newspaper
- Hotel Owner

The Roles

Chairperson: You are the Chairperson of the committee
constituted to deal with the threats faced by Olive Ridley turtles
on Borja beach. The main threats come from mechanized
fishing, streetlights, destruction of the sand dunes and poaching.
You feel that a plan should be designed that will help
solve the problem of the destruction of the turtle nesting sites.
At the same time you are also concerned about the livelihoods
of the local fishermen.

Director, Wildlife and Ecotourism: You are the
Director of Wildlife and Ecotourism. You have seen that over
the years the number of Olive Ridley Turtles coming to the
beach has reduced drastically. Also you have witnessed huge
numbers of turtles dying in trawler nets and turtle eggs being
poached and sold to hotel owners. You are of the opinion that
the area should be fenced and entry strictly prohibited.

Sarpanch: You are the Sarpanch of Borja village. You feel
that the ban on fishing activities during the nesting season has
affected the livelihood of the people of the village. It is their
only source of income. You agree with the local fishermen that
the use of TED has reduced the catch of fish. With the growing
popularity of Borja as a tourist spot, you feel ecotourism can
be started in the area.

Post-graduate Student: You are a postgraduate stu-
dent. You are carrying out research on the “Status of Olive
Ridley Turtle on Borja beach”. Through your study, you have
found that the population of Olive Ridley has drastically
reduced. You have seen hundreds of turtles dying in fishing
nets of mechanized trawlers. The lights from shacks and
houses disorient the turtle hatchlings. You feel that the use of
TED should be made mandatory in trawl fishing.

Volunteers: You are helping the forest department protect
the nests. You also keep vigil on the nests during the daytime
because you have a small tea stall near the seashore. Many
tourists approach you and request for information on turtles.
You feel that protecting turtles and their habitat will bring more
tourists.

Naresh: You are a local fisherman fishing in this area for the
last 30 years. You depend on fishing for your livelihood. The
recent ban on fishing during the nesting season has affected
your livelihood. You feel that the use of “Turtle Excluder Device”
(TED) has reduced your fish catch. You were caught by the
Coast Guard while fishing during the nesting season and had
to pay a huge fine. Hence you feel that the only alternative to
make money and sustain life during the nesting season is to sell
turtle meat and eggs in the local market because there is a high
demand for them. You do this only as a means for bare
survival.
**Forest and Wildlife Guards:** You are a Forest & Wildlife Guard and have been patrolling the beach throughout the night during the season in spite of your son being in a hospital. You feel that the villagers are not supporting turtle conservation activities. A lot of poaching is taking place. You strongly feel that high demand for turtle eggs and turtle meat from foreigners has provoked the villagers to poach turtles and their eggs.

**Director, Department of Fisheries:** You are the Director, Department of Fisheries. You have been requested by the Fishermen’s Association and the Panchayat to relax the fishing ban during the nesting season. You have tried hard to convince the local fishermen to use the TEDs.

**Director, Tourism:** You are the Director, Tourism. You foresee a lot of tourism potential in this area. You have already spoken to the Minister, Tourism in this regard and have got assurances that more tourism infrastructure will be developed. You feel that developing this area will provide employment to the local people, many hotels will come up and the income generated thereby will contribute to the state economy.

**Savita, an old Lady:** You are an old lady of this village. You used to see many turtles coming to the shore when you were a child. You enjoyed turtle meat and eggs. But over the years, you have seen a huge decline in the population of turtles coming to the beach. The ban on turtle meat and eggs really worries you because now you cannot have turtle meat and eggs anymore. Once you had made an attempt to get a few eggs for self-consumption, but you were caught by the Forest Department. You would like to see this area as it was during your childhood, see turtles thrive and also be able to enjoy turtle eggs and meat again.

**Representative, Coast Guard:** You are a representative of the Coast Guard. You carry out regular patrols on sea to ensure that no one goes fishing in offshore waters during the nesting season. But your problem is shortage of staff in view of the vast area you need to patrol.

**NGO Representative:** You have been working towards turtle conservation in this village for the past many years. You have organized various workshops and awareness campaigns in the village and are trying to convince fishermen to use the Turtle Excluder Device (TED) in their nets. You feel that the functioning of the Forest Department, Coast Guard and the Fisheries Department is not people-friendly. Also, you are very agitated as hotels and shacks are violating CRZ regulations.

**Reporter:** You are the reporter of a daily newspaper and a nature lover. You have written various articles on turtles in the past 10 years. Many of your articles were about the arrival of turtles on the beach to lay their eggs. Now, you feel the situation has changed completely and instead of writing on their arrival, you have started writing on the declining numbers of the Olive RIdleys that come to the beach to lay eggs. You feel very sad at the situation.

**Hotel Owner:** You are a hotel owner and very proud of your hotel. You believe that you are providing employment to the local people. You have also installed streetlights, which you feel, are helping the local people. You also strongly feel that your hotel is contributing towards the state economy.
A plant or animal becomes extinct when the last living individual of its species dies, causing it to vanish from the earth forever. If there is ever a time when the last sea turtle on earth dies, then never again will this magnificent creature grace our world.

Species have been going extinct for millions of years; it is a natural part of the evolutionary process. For example, most of the species that existed during the time of dinosaurs have perished. Many probably became extinct because of sudden geological or climatic changes—possibly because of a large volcanic eruption or because of a large meteor impacting the Earth.

Today however, species are being driven to extinction because of abrupt changes brought about by humans. Habitat destruction, pollution, poaching and over-consumption of resources by humans are causing species to decline at a rate never before known in evolutionary history. This loss of species is eroding the diversity of life on Earth, and a loss of diversity can make all life vulnerable.

Sea turtle populations all around the world have declined drastically in the last fifty years, including in the Indian Ocean, particularly the populations in the Bay of Bengal and the Arabian Sea.

Among India's five species of sea turtles, only one species—the Olive Ridley, is still found in large numbers. The other four species—Loggerhead, Leatherback, Hawksbill and Green Sea Turtle, are all rare. Their numbers have been badly depleted by killing and habitat destruction. Very few of these turtles nest on the Indian mainland, although they are known to nest on some of the remote uninhabited islands of Andaman and Nicobar, as well as Lakshadweep.

Worldover there has been concern over the status of sea turtles. Efforts are on, both at national and international levels, to save the sea turtles.

International Efforts

In November 1979, the first World Conference on the Biology and Conservation of Sea Turtles was held in Washington DC, USA. The conference brought together experts, scientists and policy makers of various countries to discuss different aspects of sea turtle biology and to develop strategies and programmes for their conservation and management.
Since then, most of the maritime countries which have sea turtles have put in place a variety of measures to conserve turtle habitats and protect these threatened species. These include laws (international, national and local), policies of concerned Ministries, and efforts by government departments, research institutions, NGOs and people.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international treaty that monitors and regulates international trade in endangered species. The species are categorised in terms of the extent of threats they face, and consequently the varying degrees of regulation they require. Appendix I of the CITES bans trade in the species listed therein. It lists six species of turtles viz. Olive Ridley, Loggerhead, Leatherback, Hawksbill, Green Turtle and Kemp’s Ridley. This implies that any international trade in these would entail legal consequences as dictated by the international agreement. CITES came into force in 1973. India became a signatory to CITES in 1976. Eighty-seven nations of the world are signatories to CITES, wherein each nation pledges to protect sea turtles from poaching, import of their meat or use in ornament trade.

The IUCN Red Data Book also lists six species viz. Green Turtles, Loggerheads, Hawksbill, Kemp’s Ridley, Olive Ridley, and Leatherback. This indicates that conservation of the listed species is of international concern as they are critically endangered and thus require to be given maximum protection.

The Convention on the Conservation of Migratory Species of Wild Animals 1979 requires parties to conserve migratory species, the conservation status of which is unsatisfactory. The list of endangered migratory species under this Convention includes all five species of India’s sea turtles.

There are also some international laws which attempt to solve specific problems arising out of maritime operations such as oil pollution from tankers, other types of pollution generated by ships at sea, etc. These contribute to protection of the marine habitat of the sea turtles. The United Nations Convention on the Law of the Sea (UNCLOS III), concluded in December 1982, is one such set of laws, with comprehensive legal provision for protection and preservation of the marine environment. While laying down the general obligation of all states to protect and preserve the marine environment, the Convention elaborates measures to prevent, reduce and control pollution of the marine environment.

In spite of these Conventions and other efforts, sea turtles are under serious threat.

### National Efforts

Conservation of the sea turtle requires a different approach from the conservation measures for other species such as tiger or elephant. This is because the threats to marine turtles are more indirect than direct. The large scale exploitation of marine resources and products affects all marine life including turtles. The threats are further aggravated by loss of nesting beaches, deterioration of marine habitats, pollution of the coastal environment etc.

Thus, conservation and protection of marine turtles requires laws relating to conservation and use of seas, oceans, and coasts, as well as laws that protect species.

The Constitution of India recognizes the need to protect marine habitats. The land, minerals and other economically valuable materials lying under the oceans within the various zones such as the territorial waters or the continental shelf or the exclusive economic zone, vest with the Union of India. In addition to this, there is a provision under Article 48-A which mandates the State to protect and safeguard the environment. A fundamental duty under Article 51A requires citizens to protect and improve the natural environment.

The Coastguard Organization, constituted under the Coastguard Act, 1978 is the nodal agency which looks after the enforcement of several of the legislative measures to protect the marine habitat. The above Act defines “marine zones of India” as per the Maritime Zone Act, which makes it the duty of the Coast Guard to protect, “marine and other national interests of India in the maritime zones of India”. This includes measures necessary for preserving and protecting “marine environment” and prevention of marine pollution.

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Under the Environment Protection Act, 1986, "environment" is defined to include "water" and "inter-relationship between water and "other living creatures, plants, micro-organisms and property". Section 25 of this Act empowers the Central Government to make rules regarding the conservation and improvement of the natural environment. The most significant of these Rules that is related to the Coastal Environment is the Coastal Regulation Zone notification, 1991 (CRZ). This notification prohibits as well as regulates, the setting up or expansion of industries in ecologically sensitive areas. There is a prohibition of construction activities in the CRZ-1 category which are defined to be areas that are ecologically sensitive and important, such as marine parks, areas close to breeding and spawning grounds of fish and other forms of marine life.

The highest protection to both the species as well as habitat of turtles in India is provided by the Wildlife Protection Act, 1972 (WELPA). All five species of turtles have been included in Schedule-I of the WELPA, which means they are accorded the highest degree of protection under this Act. Hunting, which includes damaging or destroying the eggs/nests of these creatures, is strictly prohibited and entails maximum penalties under the Act. The various species of turtles including the Olive Ridley are further protected from illegal trading activities under the WELPA wherein trade in any such animal is prohibited and any violation of such provisions entails penal consequences. The WELPA is thus the most important legislation that protects species that are threatened, including turtles.

The state governments also have the power to declare areas which fall within any part of the territorial waters which they think to be of "zoological significance" for "protecting/propagating/developing wildlife/its environment", as a Sanctuary or a National Park. Protected Areas (PA) such as Gulf of Kachchh Marine National Park, the Gulf of Mannar Marine National Park and the Marine Sanctuary of Gahirmatha have been created with the sole purpose of conserving the overall biodiversity of the area. Sea turtles being pan-oceanic (as they are migratory), are ensured protection within these areas. In these PAs, the Forest Department conducts regular patrolling to ensure no illegal turtle hunting occurs. In places like Gahirmatha and Gulf of Mannar, the Coast Guard and the Indian Navy patrol areas under their jurisdiction periodically.

The Government of Orissa has a high powered committee for the conservation of sea turtles. The committee is chaired by the Chief Minister and includes turtle experts, as well as representatives of different departments such as Home, Forest, Agriculture, Fisheries, Defence, etc. The committee meets twice a year to review and monitor turtle conservation activities.

The Ministry of Environment and Forests, with various agencies such as autonomous institutes, NGOs, citizens' action groups, and State Pollution Control Boards is also trying to find ways and means of reducing beach debris, oil spills and toxic waste, and of regulating solid waste and domestic sewage.

There are numerous agencies that have been entrusted with the protection of marine ecosystems in India. The Coast Guard, the Chief Wildlife Warden's office (entrusted with protection and management of endangered species) under the Ministry of Environment and Forests, the Ministry of Transport, the Department of Ocean Development, MPEDA and Ministry of Commerce, Ministry of Petroleum and Natural Gas, Ministry of Tourism, Ministry of Shipping all have roles in ocean management. However, there is no formal forum for co-ordination of these efforts. There have been suggestions for a multidisciplinary Ocean Management Cell which could be formed for better coordination between the relevant agencies.

Regulation of trade and enforcement of maritime laws are essential prerequisites for marine conservation. Coordination between the Coast Guard, Wildlife Authorities, Ministry of Commerce and Ministry of Defence is important in this regard.

Strengthening of technological and scientific inputs for understanding the science of turtle conservation is another area requiring more attention. Simultaneously, it is essential to look at issues of livelihood and economic issues of the communities affected by any related laws.

India has enacted most of its international obligations into national laws. Some experts feel that there is still a need for greater integration of the illegal usage-oriented legislation on the one hand, and conservation-oriented legislation on the other, for a sustainable management of marine ecosystems.

**Conservation Projects**

In 1999, the Ministry of Environment and Forests, Government of India, launched a sea turtle conservation project, funded by the United Nations Development Program, with the Wildlife Institute of India as the implementing agency. The project aims to strengthen sea turtle conservation and management by gathering baseline scientific information and assessing threats to turtles in coastal states and offshore islands. An evaluation of community-based conservation, a review of relevant legislations and characterisation of nesting beaches based on Geological Information System (GIS) and satellite imagery is part of the project which involves Forest and Fisheries departments and local communities in developing conservation strategies and implementing action plans. Orissa with its large Olive Ridley rookeries, is the focal point of the project.
Research

In order to conserve sea turtles, it is necessary to know as much as possible about them. In the case of turtles this is not easy, as sea turtles spend most of their lives in deep ocean waters, coming to sand only to nest (and that too, only the females). Also, this is a migratory species. Sea turtles may travel over thousands of kilometers during a year. To keep track of a single turtle over its lifetime is almost impossible. Yet, scientists must, and do, study these wandering creatures.

Though sea turtles have been the focus of conservation attention and scientific research for decades, much about these ancient animals is still unknown. Foremost amongst these questions are: where do these animals migrate to after having nested, what migratory routes do they follow, and where do they forage?

Orissa is well known for its large Olive Ridley rookeries at Gahirmatha, Devi river mouth and Rushikulya. Much attention has been centered around the threats to these turtles in recent years. Yet, there is an abysmal lack of information about the turtles once they leave the coast of Orissa. The same applies to turtles migrating to various places from the coasts of the Indian Ocean.

Satellite telemetry (whereby a signal source placed on a turtle is identified by a receiver on a satellite) is now being used to track Olive Ridley turtles which nest on the coast of Orissa, to study their long range migrations and foraging areas. Such studies provide useful scientific information to help frame conservation strategies.

Institutions such as Wildlife Institute of India (WII), Dehra Dun, Salim Ali Centre for Ornithology and Natural History (SACON), Wildlife Wing (Government of Orissa), Utkal University, Central Marine Fisheries Research Institute (CMFRI), Environment Management and Policy Research Institute (EMPRI), Ban-
galore, Bombay Natural History Society (BNHSS), Mumbai, Gujarat Institute of Desert Ecology (GUIDE), and some Universities based on the coast have been conducting research activities such as collecting data on nesting habitats, impact assessments etc., in collaboration with the State Forest Departments and Ministry of Environment and Forests, in the coastal states of India.

Various technologies have been used to help the study of these creatures.

Tagging: One of the earliest techniques used to track turtles involved the fixing of metal or plastic tags to the flippers of turtles which came to the beach to nest. This technique was used in the 1950s by Dr. Archie Carr in Tortuguero in Costa Rica. It was also used in the 1990s in India for studies on mass nesting carried out by the Orissa Forest Department and in the late 1970s by the Wildlife Institute of India. A turtle that came to nest was first measured and then a numbered metal tag was affixed on its foreflipper. The tag has an address to which it is to be returned.

On the Galathia islands of the east coast of Great Nicobar, Leatherbacks have been monitored since 2000 with the help of Passive Internal Transponders (PIT). A transponder is a communication device that picks up (and responds to) any incoming signal. This is a wireless communication tool. Passive Internal Transponder tags are small inert transponders sealed in glass which transmit a unique identification number to a handheld scanner or reader at close range (approximately 0.5 m). PIT tags are generally about 10-20 mm long and 2-3 mm thick. These PITs are injected under the skin, and scanner-like bar codes are used to read these. Over 300 turtles have been tagged with PITs.

Tagging of turtles provides limited information as only data about tagged turtles which are recaptured can be collected. However, the rate of recapture is not very high. Even in cases of those that are recaptured (and reported), their movements and route from the point of tagging to the point of recovery continue to remain a mystery. Baby turtles or hatchlings cannot be tagged in this way, as it would cripple them.

Genetic Studies: Use of molecular genetics is becoming an important input into the study of population structures, relationships and migration patterns of sea turtles. Studies of sequences of mitochondrial DNA are providing vital information on areas such as natal homing (which is maternally inherited).

Recent studies using molecular genetic analysis have indicated that Olive Ridley turtles on India's East coast could be ancestral to turtle populations in the Atlantic and Pacific Oceans.

This is a newly emerging application of molecular genetics but one which will play a key role in studying sea turtles in the not too distant future.

Counting Turtles: Estimates of the numbers of Olive Ridleys that arrive in hundreds of thousands to nest on Orissa beaches vary considerably. There is often confusion as to whether some turtles have been counted twice, as Ridleys are known to nest two or three times in one season. Also the number of turtles actually coming ashore to nest may not

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be indicative of the total number of turtles in the offshore waters. Some turtles may come to the shore several times before they actually come to the beach to nest. These are only some of the difficulties in getting an accurate picture of the numbers of sea turtles.

There is a need for a standardised technique for counting sea turtles. One of the techniques is the sampling technique. This involves counting turtles in strips one to two metres wide, at intervals of 200 - 300 m. The strips are considered from the high tide line to the beach vegetation. Only turtles actually laying eggs (oviposting) within this strip are counted. Counts are carried out every hour or two during the Arribada. A few persons can cover several kilometres in this way.

The nearest scientifically reliable estimate of turtles that nested at Gahirmatha by the end of March 1999 is considered to be about 200,000. This was done through a sampling technique used by WII researcher Bivash Pandav in 1999.

**Conservation Measures**

**Turtle Excluder Device**

The Turtle Excluder Device (TED) is a device which facilitates turtles to escape unharmful from fishing trawl nets, while at the same time allowing fishermen not to lose the main catch. TED is basically an oval or square metal frame with grids, which can be fitted on the mouth of the net. Just near the entrance to the grid, on the floor of the net, is a trap door. Any large fish, dolphins, and turtles that pass through the mouth of the net are stopped by the grid and get deflected to the trap door. The weight of the animal opens the trap door and allows the animal to escape.

In the US, Australia, Mexico and a few other countries, it is compulsory to fix Trawling Efficiency Device or Turtle Excluder Device (TED) on every shrimp trawler. TED trials have already been conducted in India, and some boats have been fitted with TEDs on the coast of Orissa.

Fishermen in India have been reluctant to use TEDs in their trawls as they believe that while keeping out turtles, these devices also reduce their catch of target species (fishes and shrimps). It is important that TEDs are used. One way to ensure this may be to redesign or modify TEDs so as to suit the typical fishing styles and needs in India, so as to minimize loss of target species. It would also help to offer a choice of designs so that fishermen could choose which they would like to install.

**NGO Efforts**

Various NGOs have been involved in working with local communities along coastal areas, creating awareness about sea turtle issues and encouraging them to participate in monitoring and protecting local beaches. Some have been working with local fishermen to make them aware of the existing fishing and wildlife regulations including use of Turtle Excluder Devices. In Orissa, Wildlife Protection Society of Orissa, WWF-India, Wildlife Dept, Orissa, and Project Swarajya are involved in such activities.

Operation Kachhapa is a turtle conservation programme executed by Wildlife Protection Society of India and Wildlife Society of Orissa. It has been actively assisting the Orissa State Forest Department in protecting sea turtles.

Regular patrolling in the sea is being carried out with the help of a fishing trawler hired by Operation Kachhapa. Field assistants employed under this initiative are assisting the Forest Department staff in enumerating nesting turtles, as well as counting dead turtles.

Education of village communities in coastal areas has been taken up for the first time under Operation Kachhapa, using traditional song and dance programmes for increasing awareness about turtles and their importance to fishermen.

This has not only sensitized the local fishermen to sea turtle conservation issues but also made them aware of their rights over fishing in the near-shore waters. They are now aware of the fact that the waters 10 km from the shore constitute a prohibited fishing zone for trawlers.

An unique feature of Operation Kachhapa was involvement of two local minstrels to carry the message of turtle conservation to the coastal villages of Orissa. The singers accompanying the,
What is satellite telemetry?

Transmitters, also called PTTs (Platform Terminal Transmitters) are attached to an animal whose long distance movements are to be studied. Once they are turned on, the transmitters send high frequency signals which are received by polar orbiting weather satellites. ARGOS, a French company, has equipment on board these satellites for tracking animal movements. The transmissions are first decoded to identify the transmitter, each of which has a unique code, and then the position of the transmitter is calculated. The data is then downloaded by ARGOS. Once the data is received, the latitudes and longitudes can be plotted on a map and the migratory routes of the animal can be traced. The data is sorted and classified by ARGOS depending on the quality of data received by the satellite.

The first satellite telemetry study in India was carried out from April 17 to 19, 2001. Four nesting sea turtles were fitted with satellite transmitters at the coast near Devi River mouth. The transmitters, each weighing about 600 gms, were attached to the turtle using epoxy, which could hold the transmitter in place for at least one year. The first of the turtles, fitted with PTT # 14577, was named ‘Chandro’ after Dr. Chandrasekhar Kar, well-known turtle biologist of the Orissa Forest Department. The second transmitter (14580) was ‘switched on’ by a small boy from the adjacent village, Soharia, and the turtle was named Narayani after him. The last two turtles were named Sundari (14581) after a girl from the village, and Devi (14582) after the location where the PTT study on turtles was done for the first time in India. The turtles were then released in the presence of the local fishing community.

As of May 8, 2001, two of the tagged turtles had started migrating south, while one had moved north and one remained in the area where she was tagged. The data is being received and analysed by the VIT and the Orissa Forest Department and mapped at the Geographical Information System (GIS) cell in VIT (GIS is a spatial database management system). The map shows the migratory route of the turtles.

The PTTs have a battery which is designed to last one year, assuming that the turtle spends 70 per cent of its time under water. During this time, the PTT stays switched off. It comes on only when the turtle comes to the surface.

The technology of satellite telemetry has advanced to the stage of allowing researchers to track turtles in the open sea by attaching transmitters to the back of adults or immature sea turtles. The transmitters send signals to an orbiting satellite each time the turtle comes to the sea surface for air. The satellites retransmit the data to a receiving station on Earth, which researchers can access.

Operation Kachhapa team also carried hand painted scrolls that had pictures of turtles on the nesting beach, dead turtles with trawlers in the background; Lord Vishnu in the kurma (turtle) incarnation; as well as visuals showing the 10 km prohibited fishing zone from the coast for trawlers.

The teams went to coastal fishing villages, showed the scrolls and sang conservation-oriented songs. This sparked a lot of interaction and discussion with the local people, who were fascinated by the scrolls and impressed by the catchy song. Discussions revealed that the locals, in most cases, were not even aware of government's fishing regulations, and were also disturbed by the threat of trawlers to their traditional livelihood, i.e., fishing.

The experiment of using traditional art forms like music and scrolls proved very successful in communicating to the local communities.

Awareness Raising

It is important that people understand and appreciate turtles and their life cycles, habits and habitats, in order to conserve them. Such education needs to reach out to children and adults in the general community, fishing communities, the tourism industry, the fishing industry, communities and industries which discharge their wastes into water, tourists, decision makers in the government etc. One way to do this is by providing such education at marine national parks, aquaria, zoos etc. which provide an opportunity for the public to learn, up-close, about animals and how human activities may impact their survival. Education must also extend to the level of the shipping industry and trawler owners who pollute habitats or 'incidentally' catch turtles.

India has several recent examples of how valuable and effective public opinion can be to species protection.

One of the earliest NGO efforts at creating public awareness about sea turtles was initiated in the early 1970s by the Madras Snake Park Trust (now called Chennai Snake Park Trust) by World Wide Fund for Nature - India (WWF-I) and the Tamil Nadu Forest Department.

Prakruthi, a Chennai based nature club was among the first to involve students in Turtle Walks and beach patrols. Volunteers also helped collect eggs from beach nests and translocate these to Forest Department hatcheries.
Several institutions such as the State Forest Department, Central Marine Fisheries Research Institute (CMFRI), Students’ Sea Turtle Conservation Network, etc. are involved in activities to conserve sea turtles along the Tamil Nadu coast.

Hatcheries

In the early 1970s and the 1980s, State Forest Departments set up sea turtle hatchery rearing facilities. This basically involved transfer of newly laid clutches to an artificial hatchery, where they were protected, and the progress till the eggs hatched was monitored. The hatcheries are protected on all sides in various ways—from bamboo stakes and palm thatch, to chain link fences with zinc sheets driven in the ground. This is to prevent entry of mongooses, jackals, snakes etc. The hatchery is also covered with old fishing nets to prevent raids by raptors such as pariah kites.

Newly born hatchlings were released as near the spot from which the eggs had been collected as possible. Meticulous records were maintained.

Artificial hatcheries were a response to studies that revealed that predation by jackals, dogs, birds, and poaching of eggs from unprotected sites was a major threat to the eggs at several nesting sites. Under this initiative, round the clock vigil is kept on the beach during the nesting season. As soon as a turtle lays its eggs and returns to the sea, the team members collect the eggs and transfer them to the hatchery. Sometimes, turtle tracks are followed and what looks like a fresh nest site is searched for eggs. Detailed records are kept of the location of the site, date of laying, number of eggs, etc. The observation and recording continues till the eggs are hatched, and hatchlings are released on the beach.

However, current developments in sea turtle biology indicate that hatcheries are not the best solution to ensure the safety of eggs till they hatch. Sea turtles have a unique feature called Temperature Dependent Sex Determination (TDS) which means that the sex of a turtle is determined by the temperature of the nest. In case of artificial hatcheries, there is a danger that a difference in temperatures between the real nest and the artificial hatchery produces a distortion in the natural sex ratio in the population.

Care has been taken to have hatcheries with differential penetration of sunlight (25 per cent, 50 per cent, 75 per cent) so as to have a variation of temperatures to ensure sexual diversity in the hatchery.

In fact, in the early sea turtle hatchery programmes in the US, styrofoam boxes were used to incubate eggs, and the temperature maintained was such that only males were hatched! The reason for this was understood by scientists when the temperature determination of sex was discovered.

Today it is believed that rather than transferring the eggs, it is better to protect the natural nests and ensure that they remain undisturbed. This can be done by continuous beach patrolling during the nesting season.

Since 1999, a long-term hatchery programme has been initiated in the nesting beaches of Gahirmatha, Rushikulya and Devi. This is under the aegis of DTRL (Defence Terrain Research Laboratory), in collaboration with researchers from Utkal University and Wildlife Wing (Government of Orissa).

In another experiment carried out in the 1980s, hatchlings were kept in the hatchery till they attained a certain size, rather than releasing them immediately after they hatched. This was believed to help in reducing mortality by predation on the beach as they reached the water. The theory of natal homing however indicates that this experiment may have been counterproductive, as scientists now believe that the ‘imprint’ of the natal beach on the newly hatched turtles is critical in helping it to return years later for nesting to the same beach.

Habitat Preservation

Green Turtles and Hawksbills in particular are dependent on sea grass and coral reefs in sheltered water. Many modern fishing techniques, particularly bottom trawling (dragging a net on the seafloor because shrimps are often found at the sea bottom), causes permanent damage to turtle feeding areas. In November 2002, new deep sea fishing guidelines have been put in place, which no longer permit bottom trawling.

It is likely that already many habitats where important turtle foods like mollusks, algae and sponges live, have been rendered uninhabitable by oil spills, toxic chemical wastes and raw sewage. All this points to the need for urgent implementation of the regulations on pollution control.

Community Involvement

Children and adults who live along the coast (many in fishing villages) may prove to be the best protection against poaching of eggs and adults. Poachers always find it difficult to operate where there is a positive public attitude towards wildlife.

Reducing Beach Lighting

The most direct and complete way to resolve problems to sea turtles caused by artificial beachfront lighting is to eliminate all artificial sources that emit light visible from the nesting beach. Light
visible from the beach may include light emitted, reflected, transmitted or scattered through artificial or natural objects.

However, eliminating all beachfront lighting is not always practical or possible, as other factors such as human safety concerns and convenience need to be considered. The following are some techniques designed to reduce the effects of artificial lighting on sea turtles:

1. Keep beachfront lighting turned off during the nesting and hatching season. This season extends from September to March. Ideally, lighting should remain off throughout the night during this period. Light sources remaining on till 11 pm affects one-third of the hatchlings emerging from nests on a given night.

2. Reduce artificial illuminations near nesting beaches to the minimum necessary to accomplish the lighting goal. Lights used for purely decorative purposes should be kept off.

3. Reduce light reaching the nesting beach by lowering, shielding, recessing and/or redirecting light sources. Any light source visible to an observer on the beach is likely to affect sea turtles. Light sources that are indirectly visible from the beach also cause problems for sea turtles. For this reason, low mounted downlights are preferred over lighting that shines upward.

4. It is possible to place security lighting on motion-sensitive switches that keep lighting off when not needed. Lights that come on only when approached can be quite effective for security purposes.

5. Apply dark tainting to windows visible from the beach, and draw curtains after dark.

The best way for beachfront residents or visitors to determine whether their lighting is adversely affect sea turtles is to go to the adjacent beach at night, about 30-40 metres either way, and look for light. The quantum of light visible either directly or indirectly from any portion of the beach should be reduced by employing the methods described earlier.

In addition to the actions above, it is desirable to replace existing lights with those that emit light less detrimental to sea turtles. Studies have shown that light in certain wavelengths does not affect hatchlings and nesting turtles as much as others. For instance, a pure yellow light such as that from a low pressure sodium vapour source does not appear as attractive to turtles as some other lights. Therefore, yellow incandescent light bulbs are preferable, if they are used at low wattage.

Towards a Safer Future...

To protect sea turtles around the world, many different countries and cultures must cooperate and work together. International laws and agreements, research, organizations and individuals—each one of these has to play a part. Long-term protection of sea turtles also means developing solutions that reduce reliance on methods requiring direct human involvement, such as moving nests or raising hatchlings in captivity.

Feeding and nesting grounds need to be protected, and a public wildlife conservation ethic needs to be fostered that can withstand gaps in government regulations, pressure from private interests, and changes in the political climate.

Green Turtle in Goa

In 2004, Galgibaga, one of the secluded beaches of Goa was in the news for the green turtles. Three turtles were reported on this beach. The turtles were identified and confirmed by Shri Paresh C. Parab, Range Forest Officer, Cotigao Wildlife Sanctuary, Canacona. Unfortunately, one of the turtles probably caught in the trawlers net and washed to the shore dead. This turtle has been preserved and kept in the Nature Interpretation Centre, Cotigao Wildlife Sanctuary, Canacona South Goa.

This sighting raises the possibilities that Goaan beaches could be nesting sites for Green Turtles. But so far there has been no monitoring of the nesting.

72 Turtles in Trouble
A Turtle Saviour

In the early 1950s, Dr. Archie Carr, a sea turtle biologist, became fascinated with the enigmatic and little-known sea turtle. He searched throughout the Caribbean for clues to their life history and biology. His wanderings took him to the black sand beach of Tortuguero, a remote 22-mile beach on the northeast coast of Costa Rica. Carr quickly realized that Tortuguero ("place of turtles" in Spanish) was a globally important nesting beach for green turtles.

But while the turtles were coming up to the beach in large numbers, so were the poachers. The turtles were being killed and their freshly laid eggs were being taken. Archie knew that this rookery would soon be hunted to extinction, just as had happened to many others in the Caribbean.

Carr published his book, 'The Windward Road,' in 1956. He called the book "just a compulsive recounting of the things I saw and pondered". He had no way of knowing the impact his reflections would have on Caribbean sea turtles. Something about his stories of these magnificent creatures and their fight for survival deeply touched Joshua B. Powers, a New York publisher’s representative. He sent copies of the book to twenty friends with an invitation to join a new organization, ‘The Brotherhood of the Green Turtle.’

The Brotherhood was incorporated as Caribbean Conservation Corporation (CCC) in 1959. The organization’s primary focus was to support Carr’s groundbreaking research in Tortuguero, where he was fitting metal tags on nesting green turtles to learn about their reproductive behaviour and migratory patterns. Every year, Carr, his family, students and trusted CCC colleagues would make this rustic outpost their summer home. Living with only basic necessities, they set out to learn what they could about the turtles. The Green Turtle Tagging and Monitoring Programme was revealing astonishing facts about sea turtles.

Carr wrote hundreds of articles, research papers and eleven books on natural history. In the decades to follow, CCC, through its research and conservation initiatives, has arguably saved the Caribbean Green Turtle from immediate extinction.

Carr passed away in 1987, but the research he began is still being carried on by CCC, and has become the longest ongoing research of its kind in the world.

In 1993, CCC established the Sea Turtle Survival League (STSL), a network of experts, conservationists and members, that works tirelessly on behalf of sea turtles by educating the public, teachers, policymakers and the media about the threats turtles face and how best to protect them. Today, Caribbean Conservation Corporation and its Sea Turtle Survival League are regarded as leaders in the international effort to conserve sea turtles. Archie Carr’s ideals and mission still guide the organization as it strives to ensure a better future for marine turtles on the planet.
Talking About Turtles

Develop a survey questionnaire to evaluate and estimate people's knowledge on turtles, actually carry out the survey, and process and interpret the data.

<table>
<thead>
<tr>
<th>Objective</th>
<th>To help students gather data about peoples' perceptions and knowledge regarding turtles, and process the data to get meaningful information.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Advanced</td>
</tr>
<tr>
<td>Subject</td>
<td>Social Science</td>
</tr>
<tr>
<td>Group size</td>
<td>Groups of two to five students each</td>
</tr>
<tr>
<td>Place</td>
<td>Outside the classroom</td>
</tr>
<tr>
<td>Duration</td>
<td>Variable</td>
</tr>
<tr>
<td>Materials</td>
<td>Photocopies of questionnaire for every group, writing materials</td>
</tr>
</tbody>
</table>

It is important to know what people know, before attempting to 'educate' them. This activity will help students develop Social Science skills for this.

Before You Begin

For this activity you may need to get permission of the principal of the school so that students can carry out the survey during school hours.

Discuss with the students the purpose of a survey. Tell them that carrying out a survey on people's knowledge related to turtle distribution, status and conservation, will help them understand how much people know about this subject, as well as the wrong beliefs and misunderstandings prevalent. This can then become the basis of planning an education programme.

This activity will also help them in planning the Turtle Mela (Turtle Fair) (which can be held towards the end of the school session). Activities in the mela could be based on what people know and feel, and try to fill the gaps in their knowledge.

A day before you begin the activity, make multiple copies of the questionnaire (see page 75–76).

The Activity

Divide the class into two groups. Tell the students that the first group would be collecting information from other students in the school, while the second group would collect information from people in their neighbourhood.

Distribute the questionnaires, ten to each group. Tell the students that when they approach an individual for information, they should first introduce themselves, tell them the purpose of the study and then tell them about the questionnaire. In order to fill the questionnaire, the students should ask the individual the questions one by one, and mark the answer he/she gives. Tell the students that they should circle only one answer.

You can carry out a mock interview in the class to demonstrate the steps that should be followed while carrying out the survey. Before the students set out with the questionnaire, you should discuss with them the issues arising out of these questions. As a part of this, you should discuss with the students the answers, wherever applicable, to the questions in the questionnaire. Students can also prepare a pamphlet on turtles, listing threats and conservation efforts. They can give this pamphlet to the people they interview after the session (and also during the Turtle Mela).

After the students have finished the survey, ask them to compile the data (see page 77). Then tell them to analyze and interpret the data and draw their conclusions. (For analysis and interpretation, see page 77–80). Students can present some of the data in the form of graphs.

The following steps will be followed while conducting the activity:

- Selecting a person to be interviewed
- Asking questions
- Data compilation
- Data interpretation
Sample Questionnaire

1. Are there several types of marine turtles in the world?
   a) Yes
   b) No
   c) Don't know

2. Which is true?
   a) Turtles and tortoises are two names for the same animal
   b) Smaller tortoises are called turtles
   c) Tortoises live on land and turtles live in water
   d) Turtles live on land and tortoises live in water

3. Turtles are most closely related to
   a) Frogs
   b) Snakes
   c) Fish

4. Turtles lay eggs
   a) On land
   b) In water
   c) Don't know

5. After the eggs are laid, the female turtles
   a) Incubate the eggs till they hatch
   b) Do not incubate the eggs
   c) Protect the eggs

6. Incubation temperature in the nest determines the gender of a turtle
   a) Yes
   b) No
   c) Don't know

7. People eat turtle eggs
   a) Yes
   b) No
   c) Don't know

8. People use turtle shells for various purposes
   a) Yes
   b) No
   c) Don't know

9. Leatherback is the largest of sea turtles
   a) Yes
   b) No
   c) Don’t know
10. The most important cause of large-scale turtle deaths is:
   a) Natural deaths
   b) Being caught in fishing nets
   c) Being killed by people for meat
   d) Disease

11. It is said that out of every 1000 hatchlings that emerge from the eggs, only one reaches the sea safely. Why do you think this is so?
   a) They are eaten by dogs/jackals
   b) They are eaten by crows
   c) They are caught by people
   d) They go towards the land rather than the sea as they get disoriented
   e) All of the above

12. ‘Natal homing’ is the phenomenon by which, as adults, marine turtles return to the same nesting beaches where they were born.
   a) Yes
   b) No
   c) Not sure

13. The hatchlings are sensitive to light when emerging from the nest
   a) Yes
   b) No
   c) Not sure

14. In your opinion, the threats faced by Marine Turtles are
   a) Real
   b) Politically motivated
   c) Grossly exaggerated by interested parties

15. In your opinion what is the most significant threat to the survival of Marine Turtles in India? Rank the four statements from 4 to 1 according to the level of seriousness, 4 being the highest and 1 being lowest.
   a) Poaching activities along the coast
   b) Fishing activities along the coast
   c) Threats to eggs
   d) Destruction of nesting beaches

Key to the questionnaire

1. a (Yes)
2. c (Tortoises live in land and turtles live in water)
3. b (Snakes)
4. a (Yes)
5. a (Remain in the nest to incubate the eggs till they hatch)
6. Turtles in Trouble
6. a (Yes)
7. a (Yes)
8. a (Yes)
9. a (Yes)
10. b (Being caught in fishing nets)
11. e (All of the above)
12. a (Yes)
13. a (Yes)
14. a (Real)
15. The opinion of the sample will be considered to be the correct answer. This is an open-ended question.

Selecting a Sample

A sample size of above 30 is a good sample for generalization. You could take a sample of 40 to be on the safe side, so that in case there are a few dropouts, you will still have a good sample.

Community Sample

Ask the students who are going to carry out the community survey to list down the localities where they live. From this, you can select four neighbourhoods. For each neighbourhood, make one group of two to five students responsible for the survey. Tell each team that they have the responsibility of selecting five adult males and five adult females (adults are defined as persons of age above 21 years) for answering the questionnaire. This will be their sample.

As we are selecting four localities and 10 people per locality, sample size for the community survey will be 40.

Students’ Sample

For the students’ sample, the sample should be drawn from students of standards V, VI, VII and VIII from your own school. Divide the group of students responsible for surveying the students into four teams, each team comprising of not less than two and not more than five students. Put one team in charge of selecting a sample and interviewing students from one of the four selected classes. Tell each team to approach ten students.

As we are selecting four standards and ten students per standard, sample size of the students’ sample will be 40.

Data Compilation

For analysis and interpretation, let the teams who have done the community survey get together, pool and analyze their data. Similarly, the groups who have done the student survey should get together, pool and analyze their data.

Tell the students that they will analyze their data at two levels:

1. At the level of an individual, to gauge the individual’s overall understanding on the subject. This data will then be compiled to get an idea of the level of understanding of the sample.
2. At the level of questions, to get an idea of the knowledge of the sample on specific aspects of turtles.

I. Individual Analysis

For analyzing an individual respondent’s data, check all the answers that he/she has given and mark the total number of correct answers. The higher the number of correct answers, the better is the understanding of the individual of turtles.

1.a Individual Interpretation (For questions 1 to 14): For interpreting the individual’s understanding, find the total number of correct answers given by the individual and divide it by the total number of questions. This will give you the score of the individual in per cent.

For example, if individual A has given 9 correct answers from the set of 14 questions, then the percentage of correct answers is \( \frac{9 \times 100}{14} = 64 \) per cent.

Use the Interpretation Table (Table B-1) to rate the knowledge of this individual. As individual A has obtained 64 per cent, according to the Interpretation Table he/she has a moderate understanding of turtles.

<table>
<thead>
<tr>
<th>Interpretation for an individual respondent</th>
</tr>
</thead>
<tbody>
<tr>
<td>To rate people’s knowledge regarding turtles, use the following Interpretation Table.</td>
</tr>
<tr>
<td>80 to 100 per cent</td>
</tr>
<tr>
<td>50 to 80 per cent</td>
</tr>
<tr>
<td>Less than 50 per cent</td>
</tr>
</tbody>
</table>

Table B-1
1.b **Total Sample Interpretation:** Now from the individual ratings, we will try to rate the knowledge of the sample as a whole. For interpreting the whole sample, first interpret the level of knowledge of each respondent, then insert that data into a table like the sample table. There should be as many columns as respondents.

Suppose the first respondent has high knowledge, you should mark ‘1’ in the first position corresponding to column 1 and row marked ‘high’ knowledge. If the second respondent has moderate knowledge, mark ‘1’ in the position corresponding to column 2 and row marked ‘moderate knowledge’. Similarly you need to fill in data for all the 40 and add the ‘1’s’ in the rows.

### Sample Table

<table>
<thead>
<tr>
<th>Respondent Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>High Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To understand this better, let us look at an example with a sample size of 10 students.

<table>
<thead>
<tr>
<th>Respondent Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>6/10=60%</td>
</tr>
<tr>
<td>High Knowledge</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>3/10=30%</td>
</tr>
<tr>
<td>Moderate Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>1/10=10%</td>
</tr>
<tr>
<td>Poor Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the above table, we can see that of this sample of 10 respondents, 60 per cent have good knowledge relating to turtles, 30 per cent have moderate knowledge and 10 per cent have poor knowledge.

### Table B-2

#### Interpretation for a sample

To rate the sample’s knowledge regarding turtles, use the following Interpretation Table.

- Correct answer by 80 per cent and above
  - High knowledge

- Correct answer by 50 to 80 per cent
  - Moderate knowledge

- Correct answer by less than 50 per cent
  - Poor knowledge

### II. Question Analysis

For each question 1 to 14, a table similar to Table A will need to be prepared. The data regarding all the respondents in the sample with regard to that question should be put into this table.

#### Table A

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Answer option 1</th>
<th>Total Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
<td>Answer option 2</td>
<td>Total Percent</td>
</tr>
<tr>
<td></td>
<td>Answer option 3</td>
<td>Total Percent</td>
</tr>
</tbody>
</table>

78  Turtles in Trouble
Coding

As we can see from the questionnaire, each question has three to five options, but the type of options varies from question to question. Some questions have options like 'Yes', 'No', 'Don't know', while others have more informative options. To help in analysis of both types of questions, a sample analysis has been provided here for both types of answer options.

For a particular question, the answer option that each respondent has marked should be filled in the table. A sample coding table has been filled for your reference. The total sum of answers for any given question will not exceed the sample size.

a. Example for analysis of 'Yes', 'No', 'Don't know' option answers

Sample: Students’ Sample size: 40

Once the students have prepared a table for each question, tell them to take each questionnaire in turn and for that particular question mark '1' for each answer option 'Yes', 'No' and 'Don't know' in the appropriate categories as indicated. Add up the number of '1's in each of the answer option categories and find the per cent of people who say 'Yes', who say 'No' and who say 'Don't know' for that particular question.

For example: For the question in Table B, for a Students’ Sample of 40, 30 say 'Yes', 8 say 'No' and 2 say 'Don't know'. Now tell the students to calculate the percentage of people who say 'Yes', who say 'No' and who 'Don't know'. For this they will need to do the following computation: The percentage of people who say 'Yes' is (30x100)/40, i.e., 75 per cent. The percentage of people who say 'No', is (8x100)/40, i.e., 20 per cent and the proportion of people who say 'Don't know', is (2x100)/40, i.e., 5 per cent.

Table D

<table>
<thead>
<tr>
<th>Question 2</th>
<th>Habitat, Shell, Limbs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1111 1111 1111 1111</td>
</tr>
<tr>
<td></td>
<td>1111 1111 1111</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
</tr>
<tr>
<td>Per cent</td>
<td>63%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Habitat, Shell</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1111 1111</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
</tr>
<tr>
<td>Per cent</td>
<td>25%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1111</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
</tr>
<tr>
<td>Per cent</td>
<td>12%</td>
</tr>
</tbody>
</table>

b. Example for Analysis: Informative Answers

For coding this type of questions, you have to make a table similar to Table A, with the difference that instead of writing 'Yes', 'No' and 'Don't know' in the extreme right rows, you need to write the options that are given for that question. A sample question of this type has been illustrated for your convenience in Table D.

Take an example. For the question in Table D, for a Students’ Sample of 40, 25 say 'habitat, limbs and shell' are different between the tortoises and turtles, 10 say 'habitat and shells' and 5 say 'None'. Now tell the students to calculate the per cent of people who say 'habitat, limbs and shell', who say 'habitat and shell' and who say 'None'. For this they need to do the following: People who say 'habitat, limbs and shell' is (25x100)/40, i.e., 62.5 per cent. The per cent of people who say 'Habitat and shell' is [10x100]/40, is 25 per cent, the per cent of people who say 'none', is [5x100]/40, i.e., 12.5 per cent.

Table C

<table>
<thead>
<tr>
<th>Question 1</th>
<th>Are there more than one type of turtles in the world?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes 1111 1111 1111</td>
</tr>
<tr>
<td></td>
<td>1111 1111 1111</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
</tr>
<tr>
<td>Per cent</td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td>No 1111 1111</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
</tr>
<tr>
<td>Per cent</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>Don't know 11</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
</tr>
<tr>
<td>Per cent</td>
<td>5%</td>
</tr>
</tbody>
</table>

II. Question Interpretation

In the previous sections you would have already analyzed the sample's understanding on each specific aspect of turtles (See Question Analysis). We can use that information to interpret and rate the sample's understanding of a given aspect.

For example, in Question 1, (Table C), 75 per cent people say 'No' to the statement that there are more than one type of marine turtles in the world, 20 per cent say 'No' and 5 per cent
say 'Don't know'. Using Table B-2, we can rate the sample’s knowledge on this aspect of turtles as moderate.

For a particular question, if more no. of respondents from the neighbourhood sample provide correct answers than the student sample, then the neighbourhood sample can be said to have a higher knowledge of turtles than students sample and vice versa.

**For Question 15**

For this question, ask the students to prepare a table as shown and tell them to fill it in on the basis of each respondent’s ranking. Suppose the first respondent has rated the first threat 2, the second threat 4, the third 1 and the fourth 3. Insert these ratings in the table given below. Follow the same procedure for each respondent. For the convenience of explaining the analysis for this question, let us take a sample comprising of 10 students.

**Interpretation of Question 15**

For interpretation of this question, divide the sum of ranking for each threat by the sample size. The threat with the highest ratio can be interpreted as being considered the most important threat to turtles by that sample, and the threat with the perceived by that sample.

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Threat A</th>
<th>Threat B</th>
<th>Threat C</th>
<th>Threat D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondent 1</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Respondent 2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Respondent 3</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Respondent 4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Respondent 5</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Respondent 6</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Respondent 7</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Respondent 8</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Respondent 9</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Respondent 10</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>26</td>
<td>31</td>
<td>27</td>
</tr>
<tr>
<td>Ratio</td>
<td>16/10</td>
<td>26/10</td>
<td>31/10</td>
<td>27/10</td>
</tr>
<tr>
<td></td>
<td>=1.6</td>
<td>=2.6</td>
<td>=3.1</td>
<td>=2.7</td>
</tr>
</tbody>
</table>
**Activity**

**Studying Turtles**

Write a diary as if one is a researcher studying turtles and their behaviour.

**Objective**
- To help students
  - Understand scientific methodology
  - Learn about how researchers carry out some studies on turtles that come ashore to nest.

**Level**
Advanced

**Subject**
Science

**Group size**
Individual

**Place**
In class

**Duration**
30 minutes

**Materials**
Writing materials

Scientific research aims at discovering truth. It helps to find solutions to various unanswered questions by applying the scientific method. It also helps to validate existing theories and discover new facts and generalizations in connection with existing ones.

Scientific research is a systematic process. The whole process starts with a particular or specific occurrence (a limited event), a phenomenon (an event or happening more widespread in both time and space) or just a specific problem which needs a solution. A scientist then observes the whole situation, and starts an enquiry into the subject, to arrive at a detailed analysis of the matter. This analysis and inquiry may involve categorizing the subject, finding relationships, similarities/dissimilarities or comparisons to look for possible explanations for the problem or situation. Then, some reasons are put forward to explain the particular happening—this is called hypothesis or postulate, because it is theoretical and yet to be tested. Now experiments or practical work is carried out to see if the hypothesis holds. The results are then interpreted to finally take the shape of a scientific principle or law.

Tell the students that in this activity they will imagine that they are researchers who are maintaining a diary on their research-related activities.

**The Activity**

Read out or let students have a copy of the description of survey as given in Fact Finder (See page 83).

1. Tell the students that they are to imagine that they are the researcher who carried out the surveys. They have to write a diary, as if they were the researcher. It should be a daily diary with information about what they did on that day, whom they met and interviewed (e.g. fishermen, students, local authorities, tourists, etc.), what kind of responsibilities they held, and a summary of that day’s findings.

Students must also prepare a questionnaire listing the questions that they would ask during the interviews. Some of these would be common to all groups, while some would be with reference to a specific group (see below for samples of questions for some selected groups).

**For Fishermen**

1. What kind of fishing boats and nets do you use?
2. What are the species of turtles that are generally caught in your nets? (local names)
3. Have the incidental catches of turtles decreased in recent times as compared to the past?

4. In case you incidentally catch a turtle in your net what action will you take?

5. Do trawlers have a right to fish in near-shore waters?

**For Forest Department Staff**

1. Do you see nesting sites of turtles as often as you did in the past?

2. How exactly do you measure the shell length/width of a dead turtle?

3. Approximately what fraction of the nests are with eggs?

4. What approximately is the nesting crawl distance of the turtles?

5. What are some of the dangers to the turtle eggs? How can these dangers be minimized?

**For Local People**

1. Shown these photographs [show some photographs of different turtles]. Which of the turtles come to the beach for nesting?

2. How many dead turtles had you seen on the beach and when?

3. What were the possible causes of these deaths? List a few.

4. Do you consume turtle eggs/meat?

5. Have you seen an appreciable decrement in sea turtles coming to the beach as compared to the past?

II. Make groups of four to five students. The task for each group is to discuss and formulate a problem statement based on what they think is a key question/unknown, answering which will significantly contribute to turtle conservation.

They should then formulate a methodology to answer this question/test this hypothesis.

They should consult books, surf the net and discuss with scientists (e.g., from the local university) to do this.

They should write this up in a systematic way. Constitute a panel of scientists, wildlife researchers and academics in your area. Ask each group to make a five minute presentation to this panel. The panel should give feedback on each presentation, to help them refine their hypothesis, methodology etc.
General Steps for Scientific Research

Problem/Phenomenon/Occurrence leads to
- Observation/Inquiry/Analysis which in turn, leads to
- Explanations/Hypothesis/Postulates which in turn, leads to
- Experimentation/Practical Validation/Application which in turn, leads to
- Results which in turn, leads to
- Principle/Theory/Law

Studying Sea Turtles

What kind of studies need to be carried out to support turtle conservation? Here’s a look at a real study undertaken in Andhra Pradesh.

Surveys: Information on the selected coastal area and sea turtle nesting was gathered from secondary sources and review of related literature (reports, studies, etc.). Also, data was collected through field observations and extensive and intensive survey in three phases, viz. pre-nesting survey, offshore survey and nesting survey.

Pre-Nesting survey: Researchers covered the entire coast by vehicle or on foot. One or two fishing villages/fish landing centres and nearby beaches were selected at a distance of every 50 km. Fishermen and local people were asked if they had seen sea turtles nesting on the beach or mating in the offshore waters, and so on. Photographs were used to get the local people to help identify the species that they had spotted.

The local people were also interviewed to find out about turtle mortality—how many dead turtles had they found on the beaches and when; possible causes for the deaths, etc. They were also asked whether they consumed turtle eggs or meat. Fishermen were also asked about the kind of fishing boats, nets, etc. used by them, and turtles they had captured as part of incidental catch. The local people were also given self-addressed postcards so that they could pass on more information to the surveyors as and when they needed to. The survey also took note of developmental activities along the beach such as plantations, industries, tourism-related activities, etc. Major and minor fishing harbours along the area under survey were also visited.

Fisheries and Forest Department personnel, and NGOs working on coastal issues were interviewed. The primary information sought was with reference to sea turtle sighting, nesting, etc.

This part of the survey was conducted over a period of six months.

Offshore Survey: During the three-month period which is the migration and mating period of the Olive Ridley on India’s Eastern coast, an offshore survey was carried out. This was carried out on the sea, from aboard a marine fishing research vessel. This helped the surveyors to get an idea of the offshore areas where turtles congregate; of the numbers of turtles which come to the waters for mating; and also to estimate the proportion that got caught in nets of trawlers as incidental catch.

Nesting survey: The entire coast was divided into three zones based on the findings of the pre-nesting and offshore surveys. Each zone was further divided into sectors and sub-sectors using landmarks such as rivers, backwaters, etc.

The sub-sectors were taken up for intensive monitoring over the three-month period of the nesting season. The survey team intensively covered the sectors on foot. They were helped by identified local resource persons to collect information on nesting patterns in their area.

Local NGOs were also invited to participate and a few of their members selected and oriented to provide guidance and assistance in the nesting survey.

Nests were categorized into three types: fresh nests (which had clear crawl marks nearby); old nests (which had faint crawl marks); and very old nests (which had no crawl marks).

Features that were observed and recorded included nesting crawl distance, crawl pattern, width, breadth and slope, and nests with eggs. When a dead turtle was located, the measurements of shell length and width were carried out, the sex of the turtle recorded, and external injuries, if any, were observed and recorded.

At the end of the twelve-month survey period, the data and observations were compiled and analyzed and presented as a report covering the findings, the listing of threats as perceived by the surveyors and recommendations for conserving and safeguarding sea turtles in the selected study area.

This study of sea turtles and their nesting beaches in the Andhra Pradesh coast was undertaken by the Wildlife Institute of India, Dehradun in collaboration with the Forest Department, Government of A.P.

Based on the publication “Sea Turtles and their Nesting Beaches along the Andhra Pradesh Coast, India” by Basender Tripathy and B.C. Choudhury in GOUNDF Sea Turtle Project Proceedings of the National Workshop, Bhubaneswar, Orissa, April 2001.
Chain Turtle-mail

Help to create awareness about turtles and the dangers they face through chain mail and letters to the editor of a local newspaper.

<table>
<thead>
<tr>
<th>Objective</th>
<th>To help students create awareness about turtles and spread a message about the need for conservation of turtles among their friends and relatives.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Subject</td>
<td>Language</td>
</tr>
<tr>
<td>Group size</td>
<td>Individual</td>
</tr>
<tr>
<td>Place</td>
<td>Inside the classroom</td>
</tr>
<tr>
<td>Duration</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Materials</td>
<td>Postcards, writing materials</td>
</tr>
</tbody>
</table>

People will conserve what they love and they will love only what they know.

Before You Begin

Tell the students that a letter is one of the oldest means of communication, and is still an important and effective one. Ask students how many of them have got chain letters, receiving which is usually an unpleasant experience. Tell them that now they will be trying to use chain letters for a constructive purpose.

Tell the students that the aim of the activity is to use the concept of a ‘Chain letter’ to tell people more about turtles and to explain the need for conservation of turtles. The more the number of people they can reach out to, the more effective and successful their activity is. Some students might want to send e-mails to their friends. You should encourage them.

The Activity

Part A

A day before the activity, tell each student in the class to buy five postcards. Tell them to also think of five people they will send these to, and collect their postal addresses. These five people can include grandparents, uncles, aunts, cousins, friends etc.

Tell them that each one could design and write out either one message and make five copies of it, or design five different messages. Each postcard should end with a request to the recipient to copy or create five similar postcards, and send these to five people in their circle of friends or relatives.

Discuss with students the content that could be included in the postcard. As the students express their views, you can write them on the blackboard. After the discussion is over, you can design a format for the postcard for the students. You can also show a sample postcard to the students (See sample postcard on Page 85).

For the purpose of this activity, you need not restrict yourself to marine turtles only. In case freshwater turtles (river turtles, pond turtles) are more commonly known in your area, students could write about these. They can try and find out locally about the status, and threats, if any, to these turtles.

Part B

For this part of the activity, tell the students that they should write a letter to the editor of a local newspaper, a children’s magazine or any magazine which focuses on environmental issues, discussing the threats faced by turtles and the need for their conservation. You could forward some of these with a covering letter requesting the editor to publish these.

Before they write these letters, discuss with the students the structure of the letter and the points they could include, viz:

- Turtles as a part of our tradition and history
- Relationship of humans with turtles
- Decline in the population of turtles
- Present population of turtles in India and Asia
- Threats faced by turtles, especially with respect to your state/region.
- Need for conservation

**Extension/Variation**

You can form a Turtle Protection Club in your school and involve the community to help conserve turtles.

---

**Sample Post Card**

**Ridley Facts**

- **Size:** Smallest of the sea turtles
- **Weight:** 50 kg
- **Carapace:** Short and wide, smooth but elevated (tent-shaped)
- **Diet:** Feeds on shrimp, crabs, sea urchins and other animals crustaceans, and mollusk

To

Side 1

---

The Olive Ridley is widely regarded as the most abundant sea turtle in the world.

In India Ridley are found on the east coast and on the beaches of islands of Andaman and Nicobar and Lakshadweep.

Gahirmatha located in the Bhitarkanika Wildlife Sanctuary, in Orissa, supports perhaps one of the largest nesting populations in the world, approximately 400,000 females nesting in a given year.

Human activities, including the direct harvest of adults and eggs, incidental capture in commercial fisheries, and loss of nesting habitat are leading to the decline of this species.

Side 2
Turtle Fair

Organize a mela including games, dramas, quizzes, competitions and poster exhibition relating to turtles, to spread awareness regarding turtle conservation.

**Objective**
To help students organize a Turtle Mela for their schools/community, to create awareness about turtles, their status and conservation.

**Level**
Intermediate

**Subject**
Science, Art and craft

**Group size**
Entire class

**Place**
Outside the classroom

**Duration**
A few days for preparation, a day for the Mela

**Materials**
Chart paper, pens, pictures of turtles, other materials required for the mela

Events like melas, fairs, etc. have been organized in our country for centuries. Generally, these fairs aim at fun and enjoyment. Many are associated with festivals and there are some that are trading events like the famous Sonepur Mela in Bihar, which is a cattle fair. Modern fairs have a different look, and are often guided by purely commercial considerations.

There are also educational melas that are generally a blend of both education and fun. Education coupled with fun at such events has been seen to be very effective in communicating messages. Children at the school can arrange such a mela to share knowledge about turtles. Games, dramas, quizzes, competitions and posters relating to turtles can mark the occasion and help communicate the message effectively to students in particular and the community in general.

**Before You Begin**

Before you decide to organize the mela, you should talk to the principal and take permission from him/her for the same. You should try and arrange the mela on the school premises, but if this is not possible, you will have to make arrangements for a venue.

It is essential for the students to realize why they are organizing the mela. Tell the students that by arranging a mela, they will not only share their knowledge about turtles with other students in the school, but also educate the community about the endangered status of turtles and the need for their conservation.

**Organizing the Mela**

An important component of any mela is the fun associated with it. So when they plan the activities for a mela, students will do well to keep this in mind. The Mela can have a number of activity and exhibition areas or ‘stalls’, all on the theme of "turtles" (in the broadest sense i.e., including freshwater turtles, and even tortoises). The mela can be arranged such that it has various interactive games, skits, puppet shows, puzzles and other activities that can involve a large crowd; as well as exhibit posters, competitions, skits, dramas etc. Some of these activities are discussed on the pages that follow.

Divide the class into groups on the basis of the planned activities. The number of students in each group will depend on the activities. For example, in the Games Corner, you can assign one or two students per game. If the students plan to have four games, then the number of students in the games group would be eight or so.

Tell each group that they will be responsible for their stall—from planning the activities, to putting up posters, conducting the activity, and decorating and managing the stalls. Each group can make a list of all the items they require for their corner/stall. Once those are at hand, you should ask the group responsible to make appropriate arrangements, or you can assign two to three students the responsibility of buying the materials required for the mela and making them available to the rest of the class.

**Games**

**Pin the Parts**

In this activity, you can make an outline of a large turtle shell, without the neck, head, limb and tail. Now, on a separate chart paper cut out these parts.
Blindfold the child who is going to play the game and tell her that she has to pin the parts of the turtle in the correct positions. Once the child has pinned the parts correctly, you can give him/her a brief description of the various parts.

**Turtle Jigsaw**

For this activity you will have to get a large sketch, photograph or drawing of a large turtle. Paste this picture on to a thermocol piece and cut it into pieces.

When the game has to be played, jumble the pieces. Ask the child who is playing the game to arrange the jumbled pieces to assemble a picture of the turtle.

**Turtle Statistics**

You could put up a chart giving information about turtle sizes and weights and also listing record-breaking facts in this regard. Children can calculate their weights and heights as a proportion of those of different turtles (See pages 15–16).

**Turtles in Trouble**

For this activity you can modify the board game on Page 56–57 in which the students are turtles who have to reach a beach to nest safely. Draw the board on the ground. A maximum of 5 players can play the game at a time. You could also have groups of children to play Beach Run (Page 59–60).

**Exhibition**

You can prepare large posters to help the audience learn more about turtles. These posters should be designed in such a way that they have a large number of visuals/graphics and very little text, as people do not like to read too much in such situations. Ensure that the text is in the local language. The information in different sections of this manual will help provide the basic text for the posters.

Some of the information in the posters can also be presented graphically. Information like nesting of turtles along India’s coastline, or worldwide distribution of different species of marine turtles can be presented through maps.

Subjects that can be covered in the posters include:

- Turtles, terrapins and tortoises
- Different kinds of turtles

- Characteristic features of turtles
- Habits of turtles
- Migration and mass nesting (Arribada)
- Threats faced by turtles—natural and manmade
- Conservation measures taken by the Government and others for protection and conservation of turtles.

**Competitions**

As part of the mela, you can arrange some competitions. These could be based on the activities organized and the posters displayed.

- One of the competitions could be designing a postal stamp with turtles as the theme. For this you can either provide a specific sub-theme, like threats or conservation, or it can be general, relating to any aspect of turtles.

- You can also organize a quiz related to turtles. This can consist of some simple questions. For preparing the quiz you can refer to the questionnaire (See page 47–48 and 75–76).

**Art and Craft**

This corner can be a 'Do it Yourself' corner where the children can design their own clay, shell or pebble turtles, and make greeting cards and bookmarks with pictures of turtles on them.

For this you will have to make available all required material like chart clay, pebbles, coconut or walnut shells, paper, news paper, scissors, ruler, fabric colours, brush, string, and guide the children in their creative efforts (See page 10).
Visitors' Inputs

Turtles in Your Language

In this corner, you can pin three to four large sheets of blank chart paper on soft boards and title them as 'Turtle Poems', 'Turtle Proverbs', 'Turtle Stories' and 'Turtle Jokes' respectively. You can request children, their parents and other visitors to the Mela to write what they feel on the appropriate sheets. Tell them that they may write in the language of their choice. If need be, one of the students at this corner can translate this and write the translation below the original, for the convenience of people who would be reading it.

Feedback

One stall of the Turtle Mela can be a feedback stall. Here you can ask people to comment on the mela. For this you can provide a visitor’s book in which they can record their comments. A special corner in the Feedback stall should be dedicated to the protection of turtles and be named ‘Protecting Turtles’. Encourage visitors to write down how they think they can contribute towards this aim. For this, you can place two to three large sheets of blank chart paper on soft boards.

Handouts

One of the groups can prepare an attractive handout on turtles. This can be given as a take-away to visitors. Some aspects which can be covered are:

- General information on turtles
- Information on threats faced by turtles
- What needs to be done to conserve turtles.

Remember to present your information in a brief, simple and reader-friendly style.

Did You Know?

The Olive Ridley Sea Turtle has the unique distinction of being honoured twice by the Department of Posts (Government of India). A first day cover “Sea Turtle at Gahirmatha [Orissa]” was issued on 7.10.1987 and another postal cover “Olive Ridley Sea Turtle” with a stamp showing an Olive Ridley was released on 29.1.2000.
Meet the Turtle

Design an information signboard to be put up on the seafront to create public awareness about turtles and their conservation status.

Objective
To help students educate the public about turtles and the problems they currently face.

Level
Intermediate

Subjects
Science, Language

Group Size
Group of five to six students

Place
Inside the classroom

Duration
30 minutes

Material
Writing paper, chart paper, pens etc.

Hundreds of miles of open sandy beach where sea turtles have nested for thousands of years are rapidly vanishing due to rapid development in coastal areas. The beaches are affected by development of beach resorts to cater to beach tourism; plantation along beaches; bright artificial lighting along beaches; mining of sand from beaches; and other human activities along the beach, making them unsuitable for nesting of sea turtles.

Over the years, many such beaches have been totally abandoned by sea turtles. In places where mass nesting used to take place, only sporadic nesting now takes place. It is critical to keep the few remaining nesting beaches unharmed and protected from such "development". One way to achieve this is by increasing awareness of the importance of the concerned beach and the need to protect it for the turtles.

Before you begin

Tell the students that they have to prepare an informative signboard that can be put up at turtle nesting beaches, to educate people about turtles and the problems they face. As a first step, you may like to have a brainstorming session with the students as to the type of information that can be put on the signboard and the points which need to be kept in mind while developing such a signboard. They should discuss:

- Purpose of putting up such a board
- Size of the signboard
- Visual to be put
- The size of the text
- Information that needs to be included
- Style of writing that should be used—technical, informal, pointwise etc.

As the students give their suggestions, you can write these on the board. You can then tell the students that the possible elements in such a signboard could be:

- A catchy title
- Common name of the turtle
- Scientific name of the turtle
- Fact box
- What turtles eat
- Where they are found etc.
- An attractive picture/illustration of a turtle
- A paragraph of about 80 words, giving interesting information about turtles visiting that beach, stressing the dangers they face and action needed.

Activity

Divide the class into groups of five to six students each. Tell each group to prepare a signboard for the turtles. Tell the students to keep in mind all the points they have discussed. They can first write out the text in rough and then produce a fair copy. Tell the students that they can make the signboard on a chart paper. The student can select the two best signboards and carry them when they are visiting the turtle-
nesting beach. During their visit to the nesting beach, the students can show the signboards to the tourists visiting the beach. All the signboards can be displayed during the turtle mela.

**Variation**

Ask them to add a small note on the hazards of plastics for turtles, to create an awareness in this regard among tourists coming to the beach. Often, by mistake, turtles consume plastic bags, as plastic bags look like jelly fish, a turtle food. As a result, they may suffocate and die.
Turtle Puzzle

Solve a puzzle to unravel words related to sea turtles.

Objective: To make students familiar with terms associated with sea turtles.
Level: Intermediate
Subjects: Science, Geography
Group Size: Group of 5 students each
Place: Inside the classroom
Duration: 25 minutes
Materials: Writing material

Activity

Divide the class into groups of five students each. The following table can be written out on the blackboard (alternatively an enlarged photocopy may be used). Tell the students that some of the following turtle-related words are hidden in the table, and they must search them out.

Every subject has its own words associated with it. So too turtle experts must know 'turtle words'.

Make groups of five students each. Call each group to come up to the board by turn. Each group gets a chance (30 seconds) to point out one word that they have found. Each correct answer will give them 10 points. After this, the chance goes to the next team. If this team cannot answer, the chance passes on to the next team, and so on till all the words are found. The team with the maximum points is the winner. If the students cannot find all the words listed in the 'solutions' box, you could give them hints.

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A X Y S T R N L Y I G R G U N X
C H D A O R O T S I S V N O E T
R L A N R S I Z D A O J I L E I
G P E D T Q T F Q P S T T I R T
B O H M O H U Y D I A O H V G Q
Q P R I I M L X H R L A G E D F
V L E N S Q L G O A L K I R S O
N A G I E I O L S O I L L I F T
F N G N S J P U R J B L H D E R
I T O G H X V Z O J S K C L E A
S A L U E K A D T E K E A E R W
H T S L L D P K A Q W T E Y L L
I I I W L F T J D W A S B J A N
N O I S O R E H E D H U Z V R E
G N L E A T H E R B A C K J O T
X S U Z S I X J P L A S T I C S
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Solutions
- Olive Ridley
- Loggerhead
- Hawksbill
- Leatherback
- Green
- Beach lighting
- Predators
- Pollution
- Oil exploration
- Coral Reefs
- Erosion
- Fishing
- Plantations
- Tortoise Shell
- Sand Mining
- Plastics
- Trawl Net

Extension and Variation

A game of 'pictionary' can be played with the above words. The class can be divided into 3 or 4 groups. The words are to be written on chits of paper.

One student from each group has to come up and pick up a chit and read it. He/she has to explain to students in his/her own group what the word is, by drawing, without using any other form of verbal or written communication.

The following rules apply

- The student is to use the blackboard and chalk.
- Communication should be only through pictures. No other form of verbal or written communication is allowed.
- A time limit can be fixed within which the group has to guess the word.
- If the group cannot answer within the specified time, the chance passes on to the next group. For every correct answer, the group gets 10 points. Passed answers get 5 points.
- Other words can also be used in the chits e.g., nesting, hatching, migration, turtle soup, poaching etc.
The Campaign Song

The Lord of the Universe, Lord Jagannath had taken the form of
the turtle in the 10 avatars to save the world

Mandaragiri mountain he churned the oceans and took the
form of the turtle to rescue the gods and goddesses;

Nowadays, cruel man is destroying the natural world

Without considering the pros, cons, they eat turtle meat;

Man never thinks that with every passing day turtles numbers
are decreasing

Please think once O brothers, how to save our environment;

The turtle is a useful animal and we should not harm it
knowingly

The jellyfish which eats shrimp juveniles cause much harm to
the fishermen community;

For the benefit of the fishermen community, the turtle chases
and gobbles up the jellyfish

If shrimps live, then fishermen survive and can improve their
economic position;

Fishing is the profession of the fishermen and without fish there
is no life or existence for the fishermen

By selling the fish, he obtains money and without fish he is
helpless;

The turtle is our only support and it eats plenty of jellyfish;

Increases shrimp juveniles which enables the fisherman to
sustain himself;

The entire world is aware of Orissa’s pride—the turtles

Turtles are found from Rushikulya mouth to Balasore;

Masses of turtles come rushing to Gahirmatha to stay and nest

Song sung by local minstrels of Orissa during ‘Operation Kachhapa’

Without destroying turtle eggs, let us increase their numbers;

We should save Orissa’s turtles and not destroy their
population

Since this is our race’s pride, let us not forget this fact;

Remember, remember, O fishermen brothers, that government
rules are not false

Motorized trawlers are supposed to fish beyond a distance of
10 kms from the shore;

They are prohibited from fishing within 10 kms of the coast

We wish to remind you of this rule which is for big motorized
boats;

Those who do not obey this law will be surely be punished

Caught in the nets, the turtles O brothers, sacrifice their lives
day after day;

The law provides that upto 10 kms from the coast, country
boats can fish;

Do not forget this, O brothers;

Whenever you see turtles, release them O brothers, since
they are our beneficial friends;

Let us take an oath; let us take an oath

Let us join together and take an oath;

United we join our hands;

Save the turtles together

If turtles survive, we survive;

Let us be prepared for our own selves;

Chorus: If turtles survive, we survive....
Sea Turtle Programmes

Sea turtle conservation programmes in India

- Gujarat Forest Department
  Contact: Director, Marine National Park, Jamnagar Marine (Gulf of Kachchh) WLS Pradarshan Ground, Jamnagar 361001, Gujarat

- Sahyadri Nisarga Mitra
  Contact: Vishwas B.Katdare, Near Laxminarayan Temple, Chiplun, Dist. Ratangiri 415 605, Maharashtra
  Email: sahyadri@rediffmail.com

- Forest Department, Goa.
  Contact: Range Forest Officer, Wildlife Division, Sea Turtle Study Centre, Tuye, Pernem, Goa

- Centre for Environment Education, Goa
  Email: ceegoa@ceeindia.org

- Theeram Prakruthi Samrakshana Samiti
  Contact: Surendra Babu/Dinesh Babu, Itningal Beach, Kolaavipalam, Payyoli, Calicut, Kerala

- Students Sea Turtle Conservation Network, Madras
  Contact: V. Arun, The School, Krishnamurti Foundation of India, Besant Avenue, Chennai.
  Phone: 044 24915845

- TREE (Trust for Environment Education)
  Contact: Supraja Dharini, No. 63 First Avenue, Vettuvankeni, Chennai 600 041
  Email: treeindia2002@hotmail.com

- Forest Department, Andaman and Nicobar Islands
  Contact: C/o Office of the Chief Wildlife Warden, Government of Andaman and Nicobar Islands, Post Office,
  Haddo, Port Blair 744102, Andaman & Nicobar Islands

- Green Mercy, Vishakhapatnam
  Contact: K.V. Ramana Murty, 8-77/1, Srinivasa Nagar, Simhachalam (Via), Vishakhapatnam 530028.
  Andhra Pradesh
  Email: greenmercy@yahoo.com

- Dolphin Nature Club, Vishakhapatnam
  Contact: Dolphin Nature Conservation Society, 54-12-26/2, Vidyaganagar, HB Colony, Vishakhapatnam 530022,
  Andhra Pradesh

- Vishaka Society for Prevention of Cruelty to Animals (VSPCA)
  Contact: Pradeep Kumar Nath, 26-15-200, Main Road, Vishakhapatnam 530001, Andhra Pradesh

Sea turtle monitoring and research programmes

- Orissa Forest Department
  Contact: C.S. Kar, O/o PCCF & CWLW, Forest Department, Government of Orissa, Shahid Nagar, Bhubaneswar.
  Orissa

- Gujarat Institute of Desert Ecology (Gujarat)
  Contact: Dr. Wesley Sundarrajan, Patwadi Naka, Bhuj, Kachchh 371001, Gujarat
  Email:jaws_wesley@hotmail.com

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• Bombay Natural History Society (Maharashtra and Goa)  
  Contact: Varad Giri, Hornbill House, Shahid Bhagat Singh Marg, Mumbai 400023, Maharashtra  
  Email: bnhst@bom4.vsnl.net.in

• Salim Ali Centre for Ornithology and Natural History (Tamil Nadu)  
  Contact: Dr. S. Bhupathy (sb621@yahoo.co.uk), Anaikatty P.O., Coimbatore 641108, Tamil Nadu  
  Email: sacon@md3.vsnl.net.in

• Andaman and Nicobar Environmental Team  
  Madras Crocodile Bank Trust (Andaman and Nicobar Islands)  
  Contact: Harry Andrews/Kartik Shanker, Postbag 4, Mamallapuram 603104, Tamil Nadu.  
  Email: mcbtindia@vsnl.net

• Wildlife Institute of India (Orissa, Lakshadweep)  
  Contact: B.C. Choudhury (bcc@wii.gov.in), Bivash Pandav (paandavb@wii.gov.in),  
  Post Box 18, Chandrabani, Dehra Dun 248001

Source: Sea Turtle Manuels—A GUMUNDP Project Manual. Centre for Herpetology/Madras Crocodile Bank Trust, Mamallapuram, Tamil Nadu, India.

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www.euroturtle.org
www.turtles.org