Mamanuca Sea Turtle Conservation Project

Biological Report October 2010

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1.0 Background

Current turtle conservation initiatives have developed in the recognition that, despite having existed for millions of years, 5 of the 7 species of turtles are today classified as 'Endangered' or 'Critically Endangered' on the IUCN Red List. Global efforts seek to add momentum and strength to the numerous local, national and regional initiatives for turtle conservation (McLellan et al 2005).

Numerous Pacific Island Countries, including Fiji, have formulated and are implementing sea turtle conservation projects. However, they face numerous constraints – the most challenging being the limited scientifically based information on turtle population stocks and also the limited technical and financial capacity within countries to strategically address turtle conservation. In Fiji, marine turtles are revered in legends, dramas, folklores, songs, arts and traditional occasion (Morgan, 2007). Many of these species are undergoing threats that are either contributed by man or natural hazards. A major drawback on the population of marine turtles not only in the Pacific but also a global concern is the harvest of eggs and marine turtles from foraging or nesting grounds. Marine turtles play a major ecological role in maintaining the health of a coral reef ecosystem. It acts as the major consumer and predators in coral reef habitats. A healthy marine turtle population will contribute to a healthy marine environment.

Turtles in Fiji are currently protected under the Fisheries Act (CAP 158) - PROTECTION OF TURTLES- AMENDMENT, which was enforced on February 1, 2004 and expires on the 31st December 2018. The Moratorium disallows for any killing, selling or harvesting of meat, eggs or shell during this period, unless with prior exemption obtained from the Minister of Fisheries. Anyone in breach of these regulations is liable to a fine of FJD 500 or a jail term of up to 5 months.

This is the third such Moratorium enacted since 1995. Prior to that, turtles were protected under the Fisheries Act which regulated the methods of capture, imposed size limits and closed seasons and prohibited the sale of turtle shells. The CITES legislation is also pertinent as it prohibits the international trade of turtle shell or its derivatives. Anyone in breach of these regulations is liable to a fine of FJD 20,000 or a jail term of up to 6 months http://www.paclii.org/fj/legis/consol_act/fa110/

The Fiji Sea Turtle Recovery Plan (FSTRP) was born out of the recognition that in the period of the current Moratorium, various and numerous conservation activities have been occurring. It was imperative therefore that all these efforts be captured within a framework that ensures efforts are being conducted in a cohesive and comprehensive manner.

The development of the FSTRP occurred over a period two years and involved a wide range of stakeholders from Government to local communities. It is clearly apparent that collaborative effort is absolutely vital to management and conservation efforts for a species such as the marine turtle. Its migratory nature alone underlines the importance of partnerships in order to ensure success in protecting these iconic species across its range of habitats.

Seven marine turtle species are found in the region, where 5 of these species are found to either nesting, foraging or transiting through Fiji's waters (Batibasaga et al., 2006; Guinea, 1993). These species are the Hawksbill, Green, Leatherback, Olive Ridley and Loggerhead turtles. Each species have distinctive features and ecological behavioral patterns that contribute to their survival in a preferred habitat.


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The overall goal of the Fiji Sea Turtles Recovery Plan (FSTRP) is that by 2026, sea turtle populations in Fiji have measurably recovered to levels allowing for sustainable harvest & traditional use. (This will be through mechanisms that facilitate community & national action to significantly reduce particular threats encountered by turtles). There are five components under which specific activities are attached.

The components are:

1. Significantly reduce the mortality of marine turtles by addressing domestic consumption, by-catch and compliance with the Moratorium.
2. Develop programmes and protocols to monitor marine turtle populations (nesting and foraging) in Fiji waters.
3. Manage factors that impact on successful marine turtle nesting.
4. Identify and protect habitats that are critical to the survival of marine turtles.
5. Communicate the results of recovery actions and educate stakeholders.

Following the endorsement by cabinet of the Fiji Sea Turtle Recovery Plan (2009-2026) in September 2010, the Fiji Sea Turtle Steering Committee was formed to implement the plan. It prioritizes the conservation and protection of marine turtles through Education and awareness, Policy, Community based conservation and Research in Fiji. Working groups (consisting of relevant stakeholders) were established to put these priorities into action and assist the Fiji Department of Fisheries on the management of the declining population of Sea turtles in Fiji.
The Research working group comprises of various key organizations that are directly involved with Sea Turtle's research in Fiji. These include, the Fiji Department of Fisheries, University of the South Pacific, WWF South Pacific Programme, South Pacific Projects in Leleuvia, the Wildlife Conservation Society and other interested parties.

The goal of the research working group is to improve research by verification and maintaining security of data. **Specific objectives are to:**

- refine and establish a standard research methodology
- create a database/excel for national data entry
- monitor and manage the research information collated
- update education and awareness working group on research information collated
- submit at least two national funding proposal for Turtle Conservation Project in Fiji (aerial nesting surveys/Loggerheads)
- disseminate turtle data sheets throughout interested organizations (tourism sectors/researchers) - activity
- conduct refresher course/training for sea turtles research before nesting season
- propose a turtle research topic to USP research committee
- enlist potential donors to fund national research on marine turtles in Fiji

2.0 Introduction

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The conservation of marine turtles in the Mamanuca group of islands has been a continuous effort by many conservation partner organizations including the Fiji Department of Fisheries, the Institute of Marine Resources (IMR) at the University of the South Pacific, the WWF South Pacific Programme and the main partner organization, the Mamanuca Environment Society. The turtle project was conceived through a short term regional project led by the IMR on the conservation of marine turtles in three countries, Tuvalu, Fiji and Vanuatu. Through this regional project, the IMR identified the Mamanuca group of islands as an important breeding and feeding ground for our green and hawksbill turtle populations in Fiji.

A resort based turtle conservation workshop was held at Bounty Island in 2007 for the purpose of increasing awareness to the resort and community members on the need to conserve their remaining population of marine turtles. Information gathered from the workshop, showed that out of the 32 islands in the Mamanuca, 18 of these islands are known to be nesting sites for both Hawksbill and Green turtles. With such important information collated from the workshop participants, the interest and concern to implement a long term turtle conservation project was developed.

Baseline research on the consumption level of marine turtles in four villages along the Mamanuca group of islands was conducted in 2007 led by the Institute of Marine Resources. Results indicated and supported the need to establish a long-term project to not only focus on the recovery of marine turtles population, but more importantly to promote awareness and increase the knowledge of the local communities on the main threats faced by the marine turtles. In addition, it is important to relay to the stakeholders the relevance of conservation and protection for the recovery of its population.

Following consultations, workshops, and baseline research, the Mamanuca Environment Society took the initiative to establish a three-year Turtle Conservation Project in Mamanuca from 2008 - 2010 with the financial support of the United Nations Development Programme's Global Environment Fund Small Grants. This is the first project which focuses on both resort and community based conservation and assists in the implementation of the FSTRP through the Research working group. The goal of the biological surveys was to gather information on the following aspects of turtles in Mamanuca:

- abundance and distribution of nesting turtles
- nesting beach profile
- abundance and diversity of seagrass in the foraging grounds

3.0 Site Description

The Mamanuca Group of Islands of Fiji lie to the west of Nadi and to the south of the Yasawa Islands. Majority of the islands are volcanic in nature with a few coral islands. The group, a popular tourist destination, consists of about 30 islands, but about 7of these are covered by the Pacific Ocean at high tide. These islands are relatively small in size and range from 1.2 to 90 ha http://www.govisitfiji.com/mamanuca-group/islands.asp.

In the interest of time and resources, 4 islands were selected based on favorable responses from the resort managers to allow the survey team to visit and conduct nesting turtle and beach surveys. The islands included, South Seas, Tavarua, Namotu and Navini (Figure.1.).

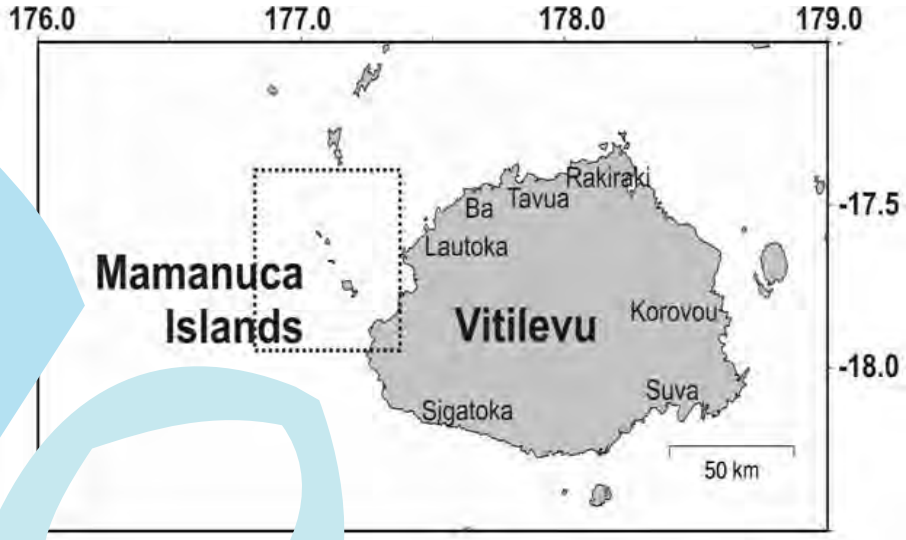

Figure 1. The project site in the Mamanuca group of islands marked in dotted lines

4.0 Methodology

4.1 Resource Mapping

A resource mapping exercise was conducted through consultation with communities from the villages of Solevu, Tavua, Yanuya and Yaro and key informants from resorts along the Mamanuca region. Turtle nesting sites, foraging sites and cultural taboo sites were identified and marked on a map. Other information was also collated such as the species diversity and important sites for conservation management.

4.2 Nesting Turtle Surveys

Foot patrol surveys were conducted within the nesting season to determine the number of nesting Green and Hawksbill turtles at selected sites (Figure 1,Table 1). Namotu and Navini Islands were chosen as key sites due to the following criteria:

1. Exceeding five nests per nesting season
2. No obstruction on the beach
3. Minimal intensity of light is produced
4. Reasonable island size to allow easy access by monitors
5. No head-starting
6. Protection of marine turtles is strictly monitored

Date	Island	Time
28-29 Dec. 2009	South Seas	8.00-12.00pm, 5-7am
2-4 Feb. 2009	Namotu	8.30-12.30pm, 5-7am
5 Feb. 2009	Tavarua	7.00-12.30pm, 5-7am
17-19 March 2009	Navini	7.00-12.30pm, 5-7am
20-21 April, 2010	Namotu	9.30am-1am, 5-6am
22 April 2010	Navini	6.00-12pm, 6-7am

Table 1. Details of nesting surveys.

The nesting beach was divided into 4 zones and each survey team member would patrol their assigned zone during the night and early morning usually coinciding with the high tide. During the patrol, disturbance to turtles was minimized by using a small hand-held light. The duration of the surveys ranged from 1-2 nights.

In addition to the surveys, interviews were carried out with key informants who had worked on the island for 15+ years to gather more information on the abundance and distribution of nesting turtles in the past.

4.3 Nesting Beach Surveys

Table 2 outlines the surveys details.

Date	Island
28 January 2009	South Sea
5 February 2009	Tavarua
4 February 2009; 21 April, 2010	Namotu
17 March 2009; 23 April 2010	Navini

Table 2. The schedule of nesting beach surveys.

The beach was divided into zones using buildings and natural features as land marks. The length and width of the different zones were measured. The most dominant plants were identified including those species which turtles preferred. In addition, the beach and the ocean were studied to identify possible predators of turtle hatchlings.

4.4 Foraging Ground Surveys

Two surveys were carried out on Namotu Island; the first one on 4 February 2009 and the second on 22 April 2010. The surveys were conducted using SCUBA gear at a depth range of 6-8m. A 50m transect line was laid along the seagrass bed, perpendicular to the beach (and approximately100m from the beach). A 1m x 1m quadrant was used to estimate the percentage cover of all sea grass species along the bed by placing it at 5m intervals on the right-hand side along the transect line. The percentage cover of algae was also estimated and recorded. Two replicate transects were laid 50m apart and the data combined. The methodology used was adapted from English et al, 1997.

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5.0 Results

5.1 Resource Mapping

As a result of consultations with the relevant communities and resorts, a map was developed using the information gathered over the period from 2007 to 2009 (Figure 2). It was deduced that out of a total of 30 islands in the Mamanuca region, 18 of these were known to be a nesting sites for sea turtles. This showed that this region was an important turtle breeding area that warranted conservation management. In addition, it was reported that turtles are usually sighted on coral reefs and channels either feeding, resting, mating or passing through. The informants reported a total of 4 species that are found in this region. These are:

1. Hawksbill turtles, *Eretmochelys imbricata*
2. Green turtles, *Chelonia mydas*
3. Loggerhead turtles, *Caretta caretta*
4. Olive ridley

Although there were no reports on the sighting of leatherback turtles in the Mamanuca islands, anecdotal evidence suggests its presence in the northern part of Vanua Levu.

The map also highlights a demarcated cultural taboo area where communities were forbidden to either visit or remove any resource. This group of uninhabited islands were an important breeding and feeding ground for sea turtles as told by some traditional fishermen (Figure 2).

Out of the 4 species reported seen the Mamanuca islands, only 2 species were known to nest on 18 islands, the hawksbill and green turtles. A masters student at the University of the South Pacific is currently conducting a detailed study on the abundance of turtle species nesting and sighted along this region. The study will provide additional information to support this turtle conservation project.

Based on the resource map, 4 sites were selected for nesting beach surveys. It was also deduced from the results of the community consultations that Navini and Namotu Islands were known to have the highest numbers of nesting turtles in the range of 5 to 10 nests per nesting season. The two islands were of similar geographical area but with minor variances beach the structures of the beach.

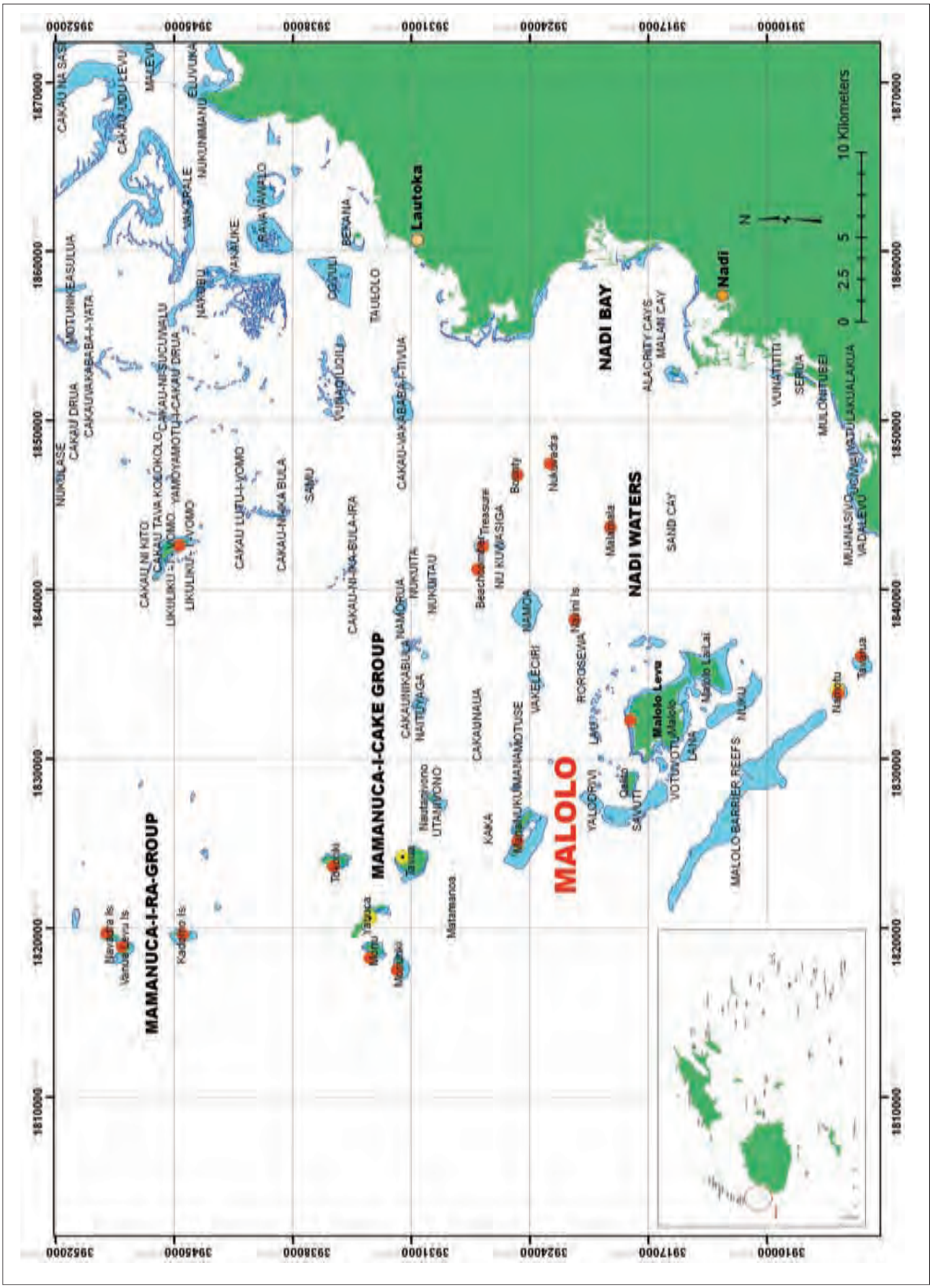

Figure 2. Resource map showing turtle nesting, foraging and cultural taboo sites

5.2 Nesting Turtle Surveys

FSurveys of nesting turtles were carried out in 4 Sites and details are presented in Table 3.

Date(s)	**Island**	**Number of Nests** ***G= Green turtle** **H = Hawksbill turtles** **L= Loggerhead turtles**		
		During surveys	Reported per year	Key informant
28-29/12/09	South Sea	0	2G-5G or 2H	Apili Nasa
5/2/09	Tavarua	3	6H-10H	Charlie
2-4/2/09; 20-21/4/10	Namotu	1G	2G-5G	Charlie
17-19/3/09; 22/4/10	Navini	6 HB	6-10 HB	Etuate Daulaca

Table 3. Number of nesting turtles on selected islands in Mamanuca

Figure 3. Two hawksbill turtle nests which was discovered on Navini Island in April 2010.

5.3 Nesting Beach Surveys

South Sea Island is 1 ha, a sandy coral island with a gentle sloping beach an average width of 24.9m and average length of 95m (Table 4). The island is surrounded by a fringing coral reef (Figure 4). Previous anecdotal reports indicate that both hawksbill and green turtles nest on this island.

Zone	Width (m)	Length (m)
1	31.3	118
2	16.6	100
3	29.5	50
4	22.0	112
Avg	24.9	95

Table 4. Beach measurements for South Sea Island

Figure 4. South Sea Island beach zones (fiji.pictures-pacific.com)

Figure 5. Tavarua Island beach zones (http://damncoolpics.blogspot.com/2008/12/9-gigantic-hearts-from-above.html)

Zone	Width (m)	Length (m)
1	22.5	120
2	80	250
3	29.5	200
4	19	200
5	20	246
6	27	189
Avg	33	201

Table 5. Beach measurements for Tavarua Island

Namotu Island is 1.5 ha with most recent average beach dimensions of 35.8m wide and 151m long (Figure 6, Table 6). Beach components consist of coarse sand, rubble and rocks. Half of the island's beach is covered with rubble and rocks. The littoral forest comprises common coastal species such as beach morning glory, coconut palm, beach gardenia, beach grass, and beach bean and umbrella sedge (Table 7). Namotu lies close to the edge of Malolo barrier reef and passage and hawksbill turtles nest on this island.

Figure 6. Namotu Island (www.googleearth.com) beach zones

Zone	Width (m)		Length (m)	
	2009	2010	2009	2010
1	23	30.3	194	200
2	14	27.4	100	150
3	19.7	22.1	100	124
4	16.2	63.3	70.7	129.2
Avg.	18.2	35.8	116	151

Table 6. Beach measurements for Namotu Island

Common name	Scientific name	Vernacular name
Mareer/Manjak/Snottygobbles	*Cordia subcordata*	Nawanawa
Umbrella sedge	*Cyperus stoloniferus*	Uto ni bulamakau
Beach morning glory	*Ipomea pes-caprae*	Lawere
Beach bean/Seaside bean	*Canavalia rosea*	Drautolu
Anapanapa	*Colubrina asiatica*	Vusolevu
Beach gardenia	*Guettarda speciosa*	Buabua
Beach grass	*Thuarea involuta*	
Beach grass	*Lepturus repens*	
Coconut	*Cocos nucifera*	Niu

Table 7. Beach vegetation on Namotu Island.

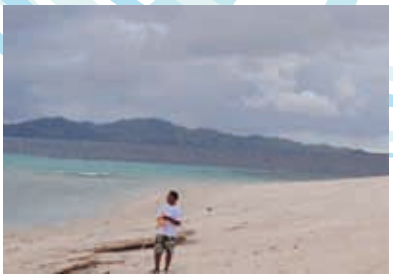
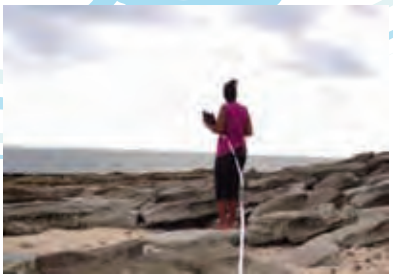


Figure 7. Namotu island beach profile (from left) showing part of zones 1, 2 and 3.

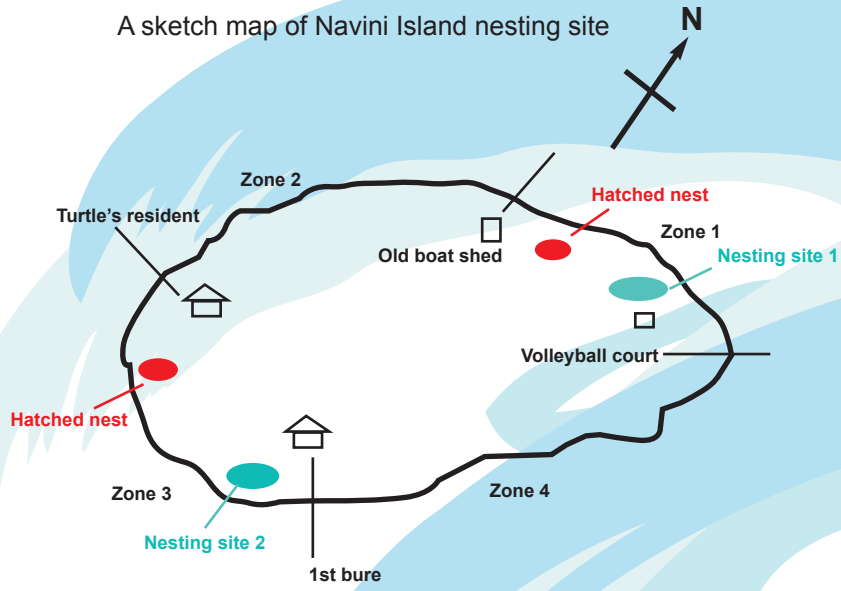

Figure 8. Sketch of Navini Island beach zones

Navini island is coral island 2 ha in size with recent average beach dimensions of 151.7m wide and 153.7 long (Figure 8, Tables 8 and 9). Beach components include coarse sand rubble and rock although rocks are less abundant than that on Namotu. Previous anecdotal reports suggest that both green and hawksbill turtles nest on this island but most recent reports are that of hawksbill turtle nesting. Common beach vegetation include, beach morning glory, beach grass, Acacia, coconut palm, beach bean and umbrella sedge (Table 9).

Zone	Width (m)		Length (m)	
	2009	2010	2009	2010
1	39.5	41.2	130	135
2	38.0	37.3	117	116.8
3	25	22.8	196.6	200
4	35.6	47.9	163	163
Avg.	34.5	37.3	151.7	153.7

Table 8. Beach measurements for Navini Island.

Common name	Scientific name	Vernacular name
Acacia simplex	*Acacia simplex*	Tatakia
Mareer/Manjak/Snottygobbles	*Cordia subcordata*	Nawanawa
Umbrella sedge	*Cyperus stoloniferus*	Uto ni bulamakau
Beach morning glory	*Ipomea pes-caprae*	Lawere
Beach bean/Seaside bean	*Canavalia rosea*	Drautolu
Anapanapa	*Colubrina asiatica*	Vusolevu
Beach gardenia	*Guettarda speciosa*	Buabua
Beach grass	*Thuarea involuta*	
Beach grass	*Lepturus repens*	
Coconut	*Cocos nucifera*	Niu

Table 9. Beach vegetation on Navini Island.

5.4 Foraging Ground Surveys

A total of 5 Green turtles with sizes ranging from approximately 20-60cm Circular Carapace Length (CCL) were seen during the surveys within the foraging grounds (Pers. Obs. Merewalesi Laveti, April, 2010).

There were only 3 species of seagrass present. These were Halodule uninervis, Halophila ovalis bulosa and Syringodium isoetifolium. The 4th species, Halodule pinifolia was absent. The major findings of the survey indicated that there was a change in seagrass species composition over about 13 months. There was less Syringodium, more Halodule uninervis and Halophila ovalis and more algae in 2010 (Figures 9 and 10).

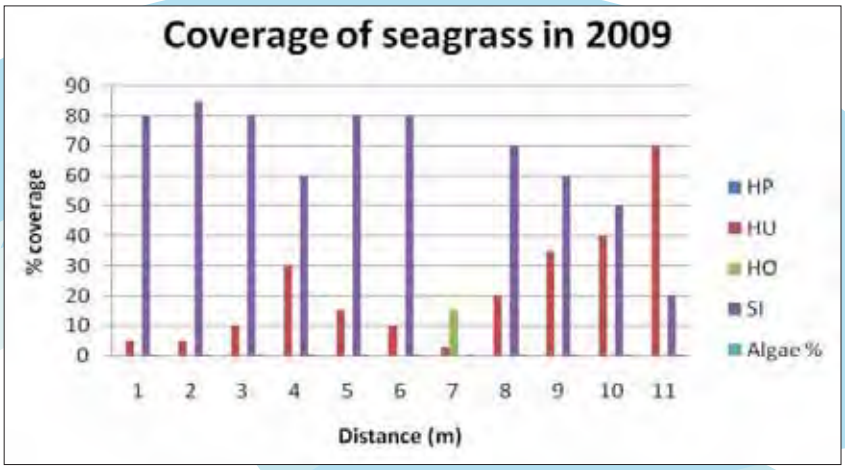

Figure 9. Seagrass species composition and percentage cover in Namotu in 2009.

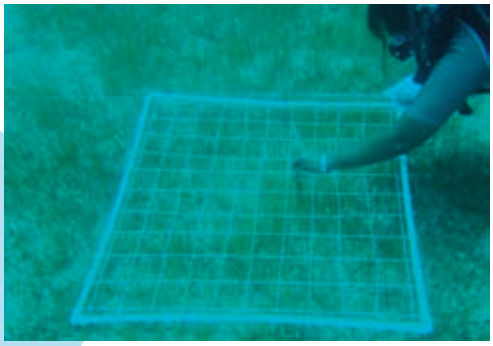

Figure 11. Namotu seagrass survey in April 2010.

Specimens from the survey and include the 3 sea-grass species

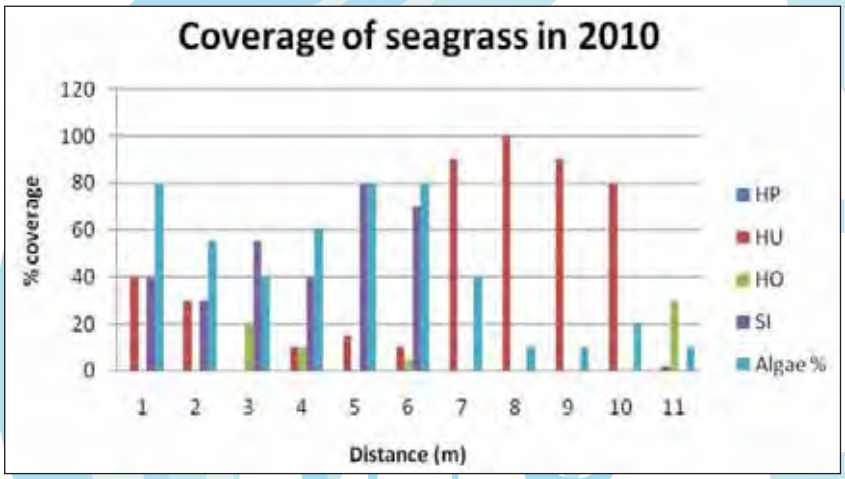

Figure 10. Seagrass species composition and percentage cover in Namotu in 2010.

***Syringodium, Halodule uninervis, Halophila ovalis* and algae**

6.0 Discussion

Nesting Turtles

Turtle population figures are difficult to determine because juvenile and male sea turtles do not come ashore and are difficult to count. Hence, population data are usually based on the numbers of adult females that come ashore to nest. Even then, the numbers are ambiguous - some females nest every two to three years, some may nest more than once on the same beach in a season, and some females will visit more than one nesting beach in a season. Females usually nest during the warmest months of the year and most of them return to the same nesting beach each year. Recent studies suggest that some females of some species will visit more than one nesting beach in a season. Females of most species usually come ashore at night, alone, most often during high tide to lay eggs (Gerrodette and Taylor 1999).

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Turtles are found in warm and temperate seas throughout the world. Adults of most species are found in shallow, coastal waters, lagoons, and estuaries and juveniles can be found in bays and estuaries, as well as at sea. Some sea turtle populations nest and feed in the same general areas and others tend to migrate great distances (Miller, 1997). Turtles have long been an intrinsic part of the culture and traditions for the village community in Fiji. Green sea turtle (Vonu Dina) populations migrate primarily along the coast from nesting to feeding grounds which is common.

Although not many turtles were observed nesting during the surveys, key informants mentioned that between 5-10 turtles (green and hawksbill) nested on the four target islands. According to Diez and Ottenwalder (1999), hawksbills routinely cross through shallow, coral strewn habitat to reach more heavily vegetated, low profile beaches, which was the case at most target islands. During the second survey on Navini island in 2010, 2 nesting pits were observed hidden amongst the littoral forest. Diez and Ottenwalder (1999) also mentioned that green turtles tend to nest in open habitat.

Charlie, the key informant on Namotu, who had spent 15 years on the island, believed that the number of nests per year has decreased compared to that of the last decade. According to Charlie, in the past, turtles used to nest further inland where littoral vegetation and buildings are now located. He believed that the decline in the number of nests per year could be due to the infrastructural changes on the island and to the increase in turtle harvesting by poachers and fishermen (Pers. comm. Charlie, February, 2009). According to Batibasaga et al (2006), there is anecdotal evidence to suggest that the decline in nesting green turtles is mainly due to overharvest. Another Namotu island staff mentioned that in 2008, there was a case of turtle eggs being exposed from the nest due to beach erosion (Pers. comm. Violet Hazelman, April 2010). According to Witherington (1999), storm events can cause extreme erosion and accretion or when placement of man-made structures modifies the natural movement of sand.

Nesting Beach

The beaches of the islands of South Sea and Tavarua were surveyed once only since it was decided that efforts would be better spent doing surveys at the key sites of Namotu and Navini Islands. All islands had similar beach components such as coarse sand, rubble and rock. After the second beach measurements of Namotu and Navini Islands in 2010, a large change in the beach profiles were observed. The beach had increased in both width and length by 98m and 115m respectively. In addition, as a result of this sand movement, rocks had been exposed and parts of the beach were severely eroded. Similarly, at Navini Island, sand was shifted around and changed the beach dimensions by 118m in width and 117m in length. This change was a natural process which is expected to continue. However, alteration of nesting beach profile could also be a contributing factor to the decline in number of nesting turtles. In such a situation, relocation of nests may be required to minimize the risk of inundation. As Witherington (1999) suggested, although natural events that cause erosion and accretion cannot be stopped, their consequences can be lessened.

Information gathered during the surveys indicated that hawksbill turtles preferred to nest high up on the beach amongst vegetation whereas green turtles preferred open beach areas. This was the case on Namotu and Navini islands and in Macuata on Vanua Levu (Pers. Obs. Merewalesi Laveti, February 2007; February 2009, March 2009). Both Namotu and Navini islands had similar beach vegetation.

Foraging

The extensive seagrass beds surrounding Namotu island marked the foraging habitat for green turtles and the shallow coral reefs surrounding Navini island marked the foraging habitat for hawksbill turtles in the Mamanucas. However, only seagrass surveys were conducted on Namotu and from the surveys conducted over the two years (2009 & 2010), it showed that seagrass and algal cover increased in 2010. The high algae cover may have been caused by sedimentation and nutrient enrichment. Visibility at the time of study was approximately 4 -5m, much less than that of the 2009 survey. However, the survey showed that the seagrass beds were healthy and expanding. Sea grass plays a major role in the marine ecosystem as a filtering mechanism to sedimentation from land and stabilizes sediments which help to keep the water clear. It is also recognized as a key habitat where many juvenile marine organisms begin their life cycle.

7.0 Conclusion

Although the results of the nesting turtle surveys provided some idea of the number of turtles nesting per year which may range from 20-30 turtles (green and hawksbill), on the 4 target islands, it seems that changes to the nesting beach profile from natural disasters and resort infrastructure may have an impact on the number of nesting turtles. This needs to be ascertained through more detailed studies. The seagrass beds at Namotu comprising 3 species provide an important foraging habitat for green turtles and appeared healthy. Over a 13 month period, the abundance of seagrass and algae has increased.

8.0 Recommendations

Marine management plans for both communities and resorts should incorporate measures for the protection of turtle nesting beaches as favorable nesting habitat is critical for sea turtle reproduction and central to the survival of sea turtle populations. It is assumed that the Mamanuca turtles are predominantly resident but more satellite tagging experiments are necessary to verify this.

There is need to build capacity and promote awareness with staff on the island to assist in collation of best quality data such as sighting, nest and hatchling counts for the purpose of collecting more data to determine the turtle population in the Mamanuca. There are no long term studies to provide information on sea turtle nesting trends.

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