

**RESEARCH, CONSERVATION AND EDUCATIONAL
ACTIVITIES OF THE SEA TURTLE RESEARCH UNIT (SEATRU),
UNIVERSITI PUTRA MALAYSIA TERENGGANU**

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INTRODUCTION

The Sea Turtle Research Unit (SEATRU) of Universiti Putra Malaysia Terengganu was established in 1984 when research on sea turtles was first initiated in the university. After concentrating its efforts on conservation-related research in the first ten years which resulted in the production of over 60 publications, SEATRU has now expanded its activities to include conservation, educational, as well as public participation projects. This presentation will highlight research activities, findings and their applications, while conservation, educational and public outreach programmes will be briefly described.

RESEARCH ACTIVITIES, FINDINGS AND APPLICATIONS

Tagging and Nesting Biology

A long-term saturation tagging and nesting study was initiated on the green and hawksbill turtles of Chagar Hutang beach in Pulau Redang in 1993. The nesting beach is only 330 m long, but represents the most important nesting beach for green turtles in Peninsular Malaysia. All nesting emergences are monitored for six to seven months each year and turtles are double tagged using titanium and inconel tags. The basic data on the nesting population here compiled over the last seven years in summarised in Table 1.

Table 1. Basic biological data on the nesting green and hawksbill turtles of Chagar Hutang, Pulau Redang. (From Liew and Chan, unpublished data and Chan and Liew, 1999)

Parameter	Green Turtle	Hawksbill Turtle
Total no. of nests deposited per year	400 - 600	4 - 21
No. individuals tagged per year	63 - 139	1 - 6
Interseasonal nesting frequency (average)	3 - 5 years	2 - 4 years
No. of nests per individual per year	range: 1- 11, mean: 5 - 6	range: 1 - 6, mean: 3 - 4
Interesting interval (days)	range: 9 - 12, mean : 10	range: 12 - 18, mean: 15
No. of eggs per nest	range: 30 - 160, mean: 99	range: 115 - 202, mean: 156

Large amounts of data initially recorded on field forms have to be processed and analysed. From 1993 to 1998, a total of 3,836 nesting datasheets and 1,949 hatching datasheets were collected. To process them, a database system using Filemaker Pro was developed to handle the data enabling rapid access to summaries and reports.

Hatchery and Sex-Ratio Related Research

Many sea turtle conservation programmes in the ASEAN region protect eggs by translocating them to fenced hatcheries. The hatching success of long-term hatchery programmes range from about 17 to

70%. The early findings of SEATRU indicated that improved handling techniques and rapid transfer of eggs to hatcheries could enhance hatch rates (Chan *et. al.*, 1985). Later, research on effects of temperature on sex ratios revealed that hatcheries were producing 100% female hatchlings (Chan & Liew, 1995a; Tiwol, 1997), while *in situ* incubation produced mixed ratios of both sexes (Tiwol, 1997, Palaniappan, 1997). These studies also provided estimates of pivotal temperatures for leatherback (between 29.2 - 30.4°C), green (between 29 - 30.4°C in Sabah Turtle Islands and 28.2°C in Pulau Redang) and hawksbill (between 28.9 and 29°C in Sabah Turtle Islands) turtles.

Hatchery and sex ratio related research have concluded that where possible, *in situ* incubation of eggs should be the preferred method of egg protection since it produces good hatch rates as well as a more natural ratio of male : female hatchlings. The *in situ* incubation programme of SEATRU initiated in Chagar Hutang in 1993 have yielded an average hatch success of over 80% (Chan and Liew, 1995b) and a sex ratio of approximately 4 female : 1 male hatchling (Palaniappan, 1997).

Interesting Movements and Behaviour

Studies on interesting movements and behaviour were initiated after a survey revealed significant incidences of turtle mortalities in fishing gear in Terengganu (Chan *et. al.*, 1988). The first such study was conducted on the leatherback turtles of Rantau Abang using a combination of radio telemetry and time-depth recorders (Chan *et. al.*, 1991; Eckert *et. al.*, 1996). The results of the study have led to the establishment of an offshore sanctuary for the leatherbacks where the use of fishing gear known to entrap turtles are prohibited during the nesting season (Chan and Liew, 1991).

The study of interesting movements of turtles at sea was extended to green turtles in Pulau Redang where radio and ultrasonic telemetry was simultaneously used. This combination allowed for more visual sightings of the animals, both underwater and when they surfaced for air. The five green turtles tracked revealed that they did not feed during the interesting periods and spent their time mostly sitting on the seabed at depths of 10-40 m (Liew and Chan, 1993; 1994). Further, the turtles did not venture far from the nesting beach, remaining within one km from the coast. These findings demonstrated that Marine Park regulations with respect to fishing activities were adequate in providing offshore protection for the breeding females. Obviously, strict enforcement of the regulations is crucial for their survival.

SEATRU is now assisting and collaborating with the Sarawak Forestry Department in the application of telemetric techniques to study interesting movements of the green turtles of the Sarawak Turtle Islands. Discussion with Sabah Parks is also underway to extend such studies to the Sabah Turtle Islands.

Long Distance Migration

It is well documented that sea turtles migrate across international boundaries and for most populations, feeding and nesting grounds are distantly separated and seldom occur within the territories of the same nation. Regional and international cooperation among nations sharing the same populations of turtles is therefore critical for the survival of these endangered animals. It is obvious that local conservation efforts will be negated if the turtles are intentionally killed once they migrate to a neighbouring country.

One of the first steps towards building regional collaboration is to identify the migratory pathways and end-points of the turtles' post-nesting migration. SEATRU undertook this work beginning in 1993 and in three years of satellite tracking studies, the post-nesting migratory pathways of five green turtles from Pulau Redang has been determined (Figure 1) (Liew *et. al.*, 1995a, 1995b). This study has demonstrated that the nesting green turtles of Redang reside in the nearshore waters of the Philippines and Indonesia. Conservation of this population therefore calls for cooperation between Malaysia, the Philippines, Indonesia and other neighbouring countries.

Satellite tracking research is now being initiated in the Sarawak Turtle Islands by the Sarawak Forestry Department in collaboration with SEATRU and funding from the Malaysian government. Sabah Parks has just launched its satellite tracking work during the Joint Management Committee Meeting of the Turtle Islands Heritage Protected Area.

Student Research

Since SEATRU functions under the umbrella of Universiti Putra Malaysia Terengganu, it plays a pivotal role in undergraduate and graduate training. To date, SEATRU scientists have supervised over 20 student research projects related to sea turtles. A complete listing is given in Table 2. Projects currently undertaken at the M.Sc. level include population genetics of Malaysian sea turtles; satellite, radio and ultrasonic tracking studies; sex-ratio studies, tagging and nesting research and factors affecting hatching success of green turtle eggs in the Sarawak Turtle Islands.

CONSERVATION AND EDUCATIONAL ACTIVITIES

***In-Situ* Incubation of Green and Hawksbill Turtle Eggs**

This project was initiated in Chagar Hutang, Pulau Redang in 1993 and is now continued on a long-term basis. Chagar Hutang represents the most important nesting beach for green turtles in Peninsular Malaysia, therefore egg protection here is crucial for the survival of the species not only in Redang, but in Terengganu itself. To date, SEATRU has incubated over 180,000 eggs, with the natural release of more than 150,000 hatchlings to the sea. The role performed by SEATRU has become increasingly important in recent years. In 1998, for example, SEATRU was responsible for over 70% of the total number of eggs protected and incubated in Redang.

Other conservation and educational activities include the following:

- Monitoring of turtle strandings in Pulau Redang
- Beach and underwater cleanups, including removal of discarded fishing gear around the waters of Pulau Redang
- Turtle camps for the children of Redang Village
- Student Internships

PUBLIC OUTREACH PROGRAMMES

Adopt-A-Nest Programme

Every year SEATRU purchases between 300-400 clutches of eggs for incubation. The adopt-a-nest programme make it possible for individual members of the public to help SEATRU purchase the necessary egg clutches for incubation. Cost for one nest adoption is RM200.00 (US 80.00 for foreign adoptions). This figure takes into consideration the actual amount paid to the egg collectors for one nest of eggs and the wages paid to the workers to do the beach work. Nest sponsors receive a certificate of adoption, information about the nest adopted and the mother turtle which laid the eggs and a SEATRU T-shirt. Sponsors of three nests or more receive in addition, a print of a turtle painting by a renowned local artist. When the incubation period is completed and hatchlings have emerged and made their way to the sea, the nests are excavated and results of the nest analysis are sent to the sponsors.

Some sponsors have written to us and expressed great joy in being able to help put hatchlings into the sea. They were grateful for the simple fact that they had a chance to do something so direct and tangible in wildlife conservation. They also learnt a little about turtle biology from the information received about the nests they have adopted. This had the effect of creating a personalised link between turtles and the general public.

Adopt-A-Turtle Programme

Although the nest adoption scheme was quite well received, we realised very early in the season that the scheme on its own would not be able to raise sufficient funds for the activities of SEATRU. We also realised that many individuals were not in the position financially to make a RM200.00 donation. In order to generate greater participation from the public, a turtle adoption scheme was launched later in the season in 1998. One turtle adoption was priced at RM100.00 (US\$ 40.00 for foreign adoptions). Sponsors of turtles receive an adoption certificate, information about the turtle at the time of adoption and a SEATRU gift. Since all turtles monitored by SEATRU at the project site are tagged, we are able to provide information on the nesting history of the turtle to the sponsors, such as year the turtle was first tagged and all nests deposited in previous nesting seasons, as well as the current one. At the end of the season, a summary is sent out again, detailing number of nests and hatchlings produced by the turtle for the year. When the turtles return in future to nest, their respective sponsors will be informed and given the option to adopt the turtles again for the season. In this way, SEATRU is able to maintain contact with sponsors and keep them updated with personalised bits of information. As in the nest adoption scheme, the effect of building relationships between turtles and the average layman was evident.

All turtles monitored in 1998 had “foster” parents. Turtle sponsors were given the option of naming their turtles. Besides their regular ID numbers, our turtles now bear names like Dream Maker, Goddess of Happiness, Scuba Queen, Mrs. Wallace (adopted by a Scottish Professor), etc.

The Volunteer Programme

This programme is offered to students of UPMT and members of the public. The activities for the two groups are similar, the only difference being the costings. Groups of six volunteers spend one week at the project site of SEATRU, assisting in the tagging and nesting research programme as well as the *in situ* egg incubation programme. In this way, they gain valuable insights into how turtle conservation programmes are run.

Duties of volunteers include the following:

- Nightly beach patrols to locate and record all turtle arrivals
- Monitoring nesting activities and timing the various stages of nesting
- Tagging and measuring turtles after they have completed the egg laying process
- Marking and measuring the location of nests
- Daytime beach patrols at regular intervals to inspect nests undergoing incubation
- Excavate hatched nests and help analyse nest contents
- Crab census and monitor lizard watch

Most of the volunteers who arrive at Chagar Hutang have never seen nesting turtles before. The experience of spending a whole week interacting with the turtles and learning how to monitor them without disrupting the nesting process is something which they will remember and cherish for the rest of their lives. They cannot help but fall in love with the gentle turtles whose fate lies so much in the hands of human beings. Quite a few of the volunteers in 1998 have signed up for the 1999 programme again.

Besides turtles, the volunteers get the experience of being very close to nature again – sleeping on the beach most nights, star-gazing, watching shooting stars, swimming and snorkeling in one of the best reefs of Redang, watching numerous different butterflies in their natural habitat, observing other wild-life such as mousedeer, squirrels, tree shrews, monkeys, rock climbing, hiking and visits to the fishing village.

Turtle Camps

Two types of turtle camps are conducted by SEATRU. The first, called "Kem SiPenyu" are meant for children from the Redang fishing village. Four such camps are held per year for students in year 5 (ages 10-12). In the long run, it is hoped that every child who completes primary school in the village school would have the chance to participate in the camps at least once in his/her school life. Each camp caters for 10 children only. The kids are brought to Chagar Hutang and spend the equivalent of one full day and night there. They learn about turtles in a fun way - through games, acting and drawing sessions. They learn how to behave when watching turtles at night and help in a beach cleanup. These camps are fully sponsored by SEATRU and a local beach resort.

The second camp, called the Turtle Encounter and Awareness (TEA) Project is being planned and has not been implemented yet. This programme essentially caters for nest sponsors who wish to view their nests at Chagar Hutang. The TEA camps are held only once weekly and limited to ten participants. The participants stay one night at Chagar Hutang to watch nesting turtles and select the nests they wish to adopt. They are also given a briefing about the activities of SEATRU and turtle conservation in general.

SEATRU Website

SEATRU developed a website in March 1996 for public education and providing information on its various activities. The site can be assessed at the URL <<http://www.upmt.edu.my/seatru>>

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Figure 1: Post-nesting migration routes of five female green turtles from Redang Island, Malaysia tracked using the ARGOS satellite system in 1993 and 1999

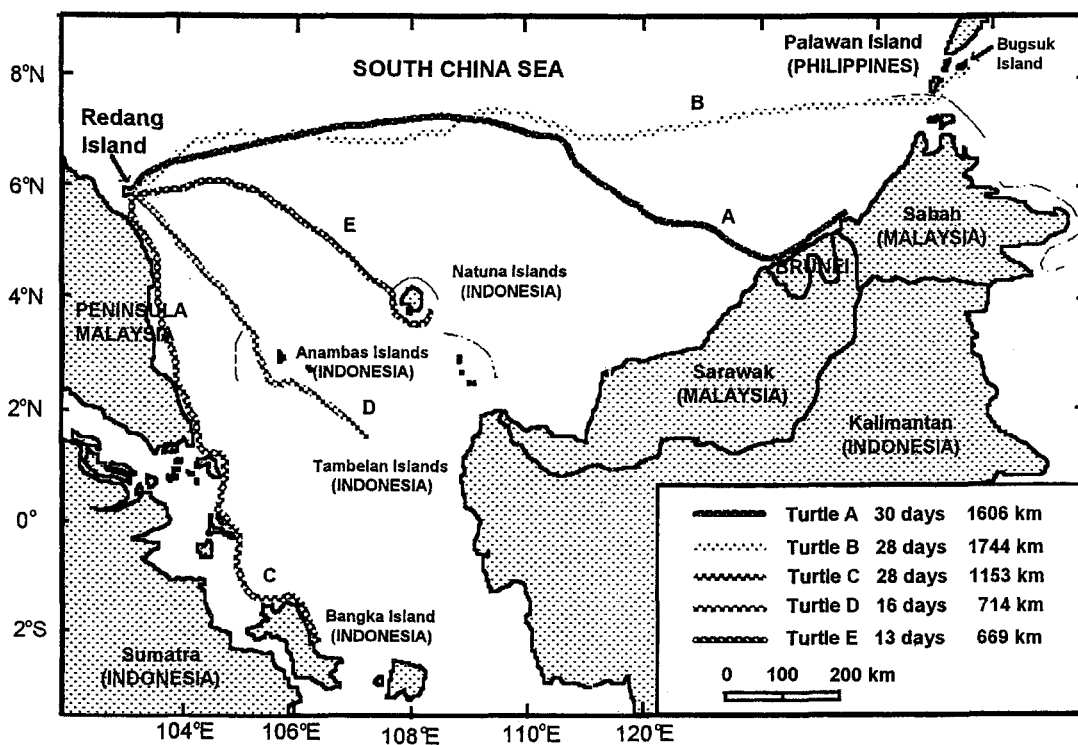


Table 2: List of Student Projects Supervised by SEATRU Scientists

1.	Bali, J. (current). Telemetric studies on offshore movements of Sarawak green turtles (<i>Chelonia mydas</i>).
2.	Regip, J.M. (current). Hatching success and green turtle egg mortality at Sarawak Turtle Islands, Sarawak.
3.	Bilang, R (current). Tagging and nesting study of the green and olive ridley turtles in the Sarawak Turtle Islands, Sarawak.
4.	Chai, S.S. (current). Temperature-profiling and sex ratios of hatchlings produced in the Sarawak Turtle Islands.
5.	Joseph, J. (current). Population genetics of green (<i>Chelonia mydas</i>) and hawksbill turtles (<i>Eretmochelys imbricata</i>) in Malaysia.
6.	Chai S. S. 1999. A comparison of hatch success and sex ratios of green turtle (<i>Chelonia mydas</i>) eggs incubated under <i>in situ</i> conditions and in hatcheries in Pulau Talang-Talang Kechil, Sarawak.
7.	Wong H. L. 1999. Tagging and nesting studies of green turtles (<i>Chelonia mydas</i>) Pulau Talang-Talang Kechil, Sarawak.
8.	Nyukang, P. 1999. Kajian ke atas persarangan penyu agar (<i>Chelonia mydas</i>) dan penyu lipas (<i>Lepidochelys olivacea</i>) di Pulau Talang-Talang Kechil, Sarawak.
9.	Ong A. P. 1999. Digestibility and growth studies on the green turtle (<i>Chelonia mydas</i>)
10.	Palaniappan, P. 1998. Temperature profiling and sex ratios of green turtle hatchlings (<i>Chelonia mydas</i>) of Chagar Hutang Beach in Pulau Redang, Terengganu, Malaysia.
11.	Fredericks John, A.H. 1998. Ghost crab (<i>Ocypode spp.</i>) predation on green turtle (<i>Chelonia mydas</i>) nests and hatchlings in Chagar Hutang, Pulau Redang.
12.	Livinu, W.J. 1997. Effects of temperature on sexual differentiation of the painted terrapin, <i>Callagur borneonsis</i> .
13.	Joseph, J. 1997. Tagging and nesting studies of green (<i>Chelonia mydas</i>) and hawksbill (<i>Eretmochelys imbricata</i>) turtles in Pulau Gulisaan, Sabah.
14.	Joannes Sigam, C. 1997. A Comparison of <i>in-situ</i> and hatchery incubation techniques for Hawksbill (<i>Eretmochelys imbricata</i>) and Green (<i>Chelonia mydas</i>) turtle eggs in Pulau Gulisaan, Sandakan, Sabah.
15.	Tiwol, C.M. 1997. Sex Ratio of Hawksbill (<i>Eretmochelys imbricata</i>) and Green (<i>Chelonia mydas</i>) turtle hatchlings incubated under different conditions in Pulau Gulisaan, Sabah.
16.	Somarny, W.M.Z. 1996. Kesan akar ke atas penetasan telur penyu agar (<i>Chelonia mydas</i>) di Chagar Hutang, Pulau Redang.
17.	Burhan, J. 1995. Kajian kadar pemangsaan ke atas anak tetasan penyu agar (<i>Chelonia mydas</i>) di Chagar Hutang, Pulau Redang.
18.	Haizam, M.A. 1995. Kajian ke atas status ekonomi pemajak dan pemajakan telur penyu di Terengganu.
19.	Palaniappan, P. 1994. The effects of retention period, incubation period and incubation method on turtle hatchling vigour.
20.	Saini, M.S. 1993. Effects of night fishing light on the orientation of sea turtle hatchlings.
21.	Low, L. 1989. Kesan cahaya ke atas gerak balas penyu (The effects of light on the movements of turtles).
22.	Malaverni, P. 1989. Orientation and response of leatherback (<i>Dermochelys coriacea</i>) hatchlings to selected physical and chemical parameters.
23.	Ramnick, L. 1987. A study on the digestibility of squids, jellyfish and macrozooplankton by leatherback (<i>Dermochelys coriacea</i>) hatchlings.