SATELLITE TRACKING FOR LOGGERHEAD TURTLES, *CARETTA CARETTA* : NOTE ON NAVIGATIONAL ABILITY IN THE OCEAN

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ABSTRACT

An adult female (104 kg) loggerhead turtle *Caretta caretta* was released and tracked with satellite transmitter after 10 years of keeping and rearing in captivity of Mannai Island Sea Turtle Conservation Station, Thailand. In 1992, she was inccidentally caught by small-scale gill net near the Mannai Island Station at 80 kg in body weight. Since having new freedom in the wild on 1st of July 2002, she immediately headed southeastward across the Gulf of Thailand for neighboring country's water. The transmission reported her journey passing over Malaysia Peninsula, South Borneo Island and Bali Sea of Indonesia until the signal ended at Coast of Derby City, Western Australia. The turtle could swim at nearly steady speed in a range of 1.3-2.6 km/h from original to the last position in 135 days with an accumulation distance of 4,309 km. The results of her genetic maker also revealed that her genotype was the same as Australian turtle. Although the loggerhead had long been kept in captivity, she still made travelling in quite straight line to foraging area with cruising speed nearly the same as the natural turtles. This evidence supports hypothesis of strong efficiency movement in navigational ability of sea turtle in the ocean.

Keywords: Satellite tracking, Loggerhead turtle, *Caretta caretta*, Gulf of Thailand, Navigational ability.

INTRODUCTION

The loggerhead sea turtle *Caretta caretta* is normally distributed in warm temperate and subtropical oceans (Pritchard, 1997). Nesting rookeries of loggerhead in Indo-Pacific region are mainly found in Japan and Australia (Uchida et al., 1982; Limpus, 1995 and Kikukawa et al.,1999). Since last 20 years, only two by-catch adult loggerhead turtles have been found in Thailand. In May 1992, a female loggerhead turtle was caught by small-scale gill net around the Mannai Island Sea Turtle Conservation Station, Rayong Province of the Gulf of Thailand. She was kept in captivity for 10 years from 1992 to 2002 in the Mannai Island Station. The plan to release an adult loggerhead in order to monitor the movement of turtle over large areas using satellite telemetry was performed under the SEASTAR Project researchers (South East Asia Sea Turtle Associative Research Project). The purposes of this study are to determine whether there is any preference to stay in when she is free to the wild.

MATERIALS AND METHODS

The female loggerhead turtle *Caretta caretta* used in this study was captured around the Mannai Island Sea Turtle Conservation Station, Rayong, Gulf of Thailand by a small-scale gill net. She was caught incidentally in May 1992 and kept in captivity of the Mannai Island Station. Her body weight increased from 80 kg to 104 kg from 1992-2002. She was tracked and released with small Platform transmitter terminal (PTT) model Kiwisat-101 ID Code 36025 on 1st July, 2002. The procedures for PTT attachment and data received via ARGOS-linked system from the turtle were the same as described by many previous studies (Balazs et al. 1994, Liew et al. 1995 and Sakamoto et al., 1997). The swimming speed of turtle was calculated by two reliable location data in difference distance for each time by the accurate data as LC1-3 (variation distance within 1,000 m). Genetic study for the turtle was proceeded in Kyoto University by using mitochondrial DNA analysis, following the method of Hatase et al. (2002).

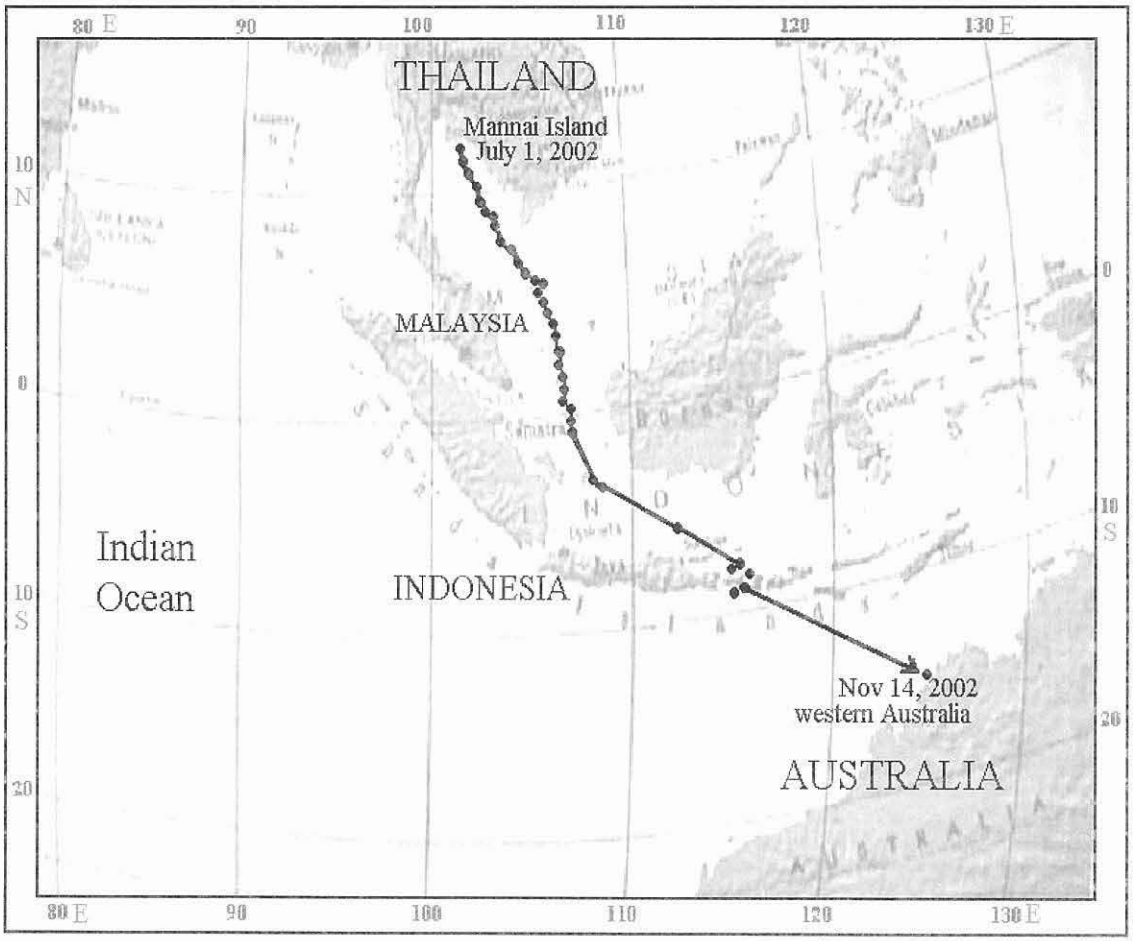

Figure 1. Satellite tracking for the loggerhead from Thailand to Australia.

Table 1. Migration route for the loggerhead turtle from 1st July to 14th November, 2002

Day release	Distance from origin (km)	Location arrival	Mean speed (km/hr)	Direction (degree)
7	351	Mid Gulf of Thailand	2.10	SE 156
15	716	Malaysian and Vietnam water	2.13	SE 140
21	1,074	Anambas Island, Indonesia	2.51	SE 148
30	1,477	Tip of Peninsula Malaysia	2.44	S 178
42	1,865	Biliton Island, Indonesia	1.40	SE 150
6	2,435	Soth Borneo Island	1.50	SE 127
78	2841	Bali Sea, Indonesia	1.25	S 178
135	3985	Coast of Western Australia	0.85	

RESULTS

The movement of the captured loggerhead after releasing to the open sea was showed in Fig.1. She immediately traveled southeastward across the Gulf of Thailand and reached to Malaysian water in 15 days. She continued the journey with nearly steady swimming speed to the ocean passing the tip of Peninsula Malaysia and Borneo Island to Indonesia water, the distance of 1,865 km from the release point in 42 days (Table 1). She arrived at Bali Sea of Indonesia in 78 days far from the original spot about 2,826 km. Then, the signal disappeared for 50 days, the recovery signal occurred again and showed her location end at the coast of Western Australia near Derby City. The transmission ended in 135 days of release with the distance of 3,985 km from Thailand. In addition, the result of her genotype showed that her DNA sequence is exactly the same as most nesting female loggerhead turtles in Australia (Type A, see Hatase, 2002). It seems this captured turtle might come from Australia and she possibly knows the way back home by excellent navigational ability.

CONCLUSIONS

1. Although the loggerhead had been kept for 10 years in captivity, she seem make a good navigation ability for travelling to foraging area probably as the original home.

2. Swimming ability in the ocean of the loggerhead turtle looks normal as the natural nesting female about 2-3 km per hour.

3. DNA analysis study showed that this captured turtle is an Australian loggerhead type, Then she might have hatched on a beach of Australia and migrate to the Gulf of Thailand while become adult for foraging.

REFERENCES

Balazs, G. H., F. Craig, B.R. Winton and R.K. Miya.1994. Satellite telemetry of green turtles nesting at French Frigates Shoals, Hawaii and Rose Atoll, American Samoa. *Proceedings of the Fourteenth Annual Symposium, NOAA Tech. Memo.* **NMFS-SEFSC-351**. p.184-187.

Hatase, H., M. Kinoshita, T. Bando, N. Kamezaki, K. Sato, Y.Matsuzawa, K. Goto, K. Omuta, Y. Nakashima, H. Takeshita and W. Sakamoto. 2002. Population structure of loggerhead turtles, *Caretta caretta*, nesting in Japan: Bottlenecks on the Pacific population. *Mar. Biol.* **141**: 299-305.

Kikukawa, A., N. Kamezaki and H. Ota. 1999. Current status of the sea turtle nesting on Okinawajima and adjacent islands of the central Ryukyus, Japan. *Biol. Cons.* **87**: 149-153.

Liew, H.C.., E.H. Chan, F. Papi and P. Luschi. 1995. Long distance migration of green turtles from Redang Island, Malaysia: the need for regional cooperation in sea turtle conservation. -International Congress of Chelo nian Conservation. 6th-10th July 1995. Gontaron, France. p.73-75.

Limpus, C. J. 1995. Global overview of the status of marine turtles: a 1995 viewpoint. In Bjorndal, K.A. (ed.), Biology and Conservation of Sea turtles. Rev. ed. Smithsonian Institution Press, Washington D.C. p 605-609.

Pritchard, P. 1997. Evolution, Phylogeny, and current status in the biology of sea turtles. In: Lutz, P.L. and J.A. Musick (eds.), Biology of Sea turtles. CRC Prees, Boca Raton, Florida. p 1-28.

Sakamoto, W., T. Bando, N. Arai and N. baba. 1997. Migration paths of the adult female and male loggerhead turtles *Caretta caretta* determined through satellite telemetry. *Fisheries Science.* **63** : 547-552.

Uchida, I. and M. Nishiwaki. 1982. Sea turtles in the waters adjacent to Japan. In: Bjorndal, K.A. (ed.), Biology and Conservation of Sea turtles. Smithsonian Institution Press, Washington D.C. p 317-319.