



Marine Conservation Action Fund

PROJECT REPORT

Project Title: Marine Turtle Monitoring Programme in Tonga

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1. BACKGROUND

SPREP, in collaboration with the Tonga Departments of Environment and Fisheries, prepared and submitted the proposal to the Marine Conservation Action Fund (MCAF), to fund this project.

Six of the seven recognized marine turtle species in the world are found in the Pacific Ocean. Of the six marine turtle species found in the Pacific, two are listed by IUCN as "critically endangered", three "endangered" and one being data deficient. There is very little information available in the Pacific Islands region on turtle populations and other parameters necessary to formulate appropriate management strategies.

Four species of marine turtles have been reported to occur in Tonga: hawksbill turtle (*Eretmochelys imbricata*, known locally as *fonu koloa*), green turtle (*Chelonia mydas*, known locally as *tu'auli*), leatherback turtle (*Dermochelys coriacea*, known locally as *fonu leta*) and loggerhead (*Caretta caretta*, known locally as *tungange*). Two of these turtle species have been reported to nest in Tonga, the green turtle and the hawksbill. However, hawksbill turtle is reported to be the most common nesting turtle species.

In Tonga, marine turtles are harvested and turtle meat is a traditional delicacy. Turtle harvesting is managed under Fisheries legislation and a closed season (August-February) to harvesting of turtles is in force during the peak turtle-nesting season. It is believed that there is substantial turtle harvesting when the season is open and live turtles are often seen being transported from the outer islands to the main island, Tongatapu, on inter-island ferries for family use and commercial sale.

The project attempted to address the issue of limited data/information by initiating a monitoring programme, particularly nesting turtle population and to conduct nesting turtle monitoring on the selected nesting beaches/islets.

Specifically, the project requested for funding to carry out the following activities:

- The purchase of basic turtle monitoring equipment such as measuring tapes, waterproof torches, waterproof paper, GPS and a computer for data storage and analysis.
- In-country training and planning.
- Turtle nesting monitoring surveys including camping on nesting beaches at night to tag, count and take measurements of nesting turtles. Costs included mainly petrol for boat, food and overnight allowances where required.

SPREP provided turtle tags and applicators as well as funding the Marine Species Officer in-country visit to assist in the development of national turtle programmes and participate in the set-up and start of the beach turtle nesting monitoring survey. In addition, SPREP also funded all costs associated with the visit by the Associate Turtle Database Officer to conduct training and install the Regional Turtle Research Database System (TREDS) in Tonga.

The conduct of the programme was a collaborative effort between SPREP and the Tonga Departments of Fisheries and Environment and a community representative.

2. PROJECT COMPONENTS/ACTIVITIES

2.1 IN-COUNTRY TRAINING AND PLANNING

2.1.1 Survey form and guidelines development

The survey forms used to record data and information for turtle track/nests and nesting turtle surveys were developed before the start of the project. These forms were further refined in consultation with the Tonga Departments concerned during the in-country training prior to the conduct of the initial surveys.

In addition to forms for recording data, guidelines were also developed to help in the conduct of the surveys and in marine turtle species identification.

2.1.2 Training

The training aspect of the project included four components:

- Classroom presentations and discussions,
- Practical outdoor training on flipper tagging and tissue sample collection,
- Field practicals, which were also the first survey activities of the project, and
- TREDS.

Two training workshops, as discussed below, were conducted by the SPREP Marine Species Officer (MSO) during the course of his visit to Tonga in December 2007. In addition, installation of the database and training of relevant officers in the use and entering data into the Regional Turtle Database System was conducted by the SPREP Associate Turtle Database Officer. The field survey work conducted also presented the opportunity for hands-on training in the field.

(i) Class room training with presentations and discussions

The first workshop was conducted before carrying out the initial survey activities and was a full day. The agenda for this workshop is attached as Annex 1.

Participants

A total of 14 representatives from the Tonga Departments of Environment and Fisheries participated. These included members of the core survey team from both Departments.

Presentations

The 1-day training workshop included presentations and discussion on the following topics:

- Over-view of the status of marine turtles



Figure 1: Participants of the Tonga Marine Turtle Workshop, Nuku'alofa, Tonga, 27 November 2007

globally and in the Pacific Islands region;

- Known information on marine turtles in Tonga;
- Generalised Marine Turtle Life Cycle;
- Marine Turtle Species Identification;
- Turtle Movement in the Pacific Islands Region-results from Satellite Tagging;
- Collecting Turtle Nesting Data;
- Guidelines to Turtle Track/Nest Beach Surveys;
- Guidelines to Turtle Nesting Surveys;
- Turtle Measurements Guidelines;
- Turtle nesting monitoring data form;
- Turtle nesting survey schedule for the 2007/2008 Nesting Season.

(ii) Practical exercises for the Core Survey Team

The second workshop was conducted after the completion of initial surveys and was mostly on practical exercises.

Participants

The second training workshop involving practicals was specifically for the survey team and the community representative from the group of islands selected for the turtle nesting monitoring programme. The Core Survey Team consisted of the following:

- Mr Tevita 'Ahoafi, Technical Fisheries Officer/OIC Ha'apai Branch, Department of Fisheries;
- Mr Samiuela Palaki (substitute for Mr Malakai Finau¹, Assistant Conservation Officer), Department of Environment.
- Mr Tali'uli Uasi, from the village on 'O'ua Island.

In addition, a Tongan MSc student (Ms Sulieti Havea) was also involved in the second workshop as her thesis will be on turtles in Tonga.

Topics

The practical exercises included conducting turtle measurement, flipper-tagging, collecting and storing tissue samples from turtle for genetic analysis, species identification and data/information recording using forms devised. For the exercises, two live turtles (1 hawksbill and 1 green) were obtained from a fisherman and used for demonstration.

(iii) Turtle Database

The SPREP's Associate Turtle Database Officer conducted a 1-day training for 5 staff from both the Departments of Fisheries and Environment on the use of the regional turtle database (TREDS). In addition TREDS was installed on computers at both Departments.



Figure 2(i): The Tonga Turtle Survey Team with MSO and MSc student



Figure 2 (ii): Community representative from 'Oua Island tagging a green turtle during the practical session.

¹ During MSO visit, Mr Finau was undertaking a turtle training in Australia funded by SPREP.

(iv) Field work surveys

The survey activities presented the opportunity for first-hand experience in the recognition of turtle nests, tracks as well as the recording of data using forms developed.

(v) Review of Work Plan to be Completed

After the fieldwork and prior to the departure of MSO, an indoor session was also conducted with the survey team and including senior representatives from both the Fisheries and Environment Departments. This session included reviewing of the survey schedules, responsibilities and tasks to be performed during each survey, i.e. daytime track and nest survey as well as the night surveys.

2.2 TURTLE NESTING MONITORING

2.2.1 Islands selected for Turtle Nesting Monitoring

The original plan was to select two of the most important known nesting beaches (on islets) for monitoring, based on earlier turtle surveys. The only turtle nesting surveys ever conducted in Tonga were in the early 1970s. The results of those surveys indicated that highest turtle nesting occurred in Central Ha'apai, particularly on the islet of Fonua'ika. Other nearby islets with reported turtle nesting included Nukulei, Luanamo and Lekaleka. Subsequently, these islets, except Lekaleka, were selected as the target sites for monitoring during this project. Figure 3(i), under the figures section at the end of the report, shows the location of the selected islets in relation to the whole Tongan Group of islands. Figures 3(ii) shows the location of the selected islets in relation to each other and the Island of 'O'ua and Ha'afeva.

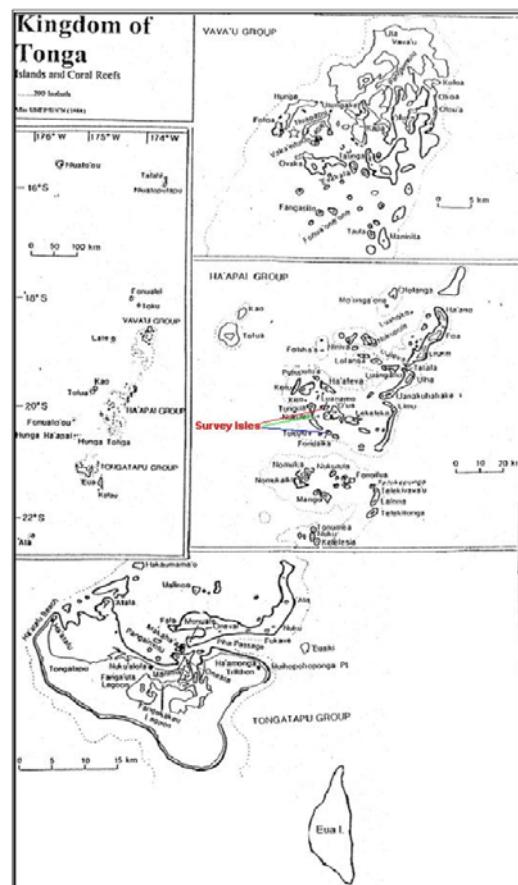


Figure 3(i): Map of Tonga showing location of Islets where surveys were undertaken.

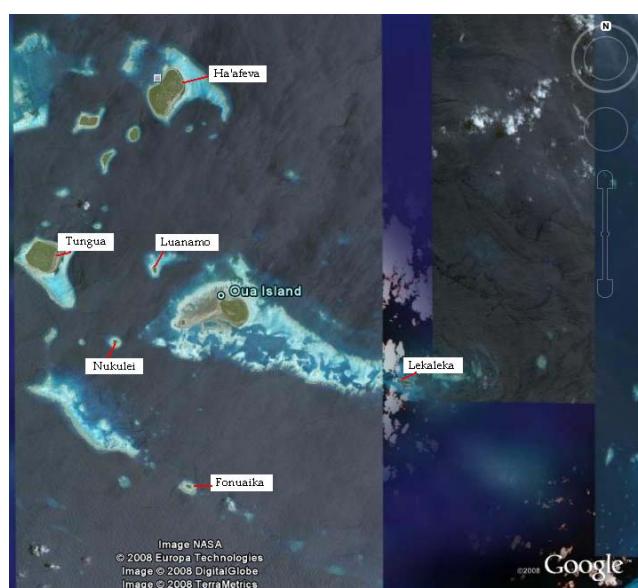


Figure 3(ii): Map of islets selected for turtle nesting monitoring, Central Ha'apai, Tonga

2.2.2 Turtle Nesting Monitoring Strategy/Activities

The turtle nesting monitoring programme initiated and developed encompassed the following two main components for turtle nesting:

(i) Day-time turtle nest and track surveys

These surveys were scheduled to be conducted at least once a week (Mondays and Fridays), when the islets are visited in the morning to check for turtle tracks/nests. The agreed schedule for these surveys is attached as Annex 2.

The conduct of this survey follows the guidelines in Annex 3 and involves the following:

- Looking for turtle tracks on the beach and above the high water mark (including among coastal vines etc) and recording, noting that Upward track + downward track = 1 total track (1 turtle). While tracks on the sand are obvious, tracks through the vines are observed where there is an obvious track with the vines flattened or depressed. The direction where vines are flattened in the middle of the track is the direction of the turtle movement.
- If a track was undetermined, either not obvious whether a track or not, or the direction of track was unclear, it was still noted down but marked "undetermined track" or "undetermined direction" on the form.
- When a track was located and recorded, it was then followed landwards to see whether it lead to a nest and recorded. When a nest was located, it was marked so it won't get counted again in following visits.
- After a track was recorded, it was then covered with sand and marked, if it went through the vines, to avoid recounting in subsequent surveys.

During the SPREP's MSO visit in December 2007, daytime track and nest surveys were conducted on 1st, 2nd and 4th December 2007 on the target islets, Fonuaika, Nukulei and Luanamo, as well as a visit to Lekaleka Isle. Additional surveys were conducted by the Team members based in Tonga where new turtle nests were recorded on 21st and 31st of December 2007, 31st of January 2008 and 4th of February 2008.

(ii) Night-time nesting turtle survey

These surveys involved camping on the isles at night and were scheduled according to the occurrence of high tides during the night. The protocol adopted for this survey was as follows:

- Start patrolling the beach about one hour before the time the highest tide occurred
- Continue patrol at ½ to one-hour intervals until about two hours after the highest tide occurrence.
- Patrolling involves walking along the beach (using minimum light) along the tide level and looking for turtle tracks on the sand.
- When a track is found, it is followed landwards to locate the turtle.
- The turtle is left alone if it is still looking for a place to nest, digging or nesting. Measurements, tagging and tissue sampling are only done after the turtle has completed the nesting process which includes covering the nest.

During the SPREP's MSO visit in December, it was only possible to "camp" for one night each on Nukulei and Luanamo. The camp night scheduled on Fonuaika was cancelled due to rough weather. The schedule after the MSO visit to be conducted by Tonga-based Team members was for every fortnight on two selected islets for two nights each. Flipper tagging, measurements and tissue sampling were to be carried out on any turtle that come up to nest and "caught" during the night survey.

2.2.3 Other associated surveys/activities

(i) Turtle landings for consumption/sales

This component was not possible during the project period due to financial constraints but the Fisheries Department will implement fish landing surveys that will include turtle landings once funds are available from donor for the fisheries data collection programme.

(ii) Turtle flipper tagging and tissue sampling

Turtle flipper tagging is an on-going project of SPREP. For the Tonga turtle project, flipper tags and applicators were provided to both the Tonga Fisheries and Environment Departments. In addition, tags and applicators were also provided to the post-graduate student from Tonga, as well as the community representative from 'O'ua. The distribution of tags and applicators was an effort to maximum this activity within Tonga. Thus, in addition to tagging turtles that come up to nest, any other turtles found during the project would be tagged and released.

Tissue samples were collected from the two sub-adult turtles caught by a fisherman that were used for practical sessions as reported under 2.1.2 (ii) above. The tissue samples were given to the Tongan post-graduate candidate for analysis as part of her MSc project. Both turtles were flipper-tagged and released into the wild.

3. RESULTS AND DISCUSSION

3.1 SURVEY FORMS

The main form developed for turtle nesting survey work is the "Turtle Nesting/Foraging Monitoring". This is attached as Annex 4. The form was developed to accommodate details of a turtle actually "caught/found" (nesting or otherwise) as well as for use to record findings of daytime surveys for turtle tracks and nests. The information included on the form is the basic information needed for proper assessment. A secondary form was also developed for daytime turtle and track survey for the community participant and for summarising the results. This is attached as Annex 5.

3.2 GUIDELINES

For use in the training workshop as well as for further referencing by the survey team as well as for use as guidance for new "turtle survey personnel", several guidelines were developed and used. These include:

- *Nesting Turtle Survey-General Guidelines*: This guideline is based on other existing guidelines and adopted and covers such topics as activities on the beach, watching a turtle nest, taking photographs, taking measurements and guidelines concerning turtle hatchlings. These guidelines are attached as Annex 6.
- *Some Guidelines for Turtle Track/Nest Survey*: This provides summary information on how the actual daytime track and nests survey is conducted. This is attached as Annex 3.
- *Turtle Measurements Guidelines*: This guideline provides detailed figure illustrations of each of the measurement included in the "Turtle Nesting/Foraging Monitoring" form. Each illustration is accompanied with a brief description on how the measurement is done and end points for the measurement. This is attached as Annex 7.
- *Marine Turtle Identification Sheet*: A marine turtle identification sheet was also produced but limited to the six marine turtle species found in the Pacific. This is attached as Annex 8.

3.3 TRAINING

3.3.1 Classroom presentations and discussions

A total of 14 representatives from both the Departments of Environment and Fisheries participated in this full one-day workshop. This included the core turtle survey team. Even though sufficient time was allocated for discussion at the end of each presentation, more time was devoted to the following topics (which were directly linked with the surveys) to ensure clear understanding, particularly by the survey team:

- Marine Turtle Species Identification;
- Collecting Turtle Nesting Data;
- Guidelines to Turtle Track/Nest Beach Surveys;
- Guidelines to Turtle Nesting Surveys;
- Turtle Measurements Guidelines;
- Turtle nesting monitoring data form;
- Turtle nesting survey schedule for the 2007/2008 Nesting Season.

Electronic copies of all presentation discussed during the one-day training workshop were provided to both Departments for reference and further use.

3.3.2 Practical outdoor training on flipper tagging and tissue sample collection

Obtaining two live sub-adult turtles (2 different species-one hawksbill turtle and one green turtle) for the practical exercise on taking measurements, tissue sampling and species identification was very valuable. The MSO first demonstrated taking measurements and tissue samples followed by each of the survey team including filling in the form. The hands-on exercises on live turtles provided the opportunity of conducting the actual work that needs to be carried when dealing with turtles in the field. This helps in building confidence and avoids guessing and reference to notes.

The full survey team consisting of one representative from each of the Departments of Environment and Fisheries, the representative from the 'O'ua community as well as the Tonga MSc student, participated in these activities.

3.3.3 Turtle database (TREDS)

Following on from the fieldwork, a training was conducted at Fisheries for Fisheries and Environment staff to become familiar with the workings of the TREDS. Training included data entry and simple reporting available in TREDS. Five representatives from both the Departments of Environment and Fisheries were involved. TREDS was installed in the offices of Fisheries and Environment. The 2 main contacts for TREDS in Tonga are Ms. Lavinia Vaikona of Fisheries and Mr. Siua Latu of Environment.

3.3.4 Field work activities

The full survey team, including the representative from the village of 'O'ua, participated in the first survey activities on the selected isles. Even though there were no new nests nor any turtle tracks located, it was an opportunity to identify turtle nests and suitable areas to look for nests. As shown in Table 1, several old nests were located. The field work also presented the opportunity to plan and execute the night surveys according to the tide. Details are discussed under 3.5.

3.4 SELECTION OF SITES

Similar to all islands in Tonga with reported turtle nesting activities, the selected islets for the project are uninhabited. The closest inhabited island is 'O'ua. In addition to the reported turtle nesting activities, the islets selected in Central Ha'apai are easily

accessible from 'O'ua for conducting the surveys. The island of 'O'ua has recently established a marine Special Management Area under a Fisheries Department programme, and this presents a good opportunity to include turtle monitoring in that programme. This would also make it convenient for the surveys whereby the representative from 'O'ua can easily conduct daytime track and nests surveys, with 'O'ua serving as a good base for the night surveys. The island of 'O'ua is very close to the Island of Ha'afeva which has a port servicing inter-island ships from Nuku'alofa and back. On days with good weather conditions, 'O'ua can also be accessed by small boats (2-3 hours) from Pangai, which is also a port of call for the inter-island ships returning from Pangai on their way to Nuku'alofa. Pangai has an airstrip with daily domestic flights, except Sundays, from Nuku'alofa.

3.5 TURTLE NESTING SURVEYS

The results from turtle nesting surveys conducted during this project and those reported in earlier surveys are recorded in Table 1 and Table 2 respectively (included at the end of the report under the Tables section).

3.5.1 Fonuaika

A total of ten new turtle nests were recorded on Fonuaika during the survey period, December to February. The highest number of new nests, five, was recorded in December with two and three new nests recorded in January and February respectively. The last survey in February was conducted on 25th.

Table 3 compares results of the present survey to those conducted before on Fonuaika. The 1971/72 survey recorded 12 turtle nests (including nine x 1-3 weeks old nests) in the first half of December 1971 while the 2007/2008 survey recorded only five nests during the whole month of December 2007. It is possible that the number of nests in December 1971 could be higher than that reported given that the survey was only conducted on 15th-20th of December. The 2007/2008 surveys covered three different dates in December including the last day of the month. Thus all nests within the month would have been picked up.

Table 3: Results from turtle nesting surveys conducted on Fonuaika, Central Ha'apai.

FONUAIKA	DEC 1971/JAN 1972	DEC 2007/JAN 2008
	SURVEY DATES: 15-20 DEC 1971	SURVEY DATES: 1, 21,31 DEC 2007
	NUMBER OF NESTS	NUMBER OF NESTS
December	<ul style="list-style-type: none"> 1 turtle nested (15? Dec, between 10 pm -12 midnight – turtle was not seen) 9 old nests (1-3 week old) 2 new nests (1-2-days old) 	<ul style="list-style-type: none"> 2 old nests on 1 Dec 07 (thus before Dec) 2 new nests on 21 Dec 07 3 new nests on 31 Dec 07
	SURVEY DATES: NONE	SURVEY DATES: 31 JAN 2008
January		<ul style="list-style-type: none"> 2 new nests on 31 Jan 08
		SURVEY DATES: 4 FEB 2008
February	SURVEY DATES: NONE	<ul style="list-style-type: none"> 3 new nests on Feb 08

3.5.2 Nukulei

A total of six new nests were recorded on Nukulei during this project on the same survey dates as Fonuaika, with the highest number, four, recorded at the end of December. One new nest each was recorded in January and February. The last survey conducted in February 25th. Table 4 records results of the surveys conducted on Nukulei.

Table 4: Results from turtle nesting surveys conducted on Nukulei, Central Ha'apai.

NUKULEI	DEC 1973		DEC 2007/JAN 2008	
	SURVEY DATES: 2-6 DEC 1973 & 22-24 DEC 1973	NUMBER OF NESTS	NOTES	NUMBER OF NESTS
December	<ul style="list-style-type: none">1 nester (Green turtle) came up to nest on 4 Dec at 9.25 – 11.45 pm4 nests found, also found tracks on 22 Dec thus nesting night of 21 Dec (2 nests dug and eggs taken)		<ul style="list-style-type: none">nest later found dug	<ul style="list-style-type: none">3 very old nests on 1 Dec 074 new nests on 31 Dec 07
	SURVEY DATES: NONE			SURVEY DATES: 31 JAN 2008
January				<ul style="list-style-type: none">1 new nest on 31 Jan 08
	SURVEY DATES: NONE			SURVEY DATES: 4 FEB 2008
February				<ul style="list-style-type: none">1 new nest on 4 Feb 08

In comparison to the earlier survey in 1973 during which five nests were recorded in December (including observation of one nester coming up to lay eggs), the December 2007 survey recorded only four nests for the whole month. In addition, the 1973 survey only covered the period 2nd-6th of December, whereas the 2007 survey can be considered to have covered the whole month given that surveys were conducted on three different dates within the month including the last day of the month. Thus there is a very high likelihood that more than five nests were laid within December in 1973.

3.5.3 Luanamo

No nest was recorded on Luanamo throughout the duration of the survey. It was later discovered that pigs were present on the island. This explains the diggings found on the coast of the island that looked like someone digging up turtle eggs or digging for land crabs.

Table 5 records results of surveys conducted on Luanamo. The 1973 survey recorded one nester coming up onto the beach but didn't nest. From the records it seems that it did not return the following day. It is unfortunate that the 1973 did not cover the later part of December to see whether any nesting ever took place on the island during that month. The 2007/2008 survey did not record any new nesting except those that looked like very old nests discovered on 1st of December 2007. However, these are most likely to be from pigs later reported to be on the island.

Table 5: Results from turtle nesting surveys conducted on Luanamo, Central Ha'apai.

LUANAMO	DEC 1973	DEC 2007/JAN 2008	
	SURVEY DATES: 8-10 DEC 1973	SURVEY DATES: 1, 21, 31 DEC 2007	NUMBER OF NESTS
December	<ul style="list-style-type: none">1 Green turtle came to nest on Dec 9 between 10.05-11.00 pm (but did not nest?)	<ul style="list-style-type: none">2 possible old nests 1 Dec 07No new nests	<p>The survey team later learnt that pigs were on the island and these "nests" could be from them</p>
	SURVEY DATES: NONE	SURVEY DATES: 31 JAN 2008	
January		<ul style="list-style-type: none">No new nests	
	SURVEY DATES: NONE	SURVEY DATES: 4 FEB 2008	
February		<ul style="list-style-type: none">No new nests	

3.5.4 Islets in Tonga where Turtle Nesting Occur

Groombridge and Luxmoore (1989) reported that turtle nesting appeared to be widespread in southern Vava'u and central Ha'apai and with the exception of Malinoa Islet, no turtle nesting has been recorded in the Tongatapu Group.

In the Vava'u Group, five or six islets were reported to have turtle nesting occurring. However the 1973 survey covered only four of these islets with nests recorded on three of them as listed in Table 2.

For the Ha'apai Group, interviews with Ha'apai fishermen in 1973 indicated that turtle nesting occurred on 28 islets (Fisheries Section, 1974). The majority of the fishermen interviewed identified Luahoko, Luanamo, Fonuaika and Nukufaiau as good turtle nesting islets. Wilkinson (1979) reported a fisheries survey conducted in May 1973 in Ha'apai that reported 28 islets (same islands as reported in Fisheries Section 1974 except Mangoiki) as hawksbill turtle nesting islands. However, the 1971 and 1973 surveys that covered 15 of these islets found turtle nests or signs of nesting on only eight islets. The results are recorded in Table 2. In addition, MSO and the Fisheries Officer in Charge in Ha'apai visited Luahoko and Uoleva in January 2007 and did not find any signs of turtle nesting there. The islet of Luahoko is also believed to be now unsuitable for turtle nesting due to steep shoreline and ruggedness in most parts of the islet.

For the Tongatapu Group, turtle nesting has only been reported to occur on Malinoa islet.

3.5.5 Turtle Species Nesting in Tonga

It has been reported that both green and hawksbill turtles nest in Tonga. It has also been reported that hawksbill nesting is more common than green turtles. For example, Wilkinson (1979) reported that a fisheries survey conducted in May 1973 in Ha'apai found that hawksbill nested on 28 islets in Ha'apai. However, it is likely that this refers to turtles nesting in general rather than specific to hawksbill turtle nesting. Groombridge and Luxmoore (1989) noted that nests and turtles identified in the 1971 and 1973 surveys were all green turtles. The non-encounters with nesters during the night surveys during this project made it impossible to ascertain species nesting on the target islets. No attempt was made to "allocate" nests recorded during the project to species in case of errors due to inexperience of the team in this particular area. This is probably a consideration for inclusion if the surveys will be repeated in the next nesting season.

The 1973 survey that covered all of Tonga recorded only the following information with regards to turtle species nesting:

- **Nukulei:** During surveys conducted on 2nd-6th of December 1973 on this islet, one nester (tu'a'uli-green turtle) came up to nest on 4th of Dec at 9.25 –11.45 pm.
- **Luanamo:** During surveys conducted on 8th-10th of December 1973, one green turtle came to nest on 9th of December, between 10.05-11.00 pm (but did not nest?).
- **Nuku (big):** During surveys conducted on this islet on 16th-19th of December 1973, it was reported that a fonu koloa (hawksbill) was taken and eaten before it laid eggs.
- **Kelefesia:** Surveys were conducted on this islet during 19th-20th of December 1973. No sign of any nesting was observed. Last reported nesting was in 1965. It is believed that both hawksbill and green turtles nested on this islet.
- **Mangoiki:** Surveys were conducted on this islet on 26th and –27th of December 1973. No turtle came to nest during the surveys and there were no signs of nesting either. It

was reported though that both green and hawksbill turtles used to nest on this islet but the last time nesting was observed was 2-3 prior to the surveys.

3.5.6 Turtle nesting numbers

During the 1971 and 1973 turtle nesting surveys, only single or a few nests were recorded on islets surveyed. On Vava'u, the highest number of nests (four old nests and one new one) was recorded on Maninita in the survey conducted on 22nd – 25th November of 1973. For Ha'apai, the highest number of turtle nests was recorded during the survey on 15th – 20th of December, 1971 on Fonuaika when nine 1-3 weeks old nests and 2 new nests were recorded. During the 2007/2008 survey on Fonuaika, two old nests were recorded at the beginning of December, five new nests were recorded during December, two new nests in January and three new nests in February. This is a total of 12 nests in more than 3 months. This translates to only very few individual nesters given the possibility of 1 nester laying 1-5 clutches per nesting season. For Nukulei, the 2 surveys (total of 8 days) conducted in December 1973 encountered 1 nester coming up to nest and 4 nests, whereas the 2007/2008 surveys recorded four new nests for the whole month of December.

The earlier surveys concluded that while turtle nesting in Tonga seemed widespread, it was extremely sparse. The 2007/2008 surveys on Fonuaika confirm this and the points to declining number of nests when comparing December data.

3.6 OTHER ASSOCIATED ACTIVITIES AND OBSERVATIONS

3.6.1 Flipper tagging and tissue sampling

Due to non-encounters with any nesters during the night surveys, no other turtles were flipper-tagged during the project except the two that were tagged during the training. The information collected on these two turtles are as follows:

- Green turtle: sub-adult; tags-right side, R31174 left side; CCL-40.5 cm; CCW-38.8 cm.
- Hawksbill turtle: sub-adult; tags-R31198 left side, R31197 right side; CCL-34.5 cm; CCW-32.7 cm.

The tissue samples collected from the two turtles were kept in small vials with DMSO and given to the Tongan MSc candidate for analysis she could include in her thesis.

3.6.2 Regional Turtle Database (TREDS)

The turtle database was installed at both the Departments of Environment and Fisheries with relevant staff trained during the project. The trained staff are able to enter data and generate reports from the database. The information on the two turtles tagged during the project was entered into the regional turtle database. A total of 12 turtle tag records have been recorded for Tonga in the database, seven of which are turtles originally tagged in Tonga. The other five records involving Tonga are all green turtles (except one unidentified) that were tagged in French Polynesia and recaptured in Tonga. One interesting recapture is that of a green mature female tagged on Scilly Atoll in French Polynesia in 1972 and recaptured in Vava'u later in the same year. Of the turtles tagged in Tonga, only one has been recaptured, which was on Ono-i-Lau, Fiji. This was a green turtle tagged in Tonga in 1975 and recaptured in Fiji in 1980.

The information on the tagged turtles, involving Tonga, contained in TREDS is recorded in Table 6 below and Figure 4 depicts turtle migration from recapture records involving Tonga.

Table 6: Information on tagged turtles involving Tonga as recorded in TREDS.

Tagging Information					Recovery Information		
Tag no.	Species	Sex	Date	Location where Tagged	Date	Location Recovery	fate
1. Turtles tagged in Tonga							
T755	Green	I	?/5/1975	Tonga	25-Dec-80	ONO-I-LAU, FIJI	??
R31128/R31127	Green	I	6-Dec-07	Tongatapu Island			
R31130/R31129	Hawksbill	I	6-Dec-07	Tongatapu Island			
R31131	Hawksbill	I	26-Jan-07	Tongatapu Island			
R31132/R31133	Hawksbill	I	26-Jan-07	Tongatapu Island			
R31174/R31173	Green	I	26-Jan-07	Haatafu, Tongatapu Is			
R31198/R31197	Green	I	26-Jan-07	Tongatapu Island			
2. Turtles tagged outside Tonga and recovered in Tonga							
R10306/R10307	Green	I	21-Jun-96	Tahaa, French Polynesia	28-Nov-96	Tongatapu Island	RA
R10451/R10452	Green	I	9-Jun-97	Tahaa, French Polynesia	12-Mar-98	Lifuka Is, Haapai	?
R9695	Green	I	25-Nov-97	Tahaa, French Polynesia	?-?2000	Hihiho, Ha'apai	??
S768	?	?	?	French Polynesia? No initial tagging record	25-Jul-94	Sopu Beach, Tongatapu	??
18	Green	F	30-Apr-72	Scilly Atoll, French Polynesia	8/9/1972	VAVAU ISLAND, TONGA	?

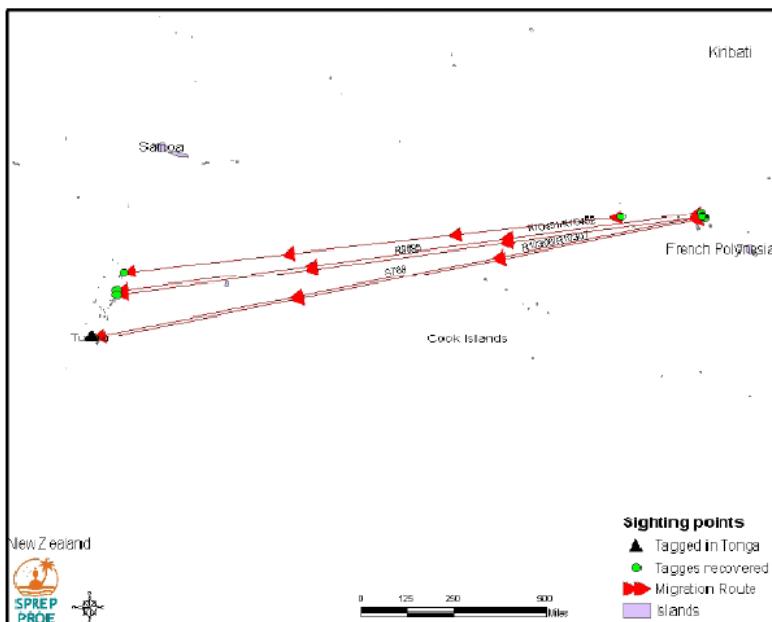


Figure 4: Turtle movements from flipper tagging for turtles involving Tonga as recorded in TREDS.

(iii) Coastal erosion

A major problem to turtle nesting that is very apparent is the very high coastal erosion on the islets. The situation in Tonga is very similar to that in Tuvalu. The southern sides of all of the islets surveyed in Tonga are mostly (if not all) too steep (resulting from erosion) making it impossible for any turtle to crawl up to suitable nesting areas above the high water mark (Figure 5(i)). In addition, fallen vegetation and vegetation growth at the edges of the high-water mark make it impossible for turtles to reach suitable nesting areas (Figure 5(ii)).



Figure 5(i): Coastal erosion on islands where turtles nest is a real problem in Tonga as seen here on one of the target islands where good nesting areas have been washed away.

3.7 LEGISLATION PROTECTING MARINE TURTLES IN TONGA

The protection and management of marine turtles in Tonga is covered under Fisheries legislation that covers all four species of turtles reported to occur in Tongan waters. Under the Fisheries (Conservation and Management) Regulations 2006 it is illegal to:

- disturb, take, have in his possession, sell or purchase any turtle eggs;
- interfere with or disturb in any way any turtle nest;
- use a spear or spear gun for the purpose of capturing, destroying or taking any species of turtle;
- at any time fish for, harm, capture or destroy any male turtle the shell length of which is less than 45 centimetres as illustrated in Schedule 9;
- fish for, harm, capture or destroy any male turtle during the closed season specified in Schedule 12; or
- at any time fish for, harm, capture or destroy any Leatherback turtle of the species *Dermochelys coriacea*;
- sell turtle meat out of the shell, unless it has been certified by an authorised officer that it came from a turtle of legal size.
- fish for, harm, capture or destroy any female turtle.



Figure 5(ii): Not only is the suitable sand for turtle nesting lost but fallen vegetation make it impossible for turtles to reach nesting areas.

The closed season for taking male turtles is from August to February. The taking of female turtles and leatherback turtles is prohibited all the time.

4. RECOMMENDATIONS

The 1971 and 1973 surveys covered most of the islets in Tonga known to have turtle nesting activities. It was the results of these survey on which the selection of sites for the current project was based.

Even though the earlier surveys were limited in terms of duration for each site surveyed, the results clearly illustrated then the low status of nesting turtle population in Tonga. The current project (2007/2008) surveys, centred around one of the islets, Fonuaika, which had the highest number of nests recorded in the 1971 surveys. The results of the 2007/2008 surveys indicate a further decline in this small nesting population. In comparing nests recorded in December alone, the current project virtually covered the whole month but with less numbers of nests compared to earlier surveys for only part of the month.

The number of nests recorded during the survey translates to very few individual nesting turtles on these islets. The results also seem to indicate that December is the peak turtle-nesting month, especially towards the end of that month.

The 1970s surveys reported harvesting of turtle eggs as a major problem, along with the taking of nesting turtles. It was not possible to determine during the 2007/2008 whether the taking of turtle eggs and nesters is still practised.

As reported above, another major problem facing the small nesting turtle populations in Tonga is coastal erosion, making many parts of the major turtle nesting islets unsuitable for nesting or difficult for nesters to reach suitable areas for nesting.

The decrease in numbers of nests recorded is coupled with an increase in portions of the islets becoming unsuitable for nesting due to climatic conditions. There is also a decrease in the number of islets on which turtle nesting take place.

From the above information and results of the surveys during this project, the following recommendations are made:

- The strategy used in this project is suitable, considering available resources, for adoption to expand turtle nesting surveys to other islets where turtle nesting are known. Another consideration for priority areas are those areas covered under the Fisheries Programme establishing Special Management Areas.
- Surveys should be continued for the next turtle-nesting season targeting the same islets, Fonuaika and Nukulei. The regional Marine Turtle Action Plan 2008-2012 recommends the collection of baseline data through nesting beaches surveys for at least 5 years to obtain meaningful information. Accordingly, remaining funds from the MCAF could be used to conduct field surveys in the next nesting season. This includes diverting funds targeted for a computer to field surveys, if acceptable. Given the resources available, efforts should concentrate on the weekly daytime monitoring by the 'O'ua community team member. However, both the Departments of Environment and Fisheries team members should ensure that these daytime surveys are consistently conducted by the 'O'ua team member through regular communication and timely provision of necessary funds to 'O'ua. It may also be preferred that the monitoring be taken over as a responsibility of the 'O'ua Special Management Area committee. Monthly visits by the team members from the Departments of Environment and Fisheries could still be conducted once a month for night surveys to tag, take measurements and identify species. Data collected by the 'O'ua team member should be collected during these visits and compiled on the form provided as Annex 5. This should preferably be in electronic form. However, if additional funds would be available, it is preferred that there be an increase in effort/frequency for the night surveys to identify species nesting and conduct tagging as well as expanding the survey period from October to March.
- Initiate a data collection programme on the use of turtles for consumption/sale, either as part of the Fisheries landing data collection or as a separate and simple inexpensive collection system. SPREP can assist in devising this data collection system. This data can be obtained from:
 - the markets and along the road, and
 - inter-island ships that dock in Nuku'alofa from the outer islands when the season for turtle is opened. Collection of tissue samples should also be part of this data collection. (Note: SPREP has provided the Department of Environment with a biopsy kit which can be used for storage/shipment of turtle tissue samples. Turtle tissue samples can be sent to USP for onward shipment for analysis in Australia).
- Recognize marine turtles as one of the more important species and that collection and monitoring data on them be incorporated in the data information gathering by communities with Marine Special Management Areas established by the Fisheries Department. Turtle flipper tagging should become a component. Community involvement in turtle monitoring and conservation is vitally important.
- Continue the efforts to "catch" a nesting turtle for satellite tagging. There is no data/information available as to where turtles that nest in Tonga forage. This information is important in determining breeding stocks etc. SPREP could be responsible for this activity with support of the Tonga Departments of Fisheries and Environment.
- While excellent legislation on the conservation of marine turtles in Tonga is in place under the Fisheries regulations, public awareness and enforcement are of paramount

importance given the status of the existing breeding population. Other considerations should also be initiated to accommodate the likelihood of a huge increase of effort for catching turtles when the season is opened.

- As a long term goal, the establishment a national “volunteer” turtle monitoring network, starting with both Departments (Fisheries and Environment), hotel owners on the outer islands, and communities involved with the Fisheries-assisted Special Management Areas would be beneficial. This type of network is working very well in Vanuatu and is a sustainable means in the light of limited resources and expanse of islands.

5. FINANCIAL REPORT

5.1 FUNDS FROM MCAF

The project budget as approved by MCAF is shown in Table 7 with corresponding activities and items. All of the funds from MCAF were sent directly to SPREP where funds for field activities were transferred directly to the Department of Environment, Tonga. An account was specifically set up in Tonga Treasury for the activities of the project.

Table 7: Project Budget, provided by MCAF

Item	COST (US\$)
Training	
Refreshments	200
Monitoring surveys associated costs	
Track/nest day surveys	
Boat fuel (for 31 days)	1,550
Nesting turtles/overnight surveys	
Boat fuel (for 24 nights)	1,200
Camping food and water for 4 officers for 24 nights	650
Out-of-base camping allowance for 4 officers for 24 nights	1,440
Equipment	4,000
Waterproof torches, measuring tapes, waterproof paper, GPS, computer	
SPREP support fee	940
Total	9,980

The total MCAF funds were transferred directly to SPREP. The disbursement of the funds from SPREP is summarised in Table 8 below.

Table 8: Disbursement/use of funds from SPREP

	Amt \$	Equiv US\$	US\$
• Funds received			9,980
• Funds transferred to Tonga	US\$5,262	5,262.00	
• Purchase of GPS and waterproof paper	NZ\$925.44	606.36	
• Administration fee	US\$940	940.00	
Total		6,808.36	
<i>Balance remaining at SPREP</i>			<i>3,171.64</i>

The statement of expenses of the funds transferred to Tonga is summarised in Table 9 below.

Table 9: Summary of expenses for Funds transferred from SPREP to Tonga.

Item/Activity	Amount in US\$	Amount in TOP ²	
Funds transferred from SPREP	5,262.00	9,824.84	
• Account administration fees		64.00	
• Bank fee fund transfers to outer island		42.00	
• Return ticket to survey site		290.00	
• Training		2,762.00	
• Awareness workshop		452.00	
• Turtle field surveys		6,171.80	
Total (TOP)		9,781.80	
<i>Balance remaining in Tonga</i>			<i>TOP 43.04</i>

² TOP=Tongan Pa'aga

The overall budget expenditures and balances are summarised in Table 10 below. The remaining balance is made up almost entirely of US\$3,171.64 at SPREP. These remaining funds are from the equipment item of which a computer is the remaining major item.

Table 10: Summary of overall budget expenses and balances for Project Funds

Item/Activity	Amt in TOP	Equiv in US\$ ³	US\$
1. Funds received			
Funds received by SPREP from MCAF			9,980.00
2. Expenses			
• Account administration fees in Tonga	64.00	34.28	
• Bank fee fund transfers to outer island in Tonga	42.00	22.50	
• Return ticket to survey site in Tonga	290.00	155.33	
• Turtle Training	2,762.00	1,479.38	
• Awareness workshop	452.00	242.10	
• Turtle field surveys	6,171.80	3,305.73	
• Equipment (GPS, waterproof paper)		606.36	
• SPREP Admin fee		940.00	
Total expenses		6,785.68	
3. Balance			
Balance remaining			3,194.33

5.2 SPREP Contribution

SPREP fully financed all expenses related to the travel of Marine Species Officer to Tonga to assist with the development and establishing the turtle monitoring programme and assisting with the surveys. In addition, SPREP also fully financed all expenses associated with travel of the Associate Turtle Database Officer to conduct training on the turtle database as well as installing the database. SPREP also met the costs of flipper tags and applicators provided under the project to Tonga.

³ Estimates where relevant using the exchange rate of 1US\$=TOP1.867

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Tables

Table 1: Results of turtle nesting surveys conducted on selected islets in Central Ha'apai, Tonga. (Note: Information and data recorded in the first 3 dates were those during the initial activities for all days in which surveys were conducted. For the other survey dates, only dates when new nests were discovered are shown).

Islet	1 Dec 07	3 Dec 07	4 Dec 07	21 Dec 07	31 Dec 07	31 Jan 08	4 Feb 08
Fonua'ika	<ul style="list-style-type: none"> • 2 old nests (close together on north-east side) • Some additional possible nests on north side amongst rubble just before the coastal vegetation. However, these could just be depressions caused by very high tides. 	<ul style="list-style-type: none"> • No new nests 	<ul style="list-style-type: none"> • Not visited 	<ul style="list-style-type: none"> • 2 new nests (also 2 sets of turtle tracks) 	<ul style="list-style-type: none"> • 3 new nests (with 2 sets of turtle tracks) 	<ul style="list-style-type: none"> • 2 new nests (with 2 sets of tracks) 	<ul style="list-style-type: none"> • 3 new nests (with 2 sets of tracks)
Nukulei	<ul style="list-style-type: none"> • 3 very old nests on north side • No turtle came to nest at night 	<ul style="list-style-type: none"> • No new nests 	<ul style="list-style-type: none"> • No new nests 	<ul style="list-style-type: none"> • No new nest • No tracks 	<ul style="list-style-type: none"> • 4 new nests • 5 tracks 	<ul style="list-style-type: none"> • 1 new nest • 1 tracks 	<ul style="list-style-type: none"> • 1 new nest • 1 tracks
Luanamo	<ul style="list-style-type: none"> • 2 possible old nests on north-west end 	<ul style="list-style-type: none"> • No new nest • No turtle came to nest on night 2 Dec., 2007 	<ul style="list-style-type: none"> • No new nests 	<ul style="list-style-type: none"> • No new nest • No tracks 	<ul style="list-style-type: none"> • No new nest • No tracks 	<ul style="list-style-type: none"> • No new nest • No tracks 	<ul style="list-style-type: none"> • No new nest • No tracks
Lekaleka	<ul style="list-style-type: none"> • 3 possible old nests on north-west end 	<ul style="list-style-type: none"> • Not visited 	<ul style="list-style-type: none"> • Not visited 	<ul style="list-style-type: none"> • Not surveyed 	<ul style="list-style-type: none"> • Not surveyed 	<ul style="list-style-type: none"> • Not surveyed 	<ul style="list-style-type: none"> • Not surveyed

Table 2: Results of turtle nesting surveys conducted in Tonga in 1971 and 1973 (Sources: Koloa, 1972 and Braley, 1974)

GROUP/ISLAND	SPECIES	DATE	NESTING INFORMATION	REFERENCE	REMARKS
VAVA'U					
Maninita (Vava'u south)	?	22-25 Nov 1973	<ul style="list-style-type: none"> • No turtle nesting during stay • 1 recent (1-week old nest) - dug up and eggs taken • 4 old nests 	Braley 1974 (Fisheries Section, 1974?)	Uninhabited, steep sandy beach around most of island, well-developed fringing reef
Taula (Vava'u south)	?	25-28 Nov 1973	<ul style="list-style-type: none"> • no turtle nesting during stay • 2 old nests (1-month old nests-but dug up and eggs removed) 	Braley 1974 (Fisheries Section, 1974?)	Uninhabited, steep sandy beach around 2/3 of island
Fonua'one'one (Vava'u south)	?	28 Nov 1973	<ul style="list-style-type: none"> • No new nests • 2 old nests (about 1-month old) 	Braley 1974 (Fisheries Section, 1974?)	Uninhabited, steep sandy beach around 1/3 of island
Fangasito	?	28 Nov 1973	<ul style="list-style-type: none"> • no sign of any turtle nesting 	Braley 1974 (Fisheries Section, 1974?)	Uninhabited very steep sandy beach around entire island
HA'APAI: Islands considered by most Ha'apai fishermen as good nesting ones: Luahoko, Luanamu, Nukufaiau, Fonuaika (Fisheries Section, 1974?)					
NORTHERN HA'APAI					
Uanuku (Hahake)		7-11 Dec 1973	<ul style="list-style-type: none"> • 2 x 1-1.5 weeks old dug up holes (nests?) • No check made on 10 Dec due to storm. Any nest on that day would have been obliterated for 11 Nov 	Braley 1974 Fisheries Section, 1974?	Narrow island, sandy beach around all island, well developed fringing reef
		7 Jan 1972	<ul style="list-style-type: none"> • No turtle nest 	Koloa, 1972	
Luahoko		20-24 Nov 1973	<ul style="list-style-type: none"> • No turtle nested • Report of turtle nesting during storm 10 Dec-eggs taken 	Braley 1974 (Fisheries Section, 1974?)	Uninhabited, sandy beach almost around entire island, well developed fringing reef
		30 or 31 Dec 1973	<ul style="list-style-type: none"> • A turtle nested - may have been taken 	Braley 1974 (Fisheries Section, 1974?)	
		30 Dec 1971-3 Jan 1972	<ul style="list-style-type: none"> • No turtles came to nest • 4 old nests (2-4 weeks) - 1 was dug and eggs taken 	Koloa, 1972 (Fisheries Section, 1974?)	Full moon (believed to be nesting time)
Uoleva		20 Jan 2007	<ul style="list-style-type: none"> • No signs of turtle nesting 	Bell & Tevita	
		20 Jan 2007	<ul style="list-style-type: none"> • No signs of turtle nesting at places visited 	Bell & Tevita	Very large island
Limu Is	?	9 Jan 1972	<ul style="list-style-type: none"> • 2 recent nests (1-3 weeks old) - one nest dug up for hatchery studies 	Koloa, 1972 (Fisheries Section, 1974?)	Uninhabited, steep sandy beach all sides except south, fringing reef

Table 2 continued

CENTRAL HA'APAI					
Nukulei	Green	2-6 Dec 1973 22-24 Dec 1973	<ul style="list-style-type: none"> 1 nester (tu'a'uli) came up to nest on 4 Dec at 9.25 –11.45 pm (nest later found dug) 4 nests found, also found tracks on 22 Dec thus nesting night of 21 Dec (2 nests dug and eggs taken) site where nester on 4 Dec, dug up nest and broken egg shells 	Fisheries Section, 1974?	Sandy beach $\frac{1}{4}$ of island, rocky beach, fairly well developed fringing reef
Luanamu (Luanamo)	Green	8-10 Dec 1973	<ul style="list-style-type: none"> 1 came to nest on Dec 9 between 10.05-11.00 pm (but did not nest?) Full moon, calm, tide going out 	Fisheries Section, 1974?	
Kito		13-17 Dec 1973	<ul style="list-style-type: none"> No turtle nested during survey 	Fisheries Section, 1974?	
Fonuaika	?	15-20 Dec 1971	<ul style="list-style-type: none"> 1 turtle nested (15? Dec, between 10 pm –12 midnight – turtle was not seen) 9 old nests (1-3 week old) 2 new nests (1-2-days old) <p>Best nesting found in 1971-72</p>	Koloa 1972 (Fisheries Section, 1974?)	Uninhabited, $\frac{1}{4}$ mile circumference, sand beach almost around entire island, has fringing reef about 75-100 yards in width
SOUTHERN HA'APAI					
Tonumea		13, 20, 21 Dec 1973	<ul style="list-style-type: none"> No evidence of recent or old nesting. Report of unusual turtle killed and eaten, including eggs. That was last time nesting occurred. 	Fisheries Section, 1974?	Gentle slope sand beach around 2/3 of island
Nuku (small)		14-16 Dec 1973	<ul style="list-style-type: none"> No turtle came to nest No evidence of nesting <p>Note: storm on 10 & 14 Dec cold have covered any nests before that</p>	Fisheries Section, 1974?	Steep sand beach around entire island
Nuku (big)	Hawksbill?	16-19 Dec 1973	<ul style="list-style-type: none"> No turtles came to nest 3 old nests (2-3 week old) nests on western side-but all dug up and eggs removed <p>Reported that a fono koloa (hawksbill) was taken and eaten before it laid eggs</p>	Fisheries Section, 1974?	Slightly sloping sandy beach $\frac{1}{4}$ of island, $\frac{1}{2}$ steep sand beach, $\frac{1}{4}$ rocky beach
Kelefesia	Green & hawksbill	19-20 Dec 1973	<ul style="list-style-type: none"> No sign of any nesting <p>Last reported nesting in 1965 (years ago). Believed to be both hawksbill and green</p>	Fisheries Section, 1974?	Gently sloping sandy beach 2/3 of island and 1/3 50-60 foot cliffs
Nukufaiau		21-24 Dec 1973	<ul style="list-style-type: none"> No turtle came to nest No sign of any nesting <p>Although reported as best nesting islands in S. Ha'apai. Large green reportedly taken around Nov while she came up to nest (had about 170 eggs inside her)</p>	Fisheries Section, 1974?	Steep sand beach 4/5 of island, rest rocky, poor fringing reef
Nukutula		22 Dec 1973	<ul style="list-style-type: none"> No evidence of nesting (however storm on 10 & 14 Dec could have hidden any nests present) 	Fisheries Section, 1974?	Steep sand beach around island except for scattered rock in a small area
Mangoiki	Greens & hawksbill	26-27 Dec 1973	<ul style="list-style-type: none"> No turtle came to nest No signs of nesting <p>Reported nesting of both green & hawksbill but it has been 2-3 years since any seen nesting</p>	Fisheries Section, 1974?	Fairly steep sand beach around $\frac{1}{2}$ of island. The other $\frac{1}{2}$ rocky.
Meana (Nomuka Group)	?	7-13 Dec 1971	<ul style="list-style-type: none"> 1 turtle nesting during visit (13 Dec) between 2-3 am - turtle not seen) 2 recent nests (1-2 weeks old) 	Koloa, 1972 (Fisheries Section, 1974?)	Uninhabited, 400 yds in circumference, steep sand beach surrounding whole island

ANNEXES