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USAID REGIONAL PROGRAM FOR THE MANAGEMENT  
OF AQUATIC RESOURCES AND ECONOMIC ALTERNATIVES

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**DELIVERABLE: SEA TURTLE PROTECTION FINAL  
REPORT**

**January 14 2014**

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REPORT**

**Contract No. EPP-I-00-04-00020-00**

The author's views expressed in this report do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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## LIST OF ACRONYMS

ADIB	Bocas Development Association ( <i>Asociación para el Desarrollo Integral de Bocas</i> )
ANABOCA	Bocas Hawksbill Association ( <i>Asociación Natural Bocas Carey</i> )
ANAM	National Environment Authority ( <i>Autoridad Nacional del Ambiente</i> )
APRORENANB	Association for the Protection of Ngöbe-Buglé Natural Resources ( <i>Asociación para la Protección de los Recursos Naturales Ngöbe-Buglé</i> )
ARAP	Authority of the Aquatic Resources of Panama ( <i>Autoridad de los Recursos Acuáticos de Panamá</i> )
STC	Sea Turtle Conservancy
USAID	United States Agency for International Development



## EXECUTIVE SUMMARY

This final report aims to summarize the results of sea turtle monitoring and protection activities conducted by the Sea Turtle Conservancy (STC) in Bocas del Toro Province and the Comarca Ngäbe-Buglé, Panama, from 15 December, 2012 to 30 November, 2013. These activities were part of the STC Task Order for year three of the USAID Regional Program for the Management of Aquatic Resources and Economic Alternatives. It will update information previously detailed in the Sea Turtle Protection Progress Reports 1 and 2 submitted to USAID (USAID, 2013<sub>a</sub>; USAID, 2013<sub>b</sub>).

## INTRODUCTION

The STC conducts a sea turtle monitoring and conservation program at various sites in Bocas del Toro Province and the Comarca Ngäbe-Buglé (See Figure 1). Program activities are detailed in the ‘*Baseline Report on the Status of Sea Turtle Populations in the Bocas del Toro Province and the Comarca Ngäbe-Buglé, Panama*’ (USAID, 2010); with the addition of two more study sites (Soropta Beach and Long Beach) at the start of the 2013 nesting season.



Figure 1. STC project sites in Bocas del Toro Province and the Comarca Ngäbe-Buglé

The region supports four species of sea turtles; leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), green turtle (*Chelonia mydas*) and loggerhead (*Caretta caretta*). Research activities have identified important nesting, migration and foraging sites for various life stages of these different species.

While program efforts are focused on hawksbill and leatherback turtles (the two most abundant species in the region), data on all sea turtle species encountered during monitoring activities are recorded.

Continuous, long-term monitoring programs provide critical information to determine the status of nesting populations of sea turtle species in the area and identify their principal threats; they also provide valuable data to evaluate the effectiveness of any protection and conservation initiatives that are implemented.

The most significant threats to sea turtles within Bocas del Toro and the Comarca Ngäbe-Buglé are anthropogenic in nature, and include illegal fishing (both direct and indirect capture) of turtles at sea or on the nesting beach, predation of nests by domestic dogs



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(*Canis familiaris*), and unregulated tourism development at key nesting sites. STC has been working to reduce the impact of these threats, with particular emphasis on reducing dog predation at Chiriquí Beach; a globally important nesting beach for both leatherback and hawksbill turtles. In addition, initiatives with local communities and government authorities aim to decrease the illegal take of turtles by fishers in coastal waters.

## METHODOLOGY

### Monitoring Activities

A detailed description of the monitoring protocol is provided in the '*Baseline Report on the Status of Sea Turtle Populations in the Bocas del Toro Province and the Comarca Ngöbe-Buglé, Panama*' (USAID, 2010); below is a summary of the activities conducted during the timeframe of this report.

Track surveys of study beaches are conducted on foot to record all sea turtle nesting activity. All tracks are identified by species, and recorded as either a successful nesting attempt or a false crawl emergence. Any evidence of nest predation, illegal take of eggs and/or female turtles, or erosion by high tides is also noted. Survey frequency varies at each site, depending on various conditions; however, there is daily monitoring at all beaches during the peak turtle nesting season.



Conducting an egg count on a nesting leatherback at Playa Chiriquí

During track surveys the location of all hawksbill nests is marked using flagging tapes in the vegetation behind the nest; the nests are located using triangulation from these reference tapes. For leatherbacks, if the turtle is encountered during the night patrol prior to laying her eggs, the location of the nest is marked using the same system of flagging tapes and triangulation. A GPS location is also recorded for each nest. All marked nests are monitored on subsequent surveys throughout the incubation period to record illegal take, predation or erosion events, and to record the date of hatching. Nest contents are examined 2-3 days after hatching is observed, to determine hatching and emergence success.

STC beach monitors conduct night patrols to encounter nesting females at Chiriquí Beach, Red Beach and Long Beach; at Chiriquí Beach STC works closely with the community organization APROENANB (Association for the Protection of Ngöbe-Buglé Natural Resources – *Asociación para la Protección de los Recursos Naturales Ngöbe-Buglé*). At Soropta Beach all the monitors are all members of the Bocas Development Association (ADIB - *Asociación para el Desarrollo Integral de Bocas*) and at Bluff Beach members of the Bocas Hawksbill Association (ANABOCA - *Asociación*



*Natural Bocas Carey*) realize patrols; at both sites the beach monitors are trained and supervised by STC staff.

### **Protection Measures**

Various methods to protect sea turtle and their critical habitats in Bocas del Toro and the Comarca were described in the *'Work Plan for the Protection of Sea Turtles in the Bocas del Toro Province and the Comarca Ngöbe-Buglé, Panama'* (USAID, 2011).

At Chiriquí Beach, hawksbill nests that were laid in areas known to be particularly vulnerable to dog predation were protected using plastic mesh 'cages', to physically prevent dogs from excavating eggs. It was not possible to use this direct protection method for leatherback nests due to the fact that nests made by this species are very large, and the eggs are buried very deep, and so it is not feasible to search for the egg chamber within the large nest site the following morning. In comparison, hawksbill nests are very small, and the egg chamber is not very deep; hence it is relatively easily to locate the eggs and position the protective mesh cage the day after the turtle has laid the nest.

In addition, STC staff held meetings with Comarca leaders to solicit support in encouraging dog owners to control their dogs during turtle nesting and hatching season. The Field Assistant and beach monitors also spoke directly to the owners of dogs that had been observed predated turtle nests on the beach; asking them to tether their animals during nesting and hatching season.

The government enforcement agencies ANAM (National Environment Authority – *Autoridad Nacional del Ambiente*), ANAM – Comarcal and ARAP (Authority of the Aquatic Resources of Panama – *Autoridad de los Recursos Acuáticos de Panamá*) were responsible for enforcing laws pertaining to sea turtles and their habitats with the Comarca Ngäbe-Buglé and Bocas del Toro Province. STC worked with the authorities to improve protection efforts for sea turtles within protected areas of the region, such as marine patrols to deter illegal turtle fishing.



A beach monitor at Bluff Beach buries eggs that were decommissioned by the police

## **RESULTS AND DISCUSSION**

### **Monitoring Activities**

At Chiriquí Beach surveys were conducted from January thru November. Escudo de Veraguas Island and Red Beach were surveyed between May/April and October. Monitoring began at Bluff Beach in February, and continued thru November. Surveys were conducted at Soropta Beach from March thru June, and Long Beach was surveyed



between February and June. Table 1 summarizes the data from track surveys conducted at all six study sites.

**Table 1. Summary of track survey data, January – November 2013**

**a) Comarca Ngäbe-Buglé**

Site	Chiriquí Beach				Escudo de Veraguas Island				Red Beach			
	Leatherback		Hawksbill		Leatherback		Hawksbill		Leatherback		Hawksbill	
Month	Nest	False crawl	Nest	False crawl	Nest	False crawl	Nest	False crawl	Nest	False crawl	Nest	False crawl
Jan	0	0	0	0	NS	NS	NS	NS	NS	NS	NS	NS
Feb	42	8	2	0	NS	NS	NS	NS	NS	NS	NS	NS
Mar	508	71	10	4	NS	NS	NS	NS	NS	NS	NS	NS
Apr	1,040	135	37	8	NS	NS	NS	NS	NS	NS	NS	NS
May	1,199	241	122	33	NS	NS	NS	NS	2	0	28	7
Jun	482	110	216	51	0	0	52	4	0	0	29	11
Jul	72	11	271	63	NS	NS	NS	NS	0	0	25	9
Aug	4	1	214	58	0	0	120	0	0	0	15	7
Sep	2	0	158	29	0	0	87	2	0	0	15	4
Oct	0	0	90	8	0	0	48	0	0	0	8	1
Nov	0	0	31	5	0	0	17	0	0	0	1	0
<b>TOTAL</b>	<b>3,349</b>	<b>577</b>	<b>1,151</b>	<b>259</b>	<b>0</b>	<b>0</b>	<b>324</b>	<b>6</b>	<b>2</b>	<b>0</b>	<b>121</b>	<b>39</b>

**b) Bocas del Toro Province**

Site	Bluff Beach				Soropta Beach				Long Beach			
	Leatherback		Hawksbill		Leatherback		Hawksbill		Leatherback		Hawksbill	
Month	Nest	False crawl	Nest	False crawl	Nest	False crawl	Nest	False crawl	Nest	False crawl	Nest	False crawl
Jan	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Feb	3	1	0	0	2	0	0	0	1	1	0	0
Mar	30	12	0	0	51	14	0	0	8	1	0	0



<b>Apr</b>	72	18	5	1	126	36	1	0	16	1	1	3
<b>May</b>	85	47	21	7	167	53	6	2	18	5	11	3
<b>Jun</b>	35	22	47	13	91	24	6	5	12	2	26	9

**Table 1. Continued**

Site	Bluff Beach				Soropta Beach				Long Beach			
	Leatherback		Hawksbill		Leatherback		Hawksbill		Leatherback		Hawksbill	
Month	Nest	False crawl	Nest	False crawl	Nest	False crawl	Nest	False crawl	Nest	False crawl	Nest	False crawl
<b>Jul</b>	3	4	34	15	6	0	7	2	NS	NS	NS	NS
<b>Aug</b>	1	0	38	12	NS	NS	NS	NS	NS	NS	NS	NS
<b>Sep</b>	0	0	18	2	NS	NS	NS	NS	NS	NS	NS	NS
<b>Oct</b>	0	0	1	1	NS	NS	NS	NS	NS	NS	NS	NS
<b>Nov</b>	0	0	0	0	NS	NS	NS	NS	NS	NS	NS	NS
<b>TOTAL</b>	<b>229</b>	<b>104</b>	<b>164</b>	<b>51</b>	<b>443</b>	<b>127</b>	<b>20</b>	<b>9</b>	<b>55</b>	<b>10</b>	<b>38</b>	<b>15</b>

NS = No surveys conducted at the site in that month

Leatherback nesting activity was observed from January to September, with a peak in May at all sites where leatherback nests were recorded (See Figure 2). The 2013 leatherback nesting season was the lowest at Chiriquí Beach since 2004, with only 3,349 nests recorded. At other study sites the season was also the lowest since monitoring activities began. A similar situation was also reported at leatherback nesting beaches in Costa Rica, and thus it is probably a natural part of the complex reproductive cycle of this species. However, it will be important to continue monitoring efforts at all leatherback beaches in the region over the coming years to ensure that it is not the start of a decline in the population.

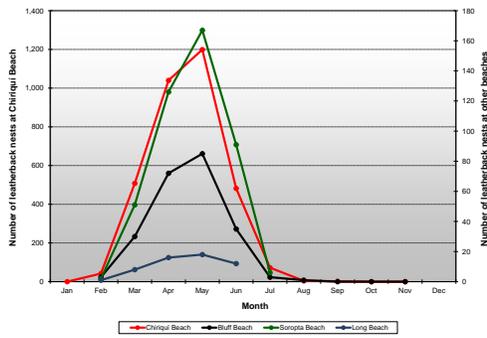


Figure 2. Monthly leatherback nesting at project study sites in 2013

Hawksbill nesting was recorded throughout the year from February onwards (See Table 1); unlike for leatherback turtles, there was no consistent peak in nesting all study sites (See Figure 3). Escudo de Veraguas Island and Red Beach continue to show increased levels of hawksbill nesting activity; also, nesting levels at Chiriquí Beach were the highest recorded since monitoring began in 2003, which is very encouraging and suggests that conservation efforts are working.

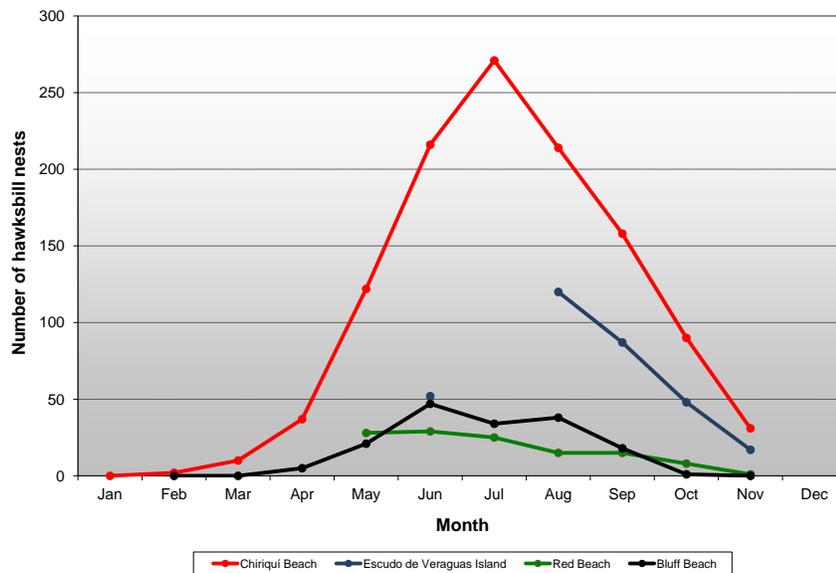


Figure 3. Monthly hawksbill nesting at project study sites in 2013



In addition to the leatherback and hawksbill turtles, 2013 was a good year for green turtles. At Chiriquí Beach, 25 green turtle nests and nine false crawls were reported; a further four nests and one false crawl were observed at Red Beach. In Bocas del Toro Province green turtles also nested at Soropta Beach and Bluff Beach (two and three nests, respectively). At Long Beach there was also a loggerhead nest recorded during surveys, and eight false crawls, possibly the same individual attempting to nest on numerous occasions. This high level of nesting by green turtles reflects the findings observed at Tortuguero, Costa Rica, the most important nesting beach for this species in the Caribbean. Furthermore, Florida, USA, experienced a record green turtle nesting season, with more than twice as many green turtle nests reported than the previous high year.

Table 2 summarizes turtle encounters recorded during night patrols at Chiriquí Beach, Red Beach, Bluff Beach, Soropta Beach and Long Beach. As in previous years, there were several nights at Chiriquí Beach and the other study sites when it was impossible to patrol the entire beach due to high tides and erosion, which made it impossible to walk along certain stretches of the beach at night. On these occasions patrols were restricted to certain sections of the beach or were cancelled for safety reasons as appropriate. Night patrols were continued at Red Beach during peak hawksbill nesting season in 2013 (May thru September), in an effort to reduce the illegal take of females from the nesting beach.

**Table 2. Summary of turtles encountered during night patrols in 2013**

**a) Comarca Ngäbe-Buglé**

Site	Chiriquí Beach		Red Beach	
	Leatherback	Hawksbill	Leatherback	Hawksbill
Jan	NP	NP	NP	NP
Feb	3	0	NP	NP
Mar	49	1	NP	NP
Apr	208	10	NP	NP
May	206	17	0	4
Jun	90	36	0	14
Jul	6	31	0	6
Aug	0	18	0	6
Sep	0	11	0	1
Oct	0	4	NP	NP
Nov	NP	NP	NP	NP



<b>TOTAL</b>	<b>562</b>	<b>128</b>	<b>0</b>	<b>31</b>
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**b) Bocas del Toro Province**

Site	Bluff Beach		Soropta Beach		Long Beach	
	Leatherback	Hawksbill	Leatherback	Hawksbill	Leatherback	Hawksbill
<b>Jan</b>	NP	NP	NP	NP	NP	NP
<b>Feb</b>	NP	NP	NP	NP	NP	NP
<b>Mar</b>	21	0	32	0	2	0
<b>Apr</b>	51	3	57	0	7	0
<b>May</b>	57	7	81	2	5	5
<b>Jun</b>	17	20	41	1	5	9

**Table 2. Continued**

Site	Bluff Beach		Soropta Beach		Long Beach	
	Leatherback	Hawksbill	Leatherback	Hawksbill	Leatherback	Hawksbill
<b>Jul</b>	1	19	NP	NP	NP	NP
<b>Aug</b>	0	14	NP	NP	NP	NP
<b>Sep</b>	0	1	NP	NP	NP	NP
<b>Oct</b>	0	0	NP	NP	NP	NP
<b>Nov</b>	NP	NP	NP	NP	NP	NP
<b>TOTAL</b>	<b>147</b>	<b>64</b>	<b>211</b>	<b>3</b>	<b>19</b>	<b>14</b>

NP = No night patrols conducted at the site in that month

At Red Beach there was also an encounter with one green turtle in August, and at Long Beach, the monitors worked with the one loggerhead female who nested in 2013.

Table 3 provides a summary of nest survivorship at each of the study sites; including the number of poached, depredated and eroded nests. In the Comarca, it was disappointing to observe that there were 11 hawksbill nests poached at Chiriquí Beach; in previous years poaching had been almost completely eradicated. It was also incredibly worrying to see



the extremely high levels of predation of both leatherback (3.5%) and hawksbill nests (35.3%) at Chiriquí Beach, despite efforts to protect hawksbill nests using mesh cages. There were no obvious reasons as to why dog predation was so high during the 2013 season; for example, there were no reports from beach monitors of a significant increase in the number of dogs they observed during monitoring activities. It may be that a small number of dogs have learned that turtle nests provide a source of food, and so they will return to the beach if hungry. Unfortunately, due to the very high level of hawksbill nests during the 2014 season, the highest observed to date for the project, it was not possible to protect all nests, and a significant number were destroyed. Obviously this remains the biggest threat to the survival of this population, and will continue to be a conservation priority in the future.

**Table 3. Summary of nest survivorship in 2013**

**a) Comarca Ngäbe-Buglé**

Site	Chiriquí Beach			Escudo de Veraguas Island		Red Beach	
	Dc	Ei	Cm	Dc	Ei	Ei	Cm
<b>Poached</b>	0	11	0	0	0	0	0
<b>Depredated</b>	117	406	7	0	0	3	0
<b>Eroded</b>	20	4	0	0	0	1	0
<b>TOTAL</b>	<b>137</b>	<b>421</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>

**b) Bocas del Toro Province**

Site	Bluff Beach			Soroapta Beach		Long Beach	
	Dc	Ei	Cm	Dc	Ei	Dc	Ei
<b>Poached</b>	1	24	2	81	4	1	2
<b>Depredated</b>	23	8	0	8	0	0	1
<b>Eroded</b>	17	2	0	17	0	3	1
<b>TOTAL</b>	<b>41</b>	<b>34</b>	<b>2</b>	<b>106</b>	<b>4</b>	<b>4</b>	<b>4</b>

Dc = Leatherback; Ei = Hawksbill; Cm = Green turtle

In Bocas del Toro Province there was also an increase in the number of nests poached at all study sites, particularly Soroapta Beach, where 18.3% of nests were taken. This may have been in part due to the fact that there was limited coverage at Soroapta Beach by



beach monitors, in comparison to previous years, since STC only took over the project site this year. Furthermore, on the 4km stretch of beach surveyed weekly poaching levels were estimated at approximately 80%, much higher than the area patrolled at night by monitors. In the future, therefore, efforts will be made to maximize patrol effort to deter poachers, particularly in identified poaching ‘hotspots’ along the entire 12km beach.

Significantly fewer nests were lost to erosion in 2013 than other years; with the majority of nests being leatherback, as observed previously. Nests of this species are typically closer to the high tide, and so are the first to be affected by rising tides and erosion.

While there was an overall decrease in the number of hawksbill females that were taken from the nesting beach (n = 10), there was a sharp rise in the number of turtles killed at Chiriquí Beach; seven of the 10 females that were killed (70%) were reported at this beach. The continuation of night patrols at Red Beach appeared to have significantly reduced the number of turtles taken at this site (n = 1) in comparison to 2012. Unfortunately, there were also a number of leatherbacks killed; the first time that this has been observed at a study site for many years. Two females were killed in the 8km section of beach patrolled at night; A further seven individuals were encountered dead during the weekly surveys of the additional 4km of beach. Again, this highlights the need to have increased presence on this stretch of beach, and improved vigilance by ANAM officials to reduce this threat to nesting females.

From January thru November 2013 a total of 428 leatherback nests were excavated to evaluate hatching and emerging success; 222 at Chiriquí Beach, 57 at Bluff Beach, 134 at Soropta Beach and 15 at Long Beach. A summary of the excavation data are provided in Table 4.

**Table 4. Summary of excavation data for leatherback nests in 2013**

Site	Destiny of nest	Number of nests	Mean % emerging success	Mean % hatching success	Estimated number of hatchlings
CHB	<i>In situ</i> Intact	85	62.5	57.0	3,714
	<i>In situ</i> Depredated	117	1.0	0.7	33
	<i>In situ</i> Eroded	20	0.0	0.0	0
<b>Sub-total CHB</b>		<b>222</b>	<b>31.8</b>	<b>28.9</b>	<b>3,747</b>
BB	<i>In situ</i> Intact	14	36.1	33.4	288
	<i>In situ</i> Depredated	23	0.0	0.0	0
	<i>In situ</i> Eroded	17	0.0	0.0	0
	Relocated <sup>1</sup>	3	0.7	0.7	2



	Intact				
<b>Sub-total BB</b>		<b>57</b>	<b>18.4</b>	<b>17.1</b>	<b>290</b>
<b>SB</b>	<i>In situ</i> Intact	48	67.6	66.7	1,943
	<i>In situ</i> Depredated	2	0.0	0.0	0
	<i>In situ</i> Eroded	9	0.0	0.0	0
	<i>In situ</i> Poached	35	0.0	0.0	0
	Relocated <sup>1</sup> Intact	15	45.7	40.3	425

**Table 4. Continued**

<b>Site</b>	<b>Destiny of nest</b>	<b>Number of nests</b>	<b>Mean % emerging success</b>	<b>Mean % hatching success</b>	<b>Estimated number of hatchlings</b>
<b>SB</b>	Relocated <sup>1</sup> Depredated	6	0.0	0.0	0
	Relocated <sup>1</sup> Eroded	8	0.0	0.0	0
	Relocated <sup>1</sup> Poached	11	0.0	0.0	0
<b>Sub-total SB</b>		<b>134</b>	<b>56.7</b>	<b>53.5</b>	<b>2,368</b>
<b>LB</b>	<i>In situ</i> Intact	12	68.2	59.4	639
	<i>In situ</i> Eroded	3	0.0	0.0	0
<b>Sub-total LB</b>		<b>15</b>	<b>68.2</b>	<b>59.4</b>	<b>639</b>
<b>TOTAL</b>		<b>428</b>	<b>43.8</b>	<b>39.7</b>	<b>7,044</b>

CHB = Chiriquí Beach; BB = Bluff Beach; SB = Soropta Beach; LB = Long Beach

<sup>1</sup>Relocated<sup>1</sup> nests were all relocated on the beach

Emerging and hatching success are both considerably higher at Chiriquí Beach, Soropta Beach and Long Beach than at Bluff Beach (See Table 4). Overall emerging and hatching success, combining all four study sites and all nests, was 43.8% and 39.7%, respectively. However, these values are obviously significantly affected by the inclusion of depredated and eroded nests, which have very low hatching or emerging success. Looking at *in situ* intact (ie. undisturbed) nests it is evident that nests laid at Bluff Beach are significantly less successful than those laid at other beaches. This may be due to various factors related to the physical and chemical characteristics of Bluff Beach, that negatively impact the survival and success of eggs. The other beaches show relatively high hatching and emerging success for intact nests; leatherbacks typically have less than 50% success, but all three beaches are above this value (see Table 4).



Predation, erosion and poaching reduce hatching and emerging success to 0.0% or very close to that value (see Table 4), thus it is important to try and eradicate these threats to nests at all study sites in the future.

It is also interesting to note at Bluff Beach and Soroopta Beach, that the success of intact relocated nests was significantly reduced. At Soroopta Beach there was a 26.4% reduction in hatching success, whilst at Bluff Beach hatching success for relocated nests was just 0.7%. This once again reinforces the fact that relocation should only be used as a last option, if it is deemed that the nest will be lost if left *in situ*. Some relocated nests at Soroopta Beach were predated, poached or subject to tidal erosion thus it is important to select the relocation site very carefully to ensure that the possibility of it being subsequently eroded, poached or predated is low, to effectively increase the survivorship and hatching success.

Obviously the number of hatchlings estimated to have been produced that is shown in Table 4 (7,044) is calculated only from the data from the 428 nests that were excavated; it does not take into consideration the other nests that were laid. However, using the data from Table 3 and the values for mean hatching success from Table 4, it is possible to make a very rudimentary estimation of the number of leatherback hatchlings produced at the four study sites in 2013; since it is known how many nests were laid, how many were lost through poaching, predation and erosion, and the effect of these impacts on hatching and emerging success. For Red Beach values from Chiriquí Beach were used. **When these calculations were conducted the total estimated number of leatherback hatchlings produced in 2013 is 152,835.**

From January thru November 2013 a total of 989 hawksbill nests were excavated to evaluate hatching and emerging success; 595 at Chiriquí Beach, 208 at Escudo de Veraguas Island, 101 at Red Beach, 81 at Bluff Beach and four at Long Beach. A summary of the excavation data are provided in Table 5. Hatching success of *in situ* intact hawksbill nests ranged from 54.9% (Chiriquí Beach) to 88.4% (Long Beach); it was interesting to observe that all three of the beaches in the Comarca had a much lower hatching success than those in Bocas del Toro Province (see Table 5).

**Table 5. Summary of excavation data for hawksbill nests in 2013**

Site	Destiny of nest	Number of nests	Mean % emerging success	Mean % hatching success	Estimated number of hatchlings
CHB	<i>In situ</i> Intact	160	59.4	54.9	12,067
	<i>In situ</i> With cage Intact	14	55.2	53.0	97
	<i>In situ</i> Depredated	396	2.4	2.4	801



	<i>In situ</i> With cage Depredated	10	0.0	0.0	0
	<i>In situ</i> Eroded	3	0.0	0.0	0
	<i>In situ</i> With cage Eroded	1	0.0	0.0	0
	<i>In situ</i> Poached	11	0.0	0.0	0
<b>Sub-total CHB</b>		<b>595</b>	<b>39.0</b>	<b>36.8</b>	<b>12,965</b>

**Table 5. Continued**

<b>Site</b>	<b>Destiny of nest</b>	<b>Number of nests</b>	<b>Mean % emerging success</b>	<b>Mean % hatching success</b>	<b>Estimated number of hatchlings</b>
<b>EdV</b>	<i>In situ</i> Intact	208	72.5	66.2	20,398
<b>Sub-total EdV</b>		<b>208</b>	<b>72.5</b>	<b>66.2</b>	<b>20,398</b>
<b>RB</b>	<i>In situ</i> Intact	97	84.9	69.9	12,142
	<i>In situ</i> Depredated	3	0.0	0.0	0
	<i>In situ</i> Eroded	1	0.0	0.0	0
<b>Sub-total RB</b>		<b>101</b>	<b>84.9</b>	<b>69.9</b>	<b>12,142</b>
<b>BB</b>	<i>In situ</i> Intact	28	84.4	84.2	3,393
	<i>In situ</i> Depredated	7	0.0	0.0	0
	<i>In situ</i> Poached	20	0.0	0.0	0
	<i>In situ</i> Eroded	2	0.0	0.0	0
	Relocated <sup>1</sup> Intact	19	74.9	74.5	2,336
	Relocated <sup>1</sup> Depredated	1	0.0	0.0	0
	Relocated <sup>1</sup> Poached	4	0.0	0.0	0
<b>Sub-total BB</b>		<b>81</b>	<b>79.7</b>	<b>79.4</b>	<b>5,729</b>
<b>LB</b>	<i>In situ</i> Intact	1	88.4	88.4	152
	<i>In situ</i>	1	0.0	0.0	0



	Eroded				
	<i>In situ</i> Poached	2	0.0	0.0	0
<b>Sub-total LB</b>		<b>4</b>	<b>88.4</b>	<b>88.4</b>	<b>152</b>
<b>TOTAL</b>		<b>989</b>	<b>72.9</b>	<b>68.1</b>	<b>51,386</b>

CHB = Chiriquí Beach; EdV = Escudo de Veraguas Island; RB = Red Beach  
BB = Bluff Beach; LB = Long Beach

<sup>1</sup>'Relocated' includes nests moved to the hatchery or relocated on the beach

At Chiriquí Beach, Bluff Beach and Red Beach, depredation of nests by dogs significantly reduced hatching and emerging success to less than 2.5%; typically predated nests were completely destroyed, with a hatching success of 0.0%. In 2013, once again there was an increase in the number of nests predated by dogs, especially at Chiriquí Beach, including some (n = 10) that had been protected with the plastic mesh. At Bluff Beach one relocated nest was also subsequently depredated by dogs.

Intact relocated nests at Bluff Beach also showed a lower hatching success than *in situ* nests (74.5% compared to 84.2%, respectively); as for leatherback nests, relocation, therefore, should only be considered as a last resort if it is very likely that the nest will be either poached or eroded.

The number of hawksbill hatchlings that were estimated to have been produced that is shown in Table 5 (51,386) was calculated from data from excavations; but it does not consider other nests that were laid. Again, as for leatherbacks, it was possible to use the data from Table 3 and the values for hatching success shown in Table 5 to make a crude estimation of the number of hawksbill hatchlings produced at the four study sites in 2013, up until the end of November; since it is known how many nests were laid, how many were lost through poaching, predation and erosion, and the effect of these impacts on hatching and emerging success. **The result of these calculations show that the total estimated number of hawksbill hatchlings produced is 116,563.**

### Protection Measures

A minimum of 32 plastic mesh cages were used to protect hawksbill nests at Chiriquí Beach from dog predation. Due to the incredibly high number of hawksbill nests laid in 2013 only a very small percentage of the nests could be protected, as it is a labor intensive process to position the netting; therefore, only nests laid in known high risk predation areas were protected. Unfortunately, the beach monitors occasionally neglected to record if a cage had been placed on the nest; hence why the number quoted is a minimum value. At the end of the season, when all nests have been excavated (when cages are encountered if not recorded previously) it will be possible to determine the actual figure. During training with the beach monitors prior to the start of the 2014 it will be emphasized to them the importance of the need to record on the data sheets if a protective cage has been placed over the nest.



The problem of dog predation is an on-going struggle that actually appears to be getting worse not better, despite the physical protection of nests and efforts by the Field Coordinator and the beach monitors to engage dog owners and advise them of the negative impacts their animals are having on the survivorship and hatching success of sea turtles in the Comarca. There is still limited cooperation to control dogs, or keep them off the beach during nesting and hatching season. STC will be dedicated in future years in finding a more viable solution to the problem of controlling domestic dogs on nesting beaches, as the current impacts are especially worrying, with 35% of hawksbill nests lost to predation in 2013; making it the single biggest threat to the population and the overall success of the conservation program. The focus will be on raising awareness of the negative impacts caused by dogs to sea turtle populations, through intensive outreach campaigns targeted in communities with a known dog control problem. In addition, STC will try to collaborate with ANAM an ANAM - Comarca in any future initiatives; it is hoped that during the development of the management plan for the Damani-Guariviara this problem will be addressed, and a solution developed among all key stakeholders.

STC staff coordinated with enforcement agencies to conduct a total of five marine operatives during 2013; while it would be preferable to have patrols at least once a month, especially during peak turtle fishing months, these five patrols were a significant improvement on protection efforts provided by government agencies in 2012. Patrols were conducted by members of ANAM and officers of the National Police force; they were accompanied by STC staff where possible. More details of these activities are included in USAID, 2013<sub>b</sub>.

The increased levels of poaching and killing of nesting females, especially at Soropta Beach prompted STC staff to meet with officials from the two agencies responsible for te protection of sea turtles and their habitats, namely ANAM and ARAP (ficials from ANAM and the Panama Aquatic Resources Authority (ARAP) to discuss the problem of increased poaching observed at several nesting beaches, and the killing of female turtles at Soropta Beach and Chiriquí Beach. The principal aims of this meeting was to share information about the levels of poaching reported by beach monitors at study beaches, and to request a commitment from the authorities to offer increased support to work together to find effective solutions to this situation, including regular marine and terrestrial patrols, especially at poaching ‘hotspots’.

### **Community Participation**

As in previous years, in 2013 all of the beach monitors responsible for conducting the monitoring and protection activities at the different study sites were members of coastal communities in the Comarca Ngäbe-Buglé and Bocas del Toro Province; STC worked closely with local organizations such as ANABOCA, ADIB and APRORENANB, developing community involvement and a sense of pride in the projects which has been critical to their success to date.



A total of 49 people were employed by STC at the various study sites in 2013 (See Appendix 1); including two field assistant, 33 beach monitors, nine cooks, four security guard and one boat captain. Of these, 10 (20.4%) were women; all of the cooks at Chiriquí Beach and Soropta Beach, and one of the beach monitors at Bluff Beach. The majority of these people were existing employees of STC, though there were new beach monitors contracted at several of the project sites throughout the course of the season. All new personnel received training from STC Research Coordinator (RC), Cristina Ordoñez, prior to participating in program activities at the nesting beach. The Field Assistants (FA), Genaro Castillo (Chiriquí Beach) and Erick Trotman, assist the RC is overseeing the daily implementation of the monitoring program activities; the RC tries to visit each site at least once a month.



STC Research Coordinator, Cristina Ordoñez explains how to identify different turtle species

Training workshops for new beach monitors, and refresher courses for existing monitors, were conducted by the RC, with support from the Scientific Director, Emma Harrison, prior to the start of the 2013 leatherback nesting season in March. These training activities consisted of a theoretical component, which covered basic sea turtle biology, reproductive behavior, species identification and an overview of the monitoring protocol. There were also practical sessions, during which the monitors learned how to collect and record data correctly, including tagging and taking standard carapace

measurements; there were also supervised night patrols. Details of these training activities, including participant lists, can be found in USAID 2013<sub>a</sub>.

In addition to the contracted personnel there were also eight community members who participated in monitoring activities at Chiriquí Beach (See Appendix 2); the majority were high school students from Río Caña who have an interest in gaining hands-on experience with sea turtles. These volunteers play a key role in the program; once trained they work alongside the regular beach monitors and their presence allows extra night patrols to be conducted, so increasing the number of encounters with nesting females over the course of the season. Indeed, all of the beach monitors currently employed by STC at Chiriquí Beach participated as volunteers on the project for at least a year before they were hired, gaining valuable experience in species identification, nesting behavior and the monitoring protocol.



## Education and Outreach Activities

In addition to the monitoring and conservation activities, STC also conducted numerous education and outreach events during 2013; the objective of which was to raise awareness among the various participating groups about sea turtles, their threats, and the importance of conservation initiatives in Bocas del Toro Province and the Comarca Ngäbe-Buglé. USAID, 2013<sub>a</sub> and 2013<sub>b</sub> provide information of activities conducted from January – September; examples of activities conducted in October and November include;

- STC staff were invited to give a presentation to more than 50 students at Rogelio Josué Ibarra High School in Bocas del Toro about sea turtles and local conservation efforts at Bluff Beach. This event was part of the school’s celebration of “Panama’s Tourist Attractions Day”; which aims to promote the natural and cultural attractions of each of the country’s provinces.
- STC RC gave a talk to 25 students from the University of Panama in Changuinola about sea turtles, the threats to their survival and the work of STC in the region. Students and faculty staff showed considerable interest in the possibility of participating as volunteers in the monitoring and conservation efforts in Bocas del Toro Province and the Comarca Ngäbe-Bugle. The event was organized as part of the “Week of Science” being celebrated at the university.



High school students learn about sea turtles



Students listen to a talk about turtle biology

## CONCLUSIONS

1. The 2013 leatherback nesting season was the lowest recorded since monitoring began in 2003; all sites in Bocas del Toro Province and the Comarca Ngäbe-Buglé registered significantly fewer nests than in previous years. This trend was also observed at key leatherback nesting beaches in Costa Rica. While such dramatic variation in nesting between successive seasons is recognized as part of the natural cycle for sea turtle nesting, it is important to continue monitoring efforts in the future to detect any negative trends that might develop.



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2. The positive trend for hawksbill nesting continued in 2013; for the second consecutive year more than 1,000 nests were laid at Chiriquí Beach, and other study beaches saw increased numbers of nests. These increases can presumably be attributed to improved conservation and protection efforts in the region for more than a decade; hopefully this encouraging recovery of a once decimated population will continue.
3. Levels of nest poaching were quite high in 2013, especially at Soropta Beach, where almost 20% of all leatherback nests were taken from the monitored stretch of beach. This disturbing statistic was compounded by the fact that several leatherback females were also killed at this beach, a practice that was essentially eradicated in the region for many years due to the regular presence of beach monitors and volunteers throughout the nesting season. In future years STC will aim to increase night patrols, to deter would-be poachers, and obviously there also need to be improved protection efforts by the relevant authorities in an effort to reduce this threat.
4. Despite threats to nest survivorship, leatherback and hawksbill nests that remained undisturbed during the incubation period were successful. In fact, leatherback nests had quite high hatching success (for this species), above 57% at all sites except Bluff Beach. Hawksbill nests were also successful; hatching success was above 55% at all sites. Beaches in Bocas del Toro Province had a higher success than those in the Comarca; it will be interesting to observe if this variation continues in future nesting seasons.
5. Predation remained the single biggest threat to the survival of both leatherback and hawksbill nests Chiriquí Beach. Domestic dogs continue to have a significant negative impact on potential hatchling production (one of several key factors in recuperating diminished turtle populations); for hawksbills, 406 nests were destroyed by dogs, which equates to a loss of up to 28,300 hatchlings. For leatherbacks, the 106 nests lost to predation could have yielded up to 4,300 additional hatchlings. Such numbers could make a significant difference for endangered species such as these. STC will have to redouble their efforts in the future to find an effective way to improve the survivorship of nests at Chiriquí Beach, obviously working in close collaboration with local communities and the authorities.
6. Continued patrols at Red Beach in 2013 resulted in a significant decrease in the number of hawksbill turtles taken from the beach; all attempts will be made to ensure that these patrols are continued in the future. It is hoped that from 2014 beach monitors will be trained to tag turtles, so that more data can be collected from individuals encountered during night patrols.
7. A minimal number of marine patrols ( $n = 5$ ) were conducted by ANAM, with support from the National Police in 2013. This is a marked improvement from previous years when no patrols have been realized. The patrols not only deter turtle fishing, but also provide the authorities with valuable data on levels of all illegal activities within, or close to, marine protected areas. In 2013 the patrols were focused on Bocas del Toro Province, specifically Bastimentos Island National Marine Park; hopefully additional patrols can also be conducted within the Comarca Ngäbe-Buglé in the future. STC has been working hard with government agencies to increase their awareness of the



importance of the region for sea turtles, and to provide them with logistical support to conduct patrols; however, there are still limited resources and a lack of institutional commitment.

8. The education and outreach activities conducted by STC in 2013 in Bocas del Toro Province and the Comarca Ngäbe-Buglé are critical to the continued success of the sea turtle monitoring and conservation program. Stakeholder groups need to be made aware of the important work STC is doing to help protect sea turtles and their habitats in the region, with as wide an audience as possible, especially coastal communities within the Comarca. Without their continued participation and support of the project it will have no long-term success. It is also necessary to raise awareness among the thousands of visitors who come to Bocas del Toro each year of the importance of the area for sea turtles, to illicit their cooperation in respecting laws and local regulations governing activities that might impact sea turtles or their habitats.

## RECOMMENDED NEXT STEPS

- STC will continue to implement the standard monitoring protocol at all six study sites in the Bocas del Toro province and the Comarca Ngäbe-Buglé in future years, to determine nesting trends for leatherback and hawksbill populations, assess the principal threats to turtles, eggs and nesting beach habitat in the region, and evaluate the effectiveness of protection and conservation measures being conducted. Efforts will be made to increase patrol effort at sites such as Soroopta Beach, where poaching and killing of nesting turtles has increased. Additional monitoring will hopefully take place at Escudo de Veraguas Island; night patrols will provide further information about possible inter-beach movements by individual turtles, which will increase our knowledge of nesting behavior and habitat use in the region.
- An effective, long-term solution to the problem of dog predation needs to be found at Chiriquí Beach, and to a lesser extent at other nesting beaches. Clearly, success can only be achieved through collaboration between STC, Comarca leaders, community members and ANAM. An integrated strategy that combines protection, monitoring and community outreach will hopefully provide the answer to this delicate situation. It is hoped to implement this program of nest protection and outreach in various communities close to nesting beaches affected by dog predation from the start of the 2014 nesting season.
- There will be continued collaboration with government authorities to improve protection efforts and enforcement of laws pertaining to sea turtles and their habitats within the region. Regular marine operatives are important to evaluate illegal activities in or close to protected areas, whilst also actively deterring such activities by the presence of ANAM officials. Hopefully a regular patrol schedule can be devised, with increased effort during peak months and in known fishing hotspots.
- Develop more education and outreach campaigns for various stakeholder groups in the region, especially coastal communities and tourists. The emphasis should be on raising awareness about threats to sea turtles in the region, and the value of the local protected areas in supporting valuable turtle populations.



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**APPENDICES**

**Appendix 1. List of indigenous community members employed by STC in 2013.**

(Full time employees receive social security and benefits required by Panamanian law. Some staff work on a limited, part-time basis and these individuals are compensated in cash based on a per-day rate.)

Name	Position	Gender	Employment history	
			Start date	End Date
Genaro Castillo	Field Assistant CHB	Male	Jan 2013	Present
Maximo Baker	Beach Monitor CHB	Male	Jan 2013	Present
Martin Quintero	Beach Monitor CHB	Male	Jan 2013	Present
Celio Morales	Beach Monitor CHB	Male	Jan 2013	Present
Romero Palacio	Beach Monitor CHB	Male	Mar 2013	Present
Silverio Juarez	Beach Monitor CHB	Male	Jan 2013	Present
Rogelio Serrano	Beach Monitor CHB	Male	Jan 2013	Present
Benicio Abrego	Beach Monitor CHB	Male	Jan 2013	Jan 2013
Juaquin Abrego	Beach Monitor CHB	Male	Mar 2013	Nov 2013
Julian Miranda	Beach Monitor CHB	Male	Mar 2013	Nov 2013
Fermina Baker	Cook CHB	Female	Feb 2013	Nov 2013
Angela Morales	Cook CHB	Female	Feb 2013	Nov 2013
Fermina Martinez	Cook CHB	Female	Feb 2013	Nov 2013
Juana Lopez	Cook CHB	Female	Feb 2013	Nov 2013
Viviana Abrego	Cook CHB	Female	Feb 2013	Nov 2013
Viviana Morales	Cook CHB	Female	Mar 2013	Oct 2013
Virginia Pineda	Cook CHB	Female	Apr 2013	Oct 2013
Anserlmo Santos	Security Guard CHB	Male	Feb 2013	Jun 2013
Leonardo Santos	Security Guard CHB	Male	Jul 2013	Nov 2013
Dionicio Beker	Boat Captain	Male	Jan 2013	Nov 2013
Roberto Bernard	Beach Monitor RB	Male	May 2013	Nov 2013
Francisco Machado	Beach Monitor RB	Male	May 2013	Sep 2013
Fernando Machado	Beach Monitor RB	Male	May 2013	Sep 2013
Mauricio Jose	Beach Monitor EdV	Male	May 2013	Nov 2013
Dianilza Martin	Beach Monitor BB	Female	Mar 2013	Ago 2013



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**Appendix 1. Continued**

Name	Position	Gender	Employment history	
			Start date	End Date
Aneldo Martin	Beach Monitor BB	Male	Mar 2013	Nov 2013
Nivaldo Taylor	Beach Monitor BB	Male	Mar 2013	Sep 2013
Alfred Martin	Beach Monitor BB	Male	Mar 2013	Nov 2013
Erick Trotman	Field Assistant SB	Male	Mar 2013	Jul 2013
Reynaldo Castillo	Beach Monitor SB	Male	Feb 2013	Apr 2013
Santiago Luis	Beach Monitor SB	Male	Feb 2013	Mar 2013
Erick Migar	Beach Monitor SB	Male	Feb 2013	Mar 2013
Sebastian Sanches	Beach Monitor SB	Male	Feb 2013	Mar 2013
Raul Beker	Beach Monitor SB	Male	Mar 2013	Jul 2013
Eduardo Lorenzo	Beach Monitor SB	Male	Mar 2013	Jul 2013
Luciano Carrera	Beach Monitor SB	Male	Mar 2013	Jul 2013
Gustavo Pineda	Beach Monitor SB	Male	Mar 2013	Apr 2013
Celio Quintero	Beach Monitor SB	Male	Mar 2013	Jun 2013
Reynaldo Quintero	Beach Monitor SB	Male	Apr 2013	Jul 2013
Francisco Galino	Beach Monitor SB	Male	May 2013	Jun 2013
Wilfredo Baker	Beach Monitor SB	Male	Jun 2013	Jul 2013
Catalina Abrego	Cook SB	Female	Mar 2013	Jun 2013
Jualia Quintero	Cook SB	Female	Mar 2013	Jun 2013
Moises Nuboni	Security Guard SB	Male	Jan 2013	Feb 2013
Diomedee Baker	Security Guard SB	Male	Ago 2013	Present
Arcelio Gonzalez	Beach Monitor LB	Male	Mar 2013	Present
Ramiro Beker	Beach Monitor LB	Male	Mar 2013	Apr 2013
Virgilio Gallardo	Beach Monitor LB	Male	May 2013	Present

CHB = Chiriquí Beach; EdV = Escudo de Veraguas Island; RB = Red Beach

BB = Bluff Beach; SB = Soropta Beach; LB= Long Beach



**Appendix 2. List of volunteers participating in research and monitoring activities during 2013.**

Name	Position	Gender	Volunteer history	
			Start date	End date
Cordencio Abrego	Volunteer CHB	Male	Mar 2013	Oct 2013
Salvador Baker	Volunteer CHB	Male	Mar 2013	Oct 2013
Wolfredo Baker	Volunteer CHB	Male	Mar 2013	Oct 2013
Abdiel Becker	Volunteer CHB	Male	Mar 2013	Oct 2013
Benjamin Becker	Volunteer CHB	Male	Mar 2013	Oct 2013
Oscario Lorenzo	Volunteer CHB	Male	Mar 2013	Oct 2013
Jonathan Morales	Volunteer CHB	Male	Mar 2013	Oct 2013
Olmedo Quintero	Volunteer CHB	Male	Mar 2013	Oct 2013

CHB = Chiriquí Beach