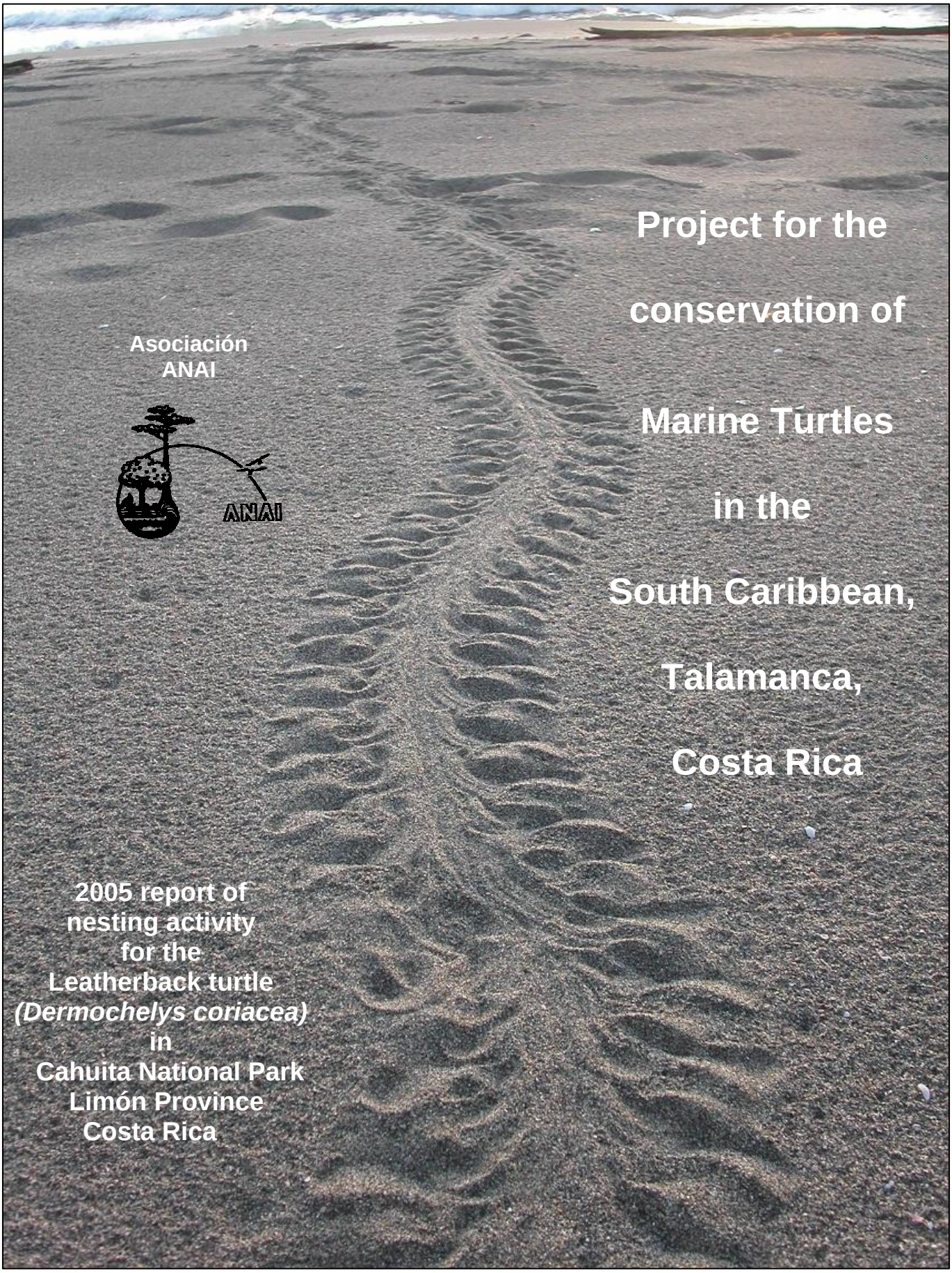

Project for the conservation of Marine Turtles in the South Caribbean, Talamanca, Costa Rica

Asociación ANAI

2005 report of nesting activity for the Leatherback turtle *(Dermochelys coriacea)* in Cahuita National Park Limón Province Costa Rica

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Project for the conservation of Marine Turtles in the South Caribbean, Talamanca, Costa Rica

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The efforts of the international Research Assistants throughout the season cannot be understated. I would like to personally thank;

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The project could not occur without the invaluable help of the many hundreds of international volunteers who came to participate. Endless nights were spent walking the long beach of Cahuita – Playa Negra looking for nesting turtles and the efforts of all resulted in a good season for the leatherback turtle and a positive project result. Many thanks also to the local and international organisations that sent volunteers to participate. These include Volunteer Latin America (VLA) and the Costa Rica Language Academy (CRLA).

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- International Fund for Animal Welfare
- WIDECAST for technical support

Glenn McFarlane
Program Coordinator

All photographs in this report by Glenn McFarlane unless otherwise stated
(Front cover: Morning survey hatchling track of *Dermochelys coriacea*)

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1. INTRODUCTION

The project area of Cahuita – Playa Negra lays approximately 65 kms south of Limón in the Talamanca Province on the south Caribbean side of Costa Rica. Three quarters of the project is situated inside Cahuita National Park with the final quarter further south on the public beach known as Playa Negra, just north of the popular tourist town of Puerto Viejo. The geographic position of Cahuita National Park is 82º49 W and 09º45 N.

The zone of study for the leatherback nesting season covers a total distance of 9.5kms extending from Puerto Vargas at the north end of the main beach, to Playa Negra in the south as shown below.

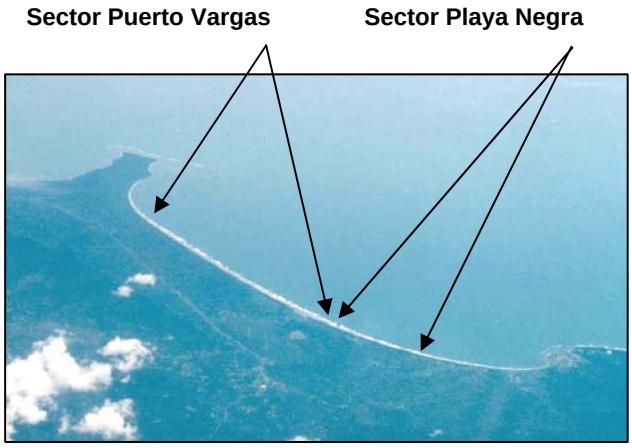


Figure 1: Zone of study for the 2005 nesting season *Dermochelys coriacea*

Nesting within the project area between early February and late July each year are three of the seven species of marine sea turtles; leatherback ***(Dermochelys coriacea)*** (Vandelli 1761), hawksbill ***(Eretmochelys imbricata)*** (Linnaeus 1766) and the green sea turtle ***(Chelonia mydas)*** (Linnaeus 1758).

While hawksbill and green sea turtles visit the project during the dates of this report, minimal nesting activity occurs as their nesting seasons come later in the year. The focus of this report and the conservation and research activities conducted relates to leatherback sea turtles. The largest of all marine sea turtles, leatherback males can grow to an overall length of 3 metres or more with females slightly smaller. When conducting research, only the total length of the carapace or shell is measured. The largest carapace during the 2005 nesting season measured 165 cms with the smallest at 133 cms. Leatherback turtles in the Atlantic Ocean or Caribbean Sea side of Costa Rica are significantly larger than their counterparts of the Pacific Ocean.

There are five project areas on this Caribbean Sea side of Costa Rica – Tortuguero, Parismina, Pacuare, Cahuita and Gandoca. The Cahuita and Gandoca sea turtle monitoring projects are operated by Asociación ANAI. During the late 1990's some monitoring of nesting activity within the park was recorded by a previous organisation, with ANAI formally commencing their conservation and research program in 2001. The results of nesting leatherbacks since the ANAI project started are listed below. Note: monitoring durations and locations varied slightly.

2001: 350 nests **2002:** 296 nests **2003:** 183 nests **2004**: 58 nests

The principal objective of this report and the activities conducted during the period of 15th February to 31st July 2005 is to continue the documented existence and status of leatherback turtles within the project area.

2. SUMMARY OF RESULTS

Table 1: Summary of results obtained from the 2005 nesting season for leatherback (*Dermochelys coriacea)* Cahuita – Playa Negra, 15th February to 31st July 2005.

Total number of records (nests and false crawls)	**351**
Number of nests of *Dermochelys coriacea*	**196**
Number of false crawls of *Dermochelys coriacea*	**112**
Number of nests of *Eretmochelys imbricata*	**10**
Number of false crawls *Eretmochelys imbricata*	**16**
Number of nests of *Chelonia mydas*	**5**
Number of false crawls of *Chelonia mydas*	**12**
Number of females recorded of *Dermochelys coriacea*	**62**
Number of neophyte females	**23**
Number of remigrating females	**39**
Number of females nesting more than once	**26**
Number of females tagged externally during the season	**31**
Number of females internally PIT tagged during the season	**28**
Number of females double-tagged (external metal tags and PIT)	**17**
Interval of re-nesting (nights)	**9**
Average number of nests per female recorded	**3**
Maximum number of nests per female recorded	**9**
Minimum number of nests per female recorded	**1**
Maximum carapace measured	**165 cms**
Minimum carapace measured	**133 cms**
Average carapace length	**154 cms**
Average number of fertile eggs per nest	**75**
Average number of vanos or infertile eggs per nest	**32**
Average depth of nest	**76**
Average width of nest chamber	**40**
Number of nests relocated and camouflaged	**113**
Number of nests left natural	**84**
Number of nests relocated to the hatchery	**2**
Number of nests poached	**36**
Percentage of nests poached	**18%**
Number of hatchlings to the sea	**3,204**
Average success rate of relocated and natural nests	**51%**
Highest success rate of a relocated or natural nest	**96%**
Lowest success rate of a relocated or natural nest	**0%**
Months of highest nesting activity (in rank order)	**May, April, June**
Total distance of the patrol area	**9.5kms**

3. ZONE OF STUDY

The majority of the study area lies inside Cahuita National Park, with the smaller section of Playa Negra adjoining the south boundary of the park. The park covers an area of 1067 hectares of land and 22,400 hectares of sea, which contains the only live coral reef in Costa Rica (approximately 600 ha). This significant area of Punta Cahuita plays a major role later in the year for hawksbill and green turtle nesting activity. Cahuita National Park is classified as Humid Tropical Forest (Holdridge 1959) and is a diverse area for both flora and fauna. Temperatures generally range between 25ºC and 32ºC with humidity 86% to 88%. Playa Negra is named such because of the fine grained black sand due to volcanic activity. This type of sand is common on the Caribbean side of Costa Rica and is also found throughout the ark, except at the north end near Cahuita (Playa Blanca) where white coral sand is found.

Figure 2: Regional map of the zone of study (Source: Asociación ANAI)

During the 2005 leatherback season, the project had two bases. The North station was located at Puerto Vargas inside the park at the MINAE headquarters. The South station was a rented house at Playa Negra. Teams of international volunteers and experienced leaders patrolled day and night throughout the five and a half month season.

Figure 3: Playa Negra South Station (Source: Asociación ANAI)

4. PROTOCOL OF STUDY

Throughout the 2005 nesting season, the methodology of obtaining scientific research data and engaging in conservation activities was conducted in accordance with ANAI protocol. These procedures cover both Cahuita and Gandoca projects and are described in the following pages.

PREPARATION OF THE BEACH

The total distance for the leatherback nesting season covers 9.5 kms and each year the beach is prepared by replacing and installing new beach markers or mojones. Each mojon is 50 m from the next but in the previous four years of the project, this distance was set at 90 m intervals.

From this year onwards (2005), the beach was prepared at a more standard measurement of 50 m interval. This meant the removal of more than 140 old mojones and the installation of 191 new markers.

The method of marking the beach involved either scraping a small section of a tree and painting yellow and black numbers, or installing small timber posts with the same markings. This year each number was deliberately nailed with the nail heads protruding so as to deter locals and poachers from destroying the mojones with their machetes – a common seasonal practice.

There are three main sections of the beach; low tide, high tide and berm or vegetation line. Mojones were placed at the upper level of the high tide mark or in the berm. The selection of location should ensure the mojon remains visible and will not be washed away. Regular vegetation clearing and maintenance of the beach markers is required throughout the season.

Figure 4: A typical post mojon near the vegetation line

The diagram below shows key mojon sectors along the project area. The south entrance trail of the park reaches the beach at mojon 0, with the Puerto Vargas MINAE station located further north towards Cahuita at mojon -27. Heading south along the main beach and Rio Carbon (Carbon River) cuts the patrol area at mojon 110. The final and most southern area of the project extends to mojon 164 on Playa Negra towards the popular tourist town of Puerto Viejo.

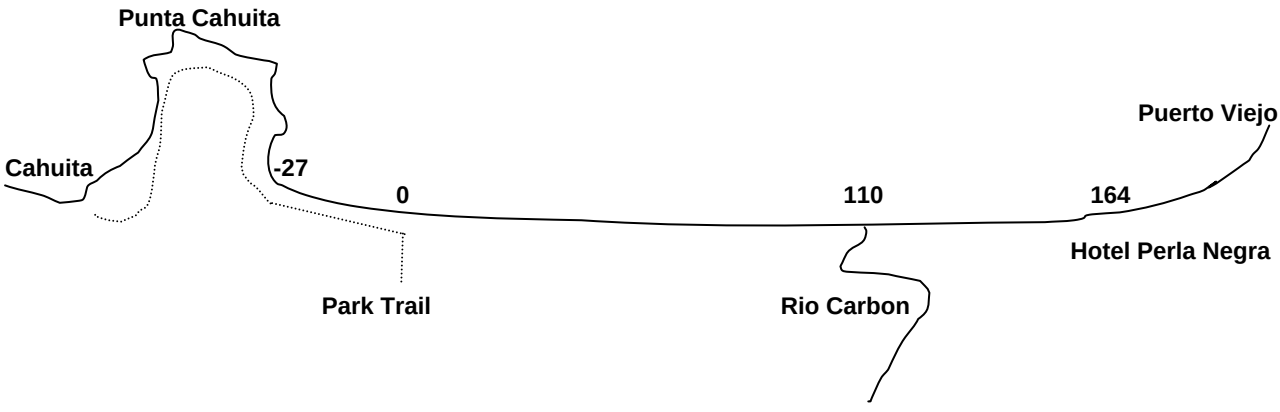


Figure 5: Map showing key beach markers

HATCHERY CONSTRUCTION

Each season a new hatchery requires building as the previous year's location cannot be used due to contamination of the sand from embryonic fluids from hatching eggs plus localised decay. The 2005 hatchery was a cage model and was moved approximately 10m from last year's site and construction began late February. For personal security reasons, the hatchery is located outside of the North station inside the park boundary.

To create a hatchery such as the one required for this project, volunteer and staff dig down and sift the entire hatchery to remove tree roots, rubbish, other debris and natural predators such as crags and nesting iguanas. The hatchery was 7 m long, 4 m wide and 1.5 m deep (42 cubic metres). Once the supports and surrounding mesh are installed to a depth of 0.5 m, the inside is marked out in a 0.5 m grid pattern to allow for nests placed in every second grid. Wire baskets protecting the eggs below from predators such as fly larvae and crabs are installed and labeled as per the species, tags numbers, date, number of eggs and nest grid code.

The 2005 project hatchery differed greatly from previous ones with the inclusion of wire fencing mesh (including the sealed roof) and barbed wire placed along each join. This more secure version of a hatchery was required to keep local poachers from cutting through the standard bird wire mesh to steal newly placed nests – a problem which occurred during 2004.

Figure 6: Volunteers assisting with the construction

Figure 7: Hatchery side view

Figure 8: Front view showing moat pit and sandbags to try and prevent encroaching tides throughout the season

PATROLS

Night patrols –

Throughout the nesting season patrols were conducted on 167 nights between the hours of 8:00 pm and 4:00 am. Departure and return times varied occasionally to ensure a greater number of turtles were located on a very long beach. The standard duration time of patrols were five hours covering a round trip distance from both ends of the beach of 13.7 kms for each of the four nightly patrols. Two patrols led by experienced Research Assistants (leaders) departed at staggered times from the North station as did two patrols from the South station. This meant a greater presence was given on the beach at night during 2005 than in past years. Patrols took short rest breaks every 40 minutes and occasionally doubled back across key nesting areas.

Changeable weather conditions meant 50% of nights that the South station was operational (59 of 118 nights), patrols were unable to cross Rio Carbon and meet at the halfway point of the entire patrol area at mojon 70. In times of flood and in conjunction with the lunar cycle, the river floor becomes unstable, preventing a safe crossing. This resulted in the two north patrols extending their walk to the river and back with the south patrols limited to the Playa Negra sector. Thankfully there were sufficient nesting turtles on this section to keep the patrols active.

Morning surveys –

Approximately once a week the Coordinator walked the entire beach to identify stable areas where the Research Assistants could relocate and camouflage the nests found at night whilst on patrol. The project at times struggled with the changing dynamics of the beach and suitable relocation areas were identified on a regular basis.

During hatchling season from the start of May onwards, daily morning surveys were conducted for a number of reasons:

- To assess the beach
- To check any natural or relocated nests from the night before
- To check the state of nests subject to predation and erosion
- To locate nests due to hatch and conduct beach cleaning
- To look for and count hatchling tracks
- To conduct nest exhumations
- To observe the presence of poachers from the night before

USE OF LIGHT

In accordance with general sea turtle practices of the RCA Agreement in Central America, all lights were covered with a red filter when working with a turtle or in the hatchery. Minimal light was use at all times for the following reasons:

- It becomes an unnecessary action and a distraction when patrolling the beach
- In the absence of radios, patrol leaders may occasionally use a series of signals to contact another patrol
- Light is a distraction to turtles attempting to nest
- The use of light signals to the poachers the position and direction of the approaching patrols

TAGGING

Two tagging methods were used when nesting female leatherbacks required identification: one **PIT** (Passive Integrated Transponder) and two Monel #49 titanium **external tags**. Note: rubber latex gloves are worn at all times when touching a turtle, handling eggs and conducting exhumations.

Before installing a **PIT**, the turtle was checked with the scanner making circular movements of the right shoulder (all left and right directions are as if you were standing behind the turtle) while she was depositing the eggs. If no PIT is located, the left shoulder is checked for a wrong side marking.

Wearing latex gloves, the right shoulder was cleaned with Vanodine (an antiseptic and anesthetic) before the leader completes the process of injecting the sterile needle. This was in accordance with the correct breathing pattern of the turtle which is when the shoulder muscle is expanded.

Figure 9: PIT tag scanner and gun with needle. Note the small plastic bar coded PIT pictured below the needle.

Once inserted, if necessary the area was cleaned with additional Vanodine. Verification of the chip is again checked with the scanner.

The turtle may also require external tagging using specially developed titanium tags stamped with consecutive numbers for ease of identification. Occasionally, only one tag is required for replacement or ill fitting tags may be removed if possible and a new one installed.

The same tagging protocol is observed in preparing the turtle for the procedure: check of previous tags, latex gloves used, cleaning the area, new tag numbers recorded on the data sheet.

Once the turtle has deposited the eggs and starts to cover the nest, the leader will insert the highest numbered tag on the right rear flipper first, ensuring it is placed with the proper distance between the edge of the skin and the edge of the tag. This is to prevent friction when the turtle is in motion. Hawksbill and green turtles are tagged in the front flipper on the second axilar scale out from the body.

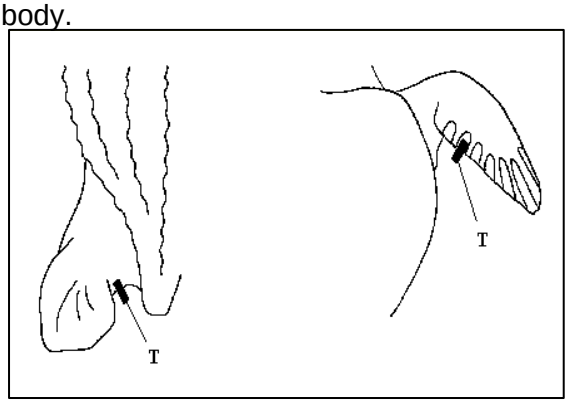


Figure 10: The diagram (left) shows the position of external tags for the leatherback in rear flippers, plus the position in the front flippers for hawksbill and green sea turtles

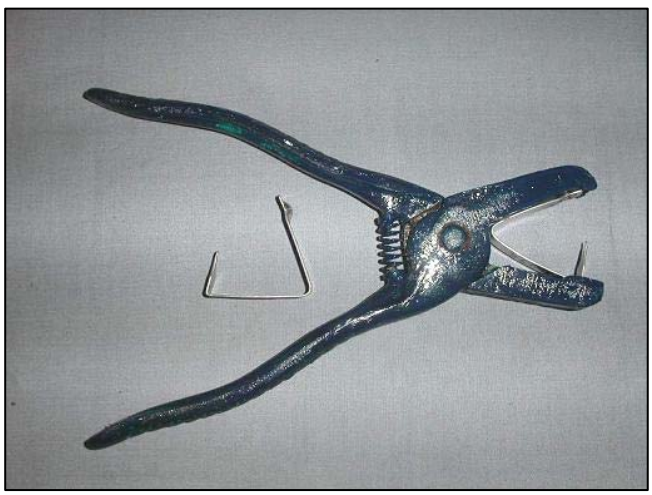


Figure 11: The photo (right) shows two Monel tags used for all species at the project. The pliers are those used for tagging cattle ears, which are commonly used by most sea turtle monitoring programs.

Tissue DNA sampling is also conducted under the protocol of Asociación ANAI.

Immediately after the female begins to lay her eggs and before she begins to cover the nest, the leader will prepare to take a tissue sample for DNA testing. Again, the same procedure of cleaning and preparing the area is followed, with a small piece of the rear flipper the approximate the size of a bean.

Figure 12: The photo (left) indicates the method of removal of a small piece of rear flipper. The turtle pictured was a dead green female which was brought to the project during the season. She was illegally killed by local fishermen and dumped overboard when the authorities approached by boat.

Volunteers and leaders also make notes on the data sheets of any abnormalities, lesions or missing flippers turtles may have. This information together with DNA sampling, allows for a greater overall picture of the health of each turtle.

BIOMETRICS

Each turtle is measured after the egg laying process when she is covering the nest. Measurements are taken three times by the leader and volunteers to ensure correct statistical information.

Only the length and width of the carapace are measured in centimeters, not the overall length of the turtle. Longitudinal measurements are taken on either side of the main centre ridge, continuing to the end of the peduncle. The widest point of the carapace is also noted.

Figure 13: The photos above indicate how a leatherback is measured after sand is cleared for accuracy
(Source: Asociación ANAI)

Additional measurements are taken of the nest depth and chamber at the bottom. The nest depth is obtained using a stick when the turtle starts to build the internal chamber.

The internal chamber width is gained by measuring the widest point of one of the rear flippers. This is best done when the turtle is stationary while depositing the eggs.

Both these measurements are crucial in relocating the nest to a safer or more desired location.

COLLECTION OF THE EGGS

Once the turtle has cleared the area and constructed a body pit, dug the nest and positioned herself, she then begins the process of depositing the eggs. Depending on the species, this may take some time or in the case of the leatherback it can be comparatively short. Prior to laying, the leader digs a small channel at the rear of the nest to allow for easy removal of the egg bag. A volunteer is positioned lying down behind the turtle and is indicated by the leader when to position the plastic bag under the clocoa or tail. It may be necessary for the volunteer to gently spread the covering flipper with the wrist or forearm to ensure the eggs are being deposited into the bag.

Figure 14: Collecting the eggs
(Source: Asociación ANAI)

Approximate times for a leatherback to emerge and lay:

- Exit the sea and move to the high tide mark **15mins**
- Prepare the area and dig the body pit **20mins**
- Dig the nest and chamber **10 - 30mins**
- Deposit the eggs **8 – 15mins**
- Cover the nest **10mins**
- Camouflage the entire area **20mins**
- Return to the sea **15mins**

FINAL DESTINATION

The two main problems associated with why the eggs are not left natural, are poaching and beach erosion.

Due to the high presence of people on the closed beach at night illegally taking the eggs, especially on the more public Playa Negra end of the project area, it is necessary for the leaders to take the bag of eggs and nest measurements and relocate and camouflage to a new nest site. Once completed, the leader takes a series of triangulated measurements and supportive compass bearings to allow for the nest to be found months later for exhumation. The location of the hatchery far from the main nesting beach is the reason why almost all nests were relocated and camouflaged during the season. Due to their large size, damage to the embryos can occur if leatherback eggs are carried too great a distance.

The patrol area of Cahuita – Playa Negra is very dynamic and erosion accounts for many nests left natural if the patrol missed seeing the nesting turtle and could not locate the eggs. In this case, each nest site was extensively camouflaged sometimes from the sea to the vegetation to remove almost all signs of the tracks and body pit. This made it extremely difficult for the poachers to locate the eggs. Unfortunately during 2005, many of these camouflaged natural nests were laid on the low tide mark and few exhumed results were obtained.

5. RESULTS

Nest and false crawl activity

A total number of 351 data registrations were recorded for the 2005 leatherback nesting season between 15th February and 31st July. The diagram below indicates total nest numbers and percentages per species.

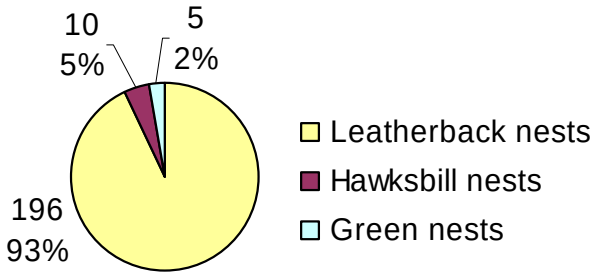


Figure 14: Nesting activity by species

The diagram below indicates the number and percentage of false crawls per species.

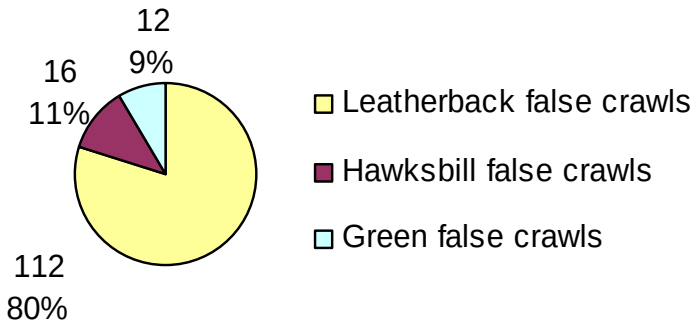


Figure 15: False crawl activity by species

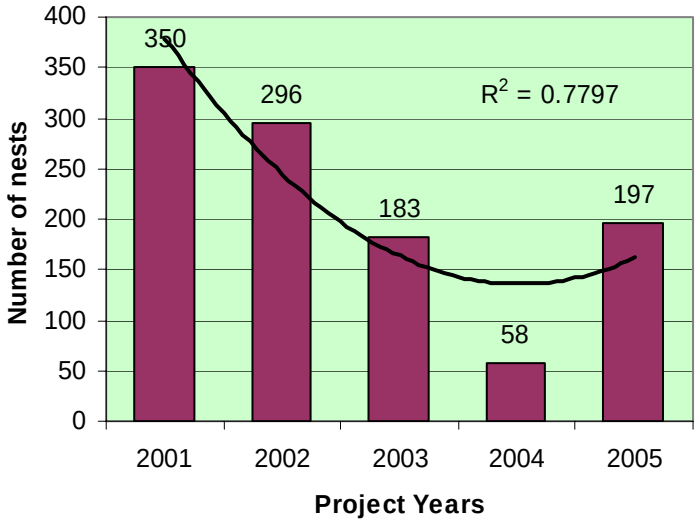


Figure 16: Annual nesting trend 2001 – 2005

Annual nesting activity

In comparison to previous years since the project commenced, 2005 registered a return to a nesting level greater than that of 2003.

This was a pleasing result as it appeared in 2004 that many leatherbacks deserted the five monitoring projects on the Caribbean side of Costa Rica (Tortuguero, Parismina, Pacuare, Cahuita and Gandoca) and instead chose to nest further south in Panama.

Nesting activity by month

Nesting leatherbacks first appeared during the 2005 season on the 27th of February. During March there was a consistent spread of nests across the month.

The season peak occurred from the 28th April to 8th June which accounted for 46% of the total nests during this 6 week period. Nesting activity after this point dropped away quite significantly and only two nests were recorded during July.

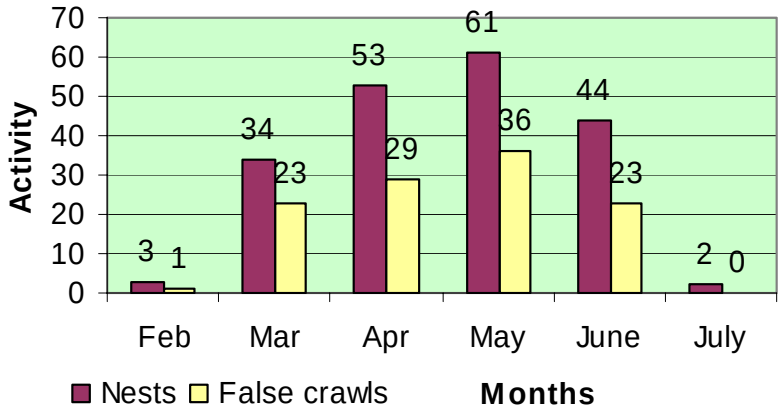


Figure 17: 2005 nesting activity by month

False crawl activity was fairly consistent across March and April with a significant increase during May. Numbers then returned to previous levels for June, with no false crawls recorded during July. The month with the greatest number of false crawls relative to the total activity was March (40%).

The diagram below indicates a comparison of monthly nesting activity from previous project years. Due to a sight variation in project operating dates, only data for March, April, May and June is shown.

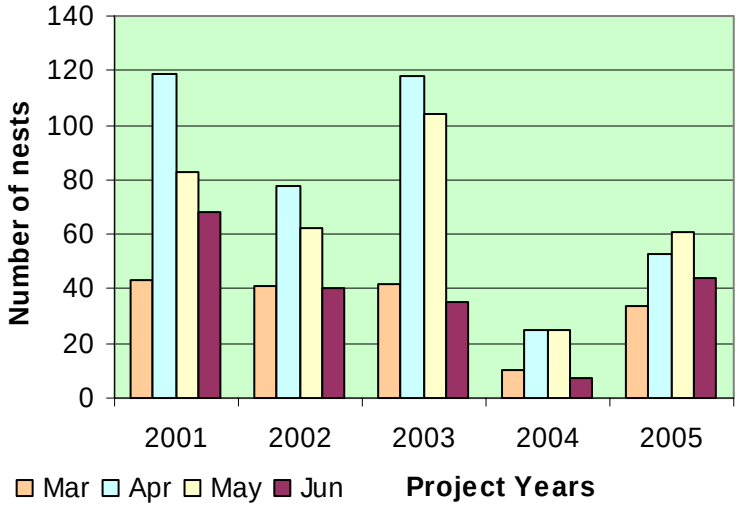


Figure 18: 2001 – 2005 monthly comparison of nesting activity

Nest and false crawl locations

The total area covered by patrols and beach markers, or mojones, extended from -27 in the north to 164 in the south. This season leatherbacks nested across almost the entire beach from mojon -21 to mojon 164.

Three key areas were identified:

- between 36 and 62 on sector Puerto Vargas
- between 76 and 92 on sector Puerto Vargas
- between 115 and 131 on sector Playa Negra

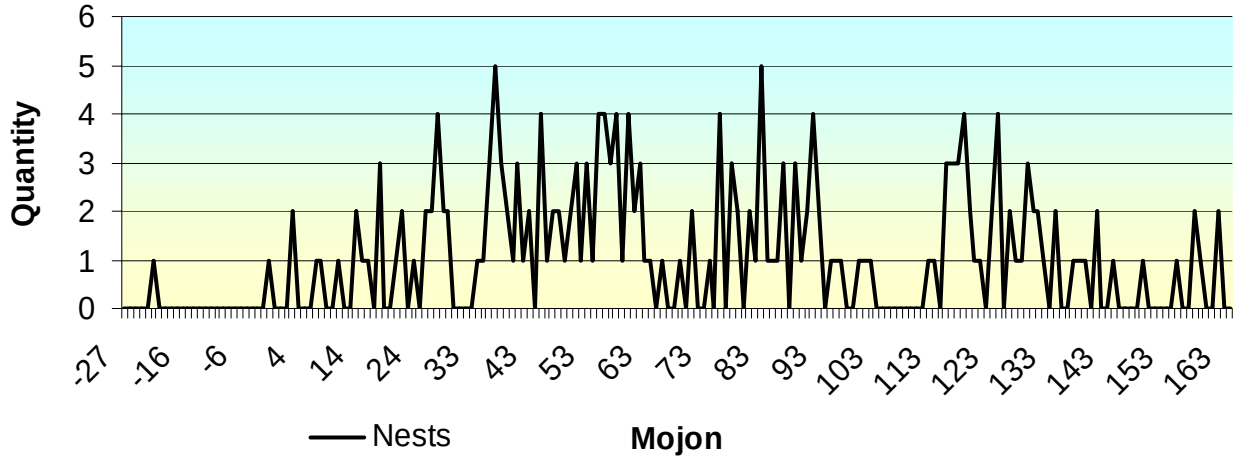


Figure 19: Distribution and frequency of nests

It is interesting to note that in the diagram below, the majority of false crawls were recorded at almost the exact same three key nesting areas: mojon 36 to 62, 76 to 92 and 115 to 131.

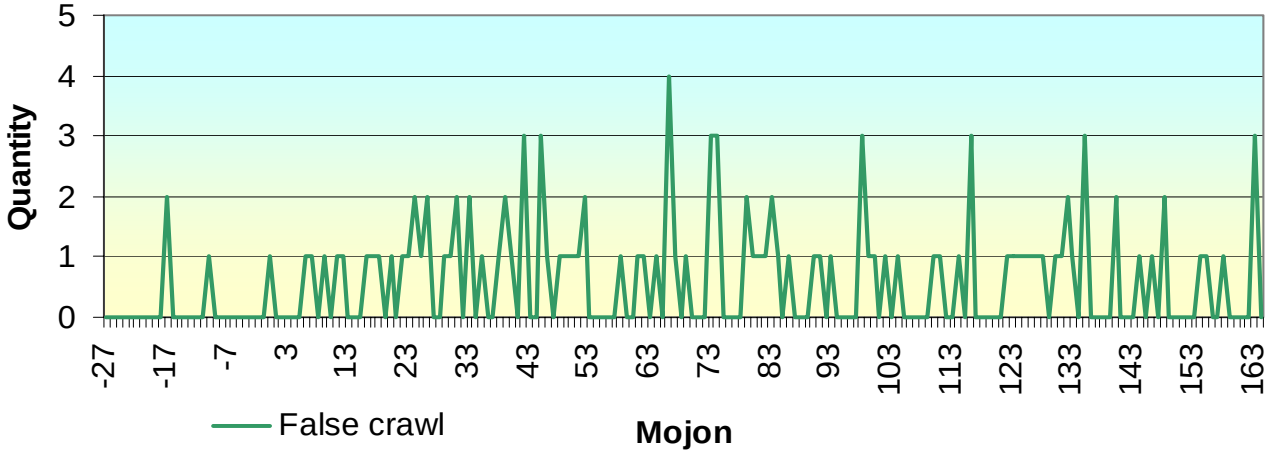


Figure 20: Distribution and frequency of false crawls

During the majority of nights when a turtle false crawled and was not seen, the researchers suggested their patrols encountered the same turtle within the next two hours. When a turtle false crawled, for example at mojon 80, she inevitably returned to the sea, turned left and swam with a small current that runs close to the beach, and then re-emerged, for example, near mojon 30. This hypothesis by the author enabled the North patrols to locate a greater number of turtles by returning the way they came rather than continuing further down the beach. In this case, patrols approaching from the south covered the remaining sector of the beach.

Hourly distribution

The peak nesting time for leatherbacks was between 10 pm and 1 am with this three hour period accounting for 56% of nests. Early morning surveys recorded an additional 5% of nests laid after the patrols (not shown on the chart).

It should be kept in mind that these times are from when each patrol recorded seeing the nest (with or without the turtle present) such that the turtle may have actually laid approximately one hour earlier.

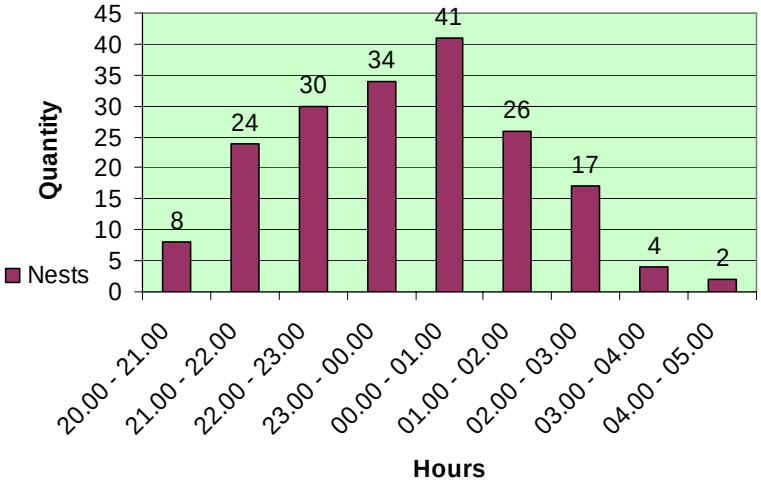
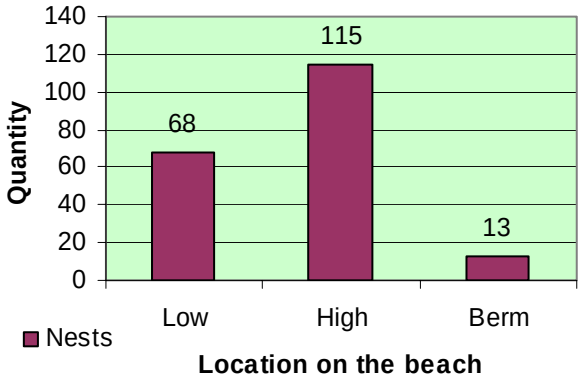


Figure 21: Hourly distribution of nesting activity



Position of the nests in relation to the sea

Turtles choose different locations to nest each time they return to the beach. Some favour nesting in the berm or vegetation, some on the more appropriate high tide sandbank and others at the low tide mark. A turtle may also choose a combination of locations throughout the course of the season.

The diagram left shows the natural position each turtle selected prior to the nest being relocated to a more suitable area.

Figure 22: Nesting beach zones selected by the turtle

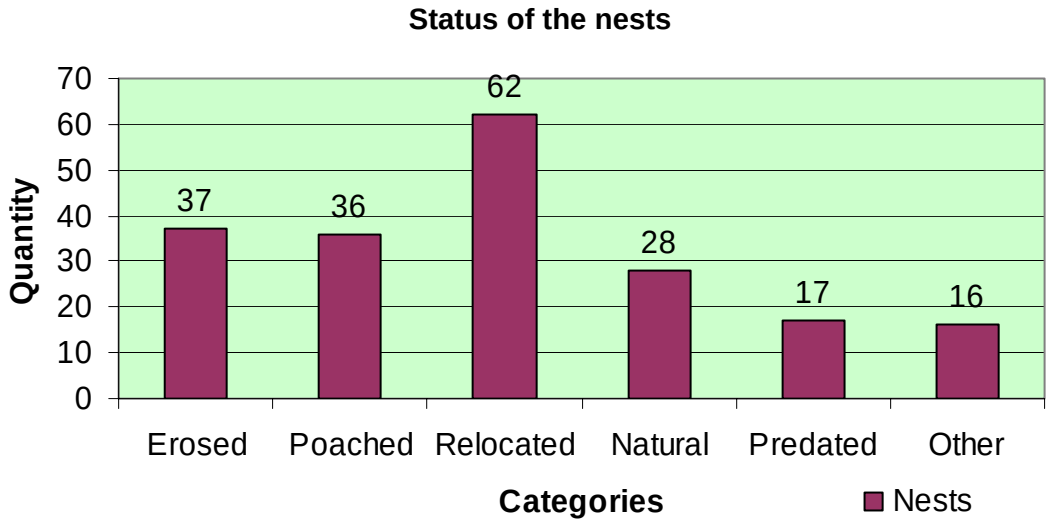


Figure 23: Status of nests during the 2005 season

One of the main aims of the project is to collect and save as many eggs as possible for a greater percentage of hatchlings to the sea. This means patrols need to effectively see the turtle before or during the laying process.

Explanation of Categories:

Erosion – Natural and relocated nests where the sea encroached to erode away the nest environment. The high water table also accounted for nests. In some cases accretion (the deposition of sand) occurred with up to 0.8m of additional sand preventing embryos from developing or hatchlings emerging.

Poached – nests illegally taken within the first 48 hours by local poachers from the communities of Punta Riel, Hone Creek, Puerto Viejo and Cahuita.

Relocated – eggs collected by the patrols then relocated and camouflaged by the leaders.

Natural – nests where the patrols did not see the turtle laying and could not locate the eggs, such that the entire area was rolled flat and camouflaged from the poachers.

Predated – nests naturally predated by animals such as raccoons, pizotes, crabs, ants and fly larvae.

Other – some nests were unable to be located for exhumation due to logs where they were measured to, being washed away or poor measurements taken in the dark.

Erosion:
Due to the large expanse of beach and the south patrols unable to cross Carbon River for 50% of nights, many natural nests were lost to erosion as the north patrols were required to cover a greater distance to the river and back. This meant some turtles and their eggs were missed. The diagram right shows the distribution of nests laid on the low tide mark. (See also Beach Dynamics)

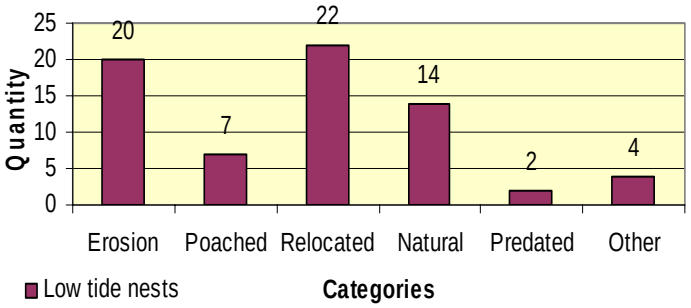


Figure 24: Status of nests laid on the low tide mark

Poached:
18% of nests were poached during the 2005 leatherback season. This figure of 36 nests was a good result when compared to the past four years of the project, the length of beach to be covered and minimal law enforcement presence to arrest poachers at night. The diagram right shows annual trends.

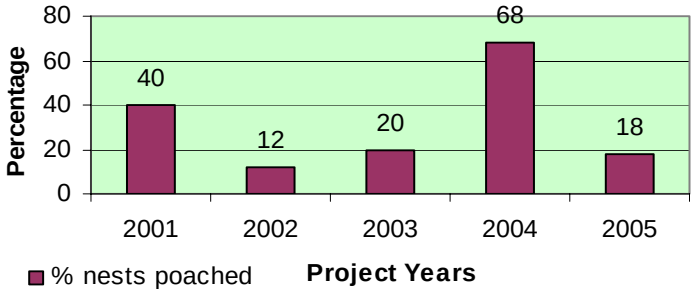


Figure 25: Percentage of nests poached 2001 - 2005

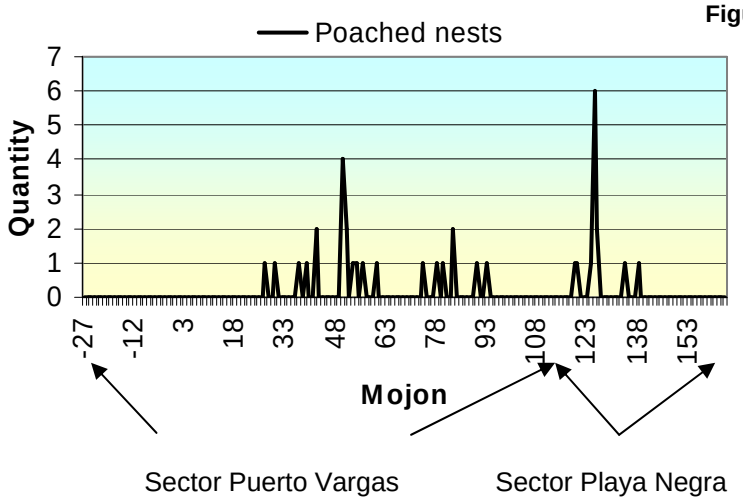


Figure 26: Distribution and frequency of poached nests

Two key relocated areas were identified as being favoured by poachers:

- mojon 50 to 56
- mojon 124 to 126

These two areas accounted for 50% of poached nests. The comparatively short section of Playa Negra represents 36% of the poaching. The diagram left shows where nests were poached in relation to the two sectors of the patrol area.

Number of turtles
State of the population

A total of 62 different leatherbacks were recorded as nesting during the 2005 season.

23 were neophytes (first time nesters) while 39 were returning and would have nested in the project area or in other places over the years. The diagram right shows the number of nesting neophytes and re-migrant turtles on an annual basis.

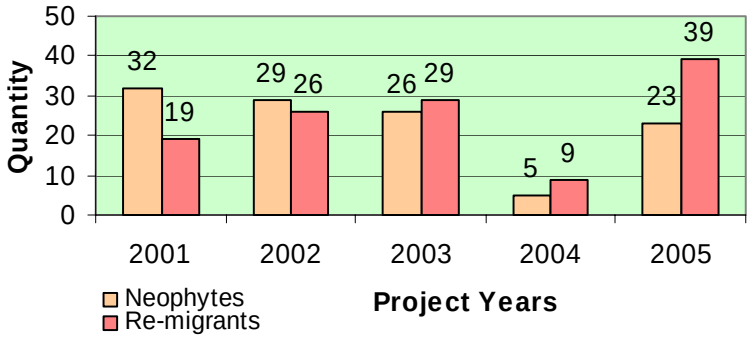


Figure 27: Comparison of neophyte and re-migrant turtles 2001 - 2005

Re-nesting intervals
Number of times

The number of nights between turtles returning to the beach to nest again averaged 10 nights. The minimum interval was eight nights with the maximum for a recorded turtle at 39 nights, indicating that this female nested possibly four additional times elsewhere before returning to Cahuita. Possible locations were Tortuguero, Parismina, Pacuare, Gandoca or nesting beaches in Panamá.

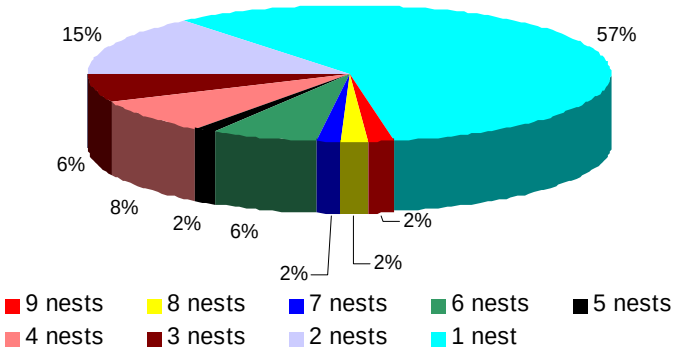


Figure 28: Percentage and frequency of nests by turtle

Some turtles remained extremely faithful to the beach nesting 6, 7, 8 and 9 times. An older turtle such as **D7735 - VA0048** nested 9 times and favoured three distinct locations – two on the main beach inside the park boundary and the other on Playa Negra. In fact, the first two nestings were within 2 m of the same mojon. The diagram left shows the percentage of times each turtle returned to the project area to nest.

Position of the turtle

The data recorded by each patrol also indicates which position the turtle eventually chose to nest in relation to the sea (not all nesting turtles were observed). Leatherbacks generally choose to nest with their head facing the berm. The water may be viewed (standing behind the turtle) on the left, the right or she may have her head facing the sea.

The diagram right shows the quantity for each category observed.

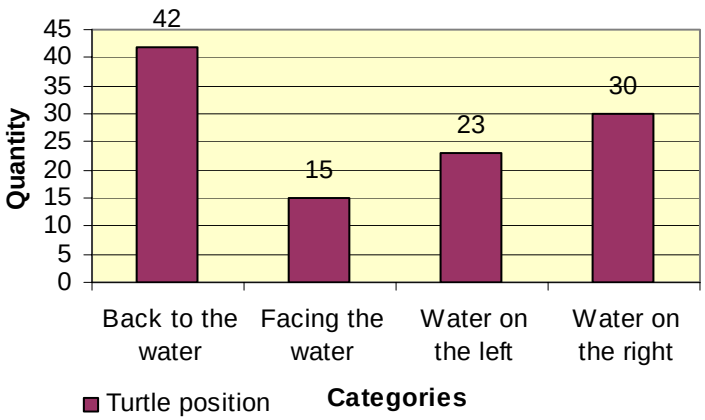


Figure 29: Position of the turtle in relation to the sea

Tagging

External:

The series of tag numbers used during 2005 was in line with recent ANAI protocols to help standardise tag numbers across all four projects on the Caribbean side of Costa Rica. External tag numbers were in the range of **VA6001** to **VA6556**.

A total of 31 turtles (50%) were tagged externally with metal tags in either the left, right or both flippers. Two external turtle tag numbers (CH1892 – CH1893, WC3137 – WC3138) were recorded with these two turtles tagged respectively by projects at Playa Chiriqui in Panama and Playona Beach in Columbia. Tag numbers were also recorded from previous project years (2001, 2002 and 2003) with known turtles tagged at Cahuita, Gandoca and Pacuare.

PIT:

The PIT tags used during the season were in the range of **123 675 650 A** to **132 647 762A**.
A total of 28 turtles (45%) were PIT tagged.

17 of 62 turtles (27%) during the 2005 leatherback season received both external and internal tags.

Turtle biometrics
Nest biometrics

Leatherbacks of the Atlantic Ocean and those found nesting in the Caribbean Sea are larger than their counterparts on the Pacific Ocean side of Costa Rica. Only the carapace or shell is measured for length from behind the head either side of the main centre ridge, to the end of the peduncle covering the tail. The width of the carapace is taken from the widest point measuring across the top and the ridges.

Of the 62 turtles with recorded tag numbers, 60 were measured. The 2005 season averaged was 154 cms (SD = 7.97cm) in length and 111 cms in width. The maximum measured 165 cms and the minimum 133 cms. By comparison, the widest turtle was 122 cms and the narrowest 99 cms with an average width of 111 cms (SD = 4.88 cms). The diagram right shows the number of turtles and percentages for length categories measured in centimeters.

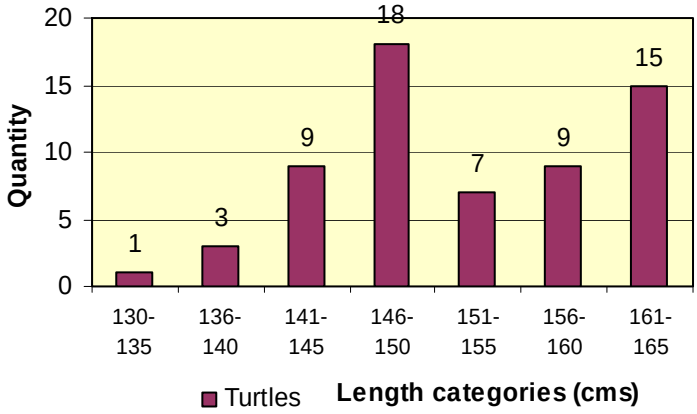


Figure 30: Carapace length 2005

Whenever the eggs were taken from the original nest environment, the patrols measured the depth and width of the eggs chamber from the original nest. This allowed for the accurate recreation of dimensions upon relocation, to ensure a more natural hatch success rate.

The depth of the nest was generally measured with a stick prior to the turtle depositing the eggs. The width of the lower egg chamber was obtained by measuring the widest part of either rear flipper. The diagram left shows the shape of a leatherback nest.
The average nest depth was 76 cms (SD = 5.03) with a width of 40 cms (SD = 3.43). The deepest nest was measured at 90 cms and the shallowest 65cms. The largest egg chamber / flipper measurement was 46cms and the smallest 30 cms.

Figure 31: Leatherback nest construction (Source: Asociación ANAI)

Inspection of turtles

One of the final pieces of data collected by patrols when working with a turtle is an observation of all flippers, the head including the eyes, the carapace and the general body structure. This is done to gain an overall picture of the health of the turtle. Many leatherbacks have pieces missing from the rear flippers in particular, as a result of poor previous tagging or attacks by fish such as barracuda. Occasionally nesting females are observed missing an entire rear flipper as a result of an attack most likely by a tiger shark.

During the 2005 nesting season inspections were carried out on 58 of the 62 recorded nesting turtles. Some turtles were observed returning to the sea when time for an inspection was not a priority. For ease of reference, observations have been divided into the three categories shown below.

Flipper tears, cuts, sections missing:
The diagram right shows the number of and percentage of injuries to each flipper.

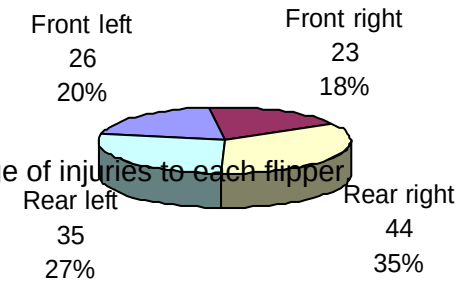


Figure 32: Observed flipper injuries

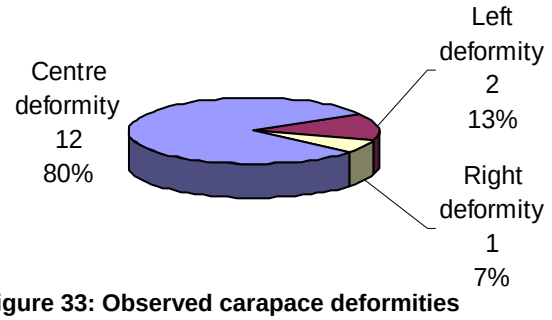


Figure 33: Observed carapace deformities

Carapace deformities:
This includes raised sections, depressions or cuts observed on the centre, left or right side as shown in the diagram left.

Surface observations:
Turtles may carry numerous external growths, some more natural than others. This category shown in the diagram right covers scars located on the head and shoulders, lumps, barnacles and FP (fibropapilloma: cancerous tumors). During the season, two turtles were observed showing possibly early stages of FP.

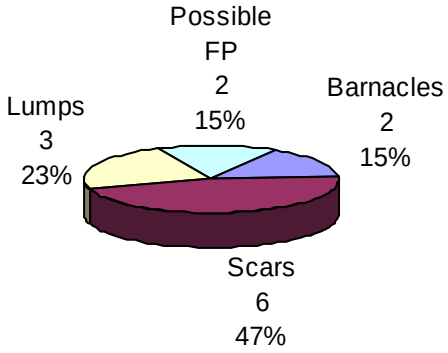


Figure 34: Observed surface markings

Other species

During the 2005 leatherback season there was a small amount of nesting activity from hawksbill and green sea turtles. 10 nests and 16 false crawls were recorded by hawksbills (*Eretmochelys imbricata)*, with 5 nests and 16 false crawls for green turtles *(Chelonia mydas).*

The nesting season at the project area for both these species is from 1st May to 30th November, such that data obtained up to 31st July is included in the hawksbill nesting report.

Number of eggs

Each time a turtle visits a beach to nest, she may deposit a varying number of eggs compared to previous nestings. This is particularly relevant to leatherbacks. The species is the only one of the seven marine species that deposits vanos or yokeless infertile eggs. There are some theories that the vanos serve to help incubate the nest through gas exchanges or may prevent full predation of a nest by animals.

During 2005, the **average** number of eggs laid was 76 fertile (SD = 21.08) and 32 (SD = 14.03) yolkless.

The **maximum** number of each type was 127 fertile and 71 yolkless.
The **minimum** was 7 fertile and 3 yolkless.

No apparent trends were noticeable between the age of the turtles (neophytes and re-migrants) and the number of fertile eggs deposited.

There appears to be little consistency between the numbers of eggs laid.
For example D7735 – VA0048 nested nine times and averaged 93 fertile eggs. Yet another turtle VA0026 – VA6007 nested 8 times but averaged only 29 fertile eggs. This category of re-migrant turtle **averaged** 76 fertile eggs (SD = 22.54) with a **maximum** of 112 and a **minimum** of 29.

Neophytes or first time nesters also did not offer any significant difference in the number of eggs deposited. By comparison, neophytes **averaged** 74 eggs (SD = 21.21) with a **maximum** of 124 and a **minimum** of 29.

Nest exhumations

Nest exhumations were carried out on a total of 90 nests in the following categories:

- 28 natural nests (31%)
- 60 relocated and camouflaged nests (67%)
- 2 nests in the hatchery (2%)

The table below lists the main results of each fertile egg which was accounted for.

Table 2: Number of eggs and staged observed on exhumation

Category:	Number of eggs:	%
Eggs opened	2,123	100
Without development	1,488	70
Stage 1	343	16
Stage 2	114	6
Stage 3	68	3
Stage 4	110	5

Explanation of terms:

Eggs opened – eggs which did not hatch

Without development – no development of the embryo was apparent

Stage 1 – embryo is from the development of the eyes and/or bloodline to occupying 25% of the shell

Stage 2 – embryo occupies 50% of the shell

Stage 3 – embryo occupies 75% of the shell

Stage 4 – embryo occupies 100% of the shell but remains inside
In addition to determining what stage of development each embryo reached, other details of the eggs and nest environment were noted. The table below lists these categories.

Table 3: Number of dead hatchlings and observed egg deficiencies

Categories:	Quantity:	%
Hatchlings dead outside nest	61	27
Hatchlings dead inside nest	165	73
Categories:	**Number of eggs:**	**%**
Embryo with larvae	113	16
Shell with larvae	86	12
Fungus	82	12
Bacteria	17	2
Coleopteron	42	6
Crab	214	31
Bones / Skin	9	1
Deformity	23	3
Undetermined	124	17

Explanation of terms:

Dead outside nest – hatchling found at the surface or on its way to the sea

Dead inside nest – hatchling out of the shell but inside the nest environment

Embryo with larvae – opened shells where the embryo and shell contained larvae

Shell with larvae – undeveloped embryo with larvae inside

Fungus – grey infestation of the embryo

Bacteria – obvious colouring on the outside or inside of the shell

Coleopteron – small white beetle-type insect inside the egg

Crab – outside of the shell contains a slit from crab predation

Bones / skin – remains of embryo

Deformity – live hatchling with side or carapace deformity

Undetermined – unclassifiable embryo due to predation or infestation of some kind

Number of hatchlings

Data collated from the 90 exhumed leatherback nests showed a total of 6,304 fertile eggs were laid. Due to natural and unnatural influences 3,204 hatchlings made it to the sea (51%).
This figure is obtained by the following formula:

$$\frac{\text{(number of shells)} - \text{(number of dead hatchlings)}}{\text{(number of eggs laid)}} \times 100$$

A total of 36 nests were poached during the season, resulting in a taking of 2,488 additional eggs.

Nest success rates

When a patrol in the project area encounters a nesting turtle, there are limited choices for the leader as to where to take the eggs. Nests left natural and camouflaged stand a fair chance of success, but collecting the eggs and relocating and then camouflaging the nest is generally a safer option. Due to the long distance to the hatchery (in some cases up to 6.5 kms) relocation was not an option. No nests were deliberately left natural if the turtle was observed depositing the eggs.

There were 62 relocated and camouflaged nests resulting in a success rate of hatchlings to the sea of 49%. This figure is comparable to Asociación ANAI's other sea turtle project in Gandoca which recorded a 47% success rate for relocated nests during the 2005 leatherback nesting season.

The success hatch rate of the 28 natural nests camouflaged was 56%. While this figure may seem more suitable as an option for the patrols, 37 additional natural nests were lost to erosion (see also Beach Dynamics) which on average would have been an extra 2,775 eggs safely relocated.

Bacteria and fungus infestation of some nests accounted for many eggs not developing. Without the use of a microscope, detection was done in the field by eye. Volunteers and staff occasionally returned following exhumations wondering why all 100 eggs of a nest were without development.

A nest anywhere is subject to natural predation but of the 17 nests in this category, 15 were situated on the high tide or in the berm where most animals frequent.

Beach dynamics

Many sea turtle nesting beaches of the highly volatile Caribbean Sea are subject to structural change and Cahuita National Park and Playa Negra are no exceptions.

During the early part of the season from mid-February to the end of April, there was no beach to walk on from mojon -27 at the North Station down to mojon 3 (a distance of 1.5 kms). Steep sandbanks of up to 1.8m regularly appeared and disappeared throughout the season, as did a small creek at mojon 10. The changing dynamics of the beach is such that in the space of a four hour patrol, this non-existent creek became a knee deep torrent upon return.

As the season progressed, the main beach suffered severe erosion in some places (mojon 26, 70 and 87) with eggs from natural nests observed scattered along the waters edge. At the same time, other sections of the main beach were either underwater (mojones 6 to 25 late in the season) or suffered from accretion. Some nests on exhumation were located at a depth of 1.3m both on the main beach in the park and also on Playa Negra.

Other natural nests while situated near the vegetation zone were subject to the high seawater table in some locations, resulting in exhumed nests cold and wet.

Playa Negra registered nests in almost all of the above examples but historically it is a narrow beach and 2005 was no exception. An extensive sand flat near the mouth of the Carbon River came and went throughout the season, although some leatherbacks liked to nest on the Playa Negra side. In fact, the river was a source of concern during the season from February to June as the south patrols were unable to cross 50% of nights (the river can extend to around 100m in width with a strong outgoing current plus incoming waves). This meant south patrols were restricted to mojon 116 to 164, leaving the north patrols having to extend their range from the halfway point of mojon 70, down to the river and back.

Playa Negra also suffers from a lack of suitable relocation areas and a high public presence on the beach which complicated matters somewhat.

Figure 35: Beach erosion at mojon 51

The photo left shows one of the many erosion points along the main beach within the park boundary.

While some sections of the beach gained in width, many like this section from mojon 48 to 53 were eroded almost to the vegetation zone.

The photo right features what was once a long and wide section of the beach extending from mojon 16 to 36 on both sides of the sand extension shown.

The picture was taken standing in a straight line to where natural nests were located.

Figure 36: High erosion zone on the low tide mark

Each year the project collates precipitation data located near or in the hatchery at the North station. By comparison to last year, 2005 was a very dry year for the leatherback season from mid-February to the end of July. Data on previous years only extends to June, so for consistency the graph below covers January to June for the past three years and July for 2005.

January 2005 was an extremely wet month with localised flooding further south in the Talamanca region, displacing thousands of people and destroying many farms and roads. From the project months of mid-February to the end of July, little rain was recorded thus making the beach wide in some sections.

The dry weather during hatchling season meant that turtles emerged from some nests during the scorching morning sun due to the intense heat of the sand, instead of emerging during cooler nightfall. A total of 43 leatherback hatchlings were found dead in their tracks on the way to the sea.

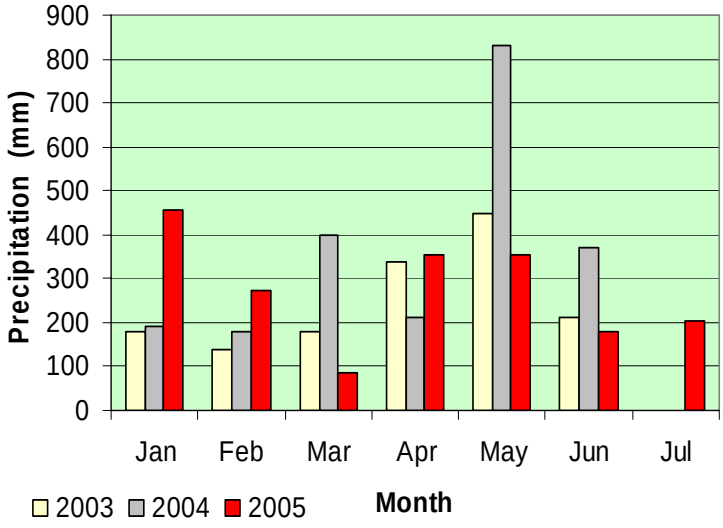


Figure 37: Annual precipitation 2003 – 2005
Note: No July statistics available for 2003 and 2004
(Source: MINAE data and ANAI hatchery data)

Illegal presence on the beach at night

The beach is closed to the public at night from 6 pm to 6 am on three quarters of the project area within the confines of the national park. The remaining section, Playa Negra, is more difficult to police as there is a high public presence of locals, poachers and fishermen at the river at night. The fishermen at either side of the river pose no real threat to nesting turtles and many often explain to the leaders that they do not walk the beach looking for turtles. Other fishermen on the beach at night are what the author would call 'opportunistic poachers'. The permits granted to Asociación ANAI are for marine sea turtle research and conservation – not for law enforcement.

18% or 36 nests were poached across both sectors of the project area, accounting for 2,488 fertile eggs stolen. 35 nests were leatherbacks and one from a green turtle.

A record was kept of information gained from each patrol when they observed a presence at night or from morning surveys when footprints under the vegetation line and poachers were seen. The table below is a summary of the results.

Table 4: Monthly record of an illegal presence at night in relation to poached nests February to July

Month	Number of known incidents	Number of nests poached
February	0	0
March	12	3
April	23	13
May	27	13
June	19	7
July	9	0

A total of 90 incidents of an illegal presence at night were recorded during the 167 nights of the project.

During the period when nests were poached (21st March to 29th June), an illegal presence was noted 77 times over 100 nights (an average of 0.8 incidents per night).

Of the nests located on exhumation as being poached months earlier, patrols and morning surveys at those dates had recorded a presence on the beach in 81% of cases.

There appears to be no logic or trends as to what poachers will take or leave behind in the re-camouflaged nest. They may take all the fertile eggs or leave just a few, plus take all or some or none of the vanos or yokeless eggs. In the nine cases where a few fertile eggs were left in the nest environment, 100% of them hatched but this was a small consolation for the 2,488 eggs that were stolen.

There are limited techniques to relocate and camouflage a nest at night from the poachers present and these techniques were varied throughout the season so as not to create too many patterns for the poachers to follow and then re-camouflage stolen nests.

In 80% of nests stolen, it was only discovered on exhumation some 70 days later. It is interesting to note that poachers were still seen on the beach at night late into the nesting season during June and July when few turtles were coming.

6. DISCUSSIONS AND RECOMMENDATIONS

Destruction of habitat:

As a regular sight in the Talamanca region, excessive timber debris and rubbish on the nesting beach was apparent during 2005 on either side of the Carbon River from banana plantations upstream. Banana trees are also now growing on the high tide mark from mojon 86 to the river at mojon 110.

The sector of Playa Negra is an important nesting ground for leatherbacks during each season. It was discovered late 2004 that construction of a road behind the beach was underway to access lands marked for housing. A temporary halt to the road by MINAE helped, but construction began again during February 2005 by some locals making roads, clearing and slashing housing blocks plus removing large quantities of sand from the beach.

Throughout the season, beach markers were under threat of removal, vegetation burning occurred near relocated nests and emerging hatchlings were squashed under the wheels of encroaching development.

Recommendation: That the relevant authorities immediately investigate the legality of development on Playa Negra in such close proximity to the beach.

The photo right shows approximately 20 cubic metres of beach sand removed by heavy equipment for construction purposes. This area subsequently recorded nesting turtles.

Figure 38: Illegal removal of beach sand from Playa Negra at mojon 124

Figure 39: An example of vegetation removal on Playa Negra within 1 metre of project beach markers and nesting sites

The photo left is an indication of the type of land clearing which occurred midway through the season.

Beach markers are located just out of picture to the left, at the base of the felled trees.

River crossings:

It was unfortunate that the river at mojon 110 was impassable 50% of nights while the South station and patrols were operating from the Playa Negra end between 15th February and 30th June. This meant a greater distance and longer patrol times from the North station to cover additional beach area, plus the occasional frustration of the patrols stuck on the relatively small Playa Negra side.

Discussion: On nights when the river is impassible, a boat crossing without motor might be possible. Problems arise where and how to secure a small boat and oars where many locals are possessive of the river entrance and not sympathetic to the sea turtle program. The problem crossing the river is that is not that it is in flood - the sea and river level remains the same – but that the currents underfoot strengthen and deepen making the sand floor give way.

Poaching and illegal presence on the beach at night:

It is only through education of the children and of local communities in the long term, that the author believes poaching in this area will be reduced. Additional good suggestions from past years are that economic alternatives could be offered to local communities and those who poach, such as public tour guides on the beach at night. In the short term, the local authorities of MINAE and the police need to have a greater presence on the beach at night to enforce the law. Improved law enforcement could be achieved by having a small control hut located at the river for observations on both sides.

Only one arrest of poachers was made in 167 night of the 2005 leatherback season.

With a recorded presence of almost one illegal presence per night on the patrol beach when nests were stolen, this one arrest is miniscule in the scheme of things.

Recommendation: That MINAE and the local police of Cahuita and Puerto Viejo work more closely with the ANAI project to enforce the law. The author suggests a correct court prosecution with a jail term, then a public naming and shaming by the police of a local poacher caught walking from Puerto Viejo each night during or after the patrol times. “This is what will happen to you if you take eggs from the park.”

Playa Negra South Station:

A two storey house was rented from March to the end of June in a relatively quiet street in Playa Negra for the South station. Staff and volunteers were housed here and conducted two patrols each night along Playa Negra, crossing the river when possible and then to the halfway point at mojon 70.

Having such an operation means the volunteers and staff must run the house, cook and clean, maintain security plus buy weekly fresh food and related items. A bulk food order is sent down from San Jose when required. Communication with the North Station in the park was limited during 2005.

Poaching is an important issue on Playa Negra as previously mentioned, with 36% of nests taken on such a small section of the total patrol area. The narrowness of the beach and lack of suitable relocation areas also makes it very difficult to get a nest past the poachers.

Recommendation: That ANAI continue to have a presence on Playa Negra each year of the project, but consider other options in relation to the running of the South Station and relocation methods of nests.

A full time cook and/or house manager would relieve the pressure on project staff and volunteers of having to run a house. If it is not within the project budget to hire a local cook, then a local or international student studying to be a chef might be obtained for four months as a field placement.

Or the daily ANAI price for volunteers in the South Station could be reduced allowing them to purchase and cook their own food if no house manager was available.

One option for relocating nests would be to send a nightly patrol down to Playa Negra and return them by car at the end of the night, with bags of eggs to be located in the North station hatchery (a separate report has been submitted on this idea).

Re-nesting and the number of turtles:

During a year when there appeared to be a return of nesting leatherbacks to the Caribbean side of Costa Rica, the level of nesting site fidelity should be looked at for the project area.

With 196 nests recorded by 62 known turtles (there may have been more unidentified turtles which nested and then left before the patrols located them), this averages at only three nests per turtle. But it must be remembered that 36 of the 62 turtles nested only once.

Discussion: What makes a leatherback return to the same beach to nest multiple times and why is there this infidelity to the project area?

Leatherbacks travel the currents migrating from feeding to mating to nesting grounds, so it is expected that some would be occasional visitors to the project area. It may also be reasonable to assume that a greater number of new turtles may come later in the season passing by from their own beach fidelity, but this was not the case in 2005.

There was an even spread of turtles nesting only once.
Of the 36 turtles; 10 came in March, 9 in April, 7 in May and 10 during June.

Nests with no embryonic development:

The results of exhumations conducted on the 90 natural and relocated nests varied from a success rate of 0% to 96%. Three nests had a 0% hatch rate and all were relocated and camouflaged reasonably close to where the turtle had originally nested.

Nest 1: Relocated to mojon 70
0 of 50 eggs hatched
17 eggs without development, 6 at stage 1
Fungus and heavy coleopteran noted
Beach stable

Nest 2: Relocated to mojon 131
0 of 84 eggs hatched
All 84 without development
Bacteria noted in one egg
Beach stable

Nest 3: Relocated to mojon 118
0 of 100 eggs hatched
All 100 without development
Heavy infestation of bacteria noted
Beach stable

Discussion: Why would some nests record no embryonic development when others located nearby and relocated under the same conditions have a success rate of up to 96%?

Bacteria and fungus were noted in 17 other exhumed nests and the hatch success rate from these nests was 49%.

Construction of the hatchery:

The 2005 nesting season for the first time saw a more secure hatchery constructed. The key feature was the use of solid fencing mesh and fully enclosed roof, walls and door. Barbed wire was placed over all joins to prevent poachers from pulling away the mesh material.

Recommendation: That funding be sought to recreate such a fencing mesh hatchery for 2006, plus the addition of internal sensor lights for when volunteer levels on guard at night are low.

Inside the hatchery, grid nest squares are marked at 500 mm intervals and nests placed in every second square. The wire baskets or canasters placed on top of each nest in the hatchery prevent crabs and other insects from digging down to the eggs, plus the canister provides a place for emerging hatchlings. The canasters are approximately 500 mm high, round, covered with thin white mesh and placed over the nest.

Recommendation: That future canasters for the hatchery be constructed square to suit the grids 500 x 500 and maintain the covering mesh.

The hatchery during the season experienced leatherback (and in particular hawksbill and green nests) erupting with more than 130 hatchlings emerging at once. There appears to be little space available in such small, round canasters and that larger half metre square baskets would be more practical.

When a nest started to drop as hatchlings made their way to the surface over a number of days, we placed these larger square canaster (without the mesh) over the nest for ease of access. This idea should be expanded and the square canasters permanently covered and in place from day one.

7. FURTHER READING

INTERNET:

www.anaicr.org
For past reports of the Cahuita – Playa Negra project in relation to nesting leatherbacks and hawksbill sea turtles. Annual reports for the Gandoca leatherback season are also online.

BOOKS:

Sea Turtles: An Ecological Guide
An excellent book by David Gulko and Karen Eckert covering the life stages and threats to all species of marine sea turtles.

Assessment about the Trade of Sea Turtles and their products in the Central America isthmus
An extensive and thorough report by Didiher Chacón on the legislation adopted by each of the six Central American countries, the use of each species of turtle, plus accompanying photographs of illegal product. The book contains both Spanish and English translations.

Fire in the Turtle House
Author Osha Gray Davidson takes the reader through the early history and discovery of FP or fibropapilloma – the tumors which are devastating turtle stocks worldwide.

SCIENTIFIC PAPERS:

Possible decline in leatherback turtle *Dermochelys coriacea* nesting along the coast of Caribbean Central America
Sebastian Troëng, Didiher Chacón and Belinda Dick

Cahuita, Limón, Costa Rica: From conflict to collaboration
Viviane Weitzner and Marvin Fonseca Borrás

8. REFERENCES

Chacón, D., C. Arancíbia, J. Hancock. 2003. Anidación de la Tortuga Baula (*Dermochelys coriacea*) en Playa Negra, Puerto Viejo, Caribe Sur, Costa Rica. Temporada 2003. Asociación ANAI.

Chacón, D., J. Carvajal. 2004. Informe de la Anidación de Tortuga Baula *(Dermochelys coriacea*), en el Parque Nacional Cahuita, Limón, Costa Rica. Temporada 2004. Asociación ANAI.