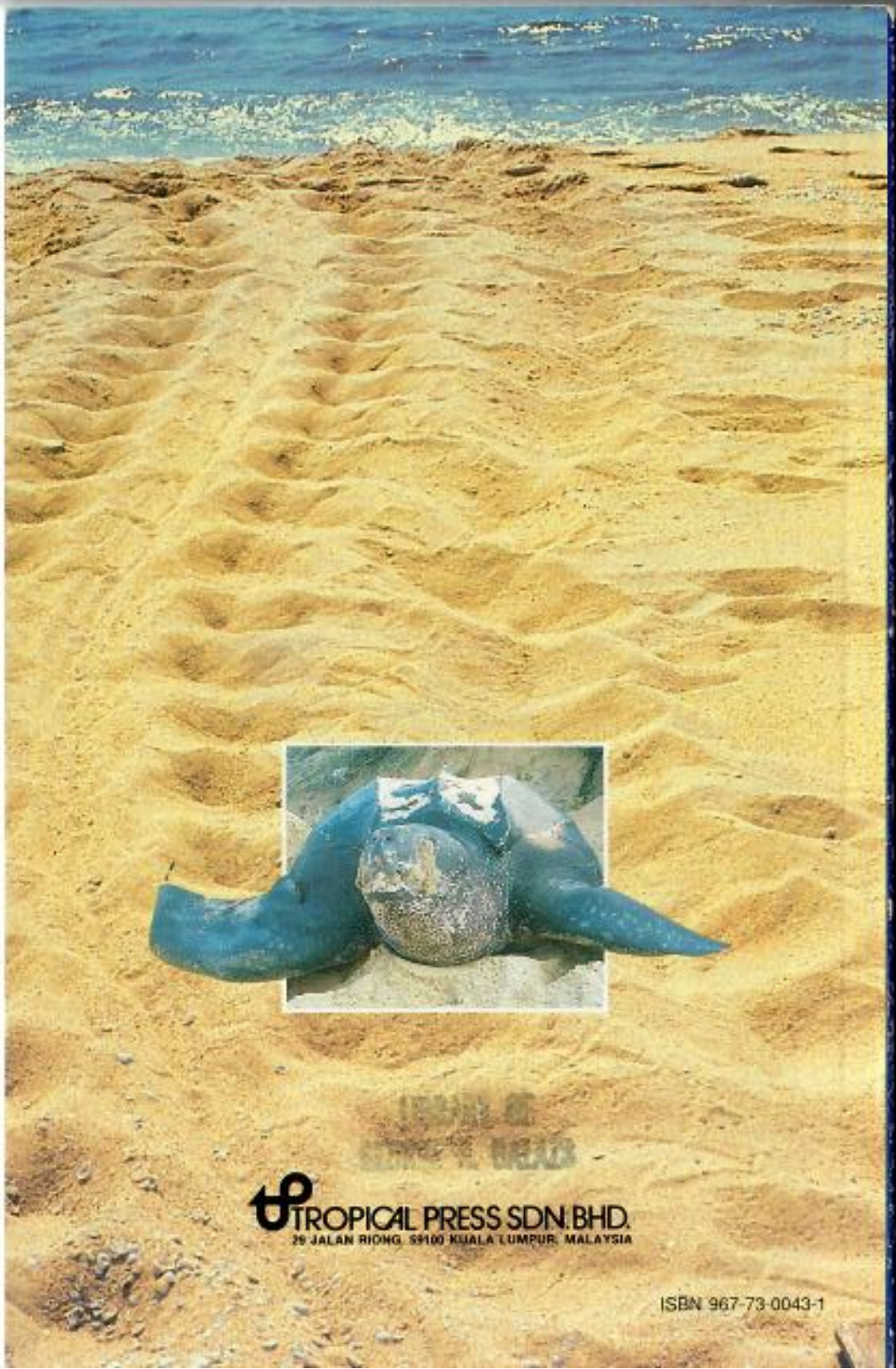
# THE LEATHERBACK TURTLE

## A MALAYSIAN HERITAGE

Chan Eng Heng and Liew Hock Chark



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# PREFACE

The leatherback turtle is a magnificent animal and is one of the most valuable of our country's wildlife heritage. Presently, available information on the biology and life style of the leatherback turtle is limited for the most part to that contained in scientific journals. But general information on Malaysian sea turtles is severely lacking. It is hoped that this handbook will provide interesting information and help develop appreciation and concern for the animal among the general public. For only with such appreciation and concern can there be hope for the continued survival of this treasure of ours.

# ACKNOWLEDGEMENTS

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# I. INTRODUCTION

*What kind of animal is the leatherback turtle?*

It is a reptile. It breathes air and lays eggs on land. It begins its life as a newly emerged hatchling (baby turtle) on land and thereafter spends most of its life in the sea. Only the female turtle will return to the beach to lay eggs while the male is never seen on land again.

The leatherback turtle, *Dermochelys coriacea*.

*Has it been around for a long time?*

The history of the leatherback, like that of all other sea turtles, goes back at least 150 million years, to the age of the dinosaurs. Apart from the sea snakes, the sea turtles are the only remaining marine reptiles today. Others like *Archelon*, the three and a half metre long turtle which swam in Cretaceous seas about 90 million years ago, had long become extinct. The sea turtles of today have not changed very much in their evolutionary history and in fact still look very much like their fossil ancestors.

*How many kinds of sea turtles are there?*

There are seven species of sea turtles living in the world's oceans today. These are the leatherback (*Dermochelys coriacea*), the

loggerhead (*Caretta caretta*), the green turtle (*Chelonia mydas*), the flatback (*Natator depressa*), the hawksbill (*Eretmochelys imbricata*), the olive or Pacific ridley (*Lepidochelys olivacea*) and the Kemp's or Atlantic ridley (*Lepidochelys kempii*).

*Do all these species come to the beaches in Malaysia to lay eggs?*

Only four species are known to nest in Malaysia. These are the leatherback, the hawksbill, the green turtle and the olive ridley. The painted terrapin, *Callagur borneonsis*, also lays eggs on our beaches. However, it is not a sea turtle as it lives in rivers and estuaries, and swims out to coastal waters only during the nesting period.

The hawksbill turtle, *Eretmochelys imbricata* taken at 25 metres, off Pulau Redang, Malaysia.

Close-up of the hawksbill, showing the hawk-like beak.

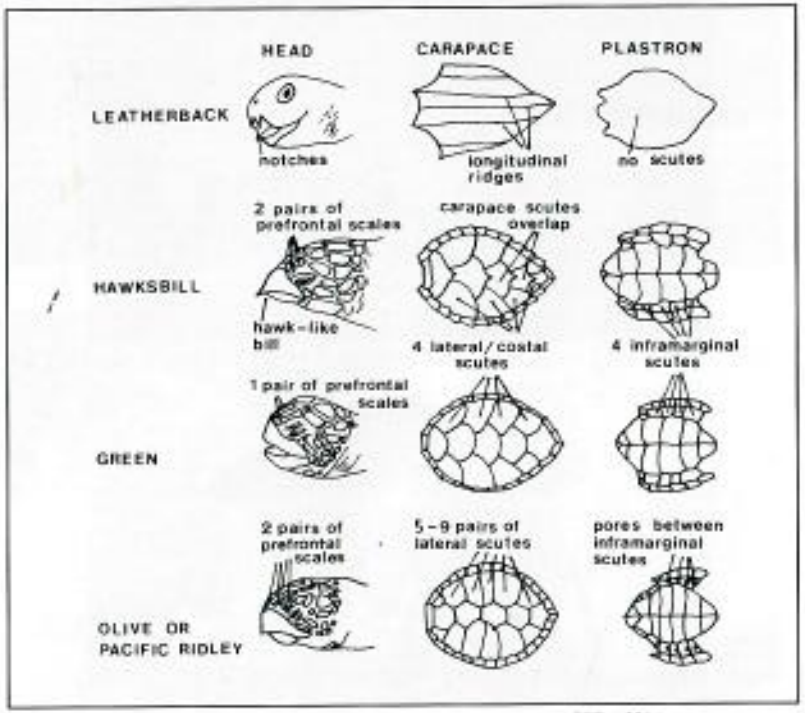


The green turtle, *Chelonia mydas*.

The olive ridley, *Lepidochelys olivacea* (Courtesy of Fundacion de Parques Nacionales.)

A juvenile olive ridley.

The painted terrapin, *Callagur borneoensis*. (Courtesy of E.O. Moll.)




Characteristic features of Malaysian sea turtles. (Adapted from M. Beath, CEE, 1981.)



*What is the difference between a terrapin, a tortoise and a turtle?*

There is no scientific distinction between these three terms. All three belong to the same major group or order called Chelonia or Testudines and can be collectively called turtles. However, tortoises are commonly taken to be terrestrial turtles with highly arched thickened shells and legs which can lift the body clear off the ground. The limbs of sea turtles are flattened to facilitate swimming and cannot support the weight of the body on land. Furthermore, sea turtles cannot retract their heads and flippers into their shells like their terrestrial and freshwater counterparts, making them more vulnerable to their predators. Many people refer to the freshwater turtles as terrapins, while Americans think of them as the species eaten as a delicacy.

*Does the leatherback look very different from the other species of sea turtles?*

The leatherback is the least mistakable of all sea turtles. It lacks the hard bony shell typical of the other species. Instead it has a smooth leathery carapace or shell marked by seven longitudinal

Note the longitudinal ridges on the smooth leathery carapace of the leatherback. (Courtesy of M.W.R.N. de Silva.)

Front view of the leatherback, showing the tooth-like projections on the upper jaw. (Courtesy of M.W.R.N. de Silva.)

ridges. It is the only sea turtle with peculiar jaw margins where the upper jaw bears two tooth-like projections flanked by deep cusps. It is also the largest of all sea turtles. A nesting female may have a carapace length of up to two metres and easily weigh half a tonne (500 kg).

*Where can we observe leatherback turtles in Malaysia?*

Leatherback turtles nest only along a 20 km stretch of beach centred

The open beaches of Rantau Abang — the nesting site of the leatherback in Malaysia.



in Rantau Abang, Terengganu. The beaches here have a deep water approach, heavy surf and a steep slope which enable the turtles to crawl shorter distances to nest.

*Do the leatherbacks have a nesting season?*

The leatherbacks start to nest early in May and the season ends in September when only a few turtles will come to nest. The best time to watch them is during the peak of the season in June and July.

*Where else in the world do they nest?*

There is documentation that they nest in about 64 locations in the world. However, only five or six are of major importance and these beaches are found in Surinam, French Guiana, Costa Rica, Mexico, Gabon and Irian Jaya. In the early 1960s, Rantau Abang was the only known nesting beach of importance for the species. Now, with diminishing numbers of leatherbacks, Rantau Abang has lost its prominence as a major nesting beach.

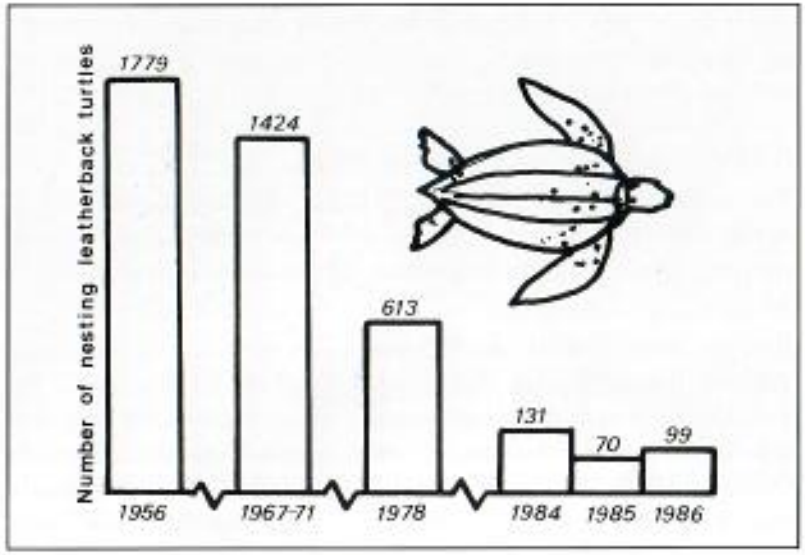

World map of important nesting beaches of the leatherback.

*Are there many leatherbacks in the worlds oceans?*

Estimates made in 1983 indicate that there are between 70,000–75,000 mature female leatherbacks in the world. No figures are available for male leatherbacks.

*How many leatherbacks come to nest each year in Malaysia?*

Statistics provided by the Fisheries Department of Terengganu show that an average of only 100 leatherbacks nested per year over the last three years. Since each female nests about six times per season, the actual number of nestings would be 600 per year. These figures represent only 5.6% of the nestings observed in the 1950s.




Decline of nesting leatherbacks in Rantau Abang.

# II. GENERAL BIOLOGY

*What is the shell of the leatherback made of?*

The leathery 'shell' consists of an outer skin with a continuous layer of tiny mosaic bones just under it. The bones are only a few millimetres thick and are embedded in a thick layer of oily cartilaginous material which gives the animal its mechanical strength.

*Can leatherbacks survive without the shell?*

The backbones as well as the ribs are embedded in the shell; hence the shell is essential for supporting and protecting the internal organs of the body.

*Do other organisms grow on the shell?*

Remora shark suckers, barnacles and algae which are common on the shells of the other sea turtles are rare on leatherbacks. The smooth and soft skin of the leatherbacks makes attachment difficult.

*How fast can leatherbacks grow?*

Growth rates for leatherbacks in the wild is not known. Attempts to rear leatherbacks in captivity have met with only limited success, compared with similar attempts to rear the other species. However, there are reports that they can reach 20 kg in weight in the first year. In Malaysia, leatherback hatchlings attain 130 g in two months, i.e. an increase of about two and a half times over their weight at hatching.

*How long can leatherbacks live?*

Nobody knows for sure. It is believed that they can reach a great age if undisturbed by humans. Scientists are still trying to find ways to determine the age of a turtle.

*What do they eat?*

The leatherbacks eat mainly jellyfish. The scissor-like jaws are

adapted for holding and cutting the soft and slippery prey. Other invertebrate animals like tunicates, medusae and ctenophores are also consumed.

*How much do they eat?*

Scientists have often wondered how the leatherback, known to be the most active of all sea turtles, can subsist on a diet of jellyfish which is 95% water and energy poor. In order to support its energy requirements and maintain its growth, it has been estimated that an adult leatherback must consume its own body weight of jellyfish per day. Pelagic jellyfish often trap macroplankton in their hanging tentacles. Macroplankton is rich in nutrients and energy and can contribute greatly to the nutrition of leatherbacks.

*Do they have teeth?*

No. The sharp ridges of the jaw act as the cutting edge. Neither do they have a tongue.

*Do they have ears?*

They do, although the external ear is absent. They have an ear-drum, a middle ear and an inner ear. The ear-drum is covered by ordinary skin. They are sensitive to the noises in their environment.

*Do they produce sounds?*

Leatherbacks make a variety of sounds during nesting. Most are 'sighs' accompanying breathing while sometimes sharp 'belches' may be heard. These sounds are probably of no significance and result merely from sudden uneven expulsions of air from the lungs during strenuous activity on the beach. When attacked in water, they apparently emit cries which have been described as "pathetic wails, groans, roars and bellows."

*Can leatherbacks breathe underwater?*

Leatherbacks are air-breathing animals and must surface periodically to fill their lungs with air. Sometimes they get caught incidentally in fishing nets, and because they cannot surface for air, they



drown. During deep dives, they can remain underwater for several hours without resurfacing for air. They are able to do this because their blood and muscle tissues can store oxygen in large quantities. They are also able to ventilate their lungs fully during respiration. The metabolic rate is controlled during dives so that oxygen requirements are reduced.

*How fast can they swim?*

Leatherbacks are beautifully adapted for swift and long distance travel. The shell is greatly reduced in weight and streamlined in shape to reduce water friction while the front and rear flippers are long and provided with well-developed muscles for swimming. Leatherbacks are known to have attained speeds of up to 10 km per hour in water.

*How far do they migrate?*

Leatherbacks are highly migratory animals. Females tagged in Rantau Abang have been found in the seas around the Philippines, Japan and China. The longest turtle migration on record is 5,900 km, made by a leatherback turtle. This migratory habit is related to the leatherbacks' search for food, i.e. jellyfish, which drift with ocean currents and are hence dispersed far and wide.

*Do they swim singly or in groups?*

Leatherbacks are generally solitary animals. Most existing records represent single sightings in the sea, in incidental captures in fishing nets and in strandings of dead or weakened animals in shallow water or on beaches. There have also been a few sightings of loosely linked groups of 40 –100 leatherbacks swimming together off coastal waters during the nesting season. These isolated reports do not provide sufficient evidence to conclude that they are gregarious in nature.

*How deep can they dive?*

From time-depth recorders secured to two leatherback turtles over a period of 10 days in the U.S. Virgin Islands, one reached a maximum depth of 475 m, with 13 dives exceeding 200 m while the

second reached 314 m, with 50 dives exceeding 200 m. Other dives exceeding 1000 m have also been recorded. These depths far exceed any previously recorded for sea turtles.

*How do they navigate?*

The exact mechanism which enables them to find their way in the vast oceans remains a mystery. For many years it was thought that they used the changing positions of the stars in the night to help them navigate. This theory was proved otherwise when it was later discovered that their eyes are adapted mainly for underwater vision, making them quite nearsighted out of water. Another theory suggests that they follow scent trails in the oceans to identify specific nesting beaches. The olfactory area of the turtle brain is very well developed and would enable them to detect small chemical differences in the water. More recently, small amounts of magnetite, a highly magnetic substance has been discovered in the brain of some sea turtles. Magnetite has also been found in the brains of pigeons and honey bees, both known for their ability to unerringly return to their homes. This same material may enable the turtles to detect the earth's magnetic field thereby providing them with both a map and compass sense in the vast ocean, enabling them to identify their positions and know which direction to swim in order to reach their destination.

*Do they rest and sleep?*

Hatchlings often rest on the surface of the water with their front flippers tucked under the carapace. Hatchlings of the other species rest with their front flippers tucked in and laid neatly along the upper edge of the carapace. Mature turtles probably rest in the same manner, or sleep on the sea floor.

# III. REPRODUCTION

*Do leatherbacks really come back to nest on the beaches on which they were born?*

It is generally believed that they do. However, we still do not know for certain because hatchlings cannot be tagged easily.

*Where and how do they mate?*

Presumably, they mate in the waters off the nesting beaches during the early part of the nesting season. So far, only one observation of mating has been reported. The male approaches the female from the rear and mounts her, positioning the centre of his plastron (under shell) posterior to the centre of her carapace. In the first few attempts of mounting by the male, the female dives under, with the male in pursuit. After three or four attempts at copulation, the female will appear less agitated while the movements of the male become more coordinated. When the male is able to maintain his position on top of the female, he curves his tail under the female's shell and beneath the base of her tail. The fore flippers of the female become rigid and elevated slightly above the surface of the water. The fore flippers and neck of the male also become rigid. At this point, the mating pair quiver slightly, then submerge slowly together. Copulation, as in other species of sea turtles, may continue for several hours.

*How do you tell a male from a female?*

Adult males differ from females by having concave plastrons and thick tails which extend past their rear flippers.

*How old are they when they first begin to lay eggs?*

Here again, no definite data is available. Scientists have variously guessed that leatherbacks begin to lay eggs at 5 years, 7 years, and between 30 and 50 years. There is one report which even suggests that they mature in 2 years!

*How big are the females when they start to breed?*

The smallest nesting female leatherback turtles measure about 1.4 m in carapace length, and weigh about 300 kg.

*How often do they nest?*

Female turtles may nest up to nine times in one nesting season, at intervals of 9–14 days. The average female nests five to six times per season.

*Do they nest only at night?*

Most nest at night, generally between 1900 and 0700 hours the next morning. Nestings at 1700 hours have been observed but are extremely rare.

*Why do they shed tears during nesting?*

Actually turtles shed tears not only when they are nesting but also when they are in the sea. These tears are normal secretions from a pair of glands situated near the eye, but are noticed only when the turtle leaves the sea. It is believed that the tears prevent the eyes from becoming dehydrated and cleanse them of sand. It has also been suggested that the tears aid in salt excretion.

*Where are the nests usually located?*

The female turtle usually digs her nest in an area which is above the high tide mark and free from vegetation. This is important as inundation by sea water would drown the developing embryos.

*Is nesting a complicated process?*

The complex nesting process can be divided into eleven stages:

1. Stranding, testing the beach and emerging from the waves.
2. Selecting a course and crawling from the surf to the dry mid beach sand.
3. Selecting a nest site.
4. Clearing the area with sweeping motions of the front and sometimes rear flippers.



Digging the nest cavity with the rear flippers which acts as a shovel.

Leatherback tracks.

5. Excavating the body pit into which the turtle will position herself.
6. Digging the nest cavity with the rear flippers.
7. Laying the eggs.
8. Filling, covering and packing the nest cavity with sand.
9. Filling the body pit and concealing the nest site.
10. Selecting a course and crawling back to the sea.
11. Re-entering the surf and crossing the breakers.

*How deep are the nests?*

The nest cavity is as deep as the hind flippers can reach, i.e. 50 to 60 cm. When this hole and the body pit are filled up with sand again, the eggs may be buried under more than a metre of sand.

*Why are the nests made so deep?*

The first obvious reason is that it makes it extremely difficult for predators to locate the nest. The deep nest also protects the eggs from excessive heat and desiccation. Sand temperatures at the level of the nest are also remarkably constant.

*How many eggs do the females lay each time?*

Usually between 50 – 140 eggs are laid each time. In addition to normal eggs, markedly undersized, yolkless eggs are also deposited towards the end of oviposition. These tiny eggs form a "cap" on top of the normal yolked eggs and may help to prevent sand from falling into the spaces between the eggs which would impair gas exchange.

Undersized yolkless leatherback eggs.

*Do they lay eggs everytime they emerge on the beach?*

Nesting may be aborted if the turtle fails to dig a suitable nest cavity. A turtle will abandon a nest and search for a new site if sand falls back into the cavity after it has been dug. Often in Rantau Abang, females



return to the sea even before they have had a chance to select a nest site. This is because large numbers of tourists descend upon them and crowd closely around them making it impossible for the turtles to even move around.

# IV. EGGS AND INCUBATION

*How big are the eggs and what are their characteristics?*

The diameter of normal eggs is usually between 50 and 60 mm. Yolkless eggs may range from a few millimetres to about 35 mm. The egg shell is soft and white and indent easily when laid. However, the eggs are quite tough and do not break when dropped into the deep nest.

*Are all the eggs fertile?*

Up to 20 % of the normal sized eggs may be infertile. Furthermore, whole clutches of eggs may sometimes be infertile.

*Is it possible to distinguish a fertile egg from an infertile egg?*

Not at the time of laying. However, after four to five days of incubation, fertile eggs will develop a white chalky patch on the shell at the top of the egg. Infertile eggs fail to develop this patch and will remain a creamy beige colour over the entire surface.

Fertile eggs develop a white chalky patch.

*What causes the development of the white patch?*

The white patch is caused by the adhesion of the membranes of the embryo to the inner surface of the egg shell. As development proceeds, the white patch enlarges and will finally envelope the entire shell surface.



*How long do the eggs take to hatch?*

Usually between 50 and 60 days under normal conditions. The incubation period depends on temperature. If the eggs are incubated indoors where temperatures are lower than on the open beach, the eggs may take up to 80 days to hatch.

A 10-day old embryo.

A 40-day old embryo.

*Do incubation temperatures have any effect on the hatchlings?*

Quite recently, it was discovered that incubation temperatures affect the sex of the hatchlings. Warmer temperatures tend to produce more females while cooler temperatures tend to produce more males.

*How many hatchlings will hatch from each nest?*

If the eggs are allowed to incubate in their natural nests and not moved after being laid, hatch rates average around 75%. Movement of eggs to hatcheries may lower the hatch rates by about 20 – 40%.

Some embryos do not make it and die while still in the egg at an advanced stage of development.

Twin embryos.

# V. HATCHLINGS

*How big are the hatchlings?*

Measurements on 200 newly emerged leatherback hatchlings from Rantau Abang gave an average weight of 38.16 g. The heaviest was 45.57 g while the lightest was 28.45 g. The average carapace length was 5.73 cm, with the maximum at 6.48 cm and the minimum at 5.10 cm.

*How long does it take a hatchling to crawl up to the surface of the nest?*

The hatchlings may take three or four days to reach the surface of the nest. The crawl is a group effort. When the topmost hatchlings are

The hatching of a leatherback — an event which usually occurs deep in the sand-nest.

near the surface, they rest until the surface temperature drops, frequently at night or on a cool rainy day. When this happens, the hatchlings continue to crawl upwards and emerge from the sand. Once out of the sand, they become very active and, if they are not restrained in the nest, head quickly towards the sea.

Leatherback hatchlings emerging from a sand-nest.

Newly emerged leatherback hatchlings.

*Do all the hatchlings emerge at the same time?*

Most do, usually on the first day of emergence. However, the emergence of hatchlings from one nest may spread over a period of five days or more.



*How do they find their way to the sea?*

Hatchlings are attracted to light. At night, the light comes from the open horizon towards the sea, away from the darker dune mass and landward vegetation. This brightness from the horizon guides the hatchlings to the open sea.

*Will artificial light distract them?*

Any form of artificial light on the beach like fluorescent lamps, kerosene lamps, street and vehicle lights will disorientate the hatchlings. Disorientated hatchlings often get caught in vegetation and die of heat and dehydration the following day.

*Where do the hatchlings go?*

Once the hatchlings reach the sea, they start swimming frantically towards the open waters. This so-called "swimming frenzy" is main-

The yolk is only partially absorbed into the body cavity at hatching.

On emergence, the umbilical opening closes.

tained for the first two to three days when they do not even stop to feed. All the energy and nourishment required during these first days at sea are derived from the yolk which is absorbed into the body cavity at the time of hatching. Once they reach the offshore waters, the hatchlings slow down and start to feed on pelagic invertebrates. There is now mounting evidence that the hatchlings are transported by ocean currents to open ocean surface feeding areas, associated with pelagic drift lines which contain *Sargassum*, a marine alga, and flotsam.

*When do they first start feeding?*

Leatherback hatchlings kept in captivity will not pay any attention to food offered on the first two days after hatching. Some start to feed on the third day while by the fourth day, most will feed voraciously on suitable food.

Leatherback hatchlings kept in captivity start to feed by the third or fourth day after emergence.

*What do they feed on?*

In nature, they presumably feed on pelagic invertebrates like salps, ctenophores, medusae and jellyfish.

*What dangers do the hatchlings face?*

Once the hatchlings reach the sea, they are exposed to many dangers. Hungry predators like sharks, groupers and snappers, as well as birds feed eagerly on them. Some hatchlings have even been found in the stomachs of adult turtles. Besides natural dangers, marine pollution



also takes its toll. Fatalities occur when hatchlings encounter fresh oil or ingest tar balls mistaken for food.

*Do mother turtles look after their young?*

After laying and covering the eggs, the mother turtle leaves them unguarded and returns to the sea. This parental neglect has many consequences. Predators on the beach, primarily humans and also wild animals dig up the nests and steal the eggs. Ghost crabs which burrow into the nests are also effective predators.

# VI. ECONOMIC IMPORTANCE

*How have the leatherbacks benefited the coastal villagers of Rantau Abang?*

Since time immemorial, coastal villagers have been collecting the eggs of the leatherbacks for consumption and for sale. The eggs hence have provided them with a nutritious source of protein as well

Licensed egg collector at work.

Young and old delight in watching the leatherback nest.




Turtle watching is a mainstay of the tourist industry in Terengganu.

A fee is charged for watching turtles.

The local inhabitants of Rantau Abang benefit from the leatherback in more ways than one.

as additional income. With the promulgation of the Turtles Enactment in 1951, turtle egg collecting came under the control of the State Government. The nesting beaches were subdivided into lots,

with each lot tendered to the highest bidder. Turtle egg collecting hence became a more organised industry, generating revenue for the State as well as creating employment opportunities in egg collecting, patrolling of beaches and in the marketing and sale of turtle eggs. The leatherbacks also attract large numbers of tourists to Terengganu each year. With the influx of tourists, a host of economic activities, ranging from the development of hotels and eating places to the guiding of tourists to nesting spots and the tending of their parked vehicles, is generated. Egg collectors also saw an increase in revenue from gate collections from tourists.

*How many eggs are collected each year?*

The number of eggs collected each year has fluctuated over the years, with a drastically decreasing trend, as shown below:

| Year | No. of eggs laid | Authority |
|---|---|---|
| 1956 | 853,000 | Hendrickson and Alfred, 1961 |
| 1978 | 300,000 | Leong and Siow, 1980 |
| 1980 | 110,000 | Khalijah and De Silva, 1985 |
| 1982 | 68,000 | Khalijah and De Silva, 1985 |
| 1984 | 60,000 | Fisheries Department, Terengganu |
| 1985 | 36,000 | Fisheries Department, Terengganu |
| 1986 | 48,000 | Fisheries Department, Terengganu |
| 1987 | 42,000 | Fisheries Department, Terengganu |

*How much does a leatherback egg cost?*

The price has soared over the years, as indicated in the table below:

| Year | 1960 | 1970 | 1974 | 1976 | 1978 | 1984 | 1986 |
|---|---|---|---|---|---|---|---|
| Price(M$) per egg | 0.08 | 0.10 | 0.25 | 0.35 | 0.50 | 1.50 | 1.80 |



*Why are the eggs so greatly sought after?*

Turtle eggs are greatly sought after for their alleged aphrodisiac and beautifying properties. However, all these claims have no scientific basis. In fact, the nutrient value of turtle eggs does not match up to that of chicken eggs, as shown below:

| | Fresh chicken egg, whole | Fresh turtle egg, whole |
|---|---|---|
| Refuse (%) | 13.0 | 5.0 |
| Energy (Kcal/100g) | 155.0 | 123.0 |
| Moisture (%) | 74.1 | 78.5 |
| Protein (g/100g) | 12.9 | 12.0 |
| Fat (g/100g) | 11.1 | 8.2 |
| Fibre (g/100g) | 0 | 0 |
| Ash (g/100g) | 1.0 | 1.0 |

Extracted from Tee, 1985

*How long can the eggs remain fresh in the markets?*

According to the egg vendors, the eggs remain fresh for up to two weeks. Beyond this period, the eggs are boiled in salt water and sold as preserved eggs.

The eggs are sold either fresh (in polythene bags) or preserved (in pail).

*Do the eggs in the markets contain live embryos?*

When freshly laid eggs are kept in the laboratory for incubation at normal room temperature, the developing embryo becomes clearly discernible after one week. By 10 days, the heart is already well-developed and can be seen actively pumping blood through the fine blood vessels surrounding the embryo. It is quite possible for the fresh eggs in the markets to develop to this point.

*Why are people so attracted to the leatherbacks?*

The leatherbacks hold people in awe. They are enormous, look very primitive and seem so mysterious as they creep silently ashore from the dark seas to perform the laborious feat of nesting, and then, just as unobtrusively, disappear into the night seas again. Unlike most other wildlife, leatherbacks are gentle creatures and are safe to watch, even at close range. They do not attack and are utterly defenceless on the beach. People who have heard of this wondrous creature often make it a point to see the real thing for themselves. Tourists come not only from all parts of Malaysia, but from foreign lands as well.

*How many tourists visit Rantau Abang each year to watch the turtles nest?*

In 1980, Leong and Siow reported that about 800 tourists visit Rantau Abang each month during the peak season. This figure is a very conservative estimate. In 1982, Siow and Moll reported that at least 50,000 tourists flock to the beaches in Rantau Abang each year. In 1984, the present authors made actual counts on the total number of tourists entering one tendered area alone for three consecutive nights and came up with an average of 300 tourists per night.

*Are the leatherbacks killed for their meat and other products?*

In Malaysia, fortunately, the leatherbacks are never intentionally killed for their meat or other products. Most of the coastal villagers associated with the leatherback are Muslims who are prohibited by religion from eating turtle meat. However, elsewhere, especially in Mexico and Irian Jaya (Indonesia), the leatherbacks are diligently



hunted for their meat and oil. The oil is used for varnishing boats, fuelling lamps as well as for medicinal purposes.

*Can we estimate the economic value of a leatherback in dollars and cents?*

The leatherback is a priceless heritage. It is impossible to put a dollar value to its worth. We can, however, estimate its value as an egg producer. Each female leatherback lays an average of about 450 eggs per season. At the current price of $1.80 per egg, this works out to a value of about $800 worth of eggs per season. Tagged turtles have been found to be still actively laying eggs 15 years after they have been tagged on the beach. Since they lay eggs every alternate year, each female, if not killed prematurely, is capable of breeding at least 7 times in her lifetime. Hence each female leatherback is worth at least $5,600 for her eggs alone. What about her value as a tourist attraction, and her biological value as a survivor of the primitive mammoth reptiles? It is indeed impossible to state these in monetary terms.

# VII. THREATS

*Is egg collection threatening the survival of the leatherbacks?*

It is one of the major causes of the decline of our leatherback population. Until 1961, all the eggs collected were sold in the markets for consumption. From 1961, with the inception of the Hatchery Programme in Rantau Abang, some of the eggs were retained for hatching, but the majority still went to the markets. The small number of eggs retained for the hatchery, together with the low hatching success rate and poor survival rates of the hatchlings to adulthood has contributed significantly to the declining numbers of our leatherbacks.

*Besides humans, are there any natural predators of the eggs?*

The most common predators of eggs buried in nests in Rantau Abang are ghost crabs and the larvae of sand flies. Mortality due to fungal and bacterial attacks is also common. In more remote nesting beaches elsewhere, wild animals like raccoons, dogs and pigs are the most serious predators.

Unhatched eggs attacked by fungus.

*Will leatherbacks nest on disturbed beaches?*

Like most other sea turtles, leatherbacks prefer quiet and remote beaches. Some parts of Rantau Abang have been turned into tourist



Eating shops are built on a stretch of beach used by leatherbacks for nesting.

Some visitors create a lot of disturbance on the beach while waiting for turtles to land.

spots with hotels, rest houses and eating shops built on the very beaches where the turtles nest. Hawkers abound and flood the beaches with their fluorescent lights. At the same time, hundreds of tourists wait on these beaches for the turtles to land. The turtles will avoid beaches with such disturbances. Fortunately, the greater part of Rantau Abang has not been developed and is still suitable for nesting.

*Are tourists responsible for the decline in our turtle numbers?*

Thousands of local and foreign visitors flock to Rantau Abang to

Turtles avoid lighted beaches.

watch the leatherbacks. While waiting for the turtle to land, some dance, sing, play music, build campfires, and shine powerful torches on the beaches. All these activities frighten the turtles away. In very remote leatherback nesting beaches, e.g. in Santa Rosa Park in Costa Rica, the number of nesting turtles has increased tremendously over the years. It has been suggested that these populations have been augmented by adults which have emigrated from less suitable areas. We in Malaysia may be losing our leatherbacks to other countries.

Hundreds of tourists descend upon a turtle when she lands, making it impossible for her to nest.



Tourists should never be allowed to approach a nesting turtle so closely.

*Do people torture the leatherback turtles?*

Some of them do. They climb onto the turtle's back to test her strength or to take souvenir photographs. Some jump on her, pull her flippers while others prod and push the defenceless animal. Many flash lights directly onto her eyes. Another form of torture is crowding a turtle when she lands on the beach. The thick crowds follow her so closely that often, the poor turtle is forced to return to the sea without laying her eggs. And even when she heads for the sea they prod her and block her path. The poor turtle is laden with eggs and must deposit them. If she is lucky, she may find a more suitable site the following night, if not, she may release her eggs in the sea.

*Why are some people so callous and inconsiderate?*

Perhaps the biggest factor is ignorance. They also lack compassion and love for animals. Public education will help alleviate this problem. Education, however, is a slow process and it may take many years before the public can start to feel for the animals and be kind to them.

*Why are plastic bags littered on the beaches fatal to the leatherbacks?*

Leatherbacks feed predominantly on jellyfish. Plastic bags littered on the beaches eventually find their way to the sea. The floating plastic bags look very much like jellyfish to the leatherback and are often mistaken for its favourite food. When eaten, the plastic bags block the intestines as the turtle cannot digest them. This results in the death of the turtle.

*Do leatherbacks get entangled in fishing nets?*

Yes, they do. They are incidentally caught in trawl nets, gill nets, trammel nets, bottom long-lines and fish traps. Once caught, most of them die as they cannot surface for air.


Part of the beach hatchery being damaged by erosion.

*Can lighted fishing boats at sea scare turtles away?*

It is possible that they do. Many squid-jigging boats and purse seiners use strong lights to attract squid and fish at night. These boats operate very near the major nesting beaches. An approaching turtle will see these lights which are often aligned in a long stretch, and may turn away, back to the offshore waters.



*Besides man-made disturbances on the beach, are there natural forces which threaten the survival of the leatherbacks?*

Beach erosion is the most powerful natural force responsible for altering the nesting beaches. However, the extent to which this may be destroying the beaches in Rantau Abang is not known. Erosion may also destroy nests. In 1986, a large portion of the hatchery was washed away by powerful waves. Some of the exposed eggs were retrieved and reburied, but it is doubtful that many of those embryos survived.

*Does pollution affect the leatherbacks?*

It certainly does, although we cannot as yet quantify the extent to which it may kill the leatherbacks. Trash, especially plastic bags, as noted earlier is fatal to leatherbacks. Chemical pollution entering the oceans may adversely affect the turtles and hatchlings. Oil spills pose a serious potential threat. When oil is spilled into the ocean, it slowly hardens and breaks up into tiny balls of tar. These tar balls are carried by the currents and may be consumed by young turtles. A few studies have indicated that the tar balls are extremely harmful to young turtles.

*Do adult leatherbacks have natural enemies in the sea?*

By nature of their size, adult leatherbacks do not have serious predators in the sea. They may lose parts of their limbs and the edges of their 'shell' to sharks and other large predators, but are known to be able to survive such attacks.

*Can active hunting for leatherbacks elsewhere affect the population in Rantau Abang?*

It can. As we know, leatherbacks are highly migratory animals and travel across national boundaries. Some of our leatherbacks may be killed by other nationals.

# VIII. CONSERVATION

*Are there any laws to protect the leatherbacks in Rantau Abang?*

The Turtles Enactment, 1951 prohibited the killing of turtles and provided for the control of collection of turtle eggs. Under this system of management, the nesting beaches were tendered to licensed egg collectors, while a half mile stretch was reserved for the State Fisheries Department to collect eggs for hatchery work. Additional eggs were also purchased from the egg collectors to augment the numbers collected on the government beach for hatching.

In view of the decline in turtle numbers, the Turtles Enactment, 1951 was amended by the Turtles (Amendment) Enactment, 1987 which included provisions for the implementation of more effective measures for the management of sea turtles in Terengganu. While licensed egg collection is maintained, the Amendment provides for the establishment of turtle sanctuaries, prohibits the disturbance of turtles and increases penalties for violations of rules. Hence, "any person who disturbs any turtle in any way whatsoever during its passage up to the nesting place or during the nesting process or on its way back to the water, or overturns, climbs on to the back of, or causes any physical injury to any turtle shall be liable to a fine not exceeding one thousand ringgit or imprisonment not exceeding six months or to both."

*Who is responsible for protecting our sea turtles?*

All concerned citizens should feel responsible for the continued survival of our sea turtles. Officially, however, management of sea turtle resources comes under the jurisdiction of the State Government, while the practical aspects of management are handled by the State Fisheries Department.

*How many of the eggs laid are actually used for hatching?*

The number of eggs purchased for hatching has fluctuated according to available funds. Since the inception of the hatchery in 1961, the



numbers incubated per year have ranged from 8,000 to 91,000. From 1988 onwards, all the eggs deposited on the beaches will be purchased for hatching. The total number of hatchlings released to date approximate 500,000.

*How are the eggs incubated in the hatchery?*

The hatchery is an open-air, fenced-off area on the nesting beach itself and is located above the high tide mark. Eggs collected at night

The Rantau Abang beach hatchery.

Preparing sand nests in the hatchery.

are brought to the hatchery within two to three hours after they have been laid. Nests of about 60 cm deep and 25 cm in diameter are excavated one metre apart. Eggs from different natural nests are not mixed but are planted in their own individual hatchery nests. The eggs are then covered with moist sand and the nest is labelled to indicate the date of burial, and number of eggs contained within. A few days before emergence is due, each nest is surrounded by a 45 cm diameter chicken mesh to a height of about 20 cm, with about 10 cm buried in the sand. Hatchlings usually emerge after sunset when the surface sand temperatures have dropped. The number of hatchlings emerged from each nest is recorded before they are released.

Leatherback eggs in a hatchery nest.

Hatchlings emerge after sunset and are restrained for counting before release.



*Can the eggs incubate in indoor hatcheries as well?*

Eggs can be incubated in styrofoam boxes kept in indoor hatcheries. Hatch rates in boxes are high and often better than in beach hatcheries. However, temperatures in styrofoam boxes stacked above ground in indoor hatcheries are generally lower than in the sand at the depth of turtle nests. Incubation temperatures affect the sex of hatchlings, with lower temperatures producing mostly males. Hence, incubating eggs in indoor hatcheries will result in more males than females. Since the discovery of the effects of temperature on sex, conservationists have advocated that open air beach hatcheries be used in conservation programmes.

*Where are the hatchlings released?*

Hatchlings are released on the beach in which they were incubated soon after emergence and are allowed to crawl towards the surf and swim towards the open waters.

Release of newly emerged hatchlings.

The hatchlings dash to the sea when released.

*Can the hatchlings be reared in captivity?*

Unlike the other species of sea turtles, leatherback hatchlings are extremely difficult to maintain. They swim incessantly into the walls of any enclosure and injure themselves. A few isolated attempts have been made to rear the hatchlings but without success. While there are on-going head-starting programmes (i.e. the practice of raising hatchlings in captivity for a period of time before releasing them) for the other species of sea turtles, none exists for the leatherback.

*What can be done to reduce the incidental catch of turtles in fishing nets?*

Fishing in coastal areas where turtles occur during the nesting season should be controlled or prohibited.

Fishermen can modify their fishing gear to reduce the incidental catch of turtles in their nets. A device called the TED (Trawling Efficiency Device) has been developed in the U.S. to release turtles which have been trapped in shrimp nets. Many shrimpers now fix the device to their trawl nets to reduce the incidental catch of turtles. The device is also able to sort out the by-catch and exclude them from the shrimp catch, hence increasing the efficiency of shrimp trawls.

Fishermen can be taught to resuscitate turtles caught in their fishing nets. These turtles often appear dead, but a good number of them are just moribund and can be revived by resuscitation.

Fishermen can also be encouraged to reduce their trawling or setting times. It has been estimated that if a turtle is rescued in less than an hour after being trapped, it stands a good chance of survival. Hence if trawl nets and other fishing gear are pulled up more frequently, trapped turtles will have better chances of survival.

*What should tourists do when watching leatherbacks to ensure that they nest successfully?*

First of all, while waiting for a turtle to come to the beach, the tourists should sit quietly in the dark. They should not build campfires, shine torches on the beach, and sing, dance or play music. When a turtle comes up from the water, the tourists should remain in the dark and avoid crowding around her and shining lights on her. Such activities



Tourists should sit quietly in the dark while waiting for turtles to land.

will scare the turtle and may cause her to turn back to sea. Watch her from a distance throughout the nesting process. When the turtle is ready to return to sea after completing her nesting, allow her to do so without causing any disturbance to her. Do not, under any circumstances, ride her, pull her flippers, jump on her or injure her physically. Such physical acts of abuse may have adverse effects on future nesting returns.

*Is there anything being done to educate the public?*

A Turtle Information Centre in Rantau Abang is now open to the

The Turtle Information Centre in Rantau Abang.

public. There the public can view displays on Malaysian sea turtles, their biology, distribution, migration, threats to their survival and conservation aspects. Presently, the Faculty of Fisheries and Marine Science, Universiti Pertanian Malaysia, with sponsorship from ESSO Production Malaysia Inc., is conducting a Sea Turtle Research and Conservation Project. A very important aspect of this project is public education. Brochures, posters, and a colouring book for children are being produced for dissemination to schools and the public to help increase public awareness of the plight of our sea turtles.


Samples of educational materials developed for public education.

*What can tourists or the general public do to help in turtle conservation?*

Sea turtles suffer from a lack of public awareness. In fact, many people do not even know that they exist. Hence the first thing people can do is to educate themselves about sea turtles. Then only can they appreciate the turtles, know the dangers facing them and effectively explain the plight of our turtles to others. Admittedly, general information on Malaysian turtles is severely lacking. Attempts are now being made by the Sea Turtle Research and Conservation Project of Universiti Pertanian Malaysia to produce educational materials on



sea turtles. These materials are obtainable from:

*Sea Turtle Research and Conservation Project,*
*Pusat Perikanan dan Sains Samudra,*
*Universiti Pertanian Malaysia,*
*Mengabang Telipot,*
*21030 Kuala Terengganu,*
*MALAYSIA*

You can help distribute turtle information to interested friends, schools, clubs, libraries, etc. The more people learn about these gentle reptiles, the more they will appreciate them. You can also submit articles and letters to local newspapers. If you see people torturing nesting turtles or disturbing them, photograph the culprits and write in protest to the newspapers, State and Federal Fisheries Departments or Universiti Pertanian Malaysia. Some of the addresses are:

*Fisheries Department,*
*Wisma Tani,*
*Jalan Mahameru,*
*50628 Kuala Lumpur,*
*MALAYSIA.*

*Fisheries Department,*
*6th Floor, Wisma Persekutuan,*
*Jalan Sultan Ismail,*
*20200 Kuala Terengganu,*
*Terengganu Darul Iman,*
*MALAYSIA.*

*Universiti Pertanian Malaysia*
- address given above.

*Are there any international laws to protect the leatherbacks?*

Several international laws and conventions provide for the protection of sea turtles in general. CITES (1973) (Convention in International Trade of Endangered Species of Wild Fauna and Flora) was

designed to control international trade in endangered species, their products and parts. Species threatened with extinction are listed in CITES Appendix I and are subject to strict trade regulation. All species of sea turtles are now listed in Appendix I. The Convention on the Conservation of Migratory Species of Wild Animals (1979) provides guidelines for the conservation of migratory animals, including sea turtles. Other conventions and treaties which may contribute to sea turtle conservation include the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere, the Convention on Wetlands of International Importance, the Convention Concerning the Preservation of the World Cultural and Natural Heritage and the Law of the Sea Treaty. It is important that national planners familiarize themselves with these international conventions so that they can encourage their governments to ratify and enforce them.

*How can research contribute towards sea turtle conservation?*

Research plays an important role in supporting sea turtle conservation efforts. It helps to advance our knowledge of the biology of sea turtles which is crucial to the formulation and assessment of conservation efforts. For example, if we wish to protect their nesting grounds and feeding or internesting grounds, we need to know where these grounds are located. We also need to do research to find out how we can optimise hatch rates in hatchery work. How should we handle the eggs? How many eggs should we put in one nest? Will the number have any effect on nest temperatures and subsequently the sex ratios of the hatchlings produced? Are all the eggs fertile? If not, how do we select fertile eggs for hatchery work? Answers to these questions and many more can be obtained only through relevant research.

*Are Malaysian scientists conducting research on leatherbacks?*

To date, over 80 papers have been written on Malaysian sea turtles, with about half of them specifically on leatherbacks. Past papers have dealt mainly with ecological and conservation aspects. Presently, Universiti Pertanian Malaysia is conducting research on



optimization of hatchery production, embryology, sex ratio experiments, development of criteria for selecting fertile eggs for hatchery work, offshore tracking, etc. Surveys are also being conducted to determine the extent of turtle mortalities in fishing nets and the economics of the turtle egg collection industry. Such work is important and will help advance our knowledge of these magnificent animals.

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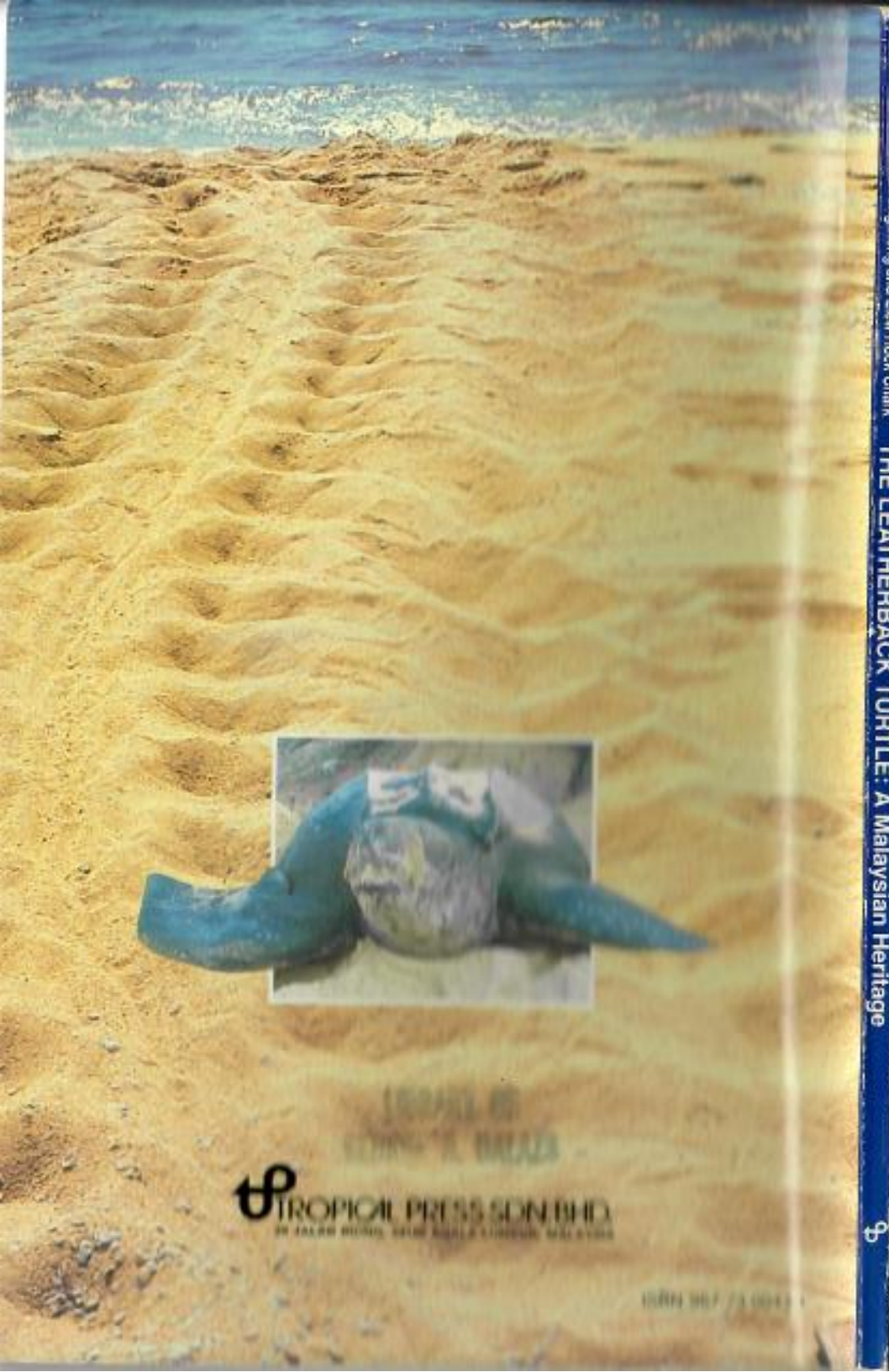

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THE LEATHERBACK TURTLE: A Malaysian Heritage

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