



The Nesting Sites of Sea Turtles in the Ryukyu Archipelago and Taiwan

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Abstract: Nested traces of sea turtles were surveyed on 122 beaches of 18 islands belonging to the Amami, Miyako and Yaeyama Groups in the Ryukyu Archipelago and 19 beaches of Taiwan. Of the total 141 beaches surveyed, sea turtle nests were found only in the Ryukyus and no nests were found in Taiwan. Among the 542 nests observed, species identification was possible for 322 nests, and nesting of three species, *Caretta caretta*, *Chelonia mydas* and *Eretmochelys imbricata*, were recognized. *C. caretta* nested in almost all islands surveyed in the Ryukyus: 201 nests were found on 45 beaches of 13 islands. As to *C. mydas*, 114 nests were found on 20 beaches in eight islands. Of these 97 (84.3%) were recorded from Iriomotejima Is. Six nests of *E. imbricata* were found on three beaches of the Yaeyama Group.

Key Words: Turtle nesting; Ryukyu; Taiwan; *Caretta caretta*; *Chelonia mydas*; *Eretmochelys imbricata*

Nesting sites of sea turtles have been reported from various localities scattered in coastal regions of the temperate to tropical zones of the world (see Sternberg 1981, for review). However, studies on their nestings in the Far East (i.e., China, the Philippines, and Japan) are quite meager; very little information is available on the distribution of nesting sites in this region.

In the insular region of East Asia, three species of sea turtles, *Caretta caretta*, *Chelonia mydas* and *Eretmochelys imbricata*, have been reported to lay eggs (Uchida and Nishiwaki, 1981). Of these, *Caretta caretta* has been reported to lay eggs on the Pacific coasts of the Japan Main Islands (exclusive of Hokkaido District), and the northeastern extremes of the Ryukyu Archipelago (i.e., Yakushima and Tanegashima Islands; Nishimura, 1967). Nestings of *C. mydas* are known from Yakushima Island (Kanno, 1980), the Yaeyama Group (Kamezaki, 1986) and the Ogasawara (Bonin) Group (Nakamura and Ueno, 1963). *E. imbricata* is recorded to nest in the Yaeyama Group (Miyawaki, 1981; Kamezaki, 1985, 1986) and the Okinawa Group (Teruya and Uchida, 1988).

In the Ryukyu Archipelago few studies have actually been made of the nesting of sea turtles. Several authors surveyed sea turtle nestings in the Japan Main Islands and the northern part of the Ryukyu Archipelago (OTBE, 1977; Uchida, 1981; Iwamoto et al., 1985; YSTRS, 1987). However, very little field work has been done for those in the central and the southern Ryukyus. Only recently, EMPMF (1984) estimated the distribution of nesting sites for each sea

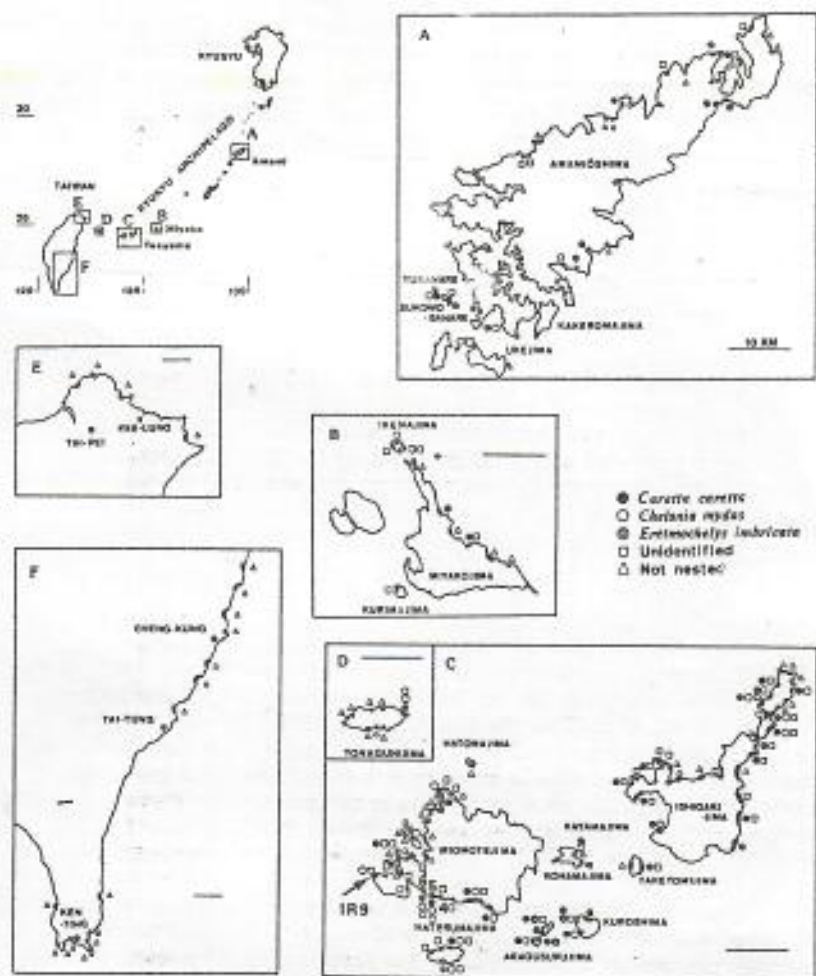


Fig. 1 Maps showing the locations of islands and beaches surveyed.

turtle species in the Ryukyu Archipelago on the basis of information from the inhabitants. However, due to this problematic method, this report seems to contain some unreliable data in terms of identification of species. For the Yaeyama Group, Kamezaki (1986) provided data concerning the species composition of sea turtle nestings. Little is, however, known about the distribution of nesting sites in the Amami, Okinawa and Miyako Groups. Moreover, no published data are available for Taiwan. Thus, it is necessary to accumulate

Table 1. The numbers of beaches surveyed, and observed nests of sea turtles species, *Caretta caretta* (C.c.), *Chelonia mydas* (C.m.), *Eretmochelys imbricata* (E.i.) and unidentified (U).

Locality	N	Not nested	Nested	Turtle species			
				C.c.	C.m.	E.i.	U
Amami Group	29	11	18	11	2	0	9
Miyako Group	10	4	6	2	1	0	5
Yaeyama Group	83	30	53	32	17	3	39
Taiwan	19	19	0	0	0	0	0
Total	141	44	97	45	20	3	53

further field data to clarify the distributional properties of nesting sites for each sea turtle species in East Asia.

Since 1983, I have surveyed species compositions of nesting sites of sea turtles in the central and the southern parts of the Ryukyu Archipelago and Taiwan by directly observing nesting traces, or hatchlings produced. The results offer data inconsistent with some previous assumptions.

METHODS

The surveys were made on 122 beaches of 18 islands belonging to the Amami, Miyako and Yaeyama Groups, and 19 beaches of Taiwan (Fig. 1 and Table 1). These beaches were selected for their sandy substrates, which may offer preferable conditions for sea turtles to oviposit. A detailed survey was made for the Yaeyama Group between 1983 and 1988, from April to October in each year. The western beaches of Kuroshima Island were especially intensively surveyed every two or three days between 1983 and 1986. Thus, it is highly probable that all nests made there in this period were checked. Dates of surveys for the other localities are as follows: April to June 1987 for the Miyako Group; June 1987 and July 1988 for the Amami Group; and July 1988 for Taiwan. During the surveys, nesting sites were detected by searching for traces of turtles crawling on beaches. When a nest was found, some twelve eggs were taken and brought back to the laboratory where they were incubated in styrofoam boxes until hatching. Sea turtle species for each nest were identified by investigating morphological features of hatchlings or embryos from the eggs incubated. *Chelonia mydas* was identified also from the traces on beaches, since it can be discriminated from the other species in hindlimb traces (Pritchard and Trebbau, 1984). This method was adopted only when eggs could not be collected due to poaching by inhabitants. When all eggs of a nest had already been poached or none of the sampled eggs developed and adjacent traces differed from those of *C. mydas*, I recorded the nest as that of an unidentified species. Emergence traces without egg cavities were not counted.

Table 2. The numbers of nests of the sea turtles species observed in the present survey. See Table 1 for abbreviations.

Locality	N	C.c.	C.m.	El.	Ul
Amami Group	69	23	2	0	44
Amami-ooshima	54	17	0	0	37
Yucubarare	5	2	0	0	3
Sukomobanare	4	2	0	0	2
Ukejima	2	0	1	0	1
Kakeromajima	4	2	1	0	1
Miyako Group	13	2	1	0	10
Miyakojima	3	2	0	0	1
Ikemajima	10	0	1	0	9
Kurimajima	0	0	0	0	0
Yaeyama Group	460	176	112	6	166
Ishigakijima	83	19	10	0	54
Iriomotejima	179	19	97	0	63
Aragusukujima	8	4	0	2	2
Kuroshima	135	124	1	4	6
Kohamajima	1	1	0	0	0
Taketomijima	4	1	0	0	3
Hatomajima	0	0	0	0	0
Kayamajima	3	0	0	0	3
Haterumajima	32	6	2	0	24
Yonagunijima	15	2	2	0	11
Taiwan	0	0	0	0	0
Total	542	201	115	6	220

RESULTS

The observations of 542 nests of sea turtles were made in 122 beaches of the Amami, Miyako and Yaeyama Groups, but not a single nest was found on the 19 beaches surveyed in Taiwan (Fig. 1 and Tables 1 and 2). Sea turtle species were identified for 322 nests, and nestings of three species, *Caretta caretta*, *Chelonia mydas* and *Eretmochelys imbricata*, were recognized.

C. caretta nested on most islands surveyed in the Ryukyus (Table 2); 201 nests were found on 45 beaches of 13 islands.

As to *C. mydas*, 115 nests were found on 20 beaches in Kakeromajima and Ukejima Islands of the Amami Group, Ikemajima Island of the Miyako Group, and Ishigakijima, Iriomotejima, Kuroshima, Haterumajima, and Yonagunijima Islands of the Yaeyama Group. Of these, 97 nests (84.3%) were recorded from Iriomotejima Island, of which 89 nests were observed on four beaches (IR4, 5, 6 and 9; see Fig. 1) along the southern coast.

Six nests of *E. imbricata* were found on three beaches of Kuroshima and Aragusukujima Islands of the Yaeyama Group.

Table 3 The survey dates and the numbers of nesting traces of *Chelonia mydas* on four beaches (IR4, 5, 6 and 9, see Fig. 1) of Iriomotejima Island.

Year	Total	IR4		IR5		IR6		IR9	
		Date	N	Date	N	Date	N	Date	N
1984	0	4 Aug	0	1 Aug	0	4 Aug	0	—	—
1985	4	4 May	0	4 May	0	5 May	0	23 Jul	1
		—		23 Jul	3	23 Jul	0	—	—
1986	60	17 Jul	3	17 Jul	14	22 Jul	28	16 Jul	15
1987	2	22 Apr	0	23 Apr	0	23 Apr	0	25 Apr	0
		3 Jun	1	3 Jun	1	4 Jul	0	2 Jul	0
1988	23	16 Jul	2	13 Jul	15	16 Jul	6	—	—
Total	89		6		33		34		16

DISCUSSION

Uchida and Nishiwaki (1981) postulated that *C. caretta* nests chiefly on coasts of the Japan Main Islands, and that it nests only rarely in the Ryukyu Archipelago and the Ogasawara Group. Uchida (1982a) also stated that nestings of *C. caretta* were fewer than those of *C. mydas* in Okinawa Prefecture, Ryukyu Archipelago. Recently, however, Kamezaki (1986) demonstrated that nestings of *C. caretta* were much more frequent than those of *C. mydas* in the Yaeyama Group. During the present survey, the number of nests of *C. caretta* was much greater than that of the other species also in the Amami and Miyako Groups. This suggests that *C. caretta* nests with the highest frequency of the three species in almost the entire range of the Ryukyu Archipelago, and that the accounts of Uchida and Nishiwaki (1981) and Uchida (1982a) are inappropriate probably due to the insufficiency of the basic field data.

Iriomotejima Island may offer the only exceptional case for the above account; 97 and 19 nests were ascertained for *C. mydas* and *C. caretta*, respectively. Of the former, 89 nests were recorded only on four beaches in the southern coast among 35 beaches surveyed on that island. The numbers of nests of *C. mydas* found on these beaches in July or August of one year varied during the survey period (Table 3). For example, the numbers of nests observed on beach IR06 (see Fig. 1) were 0 in 1984, 0 in 1985, 28 in 1986, 0 in 1987 and six in 1988. Thus, the nesting activity of *C. mydas* seems fluctuate yearly in Iriomotejima Island.

It is evident that *E. imbricata* nests in Kuroshima, Aragusukujima, and Iriomotejima Islands of the Yaeyama Group (Miyawaki, 1981; Kamezaki, 1985, 1986; Kamezaki and Yokochi, 1986). Furthermore, I had recognized specimens of this species stocked in the Yaeyama Branch of Okinawa Prefectural Fisheries Experiment Station. They were hatched from eggs laid on a beach of Ishigakijima Island (Aragaki, personal communication). Uchida (1982b) surmised that the water around the Satsunan Islands (about 28° N) is the northernmost limit of reproductive activity of *E. imbricata* on the basis of the distribution of coral reefs. However, no nests of this species were observed outside Yaeyama (about 24° N), the southernmost islands of the Ryukyu

Archipelago, in this survey. Even in the Yaeyama Group, the nesting of *E. imbricata* seems to be very rare in comparison with that in the tropical regions (Sternberg, 1981).

Mao (1971) recorded four species of sea turtles, *C. mydas*, *E. imbricata*, *Lepidochelys olivacea* and *Dermochelys coriacea*, from the waters adjacent to Taiwan, but he did not refer to their nestings in Taiwan. During the present survey in July, not a trace of the nesting or the emergence was found. The nesting of sea turtles on the main island of Taiwan may be much rarer than in the Ryukyu Archipelago. Even so, however, I heard of the occurrence of sea turtle nestings at Chiupang, Aoti, and Penghu Islands through interviews with several fishermen. However, the species could not be identified. Thus, further detailed surveys are desired for the sea turtle nestings in Taiwan.

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