

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

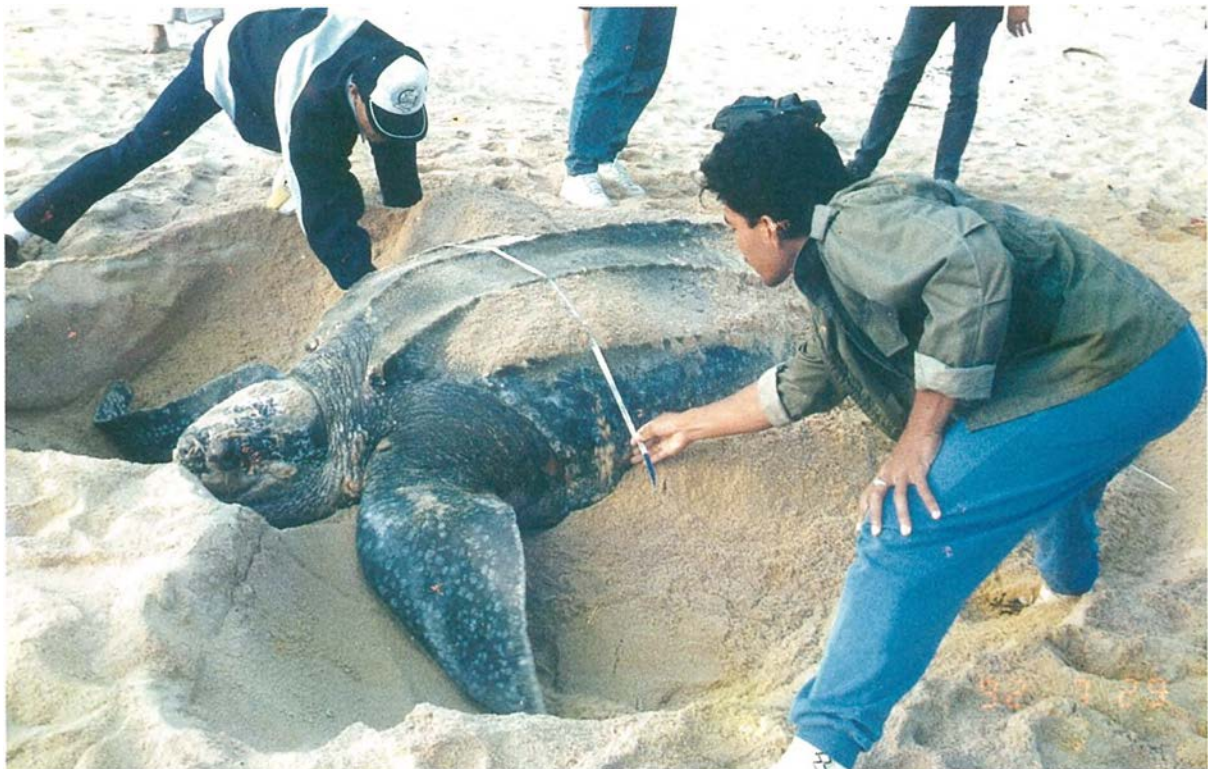


Plate 2. Sea Turtle Research Activities in Malaysia in 1990's Using National Fund

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 crocodylians, 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:

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



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 Demonstrations 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 through 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.

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



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

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.

