



**INTERNATIONAL WORKSHOP ON THE MIGRATION,
FORAGING HABITATS AND NESTING ECOLOGY OF
MARINE TURTLES IN TAIWAN**

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Editors

Cheng, I-Jiunn
Chen, chia-ming
Wei, Trip-Ping

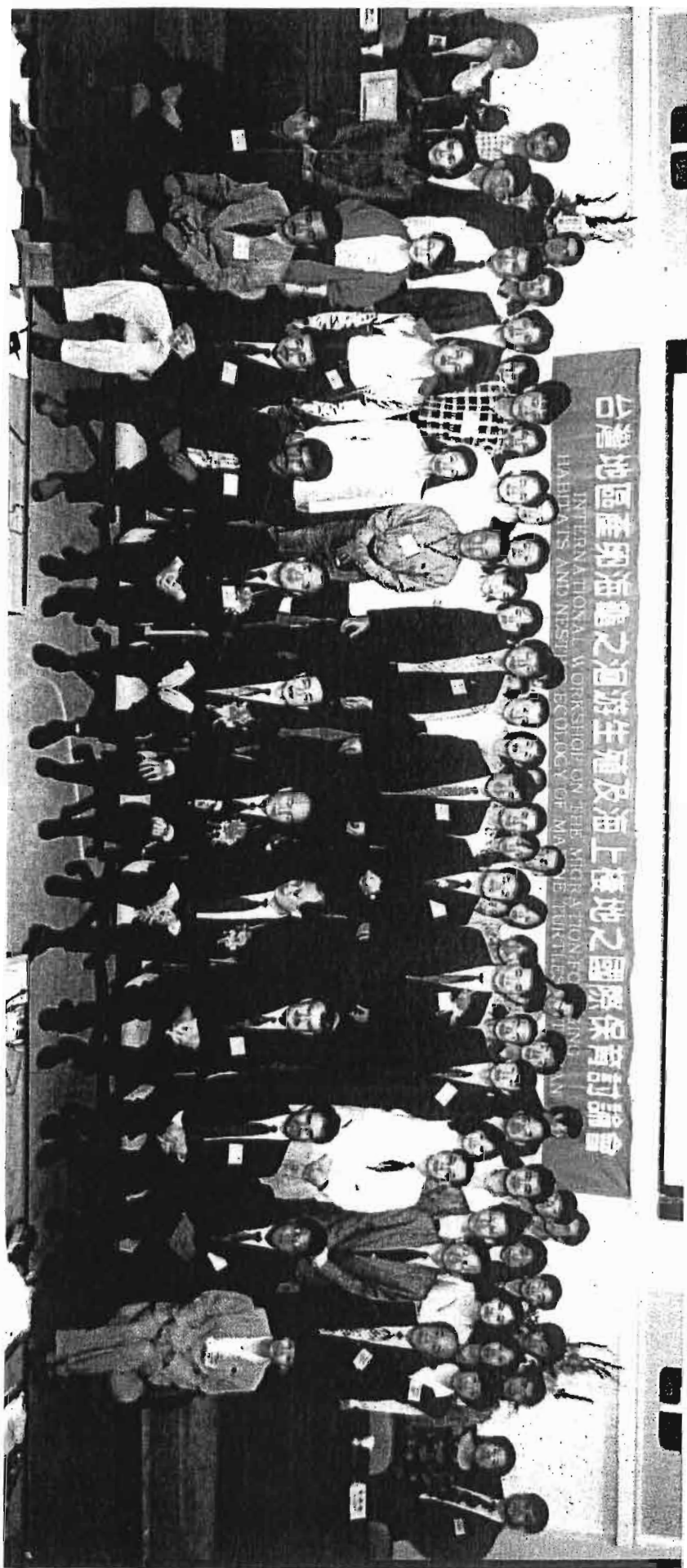
Institute of Marine Biology, National Taiwan Ocean University
Keelung, Taiwan, 202-24, R.O.C.

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Executive Summary

Problem

Sea turtles are endangered species. The characters of long-distance migration in the ocean and late maturity not only make them vulnerable to human exploitation, but also create many difficulties in the study of their life history. In spite the conservation efforts from public and private sectors, many of their populations are continuing to decline, especially in the Asian region. The satellite telemetry conducted since 1994 showed that the green turtles that nest at Wan-An Island, Penghu Archipelago of Taiwan dispersed widely on the continental shelves each of Mainland China. These results stress the importance of regional and international cooperation on sea turtle conservation efforts.

Purposes

The purposes of the workshop are first to promote and foster the information exchange on sea turtle research and conservation with nations that share the critical habitats of the green turtles that nest in Taiwan, and second, to seek the possibility of bi-lateral cooperation between these nations and Republic of China.

Planning Action Plans for the Future

The Council of Agriculture and Environmental Protection Agency of the Republic of China sponsored the International Workshop on the Migration, Foraging Habitats and Nesting Ecology of Marine Turtles in Taiwan held in April 1999. Scientists and experts and other authorities from eight nations and regions met to discuss and recommend the activities that can be used to protect the sea turtles that nest at Wan-An Island, Penghu Archipelago of Taiwan. In summary, the experts recommended (1) more genetic studies, (2) more conservation and public awareness campaigns on both the nesting and foraging sites, (3) tagging studies on the hatchling and the by-catch turtles and the use of PIT tags, (4) more information on the regional distribution of seagrass and coral reefs, (5) understanding the potential threats along the migratory route, (6) site visits, information exchanges and interviews with local people and experts at the end-point of the migration route, to understand the marine

environments, (7) collaborate research with oceanography and fishery experts, (8) international cooperation with the nations in the region, (9) training the next generation of sea turtle biologist and develop a graduate program to study the marine environment domestic end-point, (10) establishment a Taiwan sea turtle website. This workshop was envisioned by the participants as a valuable stepping-stone to the regional cooperation on sea turtle research and conservation efforts.

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Introduction

Background and Rationale

Sea turtles are long-lived reptiles that have existed on earth more than 250 million years. The characters of long-distance migration and late maturity make it especially vulnerable to human exploitation throughout their life stages. These characters also create many difficulties in the study of their life history. All these problems handicap the conservation of sea turtles. In spite of the efforts from national and international agencies, government, and NGO's in protecting the animals and their habitats, especially the nesting beaches, their populations continue to decline, possibly toward extinction.

Tracking of sea turtles in the ocean has been a major problem in the past. Tagging and helium balloons have been used to study the migration of sea turtles (Carr, 1967; Meylan, 1982; Mortimer and Carr, 1987). However, because of the high tag loss rate and even at best, only release and recapture location data become available these methods provide but scanty information. Since the early 80', the practical application of satellite telemetry to wildlife has allowed us to study the long-distance migration behavior of sea turtles, including their migration routes and diving activities, for both adults and juveniles (Stoneburner, 1982; Timko and Kolz, 1982; Balazs et al., 1994; Bolten et al., 1994; Plotkin et al., 1994; Liew et al., 1995; Papi et al., 1995). This technique does provide the ground truth for the researches and conservation efforts of sea turtles.

Under the support of the Council of Agriculture, sea turtle research and conservation has been conducted in Taiwan since 1991 (Council of Agriculture, 1995). In spite of only two major nesting sites; (Wan-An Island of Penghu Archipelago and Lanyu Island of Taitung Count), the nesting population on each island ranges only from 8 to 14 turtles and produces 50 to 70 clutches each season. The Council of Agriculture designated the nesting beaches on Wan-An Island as a sanctuary site in December 1995 (Cheng, 1995; Council of Agriculture, 1995). In addition to the intense studies and protection of the nesting sites, such as nesting

ecology, nest site selection, applying GIS techniques, estimates the sex ratio of hatchlings etc. Since 1994, satellite telemetry has also conducted determine the whereabouts of nesting turtles while they are at sea since 1994. Results from 1994 until 1997 showed that the marine habitats of these turtles distributed widely on the continental shelves east of Mainland China. These results stress the importance of regional and international cooperation on sea turtle conservation efforts (Cheng, 2000). Thus, the first purpose of this workshop was to promote information exchange and foster conservation of sea turtles that internationally share critical habitats with Taiwan. Second, this workshop investigated the possibility of bi-lateral cooperation between these nations and the Republic of China.

International Workshop

Both Council of Agriculture sponsored the workshop and Environmental Agency of R.O.C. Eight participants from the US, Japan, Malaysia, Philippine, Mainland China and Hong Kong and a physical oceanographer from the Institute of Oceanography, National Taiwan University, R.O.C. In addition, Dr. Saif, Al-Ghais from United Arab Emirates and Dr. D. Hykle from the Convention of Migratory Species (CMS) were also invited as the observers to the workshop. Mr. G.H. Balazs from the NOAA, NMFS Southwest Fisheries Service Center, U.S. participated as the scientific advisor.

The workshop was divided into two parts. On April 12, a public presentation was held and each participant gave a briefing on the conservation efforts and/or research of their native country. From April 13 to 14, after a one-hour presentation on the sea turtle research and conservation efforts in Taiwan by I-J. Cheng, the end-point marine environment of each telemetry route was discussed in detailed. To our surprise, very little information was known in the target areas. Furthermore, except a few sites, most marine environments at the end-point of migration are not protected. The results strongly suggested the urgent needs to conduct oceanographic and benthic ecology research and establish the marine park to protect the foraging sites of sea turtles.

The workshop also stressed the importance of incorporating the oceanography, fishery sectors, and local people in the sea turtle research and conservation.

Summary of the Recommendations from the Participants of the Workshop

In addition to the support of on-going research and conservation projects, the participants of the workshop also recommended that:

1. More research is needed on the genetics of sea turtles.
2. More conservation and public awareness campaigns are needed on both the nesting and foraging sites (such as Pratas Islands, Hainan Island) of the green turtles.
3. Tagging studies should be conducted on the hatchlings, by-catch turtles, and the application of PIT tags to the nesting turtles.
4. More information is needed on the regional (Asian region) distribution of seagrass and coral reefs.
5. A better understanding is needed of the mechanisms of migration and potential threats along the migration route of sea turtles.
6. Site visits, information exchange and interviews of local people are needed at the end-point of post-nesting migration, and understand its marine environment.
7. Collaborate research is needed with oceanography and fishery experts.
8. International cooperation is essential with the nations in the region, (e.g. joint research at cross-border between Lanyu and Batanes Islands), and the identification of the potential funding sources for this purpose.
9. Train the next generation of sea turtle biologists and develop the graduate programs should be implemented to study the domestic migration end-point marine environments.
10. A Taiwan sea turtle web-site should be created.

Possible Action Plans for the Future

1. Collaborate research with the oceanographers on the migrations of the hatchlings and satellite-tracking turtles.

2. Site visits to the end-point of the migratory routes identified by the satellite telemetry.
3. Tagging studies on the hatchlings and turtles taken as by-catch.
4. Obtaining information on sea grass beds and coral reef on a regional scale.
5. Collaborate genetic studies with nations in the Asian regions.
6. Joint research and conservation efforts between
 - a) Lanyu and Batanes Islands,
 - b) Japan,
 - c) Hong Kong, and expand to the China Region,
 - d) Nations in the South China Sea.
7. Training the next generation of sea turtle biologists.
8. Setting up a Taiwan Sea Turtle Web-Site.
9. Enhance the conservation and public awareness campaigns on both the nesting and foraging sites.
10. Obtaining information on the regional distribution of seagrass and coral reefs

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Appendix A --- Workshop participants

Dr. Saif, Al-Ghais

Environmental Research and Wildlife Development Agency,

P.O. Box 45553, Abu Dhabi, United Arab Emirates

Tel: 971-231-9317

Fax: 971-234-9154

E-mail: alghais@emirates.net.ae

Mr. George H. Balazs

Marine Turtle Research Program

Honolulu Laboratory, Southwest Fisheries Science Center

National Marine Fisheries, Service, NOAA

2570 Dole Street, Honolulu, HI 96822-2396

Tel: 002-1-808 983-5733

Fax: 002-1-808-983-2902

E-mail: gbalazs@honlab.nmfs.hawaii.edu

Dr. Eng-Heng Chan

Sea Turtle Research Unit (SEATRU),

Faculty of Applied Science and Technology,

Universiti Putra Malaysia Terengganu,

21030 Kuala Terengganu, Terengganu D.I., Malaysia.

Tel. 09-6694991(D/L), 6693628/29/30

Fax: 09-6694660

e-mail: ehchan@upmt.edu.my

seatru@upmt.edu.my

hcliew@pop.jaring.my

SEATRU Website: <<http://www.upmt.edu.my/seatru/>>

Dr. Cheng, I-Jiunn

Institute of Marine Biology, National Taiwan Ocean University,

Keelung, Taiwan, 202-24, R.O.C.

Tel: 886-2-2462-2195, exit 5303

Fax: 886-2-24628974

E-mail: b0107@mail.ntou.edu.tw

Dr. Douglas Hykle
UNEP/CMS Deputy Executive Secretary
United Nations premises in Bonn
Martin-Luther-King-Street 8, D-53175 Bonn, Germany
Tel: 49-228-815-2401
Fax: 49-228-815-2449
E-mail: dhykle@cms.une

Dr. Naoki Kamezaki
Sea Turtle Association of Japan
Nagaodai 3-26-18, Hirakata, Osaka, 573-01, Japan
Tel: 81-720-59-5398
Fax: 81-720-59-6962
E-mail: JCG03011@nifty.ne.jp

Mr. Hock-Chark Liew
SEATRU (Sea Turtle Research Unit)
Faculty of Applied Science and Technology
Univerisiti Putra Malaysia Terengganu
21030 Kuala Terengganu, Malaysia
Tel:609 6693628/29/30 D/L:609 6694991
Fax:609 6694660
E-mail: liewhc@upmt.edu.my
SEATRU Homepage:<http://www.upmt.edu.my/seatru/index.html>
SEATRU E-mail: seatru@upmt.edu.my

Dr. Liu, Cho-Teng
Institute of Oceanography, National Taiwan University, Taipei,
106, R.O.C.
Tel: 886-2-2362-0624
Fax: 886-2-2363-5165, or 886-2-2737-7607
E-mail: ctliu@ccms.ntu.edu.tw

Dr. Shi, Haitao
Department of Biology, Hainan Normal University,
Hai-Kuo, Hainan, P.R.O.C.
Tel: 0898-6752479
Fax: 0898-5883035
E-mail: sht@aneca.hainnu.edu.cn

Mr. Hiroyuki Suganuma
Marine Biological Division, Marine Environmental Association
of Tokyo, Yurakucho Building 708, Yurakucho 1-10-1,
Chiyodaku, Tokyo, Japan
Tel: 81-3-3287-2886
Fax; 81-3-3215-2176
E-mail: mtg@biglob.ne.jp

Mr. Romeo B. Trono
Vice-President for Conservation and Field Operations
WWF Philippine
23-A Maalindog Street, U.P. Village, Diliman, Quezon City,
1101, Philippine
Tel: 63-2-433-3220 to 22
Fax: 63-2-426-3927
E-mail: kkp@mozxom.com

Mr. John Man-Kon Wang
Chairman, Hong Kong Marine Conservation Society
15/F., Park Hovan Commercial Building, 18 Hillwood Road, TST,
Kowloon, Hong Kong, P.R.O.C.
Tel: 852-2314-3846
Fax: 852-2314-9420
E-mail: dgjoclub@netvigator.com

**Sea Turtle Research and Conservation
April 13 and 14, 1999**

**Oral presentation I:
Sea Turtle Research, Satellite Tracking, and Conservation in Taiwan
by Dr. I-Jiunn Cheng:**

Taiwan has five species of sea turtles. They are listed as first level endangered species and are protected by the Wildlife Conservation Law. Only the green turtles are nesting in Taiwan.

Turtles and other long-life animals have long been part of the way of life of the Chinese people. Because of their long lives, they have become symbol of luck, longevity, and prosperity. Many of the turtles are used in cultural activities, especially in the coastal areas such as Penghu and Matchu.

Nesting Sites

There used to be several nesting sites in the eastern and southwestern coast of Taiwan. However, due to over exploitation, the sites are no longer visited by the turtles. The current nesting sites for sea turtles are the Wang-an Island, Orchid Island, and the other islands of Penghu archipelago.

Wan-an Island is a small island with 4.7 square-kilometer area, and there are nine nesting sites on the island in the south and in the west. There are fishing villages on the island, and the residents mostly have under average income.

The other nesting site is the Lanyu Island in Taitung. There are two nesting sites on the island. The nesting beaches have mostly sand coming from the mountains, and not the beaches.

There are also nesting sites in Pratas Island and Nansha Island. In the Nansha Island, some 30 to 40 green turtles come to nest every year, and they nest all year round. The main season for nesting is during February and March, and also during summer.

Wan-an Island

On Wan-an Island, the main nesting seasons are during June, July, August, and September. On the average, each turtle emerges four to six times during the nesting season. The inter-nesting period is about 14 days.

After the eggs are laid, the eggs are dug out and measurements of the diameter and weight are taken. If the nest is not a doomed nest, the eggs will be returned to the nest. Otherwise, the nest will be relocated. The hatching period is about 50 days. The turtles also have a high nest fidelity. The turtles like to nest at the interface area between the grass land and the open sea, and in locations very remote from the village. In order to attract the turtles and protect the nesting sites, the sites should be kept as natural and as intact as possible. No permanent artificial buildings should be present on the island.

To determine the sex ratio of the hatchlings, long-term temperature loggers are used, which are buried in different depths of the nest. The main nesting season is during July and August. In September, since the temperature is lower, more males are hatched. The temperature of the beach is also found to be lower than that of the grassland interface zone. Therefore, one possible way to increase the male hatchling is to hire people monitor the hatching during September. Another is not to relocate the nests if they are not doomed, so that more males may be hatched.

Discussions from the participants:

Mr. G. H. Balazs:

In Hawaii, the nesting sites have cool temperature. In theory, cool temperature should result in more male hatchlings, however, Hawaii still has 1:1 sex ratio. Therefore, there may be different pivotal temperatures in the determination of the sex of the hatchlings. It should also be cautioned that a pivotal temperature in one place may or may not apply to other places as well.

Dr. Saif, Al-Ghais:

If we control the sex ratio of the hatchlings, is this also regarded as a kind of human interference?

Dr. D. Hykle:

There may be dangers in a local scale if we manipulate the sexes, but the dangers will not be global.

Dr. R.B. Trono:

In 1987, a sex ratio analysis is performed in Baguan Island. It was found that the hatchlings in the open area were almost 100% female.

The global information system (GIS) are also being used to help study whether the street lights will affect the nesting trails. In addition, the GIS and GPS are also used to determine where the sea turtles stay during the inter-nesting period (home range). In telemetry, the PTT is used to link to the Agro system. The ST-6 was previously used, and the ST-14 is currently being used.

The green turtle are internally shared resources, but they are also facing threats from sand mining and natural predators such as the ghost crabs. In December 1994, a refuge site for nesting turtles was set up in Wang-an Island for the nesting turtles. The hatchlings are usually released during nighttime.

Oral presentations II:

Sea Turtle Conservation in the United Arab Emirates

by Dr. Saif, Al-Ghais:

There are five species of sea turtles in the United Arab Emirates, and only two of the species nest in the UAE. They are the Green Turtle (*Chelonia mydas*) and Hawksbill Turtle (*Eretmochelys imbricata*), which are regularly found to occur in the UAE waters and nest on the local beaches north of the UAE because of the presence of small islands. In the UAE, the sea turtles come in mid-March, and the temperature in June can reach as high as more than 100°F.

Because the UAE is a small country with many development projects near the beaches, turtle conservation is difficult. Many nesting beaches were lost due to sand mining, as well as dams, hotels, and buildings that were being put up near the beaches.

In one of the islands, rearing stations were set up to collect the hatchlings. The hatchlings are kept for one to two years until they reach a certain size, before they are released to sea. The UAE government believes that the rearing stations will help increase the number of sea turtles in nature.

It is estimated that the nesting population in the UAE is about 20 nesting turtles. In 1982, the UAE government issued a decree to forbid the catching and poaching of sea turtles. Prior to that, fishermen and people who live near the sea used to catch and eat sea turtles. After the decree has been issued, although some people still buy sea turtles from the fishermen, the turtles are no longer sold publicly in the markets.

Discussions from the participants:

Dr. D. Hykle:

The value of raising sea turtles in captivity should be seen as a public relations effort and not as a conservation effort. The value of the program is to make the local people aware and interested in the conservation of the sea turtles.

Mr. John Wong:

In Hong Kong, there was one case where the eggs were moved to other nesting places. This was the only case where the eggs were relocated, because the nest was below the high water mark.

Also, in Huidong mainland China, a small number of hatchlings were kept for research.

Discussions of Satellite Tracking Results and Its End-point Marine Environments (led by Dr. I-Jiunn Cheng):

Satellite tracking of the sea turtles started in 1994. It was found that a sea turtle went to Koshikijima in Japan, an island of about 2000 residents. The island is also a nesting site for local loggerheads. Koshikijima is a protected island. The only sea turtles captured on the island are results of bycatch. In Japan, sea turtles are protected by law. The said sea turtle came back to Taiwan after three years.

In Taiwan, there are many set nets and set gill nets used for catching lobsters and prawns. Some of the sea turtles get entangled in the net and they die by drowning. The local fishermen usually release the bycatch.

Mr. G. H. Balazs:

The objective of satellite tracking is to learn about the place based on existing information, and be able to give recommendations for each location. For instance, how many turtles are present in a particular area?

What is the foraging pasture? Has the site been visited? Has any monitoring, assessment been accomplished? Tracking will also enable us to learn about the habitat, what's happening around the area, and what additional information we need to know about each area.

Dr. Naoki Kamezaki:

In Japan, the sea turtles are protected by law. Although the by-catch are released, the death rate of the sea turtles is still high. This is due to the presence of the set nets, gill nets, and trawling nets. Some 50% of the turtles caught by the nets will die.

Although the Japanese people seldom eat turtle meat, the local people at Shikoku eat loggerheads.

Mr. Hock-Chark Liew:

With respect to the marine environment of the end-points, how important are the end-points? The turtles do not end up at the same end-point all the time.

If the sea turtles stay at a particular end-point for more than one month, then the place may be a feeding pasture for the turtles.

Mr. G. H. Balazs:

Sea turtles are also fixated to their foraging pastures as they are to their nesting sites. Because if one turtle went to a particular foraging pasture, it may be assumed that other turtles will go there too. Therefore more local information on such places is needed.

Prof. Eng-Heng Chan:

In most cases, the end-points are remote places, so there is a need to visit these end-points.

Mr. John Wong:

There is a need to understand why the sea turtles go to those end-points? Are they merely riding the currents? We have information about the nesting places, but none about the foraging areas. There is a need to protect these foraging areas, because to protect these areas is also to protect the turtles.

A turtle was tagged in Penghu in 1996. The turtle traveled along the coast of mainland China to Hong Kong, and down to Dangan Island, where the transmission stopped. The place is a popular diving site with lots of coral. There are soft coral and other types of corals. The place is rich in bio-diversity; there are coral fishes, and even reports of sighting of five orcas. The shores are rocky and there are no beaches suitable for nesting.

The south of Hong Kong has beaches that are regular nesting sites for the sea turtles. The place is also heavily fished by trawlers, using line and hook and dynamites. This place is outside of the Hong Kong territory and the marine police cannot control the activities in the area. The coastal areas are also heavily eroded by wind and sea.

The turtles found in the above area are mainly green turtles with mixed sizes. The threats to these turtles are fishing, both dynamite and trawler fishing, the sea traffic between Hong Kong and the mainland, ocean liners, containers, and collision with marine vessels.

The government has taken good measures to protect the turtles, with three agencies enforcing the laws. The marine department also control the operations of the boats. There are 4,800 fish boats in Hong Kong. There is legislation to protect the plants and animals, where the maximum penalty for violation will be 100,000 HK dollars and one year imprisonment.

Mr. Hock-Chark Liew:

1. Sea turtle research in the region is mostly conducted on beach, and not in the foraging areas. There is a lack of information about sea turtles in their foraging areas. As sea turtles spend most of their lives in the water, research in this field is needed.
2. Sampling turtles, such as those conducted by Saif Al-Ghais in UAE can also be undertaken in Taiwan. Instead of the beach seine, the set nets is an excellent opportunity to catch the turtles alive, tag, measure and release them to the sea, and identify the sites where they end up to nest.
3. As more turtles are tracked, one will find other possible end-points. One must not ignore the fact that there are probably many other foraging areas for the turtles that nest in Taiwan.
4. Conduct a regional study of sea grass areas using satellite image techniques with ground verification to locate extensive sea grass areas for follow-up assessment as to their importance as foraging areas for sea turtles.
5. Conservation efforts are mostly on the protection of nesting turtles and nesting beaches. The foraging habitats are often overlooked. This needs to be addressed.

Prof. Eng-Heng Chan:

1. There is a need to establish contact and working relationships with research scientists based near the foraging areas. Visits by Taiwanese scientists to the foraging areas should be encouraged in order that collaborative work can be conducted to understand better the survival chances of Taiwan's nesting turtles at their end points or foraging grounds. Mitigate action should be taken when threats can be identified.

2. End-points very probably serve as foraging grounds for other nesting populations of the region as well. More "in-water" research should be conducted on the turtles, such as determining the genetic profiles. In time, when genetic maps of turtles within the region become available, the turtles can be traced to their respective nesting grounds.
3. There is a need to review the research currently undertaken on the nesting turtles. Some suggestions include:
 - a) Extend egg protection and research beyond the peak-nesting season. Eggs deposited at both tail ends of the peak season may be supplying males to the population.
 - b) Some attention should be placed on tagging data, such as inter-seasonal survivability, tag loss, etc. Attempts should also be made to initiate the use of PIT tags.
4. The research team can be expanded to make turtle conservation an integrated effort. Oceanographers, coral reefs, seaweed and other marine biologists can be roped in to form an integrated team.

Mr. G. H. Balazs:

1. More current and factual information is needed on the end-point foraging areas.
2. Develop a graduate program based on an research of marine habitats, i.e. Che-mei and other places in Taiwan.
3. More information is needed on seaweed and sea grasses that the turtles eat; can't assume that where there is vegetation that's what the turtles are eating.
4. Need to attract graduate students with capability of swimming and

scuba diving for research in the ocean.

5. Invite former students to participate and give presentations of their graduate work at future workshops. Draw upon their expertise.
6. Enhance study of end points by having Dr. Cheng conduct site visits at those places and work with the local counter parts (for example, Kamezaki in Japan- Koshiki Retto). Give lectures there, meet with locals, and generate interest and information.

Dr. R.B. Trono:

1. Suggest the creation of a small working group to identify the potential sources of funds and develop proposals for submission to donor agencies to carry out the recommended actions of this workshop.
2. Conduct more detailed assessment of end-points using standard questionnaires or methodology.
3. Develop common database and interactive web sites for access by the general public and sea turtle specialists.
4. Need to identify and obtain more information on the end-points and foraging habitats.
5. Need to develop the local capacity to monitor and identify end-points.
6. Identify and assess threats along the migratory routes and recommend measures to address these threats.
7. Promote cooperation with Taiwan to conduct joint research (cross-border researches) at assess conditions in the area between Batanes and Orchid Islands.

Prof. Hai-Tao Shi:

In Hainan, conservation is more important than research. However, local residents do not know how to protect the turtles. Some steps that may be taken include:

1. Increase public awareness through promotion.
2. Experts to visit Hainan and survey the current status of sea turtles in the area, in order to suggest conservation methods.
3. Re-introduce sea turtles to the island, for instance, in the Shisha area.
4. Establish more protected area for the turtles.
5. Assist Mainland China in conservation efforts.

Mr. John Wong:

1. Consider establishing a protected area to protect the remaining nesting beaches and prevent further development in these sites.
2. Need more resource and efforts to conserve and protect the habitat in Pratas Islands. There have been reports of hawksbill turtles sighting in the area.
3. Minimize capture of sea turtles through stricter law enforcement and outreach to the public.
4. Share information among different research institutions in Taiwan, for instance, to obtain physical oceanography data such as tide movements, seaweed, and weather data, and turtle sightings from cetacean researchers and whale watching operators.
5. Tagging baby turtles may be useful to find out where these turtles

go. A turtle sighting report form (similar to the ones used in Hong Kong) may be used, and distribute to country fishery officers and other fish scientists.

6. Visits local experts, e.g. Dr. So in Hong Kong and Huidong for information exchange.

Dr. D. Hykle:

1. Follow up information on end-points determined from satellite tracking.
2. Obtain maximum information from the fishery sector, and collaborate efforts with oceanography and other marine experts to take full advantage of their expertise.
3. Train next generation of biologist to carry on work on sea turtles in the future.

Dr. Cho-Teng Liu:

The current research may have reached a stated that it should be further expanded to include: the determination of what routes the turtles take in their migratory path: why do the turtles stop at a particular site; how they behave and who they grow at the end-points; and why do they come back. Some recommendations are:

1. Establish a migration control mechanism.
2. Conduct genetic study; identify the different groups of turtles at the end-points.
3. Make a constant satellite tracking between nesting periods; determine the complete route taken by the turtles.
4. Conduct physical and biological survey of the ocean conditions at

the end-points and the migratory routes.

5. The re-introduction of sea turtle in Hainan will provides incentives for graduate students; the students will have new data that is import for future studies.

Mr. Hiroyuki Suganuma:

1. Regional and international cooperation, i.e. with Hainan, Hong Kong, and other Asian countries, for sea turtle conservation and researches.
2. Exchange of information on conservation efforts and research technology, joint research, etc.

Dr. Naoki Kamezaki:

According to the experiences from loggerhead studies conducted in Japan, conducting research is easier than implementing conservation efforts. We should not shift the responsibility of conservation to the local people. It is the responsibility of all, and not just the responsibility of the people who live near the nesting or foraging areas of the sea turtles.

1. It is not appropriate to rely solely on satellite tracking work. Need also the technology for analyzing DNA. Data from satellite tracking are not enough to understand the behaviors of green turtles.
2. Need to encourage more research in the field like genetic conservation.

Dr. Saif, Al-Ghais:

1. Need to attend annual or bi-annual meetings on sea turtle conservation issues in the region.

2. Conduct educational program.
3. Enhance the low enforcement.

Sea Turtle Conservation in Taiwan and the Using of Satellite Telemetry as a Tool to Reach the Goal of International and Regional Conservation Cooperation

Cheng, I-Jiunn

Institute of Marine Biology, Taiwan Ocean University, Keelung, Taiwan, 202-24, R.O.C.

The Status of Sea Turtles in the Past

There are five species of sea turtle in Taiwan. They are the green turtle *Chelonia mydas*, the hawksbill turtle *Eretmochelys imbricata*, the loggerhead turtle, *Caretta caretta*, the olive ridley turtle, *Lepidochelys olivacea*, and the leatherback turtle, *Dermochelys coriacea*. All these species are listed as endangered species and under full protection of wildlife legislation. Among these five species, the green turtle is the most abundant one and the only one that still nesting in Taiwan these days.

In spite of listing as the endangered species, sea turtles have a deep relationship with the Chinese culture. They existed in the soul of Chinese people for thousands of years. The long life span and numerous life-saving legends and facts have made most Chinese in coastal states believe that this giant creature is the representative of the God. Thus, the local people prepares sea turtle-shaped offerings made from rice, cake, and even gold and pray in the temples during the annual lantern festival for the peace and prosperity.

Ironically, coastal fishermen still harvest sea turtles for meat to consume and bones for Chinese medicines. They poach eggs for fun and sell for profits. Most of the by-catched turtles (by the coastal setnet and drift net fisheries) were slaughtered or sell to the temples for the religious release. Fifty years ago, there are numerous nesting sites distributed on the east and southwest coasts and offshore islands of Taiwan. Right now, only on the beaches of PengHu Archipelago (especially the Wan-An

Island) and Lanyu Island of Taitung County can we still find the nesting green turtles.

Green Turtle Conservation on Wan-An Island, PengHu Archipelago

With the supports of Council of Agriculture (COA), a long-term research project on the reproductive biology of green turtle has started since the summer of 1992. Initially, the project was concentrated on the Wan-An Island of PengHu Archipelago. In 1993, the construction of walkways and bathroom-toilet combination on the nesting beaches had resulted in a strong conflict between the research and tourism. A public hearing was then held in the Legislation House. This action had resulted a strong demand for more sea turtle conservation on the Wan-An Island from conservative NGOs, researchers, press media and public opinions. The COA was then approved a proposal submitted by PengHu County Government to establish the refuge site for the nesting green turtle on Wan-An Island in December 1993. The refuge site was formally authorized in July 1995. The total nesting beaches is about 4 km long and 4.02km².

Researches and Conservation

The researches continued after the establishment of refuge site. The nesting population was found range from 8 to 14 nesters per season, and produced 50 to 70 clutches every year. In addition to the basic study on the reproductive biology of green turtles, we also apply the high technology on the field researches and conservation. We used the combination of GIS (geographic information system) and GPS (global positioning system) to determine the nest site selection of the gravid turtles on the Wan-An Island. In addition, we also combine this technology with the satellite telemetry and ultrasonic acoustic telemetry to determine the home range of the nesting females during their internesting period. The results showed that the gravid turtles would like to select their nesting sites in the interface zone between the open beach and grassland. Together this result with the high nest site fidelity of the green turtles, it is suggested on the management point of view that the

nesting beaches should keep as integrity as possible. The permanent artificial building, sand mining, motorcycle racing, and removal of vegetation should be banned on the nesting beaches. The interesting home range study found that the gravid turtles would spend at least 50% of the time within 5 km from the island with the water depth of less than 20 m. This stresses the importance of conserving the coastal ecosystem of the nesting beach. The submerged coral reefs and rocks surround the Wan-An Island. In addition, the distribution of nesting tracks and nests suggest that the streetlights have little effect on the nesting activities of the green turtles. The streetlights are sparely distributed along the coast of Wan-An Island, and are distant from the nesting beaches in most cases.

In 1996, we began to use long-term self-recording temperature loggers to determine the sex ratio of the green turtle hatchlings on Wan-An Island. Two year's study showed that more than 83% of the hatchlings were females. The ratio will be shifted to more male hatchlings in the beginning and end of the nesting seasons. More male hatchlings can also expected to produce in the nests that deposited on the open beaches. Thus, it is suggested that except the doom nests that laid in the intertidal zone, we may not need to relocate every nest on the open beach, so that more male hatchlings can be produced.

Coastal Fisheries Bycatchment

Bcatchment is a serious problem for the sea turtle conservation. Most efforts up to date have concentrated on the high sea and near-shore fisheries. Very little attention was paied on the coastal fisheries where juveniles to adult turtles were inhabited. Starting from 1991, a field survey was carried out by visiting the harbor fishery market and on board observations to determine the impact of coastal fisheries on the sea turtle population. The results showed that all five species could be by-catched by the coastal fisheries. The green turtle was the most abundant ones, followed by the loggerhead and olive ridley turtles. The by-catched rate increased with the fishing efforts. Most of the by-catched turtles were sold to the temple for the "religious release" later on. Less than 10% was slaughtered or stuffed for decoration. The "religious release", although

does not involve in the direct harvest, the illegal trading of endangered species and poor captivity environments always result in more intentionally “bycatchment” of sea turtles and poor healthy conditions of the released turtles. The situation was improved significantly after a long-term public awareness campaigns and promulgates as well as executive of domestic wildlife protection law by the county officials. In these days, the temple masters are using the artificial replacements for their religious releases.

Starting from the beginning of 1999, we sent out the first on board by-catchment observer on the high sea long-line fishery to record the sea turtle bycatchment in the tropical Atlantic Ocean. The preliminary result showed that both leatherback and olive ridley turtles were found by-catched on five months operations. The estimated CPUE was 8 turtles per 25000 hooks (half of them are leatherback turtles).

Community Participation on Wan-An Island, PengHu Archipelago

The ecological behavior of the green turtles that nest at Wan-An Island has received mass media attention since the establishment of the refuge site in December 1993. The number of turtle-watch groups has also tended to increases as the involvement of local people in the beach patrol during the summer nights. In the beginning, we used the private industry (the I-Mei Foods Corp.) donated money to hire four local villagers as the beach patrollers to protect the nesting females and the hatchlings. The success launch of this preliminary work has encouraged the PengHu County Government to hired 10 more villagers since 1995. In the meanwhile, they also adopted a “take turn policy” so that more villagers can be hired. With enough manpower on the beaches, we began to develop the management programs that local people can actively involve in the decision-making level.

In 1997, we decided that it’s the time to deploy the community participation program for the sea turtle conservation. We first use the questionnaire forms to interviewed 755 tourists (composed mainly of college graduates), 123 local residents (composed mainly of middle high

school educated fishermen) and 59 Wan-An middle and primary school students. The interviews showed that all the interviewees, tourist, local residents and students alike are well aware of the importance of sea turtle conservation in Taiwan. However, due to the variety requirements from the refuge site on the island, simply employing beach patrollers, limited entry to the nesting beaches, and enhancing basic research apparently cannot meet the future requirements. Therefore, in addition to increasing basic research and for greater campaigning awareness through public speeches, a new project which calls for tighter cooperation between researchers and the PengHu County Government to be launched since the summer 1998. This project is tended to provide the necessary facilities and software programs for the management of the refuge site.

In the summer of 1998, we have reached a record high of 20 nesting green turtles emerged on the Wan-An Island. We don't know if this record high was due to the past conservation efforts or some meteorological events such as El Niño in 1998. In the meantime, with the helps of PengHu County Government, a formal beach training program was carried out to trained the local villagers. To our surprise, 45 villagers registered the program and 29 of them, included one 78 years old grandpa, passed the test and become the certified beach patrollers. These people will become the backbone manpower for the management program of the refuge site.

In addition to this, the PengHu County Government also plans to increase its public awareness education and open a dialog with the local residents, with the object of creating an environment- the relevant job opportunities – in which ecotourism could flourish on the island. In this way, the county government also aims to improve the living standard of local people and promote grassroots movements leading towards self-sufficiency.

In the January, with the helps of PengHu County-elected Legislator, Mr. Lin, the Tourism Bureau decide to invest over 1 billion NT dollars to build a Green Turtle Ecological Exhibition and Conservation Hall on the Wan-An Island, where the refuge site for the nesting green turtles were

established. The building is scheduled to build since the summer of 1999. With this building, more management programs can be operated under the proper institutional capacity.

Satellite Telemetry and the needs for the Regional and International Cooperation on Sea Turtle Conservation

Green turtles emerge and nest on Wan-An Island every summer from late May till mid- to late October. The local people see them come and go every year for generations without knowing where they come and where they go. In order to understand the whereabouts of nesting females in the ocean in the summer of 1994, with the helps of Mr. G.H. Balazs (leader, Marine Turtle Program, NOAA, NMFS, Southwest Fisheries Service Center of U.S.A.) we deployed two ST-6 PTTs on the nesting green turtles. This is the first time people ever done the satellite telemetry on the wildlife animal in Taiwan. The results showed that one turtle (Wan-An #1) migrated northbound for 2000 km and reached the Koshiki Island, Japan. The other turtle (Wan-An #2) also migrate northbound for 300 km and reached the coastal coral reef in the outskirts of Tamshui Estuary, Taipei County. Both turtles were found returned to Wan-An Island to nest again in 1997 (Wan-An #1) and in 1998 (Wan-An #2).

From 1995 till 1998, nine Argos-linked ST-14 satellite transmitters (PTTs) were deployed on the nesting green turtle after their nesting activities. The end points of their post-nesting migration or last transmitted points are: the Koshiki Island of Japan, outskirts of Tamshui Estuary of Taiwan, east coast of Hainan Dao of Mainland China, Qinpeng Dao of Mainland China, Okinawa of Ryuku Islands, Ishigaki-shima of Ryuku Islands, Ho-Lon Town Maio-Li County of Taiwan, and east coast of Pratas Island (Dungsha Island). In addition, a fisherman in the nearshore waters of Philippine found one Inconel tagged turtle and reported to the conservation officer. He retagged the turtle, then released her for the unfinished journey. The results showed that the turtles that nested at Wan-An Island were distributed widely on the continental shelf east of Mainland China (including the East and South China Sea and the Yellow Sea). Migration speed ranges from 1.0 to 2.5 km per hour. The

turtles are submerged for more than 95% of the time, and only surface to breathe for short periods.

The results of this study strongly suggested that the green turtles of Wan-An Island are a resource that is shared among nations in northeast Asia. This stress the importance of exchanges the information with the nations that share the critical habitats of the green turtles that nest in Taiwan. It is also stress the importance of opens the dialogues and discusses the possibility of join cooperation with those nations on the conservation and researches of the green turtles. The population that nest in Taiwan can only be saved on both the solid basic biological researches, such as stock estimation and sound regional and international management basis.

This workshop is then designed to meet these goals and open the door for future cooperation of both sea turtle research and conservation on the international and regional scales. Depending on the distribution of sea turtles, some strategies in the book of “A Global Strategy for the Conservation of Marine Turtles” can be applied and modified to meet the regional needs. To our specific requirements, we can use the strategies of “Research and Monitoring”, “Building capacity for conservation, research and management”, “Public awareness, information and education” and, “Regional and international cooperation” in the content of this global strategies book to gradual develop our own regional strategy plan and save the sea turtle populations in the Asian region.

The Convention on Migratory Species and Related Conservation Agreements

Douglas Hykle*

Deputy Executive Secretary, UNEP/CMS (Convention on Migratory Species) Secretariat, Martin-Luther-King-St. 8, D-53175 Bonn, Germany

Abstract

The Convention on Migratory Species (CMS or Bonn Convention) is a global intergovernmental treaty concerned exclusively with the conservation of migratory species and the habitats on which they depend. Its taxonomic coverage is diverse, encompassing inter alia migratory birds, marine mammals, marine turtles and terrestrial mammals. Its membership currently stands at nearly 60 contracting Parties worldwide. The Convention's activities are focussed on two lists of species. Those included in Appendix I are considered endangered and are afforded strict protection. A much larger number of species listed in Appendix II warrant the development of specialized conservation agreements. Marine turtles benefit from listing in both CMS appendices, and are receiving increased attention under the Convention. So far, this has taken the form of sponsorship of regional workshops and strategic planning sessions, and financing of other important conservation initiatives.

It is a pleasure for me to share some information with you about the Convention on Migratory Species and other instruments working towards the conservation of sea turtles. The Convention on Migratory Species is better known by the short form "CMS" or the Bonn Convention. It takes its name from the German city where it was concluded in 1979 and where its secretariat is based. I have taken leave from my work in the¹ secretariat to attend this meeting in my personal capacity.

CMS is one of a handful of intergovernmental treaties concerned with the conservation and management of natural resources, including wildlife. Each one has its own area of specialization and, at least on paper, they are complementary, with relatively little overlap between them. Some of the other treaties, in the same category, that you may be familiar with include: the Ramsar Convention on Wetlands, the Convention on International Trade

¹ Mr. Hykle attended this workshop in his personal capacity.

in Endangered Species (CITES), and the Convention on Biological Diversity.

CMS is the only convention operating on a global scale that is concerned exclusively with the conservation of migratory species and the habitats on which they depend. The Bonn Convention develops conservation strategies for the many species of wild animals that cross international borders or that occur in international waters, and which are shared by many countries.

The taxonomic coverage of the Convention is quite diverse. Besides helping to conserve a wide variety of migratory birds, it is actively promoting the conservation of other groups, such as marine mammals -- particularly dolphins and porpoises -- as well as terrestrial mammals, to name just a few. Last, but by no means least, there is a growing emphasis on sea turtles worldwide.

The membership presently stands at about 60 States, and another 15 Governments are participating in special sub-Agreements concluded under the umbrella of the Convention.

CMS concentrates its efforts on two lists of species. Animals listed in Appendix I of the Convention -- which includes six species of sea turtles -- are considered endangered and warrant *concerted* conservation actions. These include strict protection measures throughout the migration range, conservation and restoration of habitat, and removal or mitigation of obstacles to migration.

The second list -- Appendix II -- contains animals that are not necessarily endangered, but which are priorities for *co-ordinated, co-operative* conservation or management actions. Indeed, one of the main goals of CMS is to co-ordinate the development and implementation of *multilateral* agreements among many countries that share migratory species with similar problems and needs. These regional agreements have several elements in common: such as detailed species and habitat conservation measures, research and monitoring provisions, as well as education and awareness components.

The Convention on Migratory species is active in most parts of the world, either through formal intergovernmental agreements or through a

wide range of CMS-funded projects covering many different taxonomic groups.

With that short introduction to the Convention on Migratory Species, I would like now to focus on the growing role that CMS is playing in relation to the conservation of sea turtles worldwide. I should like to begin by drawing attention to some of the problems that CMS is attempting to address through its work.

We know that implementation, and enforcement of domestic legislation, let alone international treaties, remains problematic where resources are stretched to the limit, especially in developing countries. The next few slides illustrate just some of the problems faced by sea turtles around the globe: (1) turtles slaughtered on the waterfront of an important city in West Africa; (2) poaching for eggs; (3) which in this case are sold for 25 cents each in the local market; (4) incidental catches in fishing gear; (5) development of nesting beaches for tourism; and (6) other obstacles to nesting turtles caused by man, such as these abandoned logs washed ashore in large numbers on an African coastline. Lastly, one of the biggest problems to overcome is a basic lack of information on what goes on in the life cycles of sea turtles from the hatchling stage to the time spent in the open ocean while reaching maturity. This search for knowledge is, of course, what brings us here today.

The Convention on Migratory Species is playing an active role in efforts to conserve sea turtles. One of the first initiatives has been the sponsorship of training workshops and strategic planning sessions organized in collaboration with the IUCN Marine Turtle Specialist Group. The first one was held in South Africa in November 1995, bringing together specialists and officials from almost all countries of the western Indian Ocean. A second one for northern Indian Ocean countries was held in India in early 1997. The value of these workshops has been to bring together small groups of specialists to receive hands-on training by top experts in the field. Over the course of 4 or 5 days, participants are exposed to many different aspects of turtle conservation, including traditional tagging techniques, beach management and data collection, as well as an introduction to some of the newer technologies, such as PIT tags, satellite telemetry and GPS. Similar workshops are planned for West Africa this year and hopefully in the Gulf region as well. These workshops are useful, but to be truly successful a lot of follow-up is needed after people have returned to their countries, especially on the part of governments.

CMS is also helping to increase knowledge and awareness of the conservation status of sea turtles. For instance, it has funded the production of a French language version of turtle identification sheets which have been widely distributed among French-speaking countries bordering the Atlantic Ocean. It is currently producing, with the help of Jacques Fretey of France, a bilingual report on the status of sea turtles of the Atlantic coast of Africa. It is also putting funding into the production and translation of a long-awaited conservation techniques manual.

The Convention on Migratory Species has a lot of potential to focus attention on sea turtle conservation around the world, especially in the field of regional co-operation. It has many years of experience in developing regional agreements for different groups of species, much of which is transferable to other regions and situations. In fact, one of the more interesting projects with which CMS is associated involves the satellite tracking of Siberian Cranes from their wintering grounds in northern Russia to south Asia - a collaborative effort of about 10 governments working under the auspices of an agreement developed by CMS.

There are, of course, other treaties that have an important part to play in sea turtle conservation on a global and regional level. I have summarized these in a separate paper which has been made available to the meeting. One that is worthy of special mention is the Convention on International Trade in Endangered Species, CITES. Whereas CMS exists to regulate domestic harvesting of wildlife and to promote international co-operation for their conservation, CITES aims to regulate wildlife trade among countries to ensure that it does not reach unsustainable levels. In this way, CITES is a perfect complement to the Convention on Migratory Species. Both conventions are vital in order to tackle all aspects of the problems facing sea turtles. Similarly, there are other regimes operating at more local levels - such as the South Pacific Regional Environment Programme - which are attuned to addressing regional needs.

It is through global Conventions like CMS that these regional initiatives can be linked together to form a comprehensive conservation strategy. The evidence that exists of trans-oceanic migration of sea turtles is ample proof that it is not sufficient to be looking only at what is going on in our own waters; instead we must constantly keep in mind what is happening on "the other side of the pond" so to speak, and to learn from the vast amount of experience and knowledge that exists elsewhere. This is what makes

meetings of this kind so valuable.

I hope this brief explanation has helped to show how international legal instruments, such as the Convention on Migratory Species, are an important piece of the puzzle that has to be put together to form a complete picture of sea turtle conservation.

Sea Turtle Research and Conservation in Oceania

George H. Balazs

Zoologist and Leader, Marine Turtle Research Program, NOAA, NMFS, Southwest Fisheries Service Center, Hawaii, 96822-2396, U.S.A.

Sea turtles are designated worldwide as threatened and endangered species. Population declines have been prominent in the Pacific islands of Oceania as a result of nesting habitat loss and excessive and widespread harvesting for commercial and subsistence purposes. The principle species of concern to Pacific islanders are the green turtle (*Chelonia mydas*) and the hawksbill (*Eretmochelys imbricata*). Both turtles are the focus of considerable conservation efforts by the Regional Marine Turtle Conservation Programme (RMTCP) of the South Pacific Regional Environmental Programme (SPREP) based in Apia, Western Samoa. The SPREP is a non-governmental organization providing assistance to the environmental needs of 22 Pacific Island nations. The National Marine Fisheries Service Honolulu Laboratory play an important role in assisting SPREP in the conduction of the RMTCP. There is presently the strong desire by native inhabitants of Oceania to reverse declining trends of sea turtles so as not to lose an acknowledged important part of their cultural, traditional and nutritional way of life. This task will not be easy due to inherent biological constraints of most sea turtles, which include extensive ocean migration for reproduction, vulnerability to predation, unknown pelagic life stages, and slow growth resulting in delayed sexual maturity of 20 or more years.

There are only two populations of loggerhead (*Caretta caretta*) in the Pacific, one originating in Australia where serious declines are occurring, and the other in southern Japan where number of nesting females appear to be stable. Leatherbacks (*Dermochelys coriacea*) inhabiting the Pacific mainly originate from nesting beaches in Mexico and Costa Rica where significant declines have been documented, in Indonesia where their status is uncertain but possibly stable, and Malaysia where the nesting colony is bordering on extinction despite 30 years of conservation measures. Both leatherbacks and loggerheads are the species of principle concern with regard to incidental take in pelagic longline and other commercial fisheries of the Pacific conducted mainly by Japan, Taiwan, Korea and, to a lesser extent, by U.S.A.

Green turtle in the Hawaiian Islands are genetically discrete and geographically isolated. Under the protection of U.S. Endangered Species Act, this population has responded favorably to 20 years of recovery and

research efforts by the National Marine Fisheries Honolulu Laboratory working in cooperation with the U.S. Fish and Wildlife Service, the State of Hawaii, and several private conservation organizations. The number of green turtle nesting in Hawaii each year has substantially increased at the index nesting site of East (Hikina) Island, French Frigate Shoals in the Northwestern Hawaiian islands. However, the total number of nesting females in the population is still well below historical levels and the fibropapilloma tumor disease continues to be a threat. The number of green turtles observed in waters around the main Hawaiian Islands has also increased significantly. Turtles in these foraging pastures are mostly immature turtles resulting from the increased nesting success. The greater number of green turtles in the main Hawaiian islands have resulted in more opportunities for tourists and local people to view turtles in the water in the same manner that humpback whales are an ecotourism attraction. The successes thus far achieved in the biological recovery of the Hawaiian green turtle population constitute a model example in research and management for the rest of the Pacific islands. The olive ridley (*Lepidochelys olivacea*) nesting in the East Pacific has also shown a significant population increases in recent years under protective management and research by Mexican authorities.

Goals of the NMFS Honolulu Laboratory Sea Turtle Program

The goal of the Marine Turtle Research Program at the Honolulu Laboratory is to achieve the biological recovery and sound long term management of sea turtle population in Hawaii and other U.S.-affiliated Islands of Oceania, and to assist Pacific Island and Pacific Rim Nations to recover sea turtle population to degree possible. To obtain the best scientific information possible to achieve this objective, research efforts at the Honolulu Laboratory emphasize the following:

- Monitoring, assessment and biological investigation at selected sea turtle breeding sites.
- Monitoring, assessment and biological investigation at selected sea turtle foraging pasture aggregations in benthic habitats.
- Development of comprehensive computer simulation models and other quantitative tools to monitor population trend in order to better facilitate sea turtle recovery efforts and to assess impacts of fishery bycatch.
- Assessment of post-hooking survival, movements and ecology in pelagic habitats relating to bycatch of sea turtles in longline fishing.
- Investigations of the pathology, etiology and epidemiology of fibropapilloma disease.
- Conducting cooperative research, technical assistance and research

training with Pacific Island and Rim Nations to promote the collection, analysis and sharing of reliable sea turtle data, including fishery bycatch data.

Major Research Activities in the Hawaiian Islands:

Biology, Ecology and Life History Investigations

Important progress is being made in understanding the biology, ecology, and life history of green turtles through long-term in-water monitoring at study site throughout the Hawaiian Islands. Growth rates of immature turtles, diets, habitat characteristics and use, daily foraging patterns, and trends in the number of turtles are being determined. For example, an analysis of data collected on 171 green turtles recaptured one or more times (1,458 turtles tagged) at Palau, Molokai yielded a mean growth rate of only 2.1 cm (or 7/8 inch) per year in carapace length. The use of high technology acoustic telemetry and dive recorders is revealing that green turtles undergo exceedingly limited daily movements between underwater resting areas and sites where feeding occurs on selected seaweeds.

The Hawaiian green turtle nesting colony at French Frigate Shoals has been systematically studied since 1973 in a cooperative program with the U.S. Fish and Wildlife Service. Approximately 500 migrant females were present at East Island in 1997, the highest year on record for the 25 consecutive seasons that nesting has been monitored at this vital location.

Fishery Interactions Research

The National Marine Fisheries Service Honolulu Laboratory plays a central role in the research, monitoring and mitigation of sea turtle interactions with commercial fisheries. In particular, the Laboratory provides critical support to the scientific observer program conducted since 1994 to monitor the interactions with sea turtles of the Hawaii-based pelagic longline fishery. Honolulu Laboratory staff carry out sophisticated statistical analyses of observer data to assess the total magnitude of the fishery's interactions with turtles and identify the oceanographic, biological, or operational factors associated with such interactions. Estimates of the level of interactions and resulting mortality are then combined with computer simulation models to evaluate the impacts of the fishery, and other sources of mortality on sea turtle populations in order to devise mitigation efforts.

Biological studies by the Honolulu Laboratory are also being conducted to improve the assessment of fishery impacts on turtles. During monitored longline fishing trip, vessel observers tag turtle, collect life history data, and take small biopsies of turtle tissue. When analyzed at the National Marine Fisheries Service La Jolla Laboratory (by Dr. Peter Dutton), these samples reveal the genetic origins of the turtles and show which nesting colonies, in various parts of the Pacific, are impacted by the Hawaii longline fishery.

Satellite Tracking of International Pacific Marine Turtle Migrations

NOAA's polar-orbiting satellites are being successfully used to track the movements of sea turtles across Oceania and the Pacific Rim Nations. The information from this unique research is essential in promoting international sea turtle management plans for the Pacific Islands. Except for the Hawaiian Islands, sea turtle are an internationally shared resource throughout the Pacific. For example, satellite tracking has discovered that green turtles nesting in American Samoa migrate to and from Fiji, passing through the waters of Tonga in the process. This technology has also shown that Hawaiian green turtles make migrations back and forth to the Northwestern Hawaiian Island where they nest at French Frigate Shoals. In addition, vessel observers have been trained to place small satellite transmitters on live turtle released after incidental capture in Hawaii-based pelagic longline fishing. These transmitters provide critical information on the oceanic movements of pelagic turtles and are the only basis available to evaluate post-hooking survival in the wild.

Assistance and Cooperative Research with South Pacific Islands and Pacific Rim Nations.

Substantial progress is being made in research activities and information exchange through the RMTCP of SPREP. Important bonds of cooperation have been established and are being strengthened with sea turtle researchers, managers, conservationists and their programs in Tahiti, Fiji, Samoa, CAMI, Japan, Indonesia, the Philippines, Taiwan, Mexico, Costa Rica, and elsewhere throughout the Pacific. The Honolulu

Laboratory is also conducting periodic training sessions for Pacific Islanders in the areas of data collection, tagging, satellite tracking, experimental design, necropsies, and procedures for monitoring and assessing sea turtle populations.

Fibropapilloma Tumor Disease Research.

Fibropapilloma (FP) is a tumor-forming, debilitating and often fatal disease of sea turtles that has rapidly emerged in the past decade as a potentially serious threat to populations worldwide. The disease is manifested by the formation of multiple fibrous masses of tissue 1mm to 30cm in diameter growing from the eyes, flippers, neck, tail, seams of scutes, and in the mouth. The tumors are also from in the internal organs. Although most FP tumors are histologically classified as being (non- cancerous), they can significantly disrupt the vital life-functions of breathing, feeding, vision and swimming. In advanced stages of the disease, turtles will often be lethargic, emaciated with soft and sunken plastrons, and prone to stranding ashore. Abnormal serum chemistry and blood cell count are present. In addition, the pathology of FP is often associated with heavy burdens of internal parasites consisting of spirorchid cardio-vascular flukes. FP has been shown to be transmissible in laboratory studies using injected cell-free tumor extracts.

The prevalence of FP is highest in the herbivorous green turtle, *Chelonia mydas*, the species in which the disease was first described in the scientific literature as a rare curiosity from the Florida Key in the 1930's. In the Hawaiian Islands, the earliest verifiable case of FP dates back to only 1958 when a heavily tumored green turtle was captured (and killed) in Kaneohe Bay, Oahu. At present, green turtle in Hawaii and Florida demonstrate high prevalence of FP ranging up to 90% at certain coastal foraging areas. Elsewhere in the Pacific FP in green turtle is currently limited to a few but potentially significant sites in Australia, Indonesia and the Bonin Islands of Japan where moderate prevalence has been reported, but insufficient

research has been conducted. Outside of the Hawaiian Islands, sea turtle at other insular sites of Polynesia, Melanesia and Micronesia are virtually in Taiwan by Dr. I-Jiunn Cheng.

An issue that must be urgently addressed the emergence of FP within the past few years at elevated levels in sea turtle species other than the green turtle. Olive ridleys, *Lepidochelys olivacea*, nesting in the eastern Pacific in Oaxaca, Mexico and at Ostional, Costa Rica have shown increased FP Prevalence. A similar occurrence has taken place in Australian loggerheads, *Caretta caretta*, foraging at Moreton Bay adjacent to Brisbane in Queensland. It is noteworthy that molecular genetics research by the SWFSC has shown that some pelagic-phase olive ridleys and loggerheads from these populations occur in the North Pacific and are incidentally taken in the Hawaii-based longline fishery. Loggerheads foraging in southern Florida have also shown increased FP prevalence, but to date the severity of the cases has not equaled what has been recorded in green turtles.

In 1990 the National Marine Fisheries Service Honolulu Laboratory convened the first expert workshop on FP to exchange information, discuss strategies and formulate a Research Plan to guide studies of the etiology, parthenogenesis, virology of the disease (Balazs and Pooley, 1991 “Research Plan for Marine Turtle Fibropapilloma”). Since that time the Honolulu Laboratory has been the leader in FP research through the conduction of epidemiological field studies and collaborative projects created through research partnerships with a worldwide array of outstanding disease specialists. In December 1997 the second expert FP workshop was convened by the Honolulu Laboratory to examine progress and redefine research priorities, in view of advances made in recent years. During the eight years between the two workshops, the number of journal publications and reports dealing with FP soared from 35 to 173. This reflects the intense interest in and concern for sea turtles afflicted with this enigmatic and scientifically challenging disease.

It is essential that the exact cause(s) of FP be determined along with the mode(s) of transmission in wild populations. Based upon the most recent results, the disease has a complex multi-factorial etiology involving two or more vital agents (herpes virus and retrovirus). However, the involvement of undetermined environmental co-factors, somehow predisposing turtles to FP, appears very likely. The identification of can facilitate collection of vital management-oriented information (i.e. immunity, exposure, infection and recovery rates). Such data are fundamental to formulating disease containment, control and possibly even prevention strategies. In addition, the existence of a reliable diagnostic test will allow for an informed response to any outbreaks of FP that may eventually occur at one or more of the currently unaffiliated insular pacific island and Pacific Rim Nation location.

The Honolulu Laboratory's role and responsibilities in pursuing FP research are based upon several interrelated factors of significance, as follows: 1) sea turtles are listed as threatened and endangered species mandated for ESA recovery in partnership with FWS and the impacts of FP to population recovery are unknown; 2) the overall health of coastal marine ecosystem at FP locations is in question; 3) mortalities and morbidities from FP are highly visible to the public, especially Hawaii's burgeoning sea turtle ecotourism industry, thereby exacerbating pressures on the agency to find solutions; 4) request are increasing for international assistance and training in conduction research in areas where FP has emerged in other sea turtle species; 5) concern by insular Pacific island nations that emergence of the disease in their area will cause already deleted, but culturally important, local sea turtle population to become inedible or go extinct; and 6) concern over potential human-health issues of diseased turtle.

Summary

The National Marine Fisheries Service Honolulu Laboratory is actively involved in an array of research activities important to the

conservation and management of sea turtle in Oceania and the Pacific Rim Nations. We are fully prepared and eager to collaborate with and assist other individuals, agencies and organizations to promote the survival and recovery of sea turtle populations.

Public Participation in the Conservation of Sea Turtles in Pulau Redang, Malaysia

Eng-Heng Chan and Hock-Chark Liew

Sea Turtle Research Unit (SEATRU), Universiti Putra Malaysia Terengganu
21030 Kuala Terengganu, Malaysia

Introduction

Pulau Redang, a continental island located in the South China Sea, provides nesting habitat to the largest aggregation of green turtles in Peninsular Malaysia. The annual nesting density of 1,000 to 1,500 nests support over 50% of total nestings in Terengganu.

Turtle conservation programmes on the island populations are actively pursued by the Sea Turtle Research Unit (SEATRU) of Universiti Putra Malaysia Terengganu and the Fisheries Department of the Ministry of Agriculture. These programmes basically involve the incubation of eggs in their natural nests, i.e. without moving them to hatcheries. This method is considered by many turtle conservationists to be the most appropriate method where problems of human poaching, erosion, tidal inundation and natural predation are not serious.

The conservation programme of SEATRU requires the purchase of eggs deposited on Chagar Hutang, the major nesting beach, from local egg collectors. Commercial egg collection is still sanctioned by the Terengganu

State Government which consider the activity to be a traditional right of the local villagers.

Between 1993 to 1997, SEATRU received full corporate sponsorship for its conservation programmes. However, owing to the economic downturn, corporate sponsorship has been discontinued. In order to raise the necessary funds to continue with its turtle conservation, research and education activities, public participation programmes were developed in 1998. After a one-year implementation, we have found that the programmes were quite well received. We managed to raise enough funds to run the project in 1998, and this year, we hope to be able to do the same. Eventually, we hope to make our turtle conservation programmes self sufficient. In this presentation, we will try to share with you our experiences in involving the general public in turtle conservation programmes. Our public participation programmes centre around four major schemes or activities:

1. Adopt-A-Nest
2. Adopt-A-Turtle
3. Volunteer Programme
4. Turtle Camps

Adopt-A-Nest Programme

Every year SEATRU purchases between 300-400 clutches of eggs for incubation. In the most recent years, we have been able to procure over 90% of the eggs deposited for incubation. The adopt-a-nest programme make it possible for individual members of the public to help SEATRU purchase the

necessary egg clutches for incubation. Cost for one nest adoption is RM200.00 (US 80.00 for foreign adoptions). This figure takes into consideration the actual amount paid to the egg collectors for one nest of eggs, and the wages paid to the workers to do the beach work. Nest sponsors receive a certificate of adoption, information about the nest adopted and the mother turtle which laid the eggs, and a SEATRU T-shirt. Sponsors of three nests or more receive in addition, a print of a turtle painting by a renowned local artist. When the incubation period is completed and hatchlings have emerged and made their way to the sea, the nests are excavated and results of the nest analysis are sent to the sponsors, with a card which reads: Announcing the birth of your adopted babies....

When the nest adoption programme was launched in April of 1998, we had no idea how it was going to be received by the public, especially at a time when retrenchment was rife and everyone was tightening their belts. We were rather pleasantly surprised as quite a number of people responded to our pleas for help. The media played its role and ran a few feature articles on the nest adoption programme. Of the 401 nests purchased for incubation in 1998, 250 were adopted by individual members of the public and some companies and businesses in Malaysia. You may be surprised to hear that a few WTO officials from Geneva also adopted some nests.

Some sponsors have expressed great joy in being able to help put hatchlings into the sea. They were grateful for the simple fact that they had a chance to do something so direct and tangible in wildlife conservation. They also learnt a little about turtle biology from the information received

about the nests they have adopted. This had the effect of creating a personalised link between turtles and the general public.

Adopt-A-Turtle Programme

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

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

The Volunteer Programme

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

Duties of volunteers include the following:

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

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

Besides turtles, the volunteers get the experience of being very close to nature – sleeping on the beach most nights, star-gazing, watching shooting stars, swimming and snorkeling in one of the best reefs of Redang, watching numerous different butterflies in their natural habitat, observing other wildlife such as mousedeer, squirrels, tree shrews, monkeys, rock climbing, hiking and visits to the fishing village. All in all, the volunteer experience at Chagar Hutang is an enriching and rewarding one, as recounted by the volunteers in the following quotes:

“My short stay here in this wonderful place is probably the best part of my life spent so far. Here, I have rediscovered the real meaning of friendship, survival, fun, honesty, hospitality, nature, and most of all, Life!”

Lim Shyue Yang, accounts manager

“There is a special feeling – as if there is a bond with Chagar Hutang. As I leave, I know that I will miss it and it will hold a special place in my heart. I am truly grateful for the chance to be a volunteer.”

Melinda Chong, student

“How can we further describe paradise when it is everything that you have ever dreamt for? It is perfect! ... I strongly believe that once you have been to Chagar Hutang as a volunteer, you’ll remain as one for life...”

Ong Wu Chun, student

“The one thing which really strikes me about this place is the multitude of shooting stars that we get to see at night... We city folk go on for years without seeing a single one...”

Leow Leong Chai, student

All volunteers pay a fee which covers a nest or turtle adoption. The programme therefore not only educates, but helps raise funds to run the turtle conservation programme of SEATRU. The volunteer programme proved to be quite popular as over 300 people tried to vie for the 50 volunteer slots available in 1998.

Turtle Camps

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

watching turtles at night, and help in a beach cleanup. These camps are fully sponsored by SEATRU and a local beach resort.

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

Conclusion

Public response to our outreach programmes indicate that the Malaysian public is conscious about conservation and are prepared to chip in and help out in a cause which they find meaningful and are able to relate to. The public participation programmes offered by SEATRU appear to be of appeal. We will take the cue from here and try to expand and further develop these programmes so that more members of the public can learn about sea turtles, develop a love for them and help in conserving them.

Research Activities of the Sea Turtle Research Unit (SEATRU) of Universiti Putra Malaysia Terengganu

Liew Hock-Chark and Chan Eng-Heng
Sea Turtle Research Unit (SEATRU), Faculty of Applied Science and
Technology, Universiti Putra Malaysia Terengganu, 21030 Kuala
Terengganu, Malaysia

Introduction

The state of Terengganu in Peninsular Malaysia is known for the sea turtles that frequent its beaches to nest. Even though the sea turtle populations have suffered dramatic declines (Chan, 1991), it still ranks high in importance compared to other states in Malaysia. Four species of marine turtles, the leatherback (*Dermochelys coriacea*), green (*Chelona mydas*), hawksbill (*Eretmochelys imbricata*), and Olive-Ridley (*Lepidochelys olivacea*), nest on the shores of Terengganu. Conservation efforts as early as in the 1950s were initiated where hatcheries were set up for the leatherbacks of Terengganu and tagging programs conducted for them (Siow, 1982; Chua, 1988). Due to religious reasons, exploitation of marine turtles in Terengganu have been largely restricted to eggs only. But yet, the heavy commercial egg exploitation together with other threats like incidental capture in fishing gears and pollution affected the populations which continued to decline, some to near extinction. The paucity of scientific knowledge on turtles then resulted in the level of eggs purchased for incubation in hatcheries to be insufficient. Coupled with poor hatchery techniques and increased fishing activities, the population continued to decline. Realising this need, it was timely that funding was made available in 1984 and with renewed interest, researchers from Universiti Putra Malaysia (formerly known as Universiti Pertanian Malaysia) at the Terengganu campus conducted studies on various aspects of sea turtles. This formed the beginnings of the Sea Turtle Research Unit (SEATRU) of Universiti Putra Malaysia Terengganu.

Research and Monitoring Efforts

It would be too lengthy to present all the research activities of SEATRU hence this presentation would be limited to the more recent findings especially of relevance to the workshop theme and the species that also occur in Taiwan.

***"In-situ"* Hatcheries and Hatchling Production**

Most sea turtle conservation efforts in Asia are exemplified by the protection of turtle eggs translocated to small fenced hatcheries. Early studies on such hatcheries reported hatching success averaging 55% for the leatherbacks (Balasingam, 1967) which subsequently declined to 49% in 1990 and 21.6% in 1995. The hatching success of green turtles in Sarawak also declined from averages of 59.8% in 1989 to 53.5% in 1995 (Leh, 1996). The Research activities of SEATRU began with efforts to improve hatching success of leatherback eggs incubated in fenced hatcheries through better egg handling techniques (Chan *et al.*,1985; Chan,1989). The influence of temperature on sex ratios of hatchlings produced were also studied (Chan & Liew, 1995a). These studies concluded that where possible, *in-situ* incubation of eggs would be the ideal form of hatchery management. SEATRU initiated such a hatchery at Chagar Hutang, Pulau Redang in 1993 and recorded hatching success in excess of 80% for the green turtles nesting there (Chan & Liew,1995b).

Tagging and Nesting Biology

With the establishment of the "in-situ" hatchery at Chagar Hutang beach, Pulau Redang in 1993, opportunity was available to conduct a saturation tagging program to assess the female nesting population of green and hawksbills coming to that beach. All nesting turtles were subsequently double tagged using Titanium and Inconel metal tags. Size measurements of the turtles were also taken together with other nesting parameters like timing the various stages of nesting, nest location, number of eggs layed and nest depth.

Tagging studies have revealed that green turtles may nest as much as up to 11 times in a season though most would nest on average 5 - 7 times. Nesting intervals ranged between 9 - 12 days for the green turtles and averaged 15 days for the hawksbill turtles. As expected, the turtles also did

not nest every year but do so on average every 3 - 5 years. Most turtles show strong nesting site fidelity even though they were tagged and measured, i.e. returning to the same beach to nest each time. However, a small number of the turtles (less than 6 %) do change nesting beach within a season.

Interesting Movements and Behaviour

Most of the information available for sea turtles in Southeast Asia were obtained when they come ashore to lay eggs. Though sea turtles spend over 99.9% of their time in the sea, little is known about them while at sea. Following reports of high incidences of turtle mortalities in fishing gears (Chan *et al.*, 1988), SEATRU conducted studies to determine the offshore habitat and behaviour of these turtles during the nesting season. The first such study conducted was to track the movements of leatherback turtles during the interesting period using radio-telemetry techniques (Chan *et al.*, 1991) and also to document their diving behaviour by attaching Time-depth recorders (Eckert *et al.*, 1996). A harnessing system was used to attach the equipment on the turtles (Eckert and Eckert, 1986). The leatherbacks were observed to head offshore immediately after each successful nesting to locations 30 - 40 km away. They would remain in these waters, diving regularly to near bottom, until a few days before they are due to nest again. During this period, they may range over a longshore distance of up to 140 km depending on the prevailing currents. A few days prior to renesting, they would return close to shore and cruise along the coast adjacent to the intended nesting beach. Results from this study have led to the formation of an offshore sanctuary off Rantau Abang, by the Terengganu State Government to protect the leatherbacks at sea during the nesting season (Chan and Liew, 1990).

Following the success in tracking the leatherbacks using radio telemetry, SEATRU also studied the movements of green turtles during their interesting period at Pulau Redang. A combination of radio and ultrasonic telemetry techniques were used in order to closely monitor their movements around the island and to allow for more frequent visual sightings of the tracked animal for observation while underwater and when they surface. Observations made on the five females green turtles tracked in this study concluded that during the interesting period, the nesting turtles at Pulau Redang did not feed and spend a major portion of their time sitting on the seabed in waters between 10-40m depth (Liew & Chan ,1993; 1994). The

nesting green turtles also did not venture far from the nesting beach and remained within 1 km from the coast, unlike that of the leatherbacks mentioned above. Since seaward movements of the turtles did not exceed 1 km from the shoreline, present Marine Park Regulations at Pulau Redang, Terengganu with respect to fishing appear adequate in providing offshore protection for the breeding female turtles during the internesting period. Obviously, strict enforcement of fishing regulations is crucial for the survival of the breeding females during the nesting season.

Long Distance Migration

The migratory behavior of sea turtles is well documented and has far reaching implications in the conservation and management of these animals. They migrate across international boundaries and in most cases, the feeding and nesting grounds are distantly separated and seldom occur within the territories of the same nation. Though local conservation efforts have been stepped up in recent years, they focus on protecting the turtles within the territories of Malaysia. These efforts will be futile if the turtles are intentionally killed once they migrate to a neighbouring country. Therefore, the development of regional cooperation in the conservation of sea turtles is a matter of urgency for Malaysia and the region. In order to do this, sufficient evidence on their migratory patterns must be obtained but such information from tagging studies have not been fruitful. Thus, SEATRU embarked on a study to determine the post-nesting migration routes of five green turtles using the ARGOS satellite based system to track the animals while at sea. (Liew *et al.*, 1995a; 1995b; Papi *et al.*, 1995; Lusch *et al.*, 1996).

The turtles were found to migrate soon after their final nesting for the season and head directly across open ocean to their intended destinations. The turtle tracked in 1993 nested 5 times before going to the Natuna Islands, Indonesia over 669 km in 13 days. The four other turtles tracked in 1994 nested 8 to 10 times before migrating directly to different destinations in the South China Sea. One went to Bugsuk Island, Philippines, a journey of 1,606 km in 30 days. The second migrated to Sabah, Malaysia, a journey of 1,719 km in 28 days. The third migrated to Bangka Island, Indonesia, a journey of 1,153 km in 28 days. The fourth was heading towards the Tambelan Islands, Indonesia when transmissions stopped after 714 km in 16 days. These migratory paths which radiate from Redang Island to different nations bordering the South China Sea highlight the importance of regional

sea turtle conservation programs (Figure 1). The female turtles spend a duration of at least 75 to 148 days away from their foraging grounds to facilitate reproduction.

Most of these turtles remained at those locations, probably their respective feeding grounds, for over a month before tracking was terminated. A visit to the vicinity of one of these locations off Sabah, Malaysia confirmed the presence of sea-grass beds with feeding turtles spotted by the local community. It is believed that a map-and-compass mechanism is used by the turtles to navigate during the migration (Papi *et al.*,1995; Luschi *et al.*,1996).

Conservation on a Regional Scale

Efforts are being made to protect nesting turtles and their eggs but little attention has been given to protecting foraging habitats and the turtles while in these habitats. It is unfortunate that turtles are still hunted for meat and for export in some neighbouring countries and significant numbers die each year through incidental capture in fishing gears. Research efforts have to be intensified along this direction. There is little doubt that conservation for any sea turtle population can only succeed through a conservation strategy on a regional scale. Greater public awareness, both nationally and regionally, on the plight of marine turtles to should also be promoted.

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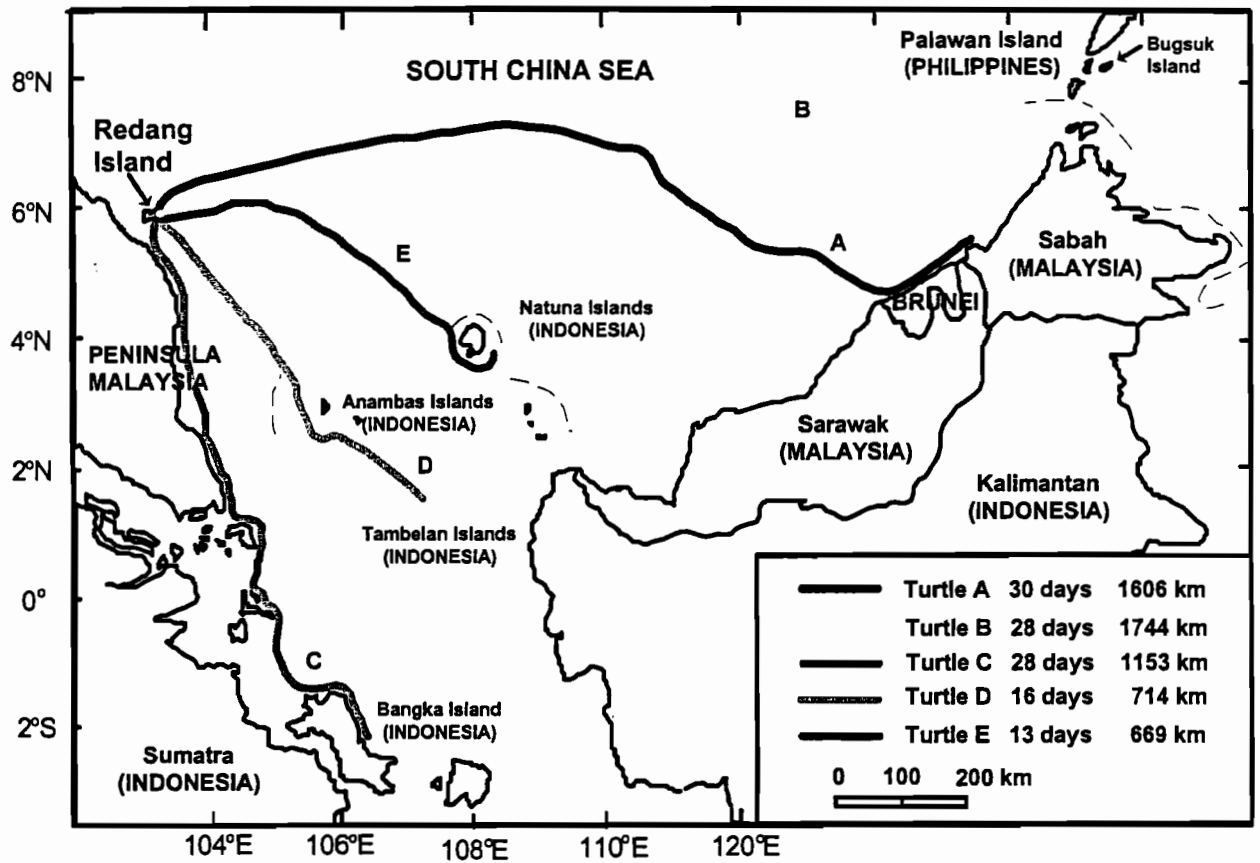


Figure 1 : Post-nesting migration routes of five female green turtles from Redang Island, Malaysia tracked using the ARGOS satellite system in 1993 and 1994.

Operationalizing a Transfrontier Management Area for Sea Turtles: The Case of Turtle Islands Heritage Protected Area

Romeo B. Trono

Vice-President for Conservation and Field Operation, WWF Philippine, 23 Maalindog St., U.P. Village, Diliman, Quezon City, 1101, Philippine

In May of 1996, a Memorandum of Agreement (MOA) was signed by the Governments of the Philippines and Malaysia formally establishing the Turtle Islands Heritage Protected Area (TIHPA) as the world's first ever transfrontier management area for sea turtles. This was widely recognized by conservationists as a landmark agreement as well as a novel and probably the most effective and pragmatic approach to conserving sea turtle populations straddling the borders of two or more states.

This paper presents the mechanisms employed and efforts undertaken over the past two years by the Joint Management Committee (JMC) and Joint Technical Working Group (JTWG) of the TIHPA to ensure that the spirit and goals of the MOA are achieved. Highlights of the meetings of the JMC as well as the salient points of the Rules of Procedure adopted by the JMC are presented. Some issues and challenges are also presented

Background

The Turtle Islands is a group of nine islands straddling the Treaty Limits between the Philippines and Malaysia in Northern Borneo. The Turtle Islands support ASEAN Region's largest aggregation of green turtles (*Chelonia mydas*). More than 5,000 nesters contribute to the annual total green turtle egg production of approximately two million eggs. Three of the nine islands lie on the Malaysian side of the Treaty Limits while the nine other larger islands are on the Philippine side.

Genetic studies as well as tagging experiments revealed that the green turtle population on both sides of the border is in fact a single population unit. These findings prompted management authorities from both countries to initiate efforts to establish a transborder protected area to more effectively conserve their sea turtles. The need to conserve this shared resource as a single management unit became obvious.

Working within the framework of the Association of Southeast Asian Nations (ASEAN), the ASEAN Working Group for Nature Conservation (AWGNC) became the forum for the development of a regional conservation program. With funding support from WWF, the First Symposium Workshop on Sea Turtle Conservation was conducted December 1993, in the Philippines to formulate the regional plan. One of the highlights of the regional plan is a recommendation to declare regionally significant sea turtle populations such as the Turtle Islands in the Sulu Sea as ASEAN Heritage Conservation Areas.

The establishment of the Turtle Islands Heritage Protected Area was proposed by the Philippine delegation at the Second RP-Malaysia Joint Commission for Bilateral Cooperation (JCBC) in 1995. A Joint Technical Working Group was created to finalize the agreement. Thus in May 31, 1996, the Governments of the Philippines and Malaysia forged an agreement establishing the Turtle Islands Heritage Protected Area, the world's first transfrontier protected area for sea turtles.

Operational Mechanism

The MOA created a Joint Management Committee (JMC) to oversee the successful development and implementation of an integrated conservation program. The JMC serves as the policy-making body of the TIHPA and may coordinate/collaborate with relevant international organizations. The JMC is mandated to study and recommend to their respective authorities the enactment of laws as may be necessary to pursue the purposes of the MOA. The JMC which meets at least once a year reports to the JCBC. The first official meeting of the JMC in May 1997 formally established the its membership comprising a total of 10 members, i. e., five from Malaysia and five from the Philippines.

The Malaysian members include : 1) Director of Sabah Parks (Chairman); 2) Director, Resource Management Section, Federal Department of Fisheries; 3) Permanent Secretary, State Ministry of Tourism and Environmental Development of Sabah; 4) Representative of the Federal Attorney General Chambers; and 5) Assistant Director, Park Management & Operations Section, Sabah Parks

Membership from the Philippine include: 1) Director, Protected Areas and Wildlife Bureau, Department of Environment and Natural Resources

(Chairman); 2) Representative from Maritime and Ocean Affairs Unit, Office of the Undersecretary for Policy, Department of Foreign Affairs; 3) Assistant Chief of Staff for Plans and Programs, AC5 Southern Command, Armed Forces; 4) Director, Special Concerns Office, DENR – Autonomous Region for Muslim Mindanao (ARMM); and 5) Vice President for Conservation and Field Operations, WWF-Philippines.

An implementing agency was designated by the respective parties to be in charge of all matters concerning TIHPA and to serve as focal points. For the Philippines, the implementing agency is the Protected Areas and Wildlife Bureau of the Department of Environment and Natural Resources (PAWB-DENR), while for Malaysia, the Sabah Parks. These two agencies also serve as secretariats for the JMC meetings. However, both parties are allowed to designate another agency, department or office as the secretariat from time to time.

Both parties are also allowed to invite technical or legal consultants whenever the situation or meeting require. In addition, the JMC may create Joint Technical Working Groups (JTWG) to perform tasks identified by the Committee. Since the MOA was signed, JTWGs have been formed to formulate a Joint Management Framework, prioritize activities identified in the framework, conduct a Strategic Destination Planning, and strategic planning for TIHPA.

The Rules of Procedure

At the first meeting of the JMC held in Sabah, Malaysia, the need for a set of operating procedures (now referred to as the Rules of Procedure) was identified. The ROP provide the guidelines and rules to be followed by the JMC in conducting its meetings and in carrying out its mandate. The Malaysian delegation was tasked to draft the ROP which was subsequently approved in principle at the second meeting of the JMC held the following year in Manila, Philippines. The ROP has been submitted to the Attorney-General Chambers of Malaysia for consent.

A total of 23 rules under 13 sections are adopted in the ROP. These include among others, the place and dates of JMC meetings; the designation of implementing agencies, subcommittees and secretariat; conducting JMC business (e.g., creation of small working groups during its meetings, review and approval or proposals, decisions adopted only by consensus,

chairmanship); joint reports; disputes settlement; amendments to the ROP; and changing the composition of the JMC.

JMC Meetings and Resolutions

The JMC has officially met twice since the MOA was signed May 1996. Hosting and venue of the meetings alternated between the two parties. The first meeting was held in Sandakan, Sabah, Malaysia on May 4 to 7, 1997 while the second meeting was held in Manila, Philippines on June 17 to 19, 1998.

The first meeting formally established the JMC. The JMC likewise agreed on some administrative matters including Chairmanship and hosting of meetings; future changes to the JMC composition, engagement of technical advisors, and sharing of meeting expenses.

A committee comprising of six members, three from each party, was formed to discuss the points to be included in the ROP. The Meeting agreed that the Malaysian delegation draft the ROP, and submit the same to the Secretariat for distribution and discussion during the next meeting.

The JMC also discussed funding issues and agreed that both parties shall individually set up their respective sustainable financing mechanism in accordance with the laws of their respective country. The Meeting also agreed that all proposals to utilize funds for TIHPA by the both parties shall be submitted to the JMC for approval. The meeting requested the assistance of WWF-US financial specialist to assist in the establishment of a sustainable financing scheme for TIHPA

The second meeting adopted the Rules of Procedure and agreed to submit the same to the Malaysian Attorney-General Chambers for consent.

Members of the JTWG and consultants reported on their activities and accomplishments including plans for conducting satellite telemetry; implementation of the MacArthur funded project; ecotourism strategic planning; framework for the joint management plan; and new projects.

The meeting adopted the Ecotourism Guidelines which was prepared by the PAWB-DENR and WWF-Philippines as long as these do not contradict with their respective national laws. Both parties likewise agreed to develop its

own Master Plan with a unified long term goal. The respective master plans will be presented in the next Meeting for integration and adoption.

On-going and Planned Activities

Below are projects and activities currently or being planned to be implemented under the auspices of the JMC. These projects go through the JMC for evaluation and approval prior to implementation. Project executants also report progress to the JMC during its meetings.

- Satellite Telemetry Of Nesters From TIHPA
- Digital Aerial Videography And GIS Mapping
- Development Of Management, Research & Education Programmes For TIHPA
- Ecological Studies And Publication Of A Book On The Ecology Of The Turtle Islands
- Training On Gender Sensitivity And Micro-Enterprise Development For Muslim Women In The Turtle Islands
- Continuing Implementation Of Conservation Programs Of Sabah Parks And PAWB-DENR
- Social, Institutional, And Gender Analyses For The Implementation Of Integrated Conservation & Development Project (ICDP) For The TIHPA

Issues and Challenges

While the TIHPA has gained significant accomplishments over the past two years, several issues and challenges require serious attention.

One issue that remain to be resolved is the continuing harvest of turtle eggs by legal permittees in the Philippines. Recognizing the importance of turtle eggs as a source of livelihood for the local communities, the management authority in the Philippines allow for a regulated harvest of turtle eggs. Although the permit issued to qualified residents is intended only for local consumption, harvested eggs are nevertheless marketed to Sabah due to its proximity to the Philippines. WWF-Philippines is now implementing an Integrated Conservation and Development Project (ICDP) that is envisioned to provide alternative livelihood to residents and slowly wean them away from egg harvesting.

An issue that was discussed at the last JMC meeting is the need to engage the active participation of other adjacent countries in the region which may be within the migratory range of sea turtles from the TIHPA. It was recognized by the JMC that any success achieved through the joint management of the TIHPA can simply be negated by exploitation activities of range countries.

It seems inevitable that some areas within TIHPA will be developed into an ecotourism destination. While this should not be seen as a negative development, the JMC should ensure that any tourism development within the TIHPA comply with the guidelines formulated by the JTWG. This will ensure that both goals of sea turtle conservation and development are achieved for the long term benefit of the local communities.

Finally, another important challenge is achieving sustainability of the joint management program. There is therefore a need to establish and operationalize sustainable financing mechanisms.

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The Current Status of Japanese Loggerheads Reproduction

Naoki Kamezaki

Director Sea Turtle Association of Japan, Nagaodai, 3-26-18, Hirakata,
Osaka 593-0106, Japan

Nesting beaches of loggerhead turtle, which is an only nesting area of northern Pacific, are distributed pacific coasts of southern Japan and Ryukyu Archipelago. Since 1990, When Sea Turtle Association of Japan was established, nesting number or volunteers in most of major nesting beaches have recorded emergence number. These records showed rapid decline of the northern pacific population of loggerhead turtles. Nesting number of 1998's season was under to 40% of 1990s. Number of nests found from all Japanese coasts was 2479. In Japan, all major beaches, containing Yakushima, Kyushu, Shikoku, Wakayama, Aichi and Shizuoka, were researched perfectly by volunteers. In the Ryukyu Archipelago, there are some beaches not researched, but these oceanic areas seems to not contain major nesting beaches. We guess that actual nest number was around 2500 in one nesting season of 1998. So, number of females nested in 1998 was estimated about 1000.

In Japan, inhabitants collected eggs of loggerheads for food until 1980's. Most prefectual government promulgated a law to stop egg poaching. According to these prefectual laws, inhabitants seldom collect egg now. The most important problem is bycatch by fisheries net. In particular, we afraid loggerheads, which come close to the coast to nest, killed by set net. Furthermore, it was thought that loggerheads were bycaughted in the East China Sea, where is a good trawl-fishery area. In there, many trawling boasts from Japan, China, Korea and Taiwan are operating actively. For conservation of Japanese loggerheads, we must expose the injuries caused by these fisheries, and reduce them in cooperation with neighboring countries.

Population Status of Green Turtles (*Chelonia mydas*) in Ogasawara Islands, Japan; the introduction of research on green turtles in Ogasawara Islands

Hiroyuki Suganuma

Marine Biological Division, Marine Environmental Association of Tokyo,
Yurakucho Bldg. 708, Yurakucho 1-10-1, Chiyodaku, Tokyo, Japan

Ogasawara (Bonin) Islands, which consists of about 30 islands, is located in 1,000km south of Tokyo. These are known as one of the northernmost rookeries of green turtles in the pacific region, and also known as the biggest nesting ground in Japan. Ogasawara Islands had been uninhabited until 1830, and Japanese colonization started in 1876. Local government has encouraged the green turtle fishery around the islands because there were no any other major industries. It is said that at the beginning around 3,000 green turtles were captured, however the number of turtles captured are reduced to less than one tenth after 25 years of harvest. To recover the green turtle population, a hatchery and headstarting project of green turtles had been conducted from 1910 through 1939. This was the first attempt of the headstarting project in the world. Although the project released only a total of 40,000 turtles, the decrease of the population continued. After World War II, Ogasawara Islands became an American territory. Twenty to fifty green turtles were annually captured during the territory period. After the administration of Ogasawara was returned to Japan in 1968, the intensive turtle fishery restarted, and the annually catch ranged from 45 to 225. The hatchery project had been interrupted in the historical alteration, however it has restarted in 1973. At the present, Ogasawara Marine Center (Marine Environmental Association of Tokyo), established in 1981, up to now 160,000 turtles were released.

Nesting of green turtles is mainly found on Chichijima Group and Hahajima Group. Around March, green turtles, which feed at the mainland of Japan, migrate to the near shore to the islands for the copulation. The nesting season continued from May through the beginning of August. To recover and conserve the green turtle population,

Ogasawara Marine Center has conducted various research projects for many years. The research methods are monitoring of green turtle fishery, monitoring of the number of nesting females by beach census, checking the nests after hatching for hatching status at the beach, tagging and releasing of nesting females, operating experimental headstarting project, collecting stranding information of sea turtles, tracking of hatchlings and adults in the ocean by bio telemetry (by satellite, radio, ultrasonic and light-emitting diode), checking stomach contents, monitoring for diseases, running educational program, and so on.

Recently, by the beach survey, the green turtle population in Ogasawara seems to be gradually increasing on Chichijima Group. The followings are some possible factors to explain this increase;

1. decrease of the green turtle harvest during the period of American territory (1945-1968).
2. Decrease of the green turtle harvest on Chichijima Group for last 20 years.
3. Prohibition of collecting eggs before the World War II and since 1968.
4. Effect of the hatching projects,

We plan to analyze these factors in detail to Construct the effective strategy of conservation for the Ogasawara green turtle's Population.

Sea Turtle Conservation in the United Arab Emirates

Saif Al-Ghais

Environmental Research and Wildlife Development Agency, P.O.Box
45553, Abu Dhabi, United Arab Emirates

Sea turtles have been listed by IUCN as endangered species with extinction that has generated international concern and awareness for their conservation. This has prompted us to study the biology, habitat, ecology, distribution and migration pattern of sea turtle species visiting the United Arab Emirates (UAE) shore. Of the seven globally recognized species of marine turtles, at least two, namely Green Turtle (*Chelonia mydas*) and Hawksbill Turtle (*Eretmochelys imbricata*) were regularly found to occur in the UAE waters and nest on the local beaches. A total of 287 specimen (284 Green Turtles and 3 juvenile Hawksbill Turtles) captured by fishermen in Ras Al Khaimak, an emirate located in the northern part of the UAE, during a period of about two years were investigated for their biological parameters and feeding habits. Stomach content analysis shows that Green Turtles in the area feed predominantly on two species of seagrass (*Halodule uninervis* and *Halophila ovalis*). The monitoring of migration pattern of two Green Turtles by satellite tracking technique revealed that both stayed near Ras Al Khaimah probably within a range of 3-4 km during the monitoring period for 8 months (May 1998 to January 1999), after which the transmitter signal was lost and monitoring was discontinued.

Status on the Conservation of Sea Turtles in Hainan

Shi Haitao

Department of Biology, Nainan Normal University,
Haiko, 571158, P.R.O.C

Five species of sea turtles were recorded in China: the leatherback turtle (*Dermochelys coriacea*), the loggerhead turtle (*Caretta caretta*), the green turtle (*Chelonia mydas*), the hawksbill turtle (*Eretmochelys imbricata*) and the olive ridley turtle (*Lepidochelys olivacea*). Hainan Island has found the tracks of them all.

Hainan and the archipelago of the South China Sea are idea end point for sea turtles. The green turtles and the hawksbills were once abundant here. In the mid-80s, nesting green turtles were reported in a few places along the east coast of Hainan, and much more green turtles and hawksbills were found in the Xisar (Paracel) Islands. It was told that one may catch more than 10 turtles per night, and a boat of 100-ton or less may profit RMB 20,000 to 30,000 in a Xisar trip. The meat of a mature turtle worth RMB 500 to 600, a turtle specimen worth even more at RMB 2000 to 3000. Driven by profits, the sea turtle population dwindles at accelerated rate. Now, the sea turtles are visible only on a few islands of Xisar, Hainan Island has not heard of sea turtle nesting for years. There are some bycatch of turtles by trinet over the east coast of Hainan.

Recently, we surveyed over the whoesale and retail seafood markets, hotels and restaurant in the Haiko City. No sea turtle was found during the four surveys of the wholesale sea food markets; the merchants said that they have only seen a few turtles in a whole year. In the sixteen surveys of retail sea food market, we only saw single turtle twice. Over forty hotels and restaurants that were surveyed, four of them used green turtles and the hawksbills as tourists attractions, and five of them has slaughtered turtles. Over the airport, ship docks and street shops, it is easy to find specimen of green turtles and hawksbills, or handcrafts made of their shells.

So far, no one in Hainan studies sea turtles. Therefore, there is lack of basic understanding of the conservation of sea turtles, and the promotion of sea turtle protection is ineffective. Hope that both domestic and international organizations and experts may pay grave concerns and offer effective assistance on the protection of Hainan's sea turtles.

海南龜類保護現況

史海濤

海南師範學院 生物系 海口市 571158 中國大陸

一、海南龜類的種類及分佈

中國目前共統計龜類 32 種，海南有 17 種，占我國龜類總數的 53%。這 17 種龜為：

- 1、稜皮龜(*Dermochelys coriacea*) 在我國分佈于黃海、東海和南海。在遼寧、山東、江蘇、浙江、福建、台灣、廣東、海南、廣西等沿海省分均有報導。
- 2、蠛龜(*Caretta caretta*) 在我國分佈于黃海、東海、和南海，在遼寧、山東、江蘇、福建、台灣、廣東、海南、廣西等沿海省分均有報導。
- 3、海龜(*Chelonia mydas*) 在我國分佈于北起山東南至北部灣海域。
- 4、玳瑁(*Eremtochelys imbricata*) 在我國分佈于北起山東，南至北部灣及南海諸島海域。
- 5、太平洋麗龜(*Lepidochelys olivacea*) 在我國分佈于東海和南海、在江蘇、浙江、福建、台灣、香港、廣東、廣西等沿海省區均有報導。
- *6、平胸龜(*Platysternon megacephalum*) 在我國分佈於雲南、貴州、安徽、江蘇、浙江、江西、湖南、福建、香港、廣東、海南島、廣西等。
- *7、黃額盒龜(*Cuora galbinifrons*) 在我國分佈於海南島、廣西。
- *8、三線閉殼龜(*C. trifasciata*) 在我國分佈於福建、香港、廣東、海南島、廣西。
- *9、地龜(*Geoemyda spengleri*) 在我國分佈於湖南、廣東、海南島、廣西。
- *10、黃喉擬水龜(*Mauremys murica*) 在我國分佈於雲南、安徽、江蘇、浙江、福建、廣東、海南島、廣西等。
- **11、費氏花龜(*Ocadia philippeni*) 海南特有種。
- 12、花龜(*O. sinensis*) 在我國分佈於江蘇、浙江、福建、台灣、香港、廣東、海南島、廣西。
- *13、鋸緣攝龜(*Pyxidea mouhoiii*) 在我國分佈於雲南、湖南、廣東、海南島、廣西。

- *14、眼斑水龜(*Scalia bealei*) 在我國分佈於貴州、安徽、江西、福建、香港、廣東、海南島、廣西。
- **15、模眼斑水龜(*S. pseudocellata*) 海南特有種。
- *16、四眼斑水龜(*S. quadriocellata*) 在我國分佈於江西、廣東、海南島、廣西。
- *17、凹甲陸龜(*Manouria impressa*) 在我國分佈於雲南、湖南、海南島、廣西。
- *表示台灣未有紀錄；**表示海南島特有種。

二、 海南島龜類保護與研究現況

海南島及南海諸島的海龜資源近年來遭到嚴重破壞。據悉沙駐島軍民及從事海上作業漁民反映，過去西沙群島是海龜的家園。許多島都有不少海龜產卵。然而由於海龜在食用、工藝方面的價值。每只成龜可值 500-600 元，做成標本可售 2000-3000 元，甚至更高。由於利益驅動，加速了對海龜資源的破壞。據報導，以前在西沙每人每晚可捕到 10 多只海龜，一只不足百噸的海船去西沙航行一次，就能獲得 2-3 萬元。每年 4-7 月份大批漁民結隊到西沙群島，在撒網捕魚的同時，也上島捕海龜挖卵。如此每條船每年可捕海龜上百只，採卵數量更是難以計數。目前在西沙個別島嶼仍可見到海龜。海南島 20 年前尚有很多綠海龜；甚至在海口沿岸也常能捕到，但近幾年在海南島已難見到海龜蹤跡。根據漁政處同志反映，在海南島海岸每年被三層網誤捕的綠海龜有 1-2 頭。

就目前所知，海南省尚無人研究海龜。因此有關海龜的分佈、數量、繁殖及保護方面的信息幾乎所知甚少。偶而提及，也是來自漁民或執法人員的零星見聞。

1996 年中科院動物所黃祝堅先生建議筆者調查海南省海龜的保護狀況，由於沒有任何經費，只能在海口市範圍內的海產品批發市場、農貿市場和賓館飯店進行了調查。結果在海產品批發市場調查四次，從未遇到過。商販說近年來這裡一年也未發現有海龜；在農貿市場調查 16 次，欲過兩次各一隻綠海龜；調查賓館飯店 40 餘家，遇到將綠海龜或玳瑁作為觀賞的動物有四家，見到海龜肉的有五家。在機場、碼頭及市區的不少商店中卻時常可見到有綠海龜和玳瑁的標本出售，至於用玳瑁盾片製作的工藝品則更常見。此外，在一些動物展示館如三亞熱帶海洋博物館等處有十餘隻綠海龜和玳瑁展出，還有菱

皮龜和麗龜的標本。拒管理人員說，這些海龜都是漁民送來出售的。

海南島的陸生龜類資源在六、七十年代是非常豐富的，但近年來由於亂捕濫殺，致使這種寶貴的資源遭到毀滅性的破壞。目前，海南的農貿市場和賓館飯店出售的陸生龜類很多，但絕大多數是來自東南亞國家的馬來閉殼龜和馬來巨龜，海南本地區的龜主要見有花龜、黃喉模水龜和鋸緣攝龜。自 1997-1999 年，筆者參加海南省野生動物調查隊，在海南各地區調查歷時一年多，發現各地區收購的龜類主要為花龜、黃喉擬水龜和鋸緣攝龜，售價每斤曾達 3000 多元的三線閉殼龜及其他一些龜類已難見其蹤跡。

近兩年我們從事海南島眼斑水龜和花龜的研究，主要對其數量、分布範圍、棲息地選擇、食性和繁殖進行研究。已收集到大量研究數據，特別在食性和養殖方面取得了突破性發展。在調查研究的同時也更深刻地體會到海南島對龜類保護意識不強，保護措施不力。許多市縣仍有不少公開收購龜類的貿易場所，導致龜類資源的進一步破壞。建議有關方面應對此引起高度重視，加大保護力度。由於我國對龜類所做的研究甚少，對許多龜類資源現況不了解，因此大部分種類的龜未被列入保護動物名錄，這嚴重影響了該類動物的保護。而實際情況是所有龜類資源都遭到了嚴重破壞，許多種甚至已絕跡。建議國家將所有龜類列為國家重點保護動物。

The Present Conditions of Sea Turtle in Hong Kong

John Wong

Chairman of Hong Kong Marine Conservation Society, 15/F Park Hovan
Commercial Bldg., 18 Hillwood Rd., TST, Kowloon, Hong Kong

Introduction

Since the Hong Kong government has started the official recording of Sea Turtle in 1950, the general public in Hong Kong has more and more accepted the concept of protecting Sea Turtle. Especially in the recent years, as Hong Kong Marine Conservation Society has officially commenced the investigation of Sea Turtle and has obtained some confirmed correct data, the intended establishment of Sea Turtle protection areas has effectively gained momentum. Guangdong Province, which in the close neighborhood of Hong Kong, has already established the first sea turtle protection area in China since 1984. After the non-stopped investigation and improvement of breeding and protection of this precious Chinese sea turtles, a certain degree of success has been made by now. However, it will not be practical by the provision of just one or two areas. The main point we are going to discuss today is how to share results of investigations conducted in all areas and to intensify the exchange of practical experience, so that much efficiency can be ensured in providing effective results.

In Hong Kong, there were Sea Turtle reported historically. Some bays in Hong Kong are named after turtle. Such as Turtle Cove, Bay of Turnover Turtle. There were seagrass bed on Hong Kong. Due to development of reclamation, much habitat for the turtle are destroyed. In older village on Lamma Island, in south Hong Kong Waters, the local residents ate turtle eggs, they believe it is good for health. And mostly because they are free protein. According to local communities, sea-turtle were fairly common in west, south and east coasts especially SE facing sandy beaches, such as Lamma Shum Wam, Ha Mei Wan, Tung O, Yung Shui Ha, Turtle Cove, beaches in Sai Kung, Clearwater Bay areas. As well at Lantau, Tong Fook Bay, Tai Long Wan and Tinkau.

No records of turtle sightings were kept before 1950. And no study has been carried out in Hong Kong Sea Turtle until 1997. HKMCS obtain funding from Environmental Conservation Fund (ECF) to carry out a one year research on local turtle sightings and survey the beaches likely to be visited by Sea Turtle and look for sights of turtle landings. HKMCS volunteers and scientific officer carried out a survey on Hong Kong beaches, and interview the villagers around Lamma. There used to be 20-50 nests each season which decreased in the last 10 years. In 1996, only 1 turtle was reported to have laid eggs. In 1997, no turtle sighted during nesting season (April – September). Educational Pack – turtle sighting that, patrol Shum Wan Beach Results: 16 boat survey were made around Hong Kong Beach 1997-4 reported sighting, including Shan Sze Wan, Shum Wan beaches reported by AFD.

Records of Turtle Sighting:

There were 4 kinds of Sea Turtle 1) loggerhead, Olive ridley, Green Turtle, Leatherback. Only Green Turtle will lays eggs in Hong Kong. In 1970's I have seen baby turtle swimming in Portshelter and in eastern water of Tai Pai. Mature Green Turtle was captured in Ting Kau – West New Territories coast.

Threats-

- 1.) Trawlers
- 2.) Gill Nest
- 3.) Lost of habitat – nesting beach lost due to reclamation and coast development
- 4.) Lost of seagrass bed
- 5.) Turtle eggs were removed and eaten
- 6.) Adult Turtle captured for food or killed by marine traffic

Legislation-

- 1.) Wild Animal Protect Ordinances- No possession, disturbance, sale of eggs. Maximum Penalty \$ 100,000 and 1 year imprison
- 2.) Animal and Plant (Protection of Endangers Species) Ordinances

Banning commercial trade, import and export of Sea Turtle.
Maximum Penalty is \$5,000,000 and 2 year imprisonment

1998

- HKMCS volunteers and AFD staff patrol beach
- July to September found 12 nesting
- 86 turtle hatches of eggs were collected and released to the sea
- Eggs were incubated at temperature 30-32°C
- 85% eggs incubated and hatch successfully

HKMCS recommendation

- 1.) Designate Shum Wan as Marine Sanctuary
- 2.) Apply turtle exclusion device (TEDs) to trawlers and fishing boats
- 3.) Public Education on Turtle and Marine conservation

■ Result – see table

■ Map of HK

Wai Tung National Marine Turtle Sanctuary China

Wai Tung Gangkou, land area is 0.8 km², is located at 114°E 22.35°N (80 km east of Shenzhen Population: 25,000 Water depth: 5-15 m
Salinity: 30‰ Sea Temperature: 28°C (July to September)

Green turtle came to beaches to lay eggs

Before 1949 100,000 – 200,000 eggs

Around 1949 there were 300-400 turtles up to 400,000 eggs per year

After 1949 60,000 – 70,000 eggs

At 1996 is 38,000 incubation period is 47-59 days

1958 Over catch

1960 No management, yearly killed 70-80

1970-80 In average, around 40-50 person removed and stolen the eggs.

1984 60 turtles were killed

In April 1984, Local fishery Department set up a protection area. In March 1986, an area totaling 4 km² has been demarcated as a protection station. On December, the protection station has been upgraded from

district class to provisional class. In October 1992, it has finally upgraded to National class.

- 1984-96 696 visits by sea turtles, 399 nests, 44382 eggs were lay, and hatches 38640, totally 36106 were return to sea.
- 1995-97 Last 3 years, 30 turtles bycatch and return to sea or kept at the station
- 1994-96 Killed 16 turtles by fishing trawlers
- 1997 52 turtles wer sighted, 29 nests, 3597 hatched eggs, 4-5 bycatch
- 1998 86 turtles were sighted, 61 nests, 6387 eggs
Use Potassium Permanganate $KmnO_4$ to disinfecting over 10 years

Now 2 adults and 100 baby turtles from last 3 years were kept for educational purpose at station.

- 1994 A nearby beach – 1 nest was found
- 1995 A nearby beach – 5 nests were found
- 1996 A nearby beach – 4 nests were found

Penalty Y100,000 to local illegally remove sand from sanctuary.

According to Chinese Aquatic Animal Protection Act, violation is liable to fine from Y300-3000.

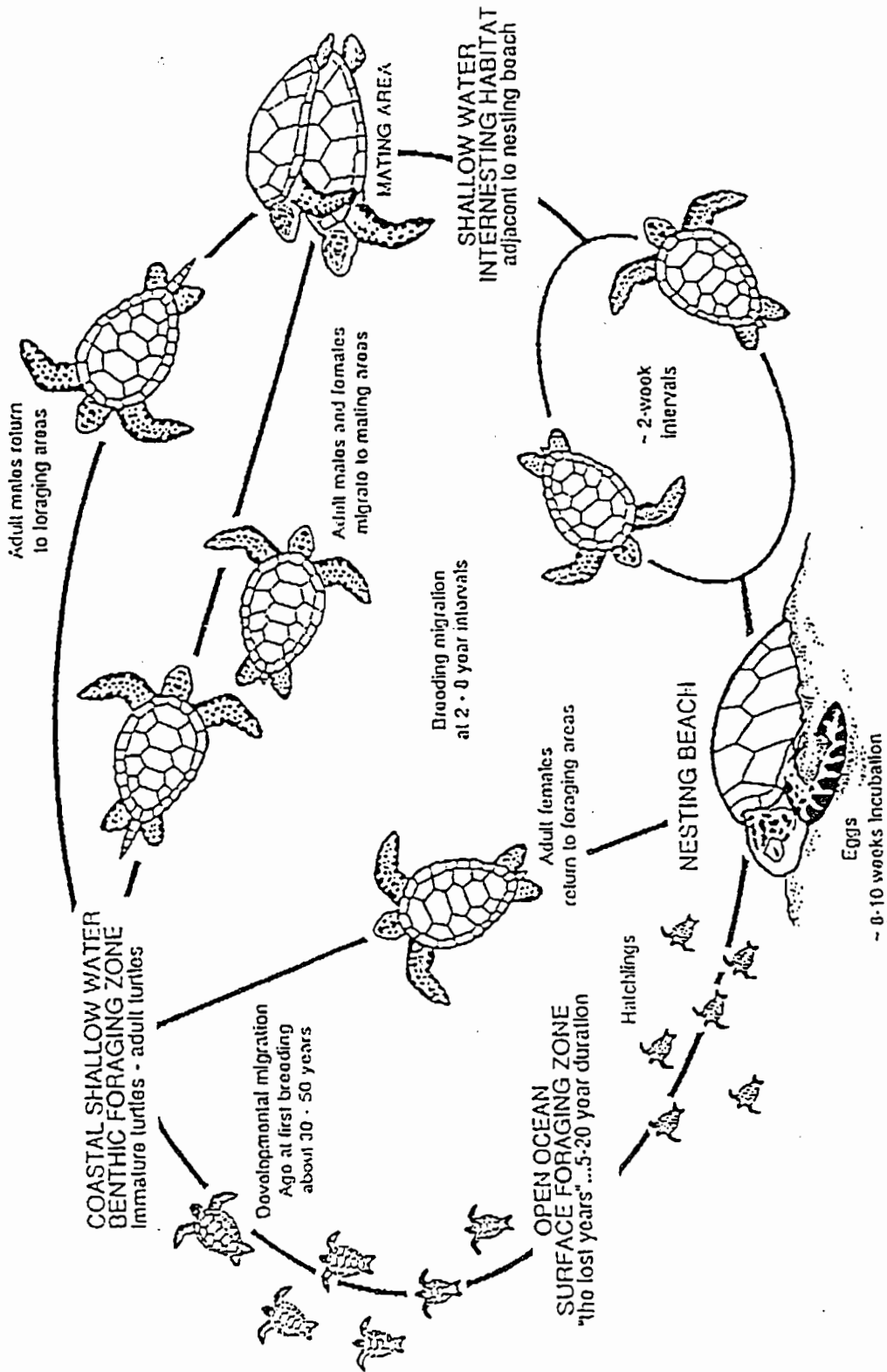


Figure 1. Generalized life cycle of sea turtles. Redrawn from Lanyon et.al. (1989); cited in Miller (1997).

Table 1. Beaches suitable for turtle nesting.

Beach number	Beach name	Beach location
1	Yi Long Wan	Chi Ma Wan Peninsula, Lantau Island
2	Tai Long Wan	Chi Ma Wan Peninsula, Lantau Island
3	Sham Wan	Southern Lamma Island
4	Ham Tin	Tai Long Wan, Sai Kung East C.P.
5	Tai Wan	Tai Long Wan, Sai Kung East C.P.
6	Chung Wan	Kat O, Mirs Bay

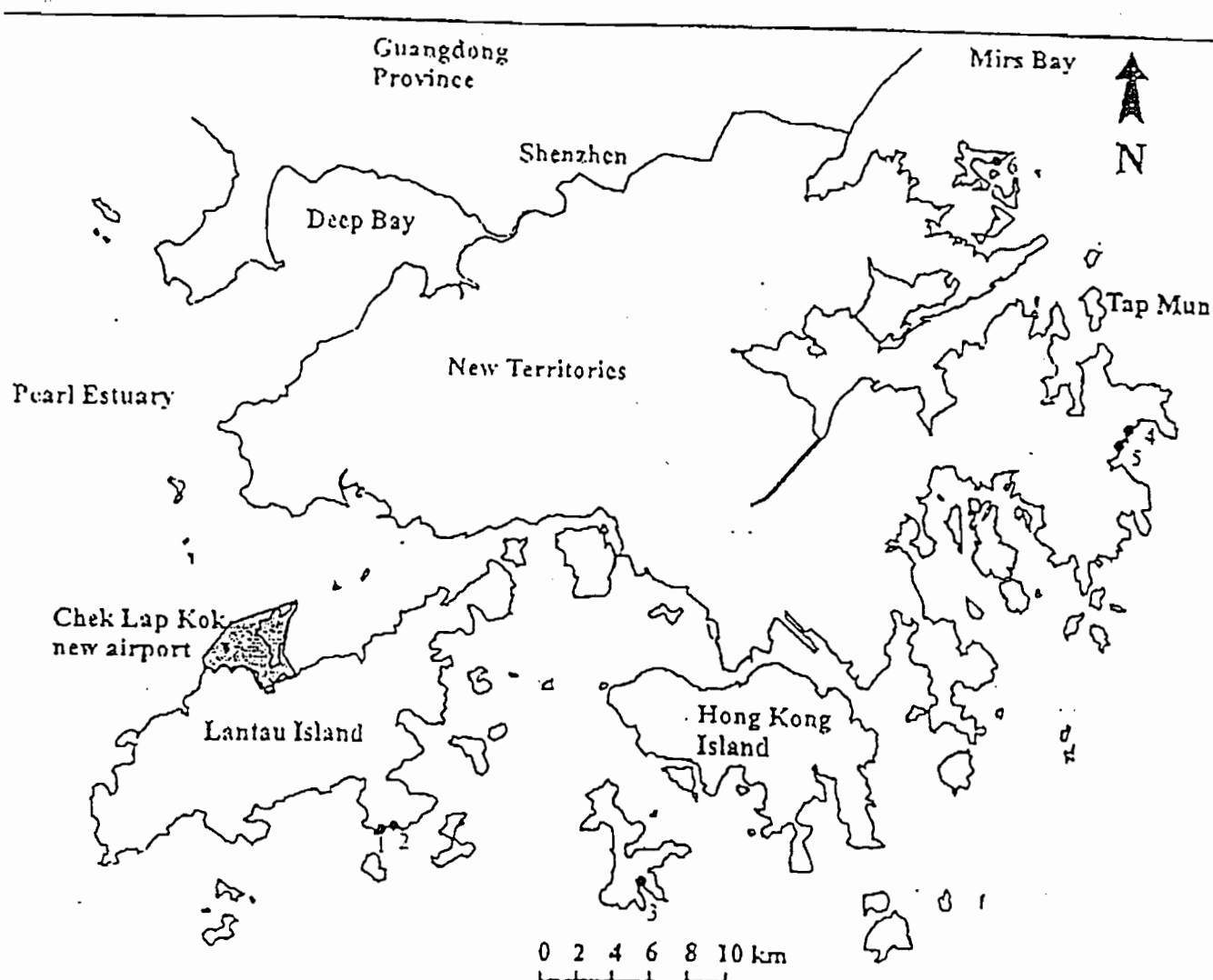


Figure 3. Map of beaches suitable for turtle nesting

Appendix 1. Records of turtle sightings in Hong Kong and surrounding islands.

Date	Species	Location	Age	Status	Activity
05/08/1951	Leatherback	Cheung Chau	adult	live	on beach
07/01/1954	Green	Paracel Island	young	dead	unknown
07/01/1954	Green	Tai Tam Bay	unknown	dead	unknown
12/01/1983	Leatherback	Lemma Island	unknown	unknown	unknown
12/08/1984	Leatherback	Lei Yue Mun, E. Victoria Harbour	adult	live	swimming
08/01/1972	Green	Tai Tam Bay	Hatchling	live	swimming
08/01/1973	Olive Ridley	North Stonecutters Island	unkown	dead	unknown
03/20/1978	Green	Tolo Channel	young	dead	floating
03/22/1978	Loggerhead	Tang Lung Chau Market	unknown	live	in market
04/13/1978	Olive Ridley	Shau Kei Wan	unknown	live	swimming
04/27/1985	Unknown	Ham Tin, Tai Long Wan, S.K.E.C.P.	Adult	dead	stranded
08/26/1986	Unknown	Rocky Bay Beach, Hong Kong Island	unknown	live	unknown
07/06/1987	Unknown	Sham Wan, Lamma Island	Adult	live	nesting
07/18/1987	Unknown	Sham Wan, Lamma Island	Adult	live	nesting
08/04/1987	Eggs found	Sham Wan, Lamma Island	eggs		
08/10/1987	Unknown	Tung O, Lamma Island	Adult	live	on beach
05/28/1988	Leatherback	Sai Wan, S.K.E.C.P.	unknown	dead	stranded
06/05/1989	Green (?)	Sai Wan, S.K.E.C.P.	adult	dead	stranded
08/29/1989	Green	Pak Sha Chau(Round Island)	unknown	dead	stranded
01/14/1991	Green	Tap Mun Chau	adult	dead	stranded
08/27/1994	Leatherback	Tung Lung Chau	adult	dead	stranded
08/01/1995	Green	Sham Wan, Lamma Island	adult	live	nesting
04/05/1996	Unknown	Clearwater Bay	adult	dead	floating
06/01/1996	Green	Sham Wan, Lamma Island	adult	live	nesting

Appendix 1. Records of turtle sightings in Hong Kong and surrounding islands (cont.).

Date	Species	Location	Age	Status	Activity
08/07/1996	Olive Ridley	Repulse Bay	unknown	dead	stranded
11/23/1996	Olive Ridley	Shek Pik, Tai Long Wan, Lantau	unknown	dead	stranded
12/15/1996	Green	Little Palm Beach, Sai Kung	unknown	dead	stranded
05/01/1997	Unknown	Powerstation Beach Lamma Island	juvenile	live	on beach
08/01/1997	Unknown	Sheung Sze Wan, Clearwater Bay	juvenile	live	on beach
08/18/1997	Green	Channel between Town Island and High Island	adult	dead	floating
10/02/1997	Green	Ham Tin, Tai Long Wan, S.K.E.C.P.	adult	dead	stranded

HONG KONG MARINE CONSERVATION SOCIETY
TURTLE SIGHTING/NESTING DATA SHEETS

Location (beach, island): Grid / GPS reference?	
Date:	
Time:	
Person recording information:	
Name of Institution:	
Tags on turtle? (Yes or no) (If yes, write down details on tag)	
Species of turtle (if unknown, please describe shell)	
Size of turtle's shell (in cm):	Length Width
Was the turtle alive or dead?	
Did the turtle lay eggs? (If yes, how many did she lay?)	
Were the eggs removed? (If yes, by whom?)	
Did the turtle return to the water? If no, what happened to her?	
Was there any visible damage? (If yes, please describe)	
Other comments or information:	

Thank you for taking the time to complete this form. Your information will be added to the HKMCS turtle database. Please return to:
HKMCS, PO Box 10165, Central, Hong Kong.
Fax: 2851 4463 or e-mail: hkmcs@netvigator.com

香港海龜的現況

王敏幹

香港海洋環境保護協會 主席

摘要

自從 1950 年，香港政府開始進行海龜的紀錄以來，保護海龜的意識得到愈來愈多市民的認同。尤其在最近，香港海洋環境保護協會正式對海龜所展開的調查，取得一些比較確實的數據，在一定程度上，對於設立海龜保護區，發揮了推動的作用。而與香港毗連的廣東省，1984 年便已成立了全中國首個海龜自然保護區，在這十多年來不斷的探索、改良對這種水中古珍稀寶的培育和保護，時至今日，亦以取得一定的成績。但是對於這種游動性非常之高的動物來說，單憑一兩個地區的保護措施是不切實際的。地區之間如何分享經驗及加強交流，以達事半功倍之效，才是今天我們的重點。

龜，在中國的文化裡，自遠古以來佔據著重要的地位。根據歷代文獻的記載，中國的沿海地區，北至黃渤海，南至南海，甚至南沙、西沙以至北部灣一帶，均有不同種類的龜的蹤影，有記載的種類便包括了菱皮龜、綠海龜、玳瑁（古稱〔王毒〕瑁）、麗龜和蠛龜。

我們的祖先，在新石器時代，已經懂得利用龜甲或龜板，來測卜天地的玄秘，或理療民間的疾痛。史載，周文王南伐楚越，在九洲遭遇水困，得巨龜以身做轎，方能脫險通過。在明戴李時珍所著的藥典《本草綱目》裡，玳瑁、綠海龜和赤海龜均被列入可「清毒散熱、強身健體」的藥目裡頭。清人屈趕到時大均所著的《廣東新語》，亦提及玳瑁產於廉、瓊洲（及今日之雷州半島）一帶，而在「惠州有巨龜，背生樹木，望之儼如洲者，然不常見」，據判斷這巨龜便是我們今日所稱之菱皮龜了。

在香港，以龜命名的地方亦有不少，例；港島南面的龜背灣、紅山半島的舊稱為「龜山」、南丫島下尾灣的前稱為「昂龜灣」等等。在在標示著香港的龜文化的久遠歷史。時至今日，深灣及東澳亦常見海龜上按，挖巢產卵。

1997年，香港海洋環境保護協會在得到環境保護基金的撥款資助下，進行了一項為期一年全港性的海龜調查，包括現場訪問、資料統計，以及派遣義工，在海龜可能出沒及挖巢的地方巡察等。調查進行期間，並未發現確切的海龜產卵地點，但在香港海域，卻發現了四頭海龜的蹤跡，其中兩頭是在東面水域發現的屍體，經證實為綠海龜，另外兩頭，因無資料，尚未查海龜屬何種龜類。此外亦接獲在南丫島發現一頭海龜產卵的報告，可惜龜蛋已被當地居民煮吃。

1998年，香港海洋環境保護協會，連同香港政府漁農處的自然保護人員，巡察南丫島的深灣，在七月至九月的期間共發現了12個海龜巢，其中兩個被發現時位處沙灘的高潮線下，有被淹沒之虞。漁農處將之移往安全地點，以攝氏30°C至32°C的恆溫進行人工孵化，結果共孵化小綠海龜86頭，全部放回大海。而其餘留在沙灘上自然孵化的龜卵，亦錄得85%的成功率，香港海洋環境保護協會將調查寫成報告，強調展開教育及執行保護的重要性，並提出設立保護區的建議，業已獲得政府接納。現在，香港政府正籌備將該灘訂為海龜的自然保護區。根據以生效的《野生動物保護條例》，任何人蓄意補殺、滋擾海龜落竊取龜卵，均屬違法，可被重罰港幣十萬元及入獄一年。

以筆者的經驗來說，80年代海龜上岸的情形較為多見，尤其在香港九龍西側的沙灘，例如荃灣、汀九一代為甚。而筆者本人，曾在親水灣、西貢海面見過剛孵出的小海龜在水面游泳，近年潛水十亦在香港以南的擔桿島及西貢海的一帶的水下見過海龜。根據當地居民的報告，從前在大嶼山南不知塘福廟灣亦有海龜上岸的紀錄。

歸納以上，我們可以看到，從前的香港，沿岸確實有很多適合上岸的地點，例如吉澳、大浪灣、浦台島、龜背灣（即現在的大潭水塘）、南丫島的東澳、深灣、下尾灣（昂龜灣）、大嶼山南部的芝麻灣、塘福廟灣、大浪灣、大小鴨洲等。這些海灘全部面向東南方向，夏天水流隨風向由東南而來，海龜便因此隨波而至，並在這些沙灘上停駐。同時，在香港的社會為如今天發達繁盛之時，對於生態造成的破壞亦較少，大多數的資源較諸今日，便顯得豐富了。

不過，近年來，在民間團體和政府的努力下，香港市民對於海洋環境保護的意識，普遍有所提高。在香港，現在已分別設立了一個海岸公園和三個海洋保護區，在不同的範疇裡，對不同的生物以致整個

海底生態，實施不同程度的保護。現在備受關注的海龜，在不久的將來，議會納入受保護的目標之內。

在中國大陸，早逾 1984 年已關注保護海龜的迫切性，並成立了保護區。該保護區是全中國第一個國家級的海龜自然保護區，主要目的是保護綠海龜，以及以人工培育方式繁殖，以增加海龜的存活率。一般海龜的孵化其約 47 至 59 天，是呼氣溫而定。

保護區坐落於東經 114.5 度北緯 22.35 度、深圳以東 180 公里、距香港只有兩小時車程的惠東港口。香港海洋環境保護協會曾兩度造訪，與其管理人員交流經驗。

根據保護區管理員提供的資料，保護區範圍約為 10 公頃，其中陸地面積佔 0.8 平方公里，只有 7 名管理人員，一年的經營費僅為人民幣 14 萬元（1996 年數據）。據介紹，在 1949 年以前，當地居民常見海龜出沒產卵，估計每年 40 萬顆，每每被居民取食。1949 年後，上岸產卵的海龜數目越來越少，估計只有 300 至 400 頭，每（繁殖）季只有 6 萬至 7 萬蛋。1958 年後，由於超捕及獵食，加上缺乏管理，平均每年均有 70 至 80 頭海龜被殺，海龜數目急遽下降。在 1970 至 1980 年間，每季均有 40 至 50 人來偷竊海龜蛋。僅 1984 年便錄得 64 頭海龜被害的紀錄。1984 年，在當地漁政部門的支持下，保護區宣告成立，並做出定期巡察，情況有所改善。1986 年 3 月，劃定保護區陸地範圍為 4 平方公里，同年 12 月保護區由地方級提昇至省級。1992 年 10 月在獲提升至國家級。1996 年，保護區的陸地範圍進一步擴大至 8 平方公里。在 1995 至 1997 的三年間，遭漁船誤捕的海龜約 30 頭，部分放回海裡，而部分則被送往保護區作教育用途。

從 1984 到 1996 年間，約 696 龜次建立了 399 個龜穴，產卵 44382 顆，成功孵出 38640 頭小海龜，其中放回海裡的約有 36106 頭，其餘的留用作教育或研究用途。同時期，保護區接待了約 3 萬人次的參觀。其實，在保護區以外的沙灘，亦曾發現零星的海龜巢穴。例如，毗鄰的亞麻娘灣，便曾於 1994、1995 和 1996 年發現過一個、5 個和 4 個巢穴。

基於資源有限，保護區現時仍只能將巡察的範圍限制於陸地，而無法擴展到海面。因此，拖網漁船誤捕海龜的事件，時有發生。1994 至 1996 年間，被拖網漁船誤殺的海龜共有 16 頭，其中 1996 年 7 月，

一頭重達 300 公斤的菱皮龜被誤殺。

在筆者逾 1996 年首次到訪保護區時，其設施非常簡陋，海龜持連上蓋也沒有，當時保護區便育有 2 至 3 尺長的蠘龜一頭，綠海龜一頭及剛孵出的小海龜 16 頭。而當年保護區發現上岸產卵的海龜僅 10 至 20 頭，巢穴 18 個。在 1998 年，香港海洋環境保護協會曾組團前往海龜保護站參觀，察覺當地設施改善不少，該會並捐贈一艘橡皮艇及船尾機作為巡邏用途。

海龜是一種洄游性的動物，牠不會定駐在某一特定地點，海龜的覓食地點，與其生產地點，距離可達一萬五千里之遠。有紀錄顯示，曾經友人以衛星定點探測儀器，錄得有海龜從墨西哥游至日本。香港發現的海龜，亦可能從日本、印尼或菲律賓等鄰國遠道而來。因此之故，保護海龜的工作，必須概括整個地區，方得行之有效。各國及地區之間的相互交流、加強合作便顯得更為重要。

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**Author/ Cheng, I-Jiunn, Institute of Marine Biology,
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