Nature Watch

The Ancient Mariners

Kartik Shanker

Kartik Shanker was involved with the conservation of the Olive Ridley with the Students Sea Turtle Conservation Network (SSTCN) in Madras. Thereafter, he spent two years in the Upper Nilgiris studying small mammal and herpetofaunal communities, a subject in which he hopes to acquire a Ph.D in the near future.

Sea turtles are a fascinating group of marine reptiles that evolved millions of years ago. They show an intriguing variety of strategies to deal with their aquatic mode of life. Their migrations are legendary, and the mass nesting of the Ridleys is one of nature's most extraordinary spectacles. The eight species are all endangered due to human activities. While some have been exploited for meat, others have suffered due to factors such as pollution. This article details some of the more interesting aspects of their life history and examines their decline in recent times.

An Eggstravaganza

Imagine. There are hundreds of eggs flying through the air and the beach is thick with thousands of turtles; some are moving around laboriously searching for a place to nest; others are digging up the sand and, with it, the nests of previous turtles; eggs, yolk and sand are flung with abandon; some are stone still, laying a hundred eggs or more into painstakingly excavated nests; and yet others are thumping the sand in a peculiar dance before

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***Figure 1** A dead Hawksbill turtle; its pretty carapace is used for making 'tortoise shell' articles like spectacles and combs.*

crawling back and disappearing into the blackness of the sea. Early next morning, the beach is deserted and silent, covered with a carpet of eggs, a seemingly senseless and futile waste.

Bizarre and fantastic as this sounds, it actually happens. This is nature's little madness, her extravaganza of eggs, known to turtle biologists as an *arribada* or mass nesting. There is meaning behind the madness, and the protagonist of this spectacular drama is the Olive Ridley sea turtle.

Sea Turtles of the World

The Olive Ridley is one of eight species of sea turtles. It is one of the smallest, measuring about 2 feet and weighing 40-50 kg. The largest is the Leatherback, growing upto 8 feet in length and weighing 600- 700 kg. The other sea turtles are the Green turtle, famous for turtle soup, the Hawksbill, known for its pretty shell, the Loggerhead, the Australian Flatback, the Black turtle and the Kemp's Ridley. Five of these are found in Indian waters: the Olive Ridley, the Leatherback, the Loggerhead, the Green turtle and the Hawksbill (see *Figures 1,2,3*). The Olive Ridley is the most common and nests all along the Indian coastline.

Sea turtles are reptiles (ie. cold blooded lung breathing vertebrates) which have adapted to an aquatic life. They are believed to have evolved more than a hundred million years ago with the dinosaurs. Their ancestors were land living reptiles which in turn had descended from sea living animals. The great advantage that reptiles had over amphibians is that they could lay their eggs on land; their eggs – called amniotic eggs – had their own aquatic

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Figure 2 An Olive Ridley lays 100-150 eggs in her nest ; the soft shelled eggs are about the size of ping pong balls.

Figure 3 (bottom left) The Leatherback is the largest of the sea turtles ; it is also different from the others in that it has a soft shell, made of cartilage.

Figure 4 (bottom right) The Olive Ridley is the smallest sea turtle ; it is found all over the world and nests all along the Indian coastline.

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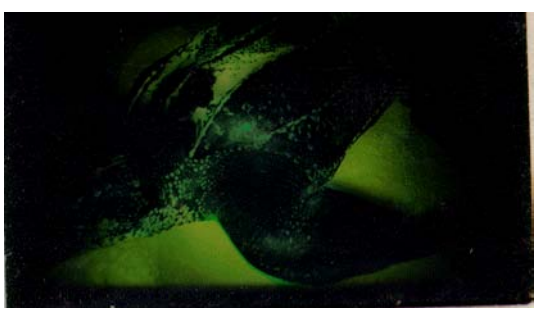

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environment, the amniotic fluid. This very adaptation was to prove almost fatal to sea turtles many million years after their evolution.

Never the Same Flipper

Though sea turtles have adapted to sea living in every way, they still have to come ashore to lay their eggs. After mating, which takes place in the sea, the female crawls 10 - 20 metres above the high water mark and finds a suitable site. Then, after clearing away surface sand, she excavates a flask shaped nest with her hind legs. All aquatic turtles do this, but sea turtles unfailingly use their hind flippers alternately; freshwater turtles are not so particular. Archie Carr, a famous turtle biologist, even suggested that a sea turtle could be defined as a turtle that never put the same flipper into its nest hole twice in succession. There is an anecdotal account of a loggerhead which had one hind flipper missing. When this turtle nested, the side with the missing flipper always made a token gesture of removing sand. This is believed to be indicative of the degree of genetic programming in the behaviour of the turtle.

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Once the two feet deep nest has been excavated, the turtle lays 100-150 eggs in the hole and covers it with sand. Some of the species like the Ridley thump the sand down with rocking movements of their body. The turtle then returns to the sea. Most of the species have specific breeding seasons. They also have distinct breeding and feeding grounds, which may be several thousand kilometres apart. This is because the beaches that favour nesting may not be rich in their food resource (see *Figure 4*).

Before and After the Lost Year

Once the female turtle lays her eggs, she returns to her feeding ground, though she may nest more than once in the same season. There is a myth that the female waits offshore for her hatchlings, but there is absolutely no parental care in sea turtles. The eggs are incubated by the heat of the sun and their own metabolism. After

about 50 days under the sand, they hatch simultaneously and the hatchlings break out using their 'egg tooth'. After hatching, they move about vigorously, and as the nest collapses, they emerge all at once. This ensures that at least a few will escape predators. They usually emerge at night and locate the sea by the bright horizon. Once in the water, they swim frantically using their stored resources till they are past the breakers and then begin using other cues such as wave direction.

Hatchlings fall prey to crabs, birds and small mammals even before they reach the sea. Thereafter, years of peril await them as all kinds of large fish feast on them.

While hatchlings are largely carnivorous in their diet, they are believed to convert partly or wholly to a herbivorous diet consisting largely of seaweeds and algae. Loggerheads seem to have a preference for shellfish, while Leatherbacks feed almost exclusively on jellyfish. Green turtles, due to a predominantly vegetarian diet, may take 30 or more years to mature, but Olive Ridleys mature in 5 to 8 years.

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Till recently, scientists had no idea what happened to these hatchlings during what was known as the 'lost year' — they were only seen again when they were the size of dinner plates. Recently, however, hatchlings have been seen floating along in seaweed rafts. The hatchlings are believed to return eventually to the feeding grounds of their parent population. There is also reason to believe that when they mature, these turtles return to breed in the same beaches, where they hatched many years earlier. The survival rate of hatchlings to adulthood is very low, and less than one in a thousand may survive.

Finding the Ascension

Turtles display a remarkable ability to locate the same nesting beach year after year. In some instances, their powers of navigation are truly astounding.

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For example, the green turtle off the coast of Brazil nests in the Ascension islands in the Atlantic. The Ascension islands are a speck in the middle of the ocean and the ability of the turtles to locate them is remarkable. In fact, in the second world war, the pilots crossing the Atlantic had to refill at Ascension, and they had a saying "if you miss the Ascension, your wife gets a pension." Early tagging studies demonstrated that the same turtles returned to Ascension year after year. DNA studies have shown that this population was distinct from other green turtle populations, strengthening the claim that they show high site-fidelity, and also that the turtles were returning to the same beaches where they hatched.

Scientists have debated for years about the mechanisms that turtles use to navigate. Investigations show that turtles possess both map and compass sense. They are believed to use geomagnetic and chemosensory cues and ocean swells in the course of migrations that cover thousands of kilometres through the open sea.

Arribadas and Deep Sea Diving

The Olive and the Kemp's Ridley are unique for their arribadas or mass nesting. Hundreds of thousands of turtles migrate together and nest at a particular beach year after year at the same time. There is one arribada nesting beach in Orissa at Gahirmatha. In a 10 km stretch of beach, several hundred thousand turtles nest each year within the space of 2 weeks in February or March, and

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Figure 5 During an 'arribada', as many as 50,000 Ridleys may nest in a single night on a short stretch of beach.

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Turtles are beautifully adapted to life in the water, with their long flippers and streamlined bodies. The turtles' unique metabolism enables them to stay underwater for very long periods, and some are even known to hibernate under water. Marine mammals like the sperm whales and the elephant seals were believed to be the champions of deep sea diving, going down 4000 feet and deeper. But leatherbacks can also dive to depths of 4000 feet and stay there for an hour or more in search of their favourite food —jellyfish. Several adaptations to marine life believed to have evolved in aquatic mammals may actually have evolved millions of years before in sea turtles.

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Temperature Determines Sex

Another interesting aspect of their biology is that the sex of the hatchlings is not determined by chromosomes as it is in most other animals. There is a critical temperature of incubation at which the hatchlings in a clutch are 50 percent male and 50 percent female. Above this temperature, hatchlings develop into females and below it, into males. This has had serious implications in the conservation of sea turtles.

Decline of the Turtles

Turtles have long been exploited for various reasons. Green turtles have been caught en masse for their meat (even its name 'Green' is derived from the colour of the meat). Hawksbill shells

Figure 6 (bottom left) Sea turtles have been exploited and killed for various reasons through the centuries.

Figure 7 (bottom right) An Olive Ridley hatchling struggles back to the sea.

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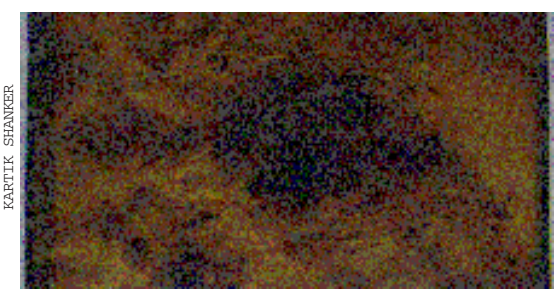

The sex of the hatchings is not determined by chromosomes, but by the temperature of incubation.

have been used for making tortoise shell products such as combs and spectacles. In fact, in some parts of the world, turtles were heated alive and their shells stripped off as it was believed that the shell would grow back.

The fact that they have to come ashore to lay their eggs has rendered them most vulnerable. The eggs of most species have been poached for consumption. Many adult turtles have been easily killed when ashore. Natural predators like crabs and birds and human induced predators like feral dogs and crows also take their toll on the hatchlings.

Other factors have contributed indirectly to the decline of the turtles. Beach lighting confuses the hatchlings when they emerge from the soil at night. Sand mining and erosion have reduced nesting beaches. Turtles die as incidental catch in large trawl nets (though conscientious trawlers now have 'turtle exclusion devices' which allow the turtles to escape). A number of leatherbacks die by consuming plastic packets mistaking them for jellyfish. Pollution, habitat destruction and other aspects of urbanization have effectively led to the decline of sea turtles.

S.O.S - Save our Sea Turtles

Conservation efforts are on worldwide, to save the sea turtles from extinction (see *Figures 6,7*). Attempts at conservation have largely involved the setting up of hatcheries where eggs are translocated to protect them from poaching and predation. The eggs are incubated in natural conditions or styrofoam boxes and hatchlings are released after the eggs hatch. In India, the Forest Department and NGOs like the Students Sea Turtles Conservation Network (SSTCN) in Madras have conducted conservation programmes.

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However, since sex is temperature determined, hatcheries may be tampering with sex ratios in the wild. There has been a shift

to in–situ conservation or beach management where the entire beach is protected. Again, due to human pressure, this has been very difficult in many places since socioeconomic and cultural factors come into play. Conservationists have had to seek compromises between the two methods and the battle to save the sea turtles is far from over. Sea turtles are fascinating denizens of the deep we know so little about and we can little afford to lose such a precious part of the marine world.

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Suggested Reading

Archie Carr. So Excellent a Fish: A Natural History of Sea Turtles. Charles Scribner's Sons. Revised Edition. 1984.

Archie Carr. Rips, Fads, and Little Loggerheads. *Bioscience.* Vol. 36. 92-100. February 1986.

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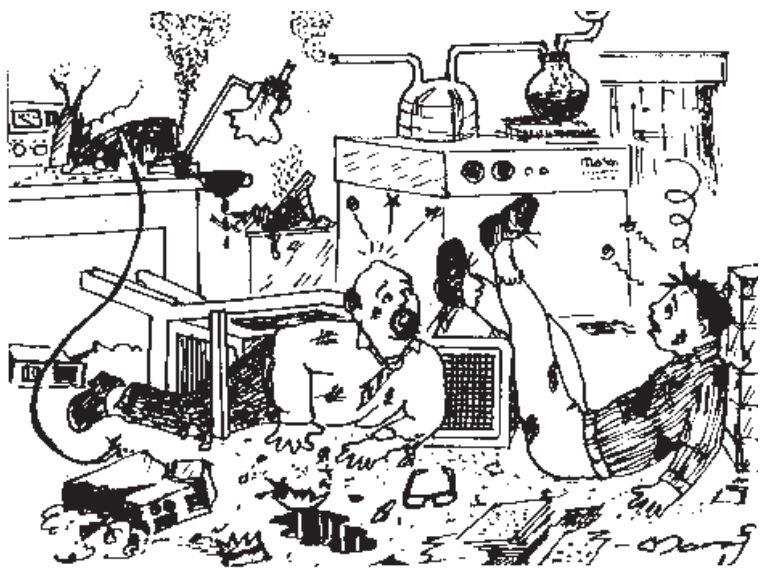

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