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Sea Turtle
Biology & Conservation

UNIVERSITI MALAYSIA TERENGGANU

TOPIC 3: REPRODUCTION

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Topic Outline:

- Nesting
- Eggs and hatchlings
- Juveniles and adults

Nesting

- Reproduction in sea turtles occurs within three general constraints:

i. Nesting must occur during conditions which are conducive to adult activity

ii. Nesting must occur during conditions which facilitate embryonic development and survival

iii. Hatchlings must emerge into conditions that are conducive to their survival

Miller, 1997

Nesting

- **Because of the constraints:**

i. **Sea turtle exhibit iteroparous reproduction (multiple reproductive cycles over the course of its lifetime.)**

ii. **Stereotyped nesting behavior**

iii. **Laying large number of eggs several times during reproductive period**

iv. **Strong attachment to a particular location for nesting**

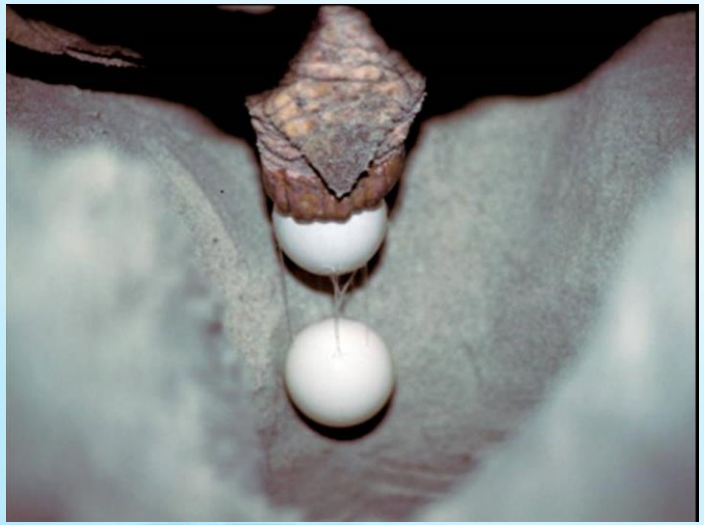
Miller, 1997

Nesting

- The major aspects of reproduction are very similar among the seven species of sea turtles.
- Carr (1967) suggested philopatry and nest site fidelity within the birth region for sea turtles. This is called as natal homing. It is now well established that sea turtles migrate between their foraging and nesting areas with a high accuracy.
- After mating, female sea turtles will come up to the beach to lay eggs. They emerge at night to deposit eggs and nesting processes take about 1 – 3 hours. Females can deposit up to 10 clutches in a breeding season at intervals of 10-14 days. Mean clutch size is about 110-115 eggs, but it varies among populations.
- Sea turtles are spreading their reproductive effort through time, which reduces the impact of an unpredictable environment on hatchling production. By laying several clutches of eggs at approximately 2 weeks intervals, the likelihood of all eggs being lost is greatly reduced.

- Mating occurs during the beginning of each nesting season
- Near the nesting beaches
- After mating, male turtles will return back to the foraging grounds
- Female mates with multiple males

Nesting



- Nesting normally occur at night
- Female sea turtles will lay several nests in a breeding season
- Depending on the species, sea turtles can lay 100 – 200 eggs
- Cloaca: the structure that releases the eggs
- Eggs are laid singly or in small groups, covered with thick mucus
- The mucus & soft leathery shell help to cushion the eggs as they drop into the nest

Nesting Process

- The general nesting process is essentially the same in all species of sea turtles. The nesting behavior of sea turtles is constrained by their anatomy and the environment in which nest is constructed.
- Most of the differences in nesting behavior may be attributed to the size of nesting turtle, which influence the speed and mobility on the beach and the depth of the nest.

Nesting Process

1. Landing
2. Crawling up the beach
3. Digging of body pit
4. Digging of egg chamber
5. Laying eggs
6. Covering the egg chamber
7. sand-bathing (camouflaging of the nest)
8. Crawling down to the sea
9. re-entering the sea

Nesting process: 1 to 3 hours. In extreme cases (dry sandy beach) it may take 7 or more hours.Process 1 - 5: sea turtles are very sensitive to any disturbance.

Nesting

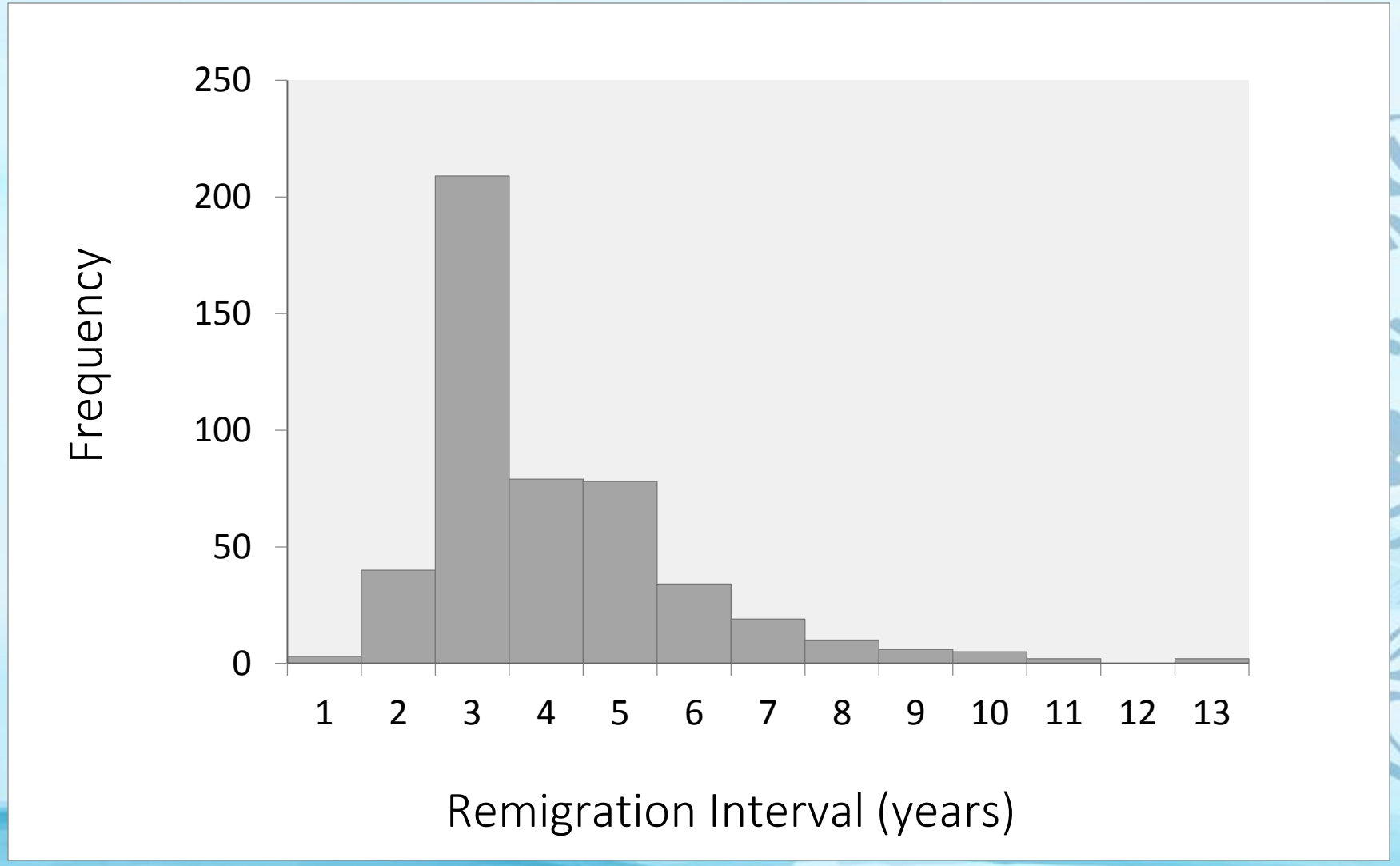
Unusual nesting behaviour:

- Some populations of Ridley turtles nest during day time
- Nest '*en mass*' in Costa Rica (Arribada – which means the arrival in Spanish)
- Thousands of females come ashore to lay their eggs at the same time (correlated with moon and tidal phases)

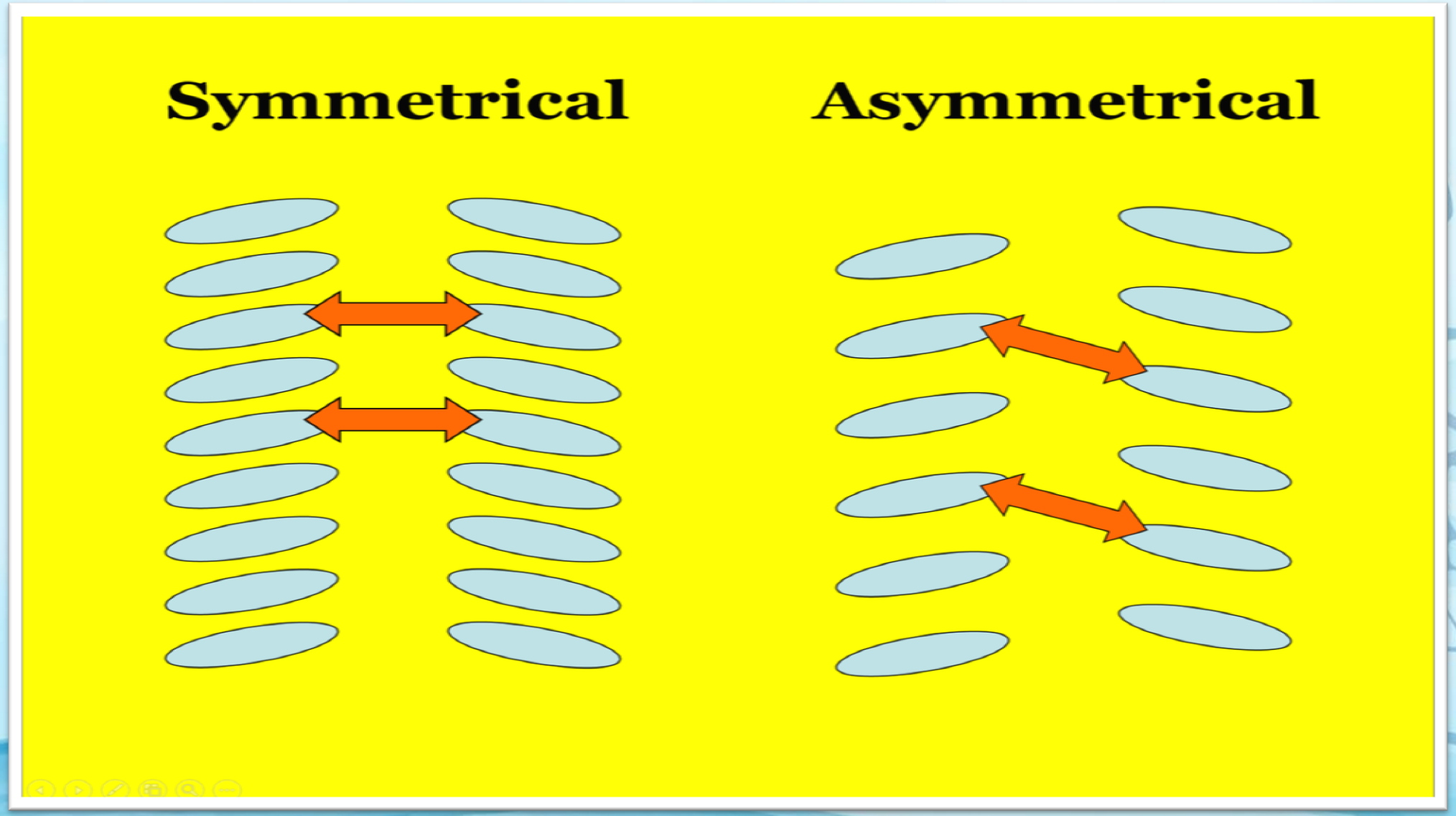
Nesting

- In general, female sea turtles do not reproduce every year.
- However, males of at least some species (e.g. Caretta caretta) may breed every year.
- The duration of the period between reproductive seasons is defined as the remigration interval. The remigration interval reported for female sea turtles varies among the species. For the green turtle in Redang, remigration interval is between 2 to 10 years and for the hawksbill turtle between 2 to 5 years.
- The timing of reproduction in marine turtles tends to follow periods of ample food during which the turtles accumulate fat reserves (one to several years), complete vitellogenesis (production and storage of yolk in the oocyte; 10 to 12 months) and migration to breeding and nesting areas (a few days to a few months).
- In the herbivorous green turtle, the interval period varies according to El Nino-Southern Oscillation (ENSO) events. It can be as short as 2 years following ENSO or up to 10 years during anti-ENSO periods. It is postulated that the ENSO weather events are associated with warming of sea surface temperatures and increased growth of seagrass and algae, which has a positive impact on the energy cycle, and hence reproductive cycle, of the green turtle.

Remigration Interval of gereen turtle at Chagar Hutang



Sea Turtle Track



Sea turtle track

Asymmetrical Tracks

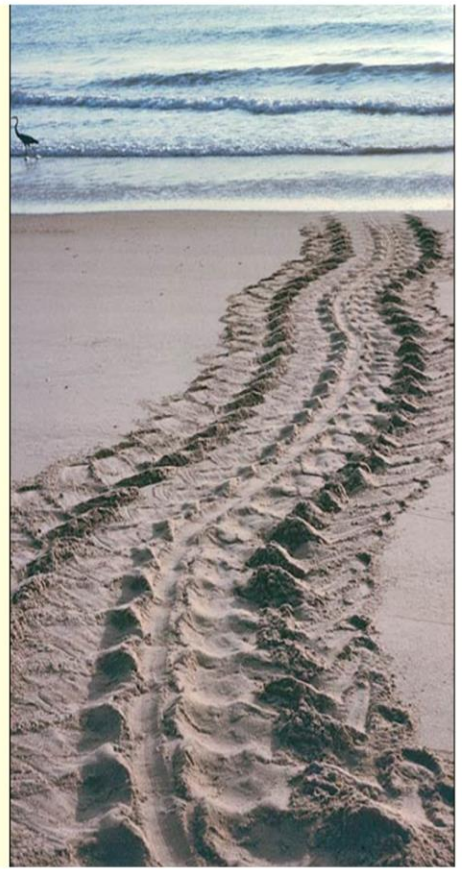
Kemp's Ridley

Olive Ridley

Hawksbill

Loggerhead

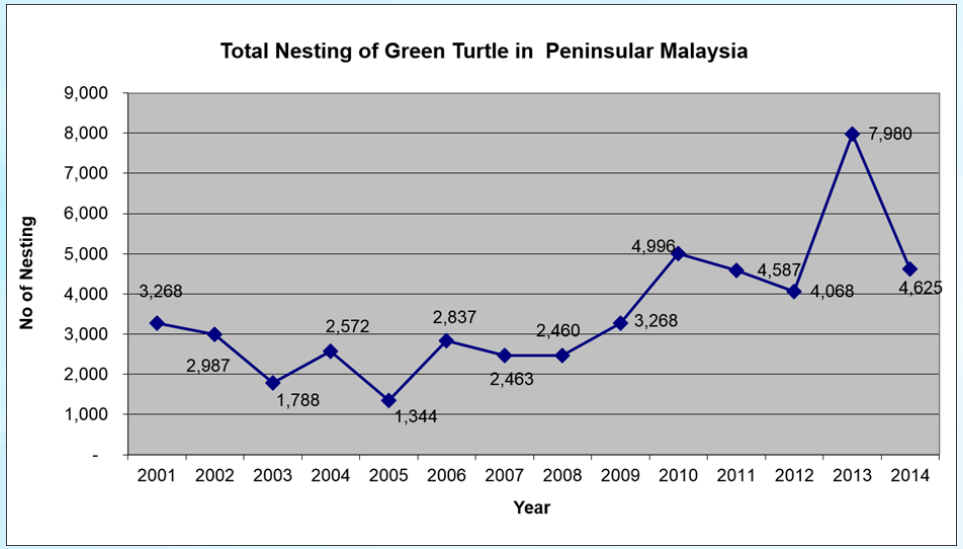
Symmetrical Tracks

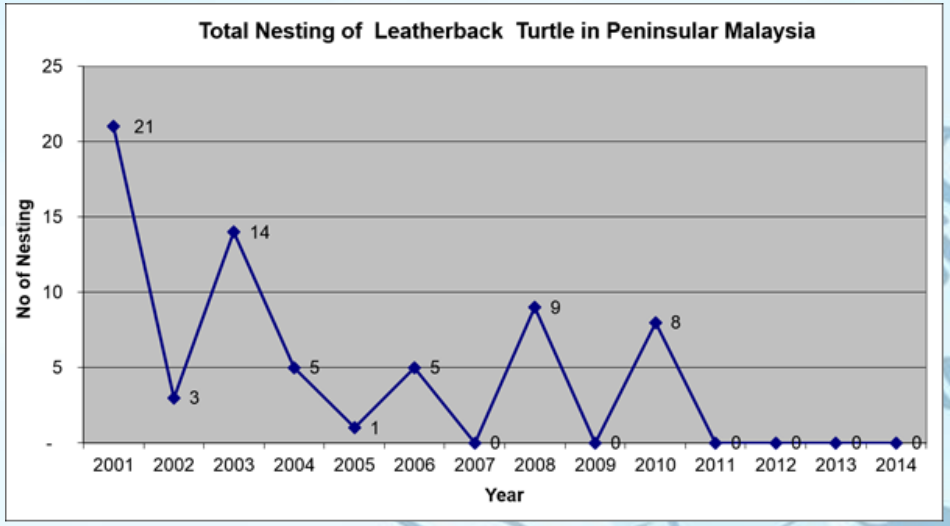


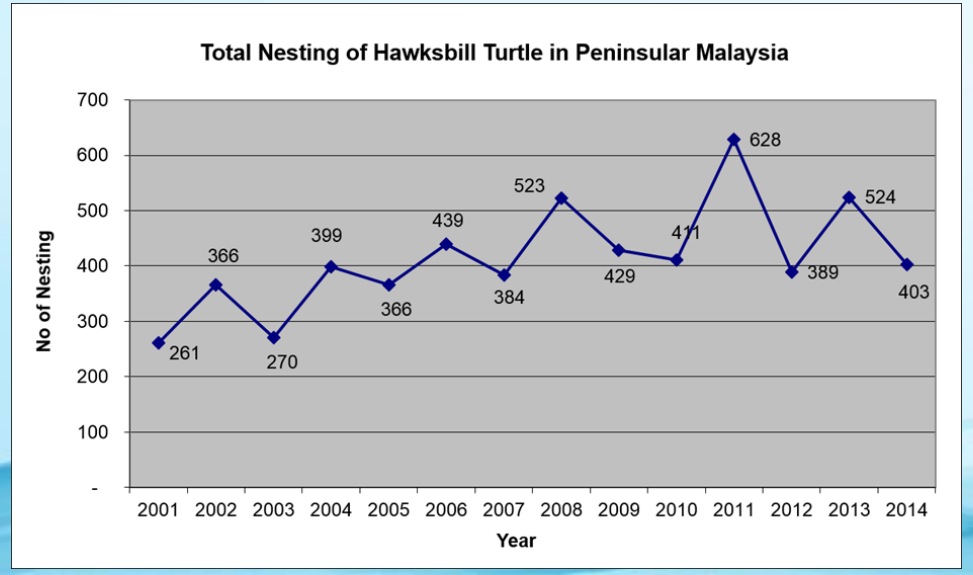
Leatherback

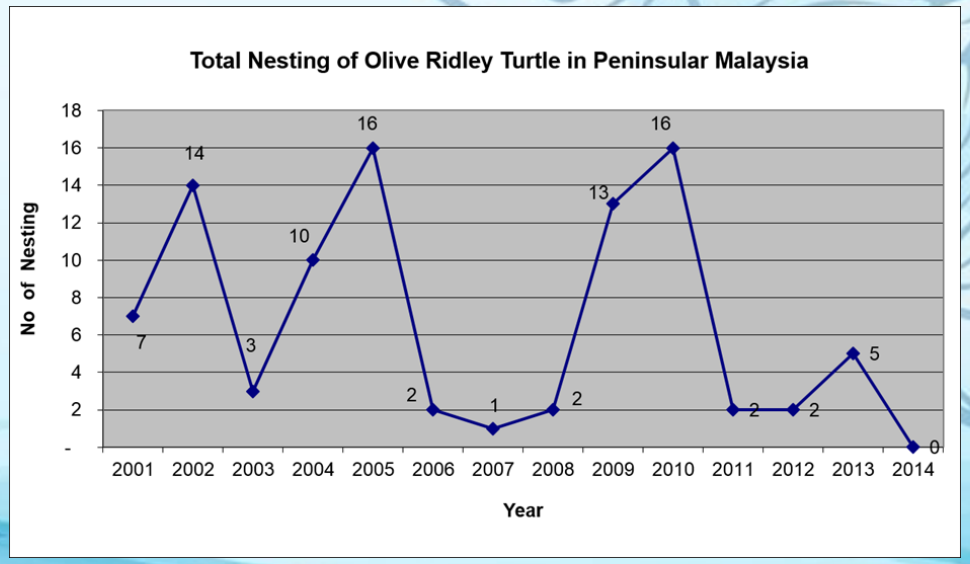
Green

Nesting statistics of sea turtles in Peninsular Malaysia



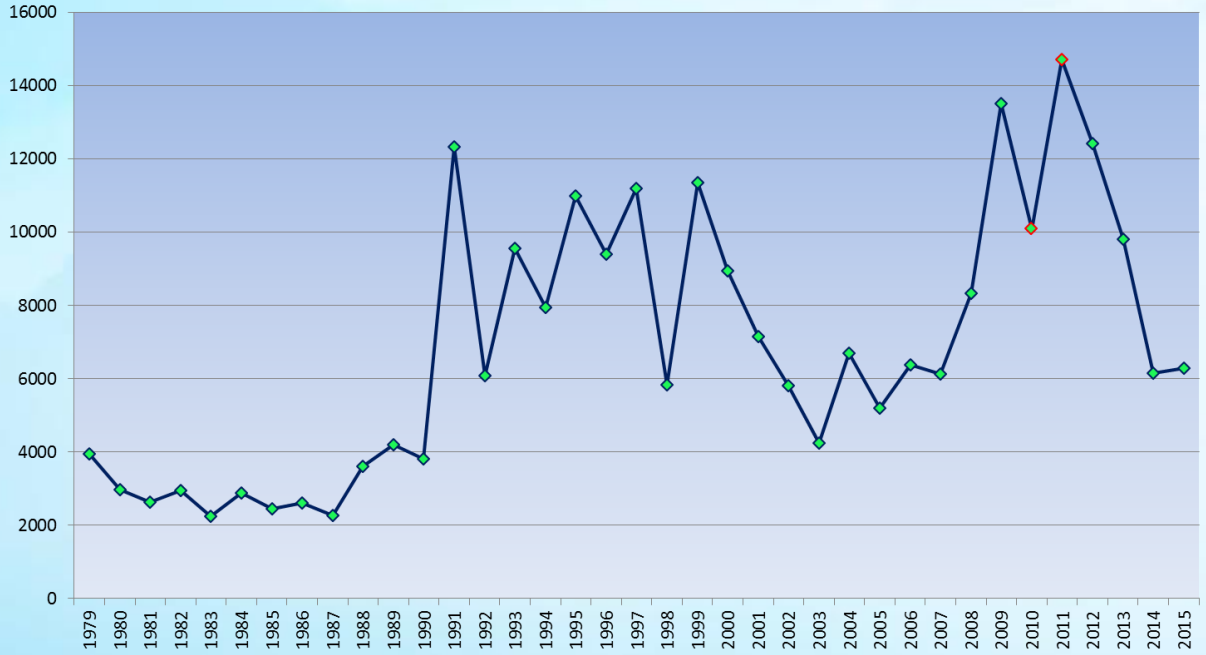




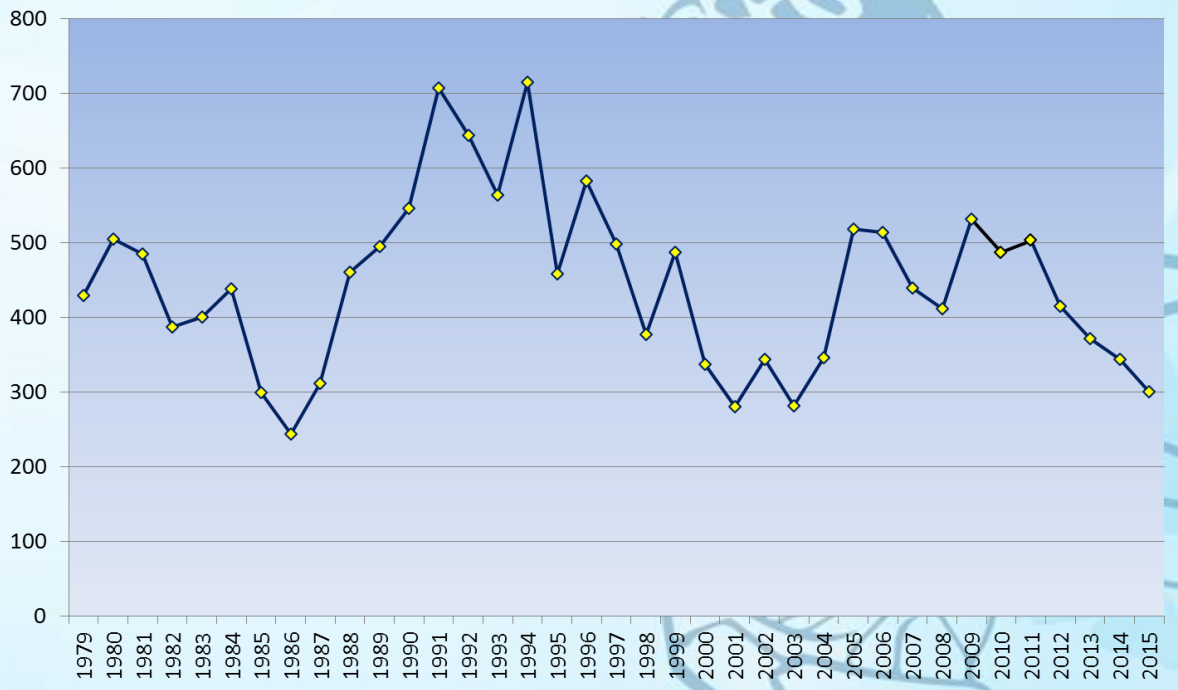


Nesting statistics of sea turtles in Sabah

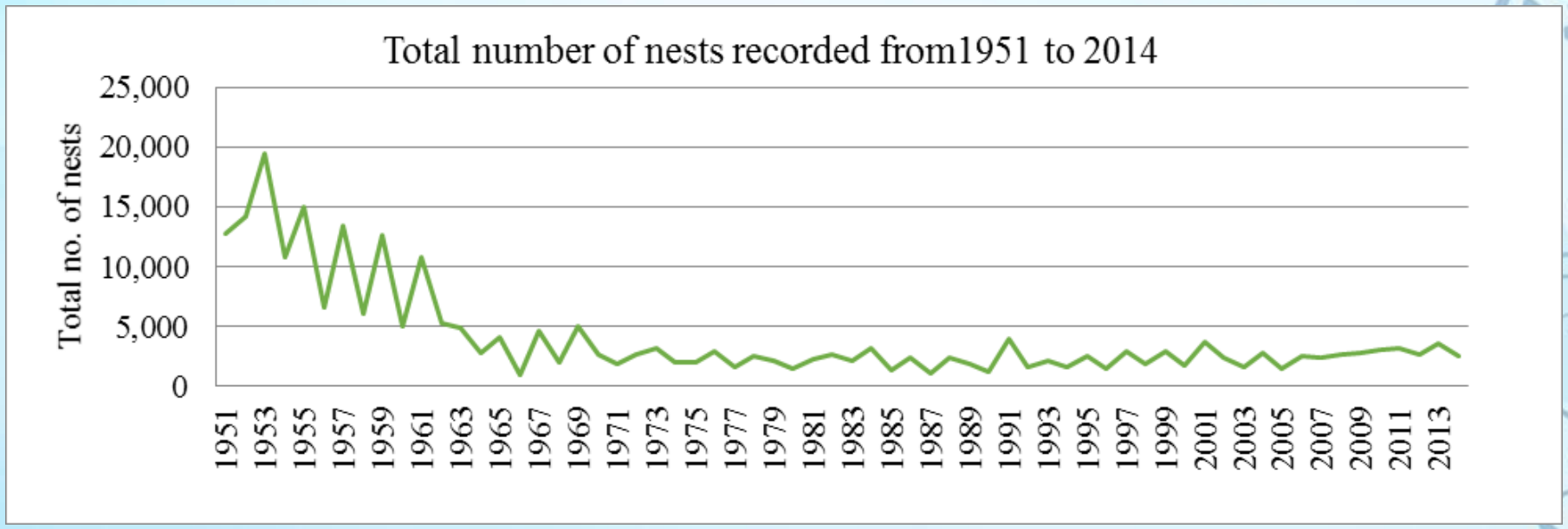
Total Nesting of Green Turtle at Sabah Turtle Islands



Total Nesting of Hawksbill Turtle at Sabah Turtle Islands



Nesting statistics of sea turtles in Sarawak



Eggs and hatchlings

- All sea turtles lay white, spherical cleidoic eggs with flexible calcareous shells.
- The size of eggs laid in each clutch varies slightly between clutches laid by one female as well as within and between species. At species level, large sea turtles lay large eggs and small ones produce small eggs.
- The number and size of eggs, and the number of clutches laid represent the result of an adaptive compromise for survival.

Eggs and hatchlings

- Sea turtle nest contains around 100 eggs, which measure 4-5cm and weigh 20-30g. Eggs hatch after about 60 days and sex determination of the hatchlings depends upon the incubation temperature.
- Hatchlings excavate through the sand for two to three days, before emerging, weigh 20-25g and measure 4-5 cm in length.
- The mutual stimulation by the hatchlings was described as ‘social facilitation’. Social facilitation describes the upward digging activity of the hatchlings that is stimulated by the activity of other hatchlings, usually from the bottom of the chamber.

Eggs and hatchlings

- Hatchlings usually emerge onto the surface of the beach during the early evening.
- Hatching success of undisturbed nests is usually high (80% or more), but predators destroy a high percentage of nests in some beaches. Hatchlings are believed to have a survival probability of <0.01.
- Upon leaving the nesting beach, it has been hypothesized that hatchlings begin an oceanic phase, perhaps floating passively in major current systems that serve as open-ocean developmental grounds.

It is estimated that only 1 in 1,000 hatchlings will survive to sexual maturity (adulthood)

Juveniles and Adults

- After a number of years in the oceanic zone (about 10 years), juvenile turtle recruit to neritic developmental areas rich in seagrass and marine algae where they forage and grow until maturity.
- Foraging habitat normally are shallow with abundance of food. Juvenile sometimes shared this area with adult turtles.
- Juvenile will shift from one developmental area to another.
- Adult turtle: will be a resident to a particular foraging ground

- Sea turtles do not begin to breed at a uniform or minimum size. This means that size is not a reliable indicator of maturity or breeding status.

How to identify male and female sea turtles

Males have a longer thicker tail than females

Juveniles and Adults

- Upon attaining sexual maturity green turtles commence breeding migrations between foraging grounds and nesting areas, that are undertaken every few years.
- Migrations are carried out by both male and female turtles. During non-breeding periods adults reside at coastal neritic feeding areas and sometimes coincide with juvenile developmental habitats.

- Reproductive migrations of green turtles are the best documented because of the ease of tagging adult females on nesting beaches, as well as telemetry studies conducted over the years.

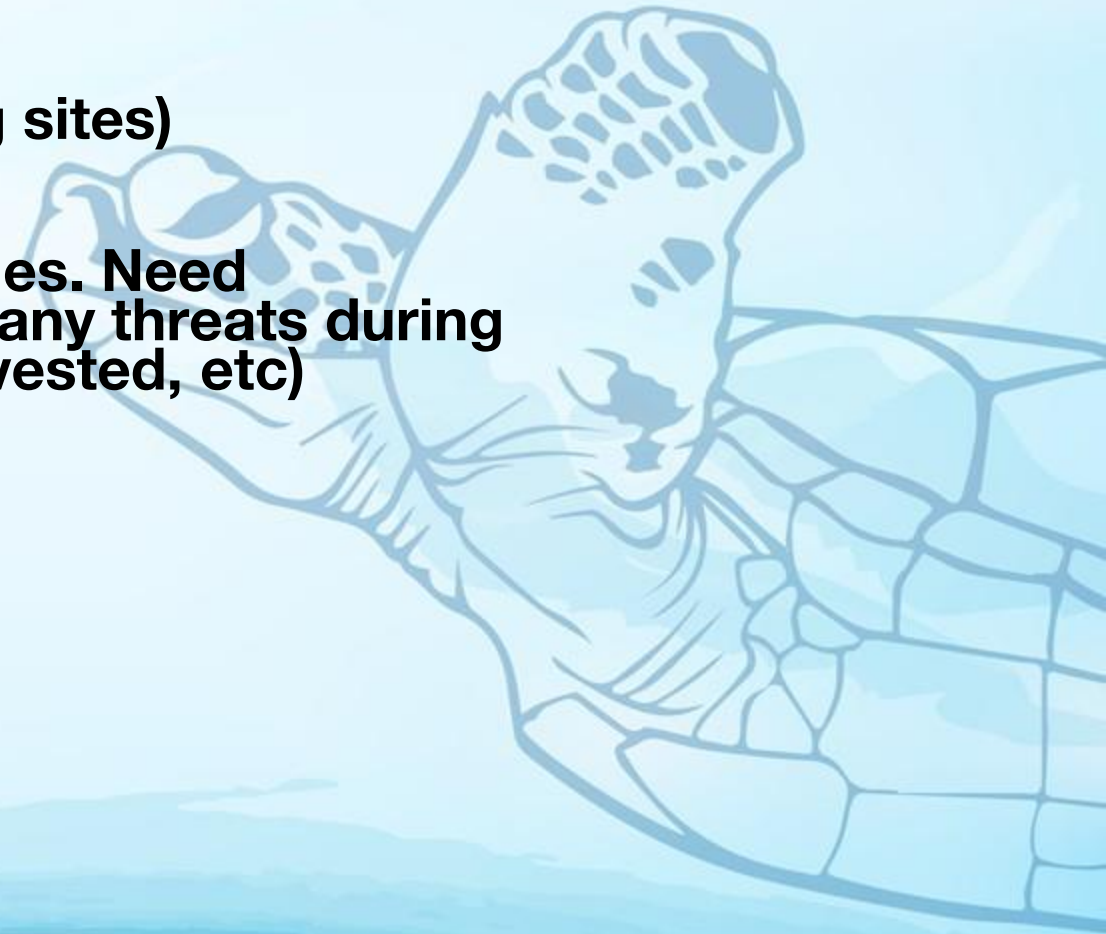
Juveniles and Adults

Migration routes of green turtles in South East Asia using Satellite Telemetry Study (SEAFDEC)

Critical Biological Adaptations

1. Migration of sea turtles

- Unique characteristic of sea turtles
- Seasonal migration (nesting to foraging sites)
- Natal homing
- During migrations: Involved few countries. Need international collaboration. Faced so many threats during migration (entangled in fishing net, harvested, etc)

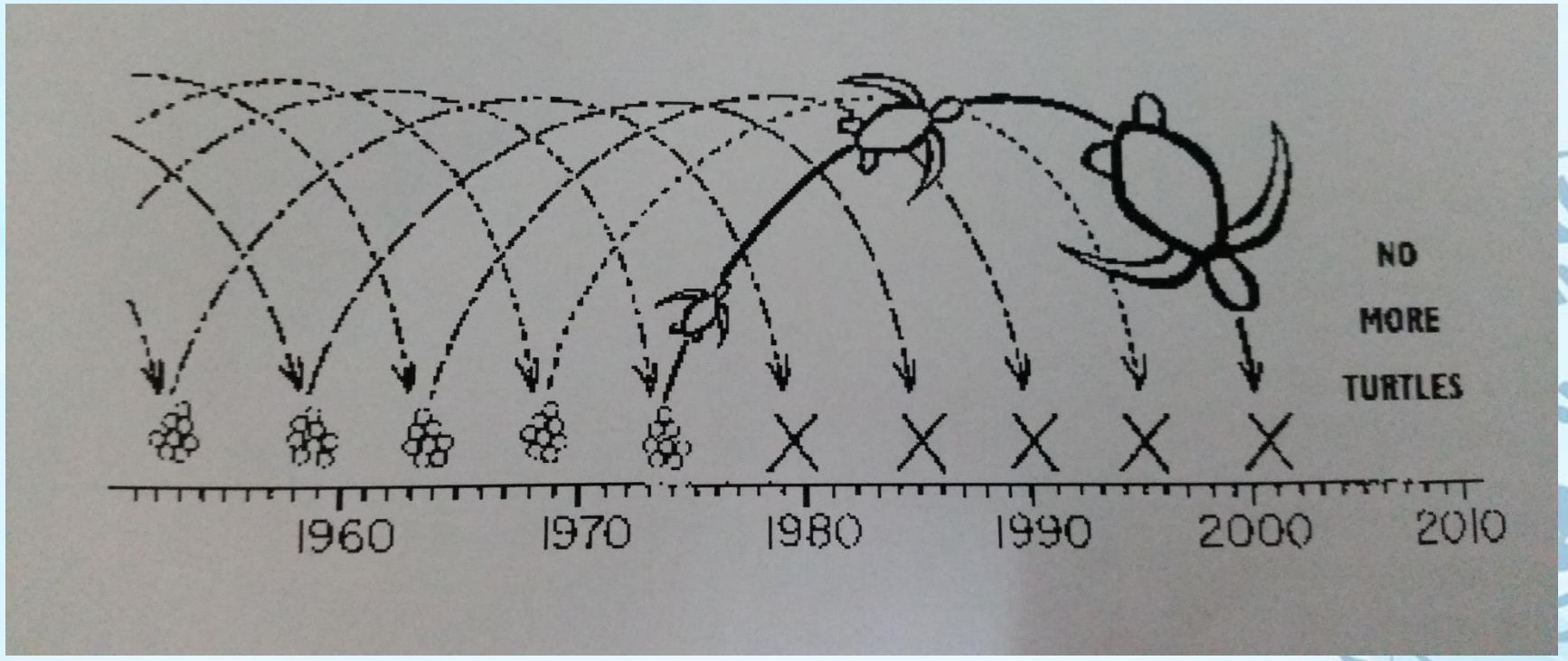


Critical Biological Adaptations

2. <u>age at maturity</u>

- Long lived (> 100 years)
- Sexual maturity (20 – 50 years).
- Need proper conservation measure. Hatchlings produced will only come back to natal beach in 20 – 50 years.
- Exploitation effects (eg: exploitation of eggs, harvesting of sea turtles at their foraging grounds) will only be known in 20 years time

Critical Biological Adaptations



If 100% of turtles were harvested each year before laying eggs, there would reach a point at which no further breeding females would be available. However, this would not become apparent for another 25 years (Mortimer, 1995)

Critical Biological Adaptations

3. Habitat requirement

- **Different habitat in turtle life cycle (nesting beach, open ocean, foraging habitats –seagrass, coral reef, deep ocean)**
- **All habitats must be protected and conserved**
- **Global climate change issues**