REPORT ON PTT-ATTACHED GREEN TURTLES *CHELONIA MYDAS* IN THE ANDAMAN SEA

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ABSTRACT

Three models of Platform Transmitter Terminals (PTT) were attached to four green turtles (*Chelonia mydas*) living in the Andaman Sea in 1995 and 2000. After released from Phuket and Similan Islands, each turtle revealed its unique migrating route. Two turtles (a 6-month old and an sub-adult female reared in captivity for 6 years) went to southwestern coast of Thailand while the third post-nesting one went to northwestern coast. The fourth post-nesting turtle went to Andaman Islands, India. The destinies of these turtles were sea grass habitats. The duration of PTT signal was 3-32 days. During cruising and feeding, the adult turtles swam 18-66 and 2-12 km/day, respectively. The fourth turtle spent 9±2 % on the sea surface each day. The surface time was highest after sunset and decreased exponentially onward. Since this study revealed that the post-nesting turtles migrated to several feeding grounds. The collaboration among countries within the region is required to guarantee the survival of sea turtles in this region.

Keywords: PTT, satellite tracking, migration, green turtle, Andaman Sea, swimming speed, surface time

INTRODUCTION

Migration pattern is known as an important tool for conservation and management of sea turtles. Several studies employing satellite transmitters revealed that the turtles migrated for very long distance between feeding and nesting grounds (Balazs 1994; Balazs *et al.* 1995; Luschi *et al.* 1996). The result of having such long migrations leads to collaboration among countries for efficient conservation of sea turtles in each region (Liew *et al.* 1995). Studies employing molecular markers revealed that there was a great separation between green turtles living in Atlantic Ocean and Pacific Ocean (Bowen *et al.* 1992; Bowen & Karl 1997). Unfortunately, most recent studies neglected an important nesting area, Indian Ocean.

In order to add a piece of jigsaw to migration patterns of green turtles, we employed platform transmitter terminals (PTT) to the green turtles living in the Andaman Sea. The major aim of this study is to determine the migration routes of nesting green turtles. Additional information such as swimming behavior, surface time and sea surface temperature were also reported.

MATERIALS AND METHODS

Three models of PTT were employed: the Trial, Telonics ST18 and Kiwisat101. The specification of these PTT was listed in Tab 1. The Trial PTT was connected to the turtle with a monofilament that tied to a man-made hole on a posterior scute. The other two models were attached to the cleaned second mid-scute of the turtles. Putty and epoxy glue were used to adhere the PTT. Later on, carbon fiber clothes soaked with epoxy glue were covered over the PTT and part of the mid-scute. To assure that the glue was fully hardened, the turtles were kept dry at least 1-2 hr before releasing. In addition, the turtles were tagged with external Inconel tags and internal microchip tags (Tab. 2). The position signals from the PTT were obtained via ARGOS.

Four green turtles (*Chelonia mydas*) namely Panwa1, Panwa2, Sri Nuan and Kayano were attached with PTT as shown in Tab 2. Panwa1 was a 6-month old turtle. Panwa2 was caught from the sea around Phuket and reared at Phuket Marine Biological Center for 6 years. Sri Nuan and Kayano were wild females came to lay eggs at Huyong, Similan Islands. At the time we were tagging, Sri Nuan had laid eggs for the 6th time in that year. The record from The Third Fleet of Royal Thai Navy showed that Sri Nuan also came to lay eggs at the islands 3 years ago. While, Kayano was recorded as her first egg laying in that year and there was no record to lay eggs at the islands during past 4 years.

The position data were plotted with global information system (GIS) program. The additional information on sea grass habitats in Thailand was obtained from Chansang & Poovachiranon 1994 and Poovachiranon & Chansang 1994. The minimum accumulated migrating distance (D_m) in kilometer

was calculated as $A \times \sum_{i=1}^{n} \sqrt{(Y_{i+1} - Y_i)^2 + (X_{i+1} - X_i)^2}$, where; A is a conversion constant from a degree to km, which equals to 111.12; Y_i and X_i are decimal degree of latitude and longitude, respectively. The swimming speeds were interpreted from slopes between accumulated migrating distance and time. All sampling errors were calculated as confidence interval at 95%.

Table 1. Specification of three platform transmitter terminals (PTT) employed in the study

Company	Model	Duty cycle (hr/day)	Sending Power (watt)	Salt-water switch	L cm	W cm	H cm	WT g	Battery life, day	Obtained information
NTT CODOMO and Kyoto University	The Trial	24	NA	No	4	3			180	Position
Telonics, USA	ST18	8	0.5	Yes	13.4	4.7	2.1	200	255	Position
Sirtrack Limited, New Zealand	Kiwisat101	24	1.0	Yes	18	8.5	5	610	150	Position, surface time and surface temperature

Table 2. Information of PTT-attached green turtles (*Chelonia mydas*) from the Andaman Sea

Turtle Name	Sat ID	PTT	External Tag	Internal Tag	Attached Date	Released Place	WT kg	L cm	W cm
Panwa1	-	NTT	-	-	Sep 15th, 00	Phuket			
Panwa2	19277	Telonics ST18	*Left* TH/P 0471 *Right* TH/P 0470	*Left* 116479195A *Right* 116563472A	Mar 7th, 00 10:05	Phuket	93	88	78
Sri Nuan	19278	Telonics ST18	*Left* TH/P 0417 *Right* TH/P 0420	*Left* 017-864-343 *Right* 020-341-840	Jun 10th,00 4:45	Similan Islands	-	119	100
Kayano	18683	KiwiSat 101	*Left* TH/P 0470 *Right* TH/P 0477	*Left* 116479195A *Right* 116563472A	Sep 5th, 00 18:50	Similan Islands	-	110	90

RESULTS AND DISCUSSION

The PTT

The signal durations from PTT-attached turtles lasted much lesser than the specification (*see* Tab. 1, the Trial: 3 days, Telonics ST18: 21 days, Kiwisat101: 32 days). Several reason can be assumed: 1) Since, the Trial PTT was connected to the turtle by a monofilament, a chance that it will tear apart was high; 2) the Telonics ST18 and Kiwisat101 may be detached when the turtles rubbed their backs on hard substrates or during mating; 3) The turtles may be caught by fishing gears.

Comparison between Kiwisat101 and Telonics ST18 showed that Kiwisat101 sent twice higher number of data per day than Telonics ST18 (4.0±0.9 times/day VS 1.6±0.3 times/day). However, this is because Kiwisat101 has higher sending power (1 watt) compared to Telonics ST18 (0.5 watt). Besides, Kiwisat101 was turned on 24 hr a day while Telonics ST18 was turned on 8 hours a day only. The number of signal was high during 4:00-11:00 and 16:00-21:00 (local time).

The tracks and speeds

All PTT-attached turtles migrated to different directions (Fig. 1).

Panwa1 went to a small island (98°24'N 7°45'E), 4.3 km far from the released point. There were only 2 signals received. The swimming speed was 1.4 km/day.

Panwa2 swam average 18 km/day to the southeastern direction and reached the sea grass habitats 8 days later. She spent 3-4 days in this habitat. D_m was 215 km in 12 days. The last position recorded was 98°24'N 7°45'E.

SriNuan went to the northeastern direction from Similan Island and reach to a sea grass habitat in 3 days. She had spent about 7 days feeding in this area before went back to lay eggs for the 7th time in this year at Similan Island (13 days after the previous eggs laying). Later on, she went to the same feeding ground. Her last position was detected at 98°13'N 7°27'E. SriNuan swam 35-46 km/day when cruising between nesting and feeding grounds. During staying in feeding ground, she swam 2-4 km/day. D_m was 524 km in 27 days.

Kayano traveled to Andaman Islands, India (640 km far from Similan Islands). She swam 66 km/day for 15 days to reach the destination (Woodmason bay, Rutland Island, Andaman Islands) and stayed there until the signal was ceased at 92°37'N 11°26'E. D_m was 1,174 km in 31 days. It was suspected that there would be a sea grass habitat in that area.

This study revealed that green turtle from at least two feeding grounds (Andaman Islands and west coast of Southern Thailand) lay eggs at Similan Islands. Thus, conservation of green turtle in the Andaman area would require collaboration among countries in the region.

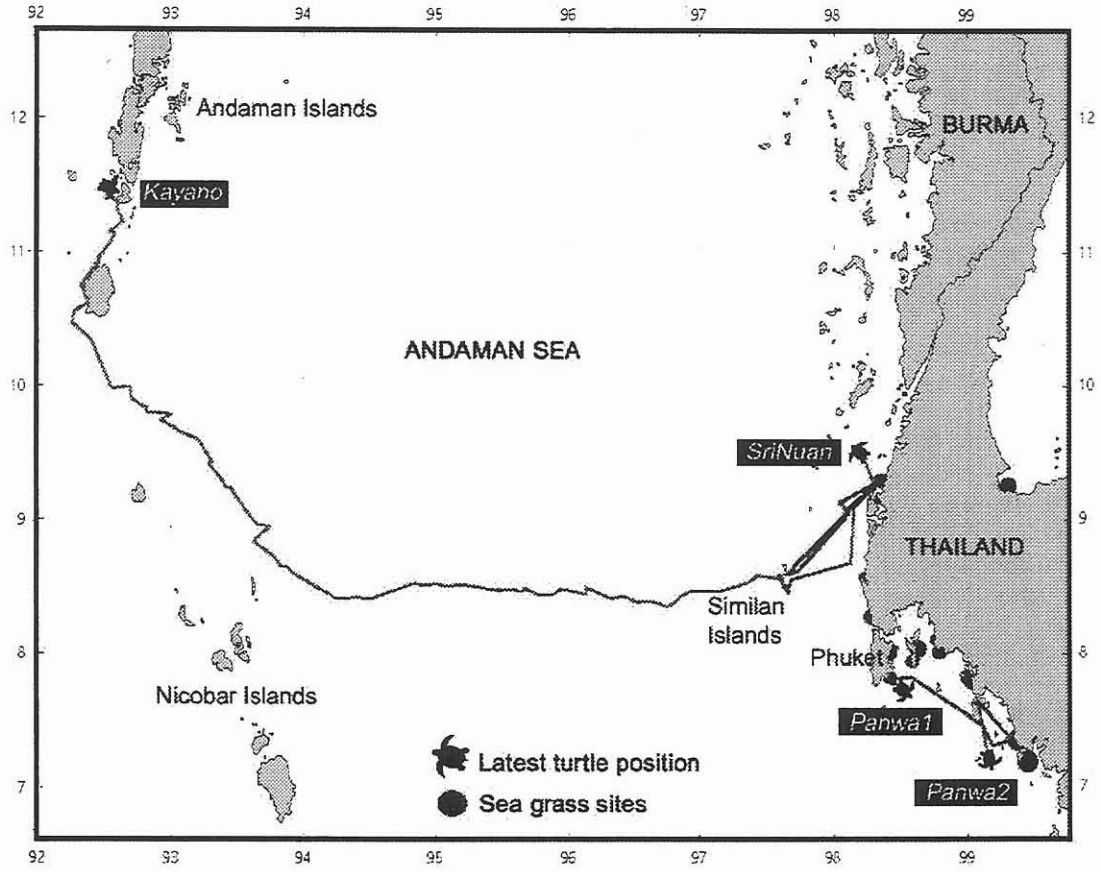

Figure 1. Migration routes to PTT-attached green turtles (Panwa1, Panwa2, SriNuan and Kayano) released from Phuket and Similan Islands in 1995 and 2000.

The surface temperature and sea surface time

The sea surface temperature was quite constant at 29.6±0.1°C. Surface time counter in PTT attached to Kayano showed that she spent 9±2 % each day. Diurnal pattern of surface time demonstrated that Kayano spent highest surface time as soon as it was dark (Fig. 2). The average surface time during day (6:00-18:30) was 6±1 % and 16±5 % at night. The lower surface time during day may be explained by feeding behavior and mechanism to avoid enemy.

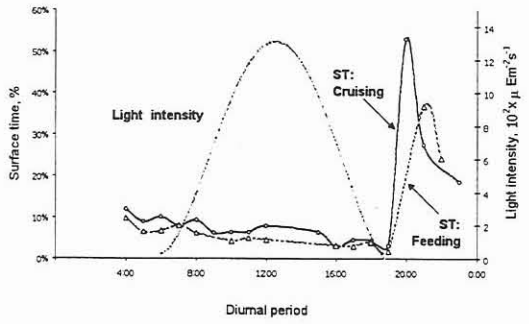

Figure 2. Diurnal pattern of sea surface time obtained from surface time counter in PTT attached to the post-nesting green turtle, Kayano.

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