

Title: Vanuatu Marine Turtle In-water and Nesting Beach Surveys, Conservation and Awareness Raising 2014-2015

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Project Goals: The project **Goal** is to increasing knowledge and conservation of marine turtles in Vanuatu working through the Vanua-Tai (VT) Turtle Monitors.

The **objectives** were:

1. Carryout in-water surveys of foraging green turtles at two sites Gaua Island and Wiawi, Malekulu to determine nesting origin of these foraging turtles;
2. Strengthen capacity to carryout nesting beach surveys and improve survival of eggs at potential index beaches (green, leatherback, and hawksbill).
3. Increased knowledge, awareness & conservation of marine turtles in Vanuatu communities, and increase awareness and information sharing among VT Monitors.

The **Activities** were to include training of turtle monitors in in-water and nesting beach survey techniques, carrying out in-water (green) and nesting beach surveys (leatherback, green and hawksbill), increase nesting survival, and collection of tissues for DNA analysis. Village conservation meetings were to encourage conservation of turtles and nests. Capacity building and information sharing was to occur at the Annual meetings. Awareness material, media pieces and review paper on Leatherbacks were to be prepared.

There were delays in approval of the budget by NOAA due to issues related to use of non-federal money, consistence of the budget forms and indirect cost agreement. These issues were resolved in late July 2014; subsequently there was a considerable delay in applying for the draw down process due to WSB allowing their registrations to lapse when the ORCA system transferred over to the ASAP system. There also has been confusion on the receipt of a password, nomination of the financial officer, and the fact that the ASAP financial system website does not accept Vanuatu banking information. As a result the application for drawdown funds was cancelled and NOAA removed the funds from the ASAP system. WSB then submitted the request for disbursement of funds. Additional difficulties were encountered in transferring to a Vanuatu Bank Account. As a result the funds where finally transferred through a US Bank Account and then subsequently on to Vanuatu. The first funds were not received until late September 2015. Fortunately WSB temporarily provide funding from their core operating grant, so that the activities could start in November 2014.

A number of **changes** occurred to the original plan related to the delayed funding and changes in staffing within WSB, and the Vanuatu reality.

1. *In-water Surveys:*

The proposal suggested training and sampling was to occur at two locations Gaua Island in Northern Vanuatu and Wiawi, Malekula Island. Due to cost overruns, potential difficult in obtaining adequate samples, and a cyclone (Pam) the training and collecting in Guau was cancelled with funds reallocated to other activities. As is reported below, due to difficulties in obtaining storage vials there was only limited in-water collecting in Wiawi.

2. *Nesting beach surveys:*

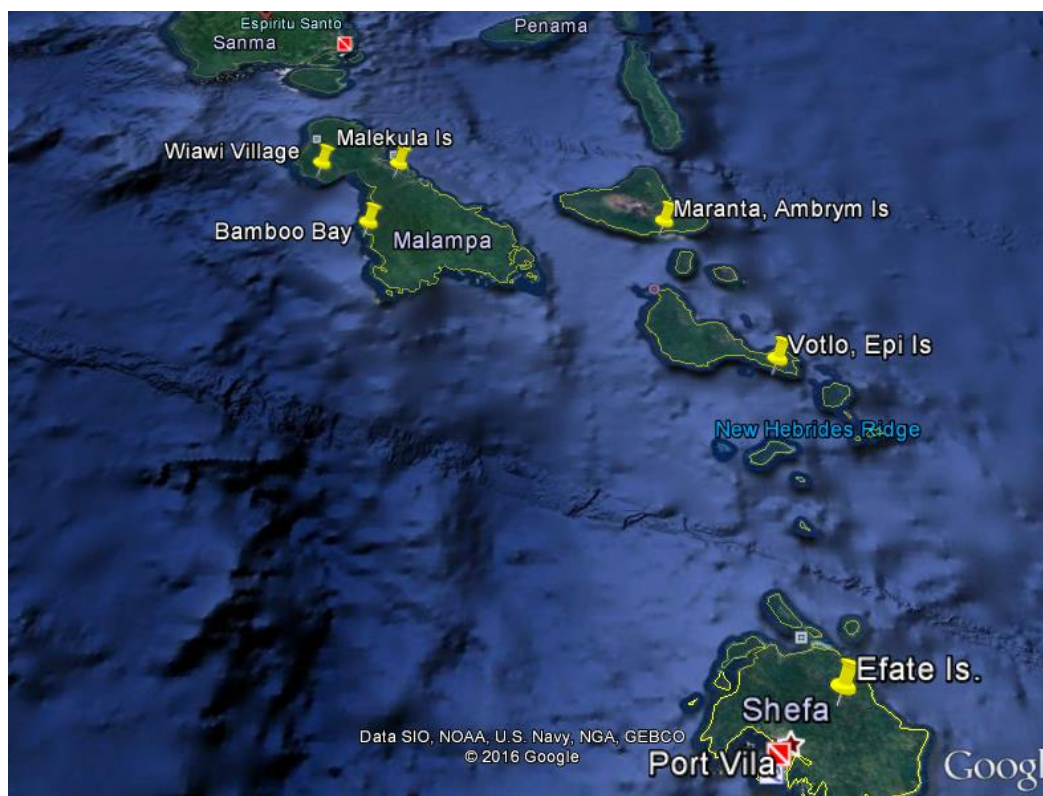
Surveys of nesting beaches was to have occurred on four nesting beaches two leatherback nesting beaches on Epi and Ambrym Islands and two green and hawksbill beaches in Malekula. Training was carried out for monitors from both the leatherback sites but unfortunately after the training contact was lost with the Ambrym monitors who could not be reached via phone. Subsequent limited contact suggested they collected only limited nesting data but that has not been passed to WSB. Nesting beach surveys were thus concentrated on three areas.

3. *Education and Outreach:*

Conservation awareness was planned in the original proposal for South-East Malekula and Pentecost Island. The awareness was delayed because of the late start-up of the project and the delay in receiving funding. The awareness training was subsequently cancelled due to staff limitations as there has been difficult in recruiting a programme manager for the VanuaTai Monitors programme who was to have assisted with this training. WSB request to NOAA to allow cancelation of these activities and transfer of the remaining budget to support the (3.2) Vanua-Tai Annual meeting was approved.

These changes resulted in research and training being concentrated on three sites on two Islands namely Epi and Malekula (Figure 1).

Figure 1: Location of research and training sites in Vanuatu for NOAA Project



1. In-Water Sampling

1.1. Training of monitors in capturing foraging turtles, turtle tagging, collection of DNA samples, and data recording, and

1.2 In-water survey to tag and collect DNA samples from foraging green turtles;

1.1.1 **Wiawi:** Training was carried out at Wiawi in December, 2014 in conjunction with the nesting beach survey training 2.1.3. The training team consisted of Donald James Aromalo Vanua-Tai Network coordinator, Wan Smolbag, the Scientific Advisor, Dr Kenneth MacKay, and a Veterinarian, Dr..Christina Shaw. Details of the training are given in 2.1.2.

1.2 In-water survey to tag and collect DNA samples from foraging green turtles;

Earlier tissue samples from Vanuatu were sent to Dr Nancy Fitzsimmons, Griffith University for DNA analysis. After discussion with NOAA and Dr Fitzsimmons it was agreed that the NOAA, Marine Turtle Genetics Program, Southwest Fisheries Science Center, La Jolla, California would carry out the analysis and coordinate with WSB and Dr. Fitzsimmons on the analysis. The lab was to send numbered vials for tissue storage. WSB was to liaise with the NOAA lab to obtain the CITES and other appropriate permits and ship the samples to La Jolla, when there were sufficient number of samples.

The original information on foraging turtles at Wiawi had indicated that foraging green turtles were abundant within a lagoon adjacent to Beach D and E (Figure 9). Reconnaissance during the training indicated that the turtles were not as abundant and were more difficult to capture, than originally assumed. A young man from the village who was adept at turtle capture led the capture team. One

hawksbill and eight green foraging turtles were capture, measured, tagged, tissue samples collected, and the turtles released. An additional tissue sample was taken from a recently dead green turtle. After the first day of collecting there appeared to be some issues about handling and holding the turtles and Dr Christina Shaw advised on more humane handling methods. The collecting experience suggested that collecting 80 foraging turtles from this site was going to be difficult and that there may be a need to identify additional green foraging areas in Malekula to obtain a suitable number for a mixed stock analysis. A follow up visit occurred in April 2015, unfortunately there were difficulties of obtaining sampling vials, (a shipment from Australia was not received and the vials sent twice by NOAA, leaked in transit) as such WSB was advised not to use the vials so no in-water collecting occurred. A few additional nesting hawksbill samples were collected from Bamboo Bay. All the samples are stored in numbered vials with DMSO or saturated salt solution and have been kept in refrigerated storage but have not yet been sent to NOAA for analysis.

2. Nesting Beach Surveys

2.1. Training in Nesting Beach Survey and Beach Conservation

Training in nesting beach surveys was carried out at three sites for 15 monitors.

2.1.1. Epi & 2.1.2. Ambrym Islands

These Islands are the major sites for leatherback nesting in Vanuatu (Petro et al 2007; Petro and MacKay 2014). Two separate trainings were planned on each islands. As the Islands are adjacent it was the most efficient to combine the training, which was held in Rovo Bay, Epi Island. Due to changes in the Air Vanuatu schedules that eliminated the direct inter-island flight and a cancelled flight the training was shortened by one day and there was a 60% overrun over the original budget.

Arrangements: Rovo Bay is the site of the SHEFA provincial administration. The facility was excellent for the training; accommodation was provided in a residence and a guesthouse, there were excellent meeting and kitchen facilities with food being prepared by local ladies. Phone connections were good, although no internet connections were available. A generator was available to allow power point presentations. Kava was also available nearby in the evenings.

Training: The training was carried out by Donald James Aromalo and Kenneth MacKay. The Training was attended by four monitors from Epi (three monitors from Votlo, one from Brisbane), three from Ambrym, two experienced monitors from Moso and North Efate, and additional staff from the SHEFA Province based in Rovo Bay including the two police officers, and a land owner. The training outline and list of attendees been reported previously (Report 2 to NOAA).

The training programme was carried out primarily in Vanuatu pidgin (Bislama) with some English translation when necessary. Frequent use was made of power point presentations to amplify the points covered. As many of the monitors have limited formal education and limited travel experiences it was important to translate some of the concepts into locally understood concepts. The DNA analysis was an example as the participants did not know what DNA was nor why you would measure it but did understand *Family line* and family relationships.

Field trip to Votlo nesting beach: All the monitors and trainers travelled to the Votlo nesting beach where 3 leatherbacks had nested the previous week. At Votlo we stayed in the village for two nights with food prepared by the village women. The nesting beach is about 1 km away which facilitated both day and night visits to the nesting beach. While no nesting was recorded leatherback, green and

hawksbill nests were encountered. Practical training was carried out on measuring beach sections, methods for recording nests, protocol for night time surveys, and a mock nest relocation. In addition informal conservation education was carried out with the Votlo village men and women.

Training Evaluation: While no formal evaluation was carried out there was excellent participation and all contributed. The attendance was perfect from the monitors and up to 10 additional Epi participants sat in on the sessions. The Votlo monitors in particular seemed very enthusiastic to continue their monitoring and subsequent to the training were in regular phone contact with Donald.

2.1.2. *Wiawi , Malekula Island*

Nesting beach training for Wiawi monitors was carried out in December 2014 and followed up in April 2015. There has been previous training with the monitors 2008-09, 2009 and 2010 in conjunction with training on collection of tissue samples for DNA analysis with Karen Frutchey, NOAA.

Arrangements: Transport from Norsup airport was supplied in an open pickup truck by the Wiawi Chief who is the official transport supplier in that area. The travel to the village apart from a flat tire was uneventful, however, the transport of the Bamboo Bay monitors was more difficult as heavy rain, slippery roads and washouts resulted in the group having to walk the last 2 km. The planned departure for Bamboo Bay was delayed from Saturday to Monday, as Wiawi villagers are Seventh Day Adventists and celebrate Saturday as the holly day so that transport was not available. Also the boat captain could not come on the Sunday to transport us to Bamboo Bay. The group either sleep in tents on the beach or in one of the monitor's houses. Food was supplied by the head monitors family. Charging of phones and camera batteries was accomplished by a solar charged battery.

Training: The training team consisted of Donald James Aromalo, Dr Kenneth MacKay, and a Veterinarian, Dr.Christina Shaw with the field training concentrated on the chief monitor and his son. The nesting beach training was informal and practical but roughly followed a prepared training outline. (see Annex 1 Report 2 to NOAA) Part way through the training we were joined by two monitors from Bamboo Bay. There was an initial review of data, inspection of nests, search for new nests, and sharing of information from Bamboo Bay. Dr Shaw carried out a survey of feral and village dogs to determine if the village needs a dog control programme. Two power point presentations were made to the monitors and community members focusing on turtle life history, tissue sampling for DNA analysis, data collection mistakes and gaps, and community conservation.

During the training a number of new nests were identified and marked, the nest identification markers were improved, some nests were protected from dog predation, identification of tracks and nests was confirmed and some data was collected on nest location and nest temperatures related to climate changes impacts. It was hoped that this would improve data quality and usefulness. The team also visited a distant nesting beach where a leatherback nest had been reported, they discovered it was a nest from the previous year. This is the second year that a single leatherback nested on this beach.

Follow-up training of Wiawi monitors was carried out in April 2015 including beach inspection for damage after Cyclone PAM, checking data sheets, and exchange of one monitor with Bamboo Bay.

2.1.3. *Bamboo Bay, Malekula Island*

Nesting beach training for Bamboo Bay monitors was carried out in December 2014 and follow-up occurred in April 2015.

Arrangements: Travel to and from Bamboo Bay (BB) was via chartered small fishing boat. A new road now connects BB with South West Bay so that in future it will be possible to fly direct to SW Bay and travel via land to BB. The training team spent 3 days in Bamboo Bay camping on the beach or in a beach hut, adjacent to the field camp, about 500m from the main village. Food was prepared by the chief monitor's family and other village women, with occasional fresh fish brought in by the young men.

Training: The training team consisted of Donald James Aromalo, Dr Kenneth MacKay, and a Veterinarian, Dr.Christina Shaw. One of the monitors (Childson) from Wiawi accompanied us to gain additional knowledge and experience from the Bamboo Bay monitors. As the two main monitors had attended the training in Wiawi most of the time was concentrated on reviewing data, obtaining missing data, and field work. Both day and night surveys were carried out, turtles were tagged, tissues were collected from three nesting hawksbills, and nests were examined, one nest was dug but had been partially washed out so no eggs were found. Dr Shaw also did a survey of feral and village dogs to determine if the village needs a dog control programme.

Results: Nesting turtles were encountered new tags were applied and return nesters observed. Some data was collected on nest location and nest temperatures related to climate changes impacts. Minor issues were identified related to data collection notable the non-recording of nests that were predated by dogs. In addition concern was expressed about the excessive application of logs, rocks, and palm fronds on nests (Figure 8c) to reduce dog predation that could lead to reduction in nest temperature possible resulting in male biased hatchlings. It was very clear that there is a need to follow closely the approaches to reduce dog predation in terms of nest temperatures and hatching rate.

A follow up visit was carried out by the Vanua Tai monitor coordinator to Bamboo Bay in April 22 to 26 2015 accompanied by a monitor from Wiawi. There was follow up with the monitors, checking of data and inspection of the beach for cyclone damage.

2.2 Nesting Beach Survey, nest protection, conservation

2.2.1 Votlo, Epi Island

Vanua-Tai Monitors have identified Votlo, Epi Island as the major leatherback nesting beach in Vanuatu (Petro et al 2007). The beach is located on the south east coast of Epi (Figures 1 & 2) and is a 4 km long black sand beach facing open water

Figure 2: Nesting Beach Votlo, Epi Island



Leatherback turtles along with some green and hawksbill turtles have been reported nesting here since 2002. The monitoring has been carried out by Vanua-Tai Turtle monitors who live in a village adjacent to the beach with backup support from the Wan SmolBag Environment staff. Coverage has been sporadic in timing and area covered, some data has been unreliable, and there has been occasional community conflict that has affected data collection. However, previous surveys have flipper tagged over 20 leatherbacks, obtained DNA, and carried out annual nesting counts. Leatherback nesting has varied from zero to over 40 nests but does not indicate a trend. There appears to have been a low hatch rate in some years due to storms and high water while other years feral animals; pigs, cattle, horses and dogs have destroyed nests and predated eggs.

In this project the original plan was to have senior monitors from Moso and North Efate travel to the leatherback (LB) nesting beaches and assist the local monitors to increase the night surveys and number of LBs tagged and measured. After the training Epi monitors kept in regular contact with Donald via phone, but there was not enough LB nesting (2-3 nest per week) to warrant sending a senior monitor

to assist. As such the 2014-2015 nesting beach survey was carried out from October to March by the local Vanua-Tai monitors.

One leatherback, one green and one hawksbill were tagged. Additionally one green remigrated after being tagged in the 2013-14 nesting season. Two leatherbacks were remigrants both showing a two year return cycle. One tagged in the 2010-11 nesting season, returned during the 2012-13 season, and again on 27 November 2014 during the 2014-15 season. The other was tagged during the 2012-13 nesting season and return 14 January, 2015. Table 1 summarises the data from the Votlo nesting beach and details on tagging and tag numbers is given in Annex 1.

Table 1: Summary of turtles tagged and size of turtles measured Votlo, Epi Island

Votlo					
Species		No. tagged	CCL	CCW	No. Nesting
Green	New Tag	2	106.0 (2)	94.5 (2)	No nesting data entered
	Return	1			
	Total	3			
Hawksbill	New Tag		82.5 (1)	65(1)	
	Return	1*			
	Total	1			
Leatherback	New Tag	1	161.3 (3)	114.0 (3)	15
	Return	2			
	Total	3			
	Total	6			

While the measure turtle numbers are low the sizes (CCL) suggest that the leatherbacks are similar in size to previous nesting at Votlo and to other western pacific nesting populations (Petro et al 2014). Of interest is that the two leatherback return migrants showed an increase in CCL from 132 to 160 cm in two years and the other increased in CCL from 152 to 160 cm in four years. The green turtles appear to be larger than nesters at Bamboo Bay.

The detailed nesting data sheets have not been supplied to Wan Smolbag, however verbal reports indicated only one leatherback nest hatched with the other nests washed out. As the Votlo beach is exposed to the weather (a beach break) there have been nest washed out in previous year but in early March Epi was in the path of the category 5 Cyclone Pam so that all nest that had not hatched by 13 March would have been washed out by the Cyclone. Thus assuming a 60 day gestation period any eggs laid after early January would have not hatched. Subsequently training has been carried out in nest relocation for the 2015-16 nesting season.

Malekula Island

Malekula Island is on the western edge of Vanuatu (Figure 1) with Queensland Australia lying over 2000km due west and New Caledonia 550km to the south west. Nesting beach surveys have been carried out for over 10 years at two Malekula locations: Bamboo Bay (16° 22.801'S; 167° 23.822'E) and Wiawi (16° 08.939'S; 167° 13.902'E). Limited tagging returns have suggested a linkage from Malekula to Australia and New Caledonia for both green and hawksbill. Recently a combination of

satellite tagging and genetic analysis has suggested that turtles from Bamboo Bay make up a small portion of green turtles foraging in New Caledonia (Read et al 2014: Read et al 2015).

2.2.4 Bamboo Bay

Bamboo Bay was first visited by Vanua-Tai monitors January-February 2004 where they identified a major nesting area with over 300 nests of green and hawksbill turtles. Subsequently a nesting beach monitoring programme was initiated for the 2006-07 season through Australian funding to the University of the South Pacific (USP). Training of monitors was initiated by Ian Bell, Queensland, Australia, Barry Kruger, Bahamas Turtle Research Centre and Kenneth MacKay USP. There are 9 discrete nesting areas (Figure 3) named A-I¹ covering over 10 kms of coast. The beaches were named and each beach surveyed in 100m segments in 2006. The beaches range in habitat from G a long (2km) black sand beach with a beach break to H a coral rubble beach surrounded by a shallow coral reef (Figure 4).

*Figure 3:
Nesting Beaches Bamboo Bay, Malekula Island*



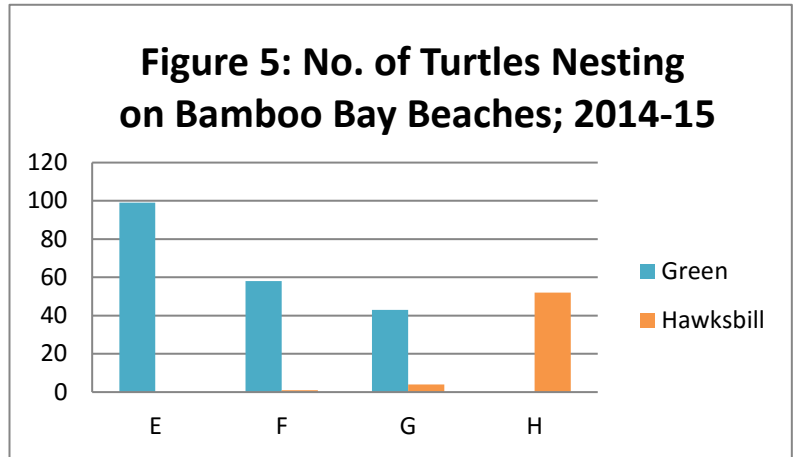
*Figure 4:
Beach G and Beach H*



There has been training and/or follow-up most years since and nest monitoring every season since 2006-07. Although there has not been consistent coverage from year to year, and there have been minor issues with data, the data from Bamboo Bay represents the best nesting beach monitoring data available in Vanuatu.

¹ Beach I has been seldom surveyed and is surveyed and is not shown in Figure 3

The 2014-15 survey was carried out by experienced Vanua-Tai Monitors who live adjacent to Beach G and surveyed from September to 10 March. This survey found 257 nests scattered across four of the nesting beaches (Figure 5). There were 201 green turtle and 56 hawksbill nests reported. As has been noted in previous year's surveys, hawksbills concentrate their nesting on beach H as they are better able to navigate through the shallow coral and nest in rocks and coral rubble. The other beaches have better access to the sea, and are predominantly sand, greens nest on these beaches almost exclusively. Previous year surveys have shown a concentration of greens on beach G whereas this survey showed considerably more on Beach E and F. It is not clear whether this is due to increased survey effort on E and F or a shift in nesting between the beaches.



There were eight turtles tagged or found with tags (Table 2, Annex 1) on the Bamboo Bay nesting beaches. Two Green turtles were return tags, one original tagged December 2006, and returned December 2010, and again December 2014. The other was originally tagged in October 2010, was reported re-nested in December 2010 and then in January 2015. Three hawksbill turtles were tagged or found with tags, two were new tags and one that nested in December 2014 was a return tag from December 2006.

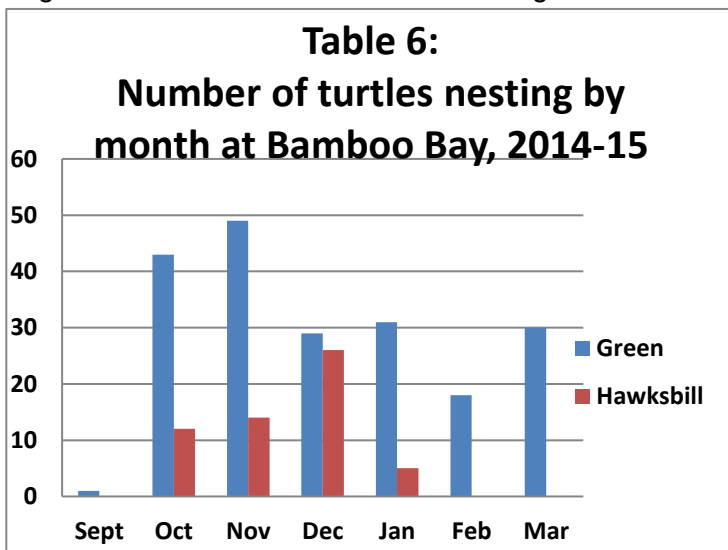
Table 2: Summary of tagging, size, clutch size and hatching success of nesting turtles at Bamboo Bay, Malekula Island

Bamboo Bay								
Species		No tagged	CCL	CCW	No Nesting	Clutch Size	Emergence Success	Total # of hatchlings
Green	New Tag	2	98.3	89.8	201	94.1	98.1	8,610
	Return	3	(4)	(4)		(82)		
	Total	5	±11.8	±9.18		±15.456		
Hawksbill	New Tag	2	95.3	85.3	56	213.9	98.7	11,073
	Return	1*	(3)	(3)		(52)		
	Total	3	±2.52	±4.36		±46.292		
Total		8						19,683

* Not recorded in TREDIS but present in WSB Records

While there was a limited number of turtles tagged and measured, the parameters (Table 2) are within the range of previous years measurements with the hawksbills (CCL=95cm, CCW=85) continuing to be much larger than hawksbill from Australia (Limpus, 2009) and they appear to be the largest reported in the Pacific.

Nesting success: The monthly distribution of nests is shown in Figure 6. Nesting for greens was first recorded in late September and continued through to March. Hawksbills started nesting in October and continued into January. The peak of nesting for greens was November but there was considerable more nesting in February and March than in previous years. Hawksbill nesting peaked in December similar to data from previous years.



Clutch Size, Emergence and Hatching Success:

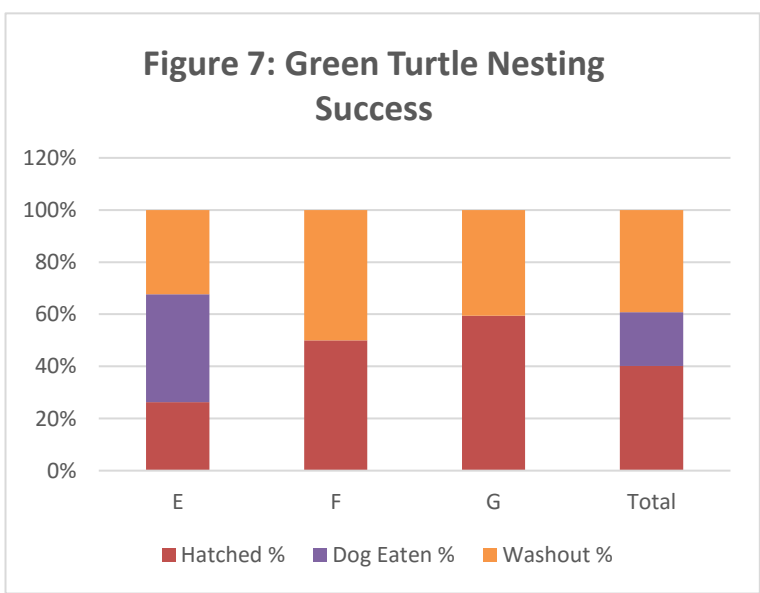
The turtle monitors mark all nests and returned after 70 days to dig the nest that have not been predated or washed out. They count the number of hatched eggs, unhatched eggs and live and dead hatchlings.

The clutch size and hatching success can then be determined (Miller 1999). The data is summarised in Table 2. The Clutch Size of 94 eggs for greens and 214 for Hawksbills are within the range of measurements from previous year. The green clutch sizes are slightly lower than for nesting beaches in Australia (Limpus, 2008) while for hawksbills the clutch sizes are substantial larger than Australian nesting beaches (Limpus 2009).

Bamboo Bay nesting beaches have a very high emergence success of the nests that successfully hatched, both green and hawksbill nests had over 98% success. What is important to the Vanua-Tai monitors and the villages near the nesting beaches is the number of hatchlings produced on their beaches. In Bamboo Bay there were almost 20,000 live hatchlings produced.

While emergent successes is high the nesting success was much lower particularly for green turtles. The data on nesting success of the green turtles in Bamboo Bay is shown in Figure 7. Overall only 40% of green turtle nests hatched

successfully, dog predation accounted for 21% of nest destruction while storm washouts accounted for 39%. Dog predation on green turtles was very high on Beach E at 41% but absent from other beaches, although we discovered that the monitor does not record dog predation on fresh nests, this would have increased the number of dog predated nests.



Previously dog predation had been a major issue on all beaches. Prevention measures have involved killing of some problem dogs and the use of bamboo grids, bamboo fronds, logs and rocks (Figure 8) to

prevent the dogs digging the nests. This appears to have reduced the problem on all but Beach E. During this nesting survey, however we observed some nest protection that resulted in too much nest shading that could impede nesting emergence and lead to reduction in nest temperature possible resulting in male biased hatchlings. (Figure 8c). The monitor was advised to reduce the nest covering and remove it at appropriate time. It was very clear that there is a need to follow closely the approaches to reduce dog predation in terms of nest temperatures and hatching rate.

Previously dog predation of hawksbills on Beach H has been a problem particularly as the hawksbill nests are shallower than greens and the early bamboo grids could be lifted by the digs particularly on the rocky substrate, however the use of the increased nest protection (Figure 8b & c) appears to have solved that problem as no dog predation was reported on Hawksbill nests. Although there was some dog predation of new hawksbill nests that occurred before the monitor could install the protection (this was not reported in the data).

The other major cause of nesting mortality at Bamboo Bay (28%) was storm washout (Figure 7). Vanuatu was hit by Cyclone Pam on 13-14 March with 250 km/hr winds. While Malekula was not as severely damaged as other areas of Vanuatu, there was considerable beach erosion and flooding. All nests that had not hatched or emerged by 13 March were destroyed. As the hawksbills nesting appeared to have ended in early January there was only 7% loss of Hawksbill nests to the Cyclone.

Figure 8; Evolution of dog predation control measures at Bamboo Bay



(a) Bamboo Grid to prevent Dog Predation of Turtle Nests, December 2006



(b) Reinforced Bamboo Grid Circa 2010



(c) Super reinforced grid 2014

2.2.3 Wiawi, Malekula Island:

Vanua-Tai monitors have been collecting turtle nesting data since 2008 at Wiawi. There are 5 nesting beaches along about 9 kms of coast. Similar to Bamboo Bay the nesting beaches were identified and surveyed when monitoring was initiated in 2008 and remained constant since then.

Figure 9: Nesting Beaches Wiawi, Malekula Island



Previously there have been considerable problems with quality of data. The monitors appear not to be able to separate greens and hawksbills either turtles or their nests. For example some of the tissue samples sent to Nancy Fitzsimmons for genetic analysis identified as green were genetically hawksbill. In addition comparing the number of eggs reported from Wiawi nests to data from Bamboo Bay (Table 2 & 3), suggest that a large number recorded as green have larger clutches of eggs (>130) than is normal for greens and the clutch size of hawksbills are much lower than Bamboo Bay.

These issues have been identified in previous NOAA reports and increased training has attempted to correct this. This was done during the December training and the March follow up, including monitor exchanges with the Bamboo Bay monitors. Unfortunately the 2014-15 data suffers from the same difficulties. Additionally there appears to be missing data sheets so that there is no nesting data after 24 December. The result is that it is difficult to use the data for any analysis particularly to differentiate between Greens and Hawksbill.

We present the following data as reported by the monitors. The monthly distribution of turtle nests is given in Figure 10 and the distribution of nest over five nesting beaches is shown in Figure 11. A more detailed breakdown of nesting data is given in Table 3.

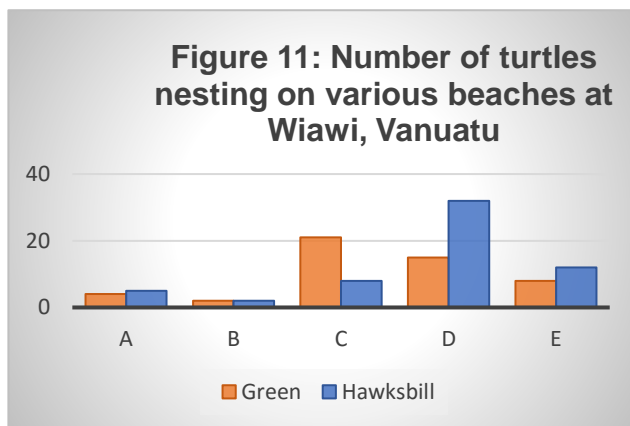
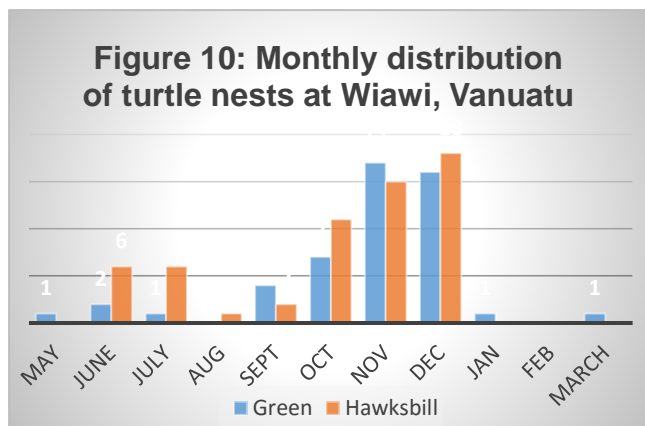


Table 3: Summary of tagging, size, clutch size and hatching success of nesting turtles at Wiawi, Malekula Island

Wiawi								
Species		No. tagged	CCL	CCW	No. Nesting	Clutch Size	Emergence Success %	Total # of hatchlings
Green	New Tag	3	85.7 (4)	75.3 (4)	50	128.8 (46) ±27.672	94.9	5,198
	Return	1 (1)						
	Total	4						
Hawksbill	New Tag				59	123.2 (58) ±24.720	95.5	7,013
	Return							
	Total	0						
Unidentified					3	150.0 (3) ±55.570	95.2	439
Total		4			112			13,355

Three new tags were attached all reported as green turtles, however, based on size and number of eggs they may have all been hawksbills. There was one re-migrant from November 2012 reported as a green but probably a hawksbill. In addition Wiawi is the only location in the Pacific Islands (except for New Caledonia) where loggerhead turtles have been reported nesting. The monitors have been asked to look out for them. The monitors recorded and tagged one nester in January 2009 as being an Olive Ridley, however an interview with the monitor and the size the turtle suggest it was not an Olive Ridley but might have been a loggerhead turtle.

The mean size of the measured turtles (combined green and hawksbill) (CCL=85.7, CCW= 75.3) was significantly smaller than turtles (either green or hawksbills) measured at Bamboo Bay (Table 2) which is 30km due south of Wiawi. This has been a consistent pattern in previous years.

Clutch Size, Emergence and Hatching Success:

The Wiawi turtle monitors use the same methodology as Bamboo Bay to determine hatching parameters. The data is summarised in Table 3. Unfortunately as indicated previously the confusion on species, gives questionable results as the clutch size data suggests the recorded Greens have larger clutches than Bamboo Bay and Australian nesting beaches (Limpus 2008) while the recorded hawksbills have considerably smaller clutches than reported at Bamboo Bay.

The emergent success of nests that hatched like at Bamboo Bay is high around 95%. The hatching success was also high (see comments on lack of data after December). While there has been previous dog predation on nests at Wiawi but there were only 4 nests out of 106 that were eaten and in some not all the eggs were predated. As there was no nesting data reported after December 2014 it was not possible to determine the effect of the cyclone on hatching, however, the monitors reported some nests were washed-out.

There was over 13,000 live hatchlings produced but the absence of data for nesting after December would suggest this is a minimum.

2.3. Nesting Beach Equipment

Nesting beach equipment including head lamps, batteries, tent and an underwater camera were purchased in Victoria Canada from the most competitive supplier and carried to Vanuatu by the science advisor in November 2014. The head lamps were distributed to the monitors at the training with instructions on how to use them and caution about using them during nesting surveys. A lap top computer along with appropriate software including office 2013 was also purchased and supplied to WSB.

3.1 Community Conservation Awareness

Informal conservation awareness was carried out during the trainings, follow up and village visits in Epi Island and at Wiawi and Bamboo Bay. A presentation on turtle conservation in Vanuatu was presented to over 60 people at the Vanuatu Environmental Science Society Meeting in Port Vila, 17 December, 2014, and the talk was subsequently filmed for use on Vanuatu cable TV.

3.2 Vanua-Tai Annual Meeting

The major awareness event was the Vanua-Tai Annual Meeting carried out 29 June-3 July 2015 Luganville, Espiritu Santo with 39 monitors in attendance. Special efforts were made to ensure that the monitors from the key nesting sites attended and brought their data sheets with them. The meeting concentrate on improving field surveys, data collection, strengthening conservation efforts, networking among monitors, and reporting on other conservation efforts that the monitors have been involved in. Some of the highlights from the meeting and recommendations are:

- Collaboration with the Research Vessel Lyar (Island Reach) was very important and enabled the Vanua-Tai monitors to become more involved in coral reef monitoring and COTS control, but also assisted monitors to get to the AGM thus reducing costs.
- The Turtle Monitors from the northern islands leaned lessons from their counterparts from the southern islands through sharing of ideas, experiences, and lessons learnt.
- Record keeping can be more efficient if experienced monitors are nominated to assist in facilitating and record minutes of the workshop. It is planned for future AGMs that two senior and experienced monitors will take on these roles.

- The logistical arrangements of planning the meeting are difficult but there needs to be improvement in sorting out travel arrangements and answer queries from monitors. This will require more human resources in the WSB Environment Programme.
- Future meetings should train monitors to become trainers
- Community members demanded compensation (200,000Vt) for turtle nesting surveys. They currently receive 40,000-50,000Vt for the season.
- WSB has had substantial reduction in their budget from the Core Donors (reduced from 6 Million Vt to 4 million), and they did not receive NOAA funding for 2015-16. In the future they will work closely with Island Reach (who rely on internet crowd funding) on fund raising and a draft MOU is being circulated for comments to interested parties.
- A major challenge is that Turtle nesting season is also the cyclone season
- Disturbing nests and killing turtles is still an issue in some Islands. In some case the Fisheries Minister has approved traditional take of turtles without advising or consulting with the Department. There needs to be continued close liaison between Department of Fisheries, WSB and the monitors. The monitors also need to do more awareness about the Fisheries regulation in their respective communities.
- There is a loss of experienced monitors from some communities as they have gone to Australia or New Zealand on temporary work permits. These monitors need to be replaced but the challenge is to travel to the communities again to elect monitors (male/female) and help set up their Sub network.
- Communication with monitors is difficult even more so when phone are out because of storms. Cell phones are the best method but issues include: who pays for the time, phone numbers often change, phones get lost, etc. Other approaches suggested include: sending radio message through Radio Vanuatu and inform monitors to call Environment office phone; use media - newspapers and FM Radios, and keep contact details for monitors and chiefs.
- There is a need to include more women and train them to become monitors and trainers. During the AGM very few women attended. In the future more female monitors will be invited to attend the AGM.
- Leadership and management training assisted monitors in understanding they should be leaders in their communities in order to carry out their roles

4. **Research Support and Science Advisor**

Science Advisors: The science advisor travelled to Port Vila, Vanuatu November- December, 2014 to assist in the planning and training of monitors in Epi and Malekula, in the nesting beach surveys, and in-water sampling, analysis of data, assistance in report writing, and drafted an outline for a FY2015 proposal. Subsequent to his return to Canada he prepared in collaboration with WSB a FY2015 Proposal “*Vanuatu Marine Turtle In-water and Nesting Beach Surveys, Conservation and Awareness Raising Phase 2: 2015-2016*” that was submitted to NOAA but not approved, prepared a request for project extensions, assisted with registration and issues related to the US Government websites, and assisted in drafting the Reports to NOAA. While recently on assignment in South-east Asia (Myanmar/Burma) he has continued to assist in liaison with NOAA, financial analysis, the analysis of the 2014-15 nesting data and final report preparation.

In addition Michelle Fletcher a former Canadian volunteer with WSB, who assisted in coordinating a previous NOAA project with WSB, spent one month (with separate funding) during March-April 2015 in

Port Vila assisting the Environment Program in budgeting, preparation of work plans, and attempting to complete the WSB registration with the ASAP system. While now back in Canada she continued to follow up on the financial issues to allow WSB to access the NOAA funds, having been successful in facilitating the transfer of NOAA funds to Vanuatu.

Products

A planned review paper on leatherbacks will be delayed as the past two years data has been quite sparse so that additional data will be required.

Data was collected on potential climate change impacts on Vanuatu nesting turtles during 2014-15 nesting season and presented at the International Sea Turtle Symposium 35 in Dalaman, Turkey. (See Abstract in Annex 2).

The previous Vanuatu work has also contributed to two publications (Read et al 2014: Read et al 2015) that shows that Vanuatu nesting green turtles are a distinct stock and that they contribute to the New Caledonia foraging green turtle population.

Recommendations:

The Science Advisor has identified a number of weakness in the data collection and entry. A summary of these are given in Annex 3. It is important that WSB through the VanuaTai Programme follow up on these issues specifically:

- Create a Master Tag Data Base;
- Ensure review of data sheets before entry, timely entry of data, and submission of data to SPREP;
- Follow up on missing data from previous nesting beach surveys (Votlo, Moso, Wiawi and Bamboo Bay);
- Follow up on missing data from previous years where tagging has been done on foraging turtles;
- Solve the issues at Wiawi especially the misidentification of turtle species or cancel the nesting surveys there;
- Follow up in Bamboo Bay on the non-recording of turtle nests eaten by dogs.

The issue of dog predation on turtle nests especially in Bamboo Bay is complicated. Current protect measures on Beach G and H appear to be working but there needs to be better record keeping of nest protection and hatching emergence, and measurement of nest temperatures to determine the effect of this protection. This, however, will require additional scientific input that is currently is not possible given current funding and staffing capacity.

The issue of the high dog predation on Beach E is also complicated as there has been a breakdown in communication between the Bamboo Bay village and the dog owner, who lives near the Beach E (and is a former VanuTai monitor), over previous dog control measures. It is suggested that the VanuTai Coordinator facilitate a meeting before the next nesting season between the two parties and present the results that show the high level (41%) of dog predation on the beach and discuss possible solutions

Another major issue is the need to summarise the previous data especially the nesting of leatherback turtles in Votlo and the over 10 years of nesting data from Bamboo Bay. Unfortunately there are considerably constraints on funding, staffing and the lack of in-house scientific support.

Given the importance of Vanuatu as both a nesting and foraging area for three species of endangered Pacific marine turtles it is important that the international turtle community assist in complimentary funding to Wan SmolBag to assist in the research on the nesting beaches and foraging grounds. Unfortunately that funding has been sporadic and has been reduced.

Financial Issues: As indicated previously there was considerable difficulty obtaining the funds through the US Government System. Additionally there has been a number of changes to the activities and resulting reallocation of funds between activities. In spite of this all funds have been spent.

The detailed financial report is summarised in Annex 4.

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Annex 1

Turtles tagged in 2014-15 nesting season

Tag # L	Tag # R	Species	Date Tagged	Date returned	Notes
Votlo					
R19222	R19221	Green	7-1-2013	28-12-2014	Two years return
R51607	R51608	Green	3-2-2015		
R49339	R49338	Hawksbill	10-11-2104		
R35737	R35736	Leatherback	1-12-2010	7-1-2011 5-1-2013 27-11-2014	Two returns on two year cycle
R49341	R49342	Leatherback	23-1-2013	14-1-2015	Two year cycle
R51605	R51606	Leatherback	24-12-2014		
Bamboo Bay					
R31806	R52654 (R37833 lost)	Green	17-12-2008	19-12-2008 8-12-2014	Six year return False crawl on 8 th ; stuck on bank
R52657	R52703	Green	15-12-2014		
R52723	R52722	Green	9-12-2014	25-12-2014	
R47554		Green	26-10-2010	16-12-2010 18-1-2015	Four year return
R52719	R52718	Green	10-1-2015		
R37758	R37753	Hawksbill	11-12-2006	26-12-2006 9-12-2014	Eight year return TREDS lists R37758 as Green tagged in 2006 but should be R37756; R37758 and 37753 are not listed in TREDS but our records show them
R52655	R52653	Hawksbill	9-12-2014		
R52652	R52651	Hawksbill	9-12-2006		

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Tag # L	Tag # R	Species	Date Tagged	Date returned	Notes
Wiawi					
R46193	R46192	Green	29-11-2012	8-12-2014	Two year return Egg #'s suggest Hawksbill
R52698	R52697	Green	27-12-2014		
R32696	R52695	Green	3-1-2015		Left tag probably 52696
R52694	R52693	Green	5-3-2015		
R52700	R52699	Green-Juvenile	12-12-2014		
R46200	R47623	Hawksbill-Juvenile	24-7-2014		Both tag #s previously ascribed to other turtles in TREDIS. R46200 used on juvenile green in 2012

Annex 2

Abstract of Paper Presented at ISTS 35

(Power Point Presentation Available)

Climate Change Vulnerability of Marine Turtles Nesting in Vanuatu

Kenneth T MacKay² and Donald James Aromalo³

The South Pacific Island archipelago of Vanuatu has nesting rookeries of Leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), and hawksbill (*Eretmochelys imbricata*) marine turtles. These three species sometimes nest on the same or adjacent beaches allowing a comparison of their vulnerability to climate change related threats. Examination of data from beach monitoring collected by “Vanua-Tai” community resource monitors give an initial indication of how vulnerability to climate change affects the three species differently and in doing so directs priority areas for further research and monitoring.

Two rookery areas are examined. Votlo, Epi Island is a long four km black sand beach. It is the major nesting beach for leatherback turtles in Vanuatu with as many as 40 nests being recorded in one year, both green turtles and hawksbill turtles also nest along this beach. The second nesting rookery is Bamboo Bay on the west coast of Malekula Island in which a number of separate nesting beaches occur that range from a two km black sand beach to smaller white sand and coral rubble beaches. Green and hawksbill turtles nest on these beaches but are generally spatially segregated among the beach types. Nesting beach data includes nest location by beach sector, date of nesting, number of nests that hatched, and hatching rate of the hatched nests, along with additional spatial surveys of the nest locations. Preliminary analysis suggests that leatherbacks and green turtle nests may be the most vulnerable to climate change threats such as increased storms and sea level rise, and increased temperature. While hawksbill nests may be more resilient to climate change threats but they are more vulnerable to anthropomorphic related dog predation. In light of this preliminary data analysis the addition of the following parameters to the current nest monitoring protocol: beach and nesting temperature; nest depth; and the spatial relationship of nests to high tide and beach morphology; would allow further exploration of these issues. A high priority strategy for mitigating the effect of climate change on leatherback turtles is reforestation of the foreshore on the nesting beach on Epi to increase beach stabilisation and lower sand temperature.

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Annex 3

Issues with Data collection and TREDS

The TREDS data base was designed to assist in tracking turtle tagging programmes in the Indo-Pacific region including Australia. In the South Pacific SPREP supplies the tags and applicators, and requires the various turtle tagging programmes to enter the data in TREDS. In Vanuatu Wan Smolbag (WSB) Environment Programme has been tagging turtles since 1996 and has tagged thousands of turtles. While TREDS is not very user friendly and difficult to use for analysis of nesting sites, it at least forces the recording of tagging data into a permanent record and allows tracking of returned tags.

The tags supplied by SPREP are distributed to Vanua-Tai Turtle monitors who tag the turtles and record the data on data sheets supplied by WSB. The monitors receive training in tagging practices and data entry at the Annual VT Annual Meeting, during special training focused on nesting beaches and during follow up by WSB staff and senior monitors.

There have been a number of difficulties in Vanuatu. They include:

- Delayed or non-entry of data thus leading to SPREP not sending additional tags so that in some years there were no tags to distribute for the nesting beach surveys;
- distribution of tags to many monitors with no systematic follow up to obtain data sheets;
- lack of review of the data sheets for errors when monitors return them;
- large number of foraging turtles tagged previously but no follow up or analysis of the data, as a result the current policy is that tags are only being released to communities involved in nesting beach surveys;
- faulty data due to monitors recording wrong tag numbers, difficulties identifying species, wrong measurement and inconsistency in recording data on hatched nests;
- some nesting beaches not recorded on the TREDS master list;

The scientific advisor has reviewed the TREDS entries, the raw data sheets, and interviewed the VT coordinator and various VT Turtle Monitors especially on the index nesting beaches. I make the following suggestions to both SPREP and Vanua-Tai in the hope this will improve data entry and data analysis.

Master Tag Data Base: There needs to be a master list of all tags received from SPREP, names of monitors to whom they were distributed, and list of returned tagging information.. This should be updated when tags are distributed during the VT Annual Meeting or visits to monitors. This list should be shared with SPREP, the VT Coordinator & Ruth, and placed on the wall of the VT office. I understand that there was a master list but not sure if it is still available or has been updated.

Timely Entry: Ruth Mora, WSB Publication department has training in data-basing and has received training in TREDS entry, she has recently been entering the data. WSB should ensure that she is available to continue entering the data. However, it is also important that the VT Coordinator Donald works closely with her to assist in correcting obvious mistakes on the data sheets. This and the Master Tag list should assist in correcting some obvious wrong tag numbers.

Return of tagging information: Tagging information from monitors who do not attend the Annual Meeting is often not obtained, unless the VT coordinator visits that area or they mail the data sheets to WSB. The Master Tag list will assist in identifying those areas that have not returned tag data and allow for follow up to request the data be sent to WSB. In general the return of data from the index

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nesting beaches has been excellent, however, data gaps for Wiawi, Bamboo Bay and Moso are indicated in the notes below.

Data Issues: *Turtle species misidentification* is an issue in some locations (see Wiawi below). There is also some misidentification of nests and hatchlings. This is an issue where continue training is necessary and appropriate colour photos of both adults, juveniles and hatchlings (best from WSBs photo collection) should be used in training, at the AGM, and distributed to the problem sites. WSB should reorder about 100 of the SPC identification guides (http://www.spc.int/DigitalLibrary/Doc/FAME/Manuals/Anon_03_ID_Turtle.pdf) for distribution to monitors.

In general it is often possible to differentiate between green and hawksbill nests. Hawksbill nests are normal shallower, there are less false pits dug and, eggs are smaller, and they lay around 175 eggs with numbers up to 300 reported, hatchlings are brown; whereas greens lay around 100-125 eggs and the hatchlings are black-blue. Given the difference in hatchling colour it may be useful to record colour on the data sheets.

Specific Issues:

Wiawi

The issues here have been identified before in previous NOAA reports but appear not to have been corrected. The result is that it is difficult to use the data for any analysis.

The major issue is species identification. They seem not to be able to separate greens & hawksbills. This appears to be a problem not just with nests that have been wrongly identified but with tagged turtles. For example some of the tissue samples sent to Nancy Fitzsimmons for genetic analysis identified as green are hawksbill. In addition there is one turtle that nested twice recorded as olive ridley –discussions with Konel suggests that it was a different species—the size is too big for what is reported as olive ridley's and Loggerhead's have been reported nesting previously at Wiawi. It will be very important to determine if loggerheads are nesting at Wiawi as they are the second most at risk species in the South Pacific (after leatherbacks).

Other issues:

- Not clear if they report live & dead hatchlings separately;
- CCL & CCW measurements questionable—they may occasionally report inches rather than metric, some nesters are much smaller than reported elsewhere (60cm), and CCW CCL records may be occasionally reversed ;
- Incomplete coverage from year to year & very little night time surveys;

- A number of tags not in TREDs but reported elsewhere, or wrong #s;
 - R47596/47597 6 Dec 2010
 - R46521/46522 (not listed in inventory)
 - R1415/R1416—missing a number

- There appears to be missing data for 2011-12

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On the positive side there appears to be a size difference between nesters at Wiawi and Bamboo Bay—but we need reliable data to compare the sizes.

Bamboo Bay

The data from here is better and reflects the early training by George Petro, Barry Kruger & Ian Bell in 2006.

There appear to be some missing data:

- Some renesting in 2011-12 not recorded
- Noel appears not to record all nests that were eaten by dogs--- this is needed to get an idea of total nests
- No data for Beach H January 2013-March 2014
- No data for H 10 Dec—8 January 2011-12
- Tagging by Allan in years 2010-11 not recorded (Noel has recorded recaptures ascribed to Alan but no data sheets or in TREDs). Donald it might be useful to visit Alan and see what data he has.
- There is a mix up on green and hawksbills' for the years that there was community monitoring particularly 2010-11—e.g. but now seems to be okay;
 - R47543/42 Nest 71-- 3 Nov-2011, renested Dec & 7 Feb identified as both green & Hawksbill
 - R47551/53—species?
- Tag R12931/ 12832 4 Jan 2014 not in TREDs
- Some TREDs data marked only as Malekula Island with no nesting beach, has been tagged by Bamboo Bay monitors so should be identified as Bamboo Bay;
- Best to concentrate on only two beaches H & G and get close to saturation in future monitoring.

Moso

In general the data here is very good. The last data on data sheets with WSB & TREDs is 2010-11 but we know data was collected through to at least 2013. This data needs to be obtained as it will help complete the Moso picture and should have remigration data.

Annex 4

Objective & #	Item	Original budget Vatu	Original budget US\$	Actual Expenses Vatu to April 30 2015	Expenses US\$ April 30 2015 based on Sept 2015 exchange rate	US\$ Remaining based on exchange rate Sept 2015	Expenditures May 1 2015 to April 30, 2016 Vatu	Expenditures May 1 2015 to April 30, 2016 US\$	Notes
Summary 1 In Water Survey									
	Personnel	0	0	0	0	0			
	Travel	303,400	3,262	183,590	1,689	1,573			
	Equipment	0	0	0	0	0			
	Supplies	10,000	108	1,245	11	96			
	Other	71,000	763	72,490	667	97			
	Total	384,400	4,133	257,325	2,367	1,766	0	0	
Summary 2 Nesting Beach survey									
	Personnel	0	0	0	0	0			
	Travel	601,000	6,463	637,020	5,860	603			
	Equipment	149,400	1,607	119,550	1,100	507			
	Supplies	20,000	215	1,245	11	204			

Annex 4

Objective & #	Item	Original budget Vatu	Original budget US\$	Actual Expenses Vatu to April 30 2015	Expenses US\$ April 30 2015 based on Sept 2015 exchange rate	US\$ Remaining based on exchange rate Sept 2015	Expenditures May 1 2015 to April 30, 2016 Vatu	Expenditures May 1 2015 to April 30, 2016 US\$	Notes
	Other	310,000	3,333	235,080	2,163	1,170			
	Total	1,080,400	11,618	992,895	9,134	2,484	0	0	
Total 3 Increased Awareness									
	Personnel	0	0	0	0	0			
	Travel	506,812	5,450	0	0	5,450	1,078,647	9,923	Travel & per diem to attend AGM
	Equipment	0	0	0	0	0			
	Supplies	0	0	0	0	0			
	Other	16,000	172	0	0	172			
	Total	522,812	5,622	0	0	5,622	1,078,647	9,923	
Total 4 Research Support									
	Personnel	186,000	2,000	209,147	1,924	76			
	Travel	247,700	2,663	279,317	2,570	94			
	Equipment	0	0	0	0	0			

Annex 4

Objective & #	Item	Original budget Vatu	Original budget US\$	Actual Expenses Vatu to April 30 2015	Expenses US\$ April 30 2015 based on Sept 2015 exchange rate	US\$ Remaining based on exchange rate Sept 2015	Expenditures May 1 2015 to April 30, 2016 Vatu	Expenditures May 1 2015 to April 30, 2016 US\$	Notes
	Supplies	0	0	0	0	0			
	Other	0		3,000	28	-28	54	90	
	Total	433,700	4,663	491,464	4,521	142	54	90	
Total All									
	Personnel	186,000	2,000	209,147	1,924	76			
	Travel	1,658,912	17,838	1,099,927	10,119	7,719	1,078,647	9,923	
	Equipment	149,400	1,607	119,550	1,100	507			
	Supplies	30,000	323	2,490	23	300			
	Other	397,000	4,268	310,570	2,857	1,411		90	US Bank Charges
	Total	2,421,312	26,036	1,741,684	16,023	10,014	1,078,647	10,013	
Funds Transferred	Date	Vatu	US	Exchange Rate					
	19-Sep-15	1,089,963	9,954	109.5000					
	26-Sep-15	1,074,037	9,954	107.9000					
		2,164,000	19,908	108.7000					

Annex 4

Objective & #	Item	Original budget Vatu	Original budget US\$	Actual Expenses Vatu to April 30 2015	Expenses US\$ April 30 2015 based on Sept 2015 exchange rate	US\$ Remaining based on exchange rate Sept 2015	Expenditures May 1 2015 to April 30, 2016 Vatu	Expenditures May 1 2015 to April 30, 2016 US\$	Notes
Final Transfer			6,128						Exchange gain 14.44%