MARINE TURTLE POPULATION AND CONSERVATION IN THE SOUTHEAST ASIA REGION

INTRODUCTION

The objective of this paper is to provide a brief review of biology and population status of sea turtles in the Southeast Asia Region. The report was compiled after a review of the scientific literatures on this region, including government documents and materials assembled by various organizations. Five major topics are reviewed; 1) biology; 2) population and distribution; 3) existing laws on sea turtles conservation; 4) conservation efforts/activities; 5) research activities; 5) regional collaborations.

Six of seven species living marine turtles recognized in the world were confirmed to nest in the South East Asia. These are leatherback (*Demochelys coriacea*), green turtles (*Chelonia mydas*), Olive ridley (*Lepidochelys olivacea*) and the hawksbill (*Eretmochelys imbricata*), loggerhead (*Caretta caretta*) and flatback (*Natator deperssa*) (Kamarruddin, 1993, Soehartono, 1993, Palma, 1993, Chantrapornyl, 1993) Sukarno et al., 1993, Chantrapornyl, 1996, Kamarruddin et al., 1996). All these six species are commonly found in ASEAN waters except the flatback which is restricted primarily to Eastern Indonesia. All these species are highly migratory, often passing through territorial and international waters from feeding to nesting ground and come back again. The turtles are likely to come from an area within a radius of 2,500 kilometers around the nesting area (Limpus, 1993). Stark, (1992), reported a tagged leatherback from Irian Jaya was recovered in Cebu, the Philippines. The sites of tagging and recovery are separated by some 1900 km. Turtles from Sabah, Malaysia are being recovered in Eastern Indonesia or in the Philippines. Since these animals transcend national boundaries, they are a shared resource among countries. Thus, the countries in the region have a common responsibility and ownership of a particular population.

BIOLOGY

Leatherback Turtles (*Dermochelys coriacea*)

The leatherback turtles is one of the largest marine reptiles alive today the heaviest known specimen weight 585 kg. The leathery covered shell or carapace distinguished it from other hard-shelled turtles. The adult female nesting in Peninsular Malaysia averaged 162.4 cm curved carapace length. Reproduction is seasonal and in Peninsular Malaysia nesting peak is in June and July. Nesting is generally nocturnal. In Terengganu Malaysia, clutches are composed on average of 60 - 120 eggs with 16.3% of yolkless eggs (Sukarno *et al.*, 1993). Typically yolkless eggs are smaller than yolked eggs and many cases misshapen and are deposited last. Generally, eggs average 5.5 cm in diameter. Embryo development is completed during an incubation period which lasts for 55 - 75 days. Hatchling emergence from nest at early evening oceanic distribution of leatherback may reflect the distribution and abundance of macroplanktonic prey. The main diet for the leatherback is primarily on cnidarians (jellyfish and siphonophores). Mating has not been observed.

Green Turtle (*Chelonia mydas*)

Green turtle is distinguished from other sea turtles by a single pair of prefrontal scales, four pairs of lateral scutes and five vertebral scutes. The carapace is broad, low and heart-shaped, it is smooth, without keels and scutes are placed side by side. The shell colour is light to dark brown. The plastron is whitish to yellowish. Sexual dimorphism is present in adult animals and the male has very long tail. The male green turtle has a single claw which is markedly enlarged and strongly curved. The curved carapace length of adult green turtle is ranging from 70 - 120 cm (average 99.5 cm in the Philippines (Trono, 1991)). Mating could occurred for several hours for example it lasts for 7 hours in Pulau

Reading, Malaysia (Sukarno *et al.*, 1993). Clutch size averages 104 eggs. Reproduction is seasonal but extended throughout the year at several areas. In Terengganu, Malaysia and Khram Island in Thailand the peak is between May to August (Sukarno *et al.*, 1993, Chantraponyl, 1996), while in Turtle Island Sabah the peak nesting period is from July to October (Saini, 1996). The main diet for the green turtles are algae and seagrasses.

Hawksbill Turtle (*Eretmochelys imbricata*)

Hawksbills are distinguished from other sea turtles by two prefrontal scales, thick, posteriorly overlapping carapace scutes, four pair of coastal scutes, the anteriormost not in contact with the nuchal scute, and two claws on each flipper. The carapace is typically serrated along the posterior margins. The head is relatively narrow, the beak tapers to a point and the maxilla projects slightly beyond the mandible. Mean straight-line carapace length (SCL) of adult female ranges from about 66 to 86 cm and weight is typically to 80 kg (Pritchard *et al*, 1983). Adult males are distinguished by along, thick tail that extends well beyond the carapace margin and well developed, recurved claws on the fore flippers. Mating occurs on the surface of shallow waters adjacent to the nesting beach and may last several hours. Nesting is mainly nocturnal. In Malacca rockeries the average clutch size is being 70 to 160 eggs. Nesting is seasonal, but the season often expended and a few localities nesting may occur throughout the year with one or two peaks. In Thailand, for example peaks are reported in February - April and June - July (Chantrapornyl, 1996). Incubation is generally 50 - 70 days at the west coast of Peninsular Malaysia. Hawksbills forage on coral reef of the offshore islands and these turtle consume variety of food but specialized on sponges.

Olive/Pacific Ridleys (*Lepidochelys olivacea*)

The olive ridley is relatively small sea turtle with six to eight and occasionally five or nine pairs of lateral scutes, asymmetry relative to the number of scutes on either is not common. The carapace is uniform olive in colour. The head is relatively large compared with green and hawksbill. Male olive ridley has a long tail with heavy terminal nail. Adult females weighed from about 35 to 45 kg. The curved carapace length is in the range of 40 - 70 cm. In Peninsular Malaysia most nestings occurs between February to August and the peak in May to July (Sukarno *et al.*, 1993). In contrast, nesting occurs between October to February at Phuket, Thailand. The number of eggs laid per clutch ranges from 50 to 110. Hatchlings emerge from the nest after about 45 to 65 days and most hatchlings emerge at night. The non-nesting range presumably reflects the availability of food. Olive ridleys are carnivores, feeding primarily mollusks, fishes, jellyfishes and crustaceans. Olive ridleys are migratory animals.

Loggerhead (*Caretta caretta*)

Loggerhead is characterized by typically five pairs of lateral scutes, the anterior-most one touching the cervical, ventral scutes broader than long and three poreless inframarginals on bridge. The carapace is reddust brown. The head is comparatively large (to 25 cm in wide). Two claws occur on the forelimbs, males have thick tails extending beyond the edge of the carapace. Adults generally weight 80 - 150 kg. The worldwide average CCL for adult female is 95 - 100 cm. Adult males in Queensland measured with average 95.8 cm CCL and 100.7 kg (Limpus and Reed, 1985). Mating often takes place adjacent waters to nesting beaches. The clutch size averages 110 eggs. Eggs hatch in about 45 - 65 days. The loggerheads reach maturity at the age 12 - 25 years and the mean nesting female is 92 cm SCL. The range of migration for loggerhead in this region is move to toward Southern Pacific covering Indonesia, Philippines, Eastern Australia, Solomon Island, Papua New Guinea and New Caledonia (Limpus, 1993).

Flatback (*Natator depressa*)

The flatback is a close relative of the green turtle, distinguished by its smaller size and flatter carapace. The flatback is only found in northern Australia and northwest Irian Jaya. The curved carapace length is in the range of 80 to 100 cm and the curved carapace width is 70 to 85 cm. The nesting female lays eggs between 30 to 80 per clutch and the mean nest depth is 50 cm (Limpus, *et al.* 1981). Flatback turtle lay up to four clutches at 15 nights interval.

POPULATION AND DISTRIBUTION

The occurrence of sea turtle nestings in the Southeast Asia is shown in Table 1. Indonesia has the most species of marine turtles compared with other countries in the region. Due to uncontrolled during past decades all species of sea turtles in this region are now threatened with extinction. In response to the rapidly declining and realizing the importance of sea turtle populations to marine environment in the region, accounts taken in obtaining closer cooperation amongst the nations. Subsequently, the First ASEAN Symposium on Marine Turtle Conservation was held in 1993 at Manila and followed by a workshop was conducted in January, 1996 at Kuala Terengganu, Malaysia.

Table 1. The occurrence of sea turtles in the Southeast Asia Nations

Country	Leatherback	Green	Hawksbill	Loggerhead	Olive Ridley	Flatback
Brunei Darussalam	x	x	x			
Indonesia	x	x	x	x	x	x
Malaysia	x	x	x		x	
Philippines	x	x	x	x	x	
Thailand	x	x	x	x	x	
Singapore					x	
Vietnam		x	x			

No through studies have conducted have conducted to determine the extend of the status of sea turtle populations in Brunei Darussalam and Singapore (Sabri, 1996; Lim, 1996). Therefore, the status of population sizes and distributions of marine turtles in both countries are not available.

Leatherback Turtle (*Dermochelys coriacea*)

The leatherback turtle in known to nest primarily beaches of Terengganu, Malaysia and the north west Irian Jaya, Indonesia. The major rookeries in Malaysia are found particularly at 1.5 kilometres stretch of beach of Rantau Abang and Paka, Terengganu and on the beach of Chendor, Pahang. In the 1950s, about 2,000 females per year were nesting but the numbers dropped drastically. In 1994, only 213 nestings were recorded Rantau Abang rookeries. Nesting season of leatherback turtle is from March to September each and between June and July is the peak period (Chan and Liew, 1989, Sukarno *et al.*, 1993). No report about the nesting of leatherback turtle on the west coast of Peninsular Malaysia as well as on Sabah and Sarawak beaches.

The leatherback turtles are also confirmed to nesting the Andaman Sea coast of Thailand but the population status is unknown (Phasuk and Rongmuangsart, 1973; Chantrapornyl, 1996). While in Indonesia, leatherbacks have only been found in South Sulawesi, Maluku and northern Irian Jaya. While in the Philippines leatherbacks were reported to nest on the Quiniuban Island groups northeast Palawan. A number of sighted and stranded leatherbacks were also reported from Hinunangan, Southern Leyte and Binnuangan, Tubay, Agusan del Norte.

Green Turtle (*Chelonia mydas*)

The green turtle is by far the most extensively distributed sea turtle species in the Southeast Asia Region. This species is known to nest on the beach of the all countries of the region. In the Peninsular Malaysia, the major nesting sites occur on Pulau Redang, Paka and Geliga in Terengganu. Chendor is main green turtle rookery in Pahang, even through nesting are also reported on the offshore islands and other remote beaches at Pekan and Rompin. The population at Pantai Segari in Perak constitutes the only significant nesting aggregation along the west coast of the peninsular.

In the East Malaysia, the green turtle nestings are concentrated on the Sarawak Turtle Island of Talang Talang Besar, Talang Talang Kecil and Satang Besar and Turtle Island of Sabah that is Pulau Bakkungaan Kecil, Selingaan and Gulisan. The annual nesting of green turtles is Malaysia is estimated about 15,500. The populations from all nesting sites have shown declining trends.

In the Philippines the major nesting sites are on the Turtle Islands (Tawi Province), a group of islands shared with Sabah in the Southern Sulu Sea (Selingaan, Gulisan, Bakkungaan Kecil) and about 80% of green nestings occur in these area (Palms, 1993). As of July 1993, a total of 50,898 complete nests were recorded from Baguan Island (Palma, 1993) and in 1992, total of 1,052,168 eggs were produced. The population of nesting green turtles in the Turtle Island is estimated about 2,500 (Trono, 1993). The green turtle are also reported to nest on Calauit and Matanubong Islands off Palawan (Mesina and Mesina, 1990).

The principal nesting site in Thailand is on the east coast (Gulf of Thailand) especially at Ko Khram which in 1993 received 282 nestings (Chantrapornyl, 1996). Nesting of green turtles nestings are also reported in the west coast from the Province of Satun, Phuket and Phangnga. In 1993, 128 nestings of green turtles were reported from the Andaman Sea nesting sites.

Green turtles are considered common all around the coastline of Indonesia. The nesting were reported from 10 provinces, however the status of the population size is still on mentioned (Soehartono, 1993). In Vietnam, the main nesting locations are Hon Bay Canh and Hon Tre Lon Islands and the nesting season occurs from April to November as May to August is the peak season. The present status of the population is unknown.

Hawksbill turtle (*Eretmochelys imbricata*)

Historically, major hawksbill concentrations have been located in the Southeast Asia. This still holds true at present. However, hawksbill numbers have been greatly declined since the hawksbill nesting may not received the same attention in areas with high green turtle nesting density (Limpus, 1993 (b)). Highest concentration of hawksbill turtle in Peninsular Malaysia is found to in Malacca (Sukarno *et al.*, 1993). The major nesting sites in the state are Pulau Upeh, Kuala Linggi and Tanjung Bidara. Hawksbill turtles also could be found in Terengganu, Pahang and the offshore islands of Johore. There are about 100 nesting females in Peninsular Malaysia. The distributions of hawksbill turtles in the East Malaysia are concentrated on the turtle islands of both Sarawak and Sabah. Sabah turtle islands are believed to be the most significant hawksbill nesting sites in Malaysia with received about 600 nestings annually. A total of 4,933 nestings of hawksbill were recorded in the period from 1982 to 1992 (Trono, 1993). Generally, the peak of nesting season for hawksbill in Malaysia is from March to June every year.

In Thailand nesting occur on both east and west coast as well as on some offshore islands, Ko Klang, Ko Kra, Pattani Province, Songkhla Province, Narathiwat Province. The main rookeries on east coast (Gulf of Thailand) are including the Ko Kut, Ko Chang and Khram Islands (Eckert, 1993, Chantrapornyl, 1993). The existing nesting population size is estimated to be 100 nestings annually.

The hawksbills occur widely with low nesting densities throughout the Philippines. No major nesting aggregations have identified but hawksbills were found to nest in small numbers on numerous islands.

Hawksbill are mostly found along the western, eastern coast and northern of Sumatra (especially Batu Islands), northern and southern Java, north of Nusa Tenggara, southern and north east Sulawesi, Maluku, southern Kalimantan and north of Irian Jaya (Suwelo, 1992; Soehartono, 1993). Meanwhile, in Vietnam the nesting areas for hawksbills are on the Con Dao National Park Islands and the size of population is not known.

Olive/Pacific Ridley (*Lepidochelys olivacea*)

In Malaysia, information on the nesting status of this species is fragmentary with records available only for Terengganu, Pahang, Perak and Pulau Pinang (Sukarno *et al.*, 1993). The major nesting places in Terengganu are Kuala Baru, Telaga Papan, Pulau Kapas, Dungun, Paka and Geliga. While in Perak and Pulau Pinang, the nesting sites are Pantai Segari and Pantai Keranchut in respective state. Nesting has been also recorded in the Turtle Islands of Sarawak and Sabah. The peak period of nesting season for this species in general is between February and May.

In Thailand, nesting sites of olive ridley are on the coast of Andaman Sea especially, along the west coast of Phangnga and Phuket Province and the adjacent islands. However, the population size had declined from 238 nestings in 1979 to 77 nesting in 1993 (Chantrapornyl, 1993). A small population of hawksbill is also located in Trang Province (Hill, 1992).

The olive ridley is not a common sea turtle found in the Philippines. Sightings of olive ridleys were recorded from the waters off Palawan and Metro Manila. The most recently olive ridleys were reported to nest in the former US Naval Base in Subic Bay, Sambales. Meanwhile, in Indonesia olive ridleys were confirmed to nest in several areas, Pantai Padang in Padang, Bengkulu, Nusa Kambangan in Central Java, Sukamade in East Java, Paloh in Kalimantan, Bualu in Bali and Pantai Utara Kepala Burung in Irian Jaya. No information is available from Vietnam.

Loggerhead (*Caretta caretta*)

With Asia, large nesting concentrations of loggerheads are outside ASEAN region, Australia and Japan. Normally, loggerheads nest on temperate beaches (Ekert, 1993). In Sarawak, Malaysia loggerhead were reported to nest in small members (Leh, 1989). In Peninsular Malaysia, the occurrence of loggerhead was not mentioned. At the same time, loggerhead was not encountered for more than 20 years in Thailand and it is believed to be extinct. Loggerhead turtles are encountered on the beaches of South and Central Sulawesi and Ambon Island in Maluku. In the Philippines, the most recent recoveries of loggerheads were from Batan Island and Albay.

Flatback (*Natator depressa*)

The flatback turtle is endemic to the Australian continental shelf (Limpus, 1981, 1996). Flatback nesting concentration occurs throughout Australia. The feeding area extends to Papua New Guinea and Irian Jaya.

EXISTING NATIONAL LAWS ON SEA TURTLE CONSERVATION

Brunei Darussalam

Brunei Darussalam is a member of CITES (Convention for International Trade of Endangered Species) since 2nd August 1990 and therefore sea turtles are protected under CITES. Wildlife Protection Act, 1978 (revised 1984) is under the jurisdiction of Museums Department to provide protection of wildlife and for the establishment of wildlife sanctuaries. The Department of Fisheries has also provisions for the protection of sea turtles under the Fisheries Act 1973, regulate the catching or killing

of turtles and their eggs. The Department of Fisheries is the process of amending the acts to have a specific chapter on turtles.

Indonesia

In Indonesia the management of sea turtles is administered by Directorate General of Forest Protection and Conservation, Ministry of Forestry. Sea turtles are listed as listed as wild fauna and therefore they are protected by Act No. 5 of 1990 for their conservation and ecosystem. The other legislations to protect and regulate sea turtles include:

- The Indonesia Constitution of 1945
- Act No. 4 of 1967 (Basic Provision of Forestry)
- Act No. 4 of 1982 (Basic Provision for the Management for Living Resources)
- Act No. 9 of 1985 (Fishery) and,
- Act No. 5 of 1990 (Conservation of Living Resources and their Ecosystem)

Malaysia

According to the Malaysian Constitution, turtles are the property of the 13 individual states. At national the Fisheries Act of 1985 repealed the Fisheries Act of 1963. The major contributions of the act are in providing for the objectives of conservation, management and development of marine resources. It also provides a comprehensive basic framework for subsidiary legislation to be enacted for the conservation and management of sea turtles, including the establishment of sanctuary or other fishing prohibited areas.

In Peninsular Malaysia, marine turtle protection legislations have been enacted in six states;

i. the Turtles and Turtle's Eggs of 1932 (Amended 1935, Enactment No. 8), Kelantan,
ii. the Fisheries Enactment (1937) and Fisheries Rules (1937), Pahang,
iii. the Turtle Enactment of 1951 (Amended 1987), Terengganu,
iv. the Fisheries rules (Turtles and Turtle's 1976), Negeri Sembilan,
v. the Fisheries Rules (Turtles and Turtle's Eggs, 1984), Johor, and
vi. the Fisheries Rules (Turtles and Turtle's Eggs, 1989), Malacca.

The legislation prohibit the capture, killing injuring, procession or sale of turtles, collection of eggs, disturbing turtle during laying eggs and the provision for establishment of a turtle sanctuary.

Protective and conservative legislation in Sarawak, includes the Turtle Trust Ordinance (1957), the Turtle Rules (1962) and the Wildlife Protection Ordinance of 1958 (Amended 1973). The Customs (Prohibition of Exports/Import) Orders of 1988 specifically to ban the exports and imports of turtle eggs to and from all countries.

In Sabah, the Fauna Conservation Ordinance 1963 (Act No. 11) partially protects the Chelonids turtles and prohibits national and international trade of sea turtles. The Fauna Conservation (Turtle Farms) Regulations 1964 regulates the taking of green and hawksbill turtle eggs for hatchery purposes. The import and export of turtles or its products is prohibited by Customs (Prohibition of Imports) and (Prohibition of Exports) (Amendment) Order 1971. Turtles and protected in Sabah Turtle Island Park, establish in 1977.

Malaysia became a party to CITES effective 18 January 1978, hence the import and export of sea turtles, their products and parts are strictly prohibited. Trade of sea turtles is also prohibited under the Customs Order as have been mentioned earlier.

Philippines

In the Philippines, Act No. 2590, An Act for the Protection of Game and Fish (1919, as amended) is the principal legislation for wildlife protection. Memorandum order No. 6 Series of 1982 (29 April 1982) declared a total ban on the exploitation of sea turtles. However, exception for a limited egg harvest in the Province of Tawi-Tawi is provides for MNF Administrative Order No. 33, Series of 1982. Harvest is allowed only with permit and under condition of 30% of all eggs laid shall be reserved for preservation purposes.

The protection of marine turtles was officially implemented in 1979 with the issuance of Executive Order 542 creating Task Force Pawikan (TFP) and then was inaugurated by the government to save the dwindling marine turtle populations (Dickson, 1996). The following are relevant rules and regulations pertaining to marine turtle conservations:

- Executive Order No. 542 (June 26, 1979) creating The Task Force Pawikan
- MNR Administrative Order No. 12 (Nov. 15, 1979) regulations concerning the conservation of marine turtles in the Philippines. Included in this A.O. are provisions prohibiting the trade of marine turtles or any of its by-products and their corresponding penalties
- MNR Memorandum Order No. 6 (April 29, 1982) suspending permits on marine turtle exploitation
- MNR Administrative Order No. 8 (June 8, 1982) establishing certain island in the provinces of Tawi-Tawi, Palawan and Antique as marine turtle sanctuaries
- MNR Administrative Order No. 10 (June 14, 1982)
  deputizing the Governor and Vice Governor of Tawi-Tawi, Mayor and Barangay Captains in Municipality of Turtle Islands, Tawi-Tawi as Deputy Conservation Officers.
- MNR Administrative Order No. 34 (June 21, 1982)
  declaring the Municipality of Caluya, Antique as a marine sanctuary
- MNR Administrative Order No. 33 (August 11, 1982)
  Regulating the collection of marine turtle eggs in the province of Tawi-Tawi and reiterating the duties and responsibilities of Deputy Conservation Officers and Deputy Game Wardens
- MNR Administrative Order No. 1 (January 21, 1983)
  Deputizing the provincial Governors and Vice-Governors, municipal Mayors, Vice-Mayors and Barangay Captains as Conservation Officers in areas critical for the protection of marine turtles throughout the Philippines
- MNR Administrative Order No. 518 (December 10, 1984)
  declaring El Nido, Bacuit Bay in northwestern Palawan as marine turtle sanctuary and promulgating rules for their administration and control.

  The Republic of Philippines acceded to CITES effective 16 November 1991.

Singapore

There is no information on recent and specific legislation for the protection of marine turtles. Lim, (1996) had briefly reported on the legal aspect covering sea turtle interests.

Thailand

The present protections of sea turtles in Thailand are considered to be better compared in the past. A number of laws and regulations have been implemented to protect and conserve the sea turtles. The Fisheries Act, Be. 2490 (1975) provide a protection on the collection or sale of marine turtles eggs, except with the permission of appropriate authorities. Under the same act, commercial fishing within 3 kilometers of the coastline is prohibited. The principal wildlife law, the Wildlife Animals Reservation

and Protection Act, B.E. 2053 (1960), was replaced by the Wild Animals Reservation and Protection Act, B.E. 2535 (TRAFFIC 1992). Under this legislation, five species of turtles were listed as endangered species and collecting of sea turtles, turtles products and cacases of turtles are prohibited. A law was enacted in 1980 to prohibit the export of sea turtles under Ministry of Commerce Enactment, 1980. In addition, Thailand signed up as member of CITES was effective in 21 April 1983.

Vietnam

There is no information on the current legislation. Vietnam is still not a Party of CITES.

CONSERVATION EFFORTS/ACTIVITIES

Almost of all species of sea turtle in the world have been declined in number in response to over-exploitation, habitat destruction, pollution, marine debris and accidental capture in fishing gear. Some turtle populations have suffered more than others, however because conservation and management factors some of the population status have been sustained.

Brunei Darussalam

The conservation effort on sea turtles is still at initial stage. However, the Department of Fisheries and the Department of Museums have been collaborated a hatching programme and release the hatchlings into the sea. In addition, the Department of Fisheries is grearing up efforts in creating awareness to the public on the need to conserve sea turtles.

Indonesia

Presently, the government of Indonesia is putting emphasis on enhancing conservation areas for marine turtles primarily for habitats that most vulnerable to human activities. The authority have been identified 143 nesting beaches throughout the country (Soehartono, 1993). The government had designated 27 protected areas for marine turtle conservation. Public awareness campaign is conducted in order to create awareness on marine turtle conservation. The West Kalimantan Province had started a pilot project on beaches hatchery in 1984 at Selimpai Beaches, Paloh (Soehadi, 1993). A total of 4,757 hatchlings had been released from hatcheries between 1984 and 1989 (Soehadi, 1993). This amount consists of 2,244 greens, 1,641 hawksbills, 832 olive ridleys and 32 others. Information on other beach hatchery operations from other part of Indonesia is available.

Malaysia

The situation of dwindling in the numbers of nesting turtles in Malaysia is no much different from other turtles nesting countries. The late 1980's showed an awakening of awareness and concern for sea turtles in Malaysia as manifested by several management applications and events.

1. Research and conservation have been initiated in University Pertanian Malaysia funded by ESSO Malaysia in 1985.
2. Department of Fisheries has stated sea turtle research activities in 1987 with finding from IRPA, Ministry of Science and Technology, Malaysia.
3. The adoption of the Turtle Enactment 1951 (Amendment) in 1987 by the State of Terengganu Government to provide more comprehensive management measure for turtle in the state.
4. The establishment of the Turtle Advisory Council in 1988 in Terengganu to advise the state government of sea turtles in Terengganu.

5. The establishment of the Rantau Abang Turtle Sanctuary in Terengganu in 1988 to allocate maximum protection on sea turtles and 15 km stretch of beaches from human activities.
6. The legislation on the ban on consumption and sale of leatherback turtle eggs in Terengganu in 1989.
7. The Malaysia Government has ban on the use of drift net (pukat pari) with mesh sizes exceeding 25.4 cm in 1990.
8. The Rantau Abang waters has been gazette as Fisheries Prohibited Areas covers the areas of 3 nautical miles in 1991. All fishing activities were prohibited in this area with exception on anchovy purse seine, hook and line lift net and squid jigging.
9. More recently, the State Government of Malacca, Johor and Pahang have been taken steps to adopt Fisheries Act, 1985 in order to provide more protection on sea turtles.

Public interpretation is an important component in sea turtle conservation efforts. Various organizations including agencies from state and federal authorities, universities and NGO's have made contribution towards this matter. The recent activity of this kind is that the nationwide campaign on the "Sea Turtle Our Heritage" under taken by the Department of Fisheries together with a private sector.

The Operation of Beach Hatcheries

Hatchery operation as a conservation technique has been practiced in Malaysia since 1949 in Sarawak, 1951 in Kelantan and Terengganu, 1966 in Sabah, 1971 in Pahang and 1988 in Malacca, Perak and Pulau Pinang. The hatcheries had successfully released in significant number of hatchlings into the sea since its operation (Table 2).

Table 2: Total number of hatchlings released from beach hatcheries in Malaysia from 1961 - 1995

State	Total no. hatchlings release
Terengganu	1,039,544
Pahang	109,614
Johor	5,275
Kelantan	3,293
Perak	37,124
Pulau Pinang	2,664
Malacca	81,408
Sarawak	122,194,631
Sabah	5,203,312
Total	**128,676,865**

Establishment of Turtle Sanctuaries

Total protection to nesting turtles, their nests and habitat could be achieved with the establishment of sanctuaries. Turtle sanctuaries have been establishment in Malaysia i.e. Rantau Abang Turtle Sanctuary in Terengganu, the Turtle Islands Parks in Sabah and the Turtle Island in Sarawak. Other important nesting rookeries in the countries would be considered for sanctuary establish such as Pulau Upeh in Malacca, Pulau Redang and Paka in Terengganu. The establishment of Malaysian Marine Parks is also protecting the flora and fauna in areas including sea turtles.

Control of Fishing

The Fishing Act 1985 prohibits the catch of sea turtles by any type of fishing methods enforcement of existing legislation within 2 nautical miles of marine park will provide protection to nesting turtles in the area. The nation-wide ban on the use of draft nets (pukat pari) with mesh sizes exceeding 25.4 cm in 1989 has provide a partial protection. In 1991, the Rantau Abang Turtle Sanctuary waters has been gazette as Fishing Prohibition Areas to protect mainly leatherback turtles especially during their inter-nesting period.

Philippines

The inauguration of Task Force Pawikan (TFP) is the starting point in integrated management and conservation in the Philippines (Palma, 1993). The TFP as presently known as Pawikan Conservation Project (PCP) is responsible for the development and implementation of conservation and protection policies, management and propagation schemes, public information and education programs. The primary objective of PCP is to conserve and propagate the ecologically and economically important marine turtles which are now in the verge of depletion.

Beach Hatchery Operations

Currently, three functional hatcheries are maintained by PCP for research purposes. A total of 512,527 hatchling were released from the hatcheries for the period from 1984 to 1992. However, about 60% of annual eggs produced were put aside for conservation purposes and for this purposes a total of 6,601,879 were conserved since 1984 to 1992 (Palma, 1993). The number of conserved eggs and the hatchlings released from the hatcheries is shown in Table 3.

Table 3. The number of eggs conserved and hatchery data in the Philippines

Year	Total Eggs Conserved	Eggs Transplanted	Hatchlings Released
1984	638,699	8,140	-
1985	590,882	40,265	2,435
1986	782,302	81,929	66,999
1987	585,259	127,874	37,748
1988	680,022	95,442	20,855
1989	822,585	74,084	28,465
1990	546,817	165,849	69,385
1991	1,140,353	368,691	177,630
1992	804,990	192,254	108,601
Total	**6,591,909**	**1,154,527**	**512,117**

Source: Palma, 1993

Table 4. Marine Turtle Sanctuaries in the Philippines

Province	Declared Sanctuaries
Palawan	Halog Island Tanobon Island EI Nido Kota Cay, Kalayaan Group Panata Cay, Kalayaan Group
Tawi-Tawi	Baguan, Turtle Islands Bancauan, Cagayan de Tawi-Tawi
Antique	Caluya

Source: Palma, 1993

Establishment of Sanctuaries

Since 1982 a numbers of marine turtle habitat and nesting areas has been identified and declared as Marine Turtle Sanctuaries under the MNR Administrative Order (MAO) No. 8 (1982) and MAO No. 518 (1985). The declared sanctuaries are listed in Table 4. The PCP is also engaged with fishing control activities especially apprehend violator of illegal fishing in the sanctuaries.

Thailand

Nesting habitats protections as a part of conservation measures are implemented by several agencies involving both government and non-government agencies which are properly coordinated by National Parks. The nesting areas at Khram Island are fully protected by the Thai Navy. The collected eggs from this island are transferred to the Man-Nai Island Sea Turtle Conservation Station. The hatchery activities on the island are managed by the Department of Fisheries. The marine turtle conservations in Phuket Province are implemented by the Thaimaung-Kao Lumpee National Park, Sirinath National Park and Phuket Marine Biological Centre. Meanwhile, marine turtles on islands in Andaman Sea are managed by respective National Parks.

RESEARCH ACTIVITIES

Conservation-oriented research at present is actively pursued by researchers from various institutions both government and non-government agencies in this region. Current research undertaken by scientists in the ASEAN countries include the following:

i. Tagging of nesting turtles to monitor their population dynamics and nesting biology.
ii. Satellite tracking to determine their migration routes.
iii. Hatchery-related operations i.e. to improve hatchling rate etc.
iv. Effects of fishing activities on turtle mortalities.
v. Study on genetics variability.
vi. Rearing of hatchlings.
vii. Socio-economics on the trade of the turtle eggs
viii. Beach survey to determine the size of population

In order to obtain better understanding and to achieve the objective of various researchs are coordination and cooperation among the various institutions involved.

REGIONAL COLLABORATION ON TURTLE CONSERVATION

The ASEAN region is considered a critical habitat for the dwindling sea turtle population. Considering that sea turtle are highly migratory which transcend international boundaries, effective management and conservation can be realized through collaborated effort between the member countries. Through the Association of Southeast Asian National (ASEAN), an effective measure could be implemented in soliciting cooperation in sea turtle conservation in this region. There are several regional agreement which actually offer some level of protection to marine turtles and their habitat in the region.

The ASEAN Agreement on the Conservation of Nature and Natural Resources has been adopted by the member-countries on 9 July 1985. The objective of the agreement is to promote joint and individual state action for conservation and management of natural resources of the ASEAN region. The ASEAN Working Group for Nature Conservation (AWGNC) has become the forum in the development of a regional programme is conserving marine turtles. As a result the First ASEAN Symposium-workshop on Marine Turtle Conservation was held in Manila, Philippines on 6 - 10 December, 1993 with participation's from Indonesia, Malaysia, Philippines and Thailand. The symposium had brought together experts and exposed to current status on marine turtle population, exploitation, conservation effort and formulated a regional management plans.

On 31st May 1996 the Government of Malaysia and Philippines signed a Memorandum of Agreement, establishing the Turtle Islands Heritage Protected Area (TIHPA), the first ever trans-boundary marine turtle conservation area. Over the past years, representatives of both governments, NGOs and academia have met both formally and informally to advance plans for joint management of this unique model for international cooperation of shared marine resources.

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