

Conservation Project on Yakushima Island

The Biggest Nesting Site in Japan

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Yakushima Island is 135 km south of Kagoshima City, Kyushu, at latitude 30° 20' N and longitude 130° 30' E (Figure 7.1). It is conical in shape with a circumference of approximately 130 km and is 1,936 m above sea level. Its climate is tropical monsoon, but the mountains often get 1 m of snow. Thus, there is variation in temperature and annual precipitation level between the mountainous area and lowlands. Yakushima Island is surrounded by the East China Sea and the Pacific Ocean. The Kuroshio Current hits the island's southern coast and meanders into the Pacific Ocean.

Sea Turtle Nesting Sites on Yakushima Island

Among all the nesting populations in Japan, 30% to 33% of loggerhead (*Caretta caretta*) females nest on Yakushima Island (Kamezaki et al. 2003), likely making it the largest nesting site in Japan. Moreover, there are some green turtles (*Chelonia mydas*) that nest on Yakushima, which is the northernmost limit for green turtle nesting in the Pacific. The Nagata District, located in the northwest region of the island (Figure 7.2), is known for its sea turtle nesting beaches. A perennial stream, the Nagata River, runs from the second tallest mountain in Yakushima, Nagata-dake, into the East China Sea, carrying fine sand onto the beach where sea turtles nest. As industrialization progressed on the island in the mid-1960s, civil engineer-

Figure 7.1 Map of Japan showing Yakushima Island.



ing and construction projects rapidly increased and the sand was mined for concrete production.

The Nagata District has three similar beaches, all consisting of coarse granite sand: Inaka Beach, Mae Beach, and Yotsuse Beach.

INAKA BEACH

Inaka Beach, the largest natural sand beach on Yakushima Island, is approximately 1,000 m long and up to 35 m wide. Tourism has developed rapidly in the area; several hotels and camping sites were built near the beach, leaving few grassy areas beyond the beach. Sea turtle watching has become an increasingly popular activity, with thousands of visitors each season. In response to concerns over large numbers of people roaming the beaches to see turtles, an information kiosk was constructed and guided turtle watching tours were organized from May to July in a way that minimizes disturbance of nesting turtles. Inaka Beach historically has the highest nesting success of loggerhead turtles in Yakushima, peaking at approximately 80% in 1986, but it has since declined to 50% to 60% in recent years.

MAE BEACH

Mae Beach, about 900 m long, is located near Nagata Village. Until 1968 the beach was left as natural as it could be, but after a concrete barrier was

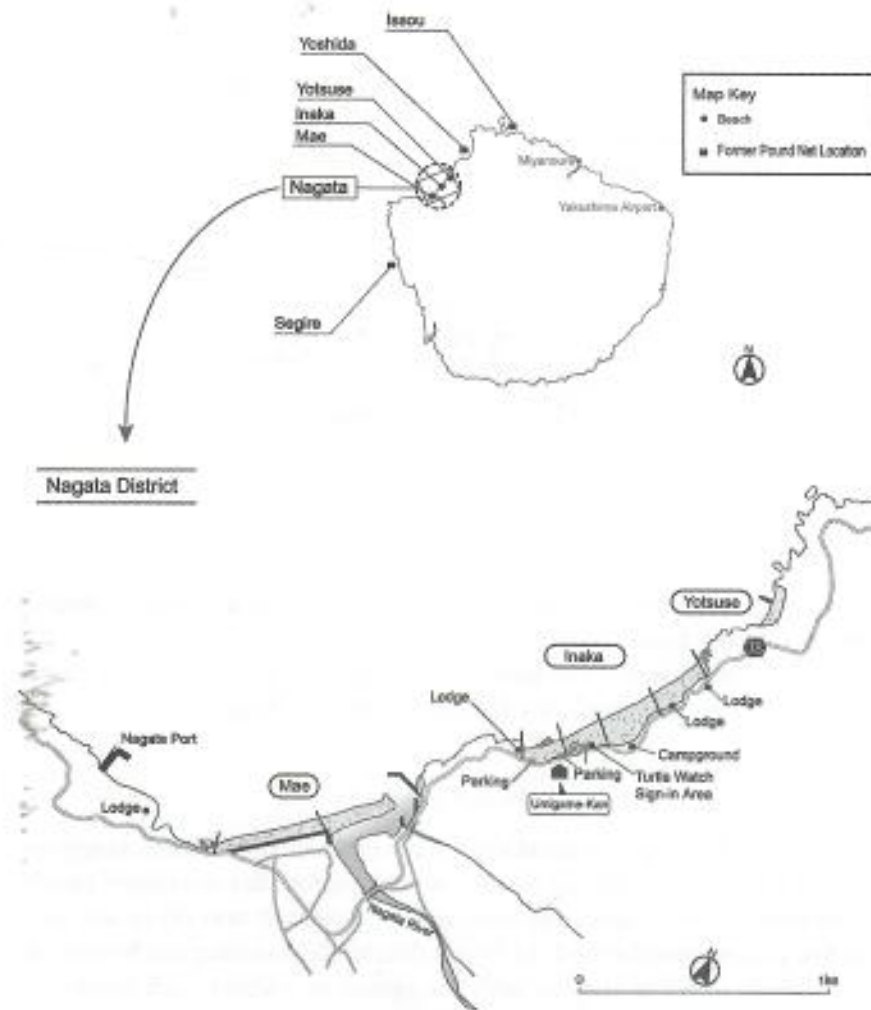


Figure 7.2 Map of Yakushima Island showing sea turtle nesting beaches in Nagata District.

built to separate the village and the beach, the sand was mined for the concrete factories and the area became unsuitable for sea turtle nesting.

YOTSUSE BEACH

Yotsuse Beach, 240 m long and 40 m wide, formerly was a port for logging. There are two rivers that run into the beach, with heavy rain changing the beach's appearance. If the rivers were not present, this beach would have been an optimal sea turtle nesting site, because unlike Inaka Beach or Mae Beach, a steep cliff hinders people from approaching the beach.

Sea Turtle Monitoring on Yakushima Island

By the mid-1980s, the once pristine beaches for which Yakushima Island was famous had been degraded by beach armoring, sand mining, and development (Omuta 1997). Tourism and development have continued to impact the island, and the growing human population has led to deforestation in the mountains. A strong urge to preserve the island's natural heritage and a deep concern for the future of Yakushima Island motivated me and other local residents to initiate a nongovernmental organization called the Yakushima Umigame Kan (Sea Turtle Center) in 1985 to survey nesting sea turtles. The organization now conducts monitoring and protection work from May to July each year, patrolling the beaches from 9 p.m. to 6 a.m. daily, with some exceptions due to bad weather. The survey consists of a census of sea turtle nesting activity, tagging nesting females, and transplanting clutches that are in danger of poaching or inundation by high tides.

Human Interaction with Sea Turtles before Conservation

Before 1973, a public bidding system for each beach allowed individuals to gain access to sea turtle eggs, which were collected to be sold on the island. During and after the food shortages of World War II, sea turtle eggs were essential protein resources for islanders. According to one of the former egg collectors, eggs could fill approximately 10 rice bags per night per beach, giving a rough estimate that about 50 or more females nested per night per beach. Moreover, the fact that some people came from Okinawa to capture sea turtles in Yakushima suggests that more females nested in Yakushima in the past.

Law Enforcement and Conservation Efforts on Nesting Beaches

In 1973, the town of Kamiyaku passed the Nature Protection Law, which made all egg collection on Inaka Beach and Mae Beach illegal. Although penalties were inconsequential for violators, the law allowed conservation groups to deploy an observer at each beach to prevent eggs from being harvested. This helped to protect almost all eggs laid on these beaches. Nests were left to incubate under conditions as natural as possible, and hatchlings emerged and entered the ocean, off to adventurous lives. Belatedly, in June 1988, Kagoshima Prefecture enforced a new ordinance forbidding any person to capture sea turtles or sea turtle eggs in all areas of Kagoshima, imposing a penalty on those who break the ordinance.

Despite this progress to protect sea turtles from direct harvest, erosion of sand beaches increased over several decades, and in some instances, there was insufficient area for females to nest; thus nest transfer became a regular task for the conservation project. Moreover, because the number of people who wish to see sea turtles in Yakushima has increased in recent years, there have been issues with people accidentally stepping on and consequently killing hatchlings. In August 1999, a simple fence was built to surround the most clustered nesting areas so that tourists would not trample on the nests.

Pound Nets and Sea Turtle Bycatch

Three pound-net fisheries formerly operated on Yakushima Island. They were located along the northwest coast and often trapped turtles migrating through the area. The nets were set offshore from Yoshida, Issou, and Segire. Pound nets at Issou and Segire allowed trapped turtles to come to the surface of the water, so that fishermen were able to release bycaught individuals before they brought their catches to the harbor. However, the pound net at Segire had a structure that prevented trapped turtles from surfacing to breathe, and they consequently drowned. The Segire pound-net operation captured as many as 10 turtles a day and an average of 100 mature loggerhead turtles per month. Occasionally, immature loggerhead turtles and mature green turtles were also caught in the nets.

In 1998, the Yakushima Umigame Kan carried out a fact-finding survey on the Issou pound-net operation. With permission from the fishery manager, staff on a boat observed the number of sea turtles in the bycatch. The survey spanned the pound-net operational season, which starts in April

and ends in July. During the survey, 14 male loggerhead turtles were caught between 16 April and 18 June, 32 female loggerhead turtles were caught between 19 April and 10 July, two male green turtles were caught on 3 July, eight female green turtles were caught between 17 May and 8 July, and eight unidentified individuals were caught. In total, 64 sea turtles, loggerhead and green turtles combined, were caught in the pound-net operation that season.

These pound nets provided jobs on Yakushima Island, but as the amount of fish catch diminished over time, it became impossible to maintain the operation for economic reasons. In 1995, the Yoshida pound-net operation closed down, followed by the Issou pound net in 1998 and the operation at Segire in 1999, thus marking the end of pound-net fisheries on Yakushima Island. The amount of fish in the region apparently declined dramatically and forced the local gillnet fishery to close down in 1999. The demise of these coastal fisheries has meant that there has been no sea turtle bycatch locally since 2000.

Loggerhead Nesting Trends in Yakushima

Sea turtle monitoring on Yakushima Island has consisted of counting adult females that emerge each night (i.e., haul out onto the beach) and the number of confirmed nestings on each beach (Kamezaki et al. 2003; Sea Turtle Association of Japan, unpublished annual data [1999–2003] on sea turtle nesting in Japan). Figure 7.3 shows the change in numbers of emergence and nesting on Inaka Beach and Mae Beach from 1985 to 2004. The numbers do not distinguish individual turtles and therefore do not represent an accurate estimate of nesting turtles, because the same individual was likely to be observed multiple times. In addition, turtles that emerged did not necessarily nest and may have emerged multiple times on different nights. Overall, the increase in nesting activity over the 20-year monitored period grew fivefold, from a low of 414 nestings in 1985 to 2,036 nestings in 2004 (Figure 7.3). The trend of this increase was gradual from 1985 to 1991, when nesting peaked and then declined for several years, until 1999, when it began to climb again. The rise since 2000 has been most dramatic (Figure 7.3).

The number of nesting females tagged each year is similar to the nesting trend, but the first peak came a year earlier, in 1990 ($n = 424$), numbers decreased until 1999 ($n = 196$) and have increased since 2001. Comparing the lowest number in 1999 ($n = 196$) and the maximum number in 2004 (n

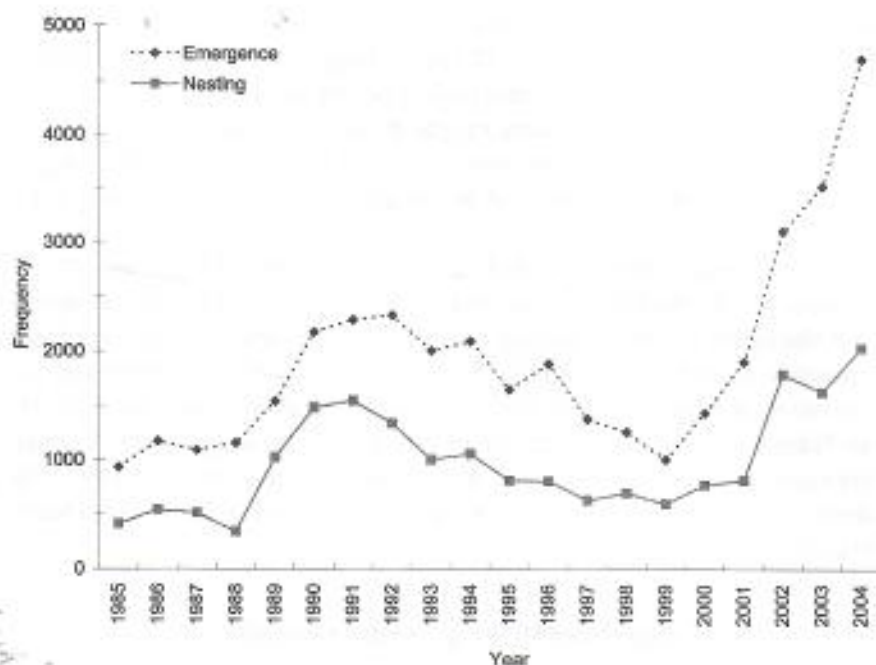


Figure 7.3 Nesting activity recorded on Yakushima Island (Inaka Beach and Mae Beach) as number of emergences and number of nesting female loggerhead turtles. (Source: unpublished data from Yakushima Umigame Kan [Sea Turtle Center] annual reports, 1999–2004, on sea turtle emergence and nesting survey in Yakushima and Sea Turtle Association of Japan annual reports, 1999–2003)

= 707), the number of nesting females tagged increased by 3.6 times (Figure 7.4). The most dramatic increase was in 2002, when nearly twice as many nesting females were observed than in previous years (Figure 7.4).

The two main possibilities that may have contributed to this dramatic increase in the nesting population are as follows: (1) sea turtle egg consumption ceased after 1973 due to enforcement of the Nature Protection Law on Yakushima Island, and (2) the disappearance of pound-net fisheries in 1999.

It is speculated that the reversal of the decline in numbers of nesting females beginning in 2000 (Figures 7.3 and 7.4) was primarily due to elimination of bycatch in the local pound-net and gillnet fisheries, which closed down after 1999. Turtles that would otherwise have drowned in fisheries that year were instead able to nest and therefore contributed to the increase ($n = 65$) in the number of nesting turtles in 2000. However, the apparent

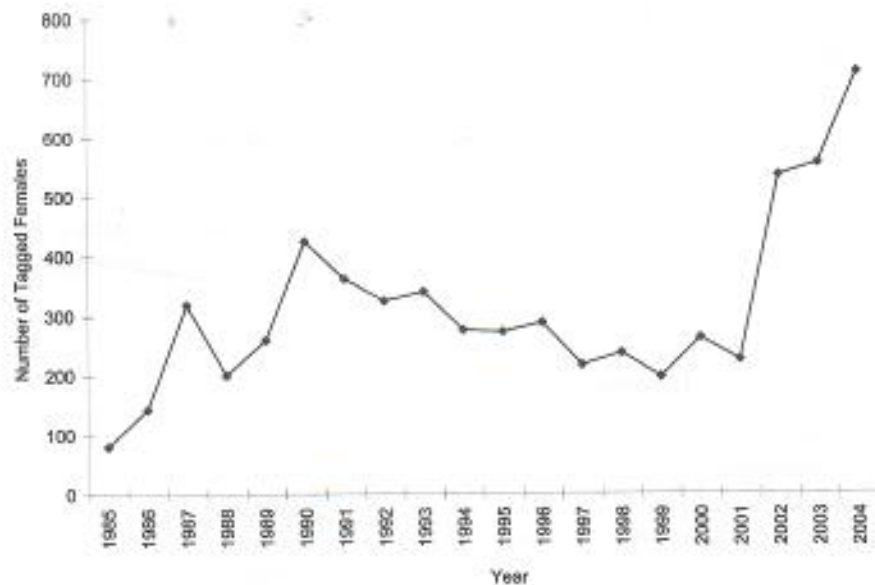


Figure 7.4 Number of female loggerhead nesters tagged each year on Yakushima Island. (Source: unpublished data from Yakushima Umigame Kan [Sea Turtle Center] annual reports, 1999–2004, on sea turtle emergence and nesting survey in Yakushima and Sea Turtle Association of Japan annual reports, 1999–2003)

boost since 2002 cannot be explained solely by elimination of bycatch, and it is suspected that the egg protection through enforcement of the Nature Protection Law in Kamiyaku Town must have come to fruition, as hatchlings produced in the early years continued to mature and join the breeding population. If we assume that natal homing (i.e., hatchlings from eggs protected on Yakushima Island beginning in 1973 return to their natal beaches) and the increasing trend observed beginning in 2002 (Figure 7.4) may in part be due to a pulse of new breeding females, we might speculate that loggerhead turtles on Yakushima Island take at least 29 years to reach maturity.

Other potential signals might help add to the circumstantial evidence to test this general hypothesis in the coming decades. For instance, there was a devastating typhoon (No. 8) in 1993, which washed away virtually all clutches in Inaka Beach. If there is an apparent decline in nesting females approximately 29 years later, it may be consistent with this minimum age of maturity. In addition, passive integrated transponder (PIT) tags have been applied to hatchlings since 2002, and we hope to identify these hatchlings

as adults, and thus determine age of maturity, if they return to nest on their natal beaches.

A Note on the Green Turtle Population

Yakushima Island is the northern limit of the nesting range for green turtles. Green turtles also nest on the three beaches that are monitored, but they are very rare, ranging from one to six reported per year throughout our survey.

Impacts of Tourism on Sea Turtle Nesting

Figure 7.5 shows the change in the number of visitors at all nesting beaches on Yakushima Island. Since the declaration of Yakushima Island as a World Natural Heritage Site in 1993, media reports and books have promoted Yakushima as a tourist destination, which has stimulated an influx of tourists to the island in recent years (Omota 1997, 2000). Before 1992, there were approximately 1,500 tourists per season that came to watch nesting loggerheads from May to July, with few visitors in August when hatchlings emerge from their nests. However, between 1992 and 1999, it was usual to have 2,000 to 3,000 people per season (Figure 7.5). For unknown reasons, the number of tourists has grown exponentially since 2000 and reached a high of 8,220 people in 2004. Moreover, since 1992, more people have started to visit the beaches in the month of August. This increase has introduced new potential impacts on hatching success due to people accidentally trampling on nests or emerged hatchlings. Female nesting is also disrupted, because they are scared off before they can lay their eggs. The dramatic increase in nesting female emergences relative to the number of confirmed nests we have observed since 2001 (Figure 7.3) indicates that females are likely attempting to nest multiple times before they are able to successfully lay their eggs. This trend corresponds to a dramatic increase in tourist visitation since 2001 (Figure 7.5).

People in Nagata Village took this situation seriously and established the Nagata Sea Turtle Watch Association. The association organizes tourists who wish to observe sea turtles by having visitors book a tour at the village community center. Tourists, who are asked to wait at the community center until an association member calls them to come down to the beach, benefit from having association members waiting for nesting sea turtles at the beach. The association consists mainly of volunteers from the village, who work from 15 May to 31 July every year.

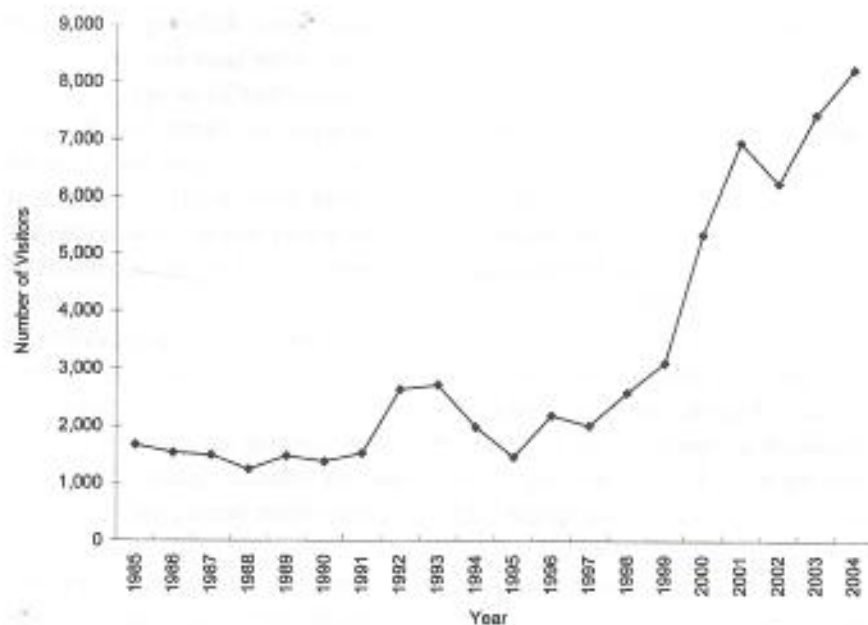


Figure 7.5 Number of visitors at beaches on Yakushima Island.

In 2001 a parking lot for cars was built on the area just above Inaka Beach. Unfortunately, headlights from vehicles at the parking lot illuminate the beach; however, the community feels that organizing tourists is more crucial for sea turtle conservation than any adverse effects that may occur as a result of the lights.

Since 2003, we have been investigating hatching success in Inaka and Mae Beach clutches, with the following results: in 2003, hatching success in Inaka Beach was 57%, where 1,572 people visited, and hatching success in Mae Beach was 48.4%, where 1,246 people visited. Similarly, in 2004, Inaka Beach had a hatching success of 50.6%, with 2,386 visitors, and Mae Beach had a hatching success of 62.8%, with 394 visitors. Thus, it appears that as the number of visitors increases, hatching success decreases; however this requires further investigation.

To protect nests at Inaka Beach from human disturbance, hatchlings that are trapped inside nests and unable to crawl out by themselves are removed and lectures are provided for tourists who wish to see hatchling sea turtles. After the lecture, hatchlings are released so that people will not accidentally step on them. This act is not for the best but for the better, because all people have the right to see sea turtles and, strictly speaking, our

organization does not have the authority to stop them. Although sea turtles on the beach are protected under national law, other laws and ordinances assure free, unblocked beach access. This means that local organizations such as the Yakushima Umigame Kan and Nagata Sea Turtle Watch Association cannot influence local community activities nor can they enforce national wildlife laws. Numerous requests have been made to municipal officers and national park rangers to establish policy and proper guidelines for ecotourism, but to date requests have been ignored to the detriment of these endangered species.

In addition, since 1999, the most clustered nesting areas in Inaka Beach are roped off after all female turtles have nested in August. Comparing July and August, the latter month has a 10% higher hatching success rate. Although a rope is a simple approach, it does provide satisfactory protection for nests by reducing traffic by people. In addition, gathering people and giving a lecture in a single location, rather than letting them wander about, helps to protect nests.

There are four major reasons that humans put pressures on sea turtles on Yakushima Island: (1) tourism leading to more cars near the beach has caused some loggerhead nesters to be scared off by headlights; (2) the nesting sites have become disorganized due to an increasing number of visitors, and unintentional disturbance of nesting females has occurred, causing some turtles to return to the sea without laying their eggs; (3) illumination from privately owned land development directly above the beaches, including hotel and lodging facility construction, has impacted nesting beaches; and (4) during the hatching season, a number of tourists accidentally step on nests before hatching, thus destroying some eggs and killing hatchlings.

Due to the factors mentioned above, nesting females seem to have made a change in their nesting time or have shifted to nesting beaches with lesser anthropologic impact.

Future Sea Turtle Application and Conservation Vision

Although egg harvest has been eliminated since Kamiyaku Town enforced the Nature Protection Law, quiet nesting beaches have disappeared as the number of tourists has increased over the years. Currently, serious beach erosion, deforestation, and land development adjacent to nesting beaches and mass numbers of visitors are all having a negative impact on hatching success. There is also concern that the pound-net fishery may resume in the future.

I suggest the following measures for sea turtle conservation on Yakushima Island:

- (4) Evaluate methods to mitigate beach erosion
- (5) Purchase the land or create new legislation to limit land development on Yakushima Island to combat the development of privately owned land
- (6) Relocate nests that are at risk of destruction by inundation or erosion to improve hatchling production
- (7) Limit the number of visitors on the beach at any given time, as well as provide simple, educational lectures
- (8) Mark off nests or sections of the beach to prevent human traffic until hatchlings emerge
- (9) Increase education and awareness among local people who appreciate Yakushima Island's natural beauty as an invaluable asset for all
- (10) Continue working at the local level but also reach out and attempt to build healthy collaboration with other nongovernmental organizations and government agencies
- (11) Work with the local fishing industry experts to design gear that is turtle friendly

References

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