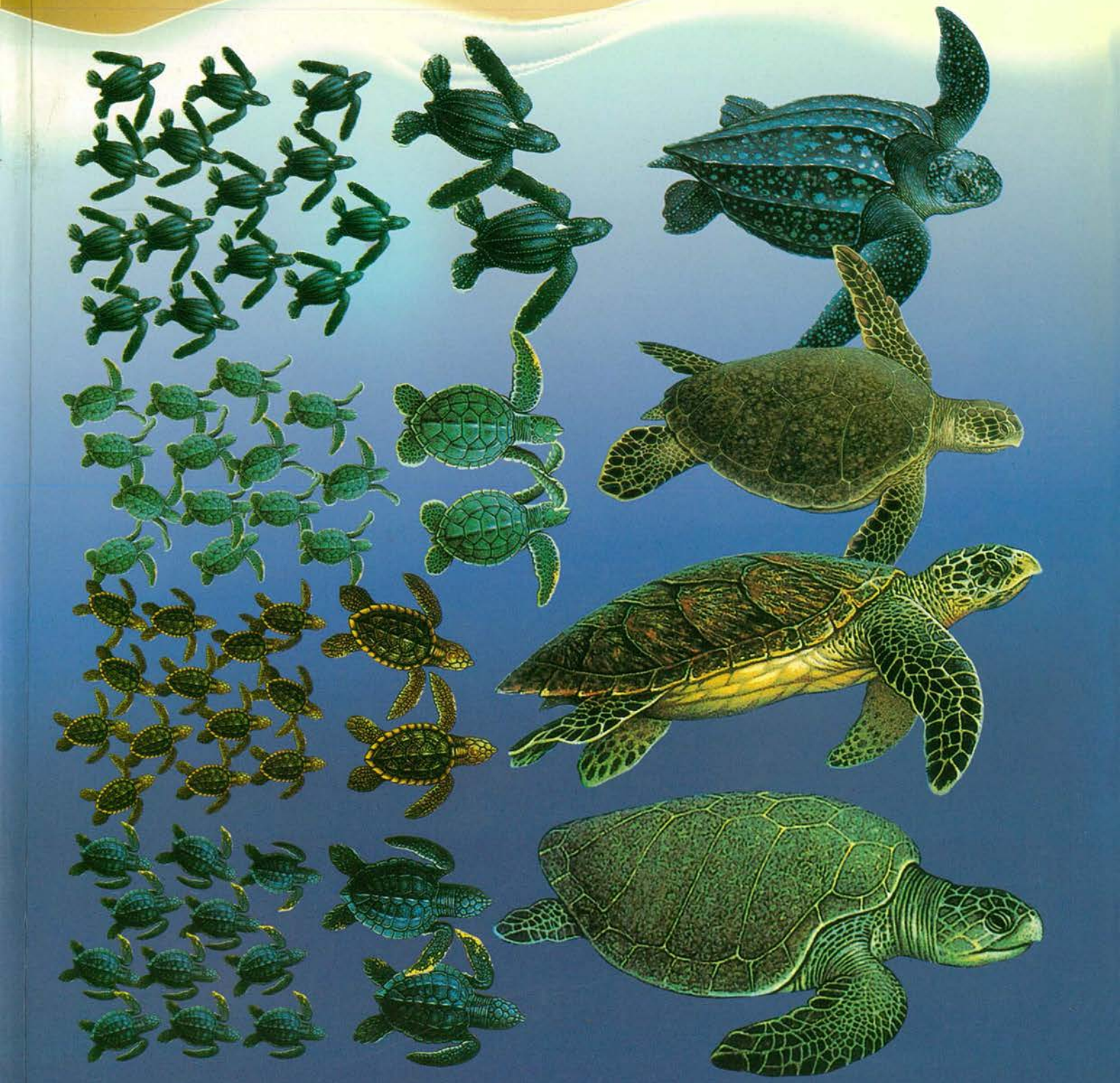
# CONSERVATION AND ENHANCEMENT OF SEA TURTLES IN THE SOUTHEAST ASIAN REGION



Marine Fishery Resources Development and Management Department
Southeast Asian Fisheries Development Center

# CONSERVATION AND ENHANCEMENT OF SEA TURTLES IN THE SOUTHEAST ASIAN REGION

Edited by

Zulkifli Talib
Ahmad Ali
Ku Kassim Ku Yaacob
Mahyam Mohd. Isa


MARINE FISHERY RESOURCES DEVELOPMENT AND MANAGEMENT DEPARTMENT
SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER

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Marine Fishery Resources Development and Management Department (MFRDMD)
Southeast Asian Fisheries Development Center (SEAFDEC)
Taman Perikanan Chendering, 21080 Kuala Terengganu, Malaysia
Tel: +609-6163150 Fax: +609-6175136

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# Contents

# Preface

This book is the outcome of a project on Conservation and Management of Sea Turtles in Southeast Asian Countries conducted from 1998 to 2003. The project was led by the Marine Fisheries Resources Development and Management Department, Southeast Asian Fisheries Development Center (SEAFDEC/MFRDMD) in Terengganu, Malaysia and financially supported by the Japanese Government under the ASEAN-SEAFDEC Fisheries Consultation Group Mechanism.

Southeast Asian countries have accorded great concern to the conservation and enhancement of sea turtles, both from the environmental and marine biodiversity point of view. These countries produce six of the seven living sea turtle species found worldwide and renowned as some of the most productive in the world. All countries recognize the significance of the sea turtle population and their habitats existing in the waters of this region. The sea turtles are highly migratory species, where the seas of Southeast Asian countries form a contiguous body of water without any interval where the sea turtle migrate freely across national boundaries. Thus, all Southeast Asian countries realize that multi-lateral efforts are necessary to ensure long-term survival of the sea turtle in this region. It was this understanding that had led to the signing of Memorandum of the Understanding (MoU) on ASEAN Sea Turtle Conservation and Protection by ASEAN Ministers on Agriculture and Forestry (AMAF) at their Nineteenth Meeting on 12 September 1997 in Bangkok. The MoU laid down the objectives and the mechanism of cooperation for the conservation, management and enhancement of sea turtles in this region.

The existence of SEAFDEC provide ASEAN Member Countries with the necessary technical competence and support that are required to achieve and to realize these needs. That ASEAN recognizes SEAFDEC as the competent technical regional organization on marine issues, including sea turtles, is clearly stipulated in the MoU on ASEAN Sea Turtle Conservation and Protection.

Currently, all member countries in this region, except Lao PDR and Singapore, have their own management and conservation measures in order to conserve and enhance sea turtles resource in their countries. These include law and enforcement, establishment of sea turtle sanctuaries, hatcheries, tagging and satellite tracking, education and public awareness as well as various field of research activities. This book tries to highlight most of the efforts taken by member countries in recent decades in the conservation and management of sea turtles in this region.

# Acknowledgements

This book was made possible based on the knowledge and experiences of the authors through their studies, especially in Malaysia, and accumulated information from researchers from member countries as well as references made from various sources available locally as well as internationally.

The authors would like to express their sincere indebtness to the Director General of Fisheries Malaysia, Y. Bhg. Dato' Junaidi Che Ayub for his continuous support in the preparation of this book as well as the conservation, enhancement and management of sea turtles in this region. Our sincere gratitude also to Mr. Niwes Ruangpanit, Secretary General of SEAFDEC for his support in the implementation of this project.

While many people have helped us in one way or another in the preparation of this book, we would particularly like to thank Mr. Junichiro Okamoto, Deputy Secretary General of SEAFDEC for reviewing our manuscript critically, formatting our style of writing and in the correction and comments made for the improvement of this book.

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Last but not least, the authors are indebted to all staff of SEAFDEC/MFRDMD, especially Mr. Mazlan Ismail, Mr. Solahuddin A. Razak, Mr. Rosdi Md. Noor, Mr. Nik Nasrudin Nik Ismail, Mr. Mohd Nasir Mohd. Kasni, Mr. Nik Rani Nik Mat, Mr. Muhammad Ibrahim, Mr. Mohd Nazir Taib and Mr. Harun Saleh who are actively involved in sea turtles tagging, hatchery and *in-situ* data collection.

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# List of Acronyms

| | |
|---|---|
| AMAF | ASEAN Ministers on Agriculture and Forestry |
| ARGOS | Advanced Research and Global Observation Satellite |
| ASEAN | Association of Southeast Asian Nations |
| ASWGFi | ASEAN Sectoral Working Group for Fisheries |
| AQD | Aquaculture Department |
| BFAR | Bureau of Fisheries and Aquatic Resources |
| CBD | Convention on Biological Diversity |
| CCL | Curve Carapace Length |
| CDNP | Con Dao National Park |
| CENRO | Community Environment and Natural Resources Offices |
| CITES | Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| CMS | Convention on Migratory Species |
| DANIDA | Danish International Development Aid |
| DCM | Department Committee Meeting |
| DENR | Department of Environment and Natural Resources |
| DNA | Deoxyribonucleic Acid |
| DOF | Department of Fisheries |
| DOFM | Department of Fisheries Malaysia |
| DOFW | Department of Forestry and Wildlife |
| EEZ | Exclusive Economic Zone |
| FAO | Food and Agriculture Organization |
| FCG | Fisheries Consultative Group |
| FRPD | Forest Resources Protection Department |
| GEF | Global Environment Facility |
| GIS | Geographical Information System |
| HIO | Hai Phong Institute of Oceanography |
| ICCC | International Congress of Chelonian Conservation |
| IFT | Institute of Fishing Technology |
| IOSEA | Indian Ocean-Southeast Asian Marine Turtle |
| IRPA | Intensification of Research in Priority Areas |
| IUCN | International Union for the Conservation of Nature and Natural Resources |
| JSPS | Japanese Society for the Promotion of Science |
| MAFF | Ministry of Agriculture, Forestry and Fisheries |

| | |
|---|---|
| MFRD | Marine Fisheries Research Department |
| MFRDMD | Marine Fishery Resources Development and Management Department |
| MMAF | Ministry of Marine Affairs and Fisheries |
| MoU | Memorandum of Understanding |
| MPA | Marine Protected Area |
| MTRC | Marine Turtle Research and Conservation |
| MTRU | Marine Turtle Research Unit |
| NGO | Non-Governmental Organization |
| NIO | Nha Trang Institute of Oceanography |
| NIPAS | National Integrated Protected Areas System |
| NOAA | National Oceanic and Atmospheric Administration |
| NRA | National Reserve Area |
| PAMB | Protected Areas Management Board |
| PAWB | Protected Areas and Wildlife Bureau |
| PCM | Program Committe Meeting |
| PCP | Pawikan Conservation Project |
| PENRO | Provincial Environment and Natural Resources Offices |
| PIT | Passive Integrated Transponder |
| PRRM | Philippine Rural Reconstruction Movement |
| PTT | Platform Terminal Transmitter |
| RIMF | Research Institute for Marine Fisheries |
| RTC | Regional Technical Consultation |
| RCCF | Research Center for Capture Fisheries |
| SCL | Straight-line Carapace Length |
| SEAFDEC | Southeast Asian Fisheries Development Center |
| SEASTAR2000 | Southeast Asia Sea Turtle Cooperative Research 2000 |
| SOM | Senior Officials Meeting |
| TED | Turtle Excluder Device |
| TD | Training Department |
| TIC | Turtle Information Center |
| TIHPA | Turtle Island Heritage Protected Area |
| TINP | Thousand Island National Park |
| TPA | Totally Protected Area |
| TTFD | Thai Turtle Free Device |
| TIWS | Turtle Island Wildlife Sanctuary |
| UNDP | United Nation Development Project |
| US | United States of America |
| VCD | Video Compact Disc |
| WWF | World Wildlife Fund for Nature |

**Ahmad Ali, Zulkifli Talib and**
**Ku Kassim Ku Yaacob**

# BACKGROUND OF SEAFDEC AND ASEAN

The Southeast Asian Fisheries Development Center (SEAFDEC) is an intergovernmental agency established in 1967. The members of SEAFDEC include Brunei Darussalam, Cambodia, Philippines, Malaysia, Indonesia, Singapore, Thailand, Myanmar, Lao PDR and Vietnam. Japan is also a member of SEAFDEC and acts as main donor. Its mandate is to promote fisheries development in Southeast Asia, and assist member countries to develop fisheries potential for the improvement of food supply in the region through training, research and dissemination of information.

SEAFDEC has four departments which assist member countries in accordance with their competence. The Training Department (TD) located in Bangkok, Thailand is concerned with fishing and fishing gear technology, and also conducts research on fishing gear. The second department is the Aquaculture Department (AQD) located in Iloilo, the Philippines. This department is concerned with aquaculture development, research, training and information concerning aquaculture. The third department, the Marine Fisheries Research Department (MFRD) is located in Singapore. This department deals with post-harvest technology and processing. The fourth department of SEAFDEC is in Malaysia, i.e., the Marine Fishery Resources Development and Management Department (MFRDMD). This department is concerned with marine resources and marine fisheries development and management in the ASEAN area. The activities of all these four Departments are coordinated and supported by SEAFDEC Secretariat based in Bangkok, Thailand.

**Plate 1.** SEADEC Departments and Secretariat

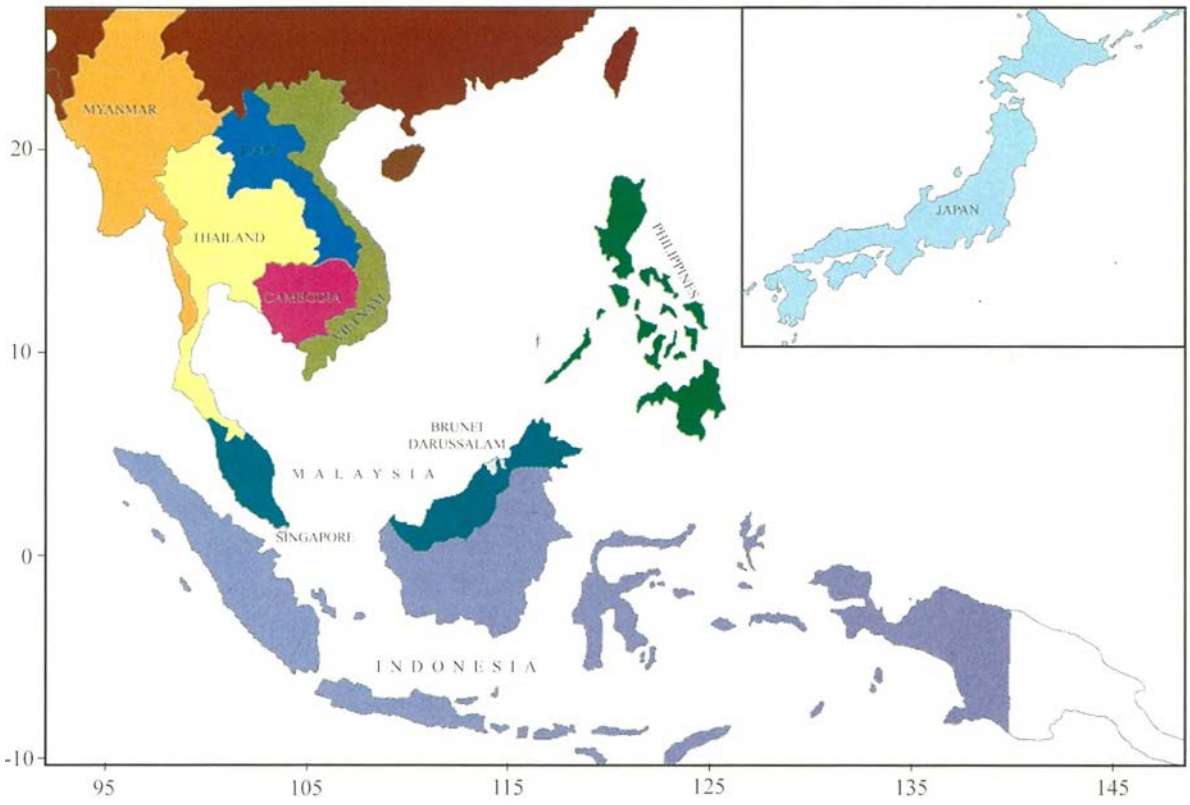



**Figure 1.** Map of ASEAN/SEAFDEC Member Countries

## ASEAN Sea Turtle Conservation and Enhancement Programs and Collaboration with SEAFDEC

Sea turtles are important marine animals, not only under CITES agreement but also as traditional living resources in the ASEAN region. Most of the ASEAN member countries have established national programs on the conservation and enhancement of sea turtles. However, information on research, conservation and enhancement of these animals in the region is rather fragmented. There is, therefore, a need for a regional approach to coordinate this information and data to provide a clear picture of the status of the programs and activities in the ASEAN region. There is also a need to look at legislative efforts at a regional level to conserve these species.

## Memorandum of Understanding on ASEAN Sea Turtle Conservation and Protection

Countering the pressure by the US embargo on the import of wild shrimps from a number of ASEAN member countries in early 1997 and following the US's accusation that shrimp trawlers of these countries did not use the turtle excluder device (TED), the 19th Meeting of the ASEAN Ministers on Agriculture and Forestry (AMAF), held in September 1997 in Bangkok, endorsed the Memorandum of Understanding (MoU) on ASEAN Sea Turtle Conservation and Protection. The objectives of the MoU are to promote the protection, conservation, replenishing and recovery of sea turtles and their habitats based on the best available scientific evidence, taking into account the environment, socio-economic and cultural characteristics of individual ASEAN member countries. The areas of

application of the MoU include the land territories and the maritime areas over which the participating ASEAN countries exercise sovereignty, sovereign rights or jurisdiction in accordance with international law as reflected in the United Nations Convention on Law of the Sea, which was concluded at Montego Bay, Jamaica on 10 December 1982 and came into force on 16 November 1994.

The MoU lays down the definitions of sea turtles as Leatherback turtle (*Dermochelys coriacea*), Green turtle (*Chelonia mydas*), Hawksbill turtle (*Eretmochelys imbricata*), Olive/Pacific Ridley (*Lepidochelys olivacea*), Loggerhead (*Caretta caretta*) and Flatback (*Natator depressus*). Sea turtles habitats refer to all aquatic and terrestrial environment where sea turtles live at any stage of their life-cycle.

Considering its long-term experience and strong efforts on sea turtle conservation, Malaysia has been designated as the Regional Coordinator to lead a Technical Experts Working Group in the implementing of MoU. This group comprises sea turtle and environmental experts from participating ASEAN member countries and reports directly to the ASEAN Sectoral Working Group on Fisheries (ASWGFi). The Technical Expert Group, at its meeting in December 1997 in Jakarta, prepared an ASEAN Sea Turtle Conservation and Protection program which was approved by Sixth Meeting of ASWGFi in March 1998 in Bandar Seri Bengawan and endorsed by the Senior Officials meeting (SOM) of AMAF and the 20th Meeting of AMAF held in September 1998 in Hanoi, Vietnam.

It also stipulated in the MoU that ASEAN member countries recognize the SEAFDEC as the competent technical regional organization on marine issues in the ASEAN region and agree to seek close cooperation and collaboration with SEAFDEC in undertaking its sea turtle conservation and protection program. As a matter of fact, the ASEAN Sea Turtle Conservation and Protection Program and Work Plan mentioned earlier were prepared with full cooperation and contribution of the SEAFDEC's Marine Fishery Resources Development and Management Department (MFRDMD) in Kuala Terengganu, Malaysia.

## ASEAN-SEAFDEC Project on Conservation and Management of Sea Turtles in Southeast Asian Countries

Along with the ASEAN movement, SEAFDEC also started to take its initiative in conservation and management of sea turtles in the Southeast Asian region as a project supported by the Japanese Trust Fund. At the first meeting on 4 March 1999 in Bangkok, the ASEAN-SEAFDEC Fisheries Consultative Group (FCG) agreed on a project of SEAFDEC on "Conservation and Management of Sea Turtles in Southeast Asian Countries". This project proposal was also approved by the 31st Meeting of the SEAFDEC Council and the ASWGFi and the SOM-AMAF.

The objectives of the project are (i) to coordinate and compile information on the status of research, conservation and management activities on sea turtles in ASEAN countries and (ii) to establish a mechanism for regional collaboration in research for sea turtle conservation and management.

Through implementation of this project, it was also expected that SEAFDEC would prepare an ASEAN-SEAFDEC publication on the status and results of research and conservation programs on sea turtles in ASEAN and an ASEAN-SEAFDEC network of national institutes involved in research on sea turtles.

The activities to achieve these objectives include the following;

- Nomination of one country coordinator by each ASEAN member country for the ASEAN-SEAFDEC Sea Turtle Research Network;
- Organization of workshops to establish a format for collecting information and data in each ASEAN country;
- Compilation of information into an ASEAN-SEAFDEC publication on sea turtle management and conservation in ASEAN; and
- Formulation of regional projects by ASEAN-SEAFDEC Network Coordinators. The Network will also be a forum for exchange of information on national programs and priorities on sea turtle research.

## Mechanism for Project Implementation

Malaysia and SEAFDEC/MFRDMD will serve as a contact point for the project for ASEAN and SEAFDEC, respectively. Figure 2 shows the implementation mechanism for ASEAN-SEAFDEC project on conservation and management of sea turtles in the Southeast Asian region.

On the SEAFDEC side, SEAFDEC/MFRDMD serves as the SEAFDEC lead department for Japanese Trust Fund project to undertake the following activities in collaboration with SEAFDEC/TD;

- Collect and compile information on national activities on sea turtle research and conservation;
- Participate in workshop/seminars for formulation or regional research programs; and
- Conduct research based on regional projects as proposed under the ASEAN-SEAFDEC Sea Turtle Research Network.

SEAFDEC/MFRDMD and SEAFDEC/TD provide expertise to assist/advise on national/regional programs on sea turtle research and conservation.

In implementing this project, SEAFDEC/MFRDMD, SEAFDEC/TD and Malaysia will jointly report to the ASEAN-SEAFDEC FCG the progress of the project. In ASEAN, Malaysia will report to the ASWGFi and subsequently to the Annual Meeting of the ASEAN Minister of Agriculture and Forestry (AMAF), through SOM-AMAF. In SEAFDEC, SEAFDEC/MFRDMD will report to the SEAFDEC Council through the SEAFDEC Secretariat and seek guidance of the SEAFDEC Council if necessary.

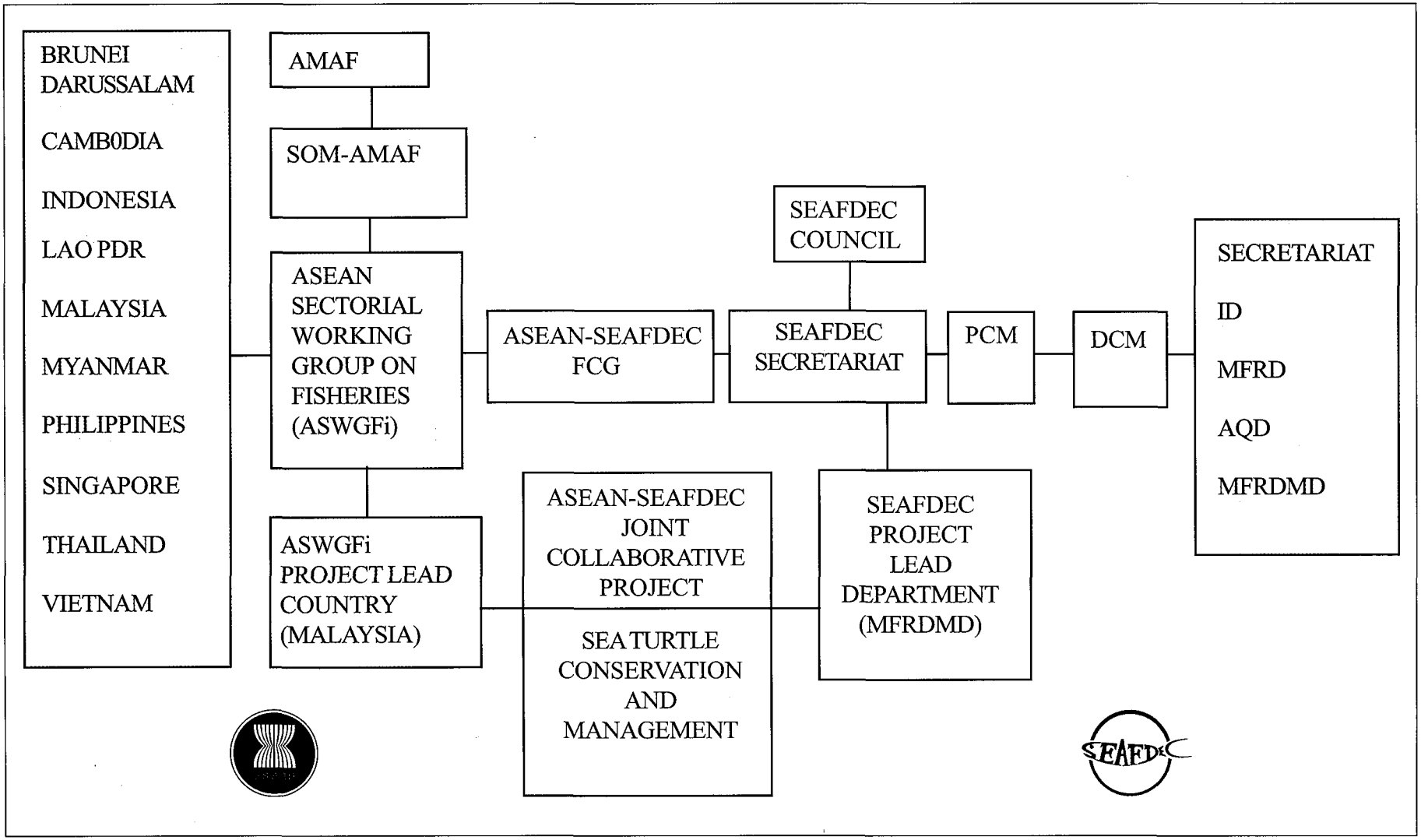
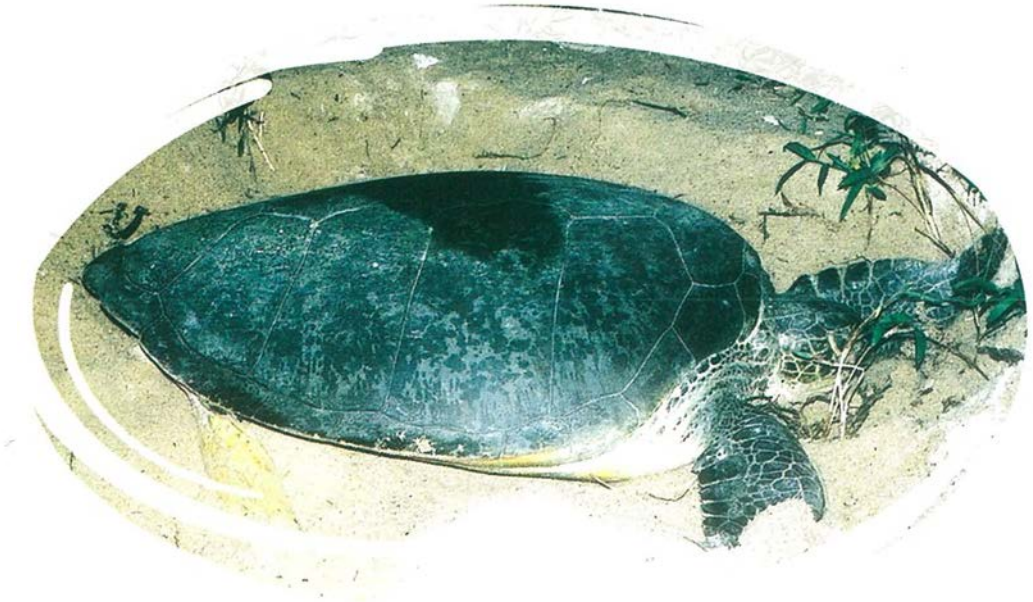



**Figure 2.** Implementation Mechanism for ASEAN-SEAFDEC Project on Conservation and Management of Sea Turtle in Southeast Asian/ASEAN Countries



**Ahmad Ali, Zulkifli Talib,**
**Ku Kassim Ku Yaacob and Bundit Chokesanguan**


# ACTION TAKEN BY SEAFDEC ON SEA TURTLE RESEARCH AND CONSERVATION ACTIVITIES (1992-2003)

## Pre-SEAFDEC Activities

The sea turtle research and conservation programs conducted by SEAFDEC/MFRDMD concentrated on three areas: research, training and information. Research on sea turtles in Malaysia was actively undertaken in the late 1980s by the Department of Fisheries Malaysia (DOFM), World Wildlife Fund for Nature Malaysia (WWF-Malaysia) and local universities following the National Workshop on Sea Turtle Conservation and Management held in Terengganu in December 1987 and the establishment of the Intensification of Research in Priority Areas (IRPA). The IRPA Strategy Panel is the mechanism under the Ministry of Science, Technology and the Environment responsible for promoting and sponsoring research and development (R&D) activities in Malaysia. After getting approval from the IRPA Strategy Panel in 1987, the DOFM began its research programs in 1988. In the 1990s the DOFM

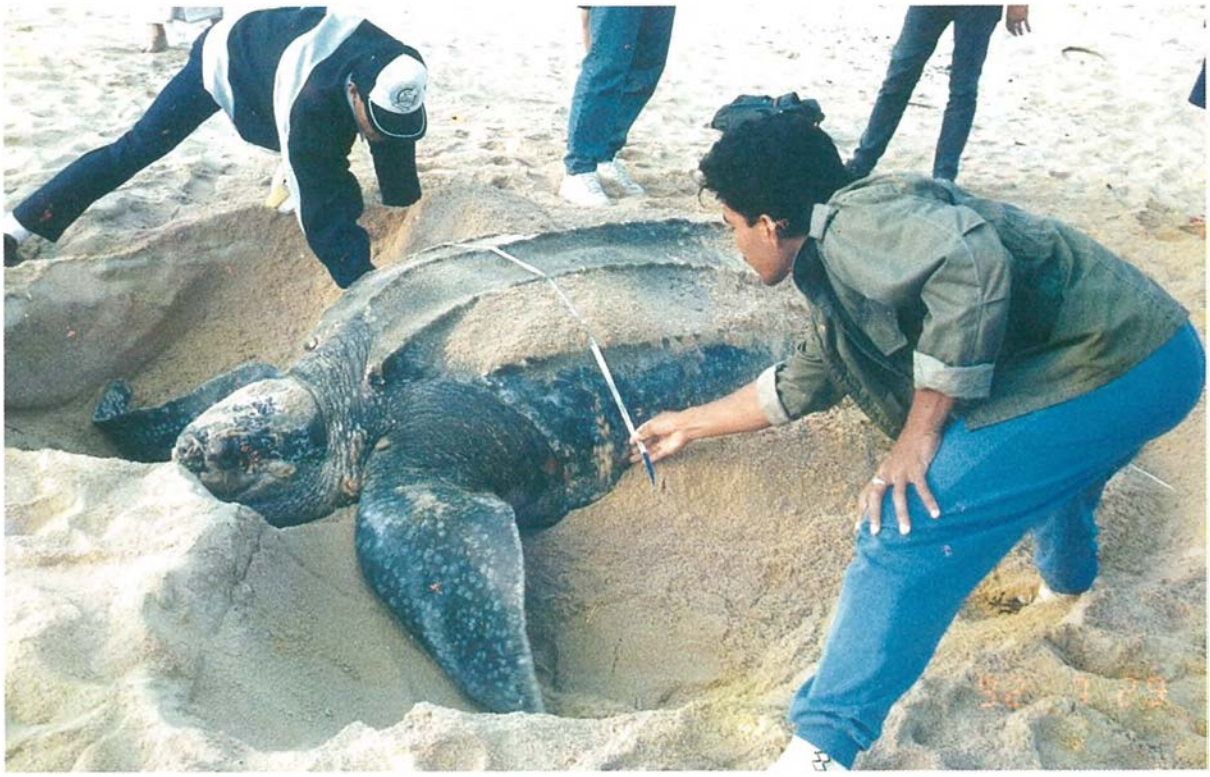


**Plate 2.** Sea Turtle Research Activities in Malaysia in 1990's Using National Fund

implemented sea turtle research through the Marine Fishery Resource Center based in Kuala Terengganu. The center later changed its name to the SEAFDEC/MFRDMD in 1992. At the initial stage, all research activities were funded by a national fund through IRPA. Under the IRPA fund from the Government of Malaysia, more than US$ 130,000 was spent to conduct 7 research activities as listed below:

- Tagging of sea turtles in Terengganu and Pahang.
- Nursing experiment of leatherback turtles.
- Studies on ecology of the Painted Terrapin in Kuala Setiu, Terengganu.
- Studies on incubation of sea turtle eggs in shade and elevated hatcheries.
- Turtle beach surveys in Pahang, Terengganu, Malacca and Perak.
- Monitoring of sea turtle hatchery operation.
- Monitoring of nesting population.

In addition to management of marine fishery resources, the focus of the SEAFDEC/MFRDMD is on sustainable development, and thus the sea turtle research and conservation program was initiated in 1996. The objective of the sea turtles program is to address immediate issues related to management and conservation of sea turtles in the ASEAN/SEAFDEC area.

## Workshops/Seminars and Training Organized by SEAFDEC/MFRDMD (1996-2003)

The First SEAFDEC Workshop on Marine Turtle Research and Conservation was held in Kuala Terengganu, Malaysia from 15-18 January 1996. The workshop was attended by participants from Malaysia, Thailand, the Philippines, Brunei Darussalam and Japan. The objectives of this workshop were to provide a platform for sea turtle scientists from SEAFDEC member countries to present, discuss and update biological information on marine turtles in the region, beside enhancing the cooperation and collaboration in research and relevant activities among member countries to help protect and conserve sea turtles. A committee called the Marine Turtle Research and Conservation Working Committee (MTRC) was established during the workshop. All participants present were automatically members of this working committee. The recommendations of the above workshop are listed below:

- Training programs in turtle management and conservation, including data analyses and management, should be conducted for relevant personnel in this region.
- There was a need to standardize the method of tagging procedures and data collection. In this respect, a workshop on turtle tagging and data management to be facilitated by a marine turtle expert should be arranged.
- Data obtained from projects funded by SEAFDEC should also be channeled to SEAFDEC/ MFRDMD to enable a comprehensive database, accessible to all members to be set up.
- There was a need to develop an effective awareness campaign to disseminate information on turtle conservation and research activities in the region as well as in other parts of the world.
- There was a need to develop an effective information exchange among members to facilitate better communication. Such abilities can perhaps be improved through setting up a proper network or by relying on existing one.
- Meetings among the members of this working group should be conducted at least once a year, and workshop regarding the progress of the various activities on turtles conducted once every 2-3 years.

The proceeding of the above workshop was published by SEAFDEC/MFRDMD in May 1997 entitled: "Proceeding of the First Workshop on Marine Turtle Research and Conservation". This publication was distributed to all participants and relevant agencies.

Based on the recommendations of the above workshop, and the MoU on ASEAN Sea Turtle Conservation and Protection, the First Meeting on Regional Tagging Program and Data Collection on Marine Turtle was held also at SEAFDEC/MFRDMD in Kuala Terengganu from 21-23 December 1997. Two main issues were deeply discussed during the meeting:

- Sea turtle statistics, and
- Sea turtle tagging program.

As a host of the meeting SEAFDEC/MFRDMD presented two project proposals namely (i) Regional Marine Turtle Statistics for the Southeast Asian Region, and (ii) Collaborative Tagging Program of Marine Turtles in the Southeast Asian Region. The objectives of these projects are to compile all available sea turtle population statistics in the region and to collect, update and disseminate the information to countries in and outside the region.

With regards to the training programs in turtle management and conservation, including data analyses and management recommended during the First SEAFDEC Workshop on Marine Turtle Research and Conservation (held in Kuala Terengganu, Malaysia from 15-18 January 1996), SEAFDEC/MFRDMD in collaboration with the DOFM had conducted the First Regional Training Course on Marine Turtle Research and Conservation from 24-30 August 1998 in Kuala Terengganu Malaysia. A total of 12 participants from Indonesia, Thailand, Myanmar, Brunei Darussalam, Malaysia, the Philippines, Vietnam and five observers from Malaysia and Thailand attended.

The training was led by a sea turtles expert, Dr. Colin Limpus from Queensland Department of Environment and Heritage, Queensland, Australia with the assistance from a local sea turtle expert of


**Plate 3.** The First SEAFDEC Workshop on Marine Turtle Research and Conservation in Terengganu, Malaysia: 15-18 January 1996


**Plate 4.** The First Meeting on Regional Tagging Program and Data Collection on Marine Turtle in Terengganu, Malaysia: 21-23 December 1997

DOFM. The training covered a wide scope of sea turtle research and conservation activities through lectures and field trips to several sea turtle rookeries and hatcheries in Malaysia. The objectives of this training were to enhance the scientific knowledge on the research, management and conservation of sea turtle for scientists in the region and to adopt a practice of proper management and conservation activities for sea turtles in the region. All participants attending the course were directly involved in their duty relating to sea turtle tagging and conservation activities.

A regional tagging project was started in 1998. A total of 11,000 units of inconel tag had been distributed by SEAFDEC/MFRDMD to SEAFDEC member countries from 1998-2002. Each country has its own code-number series; Brunei is BN, followed by a number; Cambodia (KH); Indonesia (ID); Malaysia (MY); Myanmar (MM); Philippines (PH); Thailand (TH); and Vietnam (VN). Tags supplied thus far included: 300 to Brunei (serial number BN0001 to BN0300) ; 2,000 to the Philippines (PH0001-PH2000); 2,000 to Indonesia (ID0001-ID2000); 2,000 to peninsular Malaysia (MY0001-MY2000); 1,000 to Sabah (MY(S)0001-MY(S)1000); 1,000 to Sarawak (MY(SA)0001-MY(SA)1000); 2,100 to Thailand (TH0001-TH01100 and TH(P) 0001-TH (P) 1000); 1,000 to Myanmar (MM0001-MM1000); 200 to North Vietnam (VN(N)0001-VN(N)0200); 200 to South Vietnam (VN(S)0001-VN(S)0200) and 200 to Central Vietnam (VN(C)0001-VN(C)0200). The results of these tagging activities are reported in this book under section Sea Turtle Conservation and Management in each country.

Subsequently, SEAFDEC and ASEAN met at the First Meeting of the ASEAN-SEAFDEC Fisheries Consultative Group (FCG) on 4 March 1999. The FCG agreed upon a program for conservation and management of sea turtles of Southeast Asian Countries under Japanese Trust Fund as one of FCG collaboration mechanism. Both the SEAFDEC Council and the Senior Official's meeting of the AMAF had endorsed the programs on sea turtles.

**Plate 5.** The First Regional Course on Marine Turtle Research and Conservation in Terengganu, Malaysia: 24-30 August 1998

The second SEAFDEC-ASEAN Regional Workshop on Sea Turtle Conservation and Management held from 26-28 July 1999 in Terengganu, was also to provide a platform for sea turtle scientists and managers of SEAFDEC and ASEAN member countries to meet and exchange experience and information on the current status and future directions of research, conservation and management of sea turtles. The workshop was attended by delegates from Brunei Darussalam, Cambodia, Indonesia, Japan, Malaysia, Myanmar, the Philippines, Thailand and Vietnam; resource persons from SEAFDEC Secretariat, ASEAN Secretariat, WWF-Malaysia, DOFM, local universities, SEAFDEC Training Department; and observers from Marine Environmental Association of Tokyo; Sabah Parks, Malaysia; Forestry Department Sarawak, Malaysia; Department of Fisheries Malaysia; local universities and the private sector. The proceedings of the above workshop was published by SEAFDEC/MFRDMD in December 1999 entitled: "Report of the SEAFDEC-ASEAN Regional Workshop on Sea Turtle Conservation and Management". Some of the most important recommendations of the workshop are listed below:

- Every country should have its own 'sea turtle working committee' headed by a national coordinator. The national coordinator will be the contact point for the regional coordinator for ASEAN cooperation in sea turtle conservation and management.
- The ASEAN-SEAFDEC Fisheries Consultation Group on Sustainable Management of Fisheries Resources in the Southeast Asian Region (FCG), through relevant channels in ASEAN and

**Plate 6.** Sea Turtle Tagging Activity in Cambodia

SEAFDEC, established a Regional Network of Research on Sea Turtle Research, Conservation and Management.

- Member countries of ASEAN and SEAFDEC should submit copies of all relevant materials related to sea turtle research, conservation and Management to the Regional Coordinator.
- Member countries of ASEAN and SEAFDEC should submit proposal for regional cooperation projects on sea turtle conservation and management to ASEAN-SEAFDEC Fisheries Regional Cooperative Consultative Group, through Malaysia and SEAFDEC/ MFRDMD.
- The submitted project proposal should be consistent with the various areas of concern as identified under ASEAN Sea Turtle Conservation and Protection Programs which was endorsed by the 20th Meeting of ASEAN Ministers on Agriculture and Forestry (AMAF) in September 1998 in Hanoi.
- In this regards, member countries may consider the project proposals that were presented in the workshop which fulfill or can be reformulated to fulfill the regionality criteria required by ASEAN, especially those projects that will require third-party funding support from sources other than SEAFDEC.
- SEAFDEC is to accommodate turtle conservation and management into its regionalization of the Code of Conduct for Responsible Fisheries, establish a GIS database on turtle and organize appropriate workshop and training courses within its 5-year program.

In the year 2000, the First SEAFDEC Meeting on Regional Sea Turtle Data Management was held in Terengganu from 20-21 November 2000. The meeting was attended by participants from Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam, as well as officials from SEAFDEC/MFRDMD, and observers from Sarawak Forest Department, The Board of Trustee of Sabah Parks and DOFM. The main objective of this meeting was to evaluate the


**Plate 7.** The Second SEAFDEC-ASEAN Regional Workshop on Sea Turtle Conservation and Management in Terengganu, Malaysia: 26-28 July 1999

progress action made by SEAFDEC member countries according to the agreement of the first meeting (Regional Tagging Program and Data Collection on Marine Turtle held at SEAFDEC/MFRDMD from 21-23 December 1997). The main topics of discussion were on the collection of sea turtle statistics in the region as well as sea turtle tagging programs implemented in the region. This meeting also acted as a platform to gather the current population status of six species of sea turtle reported to inhabit this region. This information will facilitate SEAFDEC/MFRDMD to produce a bulletin on sea turtle population statistics in Southeast Asia and to create a digitized atlas of sea turtles in the region. The report of the meeting was published by SEAFDEC/MFRDMD on September 2001 entitled Report of the First SEAFDEC Meeting on Regional Turtle Data Management. The meeting identified the following resolutions for sea turtle data management in the region:

- The meeting agreed that future meetings on Regional Sea Turtle Data Management to be organized once in two years. If possible, the meeting could be held back-to-back to the SEAFDEC-ASEAN Regional Workshop on Sea Turtle Conservation and Management.
- The meeting agreed that SEAFDEC/MFRDMD to publish the Bulletin on Sea Turtle Population Statistics in Southeast Asia in the form of hard copies, and, should there be enough budget, CD-ROMs on the turtle statistics could also be produced.
- Close coordination of effort among the countries of the region was vital to enable the regional sea turtle tagging exercises conducted in any of the SEAFDEC member countries to be implemented successfully. Greater awareness should also be promoted among the other member countries relating to the tagging exercises that are being undertaken.
- SEAFDEC, in particular SEAFDEC/MFRDMD, should be available in providing assistance to new SEAFDEC member countries like Myanmar and Cambodia, in the implementation of their regional sea turtle tagging programs, including the supply of inconel tags and applicators. An official request should however be made to SEAFDEC by these countries concerned relating to their needs on the training of the relevant staff members on matters relating to turtle tagging and turtle conservation activities.
- SEAFDEC/MFRDMD was required to compile and collect all sea turtle tagging data from the region and, with the help of experts to be later determined by SEAFDEC/MFRDMD, would convene a Training Workshop for the purpose of analyzing the available sea turtle data before 2003.
- The meeting recognized the need for SEAFDEC to continue with its financial support to member countries on sea turtle tagging programs.
- The meeting agreed that sea turtle tagging methodology to be expanded to include other techniques such as using satellite tracking.
- DNA studies could also be conducted by member countries to determine the population unit of sea turtles in the region.

In the same year (2000), as requested by member countries, SEAFDEC/MFRDMD conducted a second training/workshop in Terengganu, Malaysia, with the participation of sea turtle research officers from Vietnam, Cambodia and Myanmar on tagging and hatchery management. The training was jointly organized by SEAFDEC/MFRDMD and DOFM.

During 2001-2003, SEAFDEC/MFRDMD conducted two projects under ASEAN-SEAFDEC Fisheries Consultation Group Mechanism under Japanese Trust Fund program entitled Conservation and Management of Sea Turtles in Southeast Asian Countries. The program had two projects namely:

1) Sea turtle hatchery management studies.
2) Sea turtle tagging survey.

**Plate 8.** The First SEAFDEC Meeting on Regional Sea Turtle Data Management in Terengganu, Malaysia: 20-21 November 2000

Hatchery program as a common tool in conserving sea turtles in the region was most likely producing an imbalanced sex ratio and reduced hatch success. Like many other turtle species and crocodilians, sea turtles also possess temperature-dependent sex determination. The sex of the hatchling is determined during the middle third of the incubation period by the temperature of the nest.

For all species, a nest temperature above the pivotal temperature produces mostly female hatchlings, while below the pivotal temperature mostly male hatchlings are produced. At very low nest temperatures, approaching 26°C, all species produce 100% males and at very high temperatures, approaching 32°C, all species produce 100% females.

When the pivotal temperature is not known, eggs must be incubated from a full range of natural habitats, especially with regards to natural shading. Hatcheries provide very artificial nest sites with respect to the range of sand temperature available to the eggs. Endeavors should be made to provide the same range of sand temperature as occurs at natural nest sites. These can be done by using more than one hatchery. Every hatchery should use shading of different intensities to create sections of the hatchery so that one section produces all males (26-27°C) and another produces all females (30-31°C). Low cost shading can be provided with palm fronds. Shade cloth sheeting may be more suitable for allowing an altering intensity of shade in response to changing sand temperature.

Each egg contains a very small embryo (gastrula) that has temporarily ceased development. At this stage of development, a sea turtle egg can survive the bumping and rolling associated with being laid. However, within 2 hours of being laid, the embryo recommences development. From this time onwards, rotation of the egg may cause its death. The eggs continue to be very susceptible to movement-induced mortality for the next few weeks of incubation. Most failure of eggs to hatch in hatcheries is the result of disruptions of subsequent embryonic development (i.e. early embryonic death), not infertility.

There is an urgent need for the development of a proper conservation strategy in hatchery management. Information gained about the best methods for maximizing production of hatchlings of a balanced sex

ratio and high hatch success will be directly applied at all hatcheries in the region, subject to local conditions.

SEAFDEC/MFRDMD is also involved in improving hatchery management. The hatchery research began in 2000 only in Malaysia and Thailand due to limited budget constraint. This study is focused on addressing the issue of low hatch rate success, hatchling sex ratio, and hatchling orientation.

**Plate 9.** Typical Sea Turtle Hatchery in Malaysia in 1990's

Sea turtle hatchery management studies were carried out at six sites in Malaysia and two sites in Thailand in 2001-2003 and focused on the green turtle. The natural incubation has been carried out at two sites (Redang and Perhentian Island, in Malaysia) and the artificial (hatchery) incubation at another 7 sites ie; 6 sites in Malaysia namely Redang, and Perhentian Islands, Geliga, Chendor, Ma' Daerah and Segari and in Thailand namely Khram Island. Temperature logger were deployed to determine sand profile and nest temperatures (2001- 2002). Data on emergence success, nest depth, sand and nest temperature profiles, hatching morphometrics and scalation, running performance and hatchling orientation were collected.

Hatchery management studies in Thailand were conducted at Khram Island. Beach patrol for eggs hatching on Khram Island was undertaken during nesting season in 2001- 2003. All eggs in the area were counted and recorded. Study on incubation temperature and sex ratio of green turtle hatchlings was also carried out for hatchery management. About 10-50 samples of dead hatchlings were collected monthly throughout the year to determine the sexing of hatchling in relationship to incubation temperature. The experiment using black cloth technique cover in hatchery was undertaken during the nesting season. The eggs for each clutch were transplanted and incubated under 30% sunlight penetration. A temperature data logger was placed at the center of each clutch to log the temperature of each nest throughout the duration of incubation. Data of hatching success and incubation period were also recorded.

Conservation of nesting environment and eggs protection in the hatchery are the most important issues to get a high emergence success and healthy hatchlings. Treatments of eggs in the hatchery will have effects on the emergence success and sex ratio of hatchlings. The final objective of sea turtle hatchery management studies by SEAFDEC/MFRDMD projects is to clarify the best methods for maximizing production of healthy hatchlings with a balanced sex ratio (approximately 70% female and 30% male)

**Plate 10.** *In situ* Nesting Beach in Redang Island, Terengganu, Malaysia. Each Nest is Marked with a Pole.

**Plate 11.** Khram Island Rookery in Thailand

and high emergence success that can be directly applied at all hatcheries in the region, subject to local conditions. The following activities have been performed to acquire these objectives:

- Field study on incubation biology (emergence success and relevant parameters) of natural and artificial nests.
- Field study on sand and nest temperature profile (*in situ* and hatchery).
- Field experiments to improve hatch success.
- Sex ratio manipulation study.
- Hatchling orientation study.
- Hatchlings vigor and healthiness study.

Sea turtles are highly migratory animals and are known to wander the waters of this region freely. A regional cooperation among the SEAFDEC member countries in conserving these species is crucial to ensure their continued survival. Considerable biological information, such as the migration, growth, mortality, reproduction and population estimates, can be derived from tagging studies which are useful for a proper regional management.

With regards to the sea turtles tagging activities, member countries successfully implemented their tagging activities in the year 2001-2003 by using inconel tags provided by SEAFDEC/MFRDMD. Another 5 applicators were sent to Myanmar in 2003 upon a request from the Department of Fisheries, Myanmar.

The main objectives of sea turtles tagging programs are to initiate and promote regional sea turtles tagging in Southeast Asia so as to contribute to conservation and management of sea turtles by:

**Plate 12.** Study on Sand Profile and Nest Temperature at Mak Kepit, Redang Island, Terengganu

- Providing tagging equipment and methodology to member countries,
- Tagging and identifying individual nesting turtles of all species,
- Establishing sea turtles tagging data management and data analysis,
- Understanding sea turtles behavior and estimate nesting populations,
- Production and distribution of sea turtles identification sheet and tag recovery flyers,
- Publication and distribution of sea turtles tagging manual and
- Development of computer program for sea turtle tagging data base.

**Plate 13.** Inconel and PIT Tags used in Myanmar and Other Member Countries

Flipper tagging using external tags was implemented during 2001-2003. The new type of tags, i.e., the Passive Integrated Transponder (PIT) tags or microchip tags are becoming popular and many scientists now are using these tags to supplement flipper tags. PIT tags, that are injected into a turtle's shoulder muscle using a hand-held applicator gun, are about the size of a grain of rice and are now popularly used in turtle ecological studies for permanent identification of individual animals. PIT tagging activities were initiated in 2003 for the region and each member country namely Malaysia, Thailand, Myanmar and the Philippines were provided with 25 units of PIT tags and an applicator. In order to have comprehensive tag and recovery data, PIT tags would be used to supplement existing flipper tagging. In addition, the PIT tagging manual was also distributed to member countries with the aims of providing guidelines for a proper tagging technique and to standardize tagging activities in the region.

Recognizing the importance of the issue related to sea turtles and their impacts on fisheries in the ASEAN region, SEAFDEC has develop a regional program on fish trade and environment. The program was initiated in 1999 and since then SEAFDEC, in collaboration with the ASEAN and SEAFDEC member countries, has been implementing a regional program on fish trade and environment to address the importance of fish trade through the promotion of proper conservation and management to ensure sustainable fisheries in the region in the future.

**Plate 14.** Tagging of Front Flippers of Green Turtle in Sabah, Malaysia

The ASEAN-SEAFDEC Regional Meeting on Fish Trade and Environment organized by SEAFDEC in October 2002 in Bangkok strongly supported the ASEAN common positions in the implementation of management and conservation of sea turtles. This regional meeting focused on the important issues of fish trade in the ASEAN and SEAFDEC member countries related to sharks, sea turtles and chemical residues in farmed shrimp. The meeting also agreed on the following matters:

- To conduct comprehensive assessments and to quantify impacts on the reduction of sea turtle populations through either fisheries or non-fisheries factors (e.g., pollution, coastal area development, tourism, transportation, etc.);

- The outcomes of these assessments could be used as the basis to strengthen the current measures to conserve sea turtles;
- The outcomes of these assessments should be appropriately collated and disseminated to enhance the awareness of the importance on sea turtle conservation;
- The member countries should consider collective ASEAN-SEAFDEC publications to document the sea turtle conservation programs and activities that have been undertaken in their respective countries for international distributions;
- ASEAN and SEAFDEC member countries reiterated that a comprehensive sea turtle conservation program was the most effective strategy for sea turtle conservation. The use of Turtle Excluder Devices (TEDs) may be one of the possible options to alleviate the current trade problems in relation to by-catch of sea turtles. However, considering that the current trade problems were partly derived from the limited knowledge of the regional environment of the trade partners, the above assessment outcomes should be used to mitigate the trade problems on by-catch of sea turtles.

Following these resolutions and recommendations adopted at the meeting, SEAFDEC/MFRDMD had organized a Regional Technical Consultation (RTC) on the Management and Conservation of Sea Turtles in Southeast Asia in cooperation with the ASEAN Secretariat and Malaysia as an appointed lead country for the ASEAN-SEAFDEC turtle program. This consultation was financially supported by Japanese Trust Fund under the ASEAN-SEAFDEC Fisheries Consultative Group (FCG) Mechanism. The RTC was held from 16-18 October 2003 in Kuala Lumpur and attended by 2 representatives from each SEAFDEC member country (except Lao PDR and Singapore). All countries expressed seriousness in strengthening existing national conservation and management measures that included hatcheries, sanctuaries, information and education, tagging and satellite tracking. The proceedings of the above consultation were distributed to all participants and related agencies. One of the important recommendations adopted during the RTC was to make a publication in order to enhance public awareness about initiatives for conservation and enhancement of sea turtle taken in the Southeast Asian region.


**Plate 15.** Regional Technical Consultation on the Management and Conservation of Sea Turtles, Kuala Lumpur: 16-18 October 2003

## SEAFDEC and SEASTAR2000 Project

In 1999, the Japanese-Thai cooperation research of sea turtles started with the fund from Kyoto University and Tokyo University, Japan. The project has been supported by a Grant-in-Aid of Ministry of Education, Sport, Science and Technology of Japan through the Japanese Society for the Promotion of Science (JSPS) since 2001. The project mainly focused on the research of behavior and conservation of adult female green turtles during post nesting periods around the Gulf of Thailand and the Andaman Sea from 1999-2000. Every year since 2001 SEAFDEC has sponsored one participant from Brunei, the Philippines, Vietnam, Cambodia, Indonesia and Myanmar to participate and present their research findings in the SEASTAR2000 Workshop held in Bangkok, Thailand.

Satellite tracking or satellite telemetry is another advanced tool in studying sea turtles ecology. This activity aims to develop a number of satellite tracking techniques to determine the migratory and distribution patterns of sea turtles in the region. Present pressure and threats to all turtle species in the region deserve quick data acquisition and the findings of satellite tracking have a strong management implication. This technique provides quick data on turtle migration from which information is useful for the purpose of identifying offshore feeding and nesting areas as well as migration routes. This activity was conducted in collaboration with existing SEASTAR2000 (Southeast Asia Sea Turtle Cooperative Research 2000). This project is led by Kyoto University, Japan.

**Plate 16.** Participants of SEASTAR2000 Workshop in Thailand: 16-19 December 2002

# Development and Achievements in the Use of Turtle Excluder Devices in Southeast Asia

## Introduction

The management of Southeast Asia's shrimp trawl fisheries, as with others in the world, continues to occur in circumstances of sharp socio-economic pressures and there is an urgent need to minimize the effects of fishing on the environment and non-target organisms, especially sea turtles. During the last decade, SEAFDEC has achieved many important outcomes in its efforts to reduce the incidental capture and subsequent mortalities of sea turtles in shrimp trawl fisheries.

These achievements have relied significantly on the support of the Government of Japan through the Trust Fund Project, under the theme of the Conservation and Management of Sea Turtles.

## The US Shrimps Trade Embargo and Turtle Excluder Devices Issues

## Action Taken by SEAFDEC

The process of reducing the incidental capture and subsequent mortalities of sea turtles in regional shrimp fisheries through the use of Turtle Excluder Devices (TEDs) has been extremely important.

This is especially the case due to the global significance of Southeast Asia's sea turtle populations and the importance of shrimps fisheries to regional economies and fishing communities.

In order to fully appreciate the outcomes achieved thus far, it is useful to note in some detail aspects of the United States (US) Trade Embargo introduced in the mid 1990s and its ongoing influence on regional shrimp fisheries, the response from SEAFDEC in coordinating the integration of TED technology into the planning and management of regional shrimp fisheries, and the evolving international policy framework for sea turtle conservation and TEDs use.

## The US Shrimp Trade Embargo

On 1 May 1996, the US introduced an embargo against the importation of shrimps caught with gear not equipped with a means of preventing sea turtle catch. This embargo was imposed upon all shrimp exporting countries, including those in Southeast Asia. Ostensibly, this was to improve the catch composition of shrimp trawls and specifically to exclude the potential catches of sea turtles.

US law presently prohibits the importation of shrimp which have been harvested in ways harmful to sea turtles. However, this prohibition does not apply to shrimps harvested in countries that have been certified as having adopted a program comparable to the US program to protect sea turtles. In order to be certified as having a comparable program, a country must have laws or regulations similar in all meaningful respects to those of the US, which require shrimp trawl vessels to use TEDs.

Recently, the US has amended the abovementioned regulations and certification requirements for shrimp-producing countries have been modified accordingly. This demonstrates a continuing process by the US to drive the improvement of global shrimp-harvesting practices and sea turtle conservation.

The embargo introduced on a unilateral basis by the US in 1996 had a significant extraterritorial effect, especially in Southeast Asia. In fact, it was deemed by countries in the region as a serious threat to the ongoing financial viability of their shrimp trawl fisheries. SEAFDEC acted promptly and through its governing body, the Council of Directors, approval was given to the urgent consideration of practical designs for turtle exclusion devices for shrimp trawl gear and the implementation of these devices into regional shrimp fisheries.

It was intended that this process would avert the potential adverse effects of the US import ban. It was also planned that this would assist in reducing the average rate of incidental taking of sea turtles to the level that was similar to the incidental rate of capture observed for US shrimp vessels using fishing gear equipped with TEDs.

The SEAFDEC Council of Directors requested SEAFDEC/TD and SEAFDEC/MFRDMD to work on a collaborative basis with the Department of Fisheries of SEAFDEC member countries in the development of a TED suitable for use in Southeast Asia. As most research and development for trawl fishing gear in the region had focused on catching efficiency until this time, the request presented many initial challenges for SEAFDEC, the respective Departments of Fisheries of SEAFDEC member countries, as well as the many fishing communities which depend on regional shrimp fisheries.

## The Evolving Policy Framework

Although it does not specifically address sea turtles, the Food and Agriculture Organization's Code of Conduct for Responsible Fisheries, adopted in 1995, calls for a sustainable use of aquatic ecosystems and requires that fishing be conducted 'with due regard' for the environment. It also addresses specifically

biodiversity issues and conservation of endangered species and, in so doing, calls for the catch of non-target species, both fish and non-fish species, to be minimized. At the same time, SEAFDEC member countries are driven by the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region, as well as the Regional Guidelines for Responsible Fisheries in Southeast Asia – Fishing Operations, to develop fishing operations that minimize impacts on non-target species and the environment.

Also, several SEAFDEC member countries, namely Myanmar, the Philippines and Vietnam, are signatories to the 2000 Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and Southeast Asia. This memorandum had been adopted pursuant to Article IV(4), Convention on the Conservation of Migratory Species of Wild Animals. Although the Memorandum does not specifically mention the use of TEDs, its Conservation and Management Plan adopted on 23 June 2001, provides that an activity which signatory nations should undertake is "to develop and use gear, devices and techniques to minimize incidental capture of marine turtles in fisheries, such as devices that effectively allow the escape of marine turtles".

## SEAFDEC's Achievements in the Implementation and Use of Turtle Excluder Devices in Southeast Asia

Significant outcomes in the implementation and use of TED in Southeast Asia have been achieved during the last decade. This is especially the case for Thailand which played a pioneering role in cooperation with SEAFDEC in overcoming the US trade embargo in 1996. This section reviews the achievements of SEAFDEC in assisting Thailand, Malaysia, the Philippines, Brunei Darussalam and Indonesia in overcoming this problem. The Government of Japan's Trust Fund Program has played a key role in this process.

### TED Research and Demontrations in Malaysia

The achievements and lessons learned during the implementation of TEDs into Thailand's shrimp trawl fishery were used as a foundation for increasing the use of the Thai Turtle Free Device (TTFD) by Malaysia's important shrimp fisheries in early 1997. Shrimp trawl fishing has been an important fishing method along the Malaysian peninsula since 1966 and the 1996 US embargo introduced a significant threat to the ongoing financial viability for this important sector of Malaysia's fishing industry.

SEAFDEC/MFRDMD played an important role in these processes in Malaysia, although collaborating closely with SEAFDEC/TD and the DOFM. The experimental fishing trials conducted in Thailand in September 1996 were attended by SEAFDEC/MFRDMD representatives. The results of which were used as a basis for further experimentation in Malaysian waters during February 1997.

This Malaysian-based experimentation was conducted from research and industry vessels in the waters adjacent to Pantai Remis, Perak. The experiments aimed to further develop regional understanding of the aspects influencing the efficiency and effectiveness of the TTFD, whilst simultaneously providing information relevant to the potential applicability of this TED to the Malaysian situation. Specifically, the effect of TED size on escape rate was tested for small (80cm x 80cm) and medium (80cm x 100cm) sized TTFDs.

The experimental results indicated that both sizes were effective in preventing the incidental capture of sea turtles, whilst not significantly influencing the catch rates of fish and shrimp. Slight differences in


**Plate 17.** TEDs Research and Demonstrations in Malaysia, in 1997

shrimp escape rates between the two TED sizes were observed during the trials, although it was not possible to conclude if this difference was significant. Importantly, shrimp catch rate was not affected by TED size.

Following the completion of the experimental fishing trials and the ensuing data analysis process, a workshop was convened during March 1997 to provide an opportunity for stakeholders in Malaysia to develop practical skills in the installation of TEDs into shrimp trawl fishing gear, and observe the at-sea operation of these devices. This workshop was convened by SEAFDEC in cooperation with the DOFM and was attended by approximately 100 participants from Malaysia's fishing industry, government, universities and other interested parties from Thailand and the Philippines.

An industry vessel was used at the conclusion of the workshop to provide a demonstration to interested parties on the use of TEDs. Low escape rates of fish and shrimp during this demonstration was effective in building industry confidence in the use of TEDs in the Malaysian setting. Twenty TTFDs were presented to Malaysian fishers at the conclusion of this inaugural Malaysian workshop.

These processes were effective in providing the basis for ongoing experimentation and training in the use of TEDs in Malaysia. SEAFDEC/TD and SEAFDEC/MFRDMD continue to work on a collaborative basis with the DOFM and Malaysian shrimp fishers in the sharing and dissemination of information relating to the use of TEDs in Malaysia and the broader region. An example is the delivery of lectures and practical demonstrations on the use of TEDs during the Regional Training Course on Sea Turtle Conservation.

Follow-up training in the installation and operation of TEDs, specifically the TTFD, was prepared and delivered to fishers and fisheries officers throughout 1997 and 1998. An initiative to develop mechanisms to be more responsive to the information needs of Malaysian fishers using TEDs was implemented though a questionnaire-based survey in early 1998.

## TED Research and Demonstrations in Thailand

SEAFDEC activities have resulted in many important achievements in the implementation and use of TED technology in Thailand. The significant importance is the design, development and implementation of TTFD into Thailand's shrimp fisheries. The design of this uniquely Thai TED was based on the experimentation and analysis of a number of TEDs collected during a pioneering study tour to the US and Mexico by staff of SEAFDEC's Training Department in July 1996. This study tour was conducted in response to the need for Southeast Asian countries to overcome the U.S. embargo, and the identification by SEAFDEC of the urgent need to investigate TED development and use in the U.S. and Mexico, countries that were both using TED technology in their shrimp fisheries. Leading Thai fishing gear technologists and researchers participated in this study tour to gain knowledge of the types of TEDs used in these countries and the specifics of the US TED regulations.

The SEAFDEC team returned to Thailand with 5 actual TEDs. The now well-known "Anthony Weedless", "Supershooter" and the "Bent Pipe" devices were imported from the US. Researchers also collected and imported to Thailand the "Georgia Jumper" and "Mexican" devices from Mexico. Immediately, the team set about analyzing the design and construction of the various TEDs sourced from America. The high import costs for the American TEDs and some concerns regarding the appropriateness of the American designs for Southeast Asian conditions prompted the Thai research team to use the basics of the "Supershooter" and "Georgia Jumper" designs to develop the TTFD. Simultaneous to this work, the Faculty of Engineering at Kasetsart University worked on the design basics of several American TEDs to develop another Thai TED named the "Thai-KU".

Following the construction of the TTFD and Thai-KU devices, they were tested and compared with the American devices through the conduction of at-sea experimental fishing trials in coastal waters adjacent to the provinces of Chumporn and Songkhla. Aspects associated with TED performance, such as escape rates of turtles, fishes and shrimps from the TED's turtle escape opening during day and night fishing operations were investigated for all TED designs available to the research team. Similarly, aspects including the ease of handling the devices on-board the fishing vessels, their

**Plate 18.** TEDs Research and Demonstrations in Thailand in 1996

hydrodynamic performance, effects on fuel consumption, and the influence that the use of the devices had on sorting times and shrimp and fish catch quality were also investigated. The TTFD was considered most appropriate due to the design of the Thai-KU device resulting in poor handling at sea, and concerns for its effects on vessel fuel consumption due to its awkward design and predicted poor hydrodynamic performance.

The results of these rapid at-sea fishing trials were extended to representatives of the Thai shrimp fishing industry from all coastal provinces and fishery officers from Thailand's DOF through a "Workshop on the Use of TEDs in Thailand" convened in October 1996. This workshop was convened by Thailand's DOF, in cooperation with the Thai Export Department and the technical assistance of NOAA, SEAFDEC/TD and Kasetsart University.

During this inaugural workshop, stakeholders were provided with a situational report on the need for the adoption of TED technology in the region, the design process for the TTFD and a clear overview of the advantages and disadvantages associated with the use of TEDs. Fishers acceptance of the need for the use of the devices was high and, after a demonstration on the installation and use of TEDs, 100 TTFDs were distributed to fishers for installation and voluntary use in their shrimp fishing gear. Immediately after this workshop an additional 2900 TTFDs were manufactured and distributed to fishers to ensure the 3000 Thai fishing vessels participating in Thailand's shrimp trawl fishery were equipped with a means to prevent the incidental capture of sea turtles.

During this time the Thai Government instituted a law requiring Thai fishing vessels fishing for shrimp to equip their demersal shrimp trawl fishing gear with a TED. The combined effect of these actions was importantly the lifting of the US embargo against the importation of marine shrimp product from Thailand in November 1996, approximately 6 months after its introduction. It also resulted in perhaps the most important improvements to the sustainability of fishing practices in the Southeast Asian region since their broad-scale commercialization.

## TED Research and Demonstrations in Brunei Darussalam

Experimental fishing trials and demonstrations involving the use of the TTFD were completed in Brunei Darussalam by SEAFDEC/TD during September 1997. These fishing trials and demonstrations were conducted from a fisheries research vessel and two industry vessels. All activities were preceded by the delivery of technical information regarding the US trade embargo and TED regulations, important TED design characteristics, the TTFD and by-catch reduction devices, to fisheries officers and fishing industry representatives.

**Plate 19.** Demonstrations on the Use of TEDs in Brunei Darussalam in September 1997

A practical at-sea demonstration in the use of the TTFD was provided, which was followed by intensive experimental fishing trials. The experience in Brunei Darussalam was complex for the SEAFDEC team, with waters being characterised by a high prevalence of

larger fish, rays, logs and other marine debris including garbage. The recorded escape rate for shrimp was higher than that which had been observed in other regional countries, however, this has been attributed to the large quantities of larger-sized items moving through the trawl with the shrimp. The trials did much to provide the sharing of views and information amongst the representatives of SEAFDEC and Brunei Darussalam. Discussions centered on the combined use of a by-catch reduction device with a TED in shrimp trawl gear being used in waters such as this. The TTFD was shown to be effective in excluding large rays and garbage from the codend.

## TED Research and Demonstrations in Indonesia

In November 1997, representatives of SEAFDEC/TD visited Indonesia to conduct a demonstration of the TTFD in Jakarta. The intention of the demonstration was to introduce to Indonesia the experiences of other Southeast Asian countries in the adoption of TED technology. The demonstration reviewed TEDs and recent shrimp trawl gear experiments carried out by SEAFDEC. The demonstration was made to 10 fisheries officers of the Indonesian Department of Fisheries and the Research Institute of Marine Fisheries, and 52 final-year students of the Indonesian Fisheries College.

SEAFDEC continues to collaborate with the Department of Marine Affairs and Fisheries, Directorate General of Capture Fisheries, regarding the use of TEDs in Indonesia. During August and September 2002, SEAFDEC/TD staff conducted demonstrations, practical training and experimental fishing trials on the use of the TTFD and Supershooter device in Bintuni Bay of the Arafura Sea. This activity was successfully reinforced with follow–up training delivered to Indonesian fisheries officers during August and September 2003.


**Plate 20.** Introduction of TEDs to Indonesia in 1997

## TED Research and Demonstrations in the Philippines

Achievements in the use of TEDs in the Philippines have been concentrated in the area of local-level capacity building. The work in the Philippines to date has also played an important role in the testing of modifications to the commonly used TTFD that aims to further reduce the escapement rate of shrimps from this device.

**Plate 21.** Sea Trials and Demonstrations on the Use of TEDs in the Philippines in 1997

Initial implementation of TED technology in the Philippines was modeled on the successes of the practical experimental fishing trials and information extension processes undertaken in Thailand and Malaysia. The initial experimental fishing trials, conducted in April 1997 in Manila Bay and aimed to provide information relating to the effectiveness and efficiency of three TED designs in the Philippines setting. These TEDs included the TTFD, the US designed "Supershooter", and a hooped TED that had been previously used in parts of East Asia. These trials were organized by SEAFDEC/TD in cooperation with the then Philippines Bureau of Fisheries and Aquatic Resources (BFAR). Preliminary results indicated that the TTFD, like in other regional waters where it had been tested, had the highest catching efficiency and lowest shrimp escape rates.

These sea trials were followed by discussions on the use of TEDs with stakeholders, and demonstrations on the installation and appropriate installation angle of the TED in the codend of shrimp trawl gear. To complete this information extension process, SEAFDEC coordinated theoretical and practical training in the implementation and use of TEDs for instructors and trainees of the National Commercial Fisheries Development Center.

Extensive research activities focusing on the design and use of TEDs in the Philippines followed these initial activities. During March to July 1998, BFAR in liaison with SEAFDEC/TD conducted further testing of the three devices trialed in the initial assessments made in April 1997. Research results confirmed the views previously held by fishers and researchers that the TTFD is the most effective in minimizing shrimp loss. Similarly, fishers in the Philippines preferred to use the TTFD due to its ease of construction and easy handling at sea.

Research into modifications of shrimp trawl nets that aimed to increase the retention of shrimp in fishing gear equipped with TEDs was conducted from August to December 1998 in Manila Bay. Specifically, the effect of turtle escape opening positions and an inclusion of a funnel device in directing shrimp catch toward the codend's "bag" was tested. Results indicated that shrimp escapement is significantly correlated with the position of the turtle escape openings. Researchers recommended that the escape opening be placed at the top portion of the net. Unfortunately, the testing of four funnel types indicated that the funnel has no significant effect in reducing escapement.

Work to date in the Philippines has provided much reinforcement to the achievements made in Thailand and Malaysia. The innovative testing of TED design has provided a good basis from which technical design improvements to TEDs may be planned in the future.

## The Role of Information and Extension Processes in the Successful Implementation of TEDs in Southeast Asia

The successful implementation of TEDs in South East Asia has perhaps been one of the most important improvements to the sustainability of regional marine fisheries since their broad-scale commercialization. It has also enabled improvements to the ability of regional fishing communities to contribute to the challenging task of sea turtle conservation. A task which assumes significant international importance.

These outcomes have not been achieved without overcoming some key challenges. Whilst the initial implementation of TEDs was driven by the urgent need to overcome the US embargo, the development of the ongoing acceptance and use of TEDs by fishers in the region has been achieved through well-planned information and extension activities by SEAFDEC's Training Department in cooperation with the MFRDMD and the Departments of Fisheries of Member Countries.

During the initial implementation phase of TEDs in Thailand, Malaysia, the Philippines, Brunei Darussalam and Indonesia, fishers views on the use of TEDs were canvassed. Common concerns were expressed regarding the use of TEDs. Specifically, these concerns related to the loss of shrimp and fish through the TED escape opening, the effects on the efficiency of shrimp trawl gear and fuel consumption, and other factors such as the handling of TEDs at sea and the cost of construction.

Initial experimental fishing trials of the various TED designs provided SEAFDEC/TD with information that could be used to address fishers concerns during the inaugural TED workshops. The practical demonstrations in the use of TEDs were used in support of these workshops to reinforce the views of the SEAFDEC team that the Thai designed TED, the TTFD, was effective in reducing the incidental capture of sea turtles, whilst maintaining important characteristics of shrimp trawl operations such as shrimp retention rates, fuel consumption and gear handling techniques. Additional benefits in the use of TEDs were also introduced to fishers. These included (a) the effect of TED use on shrimp catch quality, and (b) the ability to increase tow durations as a result of the codend "bag" not being rapidly filled with large fish, rays, sharks and turtles when fitted with a TED.

The abovementioned process was effective in developing initial fishers acceptance of TEDs, although the ongoing maintenance of this acceptance is a key consideration of SEAFDEC in the continuation of its TED program. Various activities in training, promotion and general community education are being managed on an ongoing basis by the SEAFDEC/TD.

## Regional TEDs Training Courses

The training of fishers, government fisheries officers and students in the use of TEDs continues to play an important role in SEAFDEC/TD information and extension activities. The regular training courses aim to provide participants with current knowledge regarding TED design, whilst developing their practical ability to construct and install TEDs. Thus far, these training courses have been convened in a number of provinces and countries with the support of relevant authorities, including the Departments of Fisheries of the relevant countries.

The training courses are deemed an effective tool in developing the understanding of regional stakeholders in the use TED technology. They also assist in developing a strong support base for the use of TEDs in regions difficult to reach through other extension processes.

## Promotional Media

A large range of promotional media regarding the use and benefits of TEDs continue to be developed and made available to fishers, Governments in the region, the community and researchers. These are being used for promotional and public awareness purposes. They have included the production of various videos, posters and brochures and have been extended to a wide and large audience. These materials have focused on the need for sea turtle conservation and use of TEDs. In an attempt to further improve fishers acceptance of the use of TEDs, emphasis has been placed on how fishers and fishing communities will benefit from TED use.

The successful implementation of TEDs in Southeast Asia has perhaps been one of the most important improvements to the sustainability of regional marine fisheries since their broad-scale commercialization. It has also enabled improvements to the ability of regional fishing communities to contribute to the challenging task of sea turtle conservation. A task which assumes significant International importance.

These outcomes have been achieved in a very short period of time. However, it is essential that these achievements be considered in the context of the setting in which they were made. The US embargo of 1996 provided an urgent need for the problem of incidental sea turtle catches in prawn trawl fishing to be solved if access to important US markets was to be secured. The response was made in this context.

Whilst acceptance of TED technology by fishers has generally been good, liaison with certain groups of fishers highlight ongoing concerns regarding TED use. These concerns relate to TED performance, the often dangerous and difficult nature of handling the devices at sea, and problems with TEDs collecting marine debris and preventing shrimp catch from entering the codend.

Ongoing fishers acceptance of TEDs will require that these concerns be incorporated into mechanisms for SEAFDEC and the respective Departments of Fisheries to effectively respond to the information needs of fishers involved in the use of TEDs.

**Ahmad Ali, Zulkifli Talib and**
**Ku Kassim Ku Yaacob**


# SEA TURTLE SPECIES OF THE SOUTHEAST ASIAN COUNTRIES

## Introduction

Six of seven species of living sea turtles in the world were confirmed to nest or inhabit the Southeast Asian waters. These are leatherback (*Dermochelys coriacea*), green turtle (*Chelonia mydas*), olive ridley (*Lepidochelys olivacea*), hawksbill (*Eretmochelys imbricata*), loggerhead (*Caretta caretta*) and flatback turtle (*Natator depressus*); (Kamarruddin, 1993; Soehartono, 1993; Palma, 1993; Chantrapornyl, 1993; Sukarno et al., 1993; Chantrapornsyl, 1996 and Kamarruddin et al., 1996). All these six species are commonly found in ASEAN waters except for the flatback which are found in eastern Indonesia. The flatbacks are known to nest in Australia but the foraging areas are in the Indonesian waters. The occurrence of sea turtle nestings in the Southeast Asian nations is shown in Table 1. Indonesia has the most number of sea turtles species as compared with other countries in the region.

**Table 1.** The Occurrence of Sea Turtles in the Southeast Asian Countries

| Country | Leatherback | Green | Hawksbill | Loggerhead | Olive Ridley | Flatback |
|---|---|---|---|---|---|---|
| Brunei Darussalam | x | 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 | |
| Myanmar | x | x | x | x | x | |
| Cambodia | x | x | x | x | x | |
| Vietnam | x | x | x[i] | x | x | |

All these species are highly migratory, often passing through territorial and international waters from foraging to nesting ground and back again. The turtles are likely to come from an area within a radius 2,500 km around the nesting area (Limpus 1993). Green turtles that were satellite tracked from Pulau Redang, Terengganu indicate migration to the South China Sea and Sulu Sea areas. In addition, satellite tracking of green turtle nesting in the Sarawak and Sabah Turtle Island and some from Thailand also swam to the Sulu Sea. Additional studies of satellite-tracked hawksbills revealed movement of great

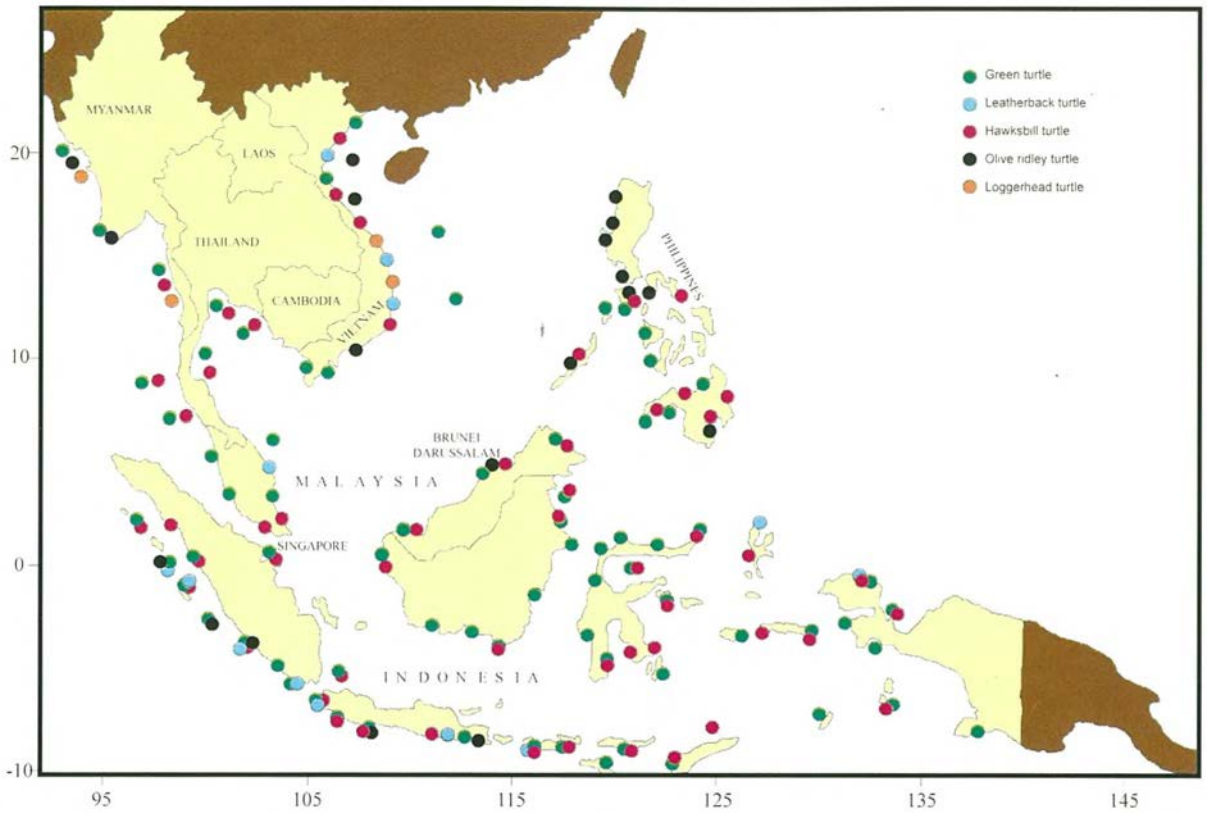



**Figure 3.** Distribution of Sea Turtles Nesting Species in the Southeast Asian Region

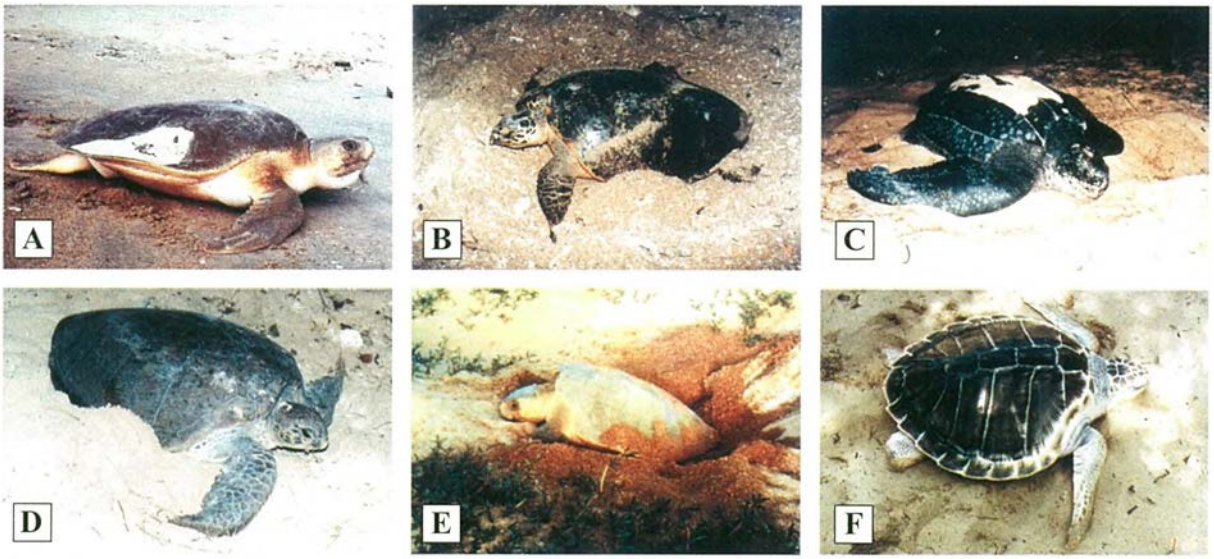



**Plate 22.** Six Species of Sea Turtles Reported to Nest or Inhabit Southeast Asian Region. A-Flatback, B-Hawksbill, C-Leatherback, D-Green, E-Loggerhead and F-Olive Ridley.

distances, over 1,000 km (Liew, 2002). Since these animals transcend national boundaries, they are shared resources among countries. Thus, the countries in the region have a common responsibility and ownership of a particular population.

# Taxonomy, Biology, Population and Distribution

## Leatherback Turtle (*Dermochelys coriacea*)

The leatherback turtle is one of the largest marine reptiles alive today. The heaviest known specimen recorded up to 585 kg. The leathery-covered carapace distinguishes it from other hard-shelled turtles. The adult female nesting in Terengganu, Peninsular Malaysia average 162.4 cm curved carapace length. Reproduction is seasonal and in Peninsular Malaysia nesting is nocturnal and the peak is from June to July. The clutches are composed on average of 60-120 eggs with 16.3% of yolkless eggs (Sukarno et al., 1993). Typical 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 cnidarians (jellyfish and siphonophores).

The leatherback turtle is known to nest primarily on the beaches of Terengganu, Malaysia and northwest Irian Jaya, Indonesia. The major rookeries in Malaysia are found, particularly at a 1.5 kilometers 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 found nesting but the numbers dropped drastically. In 1994, only 213 nests were recorded at Rantau Abang rookery. Nesting season of leatherback turtles is from March to September each year and the peak period is June and July

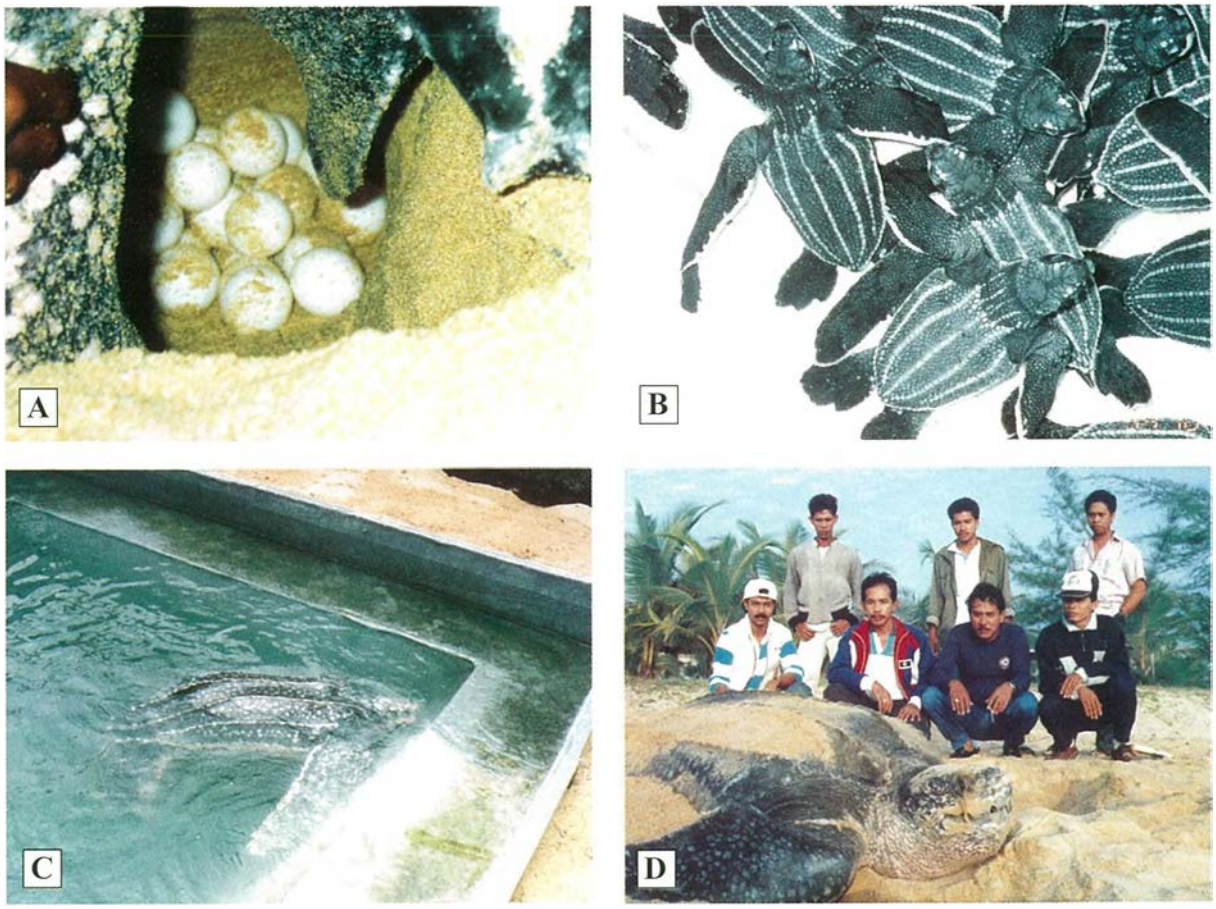



**Plate 23.** A-Eggs, B-Hatchlings, C-Juvenile and D-Adult Leatherback Turtle

**Plate 24.** Internal Organ of Juvenile Leatherback Turtle. (Note: Death in Captivity)

(Chan and Liew, 1989, Sukarno et al., 1993). No report has been made about the nesting of leatherback turtles on the west coast of Peninsular Malaysia.

The leatherback turtles are also confirmed to nest on the Andaman Sea coast of Thailand but the population status is unknown (Phasuk and Rongmuangsart, 1973 and Chantrapornsyl, 1996). While in Indonesia, leatherbacks have only been found in South Sulawesi, Maluku and northern Irian Jaya. In the Philippines, leatherbacks were reported to nest on the Quiniuban Island group northeast of Palawan. A number of sightings and stranded leatherbacks were also reported from Hinunangan, Southern Leyte and Binnuangan, Tubay, Agusan del Norte. In Vietnam, leatherbacks are distributed in the sea areas of Do Son District, Hai Phong City; Khanh Hoa Province; Phu Quoc Island in Kien Giang Province; and it is also listed as being present in the Con Dao archipelago in Ba Ria –Vung Tau Province, although evidence and sightings are lacking here.

## Green Turtle (*Chelonia mydas*)

The 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 ranges from 70 to 120 cm with an average of 99.5 cm in the Philippines. Mating could occur for several hours; for example it lasts for 7 hours in Redang Island, 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, Chantraponsyl, 1996) while in Turtle Island Sabah the peak nesting period is from July to October (Muhamad Saini, 1996). The main diet for the green turtles is algae and sea grasses.

The green turtle is by far the most extensively distributed sea turtle species in the Southeast Asian region. This species is known to nest on the beach of all countries of the region. In Peninsular Malaysia, the major nesting sites are found on Pulau Redang, Paka and Geliga in Terengganu. Chendor is the main green turtle rookery in Pahang, even through nestings 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 East Malaysia, the green turtle nestings are concentrated on the Sarawak Turtle Islands of Talang Talang Besar, Talang Talang Kecil and Satang Besar and Turtle Islands of Sabah that is Pulau Bakkungaan Kecil, Selingaan and Gulisan. The annual nesting of green turtles in Malaysia is estimated to be 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 and Bakkungaan Kecil) and abut 80% of green nestings occured in these areas (Palma, 1993). As of July 1993, a total of 50,898 complete nests were recorded from Baguan Island and in 1992, a total of 1,052,168 eggs were produced (Palma, 1993). The population of nesting green turtles in Turtle Islands is estimated to be about 2,500. The green turtles are also reported to nest on Calauit and Matanubong Islands off Palawan.

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

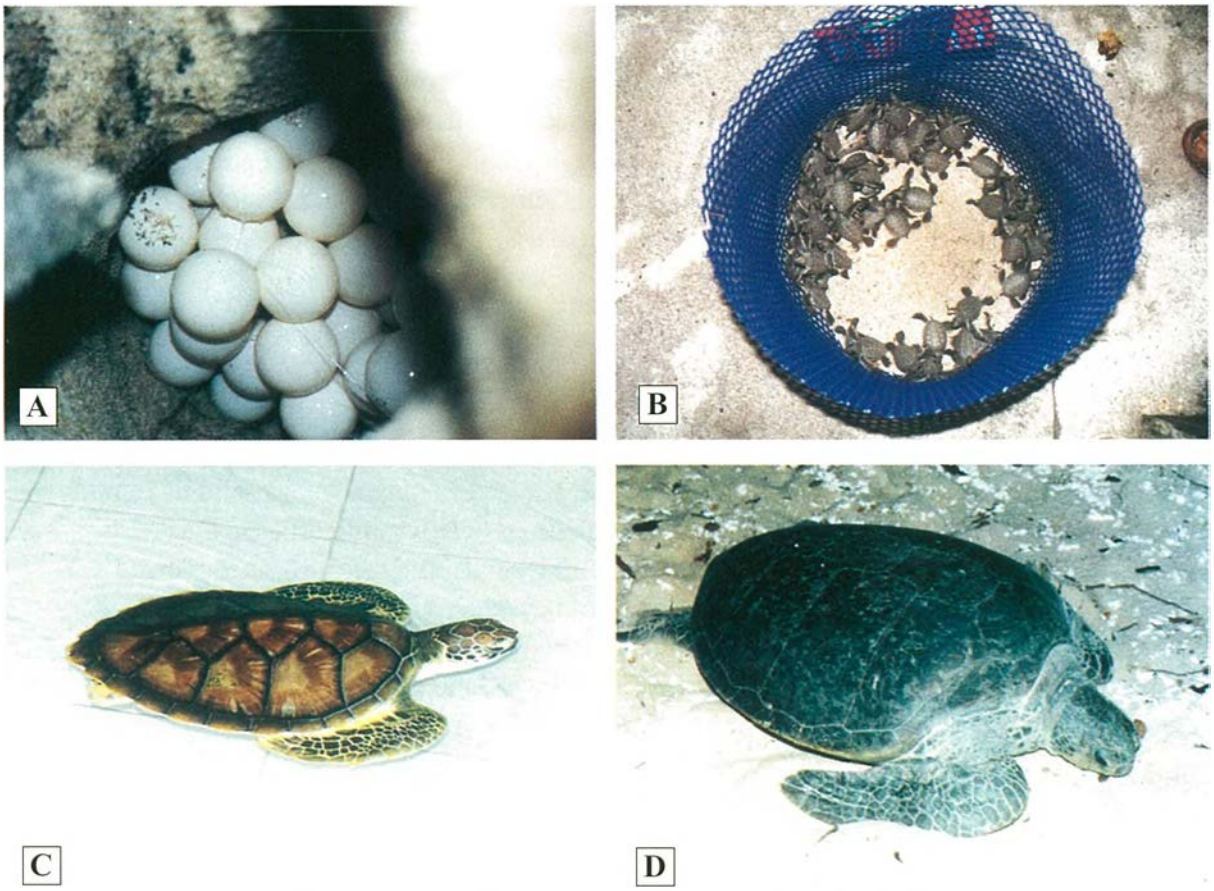



**Plate 25.** A-Eggs, B- Hatchlings, C-Juvenile and D-Adult Green Turtle

Green turtles are considered common all around the coastline of Indonesia. Nestings were reported from 10 provinces, however the status of the population size is still not 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 and from May to August is the peak season. The present status of the population is still unknown.

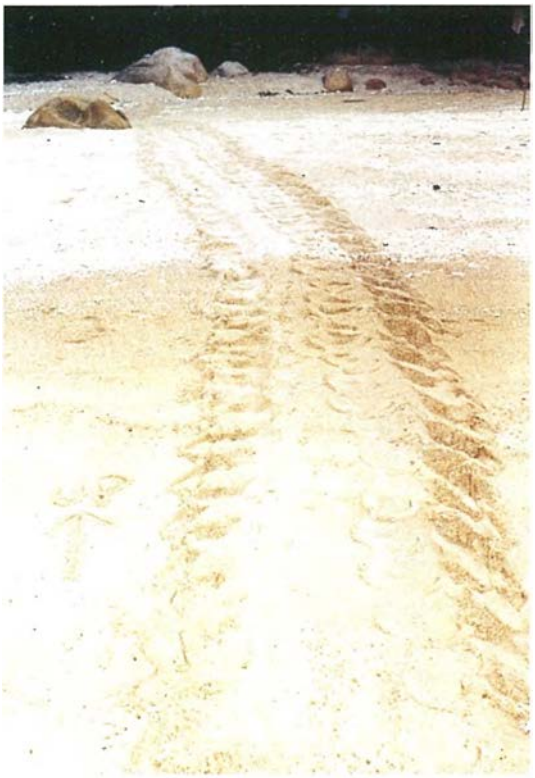


**Plate 26.** Green Turtle Track at Mak Kepit Turtle Sanctuary, Redang Island, Malaysia.

## Hawksbill Turtle (*Eretmochelys imbricata*)

Hawksbills are distinguished from other sea turtles by two prefrontal scales, thick posterior overlapping carapace scutes, four pair of coastal scutes, the anterior-most 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 80 kg. Adult males are distinguished by a long, 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 seasonal, but the season is often expanded and in a few localities nesting may occur throughout the year with one or two peaks. In Thailand, for example peaks are reported in February to April and June to July (Chantrapornsyl, 1996). Incubation is generally 50 to 70 days in the west coast of Peninsular Malaysia. Hawksbills forage on coral reef of the offshore islands and these turtles consume a variety of food but specialize on sponges.

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

In Thailand, nesting occurs on both the east and west coast as well as on some offshore islands, namely Ko Klang, Ko Kra; Pattani Province, Songkla Province and Narathiwat Province. The main rookeries on the east coast (Gulf of Thailand) are Ko Kut, Ko Chang and Khram Islands (Eckert, 1993, Chantrapornsyl, 1993). The existing nesting populations size is estimated to be 100 nests annually.

The hawksbills occur widely with low nesting densities throughout the Philippines. No major nesting aggregations have been identified but hawksbills were found to nest in small numbers on numerous islands. Hawksbill are mostly found along the western, eastern and northern coasts of Sumatra (especially Batu Islands), northern and southern Java, north of Nusa Tenggara, southern and northeast Sulawesi, Maluku, southern Kalimantan and north of Irian Jaya (Soehartono, 1993). Meanwhile, in Vietnam the nesting areas for hawksbills are on the Con Dao National Park Islands and the size of the population is not known.

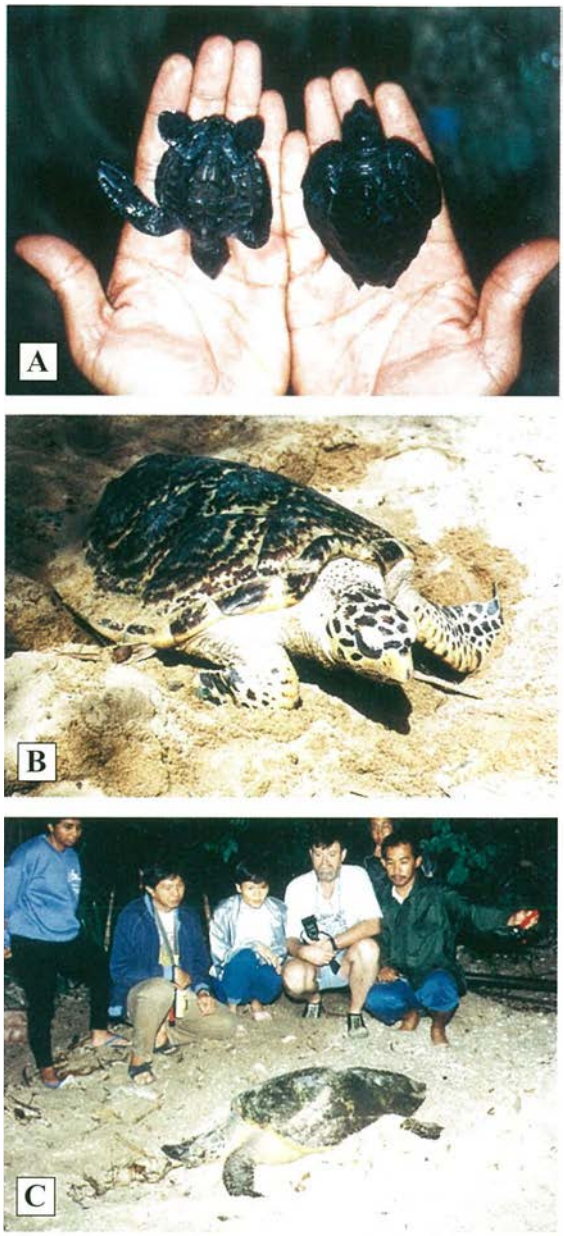



**Plate 27.** A-Hatchlings, B-Juvenile and C-Adult Hawksbill Turtle

## Olive/Pacific Ridley Turtle (*Lepidochelys olivacea*)

The olive ridley is a 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 turtles. Male olive ridleys have 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 to 70 cm. In Peninsular Malaysia, most nesting occurs between February to August and the peak is 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 on mollusks, fishes, jellyfishes and crustaceans.

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 sites in Terengganu are Kuala Baru, Telaga Papan, Pulau Kapas, Dungun, Paka and Geliga. In Perak and Pulau Pinang, the nesting sites are Pantai Segari and Pantai Keranchut in respective states. Nesting has also been recorded in the Turtle Islands of Sarawak and Sabah. The peak period of nesting season for this species in general is from February to May.

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

Olive ridleys are not a common sea turtle found in the Philippines. Sightings of olive ridleys were recorded from the waters off Palawan and Metro Manila. 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 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.

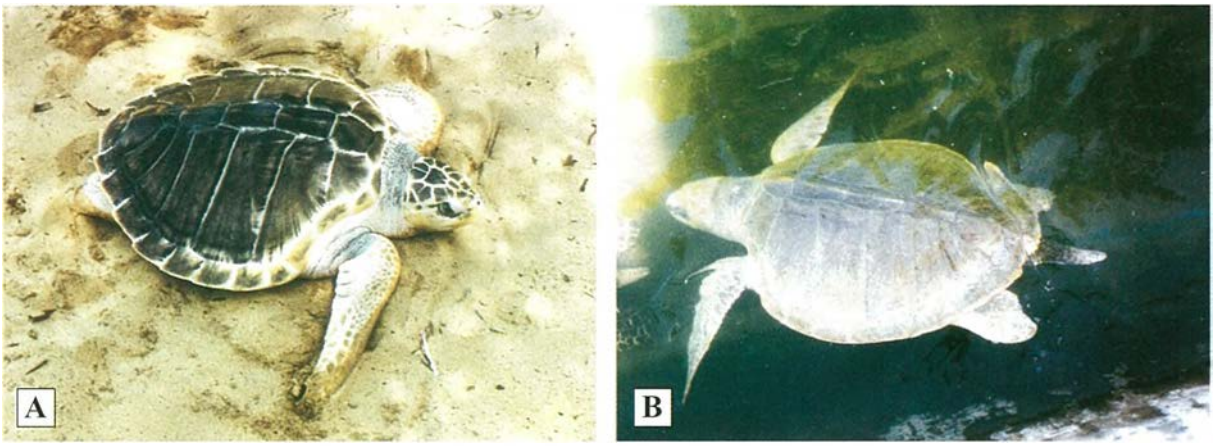



**Plate 28.** A-Juvenile and B-Adult Male Olive Ridley Turtle

## Loggerhead Turtle (*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 red dust-brown. The head is comparatively large. Two claws occur on the forelimbs, males have thick tails extending beyond the edge of the carapace. Adults generally weight 80 to 150 kg. The worldwide average CCL for adult female is 95 to 100 kg. Adult males in Queensland measured with an average 95.8 cm CCL and 100.7 kg. Mating often takes place in adjacent waters to nesting beaches. The clutch size averages 110 eggs. Eggs hatch in about 45 to 65 days. The loggerheads reach maturity at the age 12 to 25 years and the mean nesting female is 92 cm SCL. The range of migration for loggerhead in this region is more toward Southern Pacific covering Indonesia, Philippines, Eastern Australia, Solomon Island, Papua New Guinea and New Caledonia (Limpus, 1993).

Within Asia, large nesting concentrations of loggerheads are outside the ASEAN region, in Australia and Japan. Normally, loggerheads nest on temperate beaches (Ekert, 1993). In Sarawak, Malaysia loggerheads were reported to nest in small numbers (Leh, 1989). In Peninsular Malaysia, the occurrence of loggerhead was not mentioned. Loggerhead turtles are encountered on the beaches of South and Central Sulawesi and Ambon Island in Maluku. In the Philippines, the most recent discoveries of loggerheads were from Batan Island and Albay. In Vietnam, they are distributed from the Central Sea area of Vietnam (Provinces of Quang Ngai, Binh Dinh, Khanh Hoa, Ninh Thuan, Binh Thuan, and Vung Tau) southward to the South Sea area (Phu Quoc Island Con Dao archipelago and Truong Sa Archipelago) and the Gulf of Thailand. This used to be a very commonly-seen species with the highest numbers of the turtles in Vietnam.

## Flatback Turtle (*Natator depressus*)

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 80 cm. The nesting female lays eggs between 30 to 80 per clutch and the mean nest depth is 50 cm. Flatback turtles lay up to four clutches at 15 night intervals.

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

**Plate 29.** Adult Loggerhead Turtle (Photo Credit: Ian Beattie/Auscape)

**Mariani Haji Sabtu**


# BRUNEI DARUSSALAM

## Introduction

Brunei Darussalam is a coastal state in Northwestern Borneo. It has a land area of 5,762 km$^2$ and 130 km coastline bordering the South China Sea. It shares a common border with the East Malaysian state of Sarawak. The country is divided into four administrative districts, namely Brunei-Muara, Tutong, Belait and Temburong (Sabri, 1996).

The majority of the population (about 60%) in Brunei Darussalam is concentrated in the Brunei-Muara district, whilst the least populated is the Temburong district. The main population centres are in the coastal zone accounting for over 85% of the population (Scura and Dalusung, 1992).

Agbayani et al. (1992) recorded a total of 33 islands in Brunei Darussalam. The majority of these islands are uninhabited and in a pristine state. Though the islands support few flora and fauna, some of them do provide shelters and breeding sites for sea turtle species. The beaches of Pelompong Island, for example, are used by turtles for nesting.

The seabed is predominantly sandy because of the two longshore drifts which bring with them huge accumulations of sand. Long stretches of sandy beaches interrupted only by a few rocky headlands dominates the coastline of Brunei Darussalam (White and De Silva, 1987). Made up of mainly fine-grained sand, the beaches generally provide recreational areas for the public. Pelompong Islet (sand spit) is an isolated natural sand spit islet whose sandy beach faces the South China Sea and local fisherman have seen turtles nest on this beach.

The sandy coastline of Brunei Darussalam provides suitable nesting sites for sea turtles. Out of the seven species found in the world, only four are found in Brunei Darussalam, which are olive ridley, hawksbill, green, and unconfirmed reports have also indicated that leatherback turtles have been seen frequenting areas near the oil platforms (Elkin 1991). Out of the four species mentioned, olive ridley is the most common species in Brunei Darussalam, followed by hawksbill (Mariani 2004).

No thorough studies have been carried out to determine the extent of the turtle populations in Brunei Darussalam. The first sighting of turtles in Brunei Darussalam was in 1989 when twelve hatchlings were found on the beach at Seria (Elkin 1991).

A few green turtles and hawksbill turtles are known to nest on Pelompong Spit, Muara, Tutong, Lumut and Anduki beaches from November to June (De Silva et al. 1992 and Mariani, 2004). No proper records are kept on the number of clutches and the amount of eggs deposited. However, the Museums Department had conducted a systematic study in 1992 on the breeding patterns of turtles along the Pelompong Spit.

The coastal waters of Brunei Darussalam are known to be in the migration paths of the sea turtles during their migration periods. Elkin (1991) noted that some turtles had been observed swimming away from the shore in a northwesterly direction.

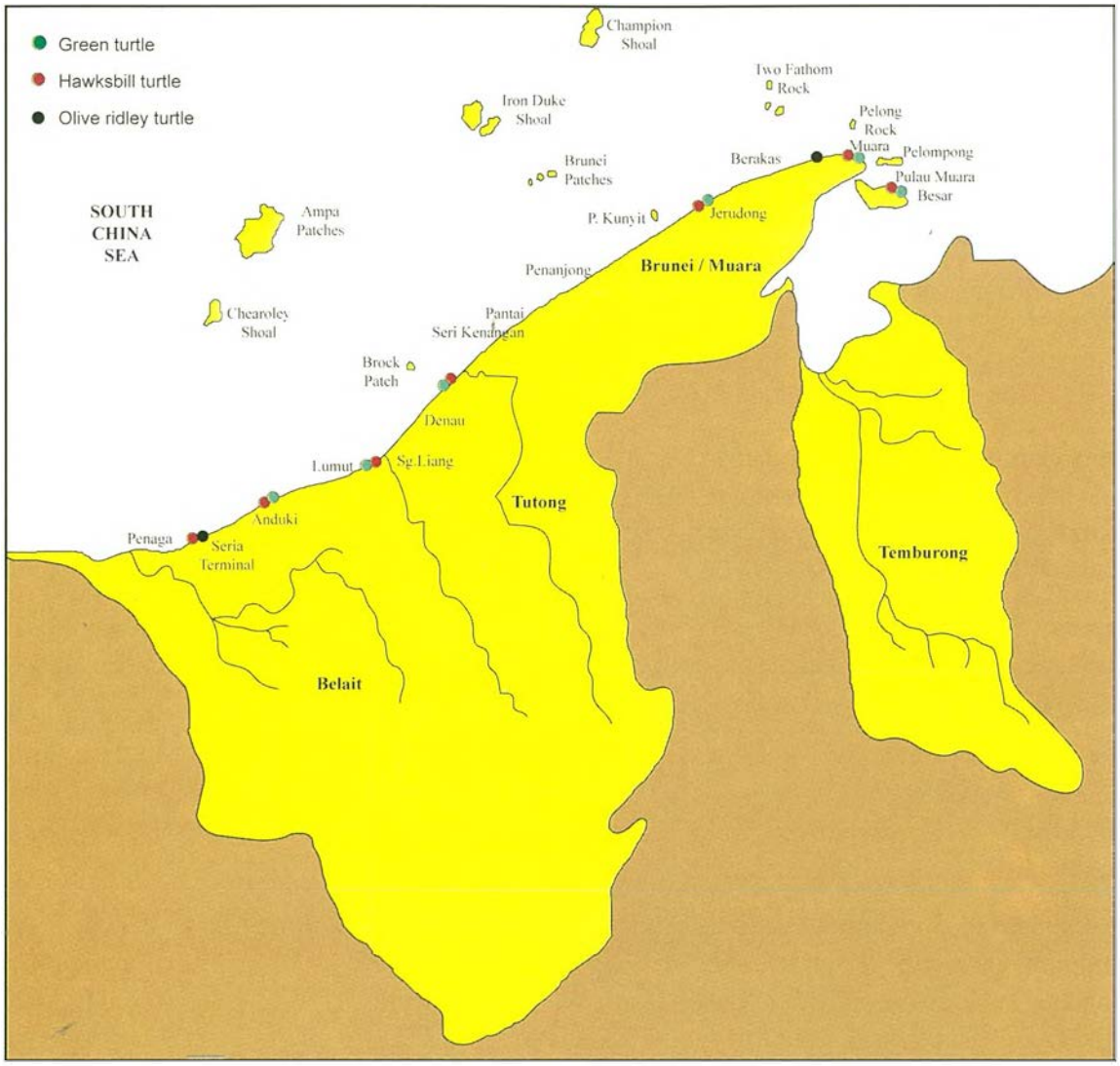



**Figure 4.** Distribution of Sea Turtle Nesting Beaches in Brunei Darussalam

Because of the many oil platforms in the coastal waters of Brunei Darussalam, the platform legs and bracings have provided excellent substratum for the growth of marine organisms such as soft corals. Turtles have been spotted by divers feeding on the organism afforded by the oil installations. These installations may also provide shelter and protection for the turtles from dangers such as predation and trawl fishing activities (Sabri, 1996).

Research and conservation efforts by government agencies have been very minimal at the initial stage. However, starting in May 1998, there has been an upsurge in the government effort that the dwindling sea turtle populations be saved from further decline.

The government strategy encompasses around the need to maintain the biodiversity and the population of the sea turtles. Initially, efforts are geared towards the creation of awareness among the public, especially the school children. The setting up of the National Sea Turtles Management and Conservation Committee and its programs are testimonial of the government's efforts to realize its strategy of increasing the sea turtle populations.

# Sea Turtle Conservation and Enhancement

## Legislations and Regulations

Sea turtles are listed under CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) and Brunei Darussalam became a party of CITES since 2 August 1990. Three species of sea turtles, namely the green turtle, hawksbill turtle and leatherback turtle, are protected by the regulation under Chapter 102 of the Wildlife Protection Act, 1978 (revised 1984). The Act was created to make provision for the protection of wildlife and for the establishment of wildlife sanctuaries. It comes under the jurisdiction of the Museum Department.

The Department of Fisheries (DOF) has a provision for the protection of sea turtles under the Fisheries Act of 1973. Chapter 61, Section III, Part 5 (o) of the Primary Resources, is authorized to make regulations "to regulate the catching or killing of turtles and their eggs". It proposes that "No person shall – (a) disturb, take, sell, purchase or have in his possession any turtle eggs; (b) interfere with any turtle nest; or (c) take, sell, purchase or have in his possession any undersized turtle". The proposed amendment also states that "No person shall take, sell, purchase or have in his possession any turtle or part thereof during the period of any close season for that species of turtle specified pursuant to a sub-regulation" as notified by the Director of Fisheries from time to time in the Government *Gazette*. This notification also includes for the Director of Fisheries to specify 'turtle species, the size, weight and a closed season". Even with these stringent measures, efforts are still needed to educate the public on the need to protect turtles, especially when they come ashore to nest, not to disturb their nesting habitat and not to harvest their eggs (Sabri, 1996 and Mariani, 2004).

## Hatcheries

The threat of the dwindling numbers of nesting turtles in Brunei Darussalam has prompted both the Museums Department and the DOF to collaborate in a program to produce sea turtle hatchlings under laboratory conditions. In 1991 and 1992, the DOF had successfully hatched 67 turtles out of 107 eggs after 59 days incubation. A total of 56 hatchlings were released into the sea and 11 hatchlings were kept at the Hasanal Bolkiah Aquarium. The condition of the sand was kept as close as possible to the natural conditions and the temperature and moisture content monitored regularly (Sabri, 1996).

A total of 133 eggs were collected by the Museums Department in Pelompong and given to the DOF for a similar program in 1992. The conditions of the eggs were variable with some eggs found to be slightly dehydrated. After an incubation period of 60 days, a total of 18 turtle hatchlings emerged and were released into the sea. Some of the hatchlings were kept under tank conditions until they reached a size of approximately 18-20 cm before they were released (Sabri, 1996).

**Plate 30.** Releasing of Sea Turtle Hatchlings in Brunei Darussalam

A temporary hatchery was built in Meragang in 2001 by the DOF and a total of 935 olive ridley and 97 hawksbill eggs were collected from nesting beaches. A total of 917 olive ridley and 63 hawksbill turtle hatchlings emerged after an incubation period of 56 to 59 days in a styro-foam box.

In 2002, a total of 2,678 olive ridley and 159 hawksbill eggs were collected from nesting beaches by the DOF and turtle egg collectors as well as turtle volunteers. A total of 2,097 olive ridley and 87 hawksbill hatchlings were kept under tank conditions for about 3-4 month before being released (Mariani, 2004).

The year 2003 saw a total of 1,378 eggs collected of which 1,308 were olive ridley and 70 hawksbill. The total number of hatchlings were 954 olive ridley and 62 hawksbill respectively. A total of 3,270 olive ridleys and 173 hawksbills hatchling were released between 2001-2003.

## Protected Areas/Sea Turtle Sanctuaries

At present, Brunei Darussalam does not have protected areas or turtles sanctuaries. However the Department of Fisheries has started an initiative to establish a national turtle sanctuary. An area of approximately 5.2 hectares in Meragang Beach has been identified as the most suitable area. The project obtained its funding from the 8th National Development Program and is expected to be completed in 2005. The center will provide infrastructure and facilities to support the various activities including research under the National Turtle Management and Conservation Program.

## Education/Public Awareness

Beside production of publications, such as posters, articles and various media announcements, campaigns through exhibitions and talks were also conducted at schools and children/students holiday camps. There was also an activity called "Adopt a Turtle and Release" for a fee of US$ 18.00. This activity was very popular among students, general public, private and public institutions. Funds collected under these activities were deposited into the National Turtle Trust Fund. Activities to educate and create awareness in sea turtles conservation were jointly organized by schools, banks, Brunei Shell and DOF.

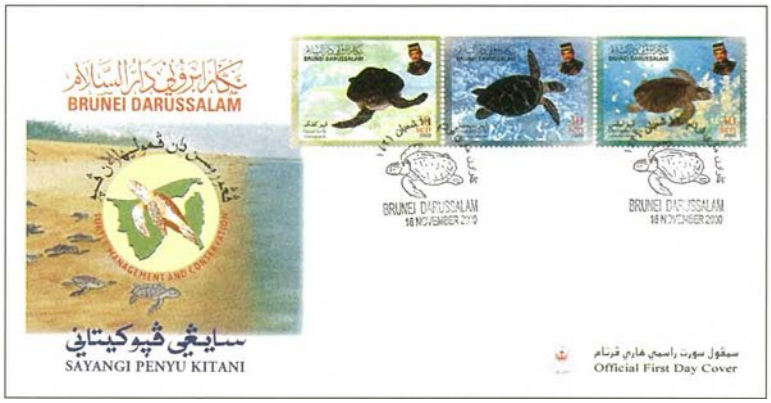



**Plate 31.** Educational Activity Related to Conservation of Sea Turtles in Brunei Darussalam

## Tagging and Satellite Telemetry Tracking Activities

Sea turtles tagging activities are carried out under the Turtle Management and Conservation Program. Several staff of DOF and a number of volunteers have been trained to conduct tagging activities. These activities started in 2000 at Muara and Sungai Liang beaches. Inconel tags provided by MFRDMD were used. However, due to lack of human resources, limited number of activities were carried out. Until the year 2003, a total of 31 turtle had been tagged, out of which 19 were olive ridleys, 7 hawksbills and 5 greens. Brunei Darussalam has not started satellite tracking activity at present (Mariani, 2004).

**Plate 32.** Tagging activity of Green Turtle in Brunei Darussalam

## International/Regional Cooperation

The list of international and regional organizations that Brunei Darussalam has collaborated with is as follows:

1. ASEAN Regional Centre for Biodiversity Conservation (ARCBC) sponsored a workshop on turtle conservation and management in 2003.

2. Marine Fishery Resources Development and Management Department (MFRDMD) of the Southeast Asian Fisheries Development Center (SEAFDEC), Malaysia provided 300 pieces of inconel tags in 1998.

There are also regional and international treaties related to the conservation and protection of sea turtles that Brunei Darussalam is signatory to, namely:

1. Brunei Darussalam became a member of CITES since 2 August 1990.
2. The Memorandum of Understanding on ASEAN Sea Turtle Conservation and Protection that was signed on September 12 September 1997 by the ASEAN Ministers on Agriculture and Forestry.

## Research Activities

Sea turtles research is still at the initial stage in Brunei Darussalam and it is envisaged, with the establishment of the 5.2-hectare sanctuary in Meragang Beach by 2005, more research activities would be undertaken. Key persons who are previously and currently active in sea turtles issues in Brunei Darussalam are listed as below:

1. Ms. Mariani Haji Sabtu
Fisheries Department,
Ministry of Industry and Primary Resources,
Jalan Menteri Besar,
Berakas BB 3910, Brunei Darussalam
Tel: 673-2-772788, 673-2-770066
Fax: 673-2-770065
E-mail: mariani_sabtu@fisheries.gov.bn
marianisabtu@yourmailnow.com

2. Mr. Hariel Haji Simpol
Fisheries Department,
Ministry of Industry and Primary Resources,
Jalan Menteri Besar,
Berakas BB 3910, Brunei Darussalam
Tel: 673-2-770066
Fax: 673-2-770065
E-mail: turtlebrunei@hotmail.com

**Pich Sereywath**


# CAMBODIA

## Introduction

Cambodia covers an area of 181,035 km$^2$, including inland waters. Fisheries are divided into freshwater and marine sectors. Both sectors play a very important role for the economy and food security of rural people. However, the Cambodian Sea is considered as one of the most diversified coastal ecosystem in the sub-equatorial climatic region, which is dominated by rainy and dry seasons. The sea area has an average depth of 50 meters with different habitats in both inshore and offshore zones. Several rivers and streams originating from the Elephant and Cardamom Mountains flow into the estuaries along the coastline, where both volume and nutrient levels are much increased during the wet season (Sereywath, 2003).

The Cambodian Sea is described by the jurisdictional Exclusive Economic Zone (EEZ), which was formally claimed in January 1978 (Tana, 2000). The total area of of the EEZ claimed by Cambodia is 56,600 km$^2$ (Nelson, 1999). The coastline has a length of 435 km located in the northeastern part of the semi-enclosed sea, the Gulf of Thailand. The coastal area extends between latitudes 8° to 12° N and longitudes 101° to 104° E from the Thai border in the north to the Vietnamese border in the south (Sereywath, 2003).

Along the coastline, there are four provinces or municipalities, namely Koh Kong, Sihanoukville, Kampot and Kep. After the end of the civil war in Cambodia, and up to 1997, the Department of Fisheries (DOF), the Ministry of Agriculture, Forestry and Fisheries (MAFF) and most Non-Governmental Organizations (NGOs) focused only on inland fisheries. After 1997, several NGOs and government agencies, particularly the DOF, changed their direction and policy to give more attention to the marine fisheries (Sereywath, 2003).

In the past, the absence of clear policy on natural resources and lack of updated laws and legislation on environmental protection and natural resource conservation, have led to poor enforcement and collusion among state bureaucracy and authorities. This has encouraged rampant anarchistic natural resource exploitation, affecting the natural environment with serious deterioration (Sereywath, 2003).

However, in the past few years, the DOF tried to draft new laws, decrees, sub-decrees and declarations with other government agencies in order to protect existing natural marine resources for future generations. Furthermore, the DOF also tried to persuade donors and NGOs to be further involved in conservation and management of marine biodiversity. To ensure long-term sustainability of marine animals in Cambodia will require marine protected areas (MPAs), research and survey activities on endangered species (Sereywath, 2003).

Five species of sea turtle have been recorded in Cambodia, namely olive ridley (*Lepidochelys olivacea*), loggerhead (*Caretta caretta*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*). Recently, only three species have been found in Cambodia,

namely loggerhead, green and hawksbill turtles. Hawksbill and green turtles are commonly found but loggerhead is rare (Try, 1999 and Try, 2000).

Green turtles can be seen at Koh Khteas, Koh Dong, Kilodapi, Kbal Romeas of Kampot Privince, eastern part of Koh Karang of Kep municipality and Thmar Rieng, Thmar Kandal and Tmar Anteas Banh of Koh Kong Province. As for hawksbill, it can be found at Koh Dong, Kbal Romeas, Phoum Ta Ang of Kampot Province, west of Koh Angkrang and south of Koh Karang municipality and Thmar Kandal and Thmar Anteas Banh of Koh Kong Province. Loggerheads are rarely seen, but have been reported at Kilodapi of Kampot Province and South of Koh Tbal, East of Koh Karang of Kep resort city (Longdy, 2003).

In order to sustainably use the natural resources and for the conservation and management of the endangered species, the Department of Fisheries has tried to draft new laws, sub-decrees and declarations for future generations. DOF has carried out many activities on sea turtle conservation and management in collaboration with both government and non-government agencies to create national regulations relating to threats and trade of natural resources, including sea turtles (Try et al., 2003a). The Department of Fisheries (DOF) has also proposed an action plan for research and management in order to ensure long-term sustainability of sea turtle populations (Try et al., 2003b).

## Sea Turtles Conservation and Enhancement

### Traditional Beliefs as Conservation Encouragement

In general, most fishermen are not targeting for sea turtles because they believe that they will get bad luck when they see or catch them. In the past, Cambodian people have always released the sea turtles for their happiness and luck, but the activity still remains for the rich people and strong believers. They buy the accidentally caught live sea turtle to release for their happiness and write on the carapace their name and the sentence "please release my turtle if you find it."

Several activities were conducted in collaboration with local commuities, concerned agencies and NGOs as well as local private companies.

**Plate 33.** Releasing of Accidentally Captured of Green Turtle by Local Community in Cambodia

## Concerned Legal Agencies

In response to the need for monitoring and enforcing legal protection of wildlife, the Ministry of Agriculture, Forestry and Fisheries (MAFF) has authorized two departments, of which the Department of Fisheries is responsible for aquatic fauna and flora, and the Department of Forestry and Wildlife (DOFW) is responsible for terrestrial fauna and flora (Try and Sereywath, 2004).

## National Regulations

So far Cambodia has a law prohibiting the serving of wild meat in restaurants. If such food is found, the restaurant's owner will be punished or heavily fined according to national proclamations, declaration and letter. Those regulations are:

- Proclamation No. 359 of the Ministry of Agriculture, Forestry and Fisheries on the identification list of the nationally-threatened wildlife species for which shooting is prohibited. This proclamation was signed and came into force on 1 August 1994.
- Proclamation No. 1563/533 of the Co-Ministry of Agriculture, Forestry and Fisheries and the Ministry of Environment on prevention and protection of all wildlife in Cambodia. This proclamation was signed by the Minister of Agriculture, Forestry and Fisheries and the Minister of Environment and came into force on 20 September 1996.
- Declaration No. 3837 of the Ministry of Agriculture, Forestry and Fisheries on prohibited trade of wildlife in Cambodia. This declaration was signed on 14 August 2001.
- Letter No. 033 of the Department of Fisheries and Cambodian CITES Scientific Authority for fisheries and aquatic animals to the CITES Management Authority for Cambodia on prohibition of the reptile trade in Cambodia. This letter was signed on 14 November 2000.

In order to strengthen the conservation and enhancement of sea turtles, DOF/MAFF has listed 28 marine species in the new fisheries law reform as endangered species in Chapter No. 5 (Fisheries Protection and Conservation), article 22. Among these 28 species, five species of sea turtles, which have been observed in Cambodia, were included (Try and Sereywath, 2004).

## Hatcheries

There is no turtle hatchery at present in Cambodia, but efforts are being made to build at least one operational hatchery in the future.

## Protected Areas/Sea Turtle Sanctuaries

There are no sanctuaries/protected areas yet in Cambodia. Recently, the DOF drafted a Royal Decree on the setting up of two marine fisheries sanctuaries, namely Group of Koh Sdach and Group of Koh Rong, to conserve and enhance marine fisheries resources, including nesting and feeding grounds for sea turtles and other endangered marine animals.

## Education/Public Awareness

In September 2002, the DOF conducted an international workshop on sea turtle research, biology and conservation in Cambodia. This workshop was funded by the World Wildlife Fund Indochina (WWF-Indochina). It was attended by concerned institutions, fishermen representatives, NGOs

and international experts. As a result, all participants became aware of the importance of conserving sea turtles and other endangered species. Moreover, during the discussion of the workshop, participants requested the government to put the sea turtle issue into the primary educational program. In collaboration with fishermen, sea turtle landings are now being reported to the local fisheries authorities for tagging purposes. Furthermore, DOF has been sending several officers to participate and attend workshops, training and regional meeting/consultation on management and conservation of sea turtles in Malaysia, Thailand and Vietnam (Try and Sereywath, 2004).

## Conservation through Public Awareness Programs

To increase the public awareness on the importance to conserve the sea turtles, notebooks, pamphlets with information and posters, were designed and published. These materials along with videos have been distributed to various groups who are living along the coastline, such as children at primary school, fishermen, navy, police and all concerned agencies. These awareness materials mainly explain and present the concepts relating to the conservation of sea turtles and other marine life. The poster shows an outline of the life cycle of sea turtles and also educates people of the need to conserve the sea turtle eggs. The pamphlets provided basic information and concepts relating to sea turtle species in Cambodia and the importance of conservation and enhancement of sea turtles. The students' notebooks included photos of sea turtles and other marine mammals for identification and conservation purposes.

**Plate 34.** Increasing of Public Awareness to Conserve Sea Turtles in Cambodia through Distribution of Posters

The DOF as the main government agency involved in sea turtles conservation activities in Cambodia, planned to increase education about national and international regulations, legislation/laws, information on the importance of sea turtle conservation, etc. This will be done by distributing awareness materials to local communities/authorities, fishermen, children in primary schools, students and concerned agencies in two provinces and two municipalities along the coastline. Other organizations and private sector companies involved in conservation activities are the Ford Motor Company, University of Kyoto and WWF-Indochina (Try and Sereywath, 2004).

## Tagging and Satellite Telemetry Tracking Activities

### Tagging

Tagging activities started in 2002 after receiving 1,000 inconel tags from SEAFDEC/MFRDMD. Most of the turtles that have been tagged were accidentally caught by the fishermen (Longdy and Try, 2004). Fishermen will inform the fisheries officers when sea turtles are accidentally caught by them. If

the turtles are caught in the remote areas, the officers will ask the fishermen to release the turtles without being tagged because the areas are inaccessible.

**Plate 35.** Tagging of Accidentally Captured Green Turtle by Provincial Fishery Authority Before Releasing

The fishermen have been asked to provide information about the sea turtles tagged with inconel tags with code numbers but, so far, the DOF has not received any information of those released turtles. Thus, no information has been gathered about the growth rate, reproduction, and migration pattern of the turtles (Longdy and Try, 2004). Although information about sea turtles tagged in Cambodia has not yet been obtained, it is hoped that more turtles will be tagged.

## Satellite Telemetry Tracking Activities

In 2002, the DOF organized a training/workshop on "Sea Turtle Research, Biology and Conservation in Cambodia" which was held from 2 to 4 September 2002 in Sihanoukville, Cambodia. This activity was funded by the WWF-Indochina. During the workshop, SEASTAR2000 provided one platform terminal transmitter (PTT) to study the post-nesting migration of a green turtle nesting in Cambodian waters. The female green turtle that was attached with a PTT was named Angkor Sdach. The PTT was attached on her carapace and released at Koh Rong Sanleom during the end of the workshop on 4 September 2002. The data indicated that she migrated around the islands of Koh Rong, Koh Rong

**Plate 36.** Satellite Telemetry Tracking of a Green Turtle in Cambodia in Collaboration with SEASTAR2000 Project

Sanleom and Koh Tang during the study period. During the monitoring period from 4 September to 14 October 2002, she stayed at sea and did not nest. In order to gather more information concerning the migration of sea turtles, more PTTs are needed in the future (Longdy and Try, 2004).

## International/Regional Cooperation

Cambodia became a full member of ASEAN, and had signed the Convention on Biological Diversity (CBD), ASEAN's MoU on Sea Turtle Conservation, Ramsar Convention and Protection and a party of CITES. Collaboration with NGOs, universities and other organizations will be strengthened to ensure a successful development of the conservation programs. An awareness program has been encouraged by the International Union for the Conservation of Nature and Natural Resources (IUCN), which published a turtle photographic guide in Khmer and English. In terms of capacity building, Cambodian officers have attended many training courses and workshops on sea turtle conservation and management, such as sponsored by SEAFDEC/MFRDMD among others (Try and Sereywath, 2004).

## Research Activities

At present, no research is being done in Cambodia due to lack of financial support. However, the scientific information on sea turtles are already disseminated to users in all level through an awareness program and publication of awareness materials. For long-term program, a research plan on nesting and breeding ground, tagging and also the establishment of a hatchery at a protected nesting beach are planned for the future.

Key persons who are actively involve in sea turtles issues in Cambodia are listed as follows:

1. Ing Try
Department of Fisheries,
Ministry of Agriculture, Forestry and Fisheries,
#186, Norodom Blvd, P.O. Box 582,
Phnom Penh, Cambodia.
Tel: 855-(0)-11-957884 / 12-735099
Fax: 855-23-219256 / 215470
E-mail: tmmp.cam@bigpond.com.kh

2. Pich Sereywath
Department of Fisheries,
Ministry of Agriculture, Forestry and Fisheries,
#186, Norodom Blvd, P.O. Box 582,
Phnom Penh, Cambodia.
Tel: 855-(0)-12-917626
Fax: 855-23-219256 / 215470
E-mail: maric@online.com.kh

**Agus Dermawan**


# INDONESIA

## Introduction

Indonesia is an archipelago country and its 17,500 islands and 81,000 km of total coastlines offer excellent habitat for sea turtles. Out of the seven species of sea turtles in the world, six species have been identified to occur in Indonesian waters. The species are leatherback, olive ridley, hawksbill, loggerhead, flatback, and green turtles (Dermawan, 2004). The flatbacks nest exclusively in Australia but have been observed feeding in Indonesian waters (Kitchener 1996).

The local names of the green turtle are *penyu hijau, penyu daging* and *penyu laut*. Green turtles are commonly found and widely distributed throughout the Indonesian archipelagos. This species can be found to nest in quite a vast amount in Berau District of East Kalimantan Province and in small and remote islands throughout Indonesia. In Berau District, this green species has long contributed economically both to the local community and the government. There are about eight nesting sites for greens throughout Berau District such as in Derawan, Sangalaki, Semana, Mataha, Belambangan, Bilang-bilangan, Balikukup and Sambit Islands. Sometimes Kakaban Island, which is located in the southern part of Sangalaki Island, has also been used by this turtles for nesting even though the nests have often been flooded during high tide. Since January 2002, the local government of Berau District has stopped the concession activity and declared the Sangalaki Island and Derawan Island as protected nesting sites. Pangumbahan in West Java is also one of the major green turtles nesting beaches in Indonesia and the only remaining nesting beach of any importance in Java (Dermawan, 2004).

The local names of hawskbill turtle are *penyu sisik, fonu koloa, penyu genteng, penyu kembang, penyu katungkera* and *wau* (Adisukresno, 1993). At present hawksbill can still be found throughout Indonesia in significant number (Salm 1984 and Salm and Halim 1984). Important nesting areas are in Anambas and Natuna-Riau; Lima Momperang, Pesemut-Belitung, Segamat Island-Lampung, South of Ujung Pandang, Birah-birahan, Derawan-East Kalimantan (Salm and Halim 1984; Schulz 1984 and Soehartono 1993). The hawksbill is exceedingly difficult to monitor for long-term trend, for a number of reasons. First of all, only a small number of animals nest on a broad geographical area. Secondly, hawksbills tend to nest on remote, inaccessible and sometime narrow beaches where the turtle leaves no crawl trace. Finally, hawksbills also exhibit large year-to-year fluctuations in nesting numbers (Dermawan, 2004).

The local names of olive ridley are *penyu lekang, slengkrah, penyu abu-abu* and *penyu ridel*. Olive ridleys are found in small numbers throughout Indonesia, with the main nesting areas in Sumatera, Alas Purwo East Java, Paloh-West Kalimantan and Nusa Tenggara (Salm and Halim, 1984). Ngagelan Beach in Alas Purwo National Park has the highest nesting of olive ridleys.

Adisukresno (1993), noted that local names of leatherback were *penyu belimbing, penyu raksasa, kantong, kantong gelingsing* and *mabo*. The leatherbacks can be found nesting in the western

coast of Sumatera, South Java, and isolated areas in Nusa Tenggara (Salm and Halim, 1984). However, the largest rookery in Indonesia and also the largest known leatherback rookeries in the world, are located on the coast of Bird's Head Peninsula of Papua, on the beach of Jamursba Medi. According to Hitipeuw and Maturbongs (2002), leatherback is a dominant sea turtle species that nests in the north coast of Bird's Head Region of Papua. Nababan and Jacob (1996) described the leatherback population in Jamursba-Medi had declined rapidly in the last 15 years. In 1984, the nests reached up to 250 per night during nesting season (May – September), on 18 km length of the beach, but in 1996 it dropped to 25-30 nests per night.

The local people call the loggerhead turtle as *penyu tempayan*, *penyu karet* and *penyu bromo*. The loggerheads are rare in Indonesia, but there are unconfirmed reports that they may be nesting in the province of Maluku, where they are found feeding (Salm and Halim, 1984). Loggerheads can also be found feeding in waters close to Taka Bone Rate Atoll, South of Sulawesi.

The flatback turtle is locally known as *penyu pipih*. Indonesian waters is known as the foraging areas of the flatback but they nest exclusively in Australia. As such, it must be considered a shared resource. This species is fully protected in Australia, as are all other sea turtle species. It was found feeding in Papua, but was never found nesting (Limpus 1993 and Kitchener 1996). However, Nababan and Jacob (1996) found one nest of flatback on Jamursba Medi beach in 1995.

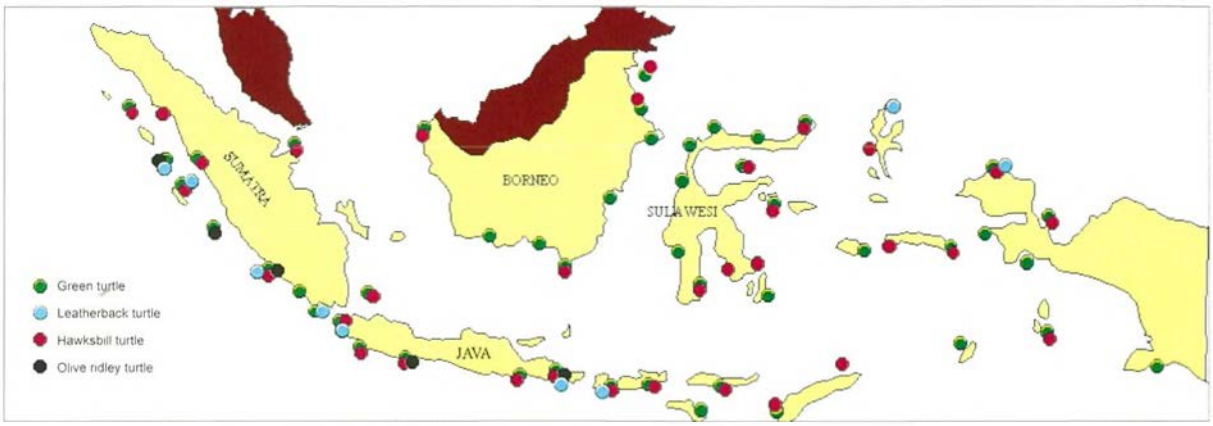



**Figure 5.** Distribution of Sea Turtle Nesting Beaches in Indonesia

## Sea Turtles Conservation and Enhancement

### Legislations and Regulations

Sea turtles cannot survive if their environment is not healthy. This means that conserving sea turtles must be accompanied by a simultaneous conservation of the marine environment. Besides, since sea turtles are highly migratory, the management of these species should be large-scale in scope. The efforts to conserve these species may not be effective and efficient without involving joint cooperation amongst the concerned countries, both at regional and international levels.

In fact, Indonesia has implemented conservation efforts to promote wise and sustainable use of the turtle species to ensure their continued survival. There are several national legal instruments that have been provided by this country to conserve and manage sea turtles:

- The Indonesian Constitution of 1945; article 33, all of the resources must be used as the greatest for humankind prosperity of the Indonesians.
- Act no. 5 of 1967; basic provision on forestry included conservation area management for sea turtles habitat.
- Act no. 4 of 1982, basic provision for the management of living resources environment.
- Act no. 9 of 1985, chapter 1 article 2 provides that fishery resources consist of all kinds of fish, including other aquatic biota such as turtles, dolphins, seaweeds, corals, etc. chapter 1 Article 4 provides that, for the sake of science, culture or conservation of aquatic nature, the government has established that certain kinds of fish and/or certain locations are protected as aquatic wildlife reserve because of the specific conditions of the aquatic area.
- Act No. 5 of 1990, Conservation of Living Resources and Their Ecosystems; the act regulates the management of wildlife and endangered species, the establishment of marine conservation area, the utilization and cultivation of wildlife (including turtles), the monitoring and supervision of their utilization and cultivation as well.
- The Government Regulation of the Republic of Indonesia No. 7/1999 concerning flora and fauna preservation. All of six sea turtles occurring in Indonesia are in the list of endangered species.
- The Government Regulation of the Republic of Indonesia No. 8/1999 has regulated a headstart program for sea turtles.

According to the international conservation point of view, all those species of turtles have been presumably rare and protected. They are categorized as endangered species in the Red Data Book of International Union for Conservation of Nature and Natural Resources (IUCN), and are put in Appendix I in Convention on International Trade of Endangered Species (CITES). Indonesia is a party of CITES and has ratified the agreement through the Act No. 43 of 1978. CITES states that all species of turtles in Appendix I are categorized as endangered species and are prohibited to trade internationally. In supporting that, Indonesia also signed a biodiversity convention and ratified it through the Act No. 5 of 1994 regarding Ratification of the United Conventions on Biodiversity. Indonesia also signed an MOU of ASEAN/SEAFDEC Conservation and Management of Marine Turtles (Dermawan, 2004).

## Hatcheries

The sea turtles hatcheries are located at Pangumbahan, Sukamande, Pulau Seribu, Kepala Burung, Papua Province, and other areas. These hatcheries are managed by the Ministry of Forestry and Ministry of Marine Affairs and Fisheries. The West Kalimantan Province started a pilot project on beaches hatchery in 1984 at Selimpai Beach, Paloh (Soehadi, 1993). A total of 4,749 hatchlings had been released from the hatchery from 1983-1989. This amount consists of 2,244 greens, 1,641 hawksbills and 832 olive ridleys and 32 other species. After 16 years of operation, the hatchery at Sukamade alone has produced 801,669 hatchlings from four species of sea turtle, the large majority being the greens (Arinal, 1997) as shown in Table 2.

## Protected Areas/Sea Turtle Sanctuaries

Marine conservation areas were established since 1980's under the Ministry of Forestry and Ministry of Marine Affairs and Fisheries. There are about 37 locations of Marine Conservation Areas covering approximately 5.1 million hectares distributed in the Indonesian Archipelago.

## Education/Public Awareness

The activities are carried out by the Ministry of Forestry, the Ministry of Marine Affairs and Fisheries and local Non-Government Organizations that include World Wildlife Fund-Indonesia, Yayasan Alam Lestari, KEHATI and Ford Foundation. The activities are trainings, workshops, adopt a nest program, leaflets, posters and VCDs.

**Plate 37.** Emergence of Green Turtle Hatchlings in Indonesia

## Tagging and Satellite Telemetry Tracking Activities

Tagging activities started in the 1980's at Pangumbahan, Seribu, Sukamade, Segamat-Lampung, Belitung Island and Semut Island. Inconel, titanium and plastic tags were used. Tagging activities on green turtle have been done quite intensively on Sukamande Beach, Meru Betiri National Park since 1984 (Wiadnyana, 2004). During 1984 to 1998, there were about 1,172 individuals of green turtles tagged (mostly female) and about 1,135 individuals were recaptured as shown in Figure 6.

The Japan Bekko Association funded the tagging monitoring program on the hawksbills from 1995 to 2000. There were 124 individuals tagged and only 2 individuals recaptured accidentally by fishermen in the same place where the turtles were released (Wiadnyana, 2004).

The satellite telemetry tracking activities of sea turtles started at Segamat Island, Lampung District in 1989 using the ST-10 PTT sponsored by the Japanese Government. The post-nesting monitoring of the hawksbill was done in 2003 by using ST-10 PTT in Thousand Islands National Park. There were three units of the transmitter, which had been attached on adult females hawksbills. The turtles would be monitored by ARGOS satellite for 6

**Plate 38.** Releasing of Green Turtle Hatchlings in Indonesia

months. The satellite tracking had also been conducted on leatherbacks in Jamursba-Medi beach of Papua Province (Wiadnyana, 2004).

**Table 2.** The Number of Sea Turtle Eggs Incubated at Sukamade Beach, Meru Betiri National Park, Indonesia: 1980-1995

| Year | Green | | Leatherback | | Hawksbill | | Olive Ridley | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | H | F | H | F | H | F | H | F | H | F |
| 1980 | 42,167 | 4,550 | 749 | 676 | 2,219 | 132 | 2,539 | 273 | 47,674 | 5,631 |
| 1981 | 102,200 | 7,711 | 1,393 | 454 | – | – | 393 | 22 | 103,986 | 8,187 |
| 1982 | 94,449 | 5,149 | 1,467 | 218 | 580 | 24 | – | – | 96,496 | 5,391 |
| 1983 | 7,752 | 720 | 1,491 | 145 | 669 | 54 | 538 | 45 | 10,450 | 964 |
| 1984 | 70,261 | 7,028 | 1,000 | 117 | 267 | 16 | 220 | 26 | 71,748 | 7,187 |
| 1985 | 71,657 | 10,101 | 861 | 137 | 595 | 79 | 86 | 12 | 73,199 | 10,329 |
| 1986 | 39,889 | 2,352 | 927 | 61 | 989 | 135 | – | – | 41,805 | 2,548 |
| 1987 | 38,010 | 1,939 | 937 | 50 | 433 | 129 | – | – | 39,390 | 2,018 |
| 1988 | 45,891 | 2,989 | 870 | 60 | 769 | 74 | 205 | 10 | 47,735 | 3,133 |
| 1989 | 63,205 | 10,389 | 232 | 28 | 303 | 52 | 274 | 42 | 64,014 | 10,511 |
| 1990 | 47,156 | 7,042 | 525 | 124 | 494 | 70 | – | – | 48,175 | 7,236 |
| 1991 | 22,213 | 3,148 | 73 | 92 | 498 | 81 | 179 | 27 | 22,963 | 3,348 |
| 1992 | 49,075 | 6,902 | 195 | 34 | – | – | – | – | 49,270 | 6,935 |
| 1993 | 30,872 | 11,506 | 281 | 54 | – | – | 248 | 48 | 31,401 | 11,608 |
| 1994 | 22,633 | 12,013 | 57 | 11 | 53 | 2 | 96 | 19 | 22,839 | 12,045 |
| 1995 | 30,115 | 5,552 | – | – | 73 | 23 | 332 | 68 | 30,524 | 5,653 |
| **Total** | **777,549** | **99,091** | **11,058** | **2,261** | **7,942** | **771** | **5,110** | **592** | **801,669** | **102,724** |

Note: H – hatched
F – failed

(Source: Arinal, 1997)

## International/Regional Cooperation

At regional level, Indonesia with the other member countries of ASEAN, also signed the MoU ASEAN/SEAFDEC on the Conservation and Management of Marine Turtles. To follow up this MoU, Indonesia should develop an Action Plan to conserve and manage sea turtles and their habitats in Indonesia. Further regional cooperation has also been established through an international workshop in Manila in March 2001, which was attended by Indonesia, Malaysia and the Philippines to formulate joint vision to conserve marine biodiversity and eco-region in Sulu Sea and Sulawesi Sea. The concept of marine eco-region conservation focuses not only on the management to conserve and utilize natural resources based on marine species and their habitats in an individual basis, but also includes broader aspects that may affect conserving areas such as socio-economics and culture of related communities including their possible threats (Dermawan, 2004).

Other regional cooperation has been continually set up, such as those resulting from the South Pacific Regional Environment Program on Sea Turtle Conservation of 1989; TIHPA; CITES Conference held in Nairobi in 2000; Memorandum of Understanding of ASEAN and Indian Ocean which was held in 2000; and Inter-American Convention on the protection and conservation of sea turtles in force which was held in 2001.

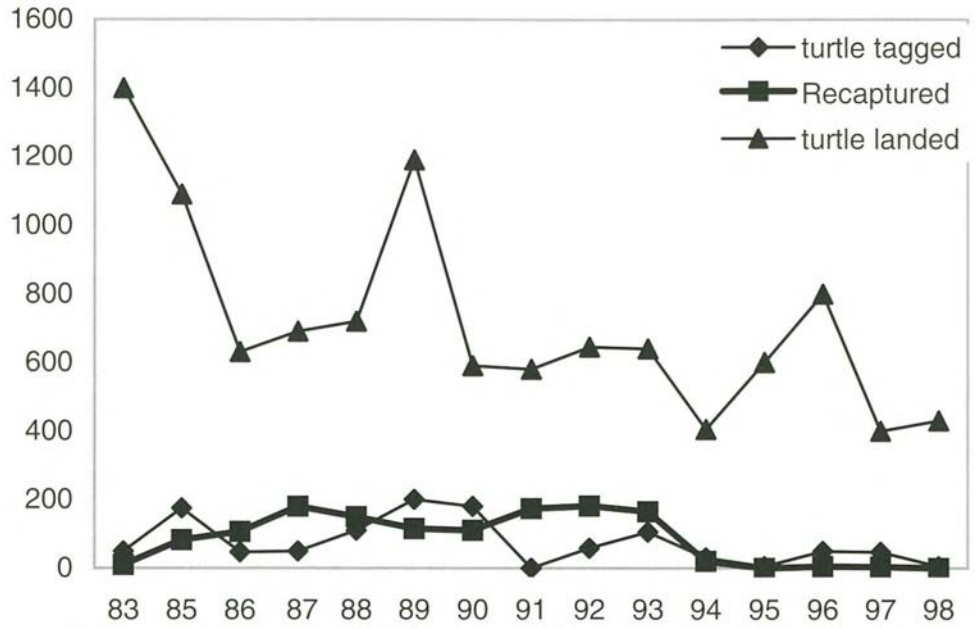



**Figure 6.** Variation of Green Turtles Tagged and Recaptured at Sukamade Beach, Meru Betiri National Park, Indonesia (Source: Wiadnyana, 2004)

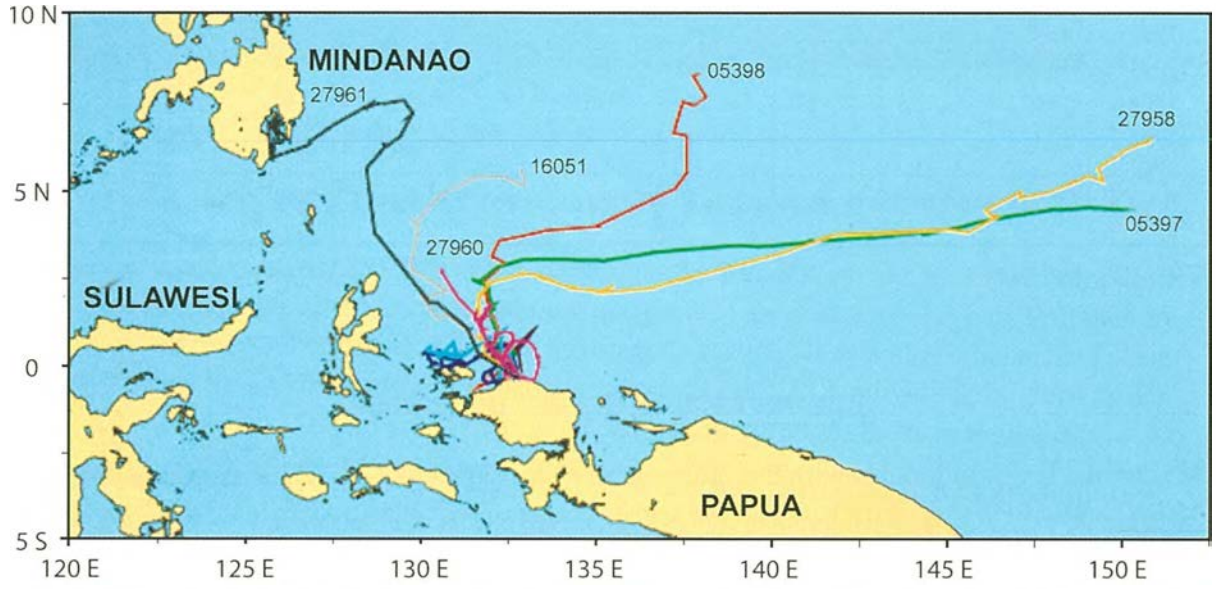



**Figure 7.** Satellite Telemetry Tracking of Leatherbacks in Jamursba Medi Beach, Papua (Source : WWF-Indonesia)

The DNA analysis from tissue samples of hawksbill in collaboration with Kyushu University, Fukuoka Japan, and the Ministry of Forestry of Republic of Indonesia is being conducted. Indonesia has also collaborated with NGOs in the conservation of sea turtles. The NGOs are WWF-Indonesia, WWF-Malaysia, WWF-Philippines and IUCN (Dermawan, 2004).

## Research Activities

Due to the widespread distribution and species diversity of sea turtles in Indonesian waters, studies are limited on their biology and its management, particularly hawksbills. Most sea turtles studies

have lasted a short time and were confined to the nesting beaches on Java and nearby islands. Some authors just obtained little information available from limited studies (Nuitja and Akmad, 1982; Sam and Halim, 1984 and Kithchener, 1996). Consequently, the data on population sizes and dynamics, including the ecology and behavior, which support the management of sea turtles conservation, are still lacking. The past experiences showed that the conservation of several sea turtles has been initiated with varying success.

In order to produce information required by the government of Indonesia to establish better management on sea turtles, a collaboration work has been done with several government agencies and NGOs to conduct the on-going research activities on bio-ecology and monitoring including:

- Survey of stocks and identification of major nesting sites and foraging areas;
- Identification of migratory routes and geographical ranges of population;
- Conservation practices on nesting beaches;
- Captive breeding and ranching;
- Trade monitoring; and identification and monitoring of incidental catch of fishing activities on sea turtles; and
- Determination of the impact of coastal fisheries on the sea turtle populations.

The data on the ecology of turtles are needed for its conservation efforts, which would be obtained progressively with the increasing interest on sea turtles studies in Indonesia. Head starting and tagging activities have been done in several conservation areas such as: Thousand Island National Park (TINP), Meru Betiri National Park, Alas Purwo National Park , Pengumbahan Beach and Cikepuh Wildlife Reserve. Currently and in the near future, monitoring post-nesting migration for hawksbill turtles will be done in TINP, Java Sea, and Jamursba-Medi Beach in Papua for leatherbacks.

Research activities on turtle biology and population dynamics are vitally important to provide knowledge and information upon which to base successful management. In the past, the research on sea turtles was limited. Currently, there is an increasing interest among government agencies, universities, NGOs and the private sector for sea turtles research. This is a positive sign in improving the database on sea turtles, which may improve management and conservation of sea turtles in Indonesia. In order to achieve good results on sea turtle conservation and enhancement program in Indonesia, collaboration work with experts from foreign countries, especially from ASEAN, is needed. Several research institutions and NGOs are currently involved in sea turtles research in Indonesia. They are the Research Center For Capture Fisheries (RCCF), the Agency for Marine and Fisheries Research under the Ministry of Marine Affairs and Fisheries (MMAF), Bogor Agriculture University, WWF-Indonesia and the Alam Lestari Foundation.

Key persons who are actively involve in sea turtles issues in Indonesia are listed as follows:

1. Mr. Agus Dermawan
   Directorate of Conservation and National Marine Park,
   DG of Coastal and Small Island,
   Ministry of Marine Affairs and Fisheries,
   Jalan Merdeka Timur No. 16
   Jakarta Pusat, Indonesia.
   Tel: 62-21-3522045
   Fax: 62-21-3522560
   E-mail: agusder81@hotmail.com

2. Dr. Ngurah N. Wiadnyana
Research Centre, Agency for Marine and Fisheries Research,
Ministry of Marine Affairs and Fisheries,
J1. Pasir Putih I, Ancol Timur,
Jakarta 14430, Indonesia.
Tel: 62-21-64711940 / 6459615
Fax: 62-21-6402640
E-mail: purispt@indosat.net.id
wiadnyana_ngurah@hotmail.com

**Ahmad Ali, Zulkifli Talib,**
**Paul Basintal and James Bali**


Leatherback Turtle
*Dermochelys coriacea*

# MALAYSIA

## Introduction

Malaysia lies in the tropics within latitudes 1°-8°N and longitudes 100°-119°E and consists of Peninsular Malaysia, and the states of Sabah and Sarawak. Peninsular Malaysia is bounded by seas on all sides, except in the north where it is joined to the Asia mainland via Thailand. Sabah and Sarawak are located on the northern part of Borneo Island. The two land masses are about 1,200 km apart, separated by the South China Sea. The East Coast of Peninsular Malaysia faces the South China Sea, as do Sarawak and the western part of Sabah. The West Coast of Peninsular Malaysia, however, is bordered mainly by the Straits of Malacca.

Four species of sea turtles, namely the leatherback, green turtle, hawksbill and olive ridley; nest along the sand beaches of Peninsular Malaysia, Sabah and Sarawak. At present, olive ridley and leatherback turtles are extremely rare in Malaysia. All four species are listed under Fisheries Regulation 1985 (Control of Endangered Species, gazetted in 1999).

The green turtle is the most extensively-distributed sea turtle species in Malaysia with about 10,000 nests recorded yearly in Sabah, 800 nests in Sarawak and 2,950 in Peninsular Malaysia (Liew, 2002). The highest concentration of green turtle occurs on the islands of Pulau Redang and Pulau Perhentian Besar, and the mainland of Terengganu at Penarik, Cukai, Kertih, Paka and Geliga. In Pahang, the green turtle rookeries are at Chendor, Cherating, and Tioman Island. Pantai Segari of Perak is a major rookery for this species on the West Coast of Peninsular Malaysia. There are also nestings of green turtles reported in the other areas, such as around Pekan and Rompin in Pahang. In addition, green turtles are also found to nest on several beaches in Pulau Pinang, Kedah (Pulau Telur), Perlis, and several islands off East Johor, namely Pulau Mertang, Pulau Lima, Pulau Pemanggil and Pulau Simbang, but their number of clutches are considered small (Mortimer, 1990). The nesting season of the green turtle occurs almost throughout the year with peaks from June to August (Kamarruddin et al., 1996 and Mohd Najib and Kevin, 1999).

Hawksbill turtles do not nest in very large numbers in Malaysia. In the Sabah Turtle Islands, there are approximately 500 nests per year while in Malacca, there are only about 250 nests. Only a few nestings were recorded in other locations, such as several islands in West Johor and Terengganu (Liew, 2002). Hawksbill turtles were also reported to nest at Tanjung Datu National Park, Samunsam Wild Life Sanctuary, Pulau Satang Besar, Sibuti and Kuala Niah from November to March in Sarawak (Bali, 1998). At each of the locations, numbers of nests recorded were not more than 10 per year. Although not a single nest has ever been recorded at Pulau Talang-Talang Besar, Pulau Talang-Talang Kechil and Similajau National Park since 1995, juvenile hawksbill turtles were often seen at coral reefs around those islands. A number of small-submerged reefs off Lawas were observed to be another feeding ground of hawksbill turtle in Sarawak.

In Sarawak, the green turtle is the main species of sea turtle nesting in large numbers from May to September each year. The main green turtle nesting sites of Sarawak are located on the Sarawak Turtle Islands (Talang-Satang National Park) of Talang-Talang Besar, Talang-Talang Kechil and Satang Besar. Turtle nests were also recorded at Tanjung Datu National Park, Similajau National Parks, Sematan and Miri. The highest concentration of green turtle occurs in the Talang-Satang National Park with around 1,700-3,000 nests recorded yearly (Bali, 1998). Hawksbills and olive ridley also nest on these islands' beaches during the wet northeast monsoon from December to March. The islands are located about 6 to 9 kilometers off the coast of Kuching Divison. Other areas are Tanjung Datu National Park and Similajau National Park (Leh, 1996 and Leh and Yakup, 1996).

Only two major species of turtle are found to have come ashore in Sabah, namely the green turtle and hawksbill. Besides the mentioned species, there were also four records of olive ridley nesting in Sabah from 1986-1988 (Basintal and Lakim, 1993 and de Silva, 1986). There are a few islands where turtle landings were reported in Sabah namely Selingaan, Gulisaan, Bakkungaan Kecil, Tegapil, Lankayan, Billean, Koyan-koyan and Nunu Nunukan (Muhamad Saini, 1996).

In general, the peak nesting period for green turtle in Sabah is from July to December and the hawksbill is from January to June. For the individual islands, the peak period for Selingaan is in September and October; Bakkungaan Kechil is in August and October while Gulisaan recorded a number of hawksbill landings in March. Gulisaan Island is believed to be the most significant hawksbill nesting island in Malaysia (Muhamad Saini, 1996).

The leatherback turtle is known to nest primarily on the beaches of Terengganu. The major rookeries in Malaysia are found particularly at the 1.5 km stretch of beaches of Rantau Abang and Paka, in Terengganu and was recorded nesting at Chendor in Pahang and in Johor (Kamarrudin, 1996 and Mohd Najib and Kevin, 1999). In the 1950s about 2,000 nests were recorded but the number dropped drastically in the 1990s. There were only 213 nests recorded at Rantau Abang rookery in 1994. In 2003, only 14 nests were recorded in Terengganu. Nesting season of leatherback turtle is from March to September and the peak season is from June to July (Chan and Liew, 1989b and Sukarno et al., 1993). At present, there is no report about the nesting of leatherback turtles on the West Coast of Peninsular Malaysia. Leatherback turtles were also recorded to nest at Similajau National Park in 1998, Tanjung Lobang off Miri; and Bedaun and Siru off Semantan in 2000 in Sarawak (Tisen and Bali, 2000).

## Overview of Sea Turtles Conservation and Enhancement in Malaysia

The diversity of habitats in Malaysia, from coastal shorelines to highland forests, supports twenty-two species of marine and freshwater turtles, terrapins, and tortoises – collectively known as chelonians. All four species of sea turtles plying the offshore waters of Malaysia's coastline are considered endangered, as well as both species of terrapins inhabiting riverine and estuarine environments. Conservation efforts to date have focused mainly on the large sea turtles, with egg collection and hatchery programs established since the end of 1949.

## Legislations and Regulations

Under the Federal Constitution, the rights to promulgate laws are distributed to both Federal and State Governments, according to Federal, State or Concurrent lists. Rules and regulations pertaining to turtles are within the purview of states; however, the Parliament is empowered to legislate on matters

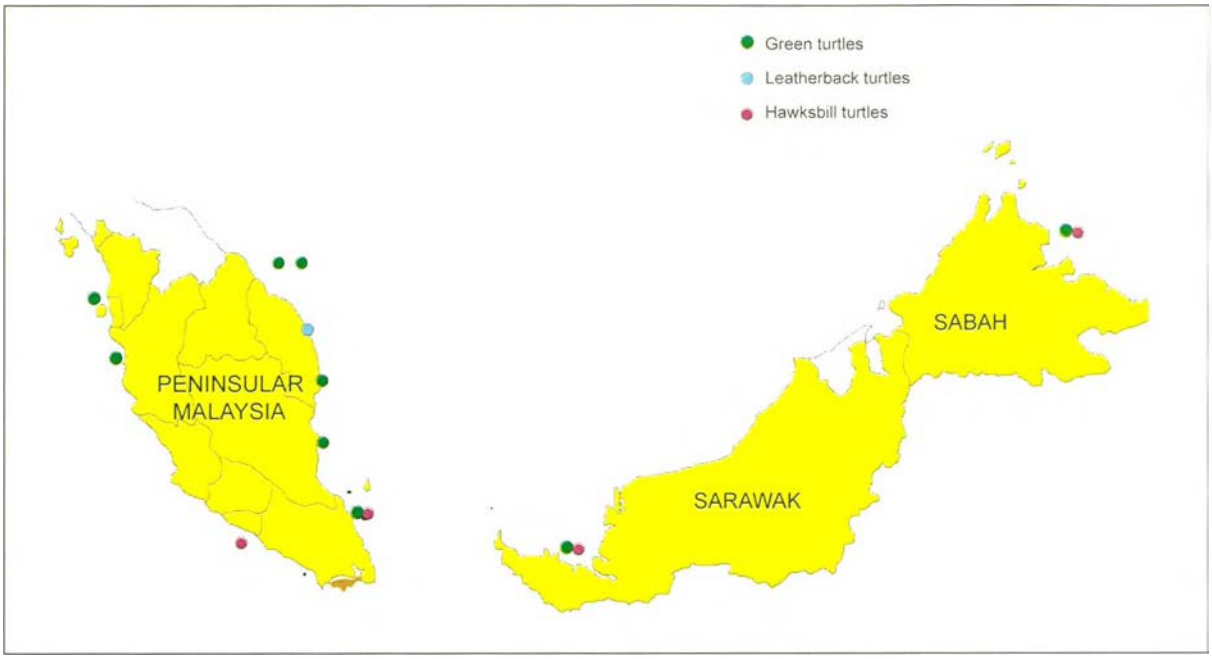



**Figure 8.** Distribution of Sea Turtle Nesting Beaches in Malaysia

enumerated in the State List, for the purpose of promoting uniformity of the law. In the case of Sabah and Sarawak, they have special privileges under the Federation of Malaysia.

According to the Malaysian Constitution, turtles are the property of the 13 individual states. At the federal level, the Fisheries Act of 1985 repealed the Fisheries Act of 1963. The major contributions of the act are regarding the objectives of conservation, management and development of marine resources. It also provides a 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. The legislation prohibits the capture, killing, injuring, possession or sale of turtles, collection of eggs, disturbing turtles during laying of eggs and the provision for establishment of a turtle sanctuary. Table 3 shows the Federal and State Legislations affecting chelonian conservation in Malaysia.

## Federal Legislation

At the federal level, at least six Acts serve as the primary legislation for the protection of wildlife and fisheries. These including the Fisheries Act 1985, the Wild Life Protection Act 1990, Fisheries Prohibited Areas (Rantau Abang) Regulations 1990, Customs (Prohibition of Exports) Order 1988 and Customs (Prohibition of Import) Order 1988. The Fisheries Prohibited Areas (Rantau Abang) Regulations 1990 is applicable only to Peninsular Malaysia.

Part VII of the Fisheries Act 1985 deals with "turtles" and inland fisheries and promotes development and rational management by the state authorities in consultation with the Director-General of the Department of Fisheries Malaysia (DOFM). This allows the states to regulate rules for the proper conservation and management of turtles and their eggs, inclusive of licensing the fishing methods. In areas beyond the jurisdiction of the states, the Director-General of DOFM has the authority to regulate the rules.

The import and export of turtle eggs are subjected to the restriction stated in the Customs (Prohibition of Imports) order (1988) and Customs (Prohibition of Exports) Order (1988).

**Table 3.** Federal and State Legislations Affecting Chelonian Conservation in Malaysia

**FEDERAL LEGISLATION**

- Fisheries Act 1985
- Wild Life Protection Act 1990
- Fisheries (Prohibited Areas) (Rantau Abang) Regulations 1991
- Fisheries (Prohibition of Method of Fishing) (Amendment) Regulations 1990
- Customs (Prohibition of Exports) Order 1988
- Customs (Prohibition of Import) Order 1988

**STATE LEGISLATION**

**JOHOR**

- Fisheries (Turtles and Turtle Eggs) Rules 1984

**KEDAH**

- Turtle Enactment 1972
- Turtles' Rules 1975

**KELANTAN**

- Turtles and Turtle Eggs of 1932 (Amended 1935, Enactment No.8)
- Fisheries (Turtles and Turtles' Eggs) Rules 1978

**MALACCA**

- Fisheries (Turtles and Turtle Eggs) Rules 1989

**NEGERI SEMBILAN**

- Fisheries (Turtles and Turtle Eggs) Rules 1976

**PAHANG**

- Fisheries (Turtles and Turtle Eggs) Rules 1996

**PENANG**

- Fisheries (Turtles and Turtle Eggs) Rules 1999

**PERAK**

- (Legislation in Draft)
- River Rights Enactment 1915

**PERLIS**

- (No Legislation)

**SABAH**

- Fauna Conservations Ordinance 1963 9Act. No.11)
- Fauna Conservations (Turtle Farms) Regulations 1964,
- Parks Enactment 1984
- Customs (Prohibition of Imports) and Prohibition of Exports (Amendment) Order 1971
- Wildlife Conservation Enactment 1997

**SARAWAK**

- Turtle Trust Ordinance, 1957
- Turtles (Prevention of Disturbance) Rules,1962
- Wildlife Protection Ordinance, 1958 (Amended 1973)
- Wildlife Protection Ordinance, 1990 (Amended 1995)
- Wildlife Protection Rules, 1998
- National Parks and Nature Reserves Ordinance, 1998
- National Parks and Nature Reserves Rules, 1999
- Wild Life Protection Ordinance, 1998 (Amended 2003)
- Customs (Prohibition of Exports/Imports) Orders of 1988

**SELANGOR**

- (No Legislation)

**TERENGGANU**

- Turtle Enactment 1951 (Amendment) 1987
- Turtle Enactment 1951 (Amendment) 1989
- Section 3A Notification Under Turtle Enactment 1951

# State Legislation

## Peninsular Malaysia

As early as 1915, when the State Rulers declared certain rights and restrictions, there were legislations regarding turtles and turtles' eggs for exploitative purposes. Today, the Fisheries Act 1963 (amended 1985), provides that the states may exercise their rights to regulate rules regarding turtles and turtle eggs. Only two states, namely Perlis and Selangor do not have any legislation concerning sea turtles as there is no nesting recorded in both states. At present, a new legislation is being drafted in Perak to provide more effective protection for sea turtles (Mohd Najib and Kevin, 1999).

**Plate 39.** Leatherback Turtles Nesting at Rantau Abang in the 1980s

Legal measures for turtle conservation in Terengganu and Kedah were gazetted in 1951 and 1972, respectively. These legislations pertained to reptiles based on local names instead of taxonomic criterion. These two states rely on Malay language terms such as "*tuntung*" and "*penyu*", which are local names for terrapins and sea turtles respectively, for identification of species.

Legislation in Johor, Kelantan and Negeri Sembilan used the phrase "any reptile belonging to the Order Chelonia" in its interpretation. However, Malacca's legislation restricts its coverage to five species listed in the First Schedule of the legislation.

Most of the enactments in Malaysia deal with the regulated exploitation of turtles and turtles' eggs. The various state regulations explain the procedures and fees for securing licenses to collect eggs and operating turtle watching areas and penalty for killing or possessing turtles. Without a permit granted by the Fishery Officer, no one is allowed to remove or destroy eggs from nesting sites. Any turtle or portion thereof, found in possession of someone on board a vessel within State territorial waters is presumed to have taken or killed the animal. Nesting places may not be used for tourism without permission. Failure to obtain a permit for any of these activities is considered an offence, which results in fines ranging from RM100 (US$26) to RM5,000 (US$1,307) and/or imprisonment up to one year. Protective measures include provisions to prevent cruelty to turtles from disturbance during nesting process or causing any physical injury to the animals, including climbing on its back for a ride. In order to fulfill conservation objectives, each licensee is required to sell a certain number of eggs to the Fisheries Officer for hatchery purposes at the prevailing wholesale price. Penalty for not doing so will result in the cancellation of the license. In order to ascertain turtle populations, any person engaging in an occupation related to turtles or eggs may be asked to provide statistical information. Failure to comply with these rules is also considered as an offence and liable to fines not exceeding RM1000 (US$261) and/or imprisonment for six months.

Recognizing the importance of protecting the sea turtles, the state of Terengganu amended the Turtle Enactment (1951) in 1987 and enacted both the Section 3A Notification Under Turtle Enactment

(1951) and the Turtle Enactment 1951 (Amendment) 1989. The first enactment set up the boundaries for the Rantau Abang Turtle Sanctuary, while the second focused on the breeding of the leatherback turtle by prohibiting the possession or sale of eggs for consumption.

## Sabah and Sarawak

Upon their entry into the Federation of Malaysia in 1963, the states of Sabah and Sarawak were provided special rights to enact legislation autonomously which are not provided for Peninsula states. The two main legislations, namely Fauna Conservation Ordinance 1963 and Wild Life Protection Ordinance 1990 form the basis to protect some of the marine and non-marine species.

In the former legislation, only two species of marine turtles (green and hawksbill) are listed in the First Schedule. However, in the preliminary section "wild animal" refers to any reptile found wild in Sabah and "turtle" refers to those animals included in Part IV of the First Schedule.

## Sabah

Sea turtle conservation effort in Sabah was first established in 1927 during the North Borneo British Company Administration (de Silva 1986). In 1928, Sabah gazetted Notification No. 227 and 228 to regulate hunting of hawksbill turtles for their shell and meat. A six year close-system under these notifications was imposed to reduce the decline of the sea turtle populations. In the 1950s, there were a few islands where turtle nesting were observed, namely: Selingaan, Gulisaan, Bakkungaan Kecil, Tegapil, Lankayan, Billean, Koyan-Koyan and Nunu Nunukan. Effort to conserve these turtles has grown under the Turtle Preservation Ordinance No.5 (1952).

On August 1966, a hatchery funded by a state government was set up at Selingaan Island. By the year 1968, similar hatcheries were also built in Gulisaan and Bakkungaan Kecil Islands. In 1972, these islands were constituted as Game and Bird Sanctuaries under the jurisdiction of the Forest Department. Sabah Parks took over the management in 1977 when the three islands were converted into a National Park.

In Sabah, the Fauna Conservation Ordinance 1963 (Act No.11) partially protects the Chelonid turtles and prohibits national and international trade of sea turtles. The Fauna Conservation (Turtle Farms) Regulations 1964 regulates the collecting of green and hawksbill turtle eggs for hatchery purposes. The import and export of turtles or their products are prohibited by Custom (Prohibition of Imports) and (Prohibition of Exports) (Amendment) order 1971. The Wildlife Conservation Enactment 1997 further enhanced the conservation of the green and hawksbill turtle by listing them as totally protected animals under Part I of Schedule 1 of the above enactment.

## Turtle Islands Heritage Protected Area (TIHPA)

Turtle Islands Heritage Protected Area (TIHPA) is a collaborative program on trans-boundary turtles management between Sabah Parks and the Pawikan Conservation Group of the Department of Environment and Natural Resources of the Philippines. This program is the first of its kind in the world, where two countries jointly manage the same turtle resources. The Technical Working Group from both countries met in Sandakan from 3-5 May, 1995 to draft the Memorandum of Agreement (MoA) for the establishment of TIHPA. According to the MoA, the contracting parties shall endeavor to develop an integrated management program that highlight the following issues:

- Implementation of an integrated and uniform approach to conservation and research that is oriented towards wise management of the TIHPA.
- Establishment of a centralized database and information network on marine turtles.
- Development of appropriate information awareness programs primarily targeted towards the inhabitants of the Turtle Islands on the conservation of marine turtles and the protection of their habitats.
- Implementation of a joint marine turtle resource management program.
- Development and implementation of a training and development program for the staff of the TIHPA.
- Development and undertaking of eco-tourism programs. Generally under the research program, all collaborative scientific research, management and case studies could be carried out not only on turtle resource but also on other areas such as elasmobranch, cetaceans and dugong resources.

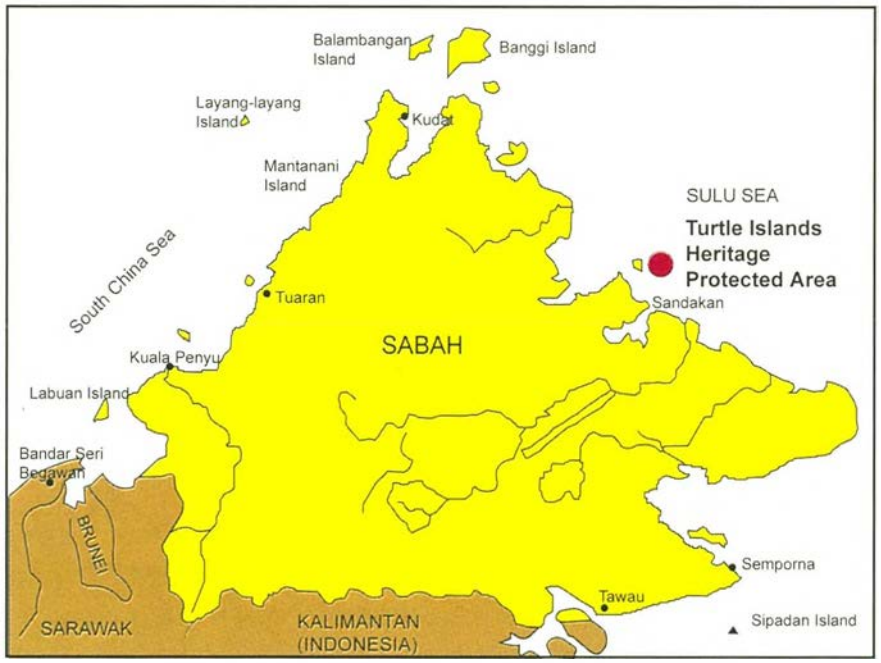



**Figure 9.** Location of Turtle Islands Heritage Protected Area

## Sarawak

Green, hawksbill and leatherback turtles are listed as protected species under the Turtle Trust Ordinance, 1957. No person should hunt, kill, or capture any of these protected species. Due to its inadequacies, the Turtle (Prevention of Disturbance) Rules were enacted in 1962 to protect the half nautical mile from the coastline of each island against illegal entry (Leh, 1996).

Under the Wildlife Protection Ordinance, 1958 (Amendment 1973), the Director of Sarawak Forest Department was vested with the authority to manage wildlife for the state, and as such was responsible for the protection of sea turtles. The Director of the Museum continues to function as the Executive Officer of the Turtles Board, but his jurisdiction now only extends to the three Turtle Islands, namely Pulau Talang-Talang Besar, Pulau Talang-Talang Kechil, and Pulau Satang Besar.

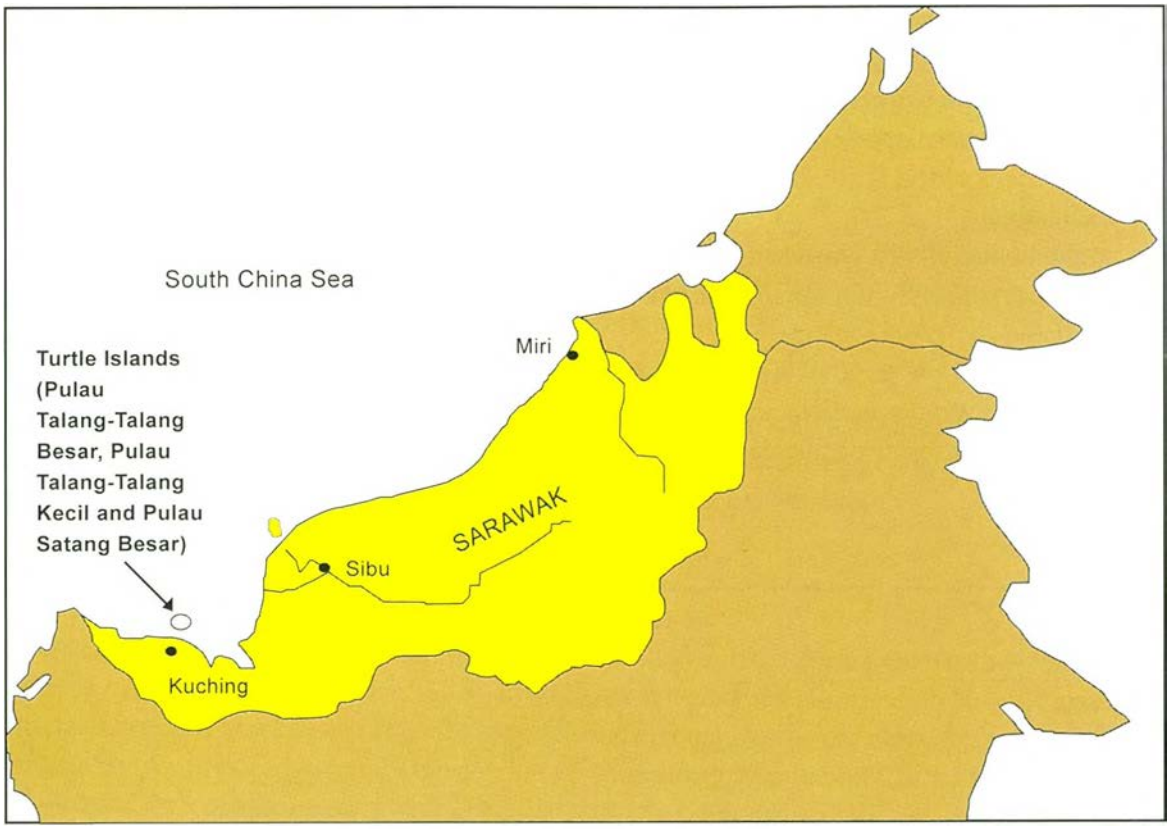



**Figure 10.** Location of Sarawak Turtle Islands

In 1990, the Wildlife Protection Ordinance 1990 was gazetted to replace the Wildlife Protection Ordinance 1958. It provides for classifications of "totally protected animals" and "protected animals". All sea turtles were listed as totally protected animals. Under the Wildlife Protection Ordinance, 1998 (Amended 2003) all species of Chelonidae and Dermochelyidae were listed as Totally Protected Animals.

Under Section 29(1) of Wildlife Protection Ordinance, 1998 (Amendment 2003): Any person who hunts, kills, captures, sells, offers for sale or claim to be offering for sale, imports, exports, or is in possession of, any totally protected animal or any recognizable part or derivative thereof, or any nest thereof, except in accordance with the permission in writing of the Controller of Wildlife for scientific or educational purposes or for protection and conservation of such protected animal, shall be guilty of an offence: Penalty – imprisonment for two years and a fine of RM 25,000 (US$ 6 535)

## Sea Turtle and Terrapin Egg Collection and Licensing System

Egg collection programs, as regulated under various state enactments, pertain mainly to sea turtle eggs, deposited in sandy beaches along the coastline. Terrapin eggs may also fall under the purview of the regulations, especially those of the Painted Terrapin, which lays clutches on beaches as well.

### Peninsular Malaysia

The legal collection of the sea turtle and terrapin eggs is provided through licensing agreements usually granted by State Fisheries authorities, or as stipulated in state enactments. In most cases, the Fisheries

**Plate 40.** Licensed Turtle Eggs Collector in Terengganu During the 1980's

Officer is empowered to grant licenses or permits to individuals for the purposes of regulated exploitation. The removal of turtles' egg from nesting places or the destruction of eggs is totally prohibited without a legitimate license. Authorities have the right to revoke licenses without compensation to licensee, to refuse a license application, and to call for tenders to grant exclusive rights to collect eggs in a specified area. In order to foster conservation, a licensee is obligated to sell a required number of eggs, at the prevailing wholesale price, to the fisheries officials for hatchery purposes. Failure to comply with the terms and conditions of licensing agreements, including the payment of fees, may result in the suspension or cancellation of a license. The normal period of validity for most licenses is one year (Dionysius, 2003).

Legislations in Malacca and Terengganu grant exclusive right to establish turtle sanctuaries for protection, research, conservation and management, through the acquisition of state and private land for such purposes. In Terengganu, the authority to appoint licensing officers lies with the Sultan on advice from the State Council. The Sultan may also reserve private or state land for turtle protection and conservation, including coastal habitat for sanctuaries. The Sultan retains the right to degazette all parts of the sanctuaries at any time. These areas are placed under the control of the Turtle Sanctuary Council in conjunction with an Advisory Council to discuss matters pertaining to management. A committee is established for every sanctuary to implement conservation measures approved by the Advisory Council. The Sultan is responsible for issuing tenders for exclusive rights to collect eggs in sanctuaries or other areas, subject to certain terms and payment (Dionysius, 2003).

## Sabah

In Sabah, the collection of eggs is regulated under the Fauna Conservation Ordinance 1963. A license authorizes the licensee to collect the turtle eggs of the species specified in the legislation. The Governor in Council is empowered to reserve areas specifically for native egg collectors and constitute turtle farms with exclusive collection rights. All terms and conditions relating to egg collections and licensing of the collection area are also within the scope of the Governor in Council.

Under the new Wildlife Conservation Enactment 1997, however, it is the Director of Wildlife that is empowered to declare an area as a turtle egg traditional collection area. Where such an area has been declared as such, "it shall be reserved exclusively for collection of turtle eggs without a permit in accordance with the traditional rights of the people who dwell reasonably adjacent to such area whose rights had been recognised by the Government prior to this Enactment."

## Sarawak

The Turtle Trust Ordinance 1957, the Sarawak Protection Ordinance 1957, the Sarawak Ordinance 1973, the Wildlife Protection Ordinance 1990 (Amended 1995), and the Sarawak Wildlife Ordinance 1998 were gazetted to conserve, protect and manage the sea turtles in Sarawak. The Turtle Trust Ordinance 1957 applies to the islands known as Talang-Talang Besar, Talang-Talang Kecil, and Satang Besar. This conservation program was the effort of the late Tom Harrison who was then the Curator of the Sarawak Museum. Between 1951 and 1962, he helped to enact the Turtle Trust Ordinance in 1957, to manage sea turtles and he established the Turtle Board. Established as a corporate body, the Turtle Trust Board has the exclusive right to collect turtle eggs from the specified areas, but the Governor of Council may amend the collection sites. Due to its inadequacies, the Turtle (Prevention of Disturbance) Rules were enacted in 1962 to protect the half nautical mile from the coastline of each island against illegal entry (Leh, 1996).

The Sarawak Museum was also traditionally been responsible for turtle research on the three islands. Beginning 1957, the Curator of Sarawak Museum was in-charge of wildlife in the state in his capacity as the Chief Game Warden.

Talang-Satang National Park (formerly known as the Sarawak Turtle Islands) has been designated as Turtle Sanctuaries since 1957, under the Turtles Trust Ordinance 1957. Since then, the three Turtle Islands have been under the management of the Director of the Museum in his capacity as the Executive Officer of the Turtles Board (This jurisdiction has been restricted to these three islands only). The Sarawak Turtles Board owned all turtles and its eggs from all of the Sarawak Turtle Islands. All the revenue from selling of turtle eggs will be used for management of Sarawak Turtles Board and for Sarawak Malay Islamic Charity.

Under the Turtle Trust Ordinance 1957, the Turtle Board has a right to (own) all turtles and its eggs that nested on that three islands. Most of the eggs collected were sold to the public. When the conservation program started in 1951, a small amount of eggs were incubated in a hatchery. The amounts of eggs put to conservation and sold to the public were decided by the Turtles Board. The Sarawak Museum pays the Turtles Board for all eggs that were incubated in hatcheries. From 1982 to 1997, all eggs nested from May to September were transfer to the hatchery, while eggs nested from October till April were sold to the public. These practices were revised by the Sarawak State Government in 1998 when Wild Life Protection Ordinance 1998 was gazetted. Under the new ordinance, it is illegal to hunt, kill, capture, sell, offer for sell or claim to be offering for sale, imports, exports, or be in possession of, any marine turtles species (totally protected animal) or any recognizable part or derivative thereof, or any nest thereof, except in accordance with the permission in writing of the Controller of Wildlife for scientific or educational purposes or for protection and conservation of such protected animal. That means it is illegal for the Turtle Board to sell turtle eggs to the public but they were permitted to sell eggs for conservation purposes to Sarawak Museum Department and Sarawak Forest Department. All eggs nested at Pulau Talang-Talang Besar and Pulau Satang Besar were bought by the Sarawak Museum Department, while all eggs from Pulau Talang-Talang Kechil were purchased by Sarawak

**Plate 41.** Collecting of Green Turtle Eggs for Hatchery Purposes

Forest Department at RM 0.75 per egg (US$0.20). In 2003, price of eggs were increased to RM1.00 per egg (US$0.26). Since than, all eggs nested at Talang-Satang National Park were sold for conservation.

## Membership in International and Regional Treaties

Currently, Malaysia is a party of the Ramsar Convention, CITES, Bonn Convention and Convention of Biodiversity (CBD). Malaysia became a party of CITES effective on 18 January 1978. It is a responsibility of member to implement the resolution adopted by CITES in the protecting of wildlife in Peninsular Malaysia and the states of Sarawak and Sabah. The import and export of sea turtles, their products and parts are strictly prohibited. Trade of sea turtles is also prohibited under the Custom Order as mentioned earlier. All the four sea turtle species and the river terrapins are included in the CITES endangered species list (Appendix I).

International conservation ratings and resolutions serve to monitor critical issues and garner worldwide expertise to recommend appropriate action plans. The International Union for Conservation of Nature and Natural Resources – World Conservation Union (IUCN) Red Data Book represents the most comprehensive guide in evaluating the conservation status of selected species, supported by scientific research. All sea turtles and terrapins in Malaysia were categorized as endangered.

The ASEAN Marine Turtle Conservation Program was approved by the ASEAN Working Group for Nature Conservation and held its first symposium in 1993. A joint project between Sabah and the Philippines, namely TIHPA was established in 1996 to conserve and manage important foraging and nesting grounds of sea turtles. The summary of Malaysia's membership in international treaties are as follows:

- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar) 1971.
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn) 1979.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 1973.

- Convention on Biological Diversity (CBD) 1992.
- International Congress of Chelonian Conservation 1995 Resolutions (ICCC).
- Turtle Islands Heritage Protected Area Agreement Between the Government of Malaysia and the Government of the Republic of the Philippines 1996.
- ASEAN Agreement on the Conservation of Nature and Natural Resources 1985.
- Langkawi Declaration 1989.

## Responsible Agencies on the Conservation and Enhancement of Sea Turtles in Malaysia

There are several agencies in Malaysia responsible directly or indirectly in the conservation and enhancement of sea turtles in Malaysia. The main agency is the DOFM which has expertise in research, tagging activities, hatcheries management, conservation as well as enforcement. Several universities have an interest in sea turtles research, especially the University College of Science and Technology (KUSTEM), University Malaysia Sabah (UMS), National University of Malaysia (UKM), University of Science Malaysia (USM), University of Malaya (UM) and University Malaysia Sarawak (UNIMAS). The most active NGO in the sea turtles conservation activity is WWF-Malaysia. A number of commercial banks and private sector companies also actively involve in the sponsoring of sea turtle conservation and enhancement activities in Malaysia.

With regard to chelonian habitat destruction due to the environmental threats from pollution and coastal development, the strict enforcement of protective measures prescribed in the Environmental Quality Act 1974 is necessary. The DOFM in various states and the Wildlife Department, in coordination with the Department of Environment, is always alert to the rapid changes occurring in marine and riverine ecosystems. The Environmental Quality, (Prescribed Activities, Environmental Impact Assessment) Order 1987 lists those activities that require an environmental analysis before a project commences.

The Director of Sarawak Museum Department who is also the Executive Officer for the Turtle Board, is responsible for research and conservation programs of turtle on the Sarawak Turtle Islands. Under the Wildlife Protection Ordinance, 1995 all sea turtles were listed as totally protected animals. This was the starting point of the involvement of the Sarawak Forest Department in sea turtles conservation programs. At the same year, a small hatchery was set up at Tanjung Datu National Park to relocate eggs from the nesting beaches that were exposed to natural predators such as monitor lizards and wild boar. In 1996, the Turtles Board gave approval for the Sarawak Forestry Department to conduct conservation program at Pulau Talang-Talang Kechil from June to September. Conservation programs at Pulau Talang-Talang Besar and Pulau Satang Besar were under the preview of the Sarawak Museum Department. In 1997 the Forest Department was granted approval to conduct conservation programs at Pulau Talang-Talang Kechil from February to September. Eggs nested during the monsoon season (October to February) were sold to public.

The management and research on sea turtles of Sarawak changed in 1998 with the gazettement of the Wildlife Protection Ordinance, 1998 and Sarawak Biodiversity Ordinance, 1998. Under the Sarawak Biodiversity Ordinance 1998, with exception to the Departments of Forestry, Agriculture and Medical Services, no research on biodiversity is allowed without the written permission from the Controller of the Sarawak Biodiversity Centre. Since 1998, management and research on sea turtles of Sarawak have been taken over by the Sarawak Forest Department.

Turtle conservation efforts fall within the preview of a number of agencies. Thus their cooperation is crucial. With this in view, the Talang-Satang Turtle Research Working Group was established in 1998. It comprises of the Sarawak Forest Department, the Sarawak Museum Department, the Turtles Board and the Marine Fisheries Department of Sarawak. This working group is chaired by the Permanent Secretary for the Ministry of Social Development (Chairman of Turtles Board). The main function of this working group is to review any research proposal on sea turtles on Sarawak Turtle Islands. One of the outcomes from the working group is a joint patrolling and enforcement of relevant laws by various agencies.

In 2003, most of the functions of the Sarawak Forest Department were taken over by the Sarawak Forestry Sendirian Berhad (SFC Sdn. Bhd.), a company wholly owned by the Sarawak State Government. Conservation and management of sea turtles and other wildlife in Sarawak was taken over by the Protected Areas and Biodiversity Conservation Unit of the Sarawak Forestry Corporation Sdn. Bhd. Under the new organization, all research and conservation management of sea turtles of Sarawak are run by the Biodiversity Conservation Department of the Protected Areas and Biodiversity Conservation Unit.

## Incidental Capture

There are still a small number of turtles found ashore each year, believed to be bludgeoned to death and cut loose from fishing nets or boat propeller. The Fisheries Regulations (Prohibition of Method of Fishing Amendment 1990) attempts to reduce turtle deaths by prohibiting any net with a mesh size of more than ten inches (25.4 cm).

As an additional measure to prevent accidental deaths, the Fisheries Prohibition Areas (Rantau Abang) Regulations 1991, restricts fishing within the protected area around the Rantau Abang Sanctuary, except for certain equipment designed to capture anchovies and squid.

In 1998, the Minister of Environment and Public Health, initiated the Sarawak Reef Balls Project to ensure that sea turtle population do not decline further. The reef balls did this by ripping trawler nets

**Plate 42.** Incidental Capture of a Juvenile Turtle by Traditional Hand-line Fishing Boat in Peninsular Malaysia

that entangled to it. This will keep trawlers away from sea turtle internesting habitats during the nesting season. A total of 1,000 reef balls had been deployed randomly around Talang-Satang National Park from 1998 to 2003.

One of the research programs conducted on sea turtles in Sarawak is the radio telemetry study. Through this study, areas for internesting habitat of sea turtles that nest at Talang-Satang National Park have been identified. Areas used by turtles during the internesting period were seeded with reef balls to deter trawlers from trawling in the area. This led to a marked reduction in the number of dead turtles reported from Talang-Satang areas.

## Hatcheries

The main objectives for setup of sea turtle hatcheries in Malaysia are to increase the emergence success from individual clutches, to produce a natural sex ratio of hatchling (approximately 70% female, 30% male) and healthy, vigorous and correctly imprinted hatchlings entering the sea.

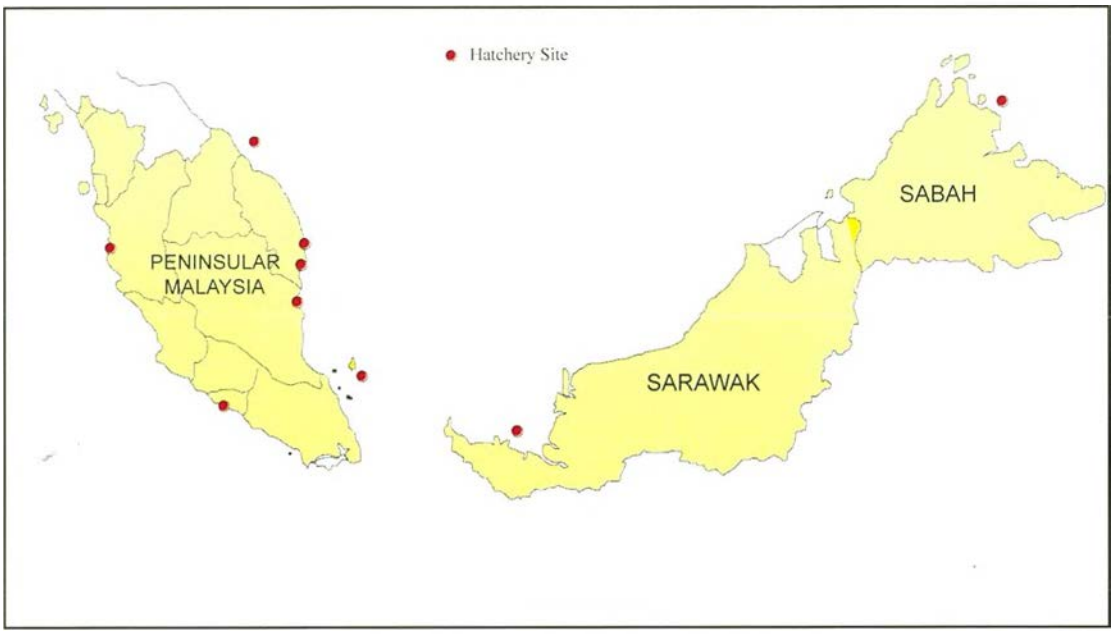



**Figure 11.** Location of Sea Turtle Hatcheries in Malaysia

## Management Practices of Sea Turtle Hatcheries in Malaysia

At present, there are two common approaches being practiced for hatchling production in Malaysia, namely the artificial beach hatchery and incubation in styrofoam boxes.

### Artificial Beach Hatcheries

In general, this technique involves the transplanting of eggs to an enclosed area on the beach. Eggs are incubated at the depth almost similar to natural nests and hatchlings produced are released immediately into the sea. Hatcheries are established in situations where natural clutches of eggs are subjected to inundation by high tides; nesting density is high resulting in high incidences of re-excavation by other nesting turtles; poaching by humans and natural predators is prevalent; and high microbial content is evident (Limpus, 1991). The percentage of emergence success totally

depends on many factors, such as weather (heavy rain, dry season etc.), the presence of predators, mainly red ants and ghost crabs, beach erosion, etc. On average the emergence success for all hatcheries in Malaysia is always more than 65%.

## The Operation of Beach Hatcheries

Hatchery operation as a conservation tool has been practiced in Malaysia since 1949 in Sarawak (Leh, 1989), 1961 in Terengganu, 1964 in Kelantan (Wyatt-Smith, 1960; Balasingam, 1967; Siow and Moll, 1979), 1961 in Sabah (de Silva, 1982 and Muhammad Saini, 1996); 1971 in Pahang, 1987 in Melaka, 1988 in Penang, 1990 in Perak (Kamarruddin and Thalathiah 1994) and in Sarawak in 1967 (de Silva, 1979). Hatchery statistics have been published by various authors (Balasingam, 1967; Tho, 1974, Siow and Moll, 1979; Leong and Siow, 1980; Brahim et. al., 1987; Chan, 1991; Kamarruddin and Abdul Rahman, 1993; Leh, 1996; Muhamad Saini, 1996; Basintal, 2000 and Basintal, 2002). This technique of conservation has been practiced with the expansion of operation at almost all nesting beaches in the country. Currently there are at least 20 hatcheries operational for the whole country.

In Sabah and Sarawak, almost all the sea turtle eggs were incubated in hatcheries since the Turtle Island Park was gazetted as a marine protected area. In Peninsular Malaysia the eggs of leatherback, hawksbill and olive ridleys were bought from collectors for incubation in hatcheries. For the green turtles, at least 70% of the eggs were buried *in-situ* or transplanted in the hatchery sites.

**Plate 43.** Leatherback Hatchery in Terengganu in 1990's

## Incubation in Styrofoam Boxes

Incubation in styrofoam boxes has a few advantages. It affords better protection against predators compared to leaving the eggs in the sand. Styrofoam boxes are washable, stackable, and relatively cheaper as well as can improve hatching success of clutches laid at remote beaches. Limpus (1993), recommended the use of a combined styrofoam box-hatchery technique as the solution. This technique involves the incubation of eggs in styrofoam boxes for a period of 4-5 weeks before transplanting them to a beach hatchery.

**Plate 44.** Incubation of Sea Turtle Eggs in Styrofoam Boxes in Terengganu

## *In situ* Incubation

In this method, clutches of eggs laid are left undisturbed and hatchlings produced are released naturally into the sea. In some cases, the nests had to be fenced to avoid poaching by natural predators. Several

research activities have been conducted in Malaysia for leatherbacks at Rantau Abang and green turtles at Mak Kepit and Cagar Hutang in Pulau Redang. Research conducted in 1990 for 11 clutches of leatherback turtles showed that the average emergence success was 65.7% and, in 1992, (for one 1993. The emergence success from 26 clutches of naturally-incubated eggs was reported to be higher at an average of 86.4% in 1993 (Kamarruddin and Abdul Rahman, 1993). Without ghost crabs and red ants predation, 9 out of 222 nests recorded 100% emergence success during the study at Mak Kepit nesting beach in 2002. The average emergence success at *in situ* nesting beach at Mak Kepit in 2002 was 83%.

### Low Hatching Success

Numerous experiments were made to improve the hatching success through better eggs handlings (Chan et al., 1985); incubation in the styrofoam boxes (Mortimer and Zaid, 1991); splitting egg clutches (Liew et al., 2003; Kamarruddin et al., 2003) and the used of 0.5 cm mesh size netlon fence to protect the predation of ghost crabs (Ahmad and Kamarruddin, 2003).

**Plate 45.** Unfertilized Eggs is One of the Factors Contributing to Low Hatching Success of Leatherback Turtle in Terengganu

## Hatchery Management

### Peninsular Malaysia

In Peninsular Malaysia, hatchery operation as a conservation tool was first proposed by the Malayan Nature Society in 1960 (Wyatt-Smitt, 1960). The first trial on the hatching of leatherback eggs was conducted by Hendrickson and Winterflood (1961) at Rantau Abang, Terengganu in co-operation with the University of Malaya and DOFM. Since then, hatchery operations have been practiced by DOFM in several states mentioned earlier with financial supports mainly from the Federal and State Governments.

From 1961 to 1995 a total of 508,000 leatherback hatchlings from the hatchery at Rantau Abang were released into the sea. A maximum of 44,480 leatherback hatchlings were released in 1976. Effectively

**Plate 46.** Leatherback Hatchlings at Rantau Abang Hatchery in 1990's

in 1988, all leatherback eggs laid in Terengganu had to be collected soon after they were laid and transported to hatcheries for incubation. A few nests were left for *in situ* incubation and for research purposes. Hatchling production from hatcheries in Peninsular Malaysia from 1961-1995 was 1,278,922. The highest number of hatchling was in Terengganu (1,039,544), followed by Pahang (109,614) and Malacca (81,408). From 1998 to 2003 a total of 574,773 turtle eggs were incubated in several hatcheries and *in situ* nest in Terengganu. About 77% emergence success were recorded and 443,633 hatchlings were released into the sea. Green turtle was the highest at 440,762 followed by hawksbills (1888), leatherbacks (606) and olive ridleys (377).

With regard to the increase of the percentage of emergence success and healthy hatchling, SEAFDEC/MFRDMD in collaboration with DOFM and universities' researchers continuously conducted research on various aspects of hatchery management. This included monitoring of sand temperature, identifying the best method of eggs handling, protection from predators, management of sex ratio, etc. The results of the above research activities were presented and published in local and international publications.

## Sabah

Transplanting of eggs to the hatchery has been practiced since 1966 (de Silva, 1979). Two other hatcheries were later established at Gulisaan and Bakkungaan Kecil Islands in 1968. At this moment Sabah Parks still maintain an average percentage of hatches between 62.9-92.2% from the hatcheries located on each island. Collaborative research on maintaining a high quality hatchery management with other local and foreign research institutions is still continuing.

The establishment of the three islands as Game and Bird Sanctuaries in 1972, and later a National Park in 1977, mandated all eggs harvested to be solely used for hatchery purposes. Turtle Islands Park (6°09' - 6°11'N, 118°03' - 118°06'E) located some 40 kilometers to the north of Sandakan town is on the East Coast of Sabah. The islands, namely Selingan (8.1 hectares), Bakkungaan Kecil (8.5 hectares) and Gulisaan (1.6 hectares) including coral reefs and the surrounding water of the islands cover a total of 1,740 hectares. Geographically, these islands are in a group of another 6 islands in the Philippines under the Sulu Sea Turtle Islands chain (Muhamad Saini, 1996). Each island has its own

**Plate 47.** Sea Turtle Hatchery at Ma' Daerah Turtle Sanctuary in Terengganu

hatchery in operational stage. During the period from 1966-1992, a total of 8,352,990 eggs had been transplanted and 5,918,400 hatchlings released into Sabah waters. From 1993 to September 2001, a total of 7,375,523 eggs comprised of 6,934,599 green and 440,924 hawksbill eggs were incubated. A total of 5,254,156 hatchlings were released which comprised 5,013,392 greens and 240,764 hawksbills (Basintal, 2002).

Internationally known as turtle nesting islands, the sandy nesting beach stretch on Selingan is estimated to reach 400-500 meters while Gulisaan is 250-300 meters and Bakkungaan Kecil is about 300-400 meters. The northeast side of Selingaan and Bakkungaan beach is formed from exposed coral reef. Nesting can be observed all year round. Currently, only Selingaan is open for tourism based on turtle-watching activity (Muhamad Saini, 1996).

On each island, rangers and general workers work in shifts (8.00 pm-1.00 am and 1.00 am-6.00 am). They undertake the data collection from adult turtles that lay eggs, tag the nesters, transplant the eggs in the hatchery and release the hatchlings. From 6.00 am -10.00 am, the staff will do maintenance and other general works (Muhammad Saini, 1996).


**Plate 48.** Hatchery at Turtle Islands Park in Sabah

## Sarawak

Presently, there are three hatchling production methods practiced in Sarawak namely: artificial beach hatchery, incubation in styrofoam boxes and *in-situ* incubation. At Pulau Talang-Talang Besar and Pulau Talang-Talang Kechil, hatcheries were set up at the nesting beaches. All clutches between May and September were transferred to and incubated at the hatcheries. The eggs were transferred within an hour after they had been laid. In order to prevent damage by high tide, all eggs in the hatchery were

**Table 4.** Number of Nests, Eggs Collected, Eggs Incubated, Hatching Success and Hatchlings Released in Sarawak: 1970-2003.

| Year | No. of Nests | No. of Eggs Collected | No. of Eggs Incubated | Hatching Success (%) | No. of Hatchlings Released |
|---|---|---|---|---|---|
| 1970 | 2598 | 269151 | 2227 | 69.7 | 1552 |
| 1971 | 1918 | 194289 | 180 | 70.6 | 127 |
| 1972 | 2601 | 265525 | 992 | 53.3 | 529 |
| 1973 | 3155 | 323734 | 8533 | 93.8 | 8004 |
| 1974 | 2043 | 204507 | 1191 | 65.9 | 785 |
| 1975 | 2009 | 203380 | 991 | 85.5 | 847 |
| 1976 | 2945 | 299398 | 13159 | 96 | 12633 |
| 1977 | 1568 | 158790 | 13134 | 89.9 | 11807 |
| 1978 | 2487 | 253518 | 18003 | 82.6 | 14870 |
| 1979 | 2062 | 211472 | 18100 | 91.4 | 16543 |
| 1980 | 1492 | 152599 | 43000 | 52.9 | 22747 |
| 1981 | 2214 | 225927 | 46046 | 52.9 | 24358 |
| 1982 | 2669 | 266740 | 113000 | 67.8 | 76614 |
| 1983 | 2095 | 208743 | 110071 | 75 | 82553 |
| 1984 | 3148 | 309800 | 113148 | 60.7 | 68681 |
| 1985 | 1371 | 138741 | 51634 | 63.1 | 32561 |
| 1986 | 2422 | 241084 | 107009 | 61.7 | 66024 |
| 1987 | 1105 | 107873 | 59520 | 56.4 | 33569 |
| 1988 | 2325 | 228117 | 109000 | 57.9 | 63111 |
| 1989 | 1869 | 185461 | 107237 | 59.8 | 64128 |
| 1990 | 1197 | 117701 | 88869 | 58.9 | 52344 |
| 1991 | 3961 | 384579 | 354519 | 54.2 | 192149 |
| 1992 | 1576 | 148017 | 129462 | 51.9 | 67191 |
| 1993 | 2148 | 219996 | 194772 | 54.3 | 105761 |
| 1994 | 1600 | 150000 | 138548 | 56.4 | 78141 |
| 1995 | 2500 | 250000 | 232327 | 53.5 | 124295 |
| 1996 | 1488 | 142872 | 127940 | 57.7 | 73821 |
| 1997 | 2892 | 276192 | 259736 | 55.3 | 143634 |
| 1998 | 1898 | 183963 | 171907 | 60.02 | 103179 |
| 1999 | 2901 | 289298 | 289298 | 51.9 | 150146 |
| 2000 | 1771 | 175078 | 175078 | 57.59 | 100827 |
| 2001 | 3643 | 326543 | 326543 | 86.04 | 280958 |
| 2002 | 2390 | 219582 | 218982 | 78.14 | 171112 |
| 2003 | 1616 | 149279 | 148679 | 77.09 | 114617 |
| **Total** | **75677** | **7481949** | **3792835** | **Average=66.5%** | **2360218** |

transferred to styrofoam boxes by the end of September every year. All clutches from early October till end of April in the following year were also incubated directly in styrofoam boxes. Sand in the hatchery was excavated and turned over in April every year to keep the hatchery clean from any kind of material such as wood, rotten roots etc. The location was also changed every two years to prevent the eggs from disease infection by fungus and bacteria.

**Plate 49.** Hatchery at Sarawak Turtle Islands

At Pulau Satang Besar, all nests were left *in situ*. Clutches below the level of tidal inundation were relocated to higher places at the nesting beach. All clutches from early October till end of March were incubated in styrofoam boxes.

All nests at Tanjung Datu National Parks were incubated in fenced artificial beach hatchery, due to significant numbers of residential natural predators such as wild boars and monitor lizards. The hatchery at Tanjung Datu National Park was set up above the tidal water mark. Sand in the hatchery was turned over every year and replaced with fresh sand from the beach every three years.

The Sarawak Museum has been recording the annual green turtle landings on each of the Turtle Islands (Talang-Talang Besar Island, Talang-Talang Kechil Island and Satang Besar Island) since 1946. Turtle conservation in Sarawak began in late 1949 (Leh, 1989). In 1951 a total of 21,363 eggs were transferred to unshaded natural beach hatchery (Harrison, 1955). During Hendrickson's term as Curator of Sarawak Museum, turtle hatcheries were established on Turtle Islands (de Silva, 1979). A total of 243,727 eggs were transplanted and 169,329 hatchlings were released during this period.

Data analysis from 1970-1995 showed that a total of 59,078 nests of green turtle were recorded with 5,719,412 eggs collected. Out of this, 2,074,672 eggs were incubated in hatcheries. A total of 1,224,747 hatchlings emerged and were released into the sea. An average number per clutch was 96 eggs with an average emergence success of 77%.

The cyclical pattern of adult green turtle returns during the last 26 years (1970 to 1995) fluctuated with an average of 2,000 clutches per year. From 1991 to 2003, as much as 90-100 % of the eggs laid were incubated in hatcheries as shown in Table 4.

There were less than ten hawksbills and olive ridleys nestings per year at the Sarawak Turtle Islands. This turtle mainly nests from January to February during the monsoon season. All the eggs of hawksbills and olive ridleys were left to hatch *in situ*.

## Tagging and Satellite Telemetry Tracking Activities

The earliest tagging program in Malaysia was reported in 1953 on the green turtle's population of Sarawak (Harrison, 1956). In Sabah, tagging programs began in 1970 (de Silva, 1986).

Tagging studies of leatherback turtles in Terengganu during 1968-1976 resulted in many long-distance tag recoveries. Tags returned from Hawaii, Japan, Taiwan and Indonesia showed that turtles nesting on

Malaysian beaches dispersed to feeding areas throughout Indo-Pacific waters (Leong and Siow, 1980 and Kamaruddin et al., 1996). Tagging activities also provide information on remigration. Remigration refers to the return of an adult sea turtle to its rookery for an additional nesting season. A female does not normally breed in consecutive years. The real interval between nesting season for leatherbacks in Malaysia would be greater than 2 years. These values have not been corrected for tag loss (Limpus, 1993). From these tagging programs, it was shown that the leatherback turtle might nest from 1-8 times (average 3.3 times per season) with the inter-nesting interval being an average of 13.4 days. Meanwhile, green turtles may nest up to 10 times, with most of them nesting 3-6 times. The nesting intervals range from 9 - 12 days.

## Tagging Activities in Peninsular Malaysia

Tagging activity was started in Peninsular Malaysia in 1966 when 11,500 leatherback hatchlings were "tagged" at Rantau Abang. In 1967, 100 hatchlings of leatherback turtle from Rantau Abang hatchery had been tagged (marked) by multiple tagging (Balasingam, 1967). A ten-year tagging program on nesting leatherbacks in Terengganu was initiated during this time and resumed in 1990 by using titanium tags and extended to other species in 1993. For the leatherback turtles, titanium tags were applied on both hind flippers while the use of plastic and monel tags on the front flippers was previously practiced. Tagging of greens, hawksbills and olive ridleys were initiated in 1993 at Mak Kepit (Redang Island) and Chendor, whereas at Geliga it was started in1994.

Application of tags was made on both front flippers using either titanium or inconel tags. However, since 1998, all tagging activities conducted by DOFM and MFRDMD have used only inconel tags. Tagging activities in the West Coast of Peninsular Malaysia were started at Segari beach in 1996. From 1993-2000, a total of 391 green turtles had been tagged at Mak Kepit and 417 at Chendor. Tagging activities in Segari has been unsuccessful since the rookery is located in a remote area. A total of 721 sea turtles had been tagged by SEAFDEC/MFRDMD and DOFM in Peninsular Malaysia from 1990-1995 which included 124 leatherbacks, 592 greens, 2 hawksbills, 3 olive ridleys (Kamarruddin et al., 1996). These figures do not include tagging activities conducted by universities at several locations in Peninsular Malaysia, especially at Cagar Hutang, Redang Island. A few hundred turtles, mostly

**Plate 50.** Satellite Telemetry Tracking of Leatherback Turtle During Nesting Season at Rantau Abang in 1990's.

**Plate 51.** Application of PIT Tag on a Nesting Green Turtle at Mak Kepit Beach in Terengganu

greens, were tagged from 1994 - 2003. In Terengganu itself, a total of 49 turtles were tagged in 2003 which included one leatherback, 47 greens and one hawksbill.

Flippers tagging is a conventional method but it is widely used by turtle ecologists. The new type of tag, i.e. the Passive Integrated Transponder (PIT) tag or microchip tag is becoming popular and many scientists now are using this tag to supplement flipper tags. The PIT tag was introduced in Malaysia in 2003 as an experiment by SEAFDEC/MFRDMD at Mak Kepit and Ma' Daerah. A total of 23 greens were tagged with PIT during the 2003 nesting season.

Turtles migrate long distance during their lives. Turtles which are nesting on Malaysian beaches may travel to the Philippines for feeding with the hatchlings drifting for a few years in the South China Sea or Pacific Ocean. Subsequently, in 1990 the DOFM attempted to use satellite telemetry tracking to study the migration routes of leatherback but it was not fully successful. Then, in 1992, one leatherback was tracked for 9 days moving a distance of 153 nautical miles from Rantau Abang to the northeast at an average speed of 0.7 knots with a range of 0.5-1.1 knots (Kamaruddin et al., 1996). Liew et al., (1995) successfully determined the post-nesting migration routes of five greens using satellite tracking systems. The turtles were found to migrate immediately after the final nesting of the year and swam across the ocean to their natural foraging area. The most recent was in July 2003 when two satellite transmitters were attached on to adult greens at Ma' Daerah, to determine their offshore habitat. Unfortunately, due to technical failure of the transmitter, the result of the tracking activities were not successfully recorded.

## Tagging Activities in Sabah and Sarawak

The turtle tagging program started in 1977 in Sabah. A monel tag was used to obtain the migration pattern. The tag bears a return address and a reward of US$5.00 to be awarded on information of tag recoveries (de Silva, 1982). In October 1998, SEAFDEC/MFRDMD provided 1000 inconel

tags to Sabah Parks with the codes started from MY(S) 0001 to MY(S) 1000. A tagging program was carried out at Selingaan Island. These inconel tags were applied to nesting sea turtles from 8 July to 4 September 1999. A total of 494 greens were double tagged, with each tag applied through the first large axillary scale on the trailing edge of both front flippers. A total of 217 greens or 43.9% returned to nest after being tagged (Basintal, 2000). The tagging activities are being continued in the Turtle Islands Park. A total of 42,907 turtles of all species had been tagged until 1995. A total of 22 foreign tags were recovered between 1994-1995, which were all from the Philippines. These significantly show that the turtles population in the Sulu Sea is a shared population between Malaysia and Philippines (Muhamad Saini, 1996).

**Plate 52.** Fitting of PTT on the Carapace of a Green Turtle for Internesting Tracking by Satellite at Ma' Daerah Turtle Sanctuary in 2003

The tagging program in Sarawak was first reported in 1953 on the green's population. Most sea turtles were tagged during their nesting at the Sarawak Turtle Islands (Harrison, 1956). In 1987, the Sarawak Museum conducted a tagging program using monel tags. However, this program was terminated due to unsuitable material and insignificant number of tags recovered.

Sarawak Forest Department started tagging activities using inconel tags at Pulau Talang-Talang Kecil in 1996. Tagging activities in 1997 and 1998 were conducted only during the peak season,

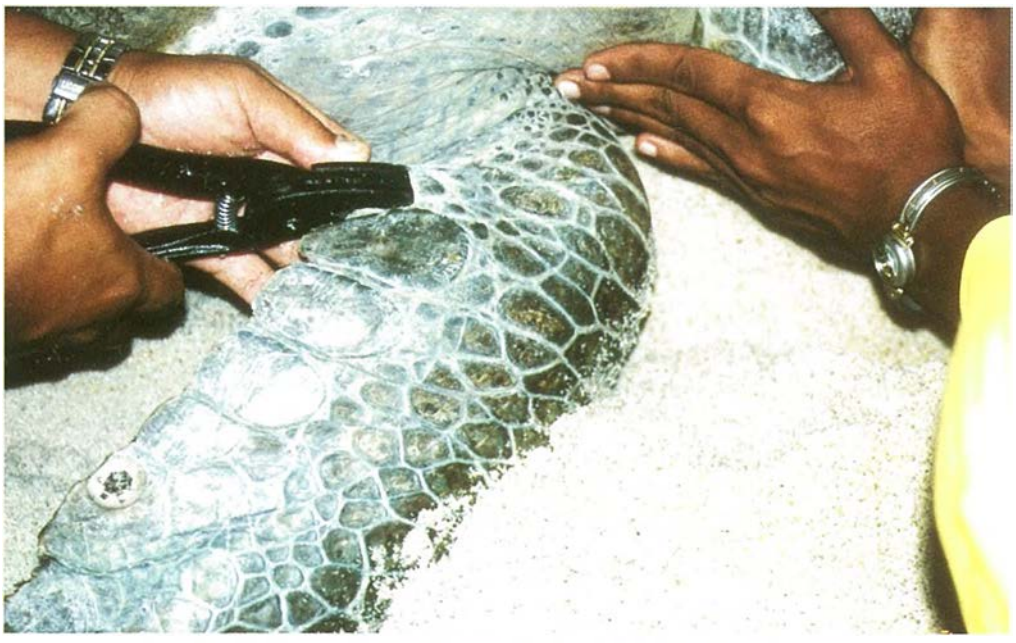


**Plate 53.** Tagging of Nesting Green Turtle in Turtle Islands Park, Sabah

mostly at Pulau Talang-Talang Besar and Pulau Talang-Talang Kecil. In 1999, a whole-year-round tagging program was conducted in the Sarawak Turtle Islands by the Sarawak Forest Department. Double tags on nested turtles were applied. However, tagging programs at the mainland were never conducted due to low number of nesting individuals in a very wide area. In 1999, tagging activities were conducted at Pulau Satang Besar using 500 inconel tags provided by SEAFDEC/MFRDMD.

## Satellite Telemetry Tracking

A satellite telemetry tracking project entitled "A Conservation Study of the Ecology of Marine Turtles in Sarawak" was conducted using IRPA national fund. A total of 11 mature female green turtles and a hawksbill (4 green turtles from Pulau Talang-Talang Besar), (4 green turtles from Pulau Talang-Talang Kechil) and (3 green turtles and a hawksbill from Pulau Satang Besar) were fitted with Platform Transmitter Terminals (PTTs) from 1999 to 2002. The result of this study is explained under the subtitle "Feeding Grounds and Migration".

## Radio Ultrasonic Tracking

In 1999, eight mature green turtles (4 from Pulau Talang-Talang Kechil and 4 from Pulau Talang-Talang Besar) were fitted with radio ultrasonic transmitters to study the internesting movement around these two islands. In the year 2000, another 4 mature green turtles were also fitted with the same equipment at Pulau Satang Besar. The result showed that all turtles swam close to the shore after after completing the laying of their eggs. They spent most of their internesting period (1-8 days) by swimming 0.4 – 2 nautical miles along the shores at an average depth of 4 meters.

Another study of the internesting movement of green turtles from Pulau Talang-Talang Besar, Pulau Talang-Talang Kechil and Pulau Satang Besar were conducted in 2003. Three mature green turtles from each of the islands were fitted with radio and ultrasonic telemetry equipment.

# Habitat Conservation/Protected Areas

## Establishment of Turtle Sanctuaries

A total protection to nesting turtles, their nests and habitat could be achieved with the establishment of sanctuaries. Turtle sanctuaries have been established in Malaysia such as Rantau Abang Turtle Sanctuary in Terengganu, the Turtle Island Parks in Sabah and the Turtle Island in Sarawak. The establishment of Malaysian Marine Parks is also protecting the flora and fauna in the areas, including the sea turtles (Sukarno, 1999).

Most recently, the Ma' Daerah Turtle Sanctuary in Paka, Terengganu was established in 1999 through a collaboration between DOFM, WWF-Malaysia and BP PETRONAS Acetyls which forged a new era in turtle conservation in Malaysia. Under this new concept of conservation, the public are invited to fund, to manage and to draw up management plans and awareness programs.

Pantai Acheh in Penang was gazetted as a National Park in 1996. The green turtle nesting beach is located within this area. Another important nesting rookery in the country, which could be considered for sanctuary establishment, is Pulau Upeh in Melaka (Kamarruddin, 1993 and Kamarrudin et al., 1996).

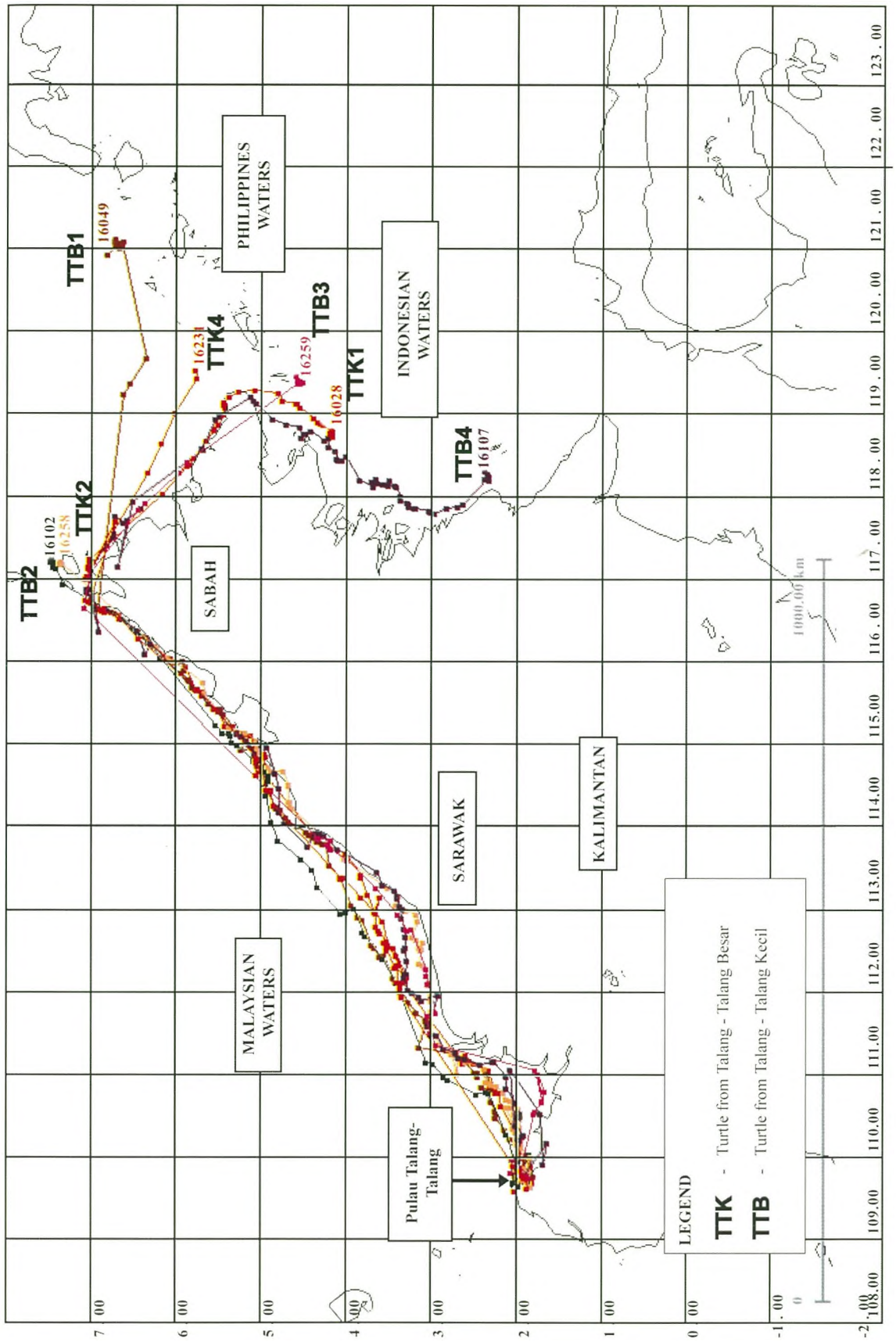



**Figure 12.** Migratory Pathway of 8 Green Turtles Released from Pulau Talang-Talang Besar and Pulau Talang-Talang Kecil from 1999-2002.

Sarawak Turtle Islands is the largest nesting concentration of sea turtles in Sarawak. These areas have been designated as Turtle Sanctuaries since 1957, under the Turtles Trust Ordinance 1957.

Under the Fisheries (Prohibited Areas) Regulations 1994, the maritime waters within two nautical miles of the outermost points of all islands in Malaysia (measured from the low water mark) are Fisheries Prohibited Areas under section 61 of the Fisheries Act 1985. All forms of fishing and collecting are banned: This is applicable for Pulau Talang-Talang Besar, Pulau Talang-Talang Kechi, Pulau Satang Kechil and Pulau Satang Besar.

The Sarawak State Government has taken another tremendous step forwards in its turtle conservation effort by gazetting the Sarawak Turtle Islands as Talang-Satang National Park in September 1999. Water bodies within 4.8 km radius of the highest point of each of the islands are declared as totally protected areas. That means both nesting beaches and internesting habitats are protected.

Beside Talang-Satang National Park, other turtle's habitat protected include Tanjung Datu National Park. In certain Totally Protected Areas (TPAs), extensions were made towards sea areas to protect marine life habitat. Three nautical miles of sea area off the coast of Similajau National Park were extended to protect turtle-nesting habitat. At Samunsam Wildlife Sanctuary, extension was proposed to protect nesting habitat for painted terrapins. To enhance protection of turtles from illegal fishing trawler activities, reef balls (artificial reefs) have been deployed in turtle-internesting habitat.

**Plate 54.** Ma' Daerah Turtle Sanctuary Established in 1999 through a Collaboration between Government, Private Sector and NGOs

## Feeding Grounds and Migration

In Peninsular Malaysia, little is known about the migratory habit of sea turtles and its association with feeding grounds. However, tagging studies on adult leatherback turtles conducted by the DOFM in the period 1967-1979 gave some information on possible routes of migration of these marine animals in the South China Sea (Leong and Siow, 1980). Based on reported recoveries of tagged turtles, mostly from the Philippines as well as from Hawaii, Taiwan, Japan and Indonesia, the waters of these countries have been predicted as the potential feeding grounds of the leatherbacks which nest in Rantau Abang, Terengganu. The post-nesting migration of leatherbacks has been postulated as following the northbound surface current.

Tagging programs of adult leatherbacks in Terengganu were reinstated in 1990 by the Marine Turtle Research Unit (MTRU) of SEAFDEC/MFRDMD using titanium tags. A preliminary study attempted in 1992 by SEAFDEC/MFRDMD on the tracking of leatherbacks using satellite-based telemetry supported this northward pattern of movement of these animals. In addition, the locations and speeds of the migrating animals were also known.

The satellite telemetry studies conducted in 1993 and 1994 on five adult female greens at Redang Island revealed that the green turtles are highly migratory animals (Liew et al., 1995). They did not remain within their final nesting area, but migrated for a long distance across international boundaries. Each turtle was finally tracked around the Southwest Coast of Sabah, Bugsuk Island of the Philippines, Bangka, Tambelan and Natuna Islands of Indonesia. The findings from this study indicated that some population of green turtles were shared among the countries bordering the South China Sea. It was proven that the nesting green turtles of Redang Island were feeding in certain areas in the waters of neighbouring countries.

Specific feeding grounds associated with adult sea turtles in the waters of Peninsular Malaysia are previously unknown. However, recent reports documented by the MTRU of SEAFDEC/MFRDMD provided some indication of the potential location of these feeding grounds. The first report relating to this matter actually came from some fishermen of Segari in October 1992. These fishermen, while operating on fishing traps and hand lines, reported to have frequently observed some juvenile and adult turtles, most probably green, feeding on the marine mosses and plants in the vicinity of Pulau Perak, an island located around 35 nautical miles west of Tanjung Dawai, Kedah (Kamarruddin et al., 1996).

Information on a female green turtle marked in Sarawak Turtle Islands found 800 km away in North Borneo is the only information known related to turtle migration of Sarawak before 1999 (Harrisson, 1960).

Results from satellite tracking study on 11 green turtles and a hawksbill from Sarawak Turtle Islands between 1999 to 2001 shows that all these turtles travelled long distances between feeding and nesting grounds. Their entire track took the same route: north-east from Sarawak Turtle Islands along the Sarawak coast to the northern tip of Borneo, then radiating out to various destinations in Sabah, Philippines and Indonesia. The green turtles nesting at Sarawak Turtles Islands migrated across international boundaries into waters within South East Asian countries. This study has shown that the breeding population of green turtles in Sarawak Turtle Islands, Malaysia, were recruited from feeding grounds within territorial waters of different nations bordering the South China Sea, Sulu Sea and Celebes Sea (Bali et.al. 2000).

Data analysed from migration routes of these turtles found that significant numbers of days were spent at Brunei waters and Lawas areas (of northern Sarawak) before continuing their journey to feeding grounds. Research conducted by the Sarawak Forest Department researchers in 2002 confirm that quite large area of sea grass beds are at Lawas area. At least nine species of sea grasses were confirmed in that area and a number of green turtles were observed during the study. A number of hawksbill turtles were also observed feeding at the nearby coral reefs area. In 2003, a juvenile green turtle was seen at that area. In 2003, a turtle tagged at Pulau Talang-Talang Besar in 2001 was found dead at Tawi-Tawi, Philippines.

## Enforcement

The Fisheries Act 1985 prohibits the catch of sea turtles by any type of fishing methods. The enforcement of existing legislation within 2 nautical miles from marine parks will provide protection to nesting turtles in that area. The nation-wide ban on the use of drift nets with mesh sizes exceeding 25.4 cm in 1989 has provided a partial protection. In 1989, the Rantau Abang Turtle Sanctuary waters had been gazetted as Fishing Prohibition areas to protect mainly leatherbacks especially during their inter-nesting period.

Collaboration work amongst governmental agencies in enforcement of relevant laws in conservation of turtles are excellent in Sarawak. Sea-patrolling is coordinated by the Sarawak Forest Department, the Department of Marine Fisheries Department Sarawak and the Marine Police through the Enforcement Committee in the Sarawak Reef Ball Working Group. The Sarawak Forest Department also gets full support from other governmental and non-governmental agencies and publics on enforcing the Wildlife Protection Ordinance, 1998 (amended 2003). When most of Sarawak Forest Department functions were taken over by the Sarawak Forestry Corporation Sdn. Bhd. in 2003, coordination and collaborative with other agencies in enforcement and protection of turtles were taken over by Sarawak Forestry Corporation Sdn. Bhd.

## Education/Public Awareness

Public interpretation is an important component in sea turtle conservation efforts. Various organizations, including agencies from state and federal authorities, universities and NGOs have made contributions towards this matter. Educational kits such as Marine Educational Kits that included environmental protection and conservation were developed and extended to various stakeholders. In order to build up public awareness as well as for tourist attraction, the DOFM had officially opened the first Turtle Information Center (TIC) in Rantau Abang in 1985, followed by Melaka (1989), Perak (1995) and Pahang in 1998. The most recent was the establishment of the Turtle and Marine Ecosystem Centre (TUMEC) in 2000 at Rantau Abang for broader objectives.

The on-going activities that are undertaken by the DOFM together with governmental agencies, NGOs and private sector in public awareness on the conservation of sea turtles are mainly through weekend camping. These activities include dialogues, talks, slide/video shows on sea turtle issues and other marine environmental aspects. Educational materials including CD/videos, pamphlets, brochures and posters are produced and distributed. The Ministry of Education Malaysia has also taken steps to incorporate an environmental education syllabus which included sea turtle conservation in primary and secondary schools.

In 1993, Adopt-A-Nest and Adopt-A-Turtle Programs were initiated by Universiti Putra Malaysia at the Pulau Redang rookery. Through these programs, it is possible for members of the public to sponsor the egg nests/clutches for hatchery project.

Another activity for educational purposes is the volunteer program which is offered to members of the public. The volunteers will spend a few days, especially during the weekend, at the sanctuary to assist the officials in tagging, hatchery works as well as cleaning the beaches. Most of the project activities are widely-promoted in the local press and media in order to gain publicity from the local and international society.

**Plate 55.** Education Activity Related to Conservation of Sea Turtles in Malaysia

There are a number of governmental agencies that have made contributions on the conservation and education on sea turtles in Sarawak. Non-Governmental Organizations, private sector and the public are also working closely with relevant government agencies to conserve and enhance the sea turtles.

For the past several years, the Sarawak Forest Department has a collaboration work with the Department of Marine Fisheries Sarawak on the preparation of Marine Education Kits. Sea Turtle Volunteer Program at Pulau Talang-Talang Besar and Pulau Talang-Talang Kecil was organized jointly by the Sarawak Forest Department and the Malaysian Nature Society, Kuching Branch from 1999 to 2003. The Sarawak Forest Department has been working closely with the Ministry of Education, Sarawak on an environmental education syllabus which included sea turtle conservation in primary and secondary schools. In 2000, Petroleum National Berhad (PETRONAS) had contributed RM50,000 (US$13,072) for purchasing 100 units of reef balls. These reef balls were deployed at internesting habitats of sea turtles around Pulau Satang Besar and Pulau Satang Kecil. Protekon Sdn. Bhd. also sponsored 1,000 turtle brochures in 1999. Activities such as dialogues, talks, slide/video shows on sea turtle issues and other marine environmental aspects were organized to public and private sectors. Education materials including CD/videos, pamphlets, brochures and posters were produced and distributed.

Under the new organization (Sarawak Forestry Corporation Sdn. Bhd.), conservation education materials and activities will be enhanced. More public participation will be involved in turtle conservation and enhancement in the future.

International volunteers are also actively involved in the research, conservation and enhancement activities in Peninsular Malaysia especially in the States of Terengganu and Pahang. This program is jointly organised by DOFM and EARTHWATCH since year 2000.

# Research Activities

Due to its serious decline of population in the world, the sea turtles researchers of Department of Fisheries Malaysia (DOFM) have taken the challenge to initiate a project on nursing of leatherback hatchlings since 9 September 1990.The objective of the preliminary trial was to understand the various factors affecting the survival and growth of leatherback hatchlings in captivity. One surviving juvenile (out 20 hatchlings) reach an age of 8 years, 5 month and 20 days before it died on 2 March 1999 due to digestive system complications. This world record was an improvement from previous achievements reported by Hendrickson and Winterflood (1961),120 days; Whitham (1988), 642 days and Deraniyagala (1963), 661 days.

Research activities on sea turtles in Malaysia started during the colonial era. During that era, European scientists mostly from England actively involved in conducting scientific expedition to gather information on the flora and fauna of Malaysia (or Malaya). Almost all publications regarding the flora and fauna recorded in Peninsular Malaysia, Sabah and Sarawak were published in the journals mostly by Raffles Museum in Singapore. After becoming independent in 1957, these activities were continued by local researchers in collaboration with the former foreign scientists. Sea turtles were one of the resources for their study and many publications were made and published in various journals.

At present, hundreds of scientific papers on various aspects of sea turtles in Malaysia are published, locally and internationally. All papers were the outcome of scientific research or management practices by researchers and managers from DOFM, universities, NGOs, local government agencies and others. Publications are also made by invited consultants and researchers from foreign countries in the collaboration with local researchers from various government agencies and universities.

The main government department of Malaysia which is actively involved in sea turtles research and enhancement activities is DOFM in collaboration with SEAFDEC/MFRDMD. The activities cover various aspects of turtles, including biology, ecology as well as management. Other institutions, such

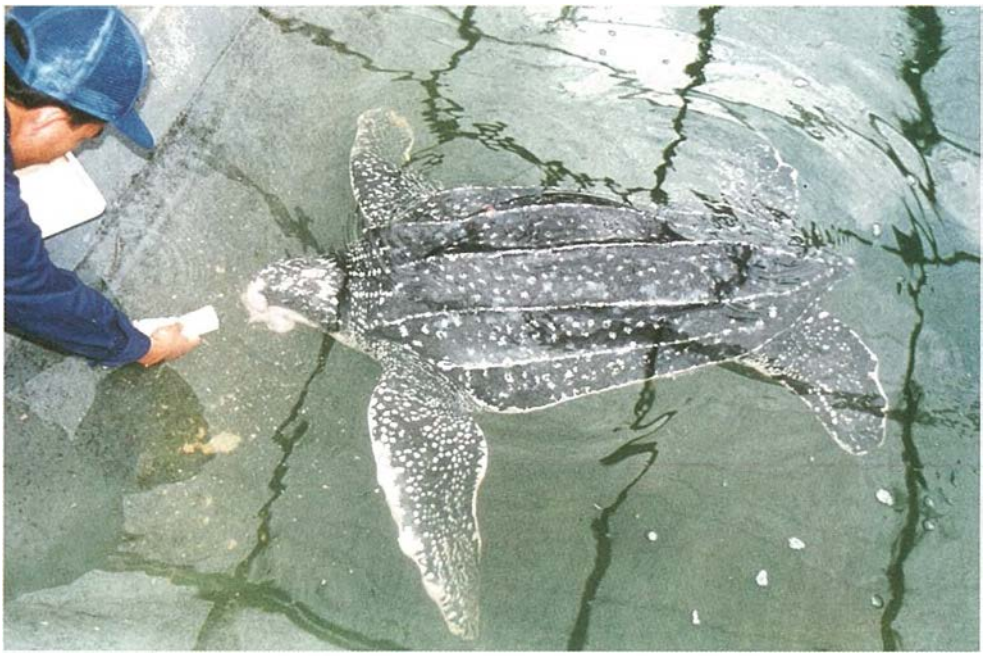


**Plate 56.** Juvenile Leatherback Turtle in Captivity

as universities, mostly focus their research activity on academic issues rather than management issues. Scientific information gathered from universities research activities is shared with DOFM for management purposes. The main sources of funding for conducting research on sea turtles in Malaysia are IRPA, SEAFDEC, DOFM, petroleum companies, commercial banks and NGOs, especially WWF-Malaysia. Research activities conducted by Sabah Parks and Turtle Island of Sarawak are funded mainly by their respective State Government.

The IRPA-funded project in 1998-2002 entitled "A Conservation Study of the Ecology of Marine Turtles in Sarawak" which amounted to RM1,359,912 (US$355,533) has enabled the Sarawak Forest Department to purchase "state of the art" equipment, as well as supplies and basic field equipment. It has also enabled the employment of full time labourers as well as sponsor postgraduate research on sea turtles in Sarawak (Bali et. al. 2001).

This project has enabled the various agencies to cooperate on research programs for the Sarawak Turtle Islands. The "Talang- Satang Turtle Research Working Group" was formed in June 1998 consisting of Sarawak Turtles Board (Chairman), Sarawak Museum, Sarawak Forest Department, and the Marine Fisheries Department, Sarawak (Bali et. al. 2001).

This working group meets and reviews research on the Turtle Islands from time to time. They also provided management advice where necessary to the Turtles Board for consideration. In addition, the working group was able to monitor enforcement of the various rules and regulations for sea turtles at the Turtle Islands. This was due to the fact that most of its members are actively in the field conducting research and were able to be the "eyes and ears" of enforcement. This has coordinated enforcement and has had the benefit of stopping transgressors who previously flouted the laws and, in doing so, disturbed the turtles (Bali et. al. 2001). Currently, Sarawak Forestry Corporation Sdn. Bhd. is the key agency that is actively involved on sea turtle research and enhancement in Sarawak.

The key researchers and officers who were actively involved in the past and in the present on sea turtle research and enhancement in Malaysia are as follows:

**Department of Fisheries Malaysia**

1. Mr. Ibrahim bin Salleh,
   Department of Fisheries Malaysia,
   Tingkat 8 & 9, Wisma Tani,
   Jalan Sultan Salahudin,
   50628 Kuala Lumpur, Malaysia.
   Tel: 603 26175551 (O), 603 26987171 (Direct Line)
   Fax: 603 26910305
   E-mail: tkpp01@dof.moa.my

2. Mr. Kamarruddin bin Ibrahim,
   Turtle and Marine Ecosystem Centre (TUMEC),
   Department of Fisheries Malaysia,
   Rantau Abang,
   23000 Dungun, Terengganu, Malaysia.
   Tel: 609 8458169
   Fax: 609 8458017
   E-mail: kdinn@eudoramail.com

3. Mr. Sukarno bin Wagiman,
Department of Fisheries Malaysia,
Tingkat 8 & 9, Wisma Tani,
Jalan Sultan Salahudin,
50628 Kuala Lumpur, Malaysia.
Tel: 603 26175551
Fax: 603 26910305
E-mail: sukarnow@hotmail.com

4. Mr. Abdul Rahman Kassim,
Department of Fisheries Terengganu,
Taman Perikanan Chendering,
21080 Kuala Terengganu,
Terengganu, Malaysia.
Tel: 609 6173353
Fax: 609 6173351
E-mail: arahman76762003@yahoo.com

**Marine Fishery Resources Development and Management Department (MFRDMD)**
**Southeast Asian Fishery Development Center (SEAFDEC)**

1. Mr. Raja Mohammad Noordin bin Raja Omar,
Taman Perikanan Chendering,
21080 Kuala Terengganu,
Terengganu, Malaysia.
Tel: 609 6163150 (O), 609 616351 (Direct line)
Fax: 609 6175136, 6174042
E-mail: rnoordin@mfrdmd.org.my

2. Mr. Ahmad bin Ali,
Taman Perikanan Chendering,
21080 Kuala Terengganu,
Terengganu, Malaysia.
Tel: 609 6163150 (O), 609 616174 (Direct line)
Fax: 609 6175136, 6174042
E-mail: aaseafdec@mfrdmd.org.my

3. Mr. Syed Abdullah bin Sayed Abdul Kadir,
Taman Perikanan Chendering,
21080 Kuala Terengganu,
Terengganu, Malaysia.
Tel: 609 6163150 (O), 609 616183 (Direct line)
Fax: 609 6175136, 6174042
E-mail: sabdullah@mfrdmd.org.my

4. Mr. Zulkifli bin Talib,
Taman Perikanan Chendering,
21080 Kuala Terengganu,
Terengganu, Malaysia.
Tel: 609 6163150 (O), 609 616173 (Direct line)
Fax: 609 6175136, 6174042
E-mail: zulkifli@mfrdmd.org.my

5. Mr. Ku Kassim bin Ku Yaacob,
Taman Perikanan Chendering,
21080 Kuala Terengganu,
Terengganu, Malaysia.
Tel: 609 6163150 (O), 609 616175 (Direct line)
Fax: 609 6175136, 6174042
E-mail: kukassim@mfrdmd.org.my

**University College of Science and Technology (KUSTEM),**

1. Assoc. Prof. Liew Hock Chark,
Mengabang Telipot,
21030 Kuala Terengganu, Malaysia.
Tel: 609 6683251
Fax: 609 6694660
E-mail: hcliew@kustem.edu.my

2. Prof. Dr. Chan Eng Heng,
Mengabang Telipot,
21030 Kuala Terengganu, Malaysia.
Tel: 609 6683251
Fax: 609 6694660
E-mail: ehchan@kustem.edu.my

**Universiti Kebangsaan Malaysia**

Dr. Yosni bin Bakar,
Faculty of Science and Technology,
Universiti Kebangsaan Malaysia,
43 600 Bangi,
Selangor, Malaysia.
Tel: 603 89215218
Fax: 603 89353357
E-mail: yosni@pkrisc.cc.ukm.my

**Sabah Parks**

1. Mr. Paul Basintal,
   P.O. Box 10626,
   88806 Kota Kinabalu,
   Sabah, Malaysia.
   Tel: 6088 211881
   Fax: 6088 221001
   E-mail: sparkshq@tm.net.my

2. Mr. Irwan Isnain,
   Turtle Islands Park,
   P.O. Box 768,
   90708 Sandakan,
   Sabah, Malaysia.
   Tel: 6089 273455
   Fax: 6089 274718
   E-mail: ewan90@lycos.com

**Sarawak Forestry Corporation Sdn. Bhd.**

Mr. James Bali,
Biodiversity Conservation Department,
Protected Areas and Biodiversity Conservation Unit,
Sarawak Forestry Corporation Sdn. Bhd.,
Level 12, Office Tower, Hock Lee Centre,
Jalan Datuk Abang Abdul Rahim,
93450 Kuching,
Sarawak, Malaysia.
Tel: 6082-348001
Fax: 6082- 488654
Toll Free Line: 1-800-88-2526
Website: www.sarawakforestry.com
E-mail: jamesbali@sarawakforestry.com

**Cho Hla Aung and**
**Maung Maung Lwin**


# MYANMAR

## Introduction

Myanmar is situated in the easternmost Indochina Peninsula. It boasts of richly-varied marine resources along extensive coastal shores which can be divided into three regions, namely Rakhine, Ayeyarwaddy and Gulf of Mottama (the Delta Zone) and the Taninthayi. The Myanmar coastline is approximately 2,831 km long. Regions are bounded by territorial sea and the Exclusive Economic Zone (EEZ). The territorial sea of Myanmar extends 12 nautical miles from the base line towards the sea and the EEZ covers all areas of territorial sea and extends 200 nautical miles from the base line seawards (Lwin, 2004).

Sea turtles are one of the most valuable and rare marine animals inhabiting in the Myanmar marine environment. Nesting of turtles is observed around Andaman Sea in Mon State and Taninthayi Division, Gulf of Mattaban in Ayeyarwaddy and Bay of Bengal in Rakhine State.

Since 1963, the Department of Fisheries (DOF) has taken up a project to incubate and protect sea turtles on Diamond Island in Ngaputaw Township, Ayeyarwaddy. Then, in 1986-87, the program was fully revived and more departmental hatcheries were established with skillful technicians (Lwin , 2004).


**Plate 57.** Thameehla Island Nesting Beach

Although Myanmar started sea turtle conservation in 1986 the momentum of the activity was not accelerated till Myanmar became a member of SEAFDEC in 1999. As a member, Myanmar was able to participate in training related to conservation and enhancement of turtles organised by SEAFDEC/MFRDMD.

The Myanmar coastal areas harbour five species of sea turtles nesting regularly. They are olive ridley (*Leik Hlaung*), loggerhead (*Leik Khway*), green (*Pyin Tha Leik*), hawksbill (*Leik Kyet Tu Yway*), and leatherback (*Leik Zaung Lyar*). The hawksbill and leatherback, which were reported by fishermen from


**Plate 58.** Kadongalay Kyun Nesting Beach

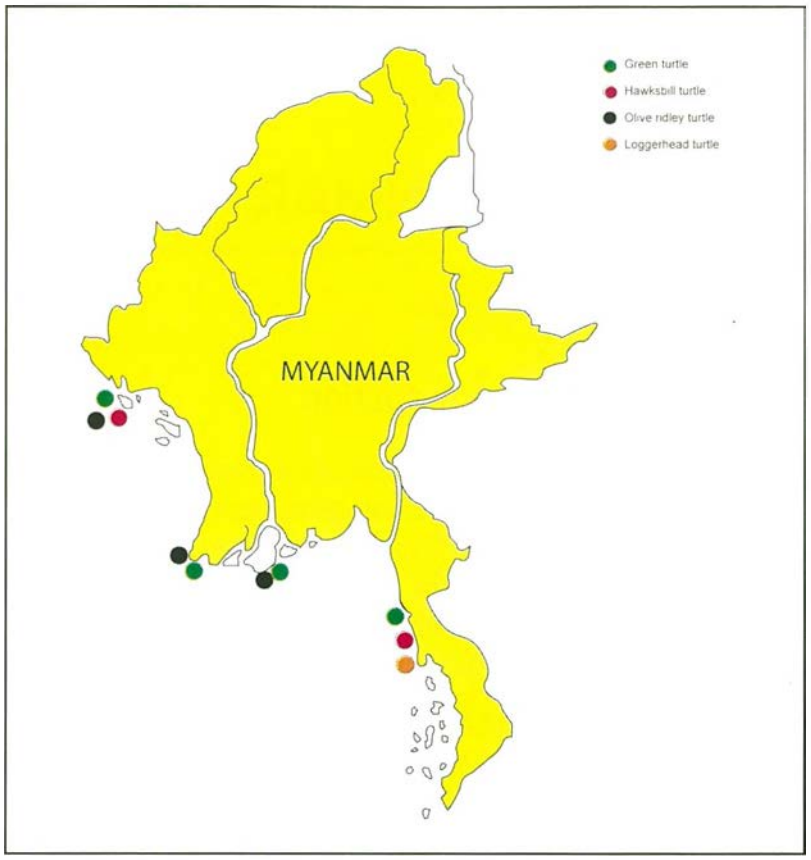



**Figure 13.** Distribution of Sea Turtle Nesting Beaches in Myanmar

some part of Rakhine and Taninthayi coastal areas, are totally absent in the Ayeyarwaddy Delta Coastal areas. These two species were evidently abundant in the past. The beaches of Thameehla Island, an island at the mouth of the Pathein River, is a nesting ground of green and olive ridley turtle. Meanwhile, Kaing Thaung Kyun and Kadongalay Kyun, the two small islands, which are situated at the mouths of Ayeyarwaddy and Bogalay Rivers, are the nesting ground of olive ridley (Lwin, 2004).

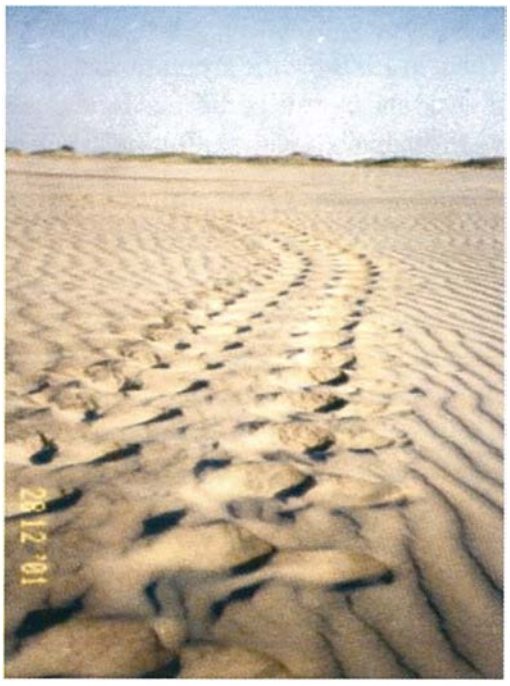


**Plate 59.** Gayetgyi Kyun Nesting Beach

In 1911, a research was extensively conducted on the "turtle banks" of coastal areas in Myanmar, as part of a review for the Burmese Fisheries Act of 1902. In 1897-98, it was learnt that 1.6 million green turtle eggs were harvested annually during that period. Based on this egg harvest and several assumptions regarding female fecundity, it was estimated that adult female green and loggerhead turtles were 5,000 and 3,750 respectively. In 1931, annual harvest of olive ridley eggs in the Ayeyarwaddy Division was estimated about 1.5 million. According to the data from the DOF, the total number of nests in the Ayeyarwaddy Division are currently about 300 olive ridley and 400 green turtles annually, indicating a drastic reduction in regional turtle population during this century.

# Sea Turtles Conservation and Enhancement

## Legislations and Regulations

Sea turtles conservation started in Myanmar under the Burma Fisheries Act (III-1905). Protection for the nesting beaches and sea turtles is included. The trespassing on those areas without official consent was prohibited. In 1924, the Government of Burma, Agriculture (Forest Department) Notification No.1 made an official announcement that no trespassing within 3 miles radius from the turtle nesting beach.

In 1989, the Government promulgated four fishing laws. The law mentioned that no person should engage in harassing, catching, killing, storing, transporting, processing, and transferring sea turtles. Other laws related to the protection of sea turtles are:

- Ministry of Livestock and Fisheries promulgated the notification regarding conservation of sea turtles (1986).
- DOF law relating to the Fishing Rights of Foreign Fishing Vessels; Section 32 b, 32 c, Section 36 (1989).
- Myanmar Marine Fisheries Law; Section 39, 40 (1990).
- Department of Fisheries declared the Notification No. II/ 93 for "Turtles and Tortoises Conservation" (1993).
- Wildlife, Wild Plants and Conservation of Natural Areas Law replacing the old Myanmar Wildlife Protection Act of 1936 was enacted under Forest Department (1994).

## Hatcheries

The Department of Fisheries, Ministry of Livestock and Fisheries has been operating one hatchery at Thameehla Island of Ngaputaw Township, Ayeyarwaddy Division which started operation in 1986. This island is the year-round nesting area for sea turtles. The sea turtle nesting area of Thameehla Island, at the mouth of Pathein River, is about one mile in length and half mile in breath and hosts the nesting of green and olive ridley turtles. For the year 1991 and from 2000-2003, a total of 159,252 eggs of green turtle were incubated and 133,043 hatchlings were released as shown in Table 5. In 2002, a total of 201 olive ridley eggs were incubated and 126 hatchlings were released. In 2003, a total of 100 olive ridley eggs were incubated and 69 hatchlings were released (Lwin, 2004).

**Plate 60.** Green Turtle Hatchlings

Although Myanmar has many islands and sandy beaches for sea turtle nesting, the DOF only operates sea turtles hatcheries and releasing program in Ayeyarwaddy Delta areas at present due to the limited capacity. Nevertheless, since the law enforcement is strictly applied, the illegal collection of sea turtle eggs and incidental catch of sea turtles is efficiently reduced.

**Plate 61.** Sea Turtles Hatchery at Thameehla Island

**Table 5.** Green Turtle Hatchlings Released from Thameehla, Ngaputaw Township in 1991 and from 2000-2003

| Year | No. of Eggs | Hatchlings released |
|---|---|---|
| 1991 | 34334 | 26939 |
| 2000 | 45673 | 43472 |
| 2001 | 46680 | 43590 |
| 2002 | 11549 | 9133 |
| 2003 | 21016 | 9909 |
| **Total** | **159,252** | **133,043** |

## Protected Areas/Sea Turtle Sanctuaries

Myanmar has one National Marine Park at Lampi Island under the supervision of the Department of Forestry. Lampi Island is one of the islands with eco-tourism activity in Myanmar.

## Education/Public Awareness

The public needs to be widely educated and informed of the importance of the conservation and protection of sea turtles. For this purpose, the Ministry of Livestock and Fisheries distributed pamphlets, inserting educational program in newspapers, magazines, radio and television (Aung and Maung, 1999). In Myanmar, a Turtle Conservation and Management Training Course was conducted for the first time from 21 February to 31 December 2001 at Gayet Gyi Sea Turtle Conservation Station in Bogalay township with the participation of 17 trainees. In that course, theory and practical application of tagging

**Plate 62.** Lampi Island National Park (Photo: WCS)

activities were included. In the Inspector Training Course No. 6/2003 for the DOF staff conducted by the DOF at the Institute of Fishing Technology (IFT) in Yangon, sea turtles conservation and management was also introduced.

Conservation of sea turtles in Myanmar and their prosperity mostly depend on the participation of the local people. Education programs have been initiated targeting the fishery communities and the people along the Myanmar coastline. With regards to strengthen effective conservation activities, the Ministry of Livestock and Fisheries prohibited any capture, killing and any other form harmful to sea turtles, along the Myanmar coastline. In addition, a notification has been issued on 20 February 1986 prohibiting the collecting, transferring, carrying or distributing of turtles and their eggs. Fishermen have been instructed to release sea turtles unharmed if they are caught accidentally in their fishing gears. The DOF has also prohibited the use of destructive fishing gears harmful on sea turtles and sand mining activities on turtle rookeries and their habitat (Lwin, 2004a).

**Plate 63.** Public Awareness Campaign on the Conservation of Sea Turtles in Myanmar

## Tagging and Satellite Telemetry Tracking Activities

Tagging activities started in 2001 using inconel tags. PIT tags provided by SEAFDEC/MFRDMD were used in March 2004. Even though there are many islands and beaches identified as turtle rookeries, there are only four places where tagging activities are being carried out. Tagging activities were conducted at Thameehla, Khone Gyi, Kadongalay and Gayet Gyi rookeries. Myanmar tagging activities are still at initial stage and so far 104 greens and 97 olive ridleys have been tagged. At present, Myanmar does not have any satellite telemetry tracking activities (Lwin, 2004b).


**Plate 64.** Application of PIT Tag on Nesting Green Turtle in Myanmar


**Plate 65.** Scanning of NestingTurtle with a PIT Scanner

**Plate 66.** Front Flipper Tagging on a Green Turtle Using Inconel Tag

## International/Regional Cooperation

At present, sea turtles conservation and enhancement activities in Myanmar are conducted with the collaboration of SEAFDEC/MFRDMD, SEASTAR2000, IOSEA/CMS and CARE Myanmar. Myanmar also signed the MoU on ASEAN/SEAFDEC Marine Turtle Conservation and Management.

## Research Activities

Research activities are being carried out by the Ministry of Education, Ministry of Livestock and Fisheries and also CARE Myanmar (Non-Governmental Organization). Tagging activities using PIT tags are now in progress using tags in the collaboration with SEAFDEC/MFRDMD.

Key persons who are previously and currently involved in sea turtles research in Myanmar are as follows:

1. Cho Hla Aung,
   Department of Fisheries,
   Sinmin Road, Ahlone Township,
   Yangon, Myanmar.
   Tel: 95-01-220597
   Fax: 95-01-228258
   E-mail: DOF@mptmail.net.mm

2. U Maung Maung Lwin,
   Department of Fisheries,
   Sinmin Road, Ahlone Township,
   Yangon, Myanmar.
   Tel: 95-01-220597
   Fax: 95-01-228258
   E-mail: DOF@mptmail.net.mm

3. Daw Khin Myo Myo,
   Department of Fisheries,
   Sinmin Road, Ahlone Township,
   Yangon, Myanmar.
   Tel: 95-01-220597
   Fax: 95-01-228258
   E-mail: DOF@mptmail.net.mm

4. Assoc. Prof. Dr. Win Maung,
   Department of Zoology,
   University of Yangon, Myanmar.

5. Win Ko Ko
   Wildlife Conservation Society,
   Myanmar Program Office,
   Bldg , C-1, 2 nd FL(R),
   Aye Yeik Mon 1st street,
   Yadana Mon Housing Avenue,
   Ward (3), Hlaing Township,
   Yangon, Myanmar.

6. Dr. Sann Aung,
   Academy of Agriculture, Forestry,
   Livestock and Fisheries,
   No. 460, Merchant Street,
   Yangon, Myanmar.

**Renato D. Cruz**


Hawksbill Turtle
*Eretmochelys imbricata*

# PHILIPPINES

## Introduction

There are five species of sea turtles that occur in the Philippines, namely green hawksbill, olive ridley, loggerhead and leatherback. Several locations for sea turtles nesting are shown in Table 6 (Cruz, 2004). The green turtles are widely found throughout the country, with high nesting aggregations in the Turtle Islands and the San Miguel Group of Islands, both in Tawi-Tawi (Cruz, 1999). The decline in the green turtles population is attributed to massive egg harvests that have been in progress for the past 43 years. The hawksbills are also widely distributed in the Philippines. Unlike the green turtles, there is no information on the aggregation of hawksbill throughout the archipelago. Lagunoy Gulf in the Bicol region has been identified as a development habitat of hawksbill turtles. The population of hawksbill is severely decimated as a result of excessive exploitation of eggs and the high demand for the shell (De Veyra, 1994).

In the early 1900's, Taylor reported that olive ridley turtles were quite common in Manila Bay. Recently, olive ridley turtles are found to nest moderately in the provinces of Zambales and Bataan and occasionally in Batangas and Palawan. The said nesting areas are all facing South China Sea (De Veyra, 1994). Loggerheads are very few in the Philippines. There were two documented tagged loggerhead turtles from Japan. These were caught in Pilas Island, Basilan in 1992 and RapuRapu, Albay in 1994 (De Veyra 1994). Loggerheads with Philippine tags were from Honda Bay in Palawan, Bais in Negros Oriental and Cortes in Bohol. There is no documented nesting in the Philippines. Visayas, or the central part of the Philippines, and the Bicol region specifically Catanduanes, Daet and Albay Gulf are the feeding areas of leatherback turtles. There is no documented nesting in the Philippines.

## Sea Turtles Conservation and Enhancement

### Legislations and Regulations

The specific law that addresses the protection and conservation of sea turtles in the Philippines is the Republic Act No. 9147 or the " Wildlife Resources Conservation and Protection Act," that was approved by Congress on July 30, 2001. The Act is generally a law that provides for the conservation and protection of wildlife resources and their habitats, particularly threatened and endangered species. RA 9147 also gives respect to traditional practices among the indigenous people. However, since this Act states that any wildlife species categorized as threatened or endangered cannot be exploited, it is illegal to exploit sea turtles in all of its life stages, including its eggs (Cruz, 2004).

The Turtle Islands in the province of Tawi-Tawi and part of the Turtle Islands Heritage Protected Area (TIHPA) are one of the most important sea turtle rookeries in the Southeast Asia region and a major nesting area for green turtles in the world. For a long time, turtle egg collection has been practiced and

**Table 6.** List of Confirmed Nesting Areas in the Philippines

| Area | Species |
|---|---|
| Santa Maria, Ilocos Sur | Olive ridley |
| Morong, Bataan | Olive ridley, hawksbill & green |
| San Antonio, Zambales | Olive ridley |
| Nasugbu, Batangas | Olive ridley |
| Lian, Batangas | Olive ridley |
| San Juan, Batangas | Green |
| Pamilacan Is., Cuyo, Palawan | Green & hawksbill |
| Halog Island, Palawan | Green |
| Tanobon Island, Palawan | Green |
| Panata Cay, Palawan | Green |
| Kota Islands, Palawan | Green |
| Brgy. Simpokan, Puerto Princesa City, Palawan | Olive ridley |
| Arricefi Island, Honda Bay, Palawan | Hawksbill |
| El Nido, Palawan | Olive ridley, hawksbill & green |
| Apo Island, Sablayan, Occidental Mindoro | Green |
| Roxas, Oriental Mindoro | Green |
| Basud, Quidolog, Prieto Diaz, Sorsogon | Hawksbill |
| Brgy. Talisoy, Virac, Catanduanes | Green |
| Panagatan and Malaqui Is., Antique | Green |
| Malalison Island and Brgy. Lipata, Culasi, Antique | Hawksbill |
| Brgy. Bulata, Cauayan, Negros Occidental | Green |
| Brgy. Nauhang, Sipalay, Negros Occidental | Green |
| Sitio Kibela, Brgy. Cantaan, Guisiliban, Camiguin | Green |
| Sito Guisi, Brgy. Dolores, Nueva Valencia, Guimaras | Green |
| Punta Dumalag, Davao City | Hawksbill |
| Malita, Davao City | Olive ridley |
| Purok 7, Inobulan, Salay, Misamis Oriental | Green |
| Soldevilla's Beach Resort, Brgy. Salay River Side-1, Salay, Misamis Oriental | Hawksbill |
| Taboc, Bobontugan, Jasaan, Misamis Oriental | Hawksbill |
| Minsalag, Bonifacio, Magsaysay, Misamis Oriental | Hawksbill |
| Hinatuan, Surigao del Sur | Hawksbill |
| Panikian Island, Pitogo, Zamboanga del Sur | Green |
| San Miguel Islands, Mapun, Tawi-Tawi | Green |
| Turtle Islands, Tawi-Tawi | Green & hawksbill |

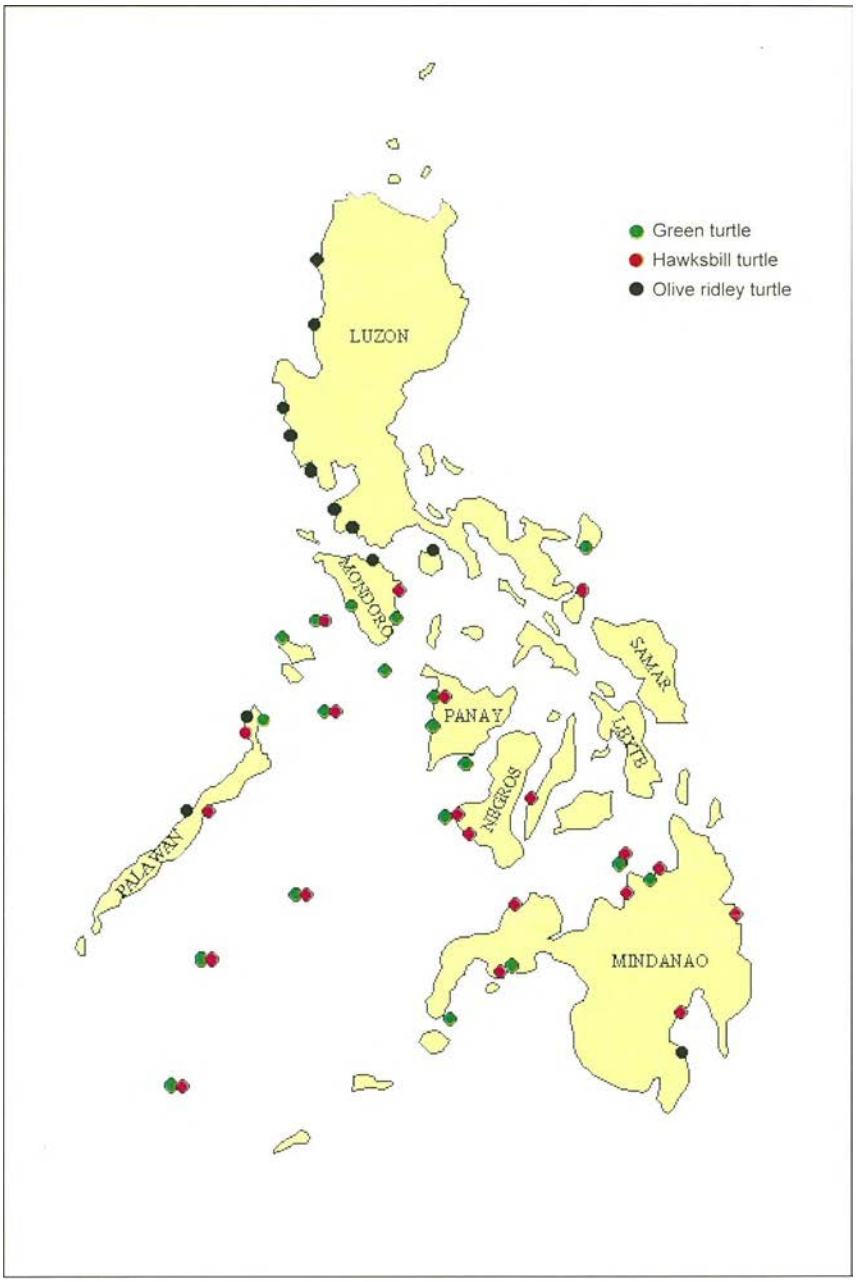



**Figure 14.** Distribution of Sea Turtle Nesting Beaches in the Philippines

traded by the residents of Turtle Islands. The National Government, in agreement with the Local Government of Turtle Islands, allowed and regulated turtle egg collection pursuant to Department of Environment and Natural Resources (DENR) Administrative Order (AO) No. 33, series of 1982 (Cruz, 2004).

After the passage of RA 9147, the Local Government of Turtle Islands appealed to the President of the Republic of the Philippines for a five-year transitory period before the full enforcement of the Law in the area. The appeal was granted this year with instructions from the President to the Local Government, the Autonomous Region of Muslim Mindanao and the DENR to collaborate and coordinate among themselves and with other stakeholders in the area to implement a Five-Year Phase in-Phase out Scheme (Cruz, 2004).

There are other related laws supporting the conservation and protection of sea turtles in the country, namely:

- Republic Act No. 8550 or the "Fisheries Code of 1998," was approved by Congress on 19 February 1998. This law mandates the local government to manage, protect and conserve the resources in the municipal waters for the benefit of municipal fishers. This law prohibits, among others, blast fishing, the use of obnoxious substances and trawl fishing within the municipal waters.
- Republic Act No. 7586 or the "National Integrated Protected Areas System (NIPAS) Act," was approved by Congress on 1 June 1992. This law provides for the establishment and management of a National Integrated Protected Areas System.

In 1998 and 1999, two guidelines came out, the Joint DENR-Department of Tourism Memorandum Circular No. 98-02 and the DENR AO No. 99-31. The Joint Memorandum Circular is a guideline for eco-tourism development in the Philippines. DENR AO No. 99-31 is a guideline for Ecological Destination (eco-tourism) development for the Turtle Islands, Tawi-Tawi. There are also provincial and municipal ordinances promulgated by the Local Governments to draw attention to the need to protect sea turtles in their jurisdiction. However, the existing laws prevail over these ordinances. In addition, importation and exportation of sea turtles and their by-products are illegal since the Philippines has been a party of CITES since 1981 (Cruz, 2004).

## Hatcheries

At present, the Pawikan Conservation Project (PCP), the Protected Areas and Wildlife Bureau (PAWB), under the Department of Environment and Natural Resources (DENR) both assist, monitor and/or manage twelve hatcheries. These are in the Turtle Islands in the Province of Tawi-Tawi, Morong in the Province of Bataan, Hinatuan in the Province of Surigao del Sur, San Juan in the Province of Batangas, Pamelikan Island and Miniloc Island both in the Province of Palawan. Five hatcheries are in the Turtle Islands, three are in Morong, and one each in Hinatuan, San Juan, Pamelikan Island and Miniloc Island (Cruz, 2004).

All the hatcheries in Turtle Islands are managed by the PCP while hatcheries in Morong, Bataan are managed by the *Bantay Pawikan* (sea turtle guard), a people's joint organization with the local government. The Unlad Chapter of the Philippine Rural Reconstruction Movement (PRRM), a non-governmental organization (NGO), was one of the groups that led to the establishment of the hatcheries in Morong. In Hinatuan, the local government, in collaboration with the Centre for Empowerment

**Plate 67.** Hatchery in Morong, Bataan

**Plate 68.** Hatchery in the Turtle Islands, Tawi-Tawi

and Resource Development (an NGO) and the DENR regional office, are managing the hatchery. Only the local government and the DENR regional office handle the hatchery in San Juan, Batangas. Pamelikan Island is managed by a private institution (Cruz, 2004).

The establishment of hatcheries in the Turtle Islands started in 1984 allowing residents to collect 60% of the total eggs produced in all islands except Baguan Island. Only 30% of the total eggs produced in the collection islands are transferred to hatcheries. From 1986-2002, there were 1,946,720 eggs transplanted in the Turtle Islands of which 941,036 hatchlings were released as shown in Table 7 (Cruz, 2004).

**Table 7.** Number of Nests, Eggs Incubated and Hatchlings Released from Turtle Islands: 1986-2002

| Year | No. of Nests | No. of Eggs Incubated | No. of Hatchlings Released |
|---|---|---|---|
| 1986 | 1,194 | 81,929 | 66,999 |
| 1987 | 1,944 | 127,874 | 37,748 |
| 1988 | 1,303 | 95,442 | 20,855 |
| 1989 | 1,053 | 74,084 | 28,465 |
| 1990 | 2,299 | 165,849 | 69,385 |
| 1991 | 4,821 | 368,690 | 177,630 |
| 1992 | 2,854 | 192,254 | 108,601 |
| 1993 | 3,746 | 244,200 | 138,852 |
| 1994 | 1,314 | 85,428 | 36,601 |
| 1995 | 648 | 41,121 | 37,961 |
| 1996 | 846 | 59,398 | 32,911 |
| 1997 | 1,545 | 95,502 | 47,970 |
| 1998 | 1,972 | 125,959 | 57,564 |
| 1999 | 908 | 57,837 | 17,124 |
| 2000 | 662 | 42,067 | 17,386 |
| 2001 | 778 | 52,563 | 28,862 |
| 2002 | 585 | 36,523 | 16,122 |
| **Total** | **28,472** | **1,946,720** | **941,036** |

Before 1998, all turtle eggs were collected and traded by some coastal residents of Morong, Bataan. With the combined conservation efforts of the PCP-PAWB and PRRM, these coastal residents were trained to become protectors of sea turtles, leading to the formation of a people's organization called *Bantay Pawikan*. The task of *Bantay Pawikan* is to monitor sea turtles and transfer their eggs to the hatcheries during the nesting season of olive ridley. The first hatchery constructed in Morong, Bataan was in Barangay Nagbalayong. Later on, two additional hatcheries were constructed in Sitios Fuerte and Matico. Proper management and dedication of the members of the *Bantay Pawikan* resulted in good hatchery results in Sitios Nagbalayong, Fuerte and Matico. The results of the emergence success for the nesting season of September 2001 to March 2002 in the three hatcheries were: 89.65% (Nagbalayong), 91.57% (Fuerte), and 97.29% (Matico) (Cruz, 2004).

## Protected Areas/Sea Turtle Sanctuaries

A total of nine islands/areas were declared as sea turtles sanctuaries in 1982 and 1984 through DENR Administrative Orders. Out of these nine islands/areas, only two islands/areas were

**Plate 69.** Public Awareness Campaign on the Conservation of Sea Turtles in the Philippines

sustained, enlarged in coverage and declared as protected areas pursuant to RA 7586 or the NIPAS Act. These islands/areas were the Bacuit Bay of the Municipality of El Nido under the province of Palawan and Baguan Island, one of the islands of Turtle Islands under the province of Tawi-Tawi The two said areas expanded in its area of coverage and the conservation and protection activities are not only for sea turtles but also for other equally important marine and coastal species and their habitats (Cruz, 2004).

There are about thirty areas with coastal areas throughout the Philippines that were declared as protected areas under the NIPAS Act. A total of 1.5 million hectares comprises all the declared protected areas with marine areas and are categorized as: Landscape/Seascape, Natural Park, Marine Reserve, Managed Resource Reserve or Wildlife Sanctuary. In every NIPAS-protected area, a corresponding Protected Area Management Board (PAMB) is established and acts as the policy-making body. The Chairperson of the PAMB is the DENR Regional Executive Director and its members comprise the officials of the Local Government, Peoples Organization, NGOs and other stakeholders in the protected area (Cruz, 2004).

A management plan is crafted for every NIPAS-protected area. The management plan must undergo a series of consultations with the stakeholders before being finalized. Included in the plan is the zoning of areas i.e., strict protection zone, recreational zone, multi-use zone and buffer zone. The use of zones will help manage and regulate activities of the tourists and residents in the area to avoid activities that may be detrimental to a particular marine or terrestrial species. The main objective of the plan is the sustainable use of marine and terrestrial resources within the protected area. In sanctuaries declared under provincial or municipal ordinances, the Local Governments are the lead agencies and the DENR advises and assists the Local Governments in sea turtle conservation activities. However, even if an area is not declared as a NIPAS-protected area nor declared as a sanctuary through ordinances, existing laws like the RA 9147 and RA 8550 are enough to protect and conserve sea turtles in the country if properly implemented by concerned agencies and institutions (Cruz, 2004).

The important NIPAS-protected areas for sea turtles are the following:

- El Nido Managed Resource Protected Area in the province of Palawan with an area of 89, 134 hectares was declared through Presidential Proclamation No. 32 on 8 October 1998.
- The whole municipality of Turtle Islands in the province of Tawi-Tawi was declared as the Turtle Islands Wildlife Sanctuary (TIWS) through Presidential Proclamation No. 171 on 26

**Plate 70.** Community Participation in Releasing of Hatchlings as Part of Sea Turtle Conservation and Enhancement in the Philippines.

August 1999. Area is 242,967 hectares. TIWS is part of the Philippine-Malaysia Turtle Islands Heritage Protected Area (TIHPA).

- Tubbataha Reef National Marine Park in the province of Palawan was declared as a World Heritage Site on 11 December 1993 and as a protected area (initial component) through Presidential Proclamation No. 306 on 11 August 1988. Area is 33,200 hectares.
- The whole province of Batanes was declared as Batanes Protected Landscape/Seascape through Presidential Proclamation No. 335 on 28 February 1994 and pursuant to Republic Act No. 8991 approved by Congress on 5 January 2001. Area is 213,578 hectares.
- Northern Sierra Madre Natural Park in Palanan, Divilacan, Moconacon, Iligan, San Pablo, Cabagan, San Mariano, Dinapique and Tumauini in the province of Isabela with an area of 359,486 hectares declared through Presidential Proclamation No. 978 on 10 March 1997 and pursuant to Republic Act No. 9125 approved by Congress on 22 April 2001.
- Apo Reef Natural Park in Sablayan in the province of Occidental, Mindoro with an area of 15,792 hectares declared through Presidential Proclamation No. 868 on 6 September 1996.
- Pujada Bay Protected Landscape/Seascape in Mati in the province of Davao Oriental with an area of 21,200 hectares declared through Presidential Proclamation No. 431 on 31 July 1994.
- Sarangani Bay Protected Seascape in Maitum, Kiamba, Maasim in the province of Saranggani with an area of 215,950 hectares declared through Presidential Proclamation No. 756 on 5 March 1996.
- Siargao Protected Landscape/Seascape in the province of Surigao del Norte with an area of 278,914 hectares declared through Presidential Proclamation No. 902 on 10 October 1996.

Other important nesting habitats not declared as NIPAS-protected areas but which have an agreement with the DENR or have provincial or municipal ordinances on sea turtle conservation activities are the following:

1. Morong, Bataan - Olive ridley turtle rookery.
2. San Juan, Batangas - Hawksbill turtle rookery.
3. Hinatuan, Surigao del Sur - Hawksbill turtle rookery.
4. Panikian Island, Zamboanga del Sur - Green turtle rookery.
5. Punta Dumalag, Davao City - Hawksbill turtle rookery.

## Education/Public Awareness

The Pawikan (sea turtles) Conservation Project (PCP) of the Protected Areas and Wildlife Bureau (PAWB), Department of Environment and Natural Resources (DENR) is the lead group in the conservation of sea turtles in the Philippines. One of the major tasks of the PCP-PAWB is to increase awareness and participation of the people in the conservation of sea turtles and other related marine resources. Since 1983, the project has been utilizing, one way or the other, all possible and effective means of communication to promote sea turtles conservation.

### Documentary film

Two documentary films, lasting for 15 to 20 minutes and produced by the PCP-PAWB, focused on sea turtles biology, causes of decline of sea turtles populations in the Philippines, brief history of the project and the activities being undertaken by the project. Besides being often shown in schools and colleges, copies of the films were also distributed to the regional offices of the DENR and some resorts. The last documentary film produced by the PCP-PAWB in 1998 contains a Filipino version to cater to the larger group of people living in the countryside. At present, as a cost-cutting measure, the PCP-PAWB collaborates with local television programs that produce documentary films on wildlife conservation and ecotourism focusing on a particular area in the country (Cruz, 2004).

### Radio Plug

The country, being archipelagic with inadequate or lacking communication facilities, makes the radio the most effective media tool that can be accessed. Thus, a 15-second radio plug that gave emphasis on the ban to collect or kill the endangered sea turtles was produced and translated into five common Filipino dialects. This was aired free of charge in the different regions of the country (Cruz, 2000).

### Posters

The PCP-PAWB has so far produced five poster designs for distribution nationwide. One of the designs depicts a sea turtle and dugong imposed on a collage of dinosaurs, with a caption saying, "Are we to let our children inherit only stories?" (Cruz, 2000).

### Primers/Brochures/Bookmarks

Print materials containing a brief description of the biology and ecology of sea turtles, as well as the pertinent laws concerning their conservation have also been produced for distribution. Mimeographed versions in both English and Pilipino are distributed during habitat surveys and IEC, and more specialized primers are given during seminars, lectures and training-workshops. The PCP-PAWB also distributes these print materials to individuals who request for them (Cruz, 2000).

### Billboards

Billboard signs have been erected in strategic locations, such as piers and gates of a complex that houses more than 100 native souvenir shops and in areas adjacent to nesting sites. In spite of the ban, local businessmen are still engaged in the trade of sea turtles by-products. In fact, surveillance and confiscation conducted by the PCP-PAWB and the enforcement arm of the DENR in Metro Manila has yielded not less than US$ 8,000.00 worth of by-products in 1996 and 1997 alone. DENR personnel deployed at the international airport have confiscated a number of stuffed turtles and guitars made of

**Plate 71.** A Fisherman Receives a Certificate of Appreciation, T-shirt and Baseball Cap as a Token of Appreciation for Reporting Live Sea Turtle to the DENR.

turtle carapaces from departing foreign tourists (Cruz, 2000). However, from 1999 to the present, there was a significant decrease in the number of confiscated sea turtle's by-products.

## T-shirts/Baseball Caps

The project has conceptualized t-shirts with different turtle designs, and a baseball cap with an embroidery patch designed with a turtle and dugong. Along with a Certificate of Appreciation, either of these products is given to individuals, especially fishermen, who have reported turtles with metal tags or surrendered the turtles to the DENR for tagging and/or for release. In 1994, a manufacturer of popular t-shirts with conservation designs forged an agreement with the PAWB to donate 10% of the sales of its sea turtle-designed t-shirts to the PCP-PAWB. This undertaking significantly helped in promoting sea turtles' conservation awareness in the people, especially since the t-shirts are widely distributed in major cities in the country. In addition, many of the PCP-PAWB's activities were financially supported through the donation (Cruz, 2000).

## Postcards and Stamp Canceller

Pre-paid postcards depicting the five species of turtles found in the Philippine's waters are distributed to the DENR Regional Offices, concerned individuals, non-government organizations, local governments and community schools. Through the data gathered from the postcards and Field Action Officers' reports, the PCP-PAWB has plotted the distribution of turtles in the entire country (Cruz, 2000).

In 1989, in commemoration of the 10$^{th}$ year of the project, a stamp canceller with marine turtle design was produced in collaboration with the Philippine Postal Corporation; the activity lasted a year (Cruz, 2000).

## Training-Workshop for DENR Personnel

The Project has been fully utilizing the assistance of the DENR's 15 regional offices and branches, 69 Provincial Environment and Natural Resources Offices (PENRO) and 159 Community

**Plate 72.** Hands-on Training Including Hatchery Management as Part of the Orientation-Training Workshop Conducted by the PCP-PAWB-DENR

Environment and Natural Resources Offices (CENRO). These offices are in the forefront in implementing DENR's mandates at the grass roots level. In 1989, DENR Special Order No. 884 was promulgated, designated all Regional Technical Directors for Environment and Natural Resources as PCP Field Action Officers (FAO). One of the specific duties and responsibilities of the FAO is to assist the PCP-PAWB in conducting a Conservation Education Program in their respective regions. The Project conducted Orientation-Training Workshops for DENR field personnel to equip them with the necessary knowledge to conduct IEC and implement other PCP-PAWB activities. The topics of the training workshop include: Biology and Ecology of Sea Turtles, Tagging and Hatchery Procedures, Existing Sea Turtles Rules and Regulations, Concepts of Marine Wildlife Conservation and Management, and Identification and Functions and Commitment of the Participants for Marine Turtle Conservation. From 1989-1997, more than 300 DENR personnel were trained by the PCP In 2002 the PCP-PAWB conducted an Orientation-Training Workshop in Region 13, the northeastern part of Mindanao covering four provinces, namely: Surigao del Norte, Surigao del Sur, Agusan del Norte and Agusan del Sur (Cruz, 2000).

## Seminars/lectures

As a cost-effective strategy, IEC is integrated with the habitat surveys conducted by the research unit of the PCP-PAWB. The method used is interpersonal-group approach consisting of a simple lecture with a slide presentation or a film show. In areas with no sources of electricity, flip charts are used as visual aids. About 50-300 people, mostly children and fishermen, attend each of these lectures. From 1992-1996, the PCP-PAWB conducted IEC in 253 local communities in 26 provinces. The PCP-PAWB also gives lectures in schools upon invitation (Cruz, 2000).

## Dalaw-Turo (Visit and Teach)

This is an outreach program of the DENR that employs a non-traditional education participatory communication design of teaching biodiversity and sustainable development. The most interesting feature of this program is the integration of lectures, drama and games as a technique in imparting conservation of natural resources among its audience. The sea turtles have become a part of this program. More than 46,829 students, 964 teachers, 3,422 communities and 576 DENR personnel from all regions have participated in the Dalaw-Turo from 1992-2000 (Cruz, 2000).

## Media Coverage

From 1991 onwards, media coverage was intensified, which have elicited considerable public support. The Department of Tourism sponsored a group of journalists from different newspaper and magazine publications to visit the Turtle Islands, some 1000 km south of Manila, the country's capital (Cruz, 2000). The Turtle Islands and Morong, Bataan were featured in two leading television programs and local tourism programs.

## Exhibits

Many non-governmental organizations (NGO) had collaborative undertakings with the PCP-PAWB. In 1994,1997, and 2000 these NGOs coordinated with the project to set up month-long exhibits on sea turtles and other endangered species in popular shopping malls. Due to their strategic location, these projects elicited a number of patrons who contributed financial support to the project. The PCP-PAWB also encourages school organizations to collaborate with the Project in this undertaking (Cruz, 2004).

## Network

Cooperation and collaboration with other national and local government agencies and non-government organizations that include universities/schools, people's organizations and cause-oriented organizations are important ingredients in the success of any conservation endeavor. Since 1997, the PCP-PAWB has been constantly expanding its collaboration and tapping the resources of these organizations in terms of manpower in support of identification and establishment of protected areas or sanctuaries for sea turtles (Cruz, 2002).

# Tagging and Satellite Telemetry Tracking Activities

## Tagging Activities

Tagging activity is done in all regions of the Philippines through the Department of Environment and Natural Resources (DENR) regional offices. The Local Government Units and NGOs assist in this activity. The first tagging activity was done in the Turtle Islands, Tawi-Tawi in 1982. From 1982-1994, locally-made steel tags were used. From 1995-1997, inconel tags imported from the United State of America were used. From 1998 onwards, monel tags were used. The Marine Fishery Resources Development and Management Department (MFRDMD)-Southeast Asian Fisheries Development Center (SEAFDEC) provided the first batch of 1000 pieces of inconel tags (Cruz, 2004).

The total number of green turtle nesters tagged in the Turtle Islands and in Bancauan Island, Mapun Province of Tawi-Tawi from 1982-2002 were 10,532. The total number of sea turtle nesters tagged in Morong, Bataan from 1999-2002 was 60 turtles. Ninety-five percent (95%) of the nesters tagged were olive ridley turtles. The total number of sea turtles that were mostly green and hawksbill turtles of different life stages tagged in other areas/regions of the Philippines from 1985-2002 was 1,683 (Cruz, 2004).

**Plate 73.** Tagging Activities in the Philippines

## Satellite Telemetry Tracking Activities

Satellite telemetry projects were conducted in the Turtle Islands Heritage Protected Area. In 1998, two green turtle nesters were tagged in Baguan Island, the Turtle Islands. In 1999, another two green turtle nesters were tagged, one from Baguan Island and one from Selingaan Island in Sabah Parks, Malaysia. Telonics ST 14 transmitters were used. In 2001, four green turtle nesters were tagged, two from Baguan Island and two from Selingaan, Sabah Parks. Telonics ST 18 transmitters, cheaper than

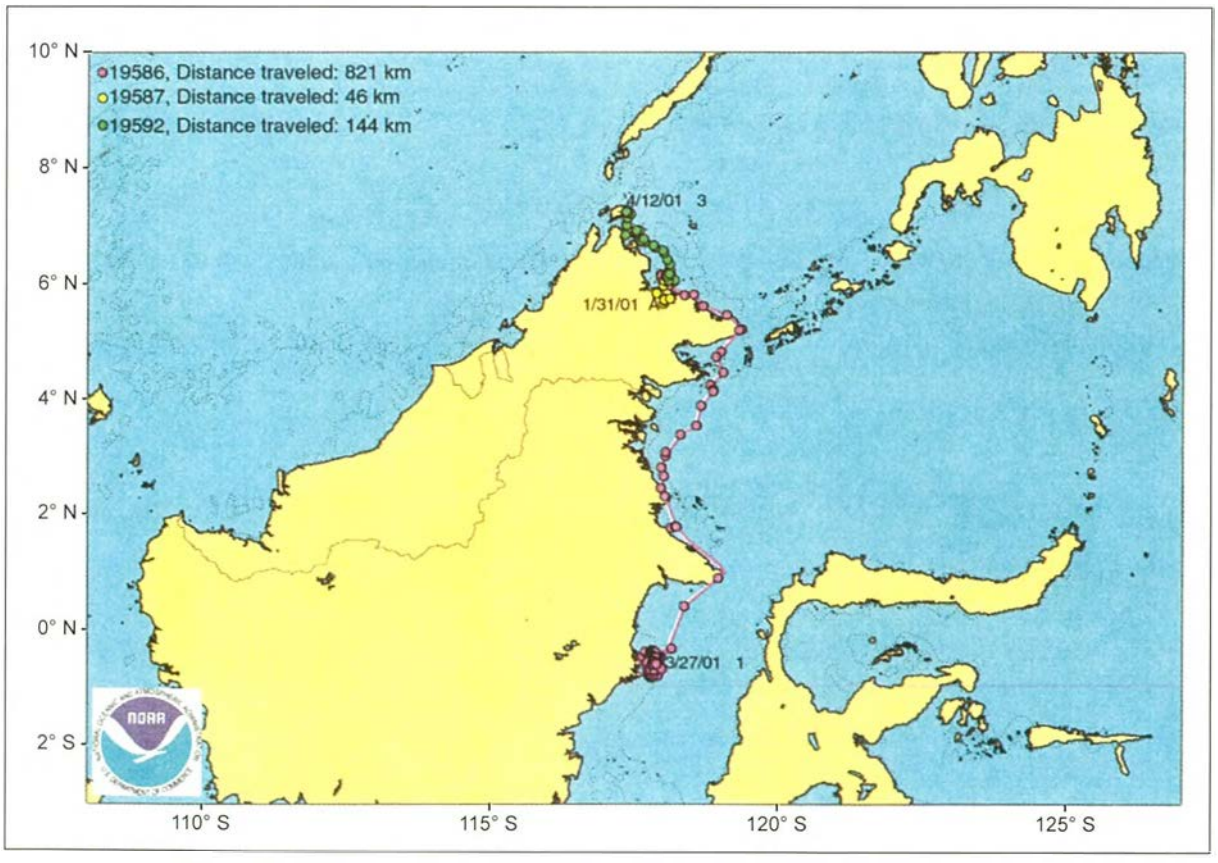



**Figure 15.** Migratory Route of Three Post-Nesting Hawksbill Turtles Tracked by Satellite After Nesting in the Turtle Islands Heritage Protected Area in 2001

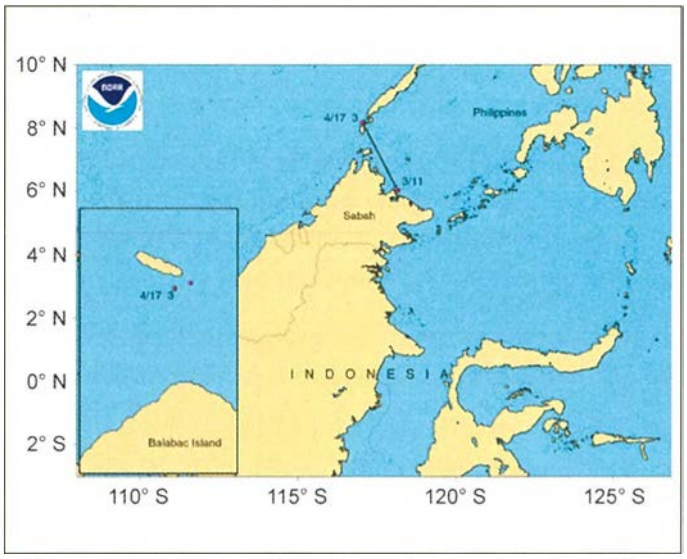



**Figure 16.** Migratory Pathway of Hawksbill Turtle Released from the Turtle Islands Heritage Protected Area in 2002

Telonics ST 14 were used. During 2001-2002, four hawksbill turtle nesters were tagged, two in Lihiman Island and two in Sabah Parks, Malaysia. Telonics ST 14 transmitters were used (Cruz, 2004).

The first four Telonics ST 14 transmitters were provided by the Coastal Resources Management Program, a USAID-funded program of the DENR. The Telonics ST 18 transmitters were donated by the WWF-Philippines and the Telonics ST 14 transmitters which were attached to hawksbill turtles were provided by the National Oceanic and Atmospheric Administration (NOAA) of the US Department of Commerce (Cruz, 2004).

The satellite tracking results showed that the probable feeding areas for green turtles are within the waters of the Balabac, Palawan and the Provinces of Jolo and Basilan, Philippines. The feeding areas for hawksbill turtles are in Balabac, Palawan, northern part of Sabah, and south beyond East Kalimantan, Indonesia (Cruz, 2004).

## International/Regional Cooperation

Collaborative activities undertaken by PCP-PAWB are as follows:

1. World Wildlife Fund-USA funded the First ASEAN Symposium-Workshop on Marine Turtle Conservation held in Manila, Philippines in 1993.
2. World Wildlife Fund-Philippines. A MoU was signed between the DENR-WWF to compliment similar activities done by both entities in the conservation and protection of sea turtles in the Philippines:
    - Satellite Telemetry Project for green turtle nesters in the Turtle Islands Heritage Protected Area (TIHPA).
    - Integrated Conservation Development Project in the Turtle Islands.
    - Ecological Studies in TIHPA.
    - Sea turtles protection and conservation in other areas in the Philippines.

3. Conservation International, Philippines is involved with TIHPA and will be involved in the preparation of establishing a tri-national sea turtles conservation program among Indonesia, Malaysia and the Philippines.

4. Coastal Resource Management Program (USAID-funded program):
   - Satellite telemetry project for green turtle nesters in TIHPA.
   - Established and is maintaining a website for sea turtle program and other marine species in the Philippines (www.oneocean.org).

5. Convention on the Conservation of Migratory Species of Wild Animals (CMS). Secretariat on the MoU on Marine Turtles in the Indian Ocean and South East Asia.

6. National Oceanic and Atmospheric Administration (NOAA), US Department of Commerce. NOAA provided training on satellite telemetry and four transmitters for hawksbill turtles in TIHPA from 2001-2002.

7. SEAFDEC/MFRDMD provided the first batch of 1000 pieces of monel tags and pit tags in 1998 and 2003, respectively.

## Regional and International Treaties and Agreements Related to Sea Turtles

There are eight regional and international treaties and agreements related to the conservation and protection of sea turtles that the Philippines is signatory to, namely:

- The MoU between the Government of the Republic of Indonesia, the Government of Malaysia and the Government of the Republic of the Philippines on the Adoption of the Conservation Plan for the Sulu-Sulawesi Marine Ecoregion signed on 13 February 2004.
- The MoU on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia that was finalized and signed by the Philippines on 23 June 2001.
- The MoU on ASEAN Sea Turtle Conservation and Protection that was signed on 12 September 1997 by the ASEAN Ministers on Agriculture and Forestry.
- The Memorandum of Agreement between the Government of the Republic of the Philippines and the Government of Malaysia on the establishment of the Turtle Islands Heritage Protected Area (TIHPA) that was signed on 31 May 1996.
- The Convention on the Conservation of Migratory Species of Wild Animals (CMS) (Bonn Convention). The date of accession was on 4 February 1994.
- The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention). The date of accession was on 8 November 8 1994.
- The Convention on Biological Diversity (CBD). The date of Accession was on 8 October 1993.
- Convention on International Trade in Endangered Species of Fauna and Flora (CITES). The date of accession was on 20 April 1981.
- The International Union for the Conservation of Nature and Natural Resources (IUCN). The year of accession was in 1968.

## Research Activities

At present, only the Pawikan Conservation Project of the Protected Areas and Wildlife Bureau, Department of Environment and Natural Resources conducts sea turtles research in the Philippines. The focal persons in research are:

1. Mr. Renato D. Cruz,
   Pawikan Conservation Project,
   Protected Areas and Wildlife Bureau,
   Department of Environment and Natural Resources,
   Ninoy Aquino Parks and Wildlife Nature Center,
   Quezon Avenue, Diliman,
   Quezon City, 1100 Philippines.
   Tel: 63-2-9258946 / 9246031 to 35 local 223
   Fax: 63-2-9258945 / 9240109
   E-mail: rcrutz@edsamail.com.ph, pawikan@pawb.org.ph

2. Mr. Daniel S. Torres
   Pawikan Conservation Project,
   Protected Areas and Wildlife Bureau,
   Department of Environment and Natural Resources,
   Ninoy Aquino Parks and Wildlife Nature Center,
   Quezon Avenue, Diliman,
   Quezon City, 1100 Philippines.
   Tel: 63-2-9258946 / 9246031 to 35 local 223
   Fax: 63-2-9258945 / 9240109
   E-mail: whalesharker@edsamail.com.ph, pawikan@pawb.org.ph

3. Mr. Virgilio G. Sagun
   Pawikan Conservation Project,
   Protected Areas and Wildlife Bureau,
   Department of Environment and Natural Resources,
   Ninoy Aquino Parks and Wildlife Nature Center,
   Quezon Avenue, Diliman,
   Quezon City, 1100 Philippines.
   Tel: 63-2-9258946 / 9246031 to 35 local 223
   Fax: 63-2-9258945 / 9240109
   E-mail: pawikan@edsamail.com.ph, virgil_76_ph@yahoo.com,
   pawikan@pawb.org.ph

However, there are persons whose present works are related to the conservation of sea turtles, namely:

1. Mr. Romeo B. Trono,
   Conservation International, Philippines,
   #5 South Lawin Avenue, Philam Homes,
   Quezon City, Philippines.
   E-mail: rtrono@conservation.org

2. Mr. Jose Angelito M. Palma,
WWF Philippines,
LBI Building, #57 Kalayaan Avenue,
Diliman, Quezon City,
1101 Philippines.
E-mail: jpalma@wwf.org.ph

3. Dr. Angel C. Alcala,
Silliman University-Angelo King Center for Research and Environment Management,
2nd Floor Marine Laboratory Bldg.,
Silliman Beach, Bantayan,
Dumaguete City, 6200 Philippines.
E-mail: suakcrem@philwebinc.com

**Mickmin Charuchinda**


# THAILAND

## Introduction

Thailand is located in the middle of the Indochinese Peninsula, between latitudes 5°27' and 20°27'N and longitudes 97°22' and 105°37'E. The Kingdom's total area is 513,115 square kilometers, of which some 84 percent falls within the mainland section and 16 percent within the Peninsular South. The extreme length from north to south measures 1,620 kilometers, while at its broadest Thailand is only 780 kilometers wide from east to west. The narrowest strip at about 11°43'N latitude on the Peninsular South is 10.6 kilometers. The Isthmus of Kra is some 64 kilometers wide, situated further south at about 10°N latitude. The form is therefore anything but compact, affording Thailand excellent access to the seas with 23 of its 76 provinces touching the coastline.

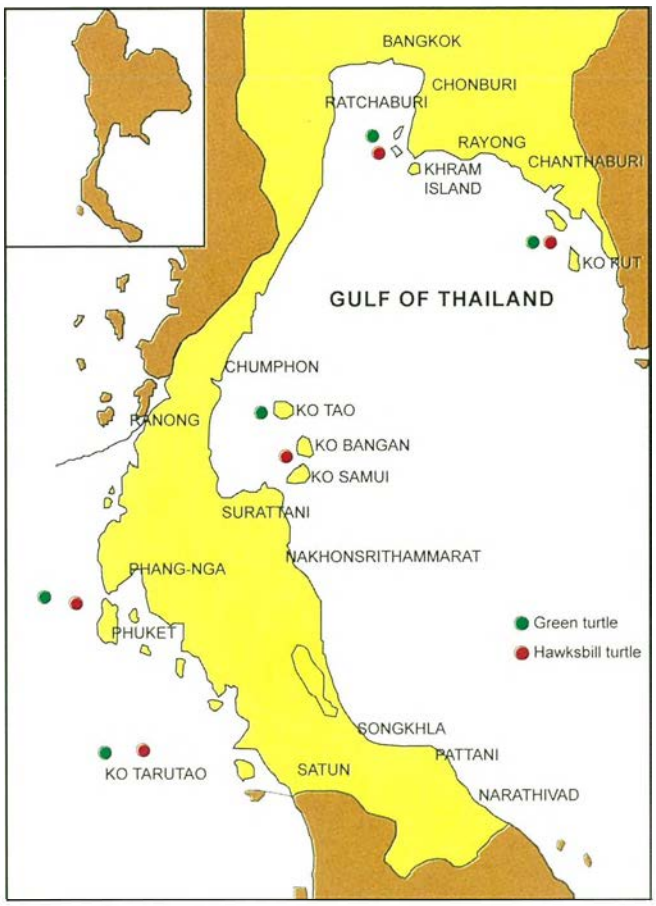



**Figure 17.** Distribution of Sea Turtle Nesting Beaches in Thailand

There are two areas that sea turtles can be found in the waters of Thailand as shown in Figure 17. Green and hawksbill turtles can be found along the coast and on some islands in the Gulf of Thailand while the leatherback and olive ridley turtles recorded on several location on the Andaman Sea coast (Chantrapornsyl 1992a, 1992b; Phasuk, 1992; Monanunsap and Charuchinda 1994). In the past, 5 species of sea turtles were recorded in Thai waters, namely green, hawksbill, olive ridley, leatherback and loggerhead turtles (Phasuk and Rongmuangsart, 1973). At present there is no record of loggerheads nesting in Thailand (Monanunsap and Charuchinda, 1994).

The nesting areas of sea turtles have been recorded in some protected areas in the gulf of Thailand, such as Mannai Island, Khram and also the adjacent islands. Sea turtles can also be found in some islands in the eastern coast and in the middle Gulf of Thailand. In the Andaman Sea coast, nesting areas are concentrated on the west coast of Phuket and Phang-nga Provinces, and on Similan Island (Charuchinda and Chantrapornsyl, 1999; Kuptawatin, 2004a).

## Sea Turtles Conservation and Enhancement

In many areas, the number of sea turtles nesting have been declining. In order to protect the animals, conservation projects have been conducted by the Andaman Marine and Coastal Resources Research and Development Institute (Phuket Marine Biological Center) since 1971. The Eastern Marine and Coastal Resources Research Center (Mannai Sea Turtles Conservation Station) in the Gulf of Thailand was established in 1979. Since then the biology of sea turtles has been studied and many rookeries have been protected. Some of these areas were declared as National Parks in order to protect these animals and their habitats. Laws and regulations for protecting sea turtles were registered. Education and conservation campaigns have also been provided to the public (Kuptawatin, 2004a).

At present, all species of sea turtles and their products are legally listed as protected animals. Sea turtles and their products have been completely prohibited for consumption and trade since 1981. Several areas of sea turtle nesting have been declared as National Parks and Fisheries Preservation Zones. Protection of sea turtles in nesting areas is one of the management measures conducted by 4 main authorized organizations, namely the Department of Marine and Coastal Resources; Department of National Parks, Wildlife and Flora; the Royal Thai Navy and the Department of Fisheries (Kuptawatin, 2004a).

### Legislations and Regulations

The present conservation and enhancement activities of sea turtles in Thailand are considered to be better compared to the past. Commercial harvest, sale and consumption of sea turtle meat and their products are prohibited. A number of laws and regulations have been implemented to conserve sea turtles such as follows:

1. Ministry of Agriculture and Cooperative Enactment 1947
   Sea turtles have been listed as protected animals. Killing of the sea turtles and eggs collection are prohibited.
2. National Park Act 1961
   The habitats and nesting areas of sea turtles in every National Park are protected.
3. Fisheries Act 1972
   Commercial fishing within 3 kilometers of the coastline is prohibited.

4. Ministry of Commerce Enactment 1980
   The export of sea turtles and their carcasses are prohibited.
5. Conservation and Protection of Living Resources Enactment 1992, Act No 19.
   Collecting of sea turtles, their products and carcasses are prohibited.
6. Wildlife Reservation and Protection Act 1992, Section 6.
   Sea turtles and their nests shall be protected from hunting, breeding, possession, trading, exporting and importing.
7. The use of Turtle Excluder Device (TED) in shrimp trawl has been enforced in 1996.

## Hatcheries

There are a number of sea turtle hatcheries in Thailand which are managed by different government agencies as follows:

- Eastern Marine and Coastal Resources Research Centre in the Gulf of Thailand, Rayong Province (Mannai Sea Turtles Conservation Station) is managed by the Department of Marine and Coastal Resources.
- Sea Turtles Conservation Centre in the gulf of Thailand, Chonburi Province is managed by the Royal Thai Navy.
- Andaman Marine and Coastal Resources Research and Development Institute in the Andaman Sea coast (Phuket Marine Biological Centre) is managed by the Department of Marine and Coastal Resources.
- Coastal Fisheries Research and Development Centres (located along the coast line of the Gulf of Thailand and Andaman Sea) are managed by the Department of Fisheries.
- National Marine Parks are managed by the Ministry of Natural Resources and Environment.

**Plate 74.** Sea Turtle Hatchery in Thailand

The number of hatchlings produced by the hatcheries from 1980 to 2000 in Thailand is shown in Table 8.

**Table 8.** Number of Incubated Eggs and Hatchlings Released from the Hatcheries in Thailand: 1980-1994

| Locations | Year | No. of Eggs Incubated | No. of Hatchlings Released |
|---|---|---|---|
| Mannai Island | 1980-2003 | 118,862 | 38,381 |
| Khram Island | 1983-2003 | 106,147 | 61,500 |
| Similan Island | 1996-2001 | 20,693 | 13,350 |
| Trang Province | 1990-1994 | 1,655 | 904 |
| **Total** | | **247,357** | **114,135** |

Several NGOs also participated in hatchery activities such as:

1. Yardfon Association in Trang Province.
2. Mai Khaw Beach Sea Turtles Conservation Club in Phuket Province.

**Plate 75.** Releasing of Juvenile Green Turtles in Thailand

## Protected Areas/Sea Turtle Sanctuaries

Habitat protection has been strengthened by increasing the manpower to patrol the nesting beaches during the nesting season. Several agencies, NGOs and other institutions are now involved in environmental protection. By proper coordination, the National Parks and NGOs are able to increase the manpower for patrolling the nesting beaches.

Thailand has established many turtle sanctuaries to protect nesting females and also their eggs. The nesting beaches at Khram Island which was established in 1950 are protected by the Royal Thai Navy. Similan Island, Sirinarth National Park and Lumpee-Thaimuang beach National Park were established in 1961 and are under the management of the Department of National Parks. Mannai Island Sea Turtles Sanctuary was established in 1979 and is managed by the Department of Marine and Coastal Resources. Both the Department of National Parks and the Department of Marine and Coastal Resources are under the Ministry of Natural Resources and Environment (Kuptawatin, 2004a).

The public are prohibited to enter the sea turtle sanctuaries. However, in some sanctuaries, people can visit and study the sea turtles nesting for the purpose of conservation. While they are in the sanctuaries, people are not allowed to make noise, light-up fires or anything else that will disturb the nester.

## Education/Public Awareness

Information concerning the sea turtle biology and conservation management has been provided to the public. Local educational campaigns on the plight of the sea turtles have been done in order to educate local people not to take sea turtles eggs for consumption. T-shirts, articles, newspapers, slide shows, radio and television announcements, posters and exhibition of the life history of the sea turtles were distributed for public awareness. The people were also invited to participate in the program of releasing young sea turtles into the sea. This impressive act created enthusiastic feelings of saving the sea turtles in the mind of the people. The agencies involved in the education campaigns are the DOF, Royal Thai Navy, Department of Marine and Coastal Resources and Department of National Parks, Wildlife and Flora (Charuchinda and Chantrapornsyl, 1999). The NGOs such as the Mai Khaw Beach Sea Turtles Conservation Club and Yard Fon Association were also involved in the campaign.

**Plate 76.** Rearing of GreenTurtles Hatchings for Public Awareness

## Tagging and Satellite Telemetry Tracking Activities

Information on feeding, foraging habitats, knowledge on life cycle and reproductive biology of sea turtles is still limited in Thailand. Tagging activities in Thailand was done by using flipper tags (inconel and plastic tags) and PIT tag. A total of 149 female green turtles were tagged with PITs during the nesting season at Khram Island from 1994-2003. Female green turtles could return to nest 3-6 times in the same year of the nesting season (Kuptawatin, 2004b).

In order to study the migration route and foraging habitats of sea turtles, the satellite telemetry tracking method for adult female sea turtles was applied. In 2000, five post-nesting green turtles were attached with PTTs in the Gulf of Thailand. The results showed that 4 different migration patterns were recorded. The first route was found from 2 females at Khram Island where they were still staying around the nesting areas. The second route was found from one turtle traced from Mannai Island where she travelled by passing through the Gulf of Thailand heading to the south. The third route was from another 2 females, one route to the southeastern coast of the Gulf of Vietnam Peninsula, and after that she travelled to the east, across the South China Sea to the north of Sabah. The other one heads in the same direction as the first one but stopped travelling in October where it stayed around the Rong Island of Cambodia until the last signal. The fourth route was from a turtle which crossed the Gulf of Thailand to the western coast and headed to south. The female turtles which nested in the gulf of Thailand, migrated a long distance from different feeding grounds and habitats but were still within the region (Charuchinda et al. 2003a).

**Plate 77.** Tagging of a Juvenile Green Turtle Using PIT Tag Before Releasing

During the same year, four green turtles were attached with PTTs and released from Phuket and Similan Islands. Two turtles went to the southwestern coast of Thailand while the third swam to the northwestern coast. The fourth moved to Andaman Island, India. The destination of these turtles was the sea grass habitats. The duration of the PTT signal was between 3-32 days. During cruising and feeding, the adult turtles swam 18-66 and 2-12 km/day respectively. In 2001, four hawksbills were attached with PTTs. Signal data obtained showed that all turtles moved randomly along the coastline in the northern part of the Gulf of Thailand, with a depth of 20 meters, probably to search for suitable feeding areas. Swimming speed was estimated in a range of about 0.45-0.57 km/hr (Kuptawatin, 2004b).

From 2001-2002, eight post-nesting greens were attached with PTTs and released from Huyong Island at the Andaman coastline. During inter-nesting period which lasts up to 100 days, the turtles aggregated mainly within 27 km from the nesting island. After the last nesting, all the turtles headed to Andaman Island (Kuptawatin, 2004b).

In 2002, one female loggerhead was attached with a PTT and released from Mannai Island. The turtle headed in a southwestward direction across the Gulf of Thailand, passed through the South China Sea

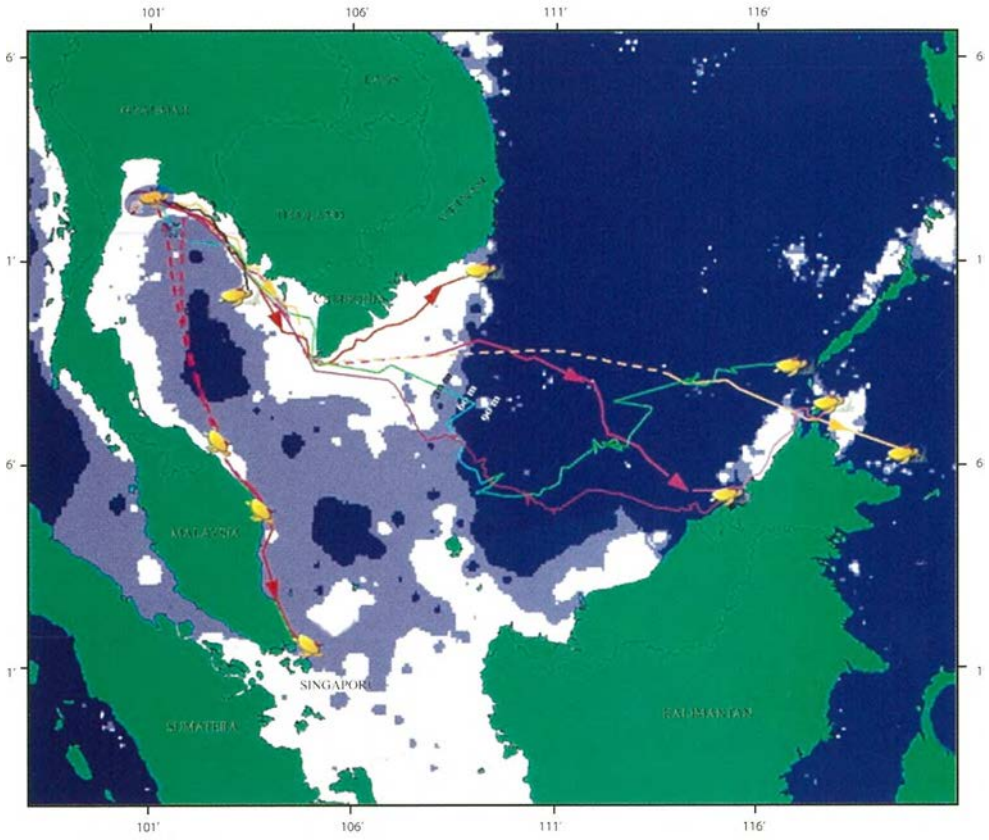



**Figure 18.** Migratory Pathway of Green Turtle Tracked by Satellite after Nesting in Thailand

off Peninsular Malaysia, crossed Indonesian waters to the Western Coast of Australia with the distance of 3,985 km from the releasing point in Thailand (Charuchinda et al. 2003b).

In the same year, two female hawksbills attached with PTTs were released at Ira and Lan Islands in the inner Gulf of Thailand. During February to March 2002, both hawksbills nested and moved within 25 km from their nesting beach. This data showed that post-nesting hawksbills do not immediately migrate to foraging areas but still move around the nesting beach (Monanunsap et al. 2003).

In March 2003, one green turtle was attached with a PTT at Mannai Island and, after being released for 20 days, the signal was lost. One post-nesting green turtle was attached with a PTT at Khra Island in Nakhonsrithammaraj province at the end of July. She swam to the south during the end of August where she stayed near Singapore. Her swimming speed ranged from 40-50 km/day (Kuptawtin, 2004b).

## International/Regional Cooperation

With regard to the conservation and enhancement of sea turtles, Thailand has collaborations with several international and regional organizations such as:

1. Sea turtle tagging program with SEAFDEC/MFRDMD.
2. Sea turtle hatchery management with SEAFDEC/MFRDMD.
3. Southeast Asia Sea Turtle Cooperative Research (SEASTAR2000).
4. Thailand is a party of CITES since 1983.
5. Thailand has signed the MoU on ASEAN Sea Turtle Conservation and Protection in September 1997.

## Research Activities

Two main institutions in Thailand actively involved in conducting research on sea turtles in various aspects are Eastern Marine and Coastal Resources Research Center and Andaman Marine and Coastal Resources Research Institute. Many publications are published locally and internationally.

The key persons who are actively involve in sea turtles issues in Thailand are as follows:

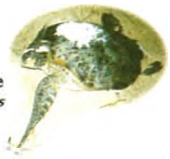
1. Mr. Mickmin Charuchinda,
   Eastern Marine and Coastal Resources Research Center (EMCOR),
   237 Moo 6, Tumbon Kram,
   Klaeng District, Rayong Province,
   21190 Thailand.
   Tel: 66-38-657466
   Fax: 66-38-657466
   E-mail: mannai@loxinfo.co.th

2. Mr. Somchai Monanunsap,
   Eastern Marine and Coastal Resources Research Center (EMCOR),
   237 Moo 6, Tumbon Kram,
   Klaeng District, Rayong Province,
   21190 Thailand.
   Tel: 66-38-657466
   Fax: 66-38-657466
   E-mail: mannai@loxinfo.co.th

3. Mr. Supot Chantrapornsyl,
   Phuket Marine Biological Center,
   P.O. Box 60, Phuket,
   83000 Thailand.

4. Mr. Kongkiat Kittiwattanawong ,
   Phuket Marine Biological Center,
   P.O. Box 60, Phuket,
   83000 Thailand.

**Phan Hong Dung**




# VIETNAM

## Introduction

The seawater of Vietnam is recognized as a critical habitat for the sea turtles in the world. There are only 5 species of sea turtles, namely greens, hawksbill, olive ridley, loggerhead and leatherback turtles found in Vietnam waters (Vinh and Tuoc, 1999; Dung, 2003). The distribution of the sea turtle in Vietnam is shown in Figure 19.

The Government of Vietnam recognizes the important of the sea turtles' conservation and enhancement. Since early 1998, the Ministry of Fisheries has appointed the Research Institute for Marine Fisheries (RIMF) as the national institution taking responsibility for research activities and proposing the general framework in conservation and enhancement of sea turtles in Vietnam (Dung, 2003).

## Sea Turtles Conservation and Enhancement

### Legislations and Regulations

There were no special enactments, regulations pertaining to sea turtles in Vietnam before April, 2002. However, the following legal documents issued by the Government of Vietnam relating to the fisheries resources protection and development (including sea turtles) can be used:

- Ordinance dated 25 April 1989 on protection and development of fisheries resources, which stipulated that:

"Prohibit any actions causing harmful affects on resources, habitats of aquatic living resources "(Chapter I, Article 5).

"Exploitation and commerce of living aquatic resources of high economic value being rare, threatened or endangered should be banned" (Chapter II, Article 12).

The Ministry of Fisheries of Vietnam has also issued other relating documents, namely:

- Circular No 04-TS/TT dated 4 August 1990 guiding execution of ordinance on protection and development of fisheries resources.
- Circular No 04-TS/TT dated 21 November 1994 guiding the execution of enactment No 85-CP on administrative punishment in fisheries resources protection.
- Decision 682 TS/QD dated 11 September 1993 enacting the provisions on marine resources exploitation and management in key fishing grounds.
- The ordinance dated 25 April 1989 stipulates that " The Government of Vietnam welcomes and is ready to cooperate closely with any regional and international organizations in protecting, conserving fisheries resources, their habitats and other shared aquatic living resources".

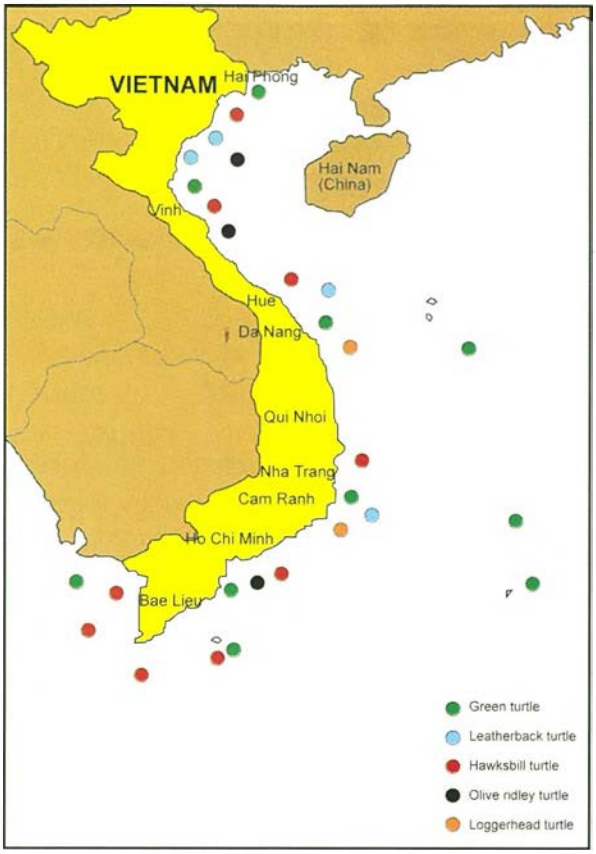



**Figure 19.** Distribution of Sea Turtle Nesting Beaches in Vietnam

- Most importantly, in April 2002, the Government of Vietnam amended Decree 48/CP to include sea turtles. Under this decree the deliberate catch, killing or use of sea turtles is illegal.

There are also rules and regulations related to sea turtles conservation in Con Dao National Park:

- Con Dao District People's Committee issued an announcement on the continuing enforcement of the previous introduction on 1 August 1978. The announcement defined: "from now on, fishing groups and people must not catch marine turtles, including male green turtles. In case of incidental catch, live turtles must be released immediately. Selling and killing for food is not allowed".
- Con Dao District People's Committee issued announcement No. 22/TB.UBQ defining "nobody is allowed to take any green or hawksbill turtle, or their products out of Con Dao" on 15 May 1981.
- The standing Committee of Con Dao District People's Committee issued an Instruction No. 01/TTLL defining: "Hawksbill, green turtles belong to the National Park, managed by the State on 1 September 1988. Violation will be settled according to the law".
- Con Dao District People's Committee issued introduction No. 02/CT.UB.890 regarding the protection of fishing grounds, natural resource and environment in marine and coastal areas in Con Dao on 14 February 1989. This instruction had more comprehensive outlines.

- Defined a corridor of 10 nautical miles around Con Dao. In this corridor, hunting of hawksbill and green turtles is banned. In marine turtle nesting season, fishing nets of all kind are not allowed to be set in front of their nesting beaches.
- Hunting, catching of green and hawksbill turtles or turtle egg collection in banned.
- In nesting season of marine turtles, people are not allowed to make fires on their nesting beaches. People must not cause any damage to the nesting beaches such as polluting the beaches, or to carry out any activities which have impacts on marine turtles.
- Buying and transport of marine turtles (live, stuffed or processed products) is banned.
- Con Dao District People's Committee issued an Introduction No. 02/CT.UB.96 regarding the strengthening of the management of natural resource and environmental protection in Con Dao District on 3 April 1996. The introduction has the content of awareness raised on forest protection, forest fire prevention, immediate actions against forest destruction, hunting of wildlife, using chemicals to catch fish, destruction of coral reefs, which have bad impacts on the marine, coastal and terrestrial environment, especially the buffer zone around Con Dao.

## Hatcheries

The sea turtles hatcheries in Vietnam are located at Nui Chua (Ninh Thuan Province), CDNP(5 hatcheries), Phu Quy Island, Phu Quoc Island and Tho Chu Island. These hatcheries are managed by RIMF and the Fish Protection Department under the Ministry of Fisheries and also the Protected Forest Department under the Ministry of Agriculture and Rural Development.

From 1994-2002, a total of 304,950 hatchlings were released into the sea, and this figure is gradually increasing as shown in Table 9. WWF-Indochina is actively involved in sea turtle hatchery activities in Vietnam.

**Plate 78.** Sea Turtle Hatchery at Con Dao National Park

**Table 9.** Hatchlings Released from the Hatcheries in Vietnam: 1994-2002

| Year | Hatchlings Released |
|---|---|
| 1994 | 6,000 |
| 1995 | 28,500 |
| 1997 | 70,000 |
| 2001 | 90,000 |
| 2002 | 110,450 |
| **Total** | **304,950** |

The emergence success ranged between 19.9-84.4% with an average of 67% during the period of 1994-2003 as shown in Table 10.

**Table 10.** The Emergence Success of Sea Turtles: 1994-2003

| Year | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| Hatching rate (%) | 19.9 | 35.3 | 74.4 | 75.3 | 78.3 | 80.3 | 81.2 | 84.4 | 73.2 | 67.0 |

Source: (RIMF_MoFI, WWF and IUCN, 2003).

**Plate 79.** Releasing of Sea Turtle Hatchlings from the Hatchery

## Protected Areas/Sea Turtle Sanctuaries

Protected areas in Vietnam consists of 15 of Marine Protected Areas (MPA) and 10 coastal wetlands in coastal areas. Con Dao National Park (CDNP) was established in 1984, while Nui Chua natural reserve area and the other 14 MPAs were established in 2000. They are under the management of RIMF, Fish Protection Department and Protected Forest Department. CDNP is the most popular protected area in Vietnam.

### Con Dao National Park (CDNP)

Con Dao is an island archipelago of Ba Ria - Vung Tau Province, located to the southeast of the coast of South Vietnam, 97 nautical miles from Vung Tau. The archipelago consists of 16 islands, with total areas of over 72 $km^2$. The forest and marine ecosystems are still relatively pristine due to less destructive activities compared to other areas of Vietnam (Thuong, 1999).

It was first set up in 1985 to protect the terrestrial ecosystems, mainly forest, on the islands. Full National Park status and recognition was granted by the Vietnam Government in 1993. In 1997, the park borders were extended to 19,998 hectares, including 5,998 hectares of forest and 14,000 hectares of sea. As such, the park occupies 80% of the islands' area, including all of the outlying islands. The marine resources of the park are rich and include coral reefs, seagrass beds and endangered species such as green and hawksbill turtles and the rare dugong, or sea cow (Thuong, 1999).

**Plate 80.** Sea Turtle Rookery at Con Dao National Park

Seagrass beds are found in the waters of the archipelago, notably the Con Son bay area. Seagrass beds are an important feeding ground for green turtles, but more importantly they are the main grazing grounds for the dugong. Con Dao has been included in the list of "areas of highest regional priority" in the World Bank's Global System of Marine Protected Areas. For these reasons, conservation activities on Con Dao should be considered of paramount importance for the marine ecosystems of the Asia-Pacific Region (Thuong, 1999).

Con Dao is the most important sea turtles site in Vietnam, and is likely to be one of the most important in Southeast Asia. There were nearly 500 turtle nests recorded in 1998 on the only five monitored beaches on Con Dao, not including the many other sites on beaches all over the archipelago. The idea of sea turtles conservation in Con Dao was mooted by the park authorities in 1995. This is a program of reducing hatchling mortality of sea turtles. The south-western wind annually makes sand expanses in islands eroded by tides and hence the nesting grounds of the sea turtle are affected. As a consequence, a large number of turtle eggs are destroyed. Therefore, the program of sea turtle's rescue has been conducted to minimize the loss from this 'washout' effect (Thuong, 1999).

A small grant was provided to CDNP in June 1995. A visit by marine experts from the World Wildlife Fund (WWF-Philippines) from August to September 1995 resulted in a series of recommendations which enabled the CDNP staff to make important improvements to their program to protect and conserve nesting beaches for hawksbill and green turtles. These beaches lie on four of the outer islands of the Con Dao archipelago. WWF-Indochina Program in collaboration with the CDNP set up a sea turtles conservation project, which started in 1995 and has been on-going since then. The project has been funded by WWF-International, WWF-United States and WWF-Netherlands during the last four years (Thuong, 1999).

Currently, there are a few studies that are being done at CDNP and Nui Chua natural reserve area. They are:

- The study on tagging, nesting behaviour and biology.
- The study on affect of environmental factor/hatchling rate, negative impact of fishing gears on sea turtles.
- The study on satellite telemetry tracking of sea turtles.

## Education/Public Awareness

The Government of Vietnam, in collaboration with other agencies and also NGOs such as United Nation Development Project (UNDP), Global Environmental Facility (GEF), National Oceanic and Atmospheric Administration (NOAA), Danish International Development Aid (DANIDA),

International Union for the Conservation of Nature and Natural Resources (IUCN) Vietnam, Traffic Indochina and also WWF-Indochina have conducted training activities, seminars, exhibitions, posters, pamphlets, TV programs and videos to educate the public and create awareness among them on the importance of sea turtles' conservation.

## Awareness-Raising Activities

Various activities on public awareness of sea turtles conservation and enhancement are conducted in Vietnam. The activities are as follows:

- The Science Department of CDNP briefed about Con Dao marine resources and sea turtles conservation activities to 3 agencies, namely the Local History Museum (20 people), Vo Thi Sau Secondary School (20 people) and C10 Military barracks in the Park on 20 March 1998.
- The CDNP organized a workshop on "Natural Resources Conservation and Planning of Con Dao National Park" on 15 June 1998. The workshop explained about the sea turtles conservation program to the park staff and local authority. A total of 50 people attended the workshop.
- The Science Department of CDNP organized a program for C10 Military Barracks to study the natural resources of CDNP, including an introduction the dugong and sea turtles on 23 September 1998. A total of 40 people joined the program.
- The CDNP organized a meeting with students of Vo Thi Sau Secondary School and briefed on the coral reefs, seagrass and Con Dao marine mammals with a slide show and lectures on 25 September 1998. A total of 40 students and 15 teachers attended the meeting and showed their interest in nature conservation.

## Clean-up Activities

In the beginning of every nesting season, the park rangers carry out clean-up activities on nesting beaches in order not to disturb adult female turtles easy access to nesting sites.

On Environment's Day dated 5 June 1998, the CDNP in collaboration with the local History Museum and Vo Thi Sau Secondary School organized a clean-up program in Con Dao Bay, including Con Dao Port. A total of 60 people took part in the program with a banner "Save Our Sea".

## Other Activities

- Printing of sea turtles pictures on t-shirts for public awareness in 1998.
- Notice billboards around the park.
- English language training to senior staff members to help in communication skills and reading/ writing international reports.

## Tagging and Satellite Telemetry Tracking Activities

Tagging of sea turtles started at CDNP in 1998 using 2000 inconel tags provided by SEAFDEC/ MFRDMD and also self-made tags. From August 1998 to August 2003, a total of 1320 turtles had been tagged (Dung, 2004).

The satellite telemetry tracking studies for two green turtles had been conducted to determine their routes and feeding ground at the southern part of Vietnam waters. The studies were conducted at two rookeries at Hon Bay Canh and Hon Cai Lon Island of CDNP. Unfortunately, a green turtle attached with PTT with its identification number TE 19590 (USA) was lost at Hon Cai Lon Island. Another one was attached with a PTT on 3 July 2001. After 8 days, a turtle was traced near Vung Tau, 150 km north-west landward. She travelled for 30 days before nesting on Phu Quy Island, which is about 342 km from the starting point. These satellite telemetry tracking activities were sponsored by NOAA of the United States of America (Dung, 2004).

**Plate 81.** Tagging of Front Flippers of Green Turtle in Vietnam

**Plate 82.** Fitting of PTT on the Carapace of a Green Turtle for Satellite Tracking

## International/Regional Cooperation

List of international and regional organizations that Vietnam has collaborated with are as follows:

1. CITES: Study on sea turtles taxonomy.
2. SEAFDEC/MFRDMD: Study on sea turtles tagging.
3. CMS: Sea turtles survey.
4. ASEAN: Establishment of marine park.
5. IUCN: Setting up National Action Plan.
6. Fauna and Flora International: Marine biodiversity.
7. NOAA and WWF: Satellite telemetry tracking.

## Research Activities

Persons who are actively involved in sea turtles issues in Vietnam are as follows:

1. Mr. Phan Hong Dung,
Research Institute of Marine Fisheries,
Ministry of Fisheries,
170 Lelai Street, Haiphong,
Socialist Republic of Vietnam.
Tel: 84-31-7677277 / 860525
Fax: 84-31-836812
E-mail: dung1960@yahoo.com

2. Mr. Dinh Thanh Dat,
Research Institute of Marine Fisheries,
Ministry of Fisheries,
170 Lelai Street, Haiphong,
Socialist Republic of Vietnam.
Tel: 84-31-7677277 / 860525
Fax: 84-31-836812

3. Professor Pham Thuoc,
Research Institute of Marine Fisheries,
Ministry of Fisheries,
170 Lelai Street, Haiphong,
Socialist Republic of Vietnam.
Tel: 84-31-7677277 / 860525
Fax: 84-31-836812

4. Mr. Nguyen Duy Hong,
Fisheries Resources Conservation Division,
Ministry of Fisheries,
Socialist Republic of Vietnam.
Tel: 84-4-8345953
Fax: 84-4-7716702
E-mail: trandiemlan@mofi.gov.vn

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## Southeast Asian Fisheries Development Center (SEAFDEC)

### What is SEAFDEC?

SEAFDEC is an autonomous intergovernmental body established as a regional treaty organization in 1967 to promote fisheries development in Southest Asia.

### Objectives

SEAFDEC aims specifically to develop fishery potentials in the region through training, research and information services in order to improve food supply through rational utilization of fisheries resources in the region.

### Functions

To achieve its objectives the Center has the following functions:

1. To offer training courses, and to organize workshops and seminars, in fishing technology, marine engineering, extension methodology, post-harvest technology, and aquaculture;

2. To conduct research and development in fishing gear technology, fishing ground surveys, post-harvest technology and aquaculture, to examine problems related to the handling of fish at sea and quality control, and to undertake studies on the fisheries resources in the region; and

3. To arrange for the transfer of technology to the countries in the region and to make available the printed and non-printed media, which include the publication of statistical bulletins for the exchange and dissemination related to fisheries and aquaculture development.

### Membership

SEAFDEC membership is open to all Southeast Asian Countries. The Member Countries of SEAFDEC at present are Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam.

## SEAFDEC Addresses


Secretariat

P.O Box 1046
Kasetsart Post Office
Bangkok 10903
Thailand
Tel: (66-2)940-6326 to 9
Fax: (66-2)940-6336
E-mail: secretariat@seafdec.org
http://www.seafdec.org

Training Department (TD)

P.O Box 97
Phrasamutchedi
Samut Prakan 10290
Thailand
Tel: (66-2)425-6100
Fax: (66-2)425-6110 to 11
E-mail: td@seafdec.org
http://www.seafdec.org/td

Marine Fisheries Research Department (MFRD)

2 Perahu Road
off Lim Chu Kang Road
Singapore 718915
Tel: (65)6790-7973
Fax: (65)6861-3196
E-mail: mfrdlibr@pacific.net.sg
http://www.seafdec.org/mfrd

Aqualture Department (AQD)

Tigbauan, Iloilo 5021
Republic of the Philippines
Tel: (63-33)335-1009,336-2891
336-2397,336-2965
Fax: (63-33)335-1008
Email: aqdchief@aqd.seafdec.org.ph
http://www.seafdec.org/aqd
http;//www.seafdec.org.ph

Marine Fishery Resources Development and Management Department (MFRDMD)

Taman Perikanan Chendering,
21080 Kuala Terengganu,
Malaysia
Tel: (609)616-3150
Fax: (609)617-5136
E-mail: seafdec@mfrdmd.org/.my
http://www.seafdec.org/mfrdmd