Nesting populations of sea turtle in Ishigaki Island, Okinawa

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ABSTRACT

The current status of the nesting activity of sea turtles in Ishigaki Island, Okinawa, Japan, was investigated. It was revealed that the dominant nesting species was changing from loggerhead turtle, *Caretta caretta*, to green turtle, *Chelonia mydas* in the most of the southern part of Japan. The nesting populations were evaluated to be 10-20 females of *C. mydas* and 3-8 females of *C. caretta*, annually. On the average, *C. mydas* re-migrate to nest every 3.7 years. The total number of females in *C. mydas* nesting population in Ishigaki was estimated to be 75 at most. The minimal estimation was 25, and in this case several females with low nest site fidelity were expected to migrate every year in addition.

KEYWORDS: *Chelonia mydas*, *Caretta caretta*, nesting activity, nesting population, Okinawa

INTRODUCTION

Generally, three species of sea turtles, *Caretta caretta*, *Chelonia mydas* and *Eretmochelys imbricata*, nest in the coast of Japan (Uchida and Nishiwaki, 1982). Ryukyu Islands, including Ishigaki Island, are utilized as a nesting site by all three species (Kamezaki, 1989, 1991). To make up conservation and management plans for sea turtles, it is important to evaluate the population size and the current status of the local breeding populations. This study introduces the evaluation of nesting populations of sea turtles in Ishigaki, the most southern part of Japan.

MATERIALS AND METHODS

All major sandy beaches in Ishigaki Island were surveyed for sea turtle nests in the daytime during the nesting season of sea turtles from 1995 through 2003. Species of the nest was identified by using the morphology of nesting females, hatchlings, or adequately developed embryo in dead eggs.

Ibaruma beach (3km in length) in the eastern coast of the island (Fig.1) is the biggest nesting site in Ishigaki, (Abe *et al.*, 1998). Night patrols were done for tagging nesting sea turtles on Ibaruma during the nesting season, which starts in April and normally finishes in August. Plastic jumbo tags and inconel tags were used. Since 2001, passive integrated transponder tags (PIT; Trovan, Ltd.) were used concomitantly with the external tags. We also used the patterns, figures, and designs on the scutes of the carapace to identify nesting individuals.

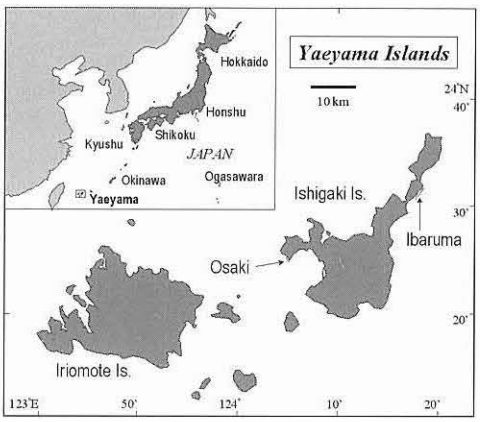

Fig.1. Study site, Ishigaki Island, Okinawa.

RESULTS AND DISCUSSION

1. Nesting activity of sea turtles in Ishigaki

Fig.2 shows the nesting activity of sea turtles in Ishigaki from 1995 through 2003. The nesting activity of *C. caretta* is low in the late 1990's, which turned to increase in early 2000's. The clutch number of *C. mydas* in 2002 increased drastically compared to the former years and restored to the former level in 2003. Although it looks there might be some increasing trend in both species, it is difficult to decide the tendency is showing the increase of the nesting populations or only yearly fluctuations at this time.

During the study, we found 569 nests of sea turtles. *C. mydas* occupied 76% (n=427) of the nests. Nests of *C. caretta* and *E. imbricata* were 17% (n=30) and 5% (n=14), respectively. The remaining 2% (N=14) was not able to identify species because of inadequate development of the embryos. In 1980's, the dominant nesting species of sea turtles was *C. caretta* in Ishigaki (Kamezaki, 1991). However, our result shows that the dominant nesting species in this island has been changed to *C. mydas* from *C. caretta* during late 1990's and early 2000's. The monitoring project of nesting turtles in Kuroshima Island since 1973, about 20km apart from Ishigaki, shows the similar tendency to shift from *C. caretta* to *C. mydas* (Kondo and Kuroyanagi, 2000). The similar shift of the dominant nesting species was observed in all over Yaeyama Islands (Shima *et al.,* 2001).

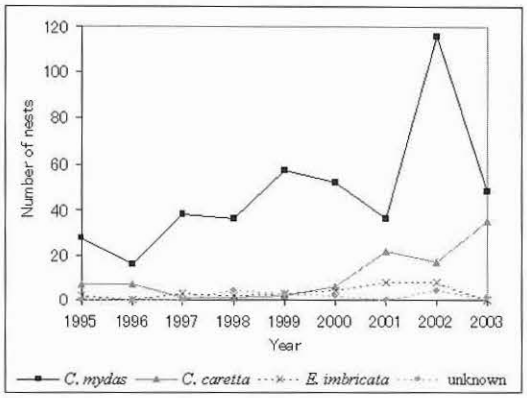

Fig.2. Nesting activities of sea turtles in Ishigaki.

The biggest nesting ground of *C. mydas* in Japan is Ogasawara Islands. In Ogasawara, annual nests of *C. mydas* are increasing, possibly because of the long term head starting project since 1976 and reduction of the fishing effort (Ogasawara Marine Center, 1999; Kondo *et al.,* 2002). Tagging project shows that *C. mydas* after breeding in Ogasawara migrate to the pacific coast of Japan Archipelago including Okinawa (Tokyo Metro. Fish. Exp. Station, 1986). *C. mydas* around the Ogasawara waters are known to have unique genotype comparing to the other Indo-Pacific and Atlantic populations (Bowen et al., 1992). It is necessary to clarify the relationships between the *C. mydas* nesting population in Ishigaki and those in Ogasawara for understanding of the population trends of *C. mydas* in the North Pacific.

It is reported that the clutch numbers of *C. caretta* had decreased along the coast of Japan during 1990's (Sato et al., Kamezaki et al., 2003). However, the numbers of *C. caretta* nest shows a tendency to recover in early 2000's in several major nesting ground in Japan (Shiode, 2002). The trend of *C. caretta* nesting activity in Ishigaki is similar to those in the other areas of Japan.

2. Nesting activities of sea turtles in Ibaruma

Ibaruma beach was nightly patrolled for tagging nesting turtles. The nesting season of *C. caretta* was from April through July, and that of *C. mydas* was from May through August, sometimes continues until December (Abe *et al.,* 1998). We had 15 to 38 nests of C. mydas and 0 to 8 nests of *C. caretta* in Ibaruma annually during 1995-2003 seasons. The numbers of nest were 28.0 ± 8.0 and 2.4 ± 2.7 for *C. mydas* and *C. caretta*, respectively (average ± SD). Nesting of *E. imbricata* was rare; only two nests were recorded during the study. We identified nesting females of 3 to 8 *C. mydas* and 0 to 2 *C. caretta* in Ibaruma every year.

Totally, 49 nesting females of *C. mydas* were tagged. The tag recovery was complemented with the photo identification. *C. mydas* can be identified using the characteristics of the carapace and the head, such as patterns, arrangement of scutes and scales, etc. This method is effective within the range of 10-20 nesting females per year. We can identify 100% of nesting females on the beach if we have their photographs. However, turtles without photographs in the early years of this study could not be identified if tags on them had been lost. The rate of those turtles without photographs was 22% (n=11).

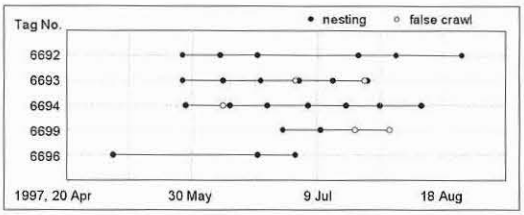

Fig.3. Examples of re-migration of nesting C. mydas in Ishigaki Island in 1997.

Fig.3 shows an example of the inter-nesting intervals of *C. mydas* in Ibaruma in a single nesting season. The upper 4 turtles in Fig.3 nested very regularly, with inter-nesting intervals of 11 or 12 days. Especially, No.6694 showed high nest site fidelity; her nests were not apart from each other by 50 m. On the contrary, No.6696 showed low nest site fidelity. At first she appeared in Osaki (Fig.1), the western coast of Ishigaki 50 km far from Ibaruma. She was found nesting in Ibaruma in the eastern coast 46 days later. And 12 days later, she went back to Osaki by 50 km. This result suggests that there are two types of nesting females. One type has high nest site fidelity and regularity. Another type is relatively migratory with low nest site fidelity. Some turtles tagged in Miyako Island, 120 km eastward from Ishigaki, were found in Ishigaki in a single nesting season (Kobayashi *et al.,* 2002), suggesting that turtles with low nest site fidelity sometimes migrate among islands even in a single nesting season.

3. Remigration between nesting seasons

In Ibaruma, 18 re-migrants of *C. mydas* were found. The 94% (n=17) of them came back 3 or 4 years after the former nesting season (Fig.4). On the average, they nested every 3.7 years (n=18, SD=0.6). There was no female returned more than 6 years after her last nesting. Therefore, we analyzed 13 nesting females identified before 1999, which were expected to come back until 2003.

The *C. mydas* identified before 1999 has been re-migrated to Ibaruma to nest by 69% (n=9). Other 31% (n=4) appeared once and has never been found in Ibaruma and the other beaches until the end of 2003. Of the 9 re-migrants, 33% (n=3) came back once, 44% (n=4) twice, and 22% (n=2) came back to nest three times.

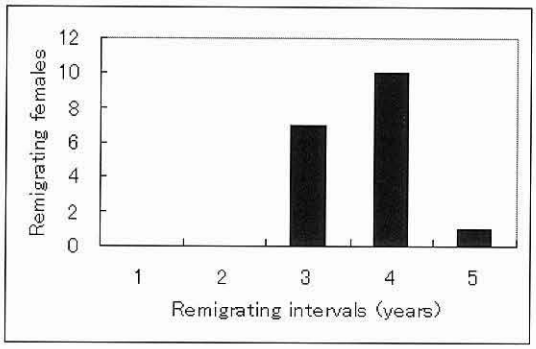

Fig.4. Frequency of re-migrating intervals of C. mydas nesting females in Ibaruma

4. Nesting populations in Ishigaki

On the average, *C. mydas* and *C. caretta* nested 4.9 and 3.1 times in a single nesting season in Ibaruma, respectively. Applying this clutch number per female, we evaluate that the annual numbers of nesting females in all over Ishigaki were 10-20 *C. mydas* and 3-8 *C. caretta*.

Normally, females of nesting populations are evaluated by N x Y, where N = number of nesting females per year, Y = average re-migrating years. In Ishigaki, we suggested two types of nesting females of *C. mydas*; i.e., those with high and low nest site fidelity. The numbers of nesting females with high nest site fidelity (H) was estimated as: H = N x P x Y, where P = proportion of nesting females with high nest site fidelity. In Ishigaki, 10-20 of annual nesting females of *C. mydas* were evaluated. For P and Y, we used 0.69 and 3.7, that is the re-migrating rate and average re-migrating years in Ibaruma, respectively. Therefore, the number of nesting females with high nest site fidelity was estimated to be 26-51.

We do not know those turtles with low nest site fidelity would migrate to another islands, or continuously stay in Ishigaki to nest in another beaches. In the latter case, the number of nesting females (L1) was estimated as: L1 = N x (1-P) x Y; i.e., 12-23 females. Totally, the number of females of the nesting population was estimated to be 38-74 by H + L1.

Or else, assume turtles with low nest site fidelity would accidentally migrate to and nest in Ishigaki only at once, the numbers of those turtles (L2) were estimated to be 3-6 per year by L2 = N x (1-P).

In conclusion, the number of *C. mydas* nesting females in Ishigaki was about 75 at most. The minimal estimation was about 25, and in addition, several females per year were expected to migrate to Ishigaki accidentally.

5. Conservation effort in Ishigaki

For conservation and research efforts of sea turtles, Ishigaki Tropical Station, Seikai Fisheries Research Station, Fisheries Research Agency (FRA) has been studying mitigation measures for bycatch of sea turtles with fisheries (Abe *et al.*, 2003). For stock enhancement of sea turtles, Yaeyama Station, National Center for Stock Enhancement, FRA has been rearing and releasing sea turtles in Ishigaki (Shimizu *et al.*, 2003). A non-profit organization, Sea Turtle Association of Japan has managed Yaeyama Marine Park Research Station in Kuroshima near Ishigaki, which has long been a carrier for conservation and research of sea turtles since 1973. A volunteer group Ishigaki-jima Sea Turtle Research Group has been monitoring sea turtle nesting activities in Ishigaki since 1993. These activities are expected to contribute conservation of sea turtles in Ishigaki.

In Japan, turtle egg poaching is illegal. However, licensed fishermen can catch sea turtle legally for local consumption in Okinawa Prefecture and some other localities. Annual catch for them is assigned every year, which are about 150 individuals in Okinawa. More than 90% of sea turtles captured in Okinawa are taken in Yaeyama Islands including Ishigaki. Most of them are immature *C. mydas*, which are harvested as meat and stuffed animals. Some hawksbill turtles are used as stuffed animals and tortoise shell. The restriction of the length is set only to the hawksbill turtle of less than 25cm in plastron length. The closed season is June and July. The impact of the fisheries on the local turtle population is still unknown. The evaluation of the population size done in this study is expected to contribute to assess impact of fisheries on the local turtle populations.

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