

MIGRATION PATTERN OF POST-NESTING GREEN TURTLE IN THE GULF OF THAILAND

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ABSTRACT

Satellite telemetry using the Argos system was employed to study the long-range migratory travel of eleven post-nesting green turtles *Chelonia mydas* in the Gulf of Thailand during the year of 2000-2001. The results showed that the turtles migrated mainly in two directions, the first route stretched eastward along the eastern coast of the Gulf of Thailand to Vietnam peninsular, some crossed South China Sea and entered Sulu Sea of Philippines water. The second route went down to the south across the Gulf of Thailand to Malaysia peninsular. The migration distance ranged from 456-2,823 km with the travel speed of 1.13-2.77 km hr⁻¹. It could be pointed out that green turtles in Thailand have wide distribution sharing many foraging sites among neighbor countries. There is thus no doubt that more cooperative research is needed between countries for conservation of our sea turtle in the region.

Keywords: green turtle, satellite telemetry, migration pattern, Gulf of Thailand.

INTRODUCTION

Sea turtles are marine migratory species, and they can be considered as shared stocks among countries according to the conservation and management concept. Southeast Asian region is one of the most important habitats for sea turtles with a large number of turtle nesting. Several studies on long-distance migration of sea turtles indicated that adult females have fidelity to their specific feeding ground after finishing reproductive activity (Balazs et al, 1994; Liew et al. 1995, Luschi et al., 1996 and Miller et al, 1998). Although most sea turtle populations in this region have been dramatically decreasing recently, the knowledge on feeding, foraging habitat and migration pattern of sea turtles in this area is

still scanty. This study therefore employed satellite telemetry equipment to track migratory routes of green turtles (*Chelonia mydas*) in the Gulf of Thailand and tried to find out the specific foraging areas of Thailand's green turtle females.

MATERIALS AND METHODS

Eleven green turtles, *Chelonia mydas* were deployed with ARGOS Platform transmitter terminals (PTTs) during nesting season of the year 2000-2001. Two models of PTTs, Telonics-ST 18, a 0.5 watts transmitter with a duty cycle of 8 hours on in a day and

Kiwisat-101 model, a 1.0 watts transmitter with a duty cycle of 24 hrs on, were employed for turtle tracking. In 2000, five adult females of Ko Khram Island (12.68 N, 100.78 E) and Mannai Island (12.61 N, 101.69 E) in the Gulf of Thailand were deployed with 4 Telonics PTTs and 1 Kiwisat PTT, and in 2001 only Kiwisat models were attached to six turtles. The PTTs were glued on the second central scale of the carapace and safely covered with fiberglass cloth and polyester resin. Nesting data of the turtles were recorded in details through the long-term tagging program on the islands. Turtle names, tag numbers, body sizes and the date of release

of the eleven turtles are listed in Table 1. Signal transmission occurred while the turtles surfaced for breathing and they were interpreted and analyzed by the ARGOS satellite system. The reliability of location is affected by the number of signal received during each passage of the polar-orbiting satellite, and is classified into six location classes. The accurate locations are represented by three classes: LC 1, 2 and 3 by a variation distance within 1000 m, 350 m and 150 m respectively, whereas LC 0, A and B locations have considerable error and their accuracy is not guaranteed by the ARGOS system.

Table 1. Tag information of green turtles nesting in the Gulf of Thailand during 2000-2001

No.	Name	PTT ID No.	PTT Tag No.	Date released	Body size CCW x CCL(cm)	Track duration (days)
GT-01	Sampreang	16724	116835593	18 May 2000	91.0 x 104.0	64
GT-02	Ko Khram	28534	116874117	29 Jun 2000	85.0 x 98.0	64
GT-03	Sattahip	28533	116918551	29 Jun 2000	86.0 x 94.0	12
GT-04	Chonburi	28532	116911111	29 Jun 2000	89.0 x 100.0	47
GT-05	Chao Samut	16723	116911594	12 Sep 2000	86.0 x 98.0	83
GT-06	Ngam Ta Khram Yai	09786	116828591	9 Aug 2001	81.4 x 95.7	92
GT-07	Khram Noi	09804	116944367	10 Aug 2001	90.0 x 98.5	74
GT-08	Sri Anunt	09785	116738171	10 Aug 2001	89.7 x 95.8	100
GT-09	Boon Loung	09787	116945225	10 Aug 2001	80.7 x 88.9	93
GT-10	Sri Suk	09788	116779761	15 Aug 2001	75.5 x 81.0	67
GT-11		17682	116736265	3 Sep 2001	85.0 x 95.0	118

RESULTS

The individual migratory journeys of green turtles, which nested in the Gulf of Thailand, are as follows:

GT-01 (Sampreang: ID 16724)

The first female was released with a Telonics ST-18 PTT on 18 May 2000 after her landing on Mannai Island, Rayong Province. Since she had not finished nesting, she reappeared again on the Mannai beach for nesting on 20 May and it looked like as her last nesting in the season. The signals received from her PTT were a very few (only 6 positions). The first signal was transmitted on 25 May that was presumed to be the start of her journey. On 8 June she went down to the south directly and seemingly crossed the Gulf of Thailand to Malaysia peninsular. The turtle arrived at the coast of Kuala Terengganu, Malaysia on 23 June and then passed off Pahang State heading to Malaga Strait. The last reliable position was recorded off the tip of Malaysian

Peninsular close to Singapore (Fig. 1). It seems the turtle was still in journey to foraging ground after the transmission was over. The total distance was about 1,307 km in 48 days with a calculated swimming speed of 1.13 km hr⁻¹.

GT-02 (Ko Khram: ID 28534)

The turtle was deployed with Telonics ST-18 on 29 June 2000 at Ko Khram Island, inner Gulf of Thailand. She started her journey on 4 July to the southeast along the coast of Rayong to Trat Province, Thailand and passed Cambodia and Vietnam waters. After 10 days of the journey, the signal retrieval did not appear for a half-month. On 29 July her signal was received again by that time she had already crossed the South-China Sea and reached to the north of Borneo Island near Sabah State, East Malaysia (Fig.1). From the last record, the turtle was found entering Sulu Sea on 17 August and she

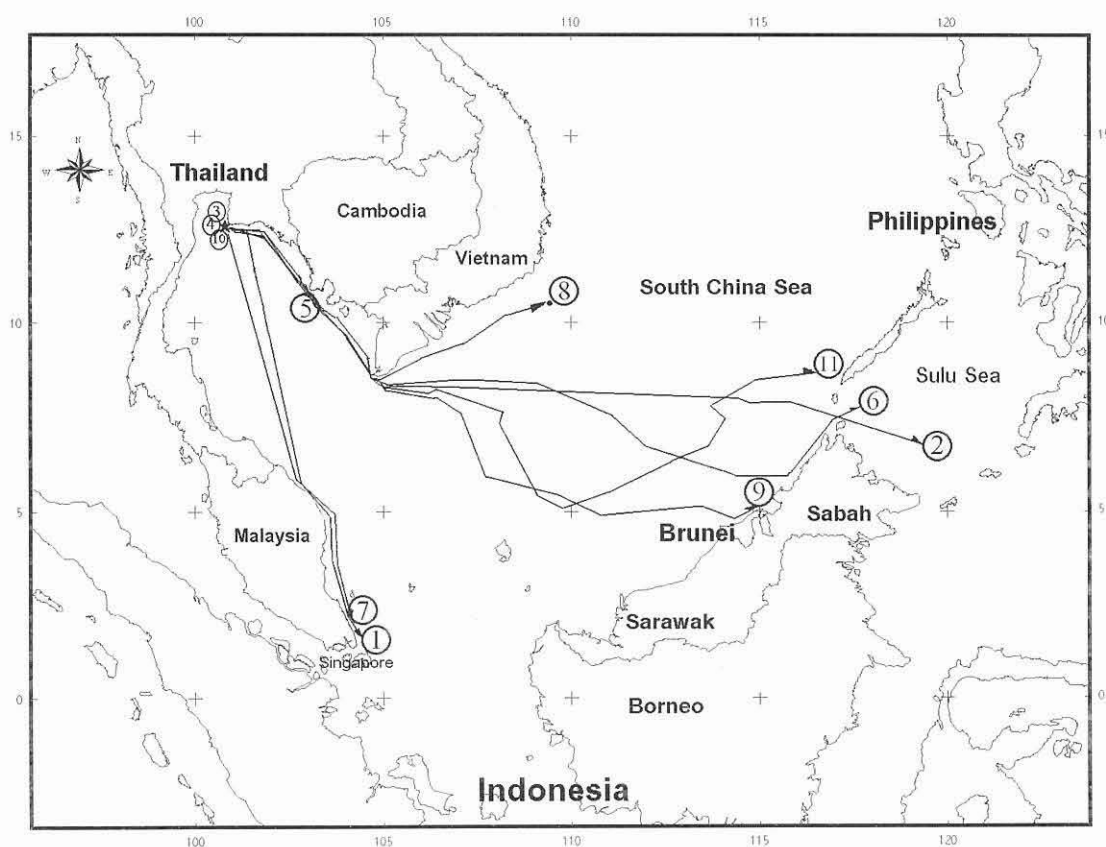


Fig. 1 Migration routes of post-nesting green turtles in the Gulf of Thailand tracked by satellite telemetry.

might have continued the travel elsewhere. The total journey distance was about 2,340 km in 45 days with a calculated swimming speed of 2.13 km hr^{-1} .

GT-03 (Sattahip: ID 28533)

The turtle was attached with a Telonics ST-18 on 29 June 2000 after her second nesting in the season at Ko Khram Island, Chonburi Province. The received signals indicated only 2 positions within a span of 9 days. The locations showed that she was still around Ko Khram Island for nesting.

GT-04 (Chonburi: ID 28532)

She was also deployed with a Telonics ST-18 on 29 June 2000 after the first nesting found at Ko Khram Island. The received signals showed 11 positions in 40 days. However she did not moved away from the island probably because she had not finished nesting for the season.

GT-05 (Chao Samut: ID 16723)

The turtle was deployed with a Kiwisat-101 on 12 September 2000 after the fourth nesting found in the season at Ko Khram Island. On 17 September she started travelling to the eastern coast of Thailand and passed through the coastal islands to Cambodian waters. She arrived at the nearshore water close to Rong Island, Cambodia on 3 October 2000 and stayed around this area for 2 months (Fig.1). The total journey distance was about 456 km in 16 days with a calculated swimming speed of 1.19 km hr^{-1} .

GT-06 (Ngam Ta: ID 09786)

The turtle was attached with a Kiwisat-101 on 9 August 2001 after the second nesting in the season found at Ko Khram Island. On 22 August she came again on the same beach for the last nesting of season and laid only 9 eggs. She then began travelling to the eastern coast of Thailand and moved to Cambodia waters and Vietnam Peninsula following the same track with the Turtle

GT-02. She crossed South-China Sea and headed toward the coast of North Borneo Island. The turtle was found moving to the northeast along the coast of Sabah State, East Malaysia until she arrived at Sulu Sea. The transmission received after 36 days of her arrival showed that she was still around some islands in Sulu Sea. She traveled totally a long distance of 2,435 km in 43 days with an averaged speed of 2.36 km hr⁻¹.

GT-07 (Kham Yai: ID 09804)

The turtle was transferred while landing on the nesting beach to the mainland of Sattahip District, 20 km far from the beach of Ko Kham Island on 10 August 2001 for displacement trial. She was attached with a Kiwisat-101 on 11 August and after releasing she went back immediately to her nesting beach and reached there within 6 hr for nesting again. Then she was found making a temporary travel to the western coast of the Gulf of Thailand and stayed there for a couple of days and traveled back to Ko Kham for nesting again on 20 August and 4 September. Unfortunately, after that the signal was lost for a half month period and was recovered again when the turtle reached the coast of Kuala Terengganu, Malaysia on 21 September 2001. Though the tracking of this turtle resembled the route of the first turtle GT-01, her travel might have terminated near shore towards the tip of Malaysian Peninsula and stayed there for many days. The total journey distance covered was about 1,260 km in 31 days with an averaged speed of 1.64 km hr⁻¹.

GT-08 (Kham Noi: ID 09785)

This turtle was also transferred to the coast of Sattahip District, 20 km away from Ko Kham Island on 10 August 2001 after she finished the first nesting found at Ko Kham Island. She was attached with a Kiwisat-101 before displacement releasing. She migrated immediately from the coast of Sattahip towards the eastern coast of Thailand and passed Cambodia water to the tip of South Vietnam Peninsula. Then she moved up to the northeast, passed through the Con Dao Island National Park of Vietnam and arrived very close to a small island named Phu Quy, located to the east of Ho Chi Minh City, Vietnam, about 120 km from shore. The turtle took only 19 days for her travelling to the destination, then the signal showed that she spent all times of more than 70 days for staying around Phu Quy Island. The last reliable position was on 14 November 2001. The total travel distance was about 1,263 km in 19 days with an aver-

aged speed of 2.77 km hr⁻¹.

GT-09 (Sri Anunt: ID 09787)

The turtle was attached with a Kiwisat-101 on 10 August 2001 after finishing the fourth nesting in the season found at Ko Kham Island. She was found on the beach for nesting again for 26 days after tag deployment. Unfortunately, after the last nesting found on 4 September, the signal was absent for 23 days and then on 27 September her position signal was appeared again in the offshore of South Vietnam, she traveled at least 850 km from the nesting area during this period. The turtle then migrated across the South China Sea and reached to Borneo Island at Brunei waters. Then she moved along the coast of Brunei for a few days until the end of transmission on 11 November. Total journey cover by this turtle was 2,004 km in 49 days with an average speed of 1.70 km hr⁻¹.

GT-10 (Boon Loung : ID 09788)

The turtle was attached with a Kiwisat-101 on 15 August 2001 after the first nesting in the season found at Ko Kham Island. After tag deployment the signals were received in good condition with reliable position but the location indicated the turtle was staying around the nesting site for more than 1.5 months. However, she was never really found on the beach during those days even though she could have nested many times. The transmission showed her small movement on 19 October, which might indicate the end of nesting and the beginning of migration. Unfortunately, it was the end of transmissions on 21 August after 67 days of signal reception.

GT-11 (Sri Suk: ID 17682)

The turtle was attached with a Kiwisat-101 on 3 September 2001 after the first landing was found in the nesting season. Her nesting was discovered on 6 September. Considering the transmission received she could have nested many times on Ko Kham beach until 12 November. She left the nesting site for her post nesting migration with the same track as many turtles by crossing South-China Sea. Her track was less straight but she also arrived at Palawan Island, Philippines, located to the north of Borneo Island. Signal transmission was over on 31 December 2001 before the turtle entered the Sulu Sea. The total migration distance was 2,823 km in 45 days with an averaged speed of 2.61 km hr⁻¹.

DISCUSSION

The results indicated that the green turtles, which are found nesting in the Gulf of Thailand can migrate to many different resident feeding grounds in the region. This study presents the data on migration patterns of the females which traveled long distance back on many ways, mainly in the southeast direction and south direction to

their foraging habitat after the end of nesting. It can be concluded that the green turtles nesting in the Gulf of Thailand are an international resource, dispersed over the waters of Malaysia, Philippines, Indonesia and Brunei. Therefore, the international strategy and effort program for the long-term research on sea turtles and their habitats are urgently needed to conserve this endangered species.

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