BAMBOO BAY

COMMUNITY TURTLE MANAGEMENT PLAN 2025

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Acknowledgements:

SPREP Library Cataloguing-In-Publication Data:
Bamboo Bay Community Turtle Management Plan. Apia, Samoa : SPREP, 2025
60 p. 29cm.

ISBN: 978-982-04-1458-7 (ecopy)

1. Sea turtles – Ecology – Vanuatu. 2. Sea turtles – Monitoring – Vanuatu. 3. Sea turtles Conservation – Vanuatu. I. Bartlett, Christopher. II. James, Donald. III. Komet, Andrew. IV. Komay, Hubert. V. Pacific Regional Environment Programme (SPREP). VI. Title.

597.9209595

This report should be cited as:
Bartlett, C., James, D., Komet, A. and Komay, H. 2025. Bamboo Bay Community Turtle Management Plan. Secretariat of the Pacific Regional Environment Programme. Apia, Samoa. 60 pp.

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Green Turtle just before they released it back into the sea. Bamboo Bay, Malekula, February 2022.
Credit: Christopher Bartlett.

Disclaimer:
This report was written and printed with financial support from the Pacific-European Union Marine Partnership (PEUMP) Programme, funded by the European Union and the Government of Sweden. The views and opinions expressed in this report do not necessarily reflect those of the European Union or the Government of Sweden. The report has been written thoughtfully, with considerable care and attention. SPREP accepts no responsibility for incorrect information or for information from incomplete sources.

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Green Turtle (Chelonia mydas). Credit: Freepik.

Approval

Bamboo Bay Community Turtle Management Plan for the protection and sustainable management of turtles in Bamboo Bay, South West Malekula Island.

By virtue of power conferred upon the people and community of Bamboo Bay, under section 5 of this plan, we the people of Bamboo Bay represented by our Chiefs and Chairman of South West Area Council hereby approve of this Community Turtle Management Plan

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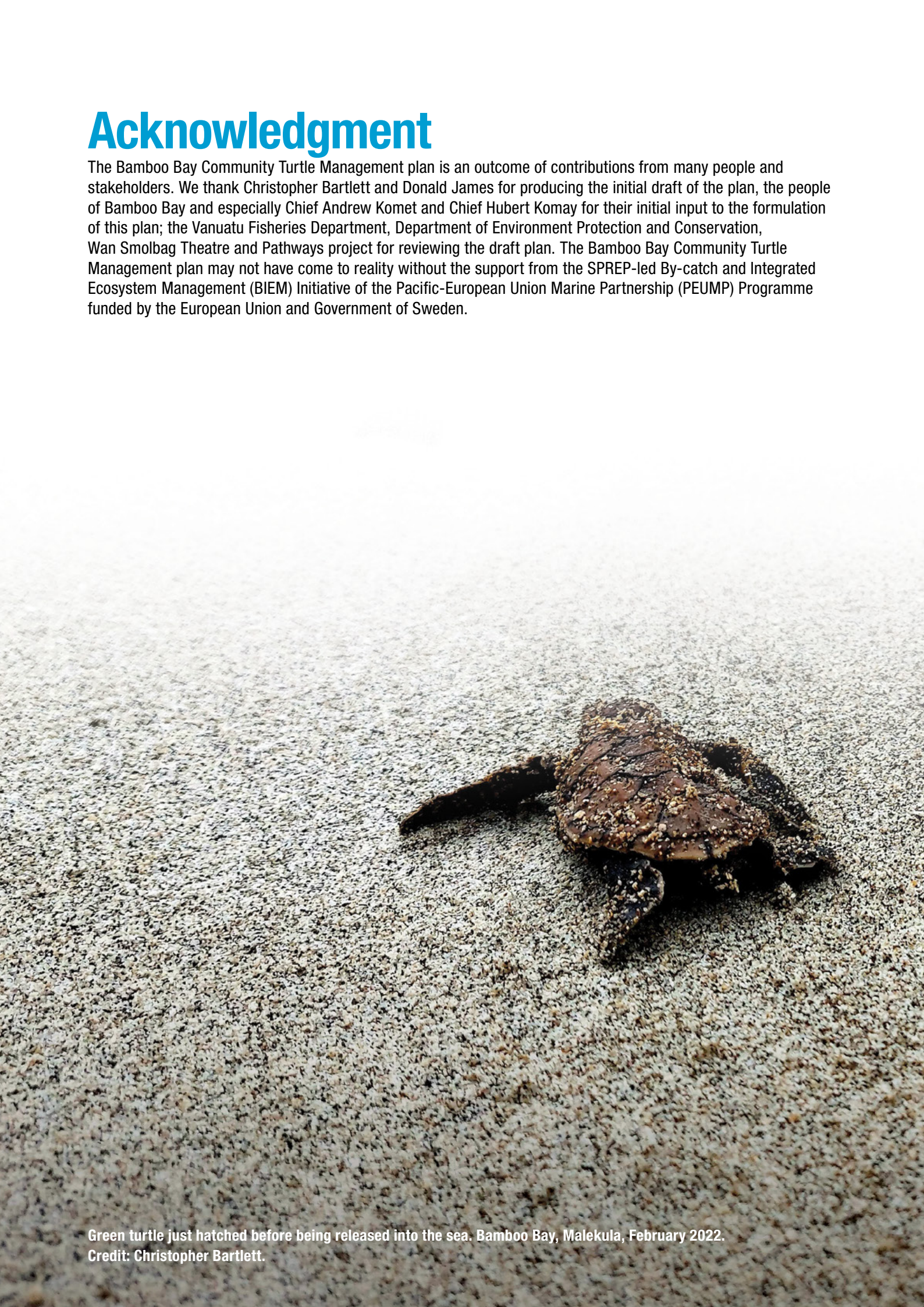
Document signed on this day: 13 JUNE 2025

Acknowledgment

The Bamboo Bay Community Turtle Management plan is an outcome of contributions from many people and stakeholders. We thank Christopher Bartlett and Donald James for producing the initial draft of the plan, the people of Bamboo Bay and especially Chief Andrew Komet and Chief Hubert Komay for their initial input to the formulation of this plan; the Vanuatu Fisheries Department, Department of Environment Protection and Conservation, Wan Smolbag Theatre and Pathways project for reviewing the draft plan. The Bamboo Bay Community Turtle Management plan may not have come to reality without the support from the SPREP-led By-catch and Integrated Ecosystem Management (BIEM) Initiative of the Pacific-European Union Marine Partnership (PEUMP) Programme funded by the European Union and Government of Sweden.



Green turtle just hatched before being released into the sea. Bamboo Bay, Malekula, February 2022. Credit: Christopher Bartlett.

1. Introduction

Bamboo Bay is an important turtle nesting site in Malekula especially for green and hawksbill turtles. The community has been monitoring and conserving turtles, their nests and hatchlings since the 1990s. A village elder, Noel Kaibaba, was the first turtle monitor in Bamboo Bay trained by the Wan Smolbag Theatre turtle programme. The WSB turtle programme has been instrumental in promoting and supporting community turtle monitoring activities through funding support from SPREP projects. While turtle monitoring continues to be undertaken, there are challenges in sustaining interest for a voluntary activity and ensuring consistent financial support.

It is the elders like Noel Kaibaba, Philip Vanua and Hubert Komay who are actively undertaking monitoring work while the youth are not showing much interest which is concerning. In a community profiling survey undertaken in 2021, the community requested support to formalise a community turtle management plan to provide a roadmap for turtle conservation in the Bamboo Bay area.

A community consultation meeting was conducted with the community of Letokas by a consultant funded by the BIEM project during the breeding season of 2021–2022. Other stakeholders consulted included Vanuatu Fisheries Department, Department of Environmental Protection and Conservation (DEPC), as well as with technical experts, International Union for Conservation of Nature (IUCN) Marine Turtle Specialist Group (MTSG), Vanuatu Risos Monitors, local NGOs, SPREP's Threatened and Migratory Species Adviser and the BIEM By-catch/CITES Coordinator from TierraMar.

This plan will inform the wider consultation exercise to determine whether the community wishes the integrated ecosystem management plans for the wider coastal areas and associated watersheds to be formalised through Community Conservation Area.

2. Purpose and Scope

Sea turtles are marine reptiles whose life cycle links the sea to the land in respect to nesting. They are valuable in the traditional Melanesian culture in Vanuatu for their meat and eggs, which are harvested as a source of protein, and the shell is used for souvenirs. Globally, overharvesting and damage of nests by humans has been the major cause of increased pressure on sea turtle populations. As a result, all species of marine turtles are listed as endangered under the Convention on the International Trade in Wild Flora and Fauna (CITES) and need management and conservation.

The use of turtles in Vanuatu is regulated under Section 59 (2) of Fisheries Regulation Order No. 28 of 2009. Traditional use is exempt, however fishers are required to apply for a permit to harvest turtles for traditional use purposes. Enforcement of existing measures is faced with challenges when fishers in the communities are involved. Often management and conservation measures do not cover the protection of nesting habitat and nests to safeguard breeders, eggs and hatchlings.

The people of Bamboo Bay have been conserving turtles for the last 20 years and continue to do this to this day. However, they would like to see interventions that help improve their effort in conserving turtles and develop livelihood activities to help them with their basic needs. The Bamboo Bay Community Sea Turtle Management Plan is helping the community achieve this goal. At the same time it is the first such plan developed to prioritise management of turtles and protection of their breeding habitat to ensure healthy turtle populations. The plan was developed in line with the Environment Conservation Act, Fisheries Act and requirements of regional and international frameworks.

The specific objectives of the Bamboo Bay CTMP are:

- Protect and maintain turtle resources for the enjoyment of present and future generations.
- Bring sustainable benefits from turtles to the people of Bamboo Bay, especially through eco-tourism.
- Keep turtle nests in Bamboo Bay safe from harm.
- Build the capacity of Sea Turtle Monitors and other stakeholders in the community on resource management.
- Contribute to sea turtle science and knowledge in Vanuatu, in the Pacific and at the international level.
- Strengthen customary and traditional management of natural resources.
- Build networks that link turtle resource champions across villages and islands for sharing information and collective action

3. Jurisdiction of the CTMP Plan

The jurisdiction of the Bamboo Bay Community Turtle Management Plan covers the turtle nesting areas which are in the customary area of Bamboo Bay community from Wingele in the south to Turtle Island in the north and extend further north to cover beaches within Dickson Reef Area right up to the boundary with Tisvel in the north. The Bamboo Bay and Dickson Reef communities are the northernmost communities in the South West Bay area and fall under the South West Area Council. The beaches in the whole area are important for turtle nesting, although the highest concentration occurs in the Bamboo Bay area. The community has agreed to maintain “Bamboo Bay Community” as the owners of the Management Plan considering the effort, commitment and investment the community has made towards turtle conservation and nest management activities.

4. Background

4.1 Bamboo Bay community and its people

Bamboo Bay is in the northern part of the South West Bay area between Lawa and Dickson Reef with the customary area between Maunvet Point in the south and Turtle Island (Figure 1). The Bay is named after the bamboo plant which is a popular forest species in the area important in local housing construction. There is only one community in this area that consists of four settlements who have direct access to the coastal zone, namely Letokas, Lawanemet, Vanavus and Labuwol. Letokas and Lawanemet stations are leading the turtle conservation work.

There is no road access and banana boats are the main transport means to Lakatoro Township and between villages. Interisland shipping services are provided by small ships based in Luganville Santo. Wintua is the nearest airport with two to three flights per week. Boat transport takes up to two hours to La Bubu jetty and by road to Lakatoto. A boat charter is VT12,000 and VT6,000 taxi charter to Lakatoro.

Mobile phone coverage is available with reception only accessed on the beach. The population of Bamboo Bay is 240 people, including two with disability and nine widows. 42% of the population are active members of the community between 18 years and 59 years. Most buildings in the villages are made of local bamboo material and thatched roofing. A few houses are made of modern materials. Other infrastructure includes a new water supply system, a new church house, a solar power lighting system, a primary school, and outboard powered fishing boats and a cattle ranch.

The community of Bamboo Bay are Sunday worshippers and there are three churches for Jehovah's Witness, Catholic and Presbyterian. Jehovah's Witness believe in not taking part in voting and that meat must be fully bled before it is eaten.

Figure 1. Map of Malekula Island showing the Bamboo Bay area

4.2 Community governance

Bamboo Bay community is a single community headed by a High Chief (Novol Tribe) who leads a Custom Chief, a Principal Chief and eleven Nasara Chiefs. The eleven nasara names are: Imory, Mefrakite, Meleben, Imtourua, Bangamolei, Batmangi, Wiawlou, Lekumoa, Momlinge, Lemanrua, Lerberap. The governance structure of Bamboo Bay is provided in Figure 2. The Custom Chief is the village custom judge in all community disputes or issues. The Principal Chief is in charge of supervising and monitoring the work of different Development Committees and receives reports from the committees for briefing to the Chief. The committees include Turtle Committee, Livestock Committee, Cocoa Committee, Water Committee, Health Committee, Education Committee, Tourism Committee, Van-wood Committee, Agriculture Committee, and Church Youth. The committees are appointed by the village Chief to organise the community on these development areas and as focal points for the Province and Government Departments.

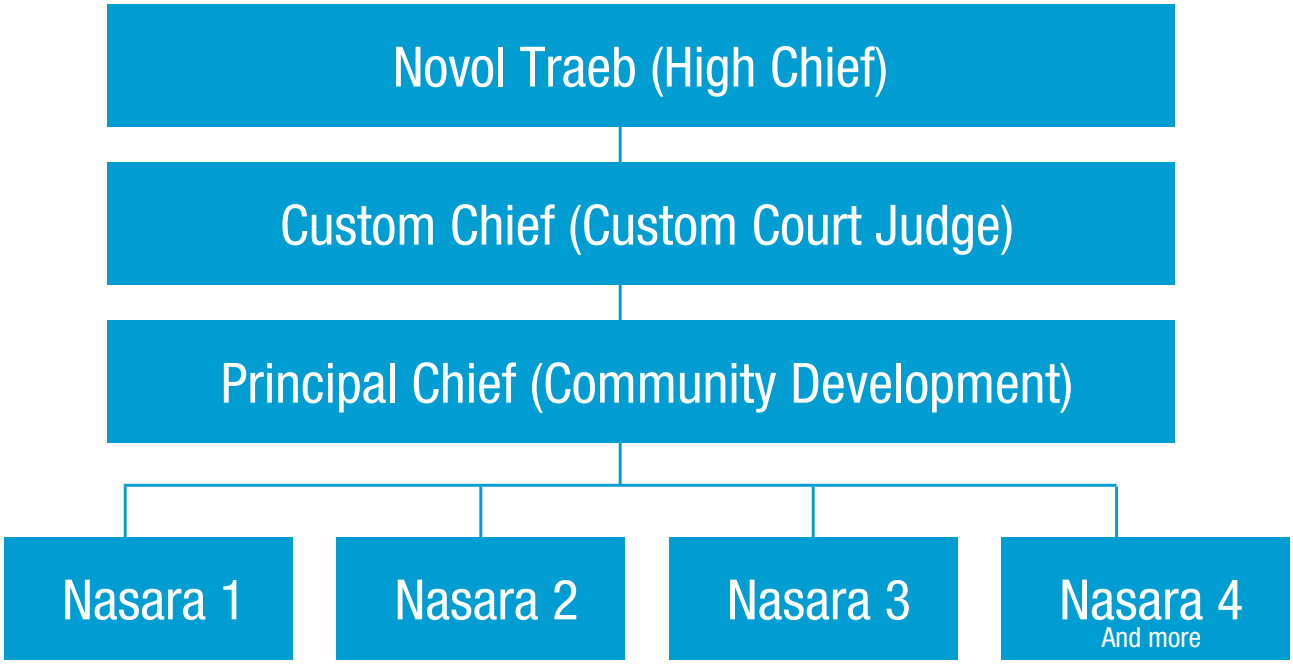


Figure 2. Chiefly Governance in Bamboo Bay

The community has registered an association called Letokas Community Association with the Vanuatu Financial Services Commission (VFSC) purposely to unite its members for the betterment of their area. The objective of the LCA are to:

- Ensure that all children/youth have access to education.
- Make people more resilient to the impacts of climate change and disaster.
- Look after and protect our local environment.
- Promote and manage sustainable tourism.
- Enhance food and water security.
- Bring back custom and culture for future generations.
- Safeguard the health of our people and communities.
- Extend access to communication to all people.
- Expand use of renewable energy sources and access.
- Improve sustainable non-extractive production from forests, agriculture, fisheries, and livestock.
- Support vulnerable groups like women, the elderly and people living with disabilities.
- Conduct and carry on the work of the Association not for profit, but exclusively for charitable, civic or educational purposes.

4.3 Traditional calendar

The functioning of the community is determined by the environment they live in and climatic conditions driving sunshine, temperature, wind and humidity, cool and warm seasons, rain and the sea conditions. These conditions can vary at the micro level influenced by the topography of the landscape and the impacts of climatic changes at the regional and global level. The marine environment and the coastal zone are influenced by marine ecosystems that include coral reefs, rivers, estuaries, lagoons, mangroves and deep-sea slopes. These varying environmental factors give each community different characteristics and are therefore unique. Community activities are driven by these factors but these are hardly documented. This Plan is the first time the calendar has been documented for this community. Having such a calendar is useful for better planning of community activities and understanding changes when they happen. The Bamboo Bay community calendar (Table 1) is developed as an outcome of community consultation.

Table 1. Bamboo Bay community traditional calendar

Month	Custom Name	Trees	Plants	Animals	Sea	Sky
January	EMBEN Wild cane	Fruit trees ripe	Arrow tree flowers come out (not yet open)	Many mosquitoes	Sea is high, comes up beach	Hot temperature
		Avocado ready		Chickens weak, chicks die		Rainy time
		Namambe ready				
February	TEP SEY MBEN Flowers open	Fruit damaged by rain	Yam growing, but hasn't started climbing yet	Many mosquitoes		Strong wind can come (cyclone)
			Some yams ready to harvest	Crabs go put eggs in river (abenmesepsep)		Weather is changing
March	BESIMIELE Red moon, problem time	Trees can be blown down (cyclone)		Many mosquitoes		Cyclone period, strong winds
				Tuna fish plentiful, good time for trawling		Rainy time
April	EBLENVSE Naviso open	Time to plant trees	Naviso is swollen open and ready	Whitebait fish go to river (sinang)	The sea tides are very low	Rainy time
		Fruit is ready: mandarin, citrus, nakatambol, naos	Time to plant seeds	Palolo worm emerges from reef	Good fishing	
				Manguru fish plenty		
				Fish are tame and unafraid		
May	ENRERE Leaves falling	Narara leaf is dropping	Time to cut and burn garden	Namarae eel fat	The sea tides are very low	Cyclone period now passed
					Good fishing	Small rains still falling

Month	Custom Name	Trees	Plants	Animals	Sea	Sky
June	ILOHUK Flowers opening	Narara is putting out flowers	Time to cut and burn garden		The sea tides are very low	Becoming dry
		Time to burn trees in garden				
		Nangai is ready				
July	ITUBO Open	Narara flowers ending	Time to plant yams, banana	Flying foxes plenty on narara flowers	The sea tides are very low	
		Nangai is ready		Turtles beginning to lay first eggs		
				Small birds (nasiviru) come all the way from Santo Island, before leaving again		
August	ISIRSIR Falling	Narara flowers falling	Time to plant in garden	Dugongs come into the bay		Dry season
		Nangai is ready	Time for custom activities, food available			Cold temperature
September	HIDRIK New leaf	Trees are putting out new leaves	Garden crops growing well	Termites plentiful	Sea tides very high	Rain starting to fall
			Time to put stakes on yams	Big naura in the rivers	Fishing not very good	Temperature warming
			Yams climbing on stakes	Wild chickens are plentiful		
				Dugong come into the bay		

Month	Custom Name	Trees	Plants	Animals	Sea	Sky
October and November	HIOMBLEBLE Lots of food		Everything is green and growing	Turtles laying many eggs	Sea is very quiet	Some rain, some sun
			Everything planted in April ready now showing what you will get to harvest	Chickens putting many eggs		Getting warm
				Crabs with eggs		
				Namalao put many eggs		
				Birds put many eggs		
				Wild chickens		
			Coconuts are mature and brown	Turtles lay eggs and hatch		Rainy time
			Root crops are mature	Wild chickens plenty		Cyclones can come
			Time to make gradetaking namangi	Shearwater lay eggs in the forest (akine)		
			Make yam storage house (ambule)	Crabs with eggs to river		
				Chickens lay many eggs		
December	EWULDAO Everything can grow	Namambe ready	Hard to get to gardens, muddy roads	Chickens lay many eggs	Sea is very rough, strong waves	Very rainy
		Fruit trees growing well, but slow to fruit	Not much food	Hard to hunt animals, muddy		Very hot temperature
			Last harvest of yams	Devil butterfly comes out at night (bebetemas)		
				Crabs with eggs to river		
				Namalao laying eggs		
				White-yellow butterfly emerges from pupae, fly to sea and softmud		

Hawksbill Turtle. Credit: Silke Baron – Flickr.com

4.4 Livelihood activity

Agriculture, livestock, forestry and fisheries are the mainstay of the people of Bamboo Bay. The community owns cattle with some 20+ head of cattle, pigs and local chickens (>100). There used to be a cattle ranch but this had broken down and farmers now tie their cows. Fishing is a daily activity for food security, with surplus sold at Wintua or Lakatoro markets. The main commodities are copra, cocoa, beef, fish and timber and root crops such as yam, taro and banana. Cacao and copra are dried and sold to a buyer in Lakatoro and at times to passing trading ships for sale in Santo. Beef is sold locally to a local buyer in Lawa village and to surrounding villages. Handicrafts such as mats, fans and baskets are sold at the Lakatoro Handicraft Centre. Other income sources available are kava, vanilla, peanuts, sandalwood, freshwater fish, land crabs and honey.

4.5 Conservation activities

As in Wiawi, Bamboo Bay also manages one of the earliest community conservation areas (CCA). The Bamboo Bay CCA was initiated in 1993 by the community with Malampa Local Government Council under an ACIAR forestry project (Tacconi and Benneth 1997). The report presented important information about boundaries and management activities for the different zones within the Bamboo Bay Conservation Area. Section 4.2.1 of that report discusses the first sea turtle management rules for nesting turtles, which included:

- Vegetation may not be subject to alteration
- Collection of firewood and other wood products is prohibited
- Fires may not be lit
- Buildings of any kind may not be erected
- Earthworks of any kind are prohibited

A nationally recognised conservation initiative initially proposed in this report did not progress because of misunderstandings of the registration process for CCA. Several non-governmental organisations (NGO) have supported the community: Oxfam Vanuatu constructed a community water system in 2015. Wan Smolbag provided support with a water tank and built a safe house in Letokas Village. ADRA and Resilience have also supported the community in various development projects.

SPREP's By-catch and Integrated Ecosystem Management (BIEM) Initiative of the Pacific-European Union Marine Partnership (PEUMP) Programme funded by the European Union and the Government of Sweden (this project) is building on these past efforts to strengthen the ridge to reef management. Activities under the project include a terrestrial biological rapid assessment (BIORAP), a marine BIORAP assessment, establishment of a turtle monitoring centre, community turtle signage and this community sea turtle management plan. These engagements have contributed positively to the community in the preservation of their environment. The historical timeline of major conservation activities undertaken in the Bamboo Bay area since 2005 is shown in Table 2.

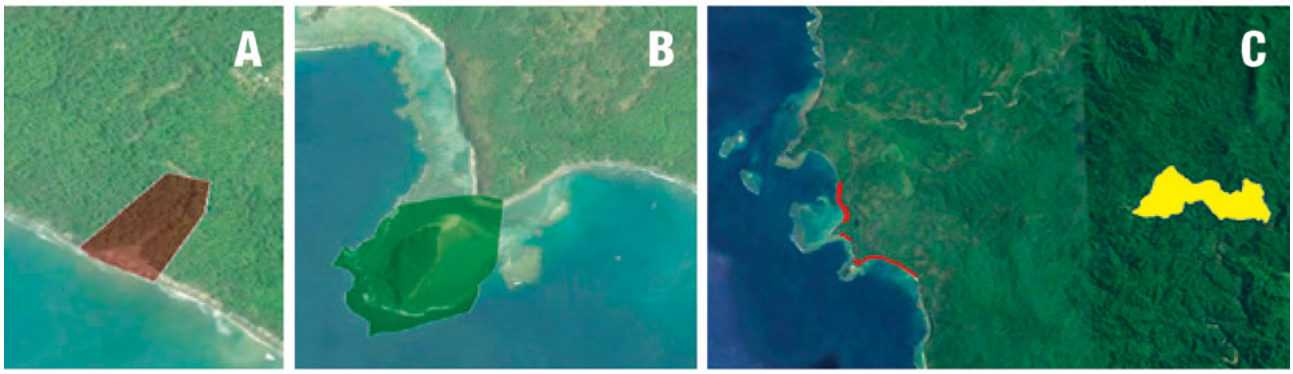


Figure 3. Conservation areas in Bamboo Bay (not registered)
A. Louillembemete Crab Conservation Area – 2014
B. Turtle Island Conservation Area – 2017
C. Meten Nawoi Conservation Area – 2005

Table 2. Designated conservation areas established by the community

Year	Activity description
2005	Wan Smolbag Turtle programme with Mr Noel Kaibaba as local monitor. The family of Mr Hubert Komul established two forest conservation Areas: 1 - Meten Nawoi and 2 - Laimblee.
2009	Mr Philip Vanua commences as additional turtle monitor.
2012	A satellite tag was affixed to a turtle, and it was tracked from Bamboo Bay to Noumea, the Turtle was named “Bamboo Lady”.
2014	Set up of Crab Conservation Area, (3.47 hectare) and signboard by Island Reach NGO.
2016	Filming by Island Reach NGO of marine conservation work. Community with guidance from Watson Vanualai from Bamboo Bay, and a member from Nguna Pele Marine Protected Area, established a no-take conservation area around Turtle island.
2018	A turtle house constructed to serve a place for visiting researchers and visiting volunteers.
2021	Visit by Live and Learn Vanuatu to take drone footage of Meten Nawoi and Laimblee Conservation Area for a potential REDD + Project.
2022	Temperature loggers deployed at nesting beaches.
2021 / 2022	Community consultation and drafting of Bamboo Bay community Turtle Management Plan.
2022	Terrestrial Marine BIORAP surveys at Bamboo Bay area by BIEM Project.
2023	Setting up of Community Turtle Signage.

4.6 Climate, rainfall and disasters

According to the World Bank knowledge portal (World Bank 2019), Vanuatu’s climate varies with latitude. It is wet tropical in the northern islands, which receive over 4,000 millimetres (mm) of annual rainfall and dryer subtropical further south, with annual average rainfall of 1,500 mm. Average temperatures range from 21°C to 27°C and seasonal temperatures in the capital city of Port Vila exhibit high variability. Summertime temperatures exceed 30°C and minimum temperatures are often below 20°C (Figure 4). Seasonal and inter-annual variations in climate are driven by changes associated with El Niño, which affect every aspect of the climate in the Pacific. Cyclones are common in Vanuatu during the warm months of November to April, although two recent cyclonic events were experienced outside of the traditional cyclonic season (The World Bank 2019). Figures 4, 5 and 6 present historical records for temperature and precipitation for Malampa. The charts are extracted from the Climate Change Knowledge Portal (The World Bank 2019)[1].

[1] https://climateknowledgeportal.worldbank.org/country/vanuatu/climate-data-historical The World Bank. 2019. The Climate Change Knowledge Portal.

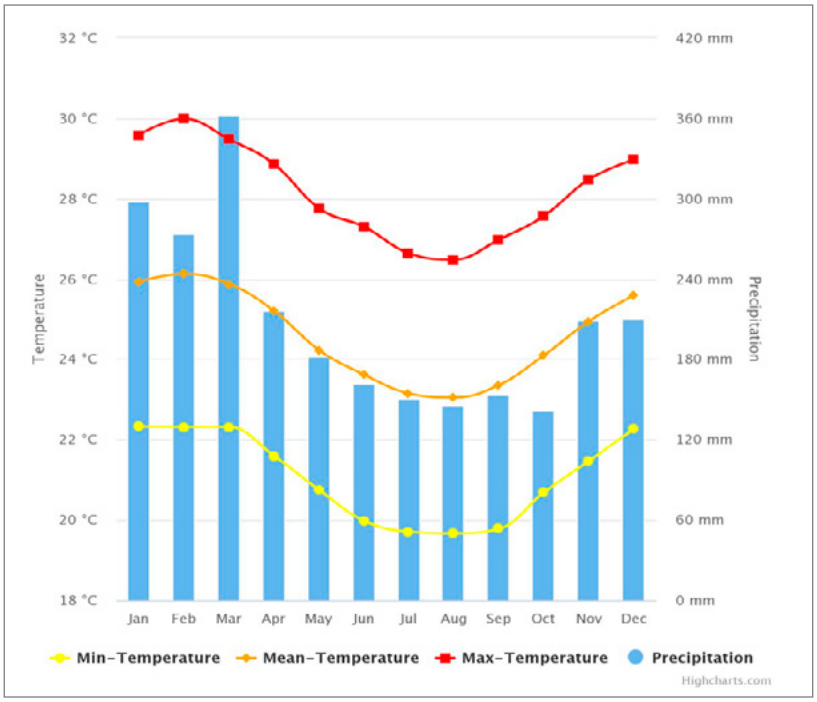


Figure 4. Monthly climatology of Min-Temperature, Mean-Temperature, Max-Temperature & Precipitation 1991 – 2020 Malampa Province, Vanuatu

Figure 5. Observed average annual mean temperature of Malampa, Vanuatu for 1901 – 2021

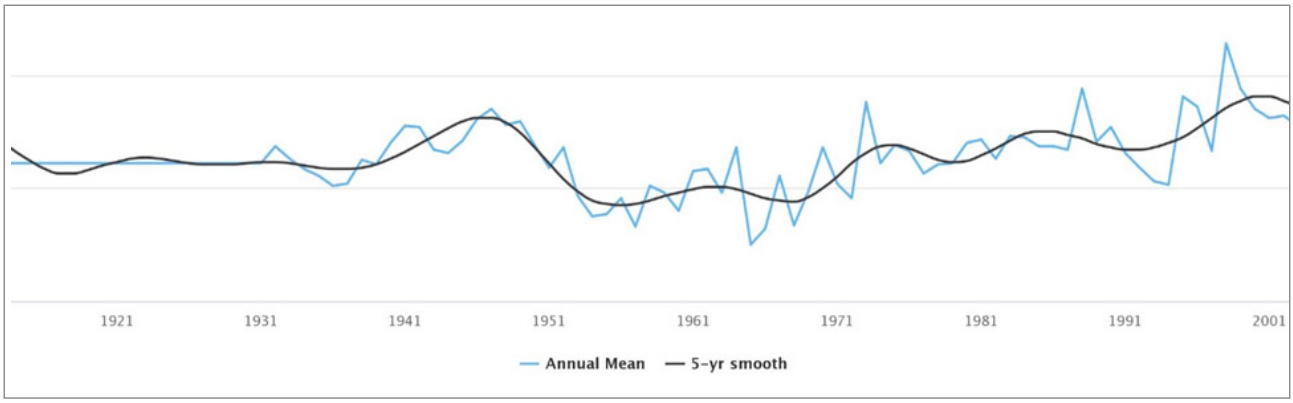
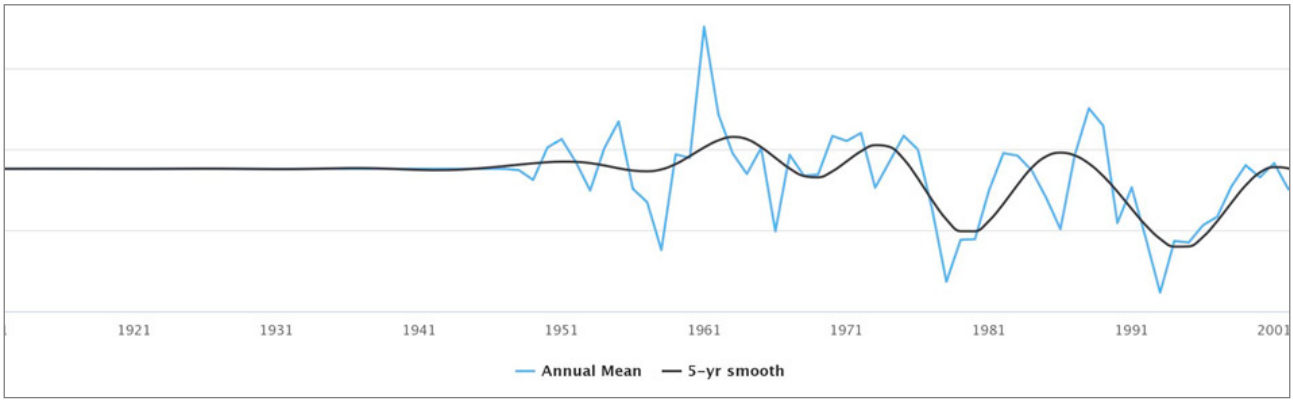


Figure 6. Observed average annual precipitation of Malampa, Vanuatu for 1901 to 2021



4.7 Exposure to natural disasters

Several disasters have affected West Malekula and the community of Bamboo Bay since pre-industrial times and have been recorded in oral history. During the consultation, community elders recalled and shared their experiences of these disasters in Table 3.

Table 3. History of disaster occurrences that affected Malekula Island and Bamboo Bay area

Year	Disasters
1700s	Tsunami (time of Captain Cook)
1940/1941	Fire on the nearby hills
1951/1952	Flooding in the entire community
1951	Hurricane[2]
1965	Earthquake – broke the coral reef and hill
1967	Hurricane
2015	Cyclone Pam (Figure 7)
2015/16	El Nino dry season
2015/16	Man-made fire burned gardens. House burned. Coconut burned.
2022	Tsunami caused by Tongan Volcano broke a large stone on the shoreline

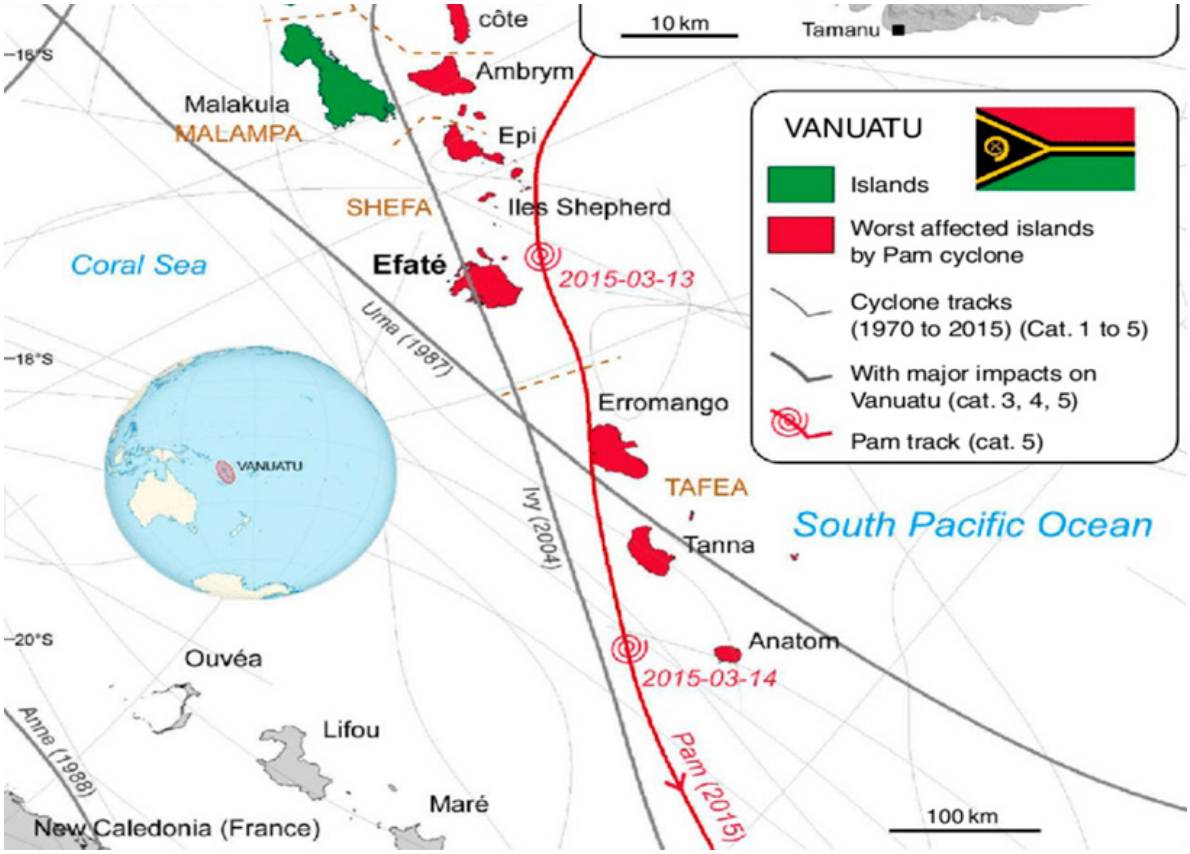


Figure 7. Image of Cyclone Pam Track in March 2015 (red line)

2 D'Aubert A.M and Nunn P.D. 2012. Furious Winds and Parched Islands: Tropical Cyclones (1558–1970) and Droughts (1722 – 1987) in the Pacific. https://books.google.vu/books?id=FThPAAAAQBAJ&redir_esc=y

Newborn Leatherback Turtle. Credit: Karen Parker – Flickr.com

5. Current Turtle Management Practices in Bamboo Bay

5.1 Species present

The three main turtles observed to nest at Bamboo Bay are:

- Hawksbill (Eretmochelys imbricata): Critically endangered (global)
- Green (Chelonia mydas): Endangered (global)
- Leatherback (Dermochelys coriacea): Vulnerable (global); Critically endangered (west Pacific subpopulation).

Green turtle is most important according to the data recorded, followed by the hawksbill turtle and leatherback turtle.

5.2 Biology of turtles

Figure 8. Adult Green Turtles mating (A) and mother turtle preparing its nest (B) and laying egg (C) on the beach at Bamboo Bay - Photos by Christopher Bartlett

Sea turtles are long-lived, slow-growing species, characterised by a complex life cycle that utilises a wide range of habitats. Generally, sexual maturity is delayed in all species and varies between 20 to 50 years. Females lay 50 to 130 eggs per nest dug in sandy beaches and can lay several nests per season. Hatchlings crawl out of their nest and enter the sea for the first time. From the many hatchlings that enter the sea, a lower proportion survives the wild ocean to reach adulthood. They spend most of their life in the open ocean feeding on seagrass, invertebrates

and jellyfish. They frequent the coastal areas for feeding and breeding when they become sexually mature. A female will always return to their beach of birth to nest. More information on the biology of sea turtles can be found in Hickey et al. 2023. Adult turtles are at high risk when nesting as the mother turtle dedicates its effort and energy to lay its eggs and will not be deterred by any disturbance. During mating season many male and female adult turtles aggregate in the shallow waters of beach G only (Figure 8) and often up to 10 male turtles can be seen aggregating around a female turtle during this activity.

5.3 Nesting beaches in Bamboo Bay

The turtle nesting in the Bamboo Bay and Dickson Reef area is divided into eleven sections from the south to the boundary with Tisvel in the north (Figure 9 and 10). These nesting beaches are named as beaches A, B, C, D, E, F, G, H, I, J and K (Table 4). The beaches are composed of both white sandy beaches (A, B C, D, E, F, H and I) from marine origins and grey-black sandy beaches of riverine influence. A nesting beach is described as a sandy beach between two headlands. There are eleven turtle nesting beaches distributed from Bamboo Bay to Dickson Reef in the north. Seven of the nesting beaches are located in the Bamboo Bay area, with four in the Dickson Reef area. The white sandy beaches are important for hawksbill turtles, while green turtles will nest on both white sand and dark sandy beaches. Leatherback turtles prefer the dark sandy areas.

The community of Bamboo Bay is leading turtle conservation work in the South West Bay Area Council and this management plan focuses on the Bamboo Bay community. While monitoring originally was undertaken only on beaches inside Bamboo Bay, over the years conservation work has spread to the Dickson Reef area and with it, an expression of interest to join the turtle monitoring programme. As a result the whole area is included in the plan activities to encourage the Dickson Reef community to participate in turtle conservation work.

Table 4. Bamboo Bay Turtle Nesting beach details

Beach	Latitude	Longitude	Local Name	Sand type
Beach A	16°25’8.01”S	167°24’17.11”E	Wingele	White sand
Beach B	16°24’53.07”S	167°24’24.95”E	Lewilewilewmavis	White sand
Beach C	16°24’30.18”S	167°24’23.06”E	Venaiberaf	White sand
Beach D	16°23’59.75”S	167°24’17.64”E	Tumarse	White sand
Beach E	16°23’22.49”S	167°24’20.80”E	Awimarai 1	White sand
Beach F	16°22’59.08”S	167°24’15.85”E	Awimarai 2	White sand
Beach G	16°22’28.09”S	167°23’54.79”E	Awilembemete	Black sand
Beach H	16°22’5.05”S	167°23’17.91”E	Lengomose	White sand
Beach I	16°21’34.46”S	167°23’13.02”E	Letesfinmonai	White sand
Beach J	16°20’58.29”S	167°23’4.77”E	ifakmoulingara	White sand
Beach K	16°20’17.09”S	167°22’53.04”E	Lemoran	Black sand

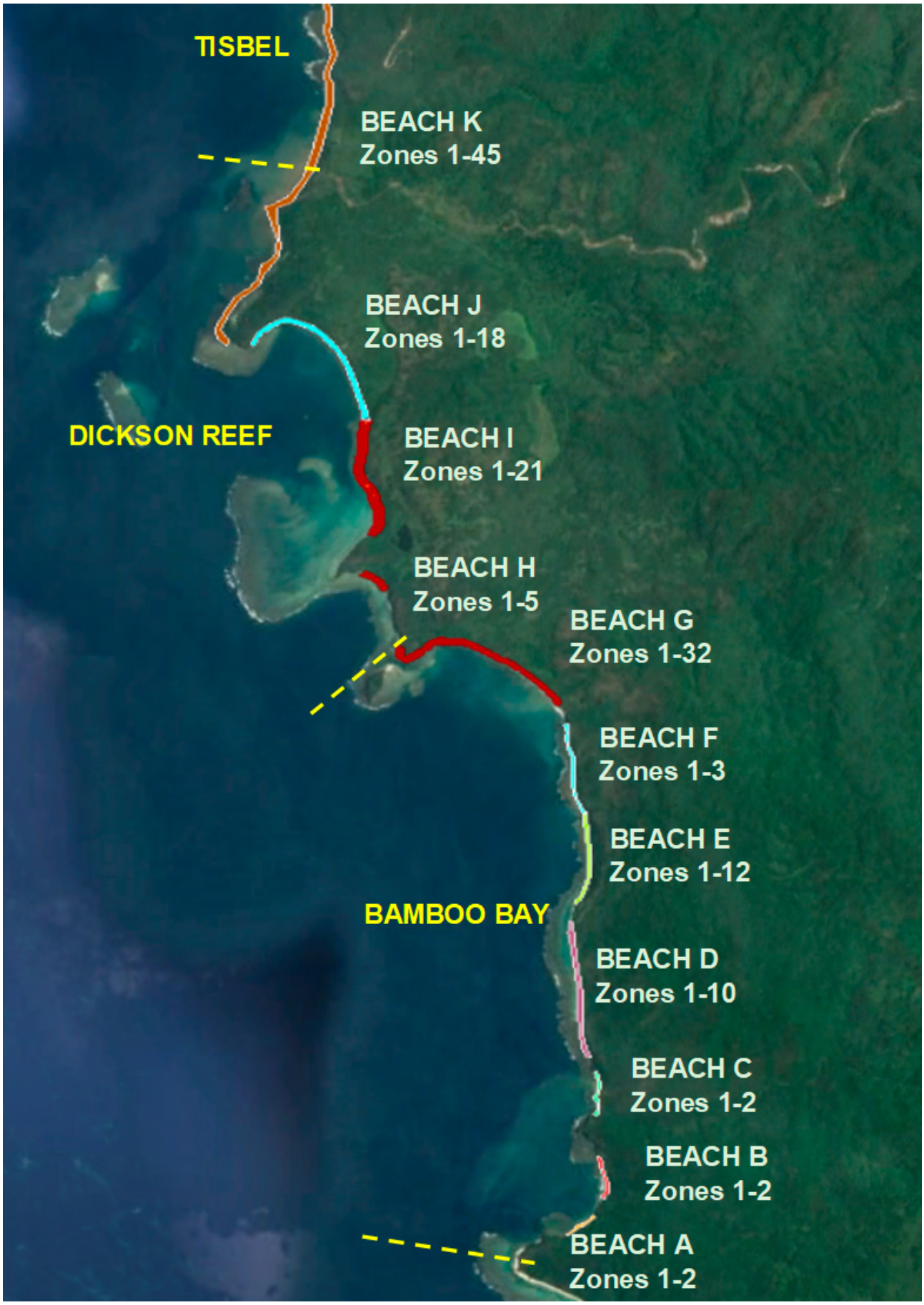


Figure 9. Map of Bamboo Bay and Dickson Reef area with location of turtle nesting beaches

Beach B (left) and Beach A (right)

Beach C

Beach D

Beach E

Beach F

Beach G

Beach H

Beach i

Figure 10. Pictures of 9 nesting beaches in Bamboo Bay - Photos by Christopher Bartlett

Figure 11. Turtle nest marker, a piece of bamboo stem written using a knife by Philippe Vanua, Turtle monitor of Bamboo Bay, Photo by Christopher Bartlett

5.4 Turtle monitoring work

Turtle monitoring is a voluntary activity undertaken by the community with support from Wan Smolbag (WSB). Turtle monitoring activities in Vanuatu are centred around the breeding season from July to April when adult turtles come ashore to mate and lay their eggs on the beaches. Vanuatu turtle monitoring started in the 1990s following a regional campaign by the SPREP turtle programme to save declining turtle populations. In Bamboo Bay turtle monitoring work commenced in 2005 with the support of the WSB.

Monitoring activities in Bamboo Bay are undertaken during the breeding season when turtles start to come ashore around August and September. Monitors will visit all the nesting beaches during daytime and nighttime, check for damage, mark new nests and tag turtles. Successful nests are marked so it is easy to identify a new nest. Using a stick split at one end and a coconut frond, nests are labelled with the nesting date and estimated hatching date (Figure 11). Nesting turtles are tagged and data is recorded.

Monitors move by foot all the time, which is an ongoing challenge to visit all the nesting beaches twice every day at daytime and nighttime. Beaches A, B, C, D and F are not being monitored effectively because they are separated by headlands which are inaccessible by foot, are far away from the village, require travelling by canoe or boat and during bad weather, access to these beaches becomes difficult. Nests in Dickson Reef are monitored by a trainee monitor with supervision by one of the trained monitors, Mr Philip Vanua.

Any nest found to be inundated or damaged by waves or flooding are dug out and relocated to higher ground inland, using nesting pens. The key activities of turtle monitoring undertaken during a breeding season are described in Table 5:

Table 5. Monitoring activities carried out by turtle monitors at Bamboo Bay.

	Activity	Work Carried Out
1	Identify breeding beaches	Identify the beach for which the nest is located and ensure to have this recorded.
2	Marking of nests with date of entry and date of hatching	Each turtle nest is marked soon after the adult has covered its nest. A piece of coconut frond us used to write the arrival date of the breeder and expected date of hatching. The coconut frond is clipped on the split end of the stick that has been tucked in the sand next to the nest.
3	Tagging of mother turtles and recording tag numbers	On arrival of the mother turtle, the monitor will inspect the turtle for existing tags, if there is none, a new tag is prepared and the turtle is tagged once the turtle has completed burying her eggs. If there is a tag, the tag number is recorded. If there is damage to the tag, the old tag is removed and replaced with a new tag.
4	Daily inspection of nests until hutching	Turtle monitors of Bamboo Bay conduct daytime and nighttime monitoring using torches, to scare dogs from damaging nests. It is hard work providing surveillance over the whole area on a daily and voluntary basis.
5	Night time inspection of hatching	Inspection of hatching at night to ensure hatchlings return safely to sea.
6	Relocation of inundated nest	Where a nest is near the high water mark, it is at risk of being inundated during storm surges. These nests are closely monitored and, if in danger, the eggs are dug out, taken to a bamboo pen enclosure, and buried in a new hole. Moving eggs is risky and many could die.
7	Counting dead shells	Egg shells are normally dug out and counted to check on nest performances but this is not done for every nest.
8	Recording of tag numbers and turtle nests on TREDS log sheet and send to WSB	Data is recorded on paper log sheets and sent to WSB after the nesting season or collected by WSB Officer during a visit.
9	Equipment used by monitors	Equipment used by monitors includes a torch, bucket, raincoat, spade, log sheet.

5.6. Turtle monitoring data collection and reporting

The key turtle nesting data collected at nesting sites are a count of:

- nests recorded by species by breeding season;
- Vanuatu tagged turtles observed at Bamboo Bay and tag number;
- nests and eggs translocated to a new nest;
- nests damaged by inundation (flooding by waves); and
- damaged eggs and hatched eggs.

Recording of turtle nesting data in Bamboo Bay was not well organised previously and as a result there are issues with data for 1973 to 2015, which are held in the regional turtle database at SPREP (TREDS). TREDS showed only 84 green turtles, 143 hawksbill turtles and 3 unidentified turtles nesting over that time (Table 6) in Bamboo Bay. WSB records of turtle nesting data collected from 2004 to 2019 recorded 1,545 green turtles (92%) and 129 hawksbill turtles (8%) nesting in Bamboo Bay (Table 7).

The increased figures are testament to the improved data collection from trained turtle monitors who conducted their work under supervision of the WSB monitoring programme. The recent records show a marked difference in the number of green turtles over hawksbill.

The distribution of nests by sites for green turtles (Table 7) suggests that beaches D, E, F, G and I are the most important nesting sites at Bamboo Bay, accounting for 80% of nesting turtles in the entire area. Data on distribution of turtle nests on the nesting beaches indicate the importance of all 11 nesting beaches at Bamboo Bay and Dickson Reef.

While data collection has improved, there are still discrepancies that need to be addressed such as the significant increase in numbers of nesting green turtles recorded (from 55 in 2012 to 789 in 2019) compared with no hawksbill nesting recorded in Bamboo Bay in the same time period with exception of 6 in 2014 (see Table 6).

A key concern is the use of paper record sheets, which puts the data at risk in terms of safely reaching WSB in Port Vila.

The lack of infrastructure support at the national level to support data collection, management and reporting is a higher level issue that needs to be addressed to improve the status quo. A trial use of electronic data collection introduced by the consultant was well received by the monitors of Bamboo Bay and this will need to be developed with SPREP support working together with the Vanuatu Fisheries Department.

Table 6. Sea turtle nesting records for Bamboo Bay and Dickson Reef (Note no record in 2016)

Year	Green Turtle	Hawksbill Turtle	Unidentified	Total	Data Source
1972-2015	84	143	3	230	TREDS/SPREP
2004	14	1		15	WSB
2005	17	1		18	WSB
2006	83	32		115	WSB
2007	41	20		61	WSB
2008	26	19		45	WSB
2009	13	28		41	WSB
2010	44	0		44	WSB
2011	61	22		83	WSB
2012	55	0		55	WSB
2013	57	0		57	WSB
2014	135	6		141	WSB
2015	83	0		83	WSB
2016	0	0		0	WSB
2017	99	0		99	WSB
2018	28	0		28	WSB
2019	789	0		789	WSB
Totol	**1545**	**129**		**1674**	**WSB**

Table 7. Distribution of turtle nests at Bamboo Bay, Dickson and Tisvel from 2004 to 2019 (WSB)

Year	Beach A	Beach B	Beach C	Beach D	Beach E	Beach F	Beach G	Beach H	Beach I	Beach J	Dickson Reef	TOTAL
2004											2	2
2005		11			5						1	17
2006				2	5		45	3		1		56
2007					3		12	1				16
2008							8	1	2	1		12
2009						1	4					5
2010					12	2	27	3				44
2011					16	6	26		5	5		58
2012				2	4	1	46		2			55
2013					1		52					53
2014					62	29	44					135
2015					33	30	20					78
2016												0
2017		1	1	33	14	4			31	15		99
2018							28					28
2019		12	2	70	169	77	321	8	84	43	3	789

5.7 Tagging of adult turtle and tag recapture

Turtle tagging has been undertaken by trained turtle monitors in Bamboo Bay since the early 2000s. Stainless steel metal tags and clippers are used to clip tags on the front flippers of the turtle. Tagging is performed after the egg laying has been completed and before the mother turtle returns to the sea. Turtle tagging in Bamboo Bay is undertaken annually during breeding season by the Bamboo Bay community turtle monitors led by Noel Kaibaba, Phillipe Vanua and Chief Hubert. The three elders were trained on turtle tagging using galvanised tags by WSB and have been active in tagging since the 1990s. Tag numbers are recorded for new tags and for returning tagged turtles.

Of the total number of female turtles tagged in Bamboo Bay, 13 turtles tagged have returned to nest comprising 6 hawksbill and 7 green turtles (Table 8), all from beaches G and H. One hawksbill turtle tagged in Bamboo Bay was encountered in New South Wales, Australia (Table 9) (Limpus (2007a). The total number of turtles tagged in Vanuatu from 1991 to 2018 is 2,596. Overall a low number of tagged turtles (208 or 8%) have returned to nest locally in Vanuatu (Hickey et al. 2023).

Satellite tracking, along with tag recoveries in Vanuatu showed tags deployed on foraging and nesting green turtles in Australia, Solomon Islands and Papua New Guinea, indicating regional connectivity (Figure 7) (Limpus 2007 and Limpus (2007a) . Support for continued tagging activities in Bamboo Bay, including tag reporting will help to clarify regional connectivity, track take, provide information about other threats to turtles, and clarify foraging patterns by location, species and size.

Table 8. Turtles tagged in Vanuatu and recovered locally at Bamboo Bay as documented in the TREDS database hosted by SPREP

Tag No.	Species	Sex	Initial Encounter			Other Encounter		
			Date	Location	Activity	Date	Location	Activity
R31893/ R31892	Green	Female	29/01/2005	Bamboo Bay	Nesting	12/12/2008	Bamboo Bay	Nesting
R31897/ R31896	Green	Female	02/02/2005	Bamboo Bay	Nesting	16/12/2008	Bamboo Bay	Nesting
R38185/ R38184	Hawksbill	Female	17/12/2006	Bamboo Bay	Nesting	01/01/2007	Bamboo Bay	Nesting
R37752/ R38018	Green	Female	01/01/2007	Bamboo Bay	Nesting	03/01/2007	Bamboo Bay	Nesting
R38120/ R38119	Hawksbill	Female	09/12/2006	Bamboo Bay	Nesting	04/02/2007	Bamboo Bay	Nesting
R38012/ R38011	Green	Female	04/01/2000	Bamboo Bay	Nesting	16/01/2007	Bamboo Bay	Nesting
R38115/ R38114	Green	Female	24/12/2006	Bamboo Bay	Nesting	06/01/2007	Bamboo Bay	Nesting
R38026/ R38024	Green	Female	17/12/2006	Bamboo Bay	Nesting	10/01/2007	Bamboo Bay	Nesting
R38037/ R38038	Hawksbill	Female	12/11/2008	Bamboo Bay	Nesting	10/12/2008	Bamboo Bay	Nesting
R41822/ R41823	Hawksbill	Female	21/12/2009	Bamboo Bay	Nesting	05/01/2010	Bamboo Bay	Nesting
R41849/ R41850	Hawksbill	Female	23/12/2009	Bamboo Bay	Nesting	07/01/2010	Bamboo Bay	Nesting
R41888/ R41889	Green	Female	07/01/2009	Bamboo Bay	Nesting	17/01/2009	Bamboo Bay	Nesting
R41898/ R41900	Hawksbill	Female	11/11/2009	Bamboo Bay	Nesting	26/12/2009	Bamboo Bay	Nesting

Table 9. Turtles tagged in Vanuatu and recovered outside as documented in the TREDS database (SPREP)

Tag No.	Species	Sex	Initial Encounter			Other Encounter		
			Date	Location	Activity	Date	Location	Activity
R41825/ R41825	Hawksbill	Female	09/12/2009	Bamboo Bay	Nesting	20/10/2010	Lake Arrangan Beach, Brooms Head NSW, Australia	Stranded, Dead

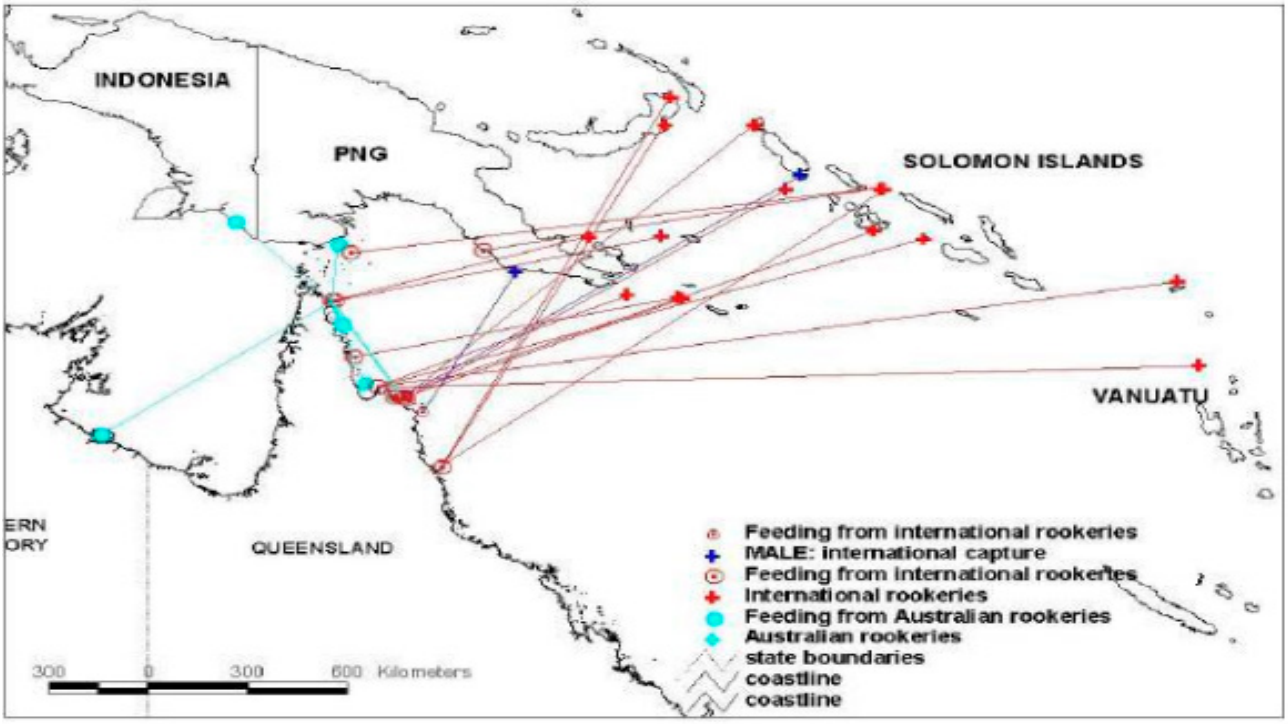


Figure 12. Green turtle tracking route (Limpus 2007)

5.8 Beach sand temperature monitoring

Temperature monitoring research was undertaken in Bamboo Bay and Wiawi from February 2021 and 2022 as part of the BIEM Project (Figure 8). The aim was to record the temperature of the beach during nesting season to identify potential temperature changes and impacts on the sex ratio of turtle eggs. The monitoring activity was completed but there was not enough data to enable any informed analysis. Cyclone damage and lack of training on the use of the loggers resulted in the loss of temperature loggers and incapacity of the local monitors to collect the loggers. A positive lesson learned from this work is to ensure community people are trained in the operation of the loggers before deployment.

Figure 13. Temperature logger deployment by Noel Kaibaba, Turtle Monitor at Bamboo Bay; Photos by Christopher Bartlett

5.9 Electronic recording trial

The SPREP-managed Turtle Research and Monitoring Database System (TREDS) https://treds.sprep.org/help/ about application is recommended for use in the Bamboo Bay turtle management plan to support turtle data recording (Figure 14). A step by step manual is available online on the database and training and a login access can be provided on request to SPREP. New Users need to be set up with access and login. SPREP is also setting up National Marine Turtle Monitoring Coordinators in each Pacific island country, who will assist with oversight of monitoring and data collection. Training is planned during 2024/25 for these MNTMC and community monitors.

Initial discussion with the Director Fisheries is positive and one of the VFD data officers need to be identified as the NMTMC and will be trained by SPREP. Community monitors can also be trained by SPREP.

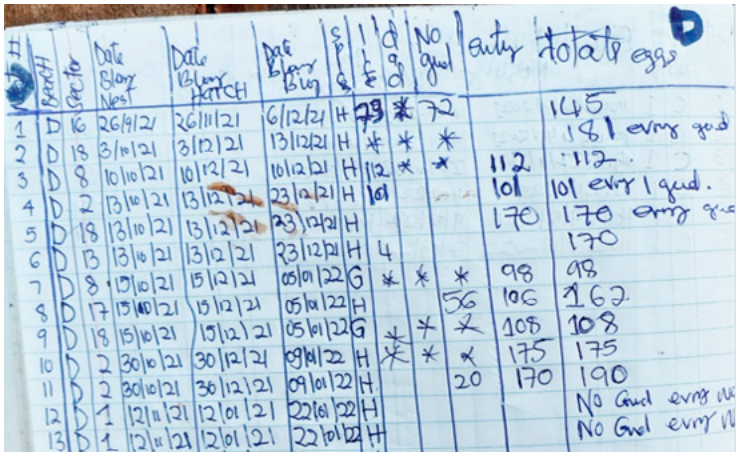


Figure 14. Electronic data recording system trailed at Bamboo Bay; Photo by Christopher Bartlett

5.10 Enforcement of turtle management regulations

The Fisheries Regulation Order No. 28 of 2009 provides protection through a regulatory framework for turtle management, including regulating take of sea turtles for food and instituting a prohibition on the killing of three species of turtles (green, hawksbill and leatherback):

Fisheries Regulation Order No. 28 of 2009 (Cap 59) Marine Turtles

(1) A person must not:

(a) Take, kill, have in his or her possession, export, sell or purchase any or all of the following turtle of the species:

(i) Dermochelys coriacea, known as leatherback turtle, illustrated in Schedule 26;

(ii) Eretmochelys imbricata, known as the hawksbill turtle, illustrated in Schedule 26;

(iii) Chelonia mydas, known as the green turtle, illustrated in Schedule 26; or

(b) Take, have in his or her possession, sell, purchase or export any shell of the turtle species referred to in paragraph (a); or

(c) Interfere with or disturb in any way a turtle nest or any turtle that is in the process of preparing to nest or laying eggs; or

(f) Take, have in his or her possession, consume, export, sell or purchase any turtle egg; or

(g) Harm, capture, kill, consume, sell, purchase, export or destroy any turtle species (hatchlings, juveniles or adults) including by use of any weapon; or

(h) Have in his or her possession any marine turtles that is held in captivity in any way.

(2) Despite subclause (1), a person may apply in writing to the Director for an exemption from all or any of the provisions under subclause (1) for the purposes of carrying out customary practices, educational and/or research purposes.

This regulation makes the killing of the three turtle species (green, hawksbill and leatherback) illegal, and prohibits use of any weapon, such as spear guns or gaff hooks, to capture turtles. An exemption is given for traditional harvest, taking of turtles for educational and research purposes, where the killing of turtles is permissible within the law upon obtaining a valid permit. The challenge for Bamboo Bay and in other communities in the country is the lack of enforcement of this regulation in the community. VFD is addressing this by appointing Community Fisheries Authorized Officers to assist in enforcement in the community. This plan is recommending one officer to be trained and appointed for Bamboo Bay. Under the Environmental Protection and Conservation Act (CAP 283), Section 45(1)(f) allows the minister responsible to make regulations in relation to the control and taking of specified species and 2(b) provides for regulating the harvesting of natural resources.

The Environmental Protection and Conservation Act (CAP 283) contains general provisions relating to the protection and conservation of the environment. It provides for the establishment of community conservation areas as well as a need for environmental impact assessment (EIA). Sea turtles are listed as a significant species to be protected under conservation and "tabu" areas management plans. Section 45(1)(f) allows the minister responsible to make regulations in relation to the control and taking of specified species and 2(b) provides for regulating the harvesting of natural resources.

6. Gender and Social Inclusion

The Bamboo Bay Community Sea Turtle Management Plan recognises womens' contribution to the management of turtles and coastal fisheries in general and promotes more inclusive marine resource management as a whole. The consultation process for the development of this plan included women and girls of Bamboo Bay. Experience gained over many years of community turtle monitoring and protection of breeding turtles since the 1990s was used in the design of this plan. All forms of social exclusion and marginalisation are addressed in this plan in such a way for economic and environmental benefit derived from this plan to be shared equally amongst the community including women and girls and those with a disability. Collaboration and involvement of women and girls will be encouraged to achieve equitable distribution of benefits from this management plan.

Noel and Philip entering turtle data.
Credit: Christopher Bartlett.

7. Challenges and Threats for Turtle Management in Bamboo Bay

Sea turtle nesting sites are under pressure globally from many threats including environmental changes caused by climate change. The greatest threat is from human activities in the coastal zone and direct human impacts from harvesting of adults and eggs and damage by domesticated animals. These impacts and challenges are discussed in greater detail in the Vanuatu Sea Turtle Management Review Report (Hickey et al. 2023). Threats and challenges identified for the management and conservation of turtles in Bamboo Bay were identified by community consultations conducted in 2022 and during the community profiling consultation in 2020. These are provided in Table 10 and highlighted in Figure 15.

Table 10: Threats and challenges to turtle management and monitoring activities in Bamboo Bay

	Issues, threats and challenges	Description
1	Geographical spread of the area and accessibility	The community of Dickson Reef is interested to join the monitoring programme. They need awareness and training to build their capacity.
2	Inactive monitoring committee	Livelihood opportunities to earn cash from cocoa, copra, beef, kava, fish and timber are necessary to enable community undertakings in turtle conservation. A lack of road access presents a challenge and a boat is the only means at the moment but expensive.
3	Lack of interest and motivation	Access to good clean water is key to improving health and wellbeing of the community members to stay healthy in order to undertake turtle monitoring work. There is a water system built but the toilet facility remains basic and housings are of local materials which are prone to cyclone damage.
4	More awareness and education of Dickson reef and Tisbel	Most predation of eggs in Bamboo Bay is from domestic dogs attracted by the smell of blood from freshly laid eggs and odour from bad eggs during hatching.
5	Inadequate access to markets for their produce	Predation of hatchlings by seabirds, sharks, crabs and other marine predators in shallow water when entering the sea for the first time.
6	Health and sanitation lacking for community	Poaching of eggs by humans is not common but is a risk for the neighbouring communities of Dickson Reef and Tisvel who are yet to fully participate in turtle conservation. Lack of awareness on turtle regulation and management measures and enforcement of fisheries regulation is a concern.
7	Predation of eggs by domestic animals	Killing of adult turtles and especially egg laying mother turtles is rare nowadays but is a risk with the lack of adequate monitoring of beaches further away in the north at Tisvel and the eastern beaches of Bamboo Bay. Lack of enforcement of existing laws presents risks of losses.
8	Predation of hatchlings on the beach at shoreline	Nests in areas prone to inundation during storm surge during cyclones and habitat loss by sea level rise and erosion (manifested as wave overtopping) can lead to washing away of nests and inundation of nests resulting in damage and loss of eggs. In addition beaches G, J and K are at risk of damage by flooding and changing course on the beach, impacting on nesting success in those areas.
9	Poaching of eggs by humans	Cattle roam freely, are found in nesting areas (Beach G and D) and have caused disturbance to the nests by trampling and interfering with nesting females during egg laying.
10	Killing of mother turtles	Alteration of the nesting environment caused by temperature changes of the beach sand affecting viability of eggs. Excessive heating can kill the eggs or affect the sex of the hatchlings.
11	Loss of nest by inundation and flooding	Coastal vegetation provides shade for nests to prevent excessive heating from the sun during daytime and damage to eggs. Unnecessary clearance and deforestation of coastal vegetation exposes nests to unnecessary heat and damages eggs.

	Issues, threats and challenges	Description
12	Trampling of nest by domesticated animals	Stones, rocks and falling trees create obstacles to the movement of adult turtles and hatchlings. For instance a female turtle was trapped by stones in 2022 and died due to exposure.
13	Temperature change of nesting beach from climate change	Lighting at night causes disorientation of adults during nesting and of hatchlings as they enter water for the first time.
14	Deforestation of coastal vegetation	Entanglement and ingestion of plastics and solid waste can affect adult turtles and hatchlings, causing injury and death.
15	Obstacle to movement on the beach	Enforcement of existing turtle management regulations is non-existent in Bamboo Bay and Dickson Reef Area and illegal activities can go unnoticed. The community is powerless.
16	Lighting disturbances at night time	Artificial light at night can confuse mother turtles coming ashore and hatchlings making their way to the sea, making it difficult for them to find their way.
17	Plastic waste pollution	Adult turtles and hatchlings can become entangled in plastic and other rubbish, or accidentally eat debris in the sea, which can cause injury or even death.
18	Lack of enforcement of fisheries laws in the community	In the Bamboo Bay and Dickson Reef area, there is no way to enforce the existing laws that protect turtles, and when someone breaks the law, it often goes unnoticed. The community does not have the authority to take action.

Figure 15. Damage to nest and hatchlings of sea turtles at Bamboo Bay area from dogs, cows and predation by crabs; Photo by Christopher Bartlett

8. Bamboo Bay Turtle Management Action and Implementation

In consultation with the leaders and turtle monitors of Bamboo Bay, the following key management activities in Tables 11 – 17 were devised and prioritised to meet the objectives of this plan:

1. Protect and maintain natural resources for the enjoyment of present and future generations.
2. Keep turtle nests in Bamboo Bay safe from harm.
3. Build the capacity of Sea Turtle Monitors and other stakeholders in the community on resource management.
4. Contribute to sea turtle science and knowledge in Vanuatu, in the Pacific and at the international level.
5. Strengthen custom and traditional management of natural resources.
6. Build networks that link turtle resource champions across villages and islands for sharing information and collective action.
7. Bring sustainable benefits from turtles to the people of Bamboo Bay, especially through eco-tourism.

Table 11. Sea turtle and nest monitoring actions in Bamboo Bay

	Activity and issues	Action to address the issue	Materials and equipment needed	Responsibility	Date achieved
1	Beach sector locations are not clear	Create a map showing each individual beach area and clearly mark all zones with GPS points. Display this on signboards using labels such as “B3” as an example, to clearly indicate the correct name and number of each beach	GPS enabled tablet and camera Small signboards (marine plywood or plastic, approximately A4 paper size, landscape orientation), nails, black and white paint	Ol lokol monita + Ol projek	
2	Monitoring not consistent – not all monitors mark and monitor nests in the same way	Follow SPREP’s Turtle Monitoring Guideline	Copy of Guideline	SPREP /WSB	
		Produce a short educational film about Bamboo Bay turtle monitoring	Filming equipment	WSB	
		Ongoing training of turtle monitors in Bamboo Bay on best practices in nest monitoring, including on the SPREP monitoring guideline document for communities	Stationery, posters, videos and printouts	WSB, VFD, DEPC	
3	Monitors do not have appropriate materials and tools to undertake monitoring	Purchase basic materials for nest monitoring activities	Stationery, posters, videos and printouts	WSB, VFD, DEPC	
4	Nest marking is inadequate, bamboo nest markers often lost or damaged	Improve nest marking, ensuring all nests are marked with bamboo or more permanent materials	Nest markers (bamboo or sign plastic)	Projects community turtle monitors	

	Activity and issues	Action to address the issue	Materials and equipment needed	Responsibility	Date achieved
5	Monitors spend late nights and early mornings patrolling beaches and have no shelter	Construct a Turtle Watch House/ Centre with satellite internet connectivity, solar power and accommodation supplies and materials for monitors during extended patrols, visiting researchers and eco visitors	House construction materials, solar system, 3-link satellite internet, beds, mattresses, mosquito net, toilet, kitchen tools etc.	Projects Fisheries Dept. Community turtle monitors	
6	Animals and humans dig and eat eggs on remote beaches, no round the clock visibility	Undertake special monitoring on damage from climate change, especially for wave overtopping as well as predation.	Cameras	Projects DCC	
7	Some nests placed in hot exposed locations, may be unsuccessful	Install nest temperature loggers on every nesting beach to better understand sex ratio outcomes of hatchlings. Logger to record hourly temperature, with data downloads every 3 months, and battery changes every year.	30x Nest Temperature Loggers (Tiny Tag Plus 2 brand). 1/2AA batteries	Projects VFD	
8	The current number of monitors is insufficient to patrol all remote beaches	Formally employ 2 existing monitors from September to February and 1 monitor in June, July, August, March and April	NA	Projects VFD or DEPC WSB	
		Write donor project applications for critical items like monitor stipends, a boat to access remote beaches	Laptop, expert support	VFD, WSB, DEPC, SPREP, Area Council	
9	Some beaches are too far to access on foot, and during high tides (E,F)	Use turtle monitoring house Use a boat to access far location	Boat hire and fuel	Community turtle monitors and projects	
10	Lack of internet connectivity and power limits online data access and uploads	Turtle monitoring centre in a location that has good reception for internet communication.		VFD, WSB, DEPC, SPREP, Area Council	
11	Tagging of turtles with satellite tags	Tag turtles with satellite tags to better understand where Bamboo Bay turtles travel, feed and breed	Satellite tags and associated equipment	Projects , SPREP, WSB, Fisheries Dept.	

Table 12. Sea turtle nest relocation in Bamboo Bay

	Issues	Action to address the issue	Materials and equipment needed	Responsibility	Date achieved
1	Some nests are exposed to wave overtopping and damage by cattle and other animals	Relocate only turtle nests that are endangered by rising sea levels, and wave overtopping, especially nests on Beach C near rocky areas and cattle following Guidelines in Annex II. Training of monitors on handling of eggs	Fence the area using fencing material of local or modern materials Shovels and plastic buckets	Community	
2	During storms, waves wash out many nests	Relocation of affected nest following Guidelines in Annex II. Training of monitors on handling of eggs	Fence the area using fencing material of local or modern materials. Shovels and plastic buckets	Community and WSB	
3	Rocks and stones impede the laying of eggs and successful crawls of hatchlings	Relocation of affected nest following Guidelines in Annex II Training of monitors on handling of eggs	Fence the area using fencing material of local or modern materials Shovels and plastic buckets	Community Projects	
4	Cattle stumbling on nests cause damage to the nest	Fence off the beaches from cattle plantations along beaches B and C to prevent cattle walking on nesting beaches	Cattle fencing (1 km) including barbed wire, staples and chainsaw for cutting posts	Community Projects	
5	Monitors do not have proper tools and materials	Purchase basic materials for nest relocation activities	Shovels, Buckets, Nest ID Board	Projects WSB	
6	Monitors do not have the skills and knowhow to hand eggs during nest relocation	Train turtle monitors on best practices in nest relocation, either in person or via a relocation training video that can be used to induct monitors	Trainer and training materials	Projects WSB VFD	
7	Need to build a new nesting pen in a new location.	Improve and renovate the current beach hatchery pen with more durable material such as plastic fencing. Build a turtle nest relocation area near the Turtle House to house nests endangered by wave wash overs	Plastic mesh, poly-coated or galvanised steel fencing 150 m length, at least 1.8 m high, with mesh sizes 20 cm – 30 cm wide, fencing staples, hinges and timber for posts and entry door	Community and Projects	

Table 13. Nest and hatchling predator control in Bamboo Bay

	Activity and issues	Action to address the issues	Materials and equipment needed	Responsibility	Date achieved
1	Animals, especially dogs, and humans dig and eat turtle eggs	Construct and deploy nest protective cages (180 total) for each zone on beaches D and E (6 per zone x 30 zones)	180x Lightweight metal alloy cages, 1.5 m x 15 m	Projects Community	
2	Poaching of eggs by people of nearby community	Ongoing legal awareness briefings with Dickson Reef and surrounding communities to better understand Fisheries Act, Environment Act and related laws and policies (including penalties)	Stationery, posters, videos and printouts	Police, VFD, DEPC, Area Council, WSB	
3	Hatchlings experience high mortality from shark and fish predation near the shoreline	Release hatchling turtles, once they have walked down the beach to imprint, in deeper waters to avoid predation by reef fish and sharks . Alternatively, swim with the hatchling turtles as they cross the reef.	Boat hire and snorkelling gear	Local Monitors	
4	Lack of signage to inform public of the turtle nesting areas	Install signs at regular intervals (200 m) along all beaches reminding locals of the law against turtle egg harvest, including applicable fines (200,000 VT)	Pre-printed notice signs (marine ply or plastic, approximately A4 paper size, portrait orientation), nails/ bolts, timber/metal stands	Projects, Community, VFD	
5	Enforcement of turtle management regulation is a challenge in community	VFD to appoint Fisheries Authorized Officer for Bamboo Bay community to ensure compliance on turtle regulations	NA	VFD, Police	
6	Lack of church involvement in conservation of sea turtles and marine life	Church Leaders hold at least one meeting per year or as part of their service to hold prayer sessions on conservation and management of wildlife of Bamboo Bay and the rules about not eating turtle eggs or meat.	NA	Chief and Church Leaders of Bamboo Bay	
7	Wild and domesticated dog damage on turtle nests and hatchlings	Organise wild-dog hunts to reduce the number of predators. Or put a limit on the number of dogs each household can have.	Rifle, ammunition	Police, Community	

Table 14. Turtle data management in Bamboo Bay

	Activity and issues	Action to address the issue	Materials and equipment needed	Responsibility	Date achieved
1	Monitors use paper records, which are prone to damage and loss during posting to Port Vila and safe keeping in the village	Purchase data collection materials Change data recording papers to proper record books or diary and introduce electronic recording application. Training community on proper recording and safe keeping of records and use of electronic recording tools. Refer Annex I for monitoring guidelines.	Field notebooks, Master Data Book, Tablets. Waterproof record sheets.	Projects	
2	Government departments do not have access to turtle monitoring data	Officer training to manage the database and recording application	Computer system	VFD, DEPC and SPREP	
		National focal Agency to be in charge of sea turtle science data to be established with support of SPREP to coordinate data collection and management from monitors on behalf of the Government. National focal Agency to introduce electronic recording of data by monitors. Manage data and remit data to SPREP.			
3	SPREP does not get good data submissions from Vanuatu	Central database system in-country to be established with appropriate government Authority (VFD or DEPC), officers trained to be in-charge of receiving data from community monitors, verify and release to SPREP.	Computer system	VFD, DEPC and SPREP	
		Refresh training for monitors on data sheets, data recording, data checking (manual and use of tablets for electronic data entry), and data sending	Stationery and printouts	WSB, VFD, Partners	
4	Data is submitted well after the season is finished, and so decision-making cannot be immediately reactive	Move away from paper recording to electronic data recording application and facilitated by a central data management system to receive real time data from monitors. Link to the national data management authority	Computer system, knowledge	VFD, DEPC and SPREP	
5	Data management require skills, which are lacking	Refresher training for monitors on data sheets, data recording, data checking (manual and use of electronic data recording and sending of data to the central data management authority.	Stationery and printouts	Projects, VFD, DEPC, community	
		Recruit and employ at least 1 data manager to support monitors during nesting/hatching season	NA	Donor working with WSB, and VFD	
6	Upgrade to Electronic data recording system	Develop and roll out an electronic, real-time, field-capable, smart-phone capable data entry and collection system, aligned to current paper formats, and includes access by multiple partners : WSB, VFD, DEPC, SPREP TREDS[3]	Kobo Toolbox App, Tablets, Renewable Power Supply Focal agency setup to manage the use of electronic system.	Community, VFD and Projects	
		Install a solar system and satellite internet with the Turtle Monitoring Centre to transmit data in real time to authorities when and communication system is down.	3 Link Satellite Station, 1KW Solar System	Projects	

3 It is very important that the Vanuatu Fisheries Department receives all turtle records, as this information helps them provide appropriate guidance, rules, and advice.

Table 15. Community and network engagement for Bamboo Bay

	Issues	Action to address the issue	Materials and equipment needed	Responsibility	Date achieved
1	Community does not receive regular feedback on the data they collect and send to Port Vila	Hold at least 4 community update meetings per year to provide updates on turtles nesting/tagged/hatched, as well as other topics like waste management, conservation, natural resource use etc.	Projector, generator, screen, laptop, software, posters, printouts, videos	VFD, DEPC, Wan Smolbag, SPREP	
		Review and analyse turtle data annually, including nesting statistics, species composition and nest beach preference, tag summaries and return information, hatchling success, predation/loss, temperature data. Provide detailed and summary reports to Bamboo Bay Chiefs and Community	Computer, good data	DEPC, VFD, WSB, SPREP	
2	Meetings and access to other monitors and experts is limited	Participate in annual WSB Vanua Tai Resource Monitors meetings, as well as other meetings, trainings and events relevant to sea turtle and environmental management hosted by Government or other partners	Travel costs	WSB	
3	There is no mechanism for local monitors from nearby villages to engage with each other	Participate in, and regularly host, meetings, trainings and events of the NW/SW Malekula Network, the Malekula Protektem Risos Coalition and other local networks	Travel costs	Area Council, Malekula Protektem Risos Coalition, NGOs,	
4	Most people in Vanuatu and abroad do not know about the turtle activities of Bamboo Bay	Have an exchange programme with monitors from Wiawi. Engage in field visits and exchange programmes to other turtle and conservation sites, and host champions from other islands to come to Bamboo Bay	Travel costs	Wiawi and Bamboo Bay monitors	
		Host an annual event: Bamboo Bay Turtle Festival, which will include 2 days of turtle related activities: nesting and monitoring tours, sand drawing, custom stories, handicrafts, music, competitions etc. Focus on domestic and international visitors	Catering, accommodation, venue, travel materials	Local monitors, Department of Tourism, Vanuatu Tourism Office, Malampa Province, Area Council VFD, DEPC, Wan Smolbag, SPREP	
		Develop songs with local string bands and groups about turtles and environment	Studio recording costs	Wan Smolbag, VFD, DEPC	

5	Young people and women are not participating equitably in turtle activities	Develop a Young Turtle Monitors programme to train and engage with young men and women to undertake conservation work, Refer Annex I for turtle monitoring guidelines	NA	Wan Smolbag, VFD, DEPC	
		Host 2 youth camps annually, during which students will learn more about turtle work in a fun and engaging format with local elders and monitors as facilitators	Projector, generator, screen, laptop, software, posters, printouts, videos	Local monitors, VFD, DEPC, Wan Smolbag, SPREP, Area Council, Department of Education	
		Make sure that there are women monitors because women are not often included in marine and turtle decision-making, and women play a role in training children to respect the environment	NA	Chiefs and village authorities	

Table 16. Sustainable finance through Sustainable Business for Bamboo Bay

	Issues/ideas	Action to address the issue	Materials and equipment needed	Responsibility	Date achieved
1	Insufficient finance for the community to improve turtle management	Develop Bamboo Bay nature tour including forest tour, bird watching, turtle nesting watch and snorkelling. See turtle monitoring guidelines in Annex I	Production equipment	MALFFB, Malampa Province, Vanuatu Skills Partnership, Area Council	
		Develop fee rate for turtle research activities in Bamboo Bay by students and researchers	Production equipment	Projects, Community, VFD, DEPC	
		Run regular tourism and ecotourism trainings on production options, standards and guest care	Projector, generator, screen, laptop, software, posters, printouts, videos	Department of Tourism, Malampa Tourism, Vanuatu Skills Partnership	
		Organise a 2022/2023 Turtle Tourism Product[4] including basic home stay accommodation	Marketing materials, website, Facebook	Department of Tourism, Leitokas Community Association	
		Organise a 2022/2023 Turtle Tourism Product upon completion of new turtle house/centre	Marketing materials, website, Facebook	Department of Tourism, Leitokas Community	
		Set up a Facebook page (Bamboo Bay Tabu) and regularly post, Set up an email account (BambooBayconservation@gmail.com), Set up a basic project website	Computer and internet	Projects	
2	Develop processing and value adding of local food based on local resources for sale	Develop alternative sources of income to support turtle work, including for example solar food preservation, virgin coconut oil, coconut chips, dried nangai, carvings, handicrafts etc.	Production equipment	Ministry of Agriculture, Malampa Province, Vanuatu Skills Partnership, Area Council	
		Sale of cooked food to guests and visitors	Production equipment	Projects, Community, VFD, DEPC	
3	Accommodation is basic and inadequate to host visitors	Setup a Turtle Monitoring House and come up with room rental charges per night per person or total rental for a group per night and set up a committee to manage the project	Local timber resources provided free of charge, timber milling machine hire, local labour, Fuel costs	Projects, Community, VFD, DEPC	
		Ensure Turtle House meets all minimum tourism standards with basic accommodation supplies and materials and is accredited with a tourism permit	Beds, mattresses, mosquito net, toilet, kitchen tools etc	Community Association, VFD, DEPC	
		Encourage development of local guest houses to meet standard for visitors	Local material, land space	Community Association	

4 We know that when tourists visit, there can be negative impacts from turtle-based tourism activities that may affect the community, damage the environment, or disturb the turtles. It is important to take care and follow the existing advice and standards to ensure everything is done properly.

Table 17. Programme governance for Bamboo Bay

	Issues/ideas	Action to address the issue	Materials and equipment needed	Responsibility	Date achieved
1	Capacity to manage projects is limited	Strengthen the customary governance of Bamboo Bay community, improving communications between turtle monitors and Chiefs	Laptop, mobile phone, stationery	Wiawi chiefs, Vanuatu Climate Action Network, WSB, Vanuatu Cultural Centre	
		Run ongoing good governance and project management training with Bamboo Bay leaders, e.g. bookkeeping, meeting facilitation, report writing, project proposal writing, monitoring and evaluation, etc	Training materials	Oxfam, Vanuatu Climate Action Network, WSB, Area Council	
		Request a volunteer to support programme operations, including environmental work, sustainable finance and programme sustainability	Volunteer accommodation	JICA, Volunteer Service Overseas, Australian Volunteers, Peace Corps	
2	Governance capacity is limited	Strengthen the operations of the Community Association (registered with the Vanuatu Financial Services Commission – VFSC - 500808) including preparing and submitting annual report, paying 5000vt annual fees, and fulfilling obligations stipulated in by-laws	Laptop, mobile phone, stationeries	Community Association, Vanuatu Climate Action Network, Wan Smolbag	
		Run ongoing good governance and project management training with Leitokas Community Association, e.g. bookkeeping, meeting facilitation, report writing, project proposal writing, monitoring and evaluation etc	training materials	Oxfam, Vanuatu Climate Action Network, Wan Smolbag, Area Council	
		Hold Executive Board Meetings monthly per Leitokas by-laws	NA	Leitokas Community Association	
		Regularly write donor project applications for critical items like monitor stipends, a boat to support their work to access remote beaches, animal cameras, community development programmes, etc	NA	Leitokas Community Association	

Green Turtle. Credit: Freepik

9. Guidelines

Specific Guidelines are developed to provide a step by step guide for local monitors to use when undertaking specific activities that require extra care and these activities include.

(a) Tagging of nesting turtles and recording – Turtle tagging and proper recording – (Annex I)

(b) Relocation of nest and eggs that are at risk of being damaged by inundation to a safer location (Annex II)

Part I.
Tagging of nesting turtles and data recording guidelines

Step 1. Beach monitors should always carry the following equipment:

- Backpack for holding tools
- Tag Applicator: simple pliers with working surfaces moulded to fit the tag, and with levers requiring less hand pressure for application.
- Turtle Tags: metal alloy tags bearing a unique serial number and the host institution's name/address.
- Head torch – to allow for hands-free measurements
- Spotlight torch – only for use to light the area after laying has begun
- Flexible tape measure – waterproof and ideally 3 metres long
- Tablet or Phone – for photos, GPS marking, data entry and communications.
- Waterproof pouch for phone/tablet
- VHF/UHF Radio – for two way communications among beach monitors
- Raincoat
- Reflective vest for visibility
- Binoculars to check for nesting turtles down the beach on moonlit nights

Turtle monitoring tools and equipment

Step 2. Trained monitors

Beach monitors must be fully trained, as nesting is a particularly vulnerable time, and any disturbance during their crawl up the beach and during nest digging can cause a female to abandon a nesting attempt. A SEA TURTLE SHOULD NEVER BE FLIPPED OVER UNLESS UNDER STRICT SUPERVISION OF A TRAINED SEA TURTLE MONITOR.

The following should be kept to a minimum during patrols:

- noise of any kind: loud talking/laughing or music;
- lights: do not build fires or use strong spotlight torches; and
- physical disturbance to turtles: turtles should never be touched, lifted, moved, blocked, corralled or otherwise physically disturbed.

Note: Once turtles begin to lay their eggs, they are fully committed and will generally complete the nest even in the face of mild disturbances required for nest monitoring (measurements/tagging etc.).

Step 3. Save long taem we mama totel i kam sho blong nes

- Turtles in reef areas tend to begin their crawl with an incoming tide. For deeper sea areas, turtles can lay at any time. Obtain a tide chart and plan the monitoring to begin around 2 hours before the highest tide.
- Turtles in Bamboo Bay almost always lay eggs at night, and so patrols typically start at dusk.

Step 4. Watch for tracks

As you patrol the beach you will come across nesting turtle tracks:

- Hawksbill turtles have asymmetrical tracks, with the right flipper, then left flipper indenting the sand as the turtle moves forward.
- Green sea turtles have fully symmetrical tracks, as both flippers pull the turtle forward simultaneously.
- Leatherback turtles also have symmetrical tracks.

Green turtle track

Hawksbill turtle track

Marine Turtle Track Identification Key

Track Features

Early morning monitoring is best as tracks will deteriorate over time. The clarity of tracks can be affected by flipper damage, terrain, sand moisture, tides, wind and weather.

The key track identification features are:

- Stroke Style
- Track Width
- Hind Flipper Marks
- Front Flipper Marks
- Plastron Drag
- Tail Drag

Track Direction

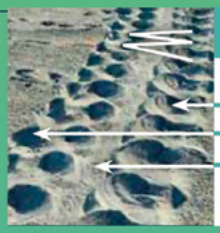
Clues to determine track direction:

- Turtles push sand backwards, the higher sand mound is at the back.
- If track overlaps, the top track is the returning track.
- Sand is always thrown back over the emerging track when digging.

Measuring Width

Measure from outer edge of track. This may be the front or rear flipper, depending on species.

Alternating Stroke
Flipper marks alternate



Loggerhead

Track Width: Less than 1 metre

- Hind Flipper
- Front Flipper
- Plastron Drag
- ✕ Tail Drag: Not present

Hawksbill

Track Width: Approx. 70–80 cm

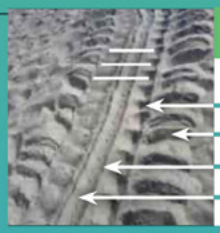
- Hind Flipper
- Front Flipper
- Plastron Drag
- Tail Drag

Olive Ridley

Track Width: Approx. 70–80 cm

- Hind Flipper
- Front Flipper
- Plastron Drag
- Tail Drag

Breast Stroke
Flipper marks side by side



Green

Track Width: Approx. 94–144 cm

- Hind Flipper
- Front Flipper
- Plastron Drag
- Tail Drag

Flatback

Track Width: Approx. 90–100 cm

- Hind Flipper
- Front Flipper
- Plastron Drag
- Tail Drag

Leatherback

Track Width: Greater than 2 metres

- Hind Flipper
- Front Flipper
- ✕ Plastron Drag: Not Visible
- Tail Drag

Step 5. Finding the female

1. If you see only one set of tracks moving toward the littoral vegetation, do not use torchlights to find her, as she may still be preparing her nest and if disturbed, may abandon the attempt.
2. Listen for sounds of sand being flung, suggesting nest digging is underway.
3. Walk or crawl slowly towards the sounds of digging, or follow the tracks.
4. It is not uncommon for a female to move around considerably on the upper beach looking for an appropriate nest site, free from vegetation, roots, debris or stones.
5. It is not uncommon for a female to commence digging a nest, find it unsuitable and move to another spot several metres away.
6. Wait for the female to commence laying before shining any lights or undertaking any measurements! Do not shine lights in the turtle's eyes, even while nesting. Red lights, if available, are best.

Female digging nest

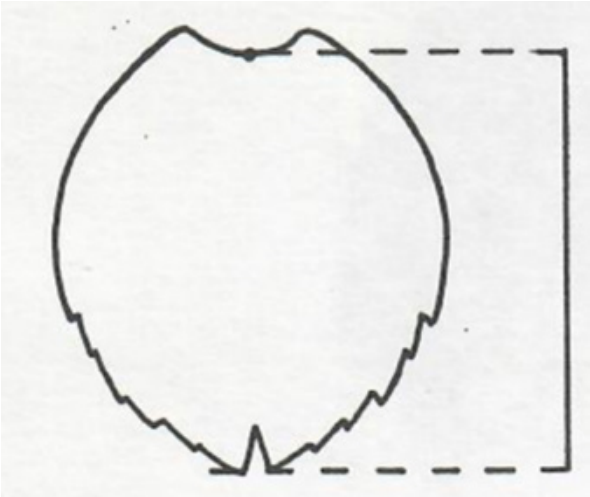
Egg laying process

Step 6. The following basic information should be collected for each nesting female:

- Date of laying
- Beach and zone/sector
  - Letter/Number Code
  - GPS point
- Species of turtle
  - Hawksbills lay smaller (4 cm) and more numerous eggs (up to 250), average 170). Tracks are asymmetrical.
  - Greens lay larger eggs (5 cm), though less numerous (up to 200). Tracks are symmetrical.
  - Leatherbacks lay very large eggs, (6 cm–6.5 cm), but typically lay less than 120. Tracks are symmetrical.
- Turtle size
  - 'Standard Carapace Length' (SCL) – the length of the shell measured along the top of the back, using a flexible measuring tape that follows the curve of the shell. Start from the front edge of the shell to the rear edge, as shown in the picture.
  - Carapace Width – the widest part of the shell, measured straight across the middle of the back using a tape measure, from the outer edge on the left side to the outer edge on the right side.
- Size of turtle
  - Standard Carapace Length (SCL) – curved measurement with flexible tape from precentral scut at carapace midline to posterior margin of postcentral.
  - Carapace Width: curved measurement with flexible tape of the distance across the widest part of the shell perpendicular to the longitudinal access.
- Any existing tag information
- New tag information

Tag numbers (see below).

- Environmental factors
  - Time of laying
  - Tide level
  - Star/Moon conditions
  - Temperature
  - Beach vegetation around nest



Turtle length (size) measuring method

Length measure along the back

Step 7. Tagging

- After egg laying has been fully completed, and the female has started to cover the nest, tagging can commence.
- It is best to tag the turtle while it is still burying the nest. Once it starts to walk back to the sea it is very difficult to contain and tag the turtle.
- Clean the tags with an antiseptic solution (alcohol, betadine or other antibacterial cream.
- Wipe the flipper location with an antiseptic solution, both upper and lower location.
- The tagger should ensure s/he has clean hands.
- Tag the turtle on both the right and left flipper.
- The tag should be placed along the trailing edge of the fore flipper, proximal to, between or through the large scales edging the centre part of the flipper.
- The sharp point of the tag should be placed on the top of the flipper and perforate and bend at the bottom.

  The tag should be applied quickly with a firm and resolute squeeze of the applicator.

  Note that the turtle will react strongly when tagged, so care should be taken to avoid injury to both the turtle and the tagger.

Tagged turtle on the back flipper

Stainless steel tag with unique number

Step 8. Post laying

Once measurements have been made and tags applied, the female should be left alone as soon as possible to finish covering her eggs and make her way back to the sea. Avoid all physical, light and noise disturbances.

Step 9. Nest markings

Comprehensive record keeping should be made of each nest.

Recording should be done as soon as possible after laying (e.g. within 24 hours).

Locate the exact location of the nest, taking note that the hole is usually found on the seaward side of the cavity.

Place a marker (usually a stick or pole) in the beach near (but not on) the nest hole.

Write on a board or piece of bamboo the following basic information:

- Nest ID (Beach/Zone)
- Date of laying
- Turtle species
- Expected Hatch Date
- Dig date

Preparation of bamboo for nest tagging

Writing of date on bamboo tag.

Turtle nest marking

Hawksbill turtle. Credit: USFWS – Flickr.com

Part 2.
Turtle nest relocation guideline

Relocation of turtle nests is not best practice and should only be done when necessary to protect the nest from a real threat. It is best to leave the nest where the mother turtle placed it. Before moving any nest, monitors must carefully consider the following points:

Step 1. Assess if there is a need to move the nest

Is the nest safe or not? Use these three questions:

- Has the mother turtle laid this nest within the last 4 hours?
- Is the nest in a place where seawater might wash it away or inundate it?
- Is there construction work or other disturbance happening nearby that could damage the nest?
- Is the nest located on a road or a place where people or animals regularly pass?

If any of these risks exist and the nest is less than 4 hours old, relocation may be necessary. If not, leave the nest in place.

Step 2. Identify a suitable new nest site

Find a safe place to move the nest to. The new site should be similar to where a mother turtle would normally choose — under a tree or in shade, not too far from the sea. If moving the nest into a protected enclosure (like a fenced area), it must be shaded and similar to a natural nest site.

Step 3. Equipment needed for relocation

Plastic bucket, shovel or stick, hand power (digging should be done by hand as much as possible)

Step 4. Timing of relocation

Relocation should only be done after sunset or in darkness. This is because the mother turtle lays eggs in the dark, and moving the eggs within 4 hours of laying reduces the risk of harming them. Do not wait more than 4 hours after laying to relocate.

Step 5. Who should relocate the nest

Only trained turtle monitors should perform nest relocations.

Step 6. Excavating the nest

The mother turtle often places eggs on the seaward side of the nest cavity. Digging must be done by hand by trained monitors.

Identifying damaged nest or nest at risk for relocation

Step 7. Carefully remove eggs, place in a bucket, and count

Place some sand from the original nest site at the bottom of the container to prevent eggs from moving during transport. Take great care to avoid breaking any eggs. If any egg breaks, remove it and its contents to avoid contaminating the others.

Mark the top of each egg with a marker pen if possible, to help keep track of egg orientation. Usually, the top of the egg is clean white, while the sides and underside are dirty from sand.

Measure the depth of the original nest to replicate it later. All eggs must remain in the same position as laid, with the marked top side always facing up.

Removal of eggs from damaged or inundated nest and careful placement of nest in a bucket

Step 8. Move the eggs to the new nest site

Carry the bucket carefully to the new nest site or enclosure.

Walk slowly and avoid shaking or rotating the eggs. If relocating during the day, prevent sunlight from shining directly on the eggs. Cover the bucket to protect from rain if necessary.

Step 9. Dig the new nest and place the eggs inside

Dig a new hole as deep and shaped as close as possible to the original nest. Use hands or a small stick for digging. Try to make the size and shape of the new hole as similar to the original nest as possible. It is good practice to dig the new nest near the old one, but higher up the beach – this will make it faster and easier to move the eggs.

Step 10. Place the eggs inside the new nest

Place each egg individually into the new nest, maintaining original orientation. Eggs from the bottom of the original nest should be placed at the bottom of the new nest, and those from the top at the top.

Do not add sand between the eggs. Any small amount of sand already on the eggs is enough.

Once all eggs are placed, bury the nest and compact the sand gently but firmly around the top, replicating the compactness of the original nest. Add a small mound of sand on top to make the nest look like a natural one. Green turtle nests should have 50 cm of sand above, and Hawksbill nests 30–35 cm minimum. Adding a little extra sand is always good.

If more than 4 hours (or even several days) have passed but the nest is at risk of being washed away, carefully excavate and relocate using the same careful method, but be extremely cautious as eggs will be more fragile after this time.

Digging of new nest and relocating eggs to the new nest making sure of minimal disturbance of egg orientation.

Step 11. Mark the relocated nest

Once relocation is complete, record the following details on a marker (stick/bamboo):

- Species of turtle
- GPS location of the original nest
- Area where the new nest is located (Beach/Zone)
- Date the mother turtle laid the eggs
- Number of eggs
- Expected hatch date (~60 days after laying)
- Dig date: hatch date plus 10 days (for survival monitoring)

Marking of relocated nest

Step 12. Release hatchlings when they emerge

Eggs will hatch naturally, either in the daytime or night. Monitors can help carefully remove hatchlings from the nest and place them on the beach to make their way to the sea. Stay with the hatchlings to ensure they safely pass through the reef and into deep water, protecting them from predators like birds, fish, and sharks.

Do not release hatchlings during daylight to avoid predation.

Step 13. Excavation and record keeping after hatching

The monitor who relocated the nest should be present at the excavation after hatching to record results: Count the number of hatchlings that successfully escaped (SE). Count the number of dead hatchlings in the nest (DN). Count the number of unhatched eggs (UH). Calculate survival rate: SE / (DN + UH).

Digging of nest after hatching to estimate hatching rate

BAMBOO BAY

TOTEL KONSEVESEN PROGRAM - MALEKULA

BEACH K
Zones 1 - 45

BEACH J
Zones 1 - 18

BEACH I
Zones 1 - 21

BEACH H
Zones 1 - 5

BEACH G
Zones 1 - 32

BEACH F
Zones 1 - 3

BEACH E
Zones 1 - 12

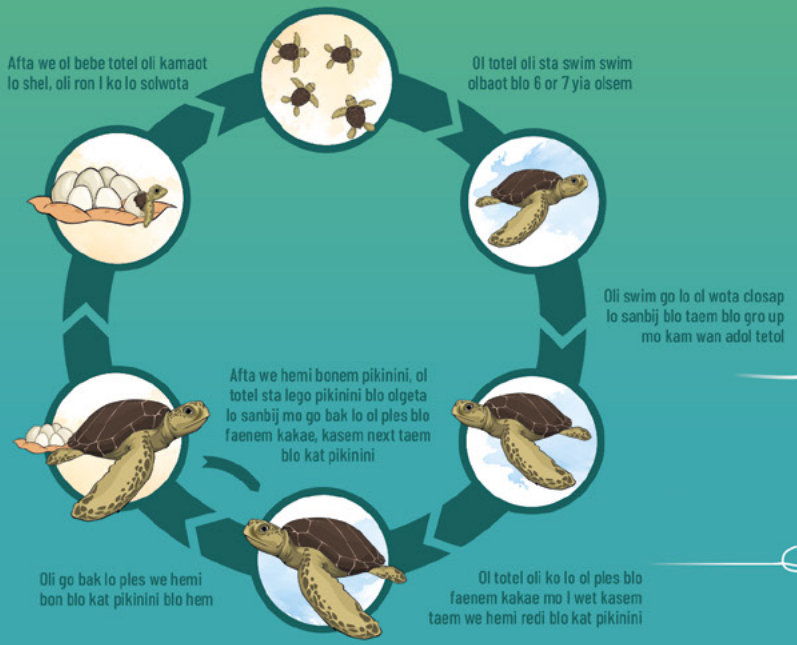
BEACH D
Zones 1 - 10

BEACH C
Zones 1 - 2

BEACH B
Zones 1 - 2

BEACH A
Zones 1 - 2

LUKAOTEM GUD OL TOTEL BLONG YUMI "DALEREKGENE"



EUROPEAN UNION

Sweden
Sverige

PEUMP
Pacific-European Union Marine Partnership Programme

SPREP
Secretariat of the Pacific Regional Environment Programme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