IN-WATER MONITORING OF SEA TURTLES OF THE SOUTH CARIBBEAN OF COSTA RICA

VOLUNTEER MANUAL

CAHUITA NATIONAL PARK

COSTA RICA

Welcome!

The In-Water Monitoring project you are about to take part was developed in 2005 in order to provide an insight into the most important Hawksbill Sea Turtle (*Eretmochelys imbricata*) population in the country, as well as other sea turtle species occurring in the region. Research in the Caribbean coast of Costa Rica indicates that the Hawksbill nesting populations in this part of the world are declining at about 4% per year (Troeng *et al.*, 2005). The first results from this project in Cahuita National Park showed that not only this species is using the park's reefs as foraging ground, as the endangered green turtle (*Chelonia mydas*) and the previously unrecorded Loggerhead turtle (*Caretta caretta*) have been recorded as well. The information gathered will be used to increase to the level of protection of the habitats where turtles nest and feed, both regionally and internationally.

The project's objective is to build on existing knowledge of the population demographics of marine turtles in the South Caribbean region. There has been no previous in-water study about the resident sea turtle populations in the area, although observations by local fisherman and Park rangers suggest that the reef at Cahuita National Park may be a significant foraging site for different species of sea turtle species. Previous research conducted by Asociación ANAI on the nesting beach demonstrates that Cahuita National Park is the most important nesting site in the country for the critically endangered Hawksbill sea turtle. The project will determine population trends and threats to the populations to develop sound conservation management strategies, from both a regional and international perspective.

The main activity of this project is an in-water survey of the foraging population found at the Cahuita coral reef. Individual sea turtles will be captured for studying and tagging using entanglement nets, while the reef will be surveyed using different techniques on a regular basis. Turtles will be tagged, their size measured, tissue samples for DNA analysis will be taken and reproductive status determined.

Given the life history parameters and on-going threats to the species it is important that long-term studies be continued to determine population trends. A long-term demographic study is required to provide detailed information for the development of a population model. This model can then be used to assess population trends, and identify and mitigate threats.

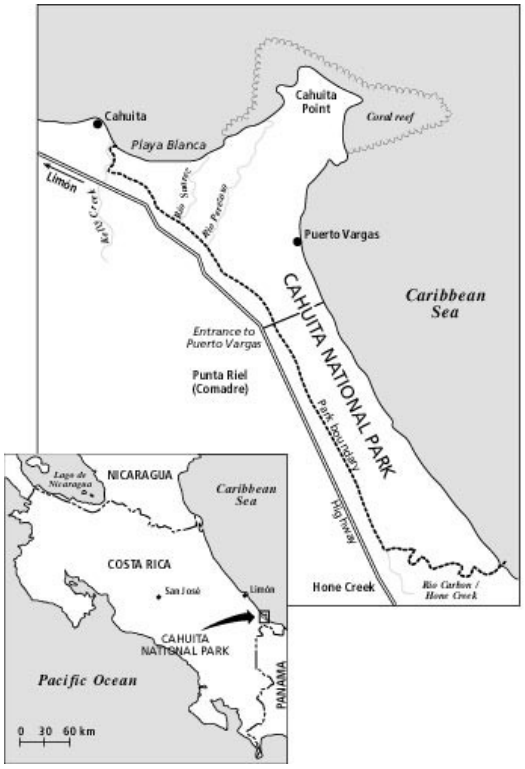
Results of this project will be used to describe the status of different species of sea turtles, with an emphasis on the Hawksbill sea turtle in Cahuita National Park and add significant information collected by the nesting research carried out in the Park in previous years.

Your role is crucial in assisting us in various aspects of data collection. Whether participating in night patrols looking for nesting females, or in-water surveys, you will have lots of "hands on" participation including tagging and measuring turtles. While on nesting surveys, volunteers will also be involved in other aspects such as counting and relocating eggs, while in the foraging ground volunteers will assist staff in catching and studying turtles.

Like many research projects the work can become arduous, the weather turn foul and the turtles be even more uncooperative than normal. However we hope that you leave the project with the feeling that you have played a vital role in the study and conservation of the Sea Turtle population at Cahuita National Park.

Thank you!

CAHUITA NATIONAL PARK



Cahuita National Park is located on Costa Rica's southern Caribbean coast in the province of Talamanca, arguably the most culturally diverse province in the country. The province is home to a large population of Afro-Caribbean, the Bribri and Cabecar Indigenous peoples, mestizos and foreigners.

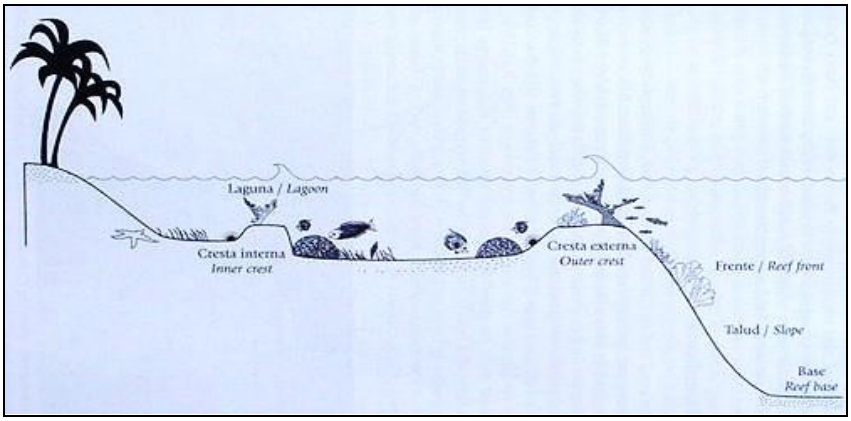
In 1970's, the coral reef that lines Cahuita Point was declared a national monument. The state wanted to protect the flora and fauna of the area, the coral reefs and various marine ecosystems.

Thre

Park Characteristics

- **Tropical Humid Forest** (Holdridge 1959).
- **Average annual temperature:** 24 ºC (varying between 25ºC and 27ºC).
- **Relative Humidity:** 86% to 88%.
- **Weather:** Two climatic cycles per year, dry seasons between January and March, August and December with intense rain in May, July and December

Coral Reef



The reef contains 35 species of corals, 140 species of mollusks, 44 types of crustaceans, 128 varieties of algae and 123 types of fish. The terrestrial portion of the monument covers 1,067.9 hectares, while the marine portion covers 22,400 hectares, including the 600 hectares of reef.

METHODOLOGY

IN-WATER POPULATION MONITORING

REEF SURVEYS AND TURTLE COUNTS

The site(s) to be sampled on any given day are reconsidered the day of the surveys so that the latest information on the weather, currents and boat availability to be taken into consideration.

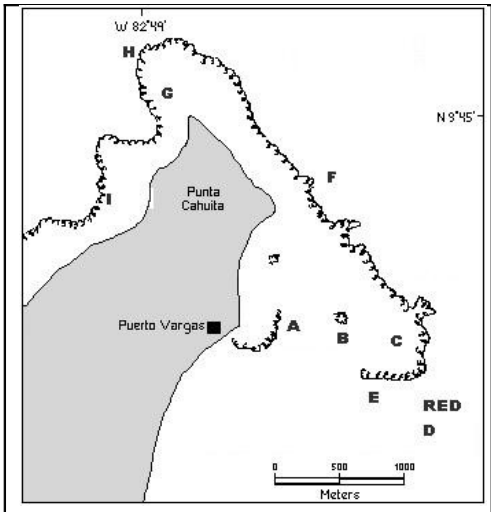
In the turtle counts, the snorkelers leave the boat or the beach and start the survey swimming in the established direction or given area.

When doing transects, volunteers will swim at 10m distance from each other and will try to locate turtles within the space between them and immediately around them.

In the area surveys, volunteers will survey a pre-determined area in the reef for a set amount of time, and make notes on numbers of turtles observed.

Most of the reef areas monitored are shallow, and surveys will be done by snorkeling. For some areas scuba gear will be needed (>6 m depth).

The main survey sites at Cahuita National Park are located below:



LOCATIONS

A	**Puerto Vargas**
B	**Eduardo's Garden**
C	**Kawe**
D	**Liki Shoal**
E	**Border/Canal**
F	**Chance's Mouth**
G	**Punta Cahuita (inner reef)/Pollito**
H	**Punta Cahuita (outer reef)**
I	**Galeones / Playa Palos**
RED	**Net**

The capture per unit effort (CPUE) is defined as the number of turtles recorded per hour of survey at a given site. Surveys will last a minimum of 15 minutes.

When a turtle is found, the volunteer must give a signal to the research assistant in charge. All sea turtle sightings must be marked with GPS. Whenever possible, and if the boat is available, capture of the turtle should be attempted. You must identify the species observed BEFORE attempting capture, and care should be taken as not to scare or stress the animal.

If possible, observe the turtle's behavior. If the animal is feeding, a sample of the food item must be collected.

USE OF NETS

Large turtles moving around the reef are captured using entanglement nets. The entanglement nets are set at a fixed point of the reef, usually blocking a passage frequented by sea turtles. Other prospective sites may be discussed and used.

The net is checked regularly throughout the day, typically at sunrise, and late afternoon.

As the boat approaches the net, attention must be paid to whether a turtle is trapped or not. When an animal is trapped, the top end of the net will be lowered, usually below the surface, and there will be water movement around the net.

If a turtle is caught, the boat will approach the turtle, and depending on the size of the animal, two volunteers will jump in the water and aid the rest of the boat crew to bring the turtle on board by pushing it from the back. Two other volunteers, in the boat, pull each extreme of the top end line of the net to make sure pressure exerted on the turtle by the net is relieved. The first thing to do when the turtle is landed is to check if net is around turtle neck and restricting its breathing, then release the weight of the net on the neck. Once the turtle is totally free, the team will proceed to tag the turtle, take biometric data and tissue sample.

Finally one or two volunteers will check the net, making sure it is straight and detangled and there are no other animals that may have been accidentally caught in the net.

Following their capture, most turtles are landed on the boat and worked on either on the boat, or taken to a nearby sandy area for tagging, weighting, measuring and tissue sampling by project staff and volunteers. Turtles are released from the beach or boat usually within 1 hour of being captured.

DATA COLLECTION PROTOCOL

TAGGING

Objectives

Turtles are tagged for the following purposes:

- Identification of individual turtles
- Identification of migration patterns through recaptures
- Residency in determined area
- Behavioral patterns

Flipper tagging

Description

All metal tags used by the project are designed to be self-piercing. They cut through the fin and lock closed when correctly applied.

The front of the tag will have a series comprised of one or two letters, followed by four or more numbers (e.g. 769431, VA0564).The reverse side of the tags there is an address of the Dept. Biol. UF, Gainesville, FL, USA.

If tags are present, both sides are read and the complete tag numbers are recorded on the right or left line of the data sheet, as appropriate. The terms RIGHT and LEFT always refer to the turtle's right and left when the plastron is DOWN. If a tag does not have a University of Florida return address on it, the complete message from the back of the tag is recorded on the data sheet. In this case, it is also noted whether the tag is metal or plastic, and the size of the tag is noted.

All tags on recaptures are carefully inspected by a team member to determine if they need replacement. The tags should be removed in the following cases:

- tag cannot be read without removal
- tag is causing disfigurement or swelling of tissues of flipper
- clasp on tag is unlocked
- tag is held in place by a very narrow strip of tissue
- tag is wearing and has become noticeably thin or corroded
- numbers etched into tag surface are becoming illegible
- Tag has a very heavy burden of algae, barnacles, etc.

If no tags are present, the front flippers will be examined for a scar that would be left if a tag had been lost

Tag application requires two people to do the job well and safely. It is done with the turtle's plastron down. One persons stands in front of the turtle's head and immobilizes the flipper that is to be tagged with both hands, keeping the face well back from the flippers possible trajectory.

Tags used will vary from turtle size. Small juvenile turtles with CCL under 65cm will be tagged with INCONEL 681 tags (smaller), while larger or adult individuals (CCL at least 65cm) will be tagged with MONEL 49 tags (larger).

The tag is firmly squarely seated in the applicator with a sharp point aimed for the opening in the other end of the tag.

The tags are applied in the axiliary tagging position of the front flipper. The axiliary tagging position is through or immediately adjacent to the enlarged scale closest to the body on the posterior edge of the left and right front flippers. Before applying the tag, the area selected for tagging and the tag must be cleaned with abundant Vanodine solution so that tissue is clean and aseptic. The tag is placed so that about one-half of its length extends beyond the edge of the flipper.

When the correct position is located, the tag is applied with a single smooth motion, closing the applicators as far as they will go but not applying excessive pressure. The TAG IS ALWAYS CHECKED to be certain that the sharp tip has passed through the flipper and has bent over to secure the tag in place. If it does not secure, the tag is removed, and a new attempt is done.

After tag is placed, clean the area with abundant Vanodine Solution, to ensure it is disinfected and clean.

Tags are always applied in numerical order, and misapplied tags are recorded and saved in waste bag, so that if a question arises about the number of an applied tag or a label on a tissue sample, it is more easily resolved.

PIT Tagging

Applying PIT tags is more invasive than applying flipper tags and is carried out only by an experienced assistant. These tags are implanted into the left front flipper between the radius and the ulna. When properly applied, they provide a permanent mark available to anyone with an Avid PIT tag reader or universal reader.

The PIT tag consist of a 12mm long, 1mm wide cylindrical tag that is injected under the skin using a 13 gauge syringe with an applicator. The Pit tag and syringe are pre-sterilized and packaged for one use only.

Before application, the area where the tag will be injected should be cleaned with vanodine. The tag is injected from medial to lateral (syringe pointed towards fin tip into the connective tissue. As soon as the PIT tag is applied, the sticker that comes with it should be stored in a safe place. The person who applied the PIT should then read it and confirm the number with the data recorder.

TURTLE BIOMETRICS

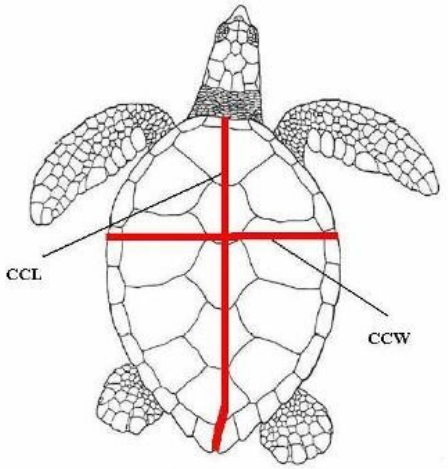
Objectives

- Distinguish different size and age classes of the turtles found at the Cahuita reef

Description

The straight (SCL/SCW) and the curved carapace measurements (CCL/CCW) will be taken, the first with a caliper, or vernier, the second using a using a flexible tape measure (± 0.1 cm) laid over the curve of the carapace. Calibration of tape measures will be checked regularly against steel rules. Any large barnacles on the carapace, likely to interfere with a measurement, will be removed.

Two methods will be used to measure the turtles: straight measurements, carried out using a large caliper, and curved measurement using a flexible metric tape.



Adapted from Eckert et al, 2000

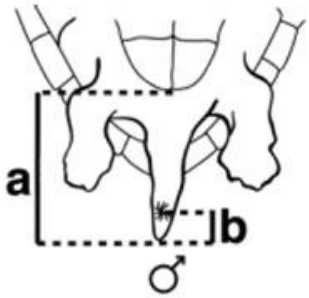
Carapace Lenght Notch to Notch (CCL N-N): measured along the midline from the junction of the skin and carapace above the neck to the most posterior edge of the last midline scute.

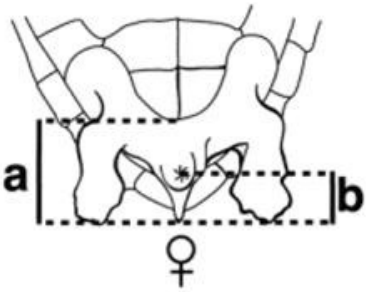
Carapace Length Notch to Tip (CCL N-T): measured along the midline from the junction of the skin and carapace above the neck to the most posterior edge of the supracaudal scute.

Carapace width **(SCW/CCW)** is measured perpendicularly to the midline axis of the carapace between the outer extremities of the marginal scales. This measurement will be repeated at several positions to obtain the greatest value.

Plastron length (PL) is measured using a flexible tape measure (± 0.5 cm) along the midline from the anterior junction of the skin and plastron scutes to the posterior margin of the cartilaginous /bony plate.

Tail measurements are taken to the tip of the straightened tail using a flexible tape measure (± 0.5 cm).

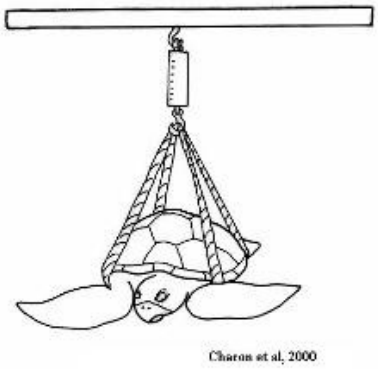




The two tail length measurements are: (a) total tail length (TTL), the distance from the midline of the posterior margin of the plastron to the end of the tail following the curvature of the tail; (b) post-cloacal tail length (PTL), the distance from mid-cloacal opening to the end of the tail following the curvature of the tail.

TURTLE WEIGHT

Turtles may be weighed by turning them on their backs and lifted via a spring balance attached by four ropes, each noosed to the base of a flipper or by a continuous 4 m long, figure '8' strap. The turtles are weighed on either 10 (± 0.2) kg or 100 (± 0.5) kg spring scales.



Charon et al, 2000

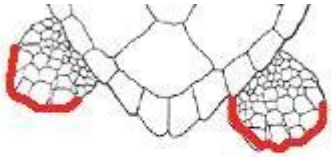
TISSUE SAMPLING

Objectives

- Genetic analysis determines the genetic relationship between the Hawksbill sea turtles at Cahuita National Park to other genetically identified populations in the Wider Caribbean.

Description

Tissue samples are extracted from the posterior edge of the hind flipper of the turtle.



Adapted from Eckert et al, 2000

The biopsy site and surrounding tissue should be cleansed with Vanodine solution, applied with a cotton wool, before the sample is obtained.

Sterile surgical gloves should be used. The sample is obtained by holding the tissue to extract with tweezers and removal is done using a scalpel blade (#10 or #15). The sample should be about 1cm^2. Following removal of the sample, the area is cleansed again with Vanodine, and left to heal by granulation.

The sample is placed inside a vial, which should contain alcohol. Each vial must be labeled with date and tag numbers of the turtle.

Never use the same scalpel for different turtles!!! Once you finish collecting the sample, dispose the scalpel and cotton wool in the disposal bag, and wash tweezers with alcohol.

GENERAL SAFETY RULES

For people

1. You must not abandon the survey without the consent or knowledge of the research assistant in charge. If you experience any physical problems during any of the projects activities, please notify them as soon as possible.
2. At some times of the day the boat traffic is intense. Always listen to approaching boats and make sure you are visible.
3. One staff member usually stays at the boat ensuring all snorkelers are accounted for and safe.
4. The net can be dangerous. Avoid getting tangled in the net if attempting to remove a turtle from it. If your mask or fins get tangled, get prepared to remove them.
5. Any objects that may become tangled in the net must be removed (watches, bracelets, rings, knifes, jewellery, etc). Fins with buckles or clasps are not advised for working around the net.
6. Pay attention when moving turtles or passing them from person to person. Turtles often bite causing painful injuries, while the claws on the turtle's flippers and the edges of the flippers and carapace can be very sharp.
7. If you see any potential dangerous species (e.g. barracudas, sharks (other than nurse sharks), jellyfish) alert the boat crew.
8. Tagging is always performed by two persons, one who tags and the other one who immobilizes the turtle.
9. Do not place any object in the plastron (belly) of the turtle or near the flippers as they may become dangerous projectiles.
10. Green turtles rarely bite, but they can, and with painful results. Loggerheads and Hawksbills OFTEN bite and can inflict painful injuries. Pay special attention when moving turtles or passing turtles from person to person.

For Turtles

1. Turtles can drown in the net. The first task is to bring captured turtles to the boat so they can be easily untangled. If net is around turtle neck and restricting its breathing, the weight of the net on the neck must be released.
2. The net needs to be thourougly checked each time to ensure no turtles or other animals are tangled
3. Turtles de-hydrate quickly and while on the boat or beach must be kept in the shade and be wetted regularly.
4. Turtles must be paced carefully on the boat, they are best stored on their carapace, with their bellies up. Try to relax the turtle by gently pulling its flippers down, or covering their eyes with a dark cloth.
5. Handle turtles gently and NEVER drop them. To avoid accidents, always ensure you have sufficient assistance when handling turtles.
6. Turtles must be placed back in the water gently, if possible tail first, then pause for a moment until turtle realizes it is in the water and pulls away.

LIST OF EQUIPMENT

REEF SURVEYS

- Snorkeling mask and fins
- GPS Unit
- Underwater digital camera
- Underwater writing boards
- Pencils

TURTLE CAPTURES WITH NETS

- Snorkeling or SCUBA equipment
- Turtle support
- Water spray
- Clipboards
- Data white boards
- Underwater digital camera
- Procedures Manual
- Waste container
- WD40 for oiling equipment at the end of each session
- Other field supplies (see below)

Tagging

- Metal pliers
- Metal tags (MONEL #49 AND INCONEL #681)
- PIT tags and PIT tag reader
- Mototool
- Vanodine
- Cotton wool
- Latex gloves

Tissue Sampling

- Scalpels
- Tweezers
- Plastic vials
- Alcohol
- Vanodine
- Cotton wool
- Latex gloves

Turtle Biometry

- Flexible 3m metric tape
- Caliper

Turtle Weight

- Scale, net, rope or bag

IN-WATER MONITORING OF SEA TURTLES OF THE SOUTH CARIBBEAN OF COSTA RICA

DATA SHEET

OBSERVERS (initials): *Please write the observers initials here*

DATE ___/___/___

CAPTURE TIME _____
RELEASE TIME _____

LOCATION

GPS (CAPTURE) : *GPS value for boat location during capture*
GPS (RELEASE) : *GPS value for boat location at release*
REEF SECTOR: *refer to reef map for identification of reef sector*

TAGS

TAG # LEFT_____ **RIGHT** _____
PIT TAG #:
write existing or new tag ID number accordingly
NEW TAGS? Y N Which _____ *write new tags applied*
REPLACED TAGS? Y N Which _____*if old tag was removed, indicate which one*

BIOMETRY *(measures must be in cm)*

CARAPACE (CM)	**CCL N-N** _____ **CCL N-T**	**CCW** _____
	SCL N-N_____	**SCW**_____
	Carapace length	*carapace width*
PLASTRON (CM)	**L** ___ *length* **TAIL**	**TTL** ___ *total tail length*
	W ___ *width* **(CM)**	**PTL** ___ *post-cloacal tail length*

WEIGHT (KG) _____

Circle the appropriate answer

SEX : M *male* **F** *female* **U** *undetermined*

Coments:

CAPTURE DETAILS

FIRST CAPTURE Y / N *turtle has no previous tags or scars*
RECAPTURE Y / N *turtle has been previously tagged*
TAG RETURN Y / N *turtle has tags unknown to the project*

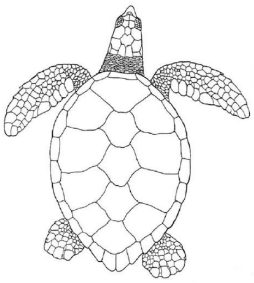
TISSUE SAMPLE: Y / N *indicate if sample was taken*

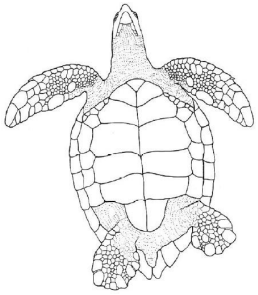
BLOOD SAMPLE: Y / N

STOMACH CONTENT: Y/N

PHOTOS TAKEN? Y / N FRAME #S (turtle's name): *what set of pictures correspond to this sighting/ in what folder was it saved*

SPECIES:
HB GR LG UND
Circle species found
HB hawksbill, GR green, LG loggerhead, UND undetermined





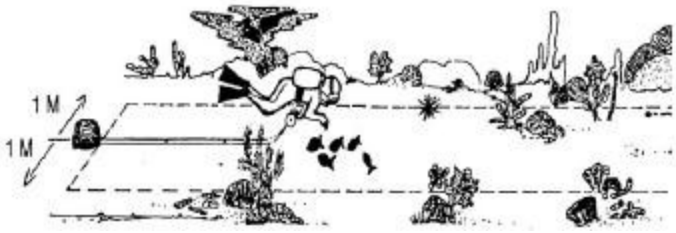
Indicate in the image any visible scars, epibiotes, fusion of scutes, discolorations, missing scutes, mating scars, etc)

HABITAT EVALUATION

Habitat evaluation is done on previously marked areas, usually the ones designated for the turtle counts, and evaluation is carried out by at least one experienced diver and a volunteer assistant.

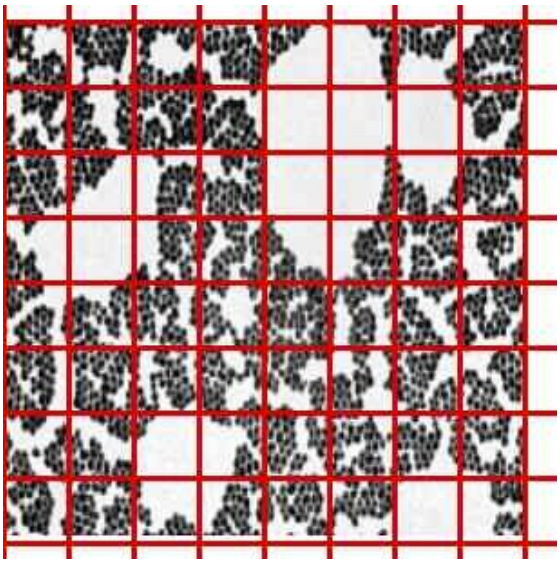
Areas will be defined by GPS locations (see previous methods described).

For each transect the general or most abundant habitat type must be noted (e.g. sea grass, sand, living coral reef, dead crumbled reef, rocky outcrops, or reef wall).



Along the transect there will be at least 5 randomly chosen sampling sites which will be studied using $1m^2x1m^2$ quadrates. For each quadrate, divers should sketch each species of coral, sponge and algae species found, while associated fish must be identified, and indicate its relative abundance.

If a species can not be identified, a small sample may be extracted for later identification at the station using appropriate guides.



You should indicate in the writing board:

- ☑ **DATE**
- ☑ **TIME**
- ☑ **TRANSECT NUMBER**
- ☑ **SPECIES DIVERSITY PER QUADRATE (Number of species)**
- ☑ **RELATIVE SPECIES ABUNDANCE PER QUADRATE (%)**

Each organism must be identified to at least Genus level.

For each quadrate, a photograph must be taken that shows the totality of the quadrate area (top view).

VOLUNTEER ASSIGNMENTS

Volunteers are integral to the success of this project and will be involved in all aspects of the research.

Turtle Captures

☑ Go on the boat trips into the reef
☑ Help releasing sea turtles from the net
☑ Help with field data collection (i.e., turtle measurement, tagging, weighting, capture)
☑ Assist in set-up, take-down, surveillance, and cleaning of capture nets
☑ Assist in cleaning the boat after each survey
☑ Help keep the research gear clean and organized

Reef Survey and Turtle Counts

☑ Survey by snorkeling or SCUBA
☑ Locate turtles underwater and count them
☑ Identify species found

Habitat Evaluations

☑ Survey pre-arranged transects by scuba diving or snorkeling
☑ Sample sites using quadrates
☑ Identify coral, sponges, algae species
☑ Take specimen samples
☑ Record data

Other Activities

The following activities may be carried out whenever weather/water conditions don't permit in-water research to take place.

Nesting monitoring

☑ Patrol the nesting beach at night looking for nesting female Hawksbill turtles
☑ Assist patrol leaders collecting data (i.e. turtle measurement, tagging, collection of eggs, relocation of nests on the beach or to the hatchery)

Hatchery guard

☑ Monitor emergence of hatchlings and report them in correct data sheet
☑ Collect data on the measurements and weight of emerged hatchlings
☑ Release hatchlings onto the beach
☑ Relocate nests brought by the night patrols in the hatchery
☑ Record incubation temperatures at different times of the day

TIMETABLE

Research activities follow a revolving schedule and depending on the number of turtle captures on any given day, there will be a varying amount of free time for volunteers. While some days the main activity will be turtle rodeo, other days you will be asked to conduct turtle transects or habitat evaluations. All sampling is done in the morning starts early in the morning.

Volunteers should be aware that schedules can and do fluctuate. Weather and work conditions can affect the daily schedule. Should this situation arise, your cooperation and understanding are appreciated. Whenever weather/water conditions don't permit in-water research to take place, you may be asked to collaborate with the staff of the program who coordinates the monitoring of the Hawksbill nesting activity, and collects data on the nesting beach. Volunteers will become involved depending on their availability and work demand of each project.

The following are examples of a typical day of work for the project, and will vary from volunteer to volunteer:

06:00-07:00	Set Entrapment net
07:00-08:00	Breakfast
08:00-13:00	Turtle Survey Count/Habitat Evaluation
13:00-14:00	Lunch
14:00-15:30	Free time
16:00-17:00	Net check
18:00-19:00	Dinner

When weather conditions don't allow in-water activities, or if you have been scheduled for beach work:

05:00-09:00	Morning survey (nesting beach)
09:00-10:00	Breakfast
10:00-12:00	Free
12:00-14:00	Lunch
14:00-17:00	Free
17:00-18:00	Dinner

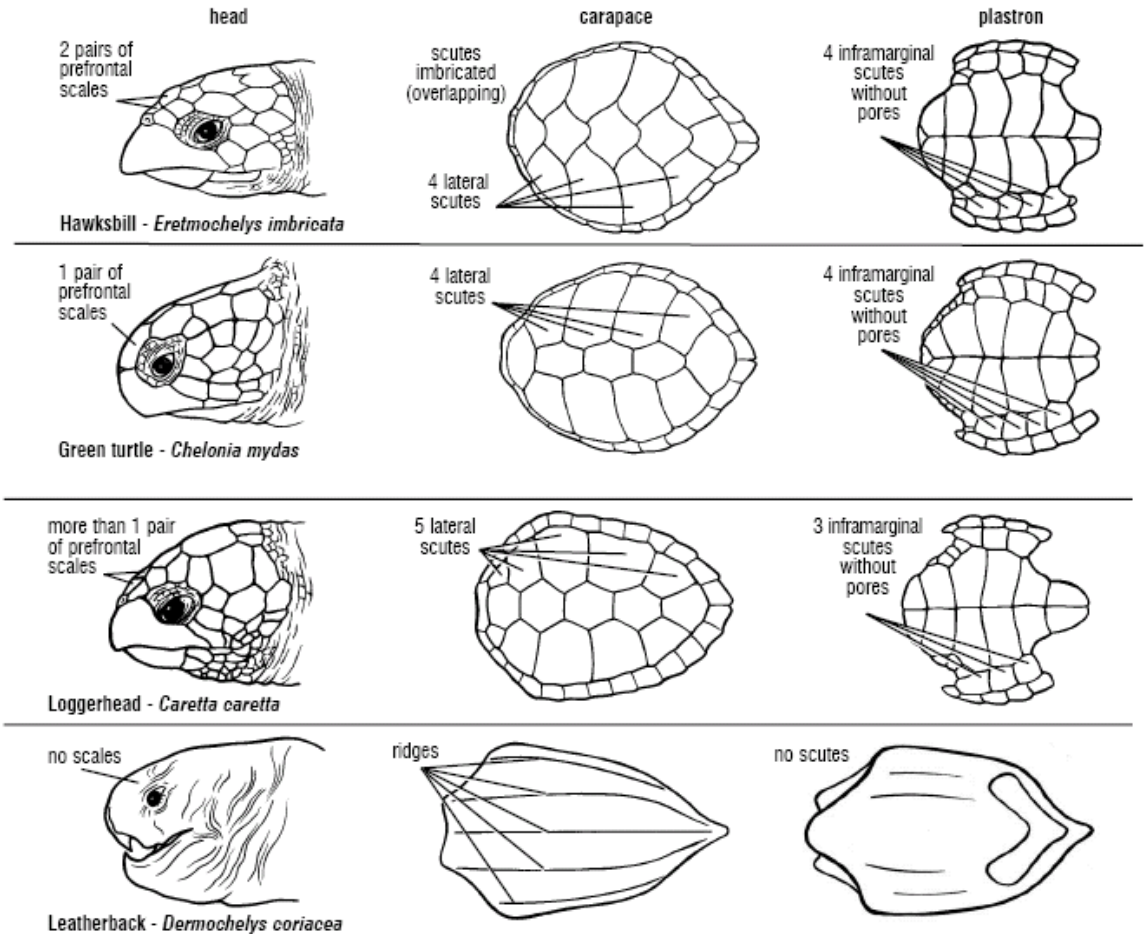
Then one of the following:

Hatchery Shift	18:00 to midnight **or** midnight to 06:00
Night Patrol	20:00 to midnight **or** midnight to 04:00

Meal Times:

Breakfast	07:00-10:00
Lunch	12:00-02:00
Dinner	18:00-19:00

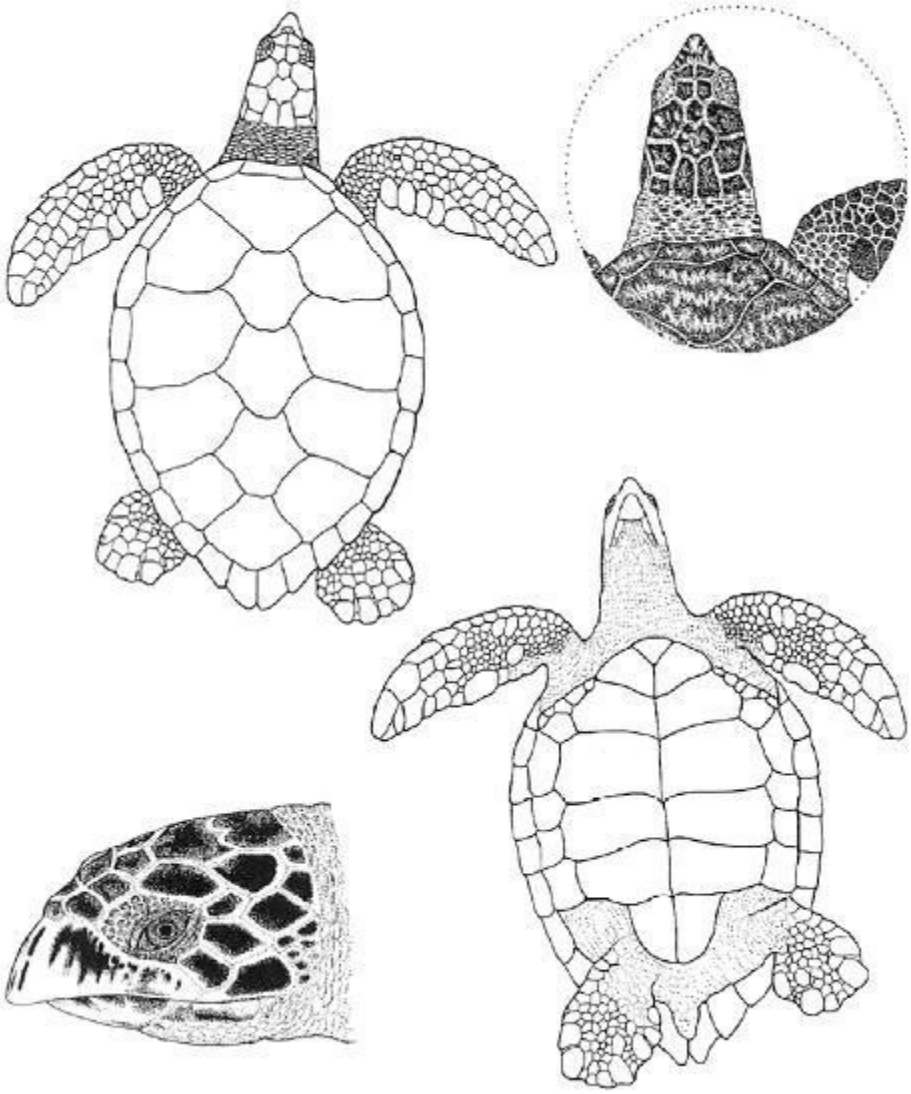
SPECIES IDENTIFICATION



Shanker *et al*, 2003

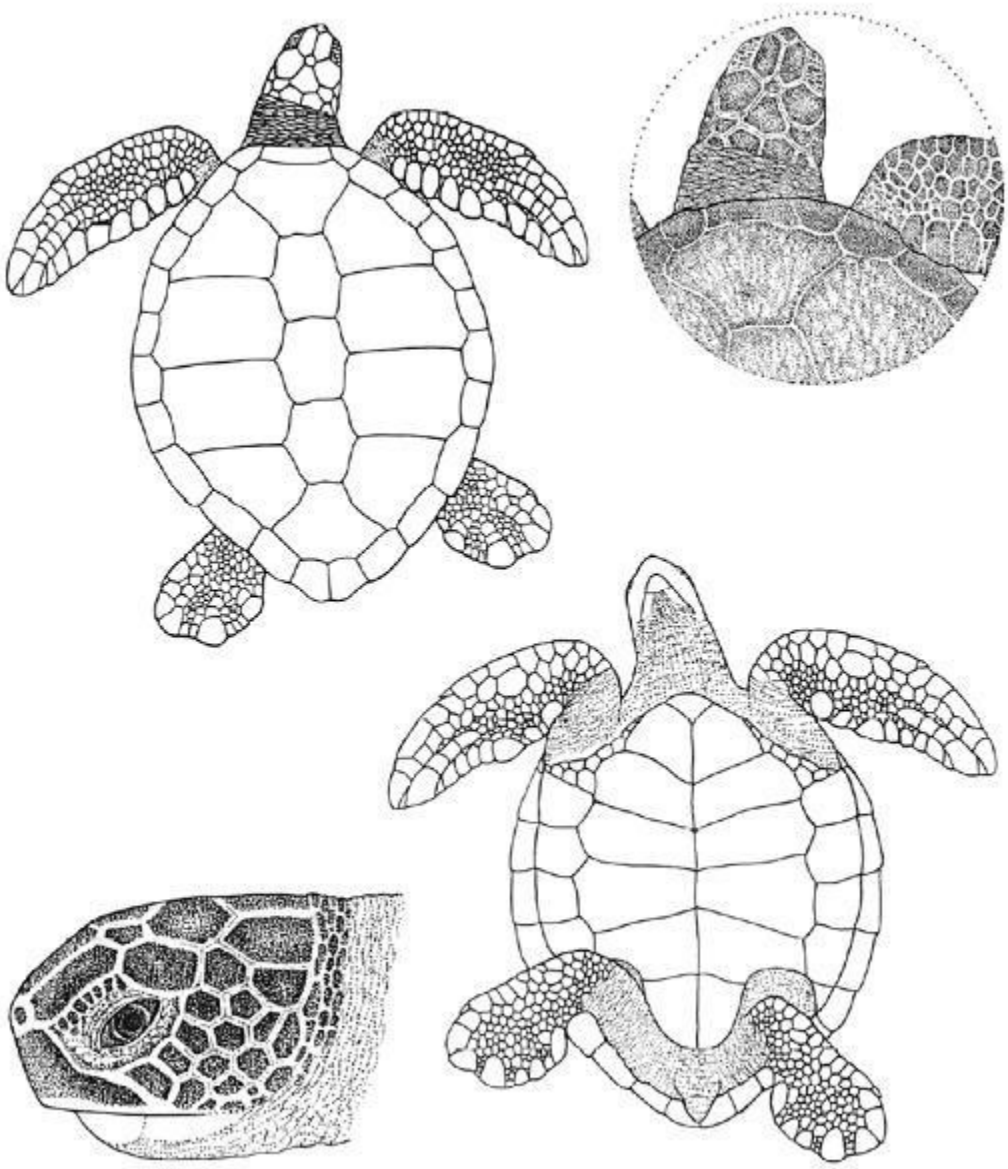
HAWKSBILL SEA TURTLE (Eckert et al, 2000)

Eretmochelys imbricata



Carapace: oval, with a strongly serrated posterior margin and thick overlapping scutes (except in hatchlings and some adults); four pairs of costal scutes, each with a slightly "ragged" posterior border; straight carapace length (SCL) to about 90 cm.
Head: relatively narrow; width to 12 cm; with a straight bird-like beak; two pairs of prefrontal scales.
Limbs: front flippers are medium length compared to other species; two claws on each flipper. Coloration: dorsally brown (dark to light) in hatchlings, often boldly marked with amber and brown variegations in juveniles and younger adults; underside light yellow to white, sometimes with black markings (especially in Pacific specimens).
Plastron: four pairs inframarginal scutes.
Weight: to about 80 kg (average about 60 kg).

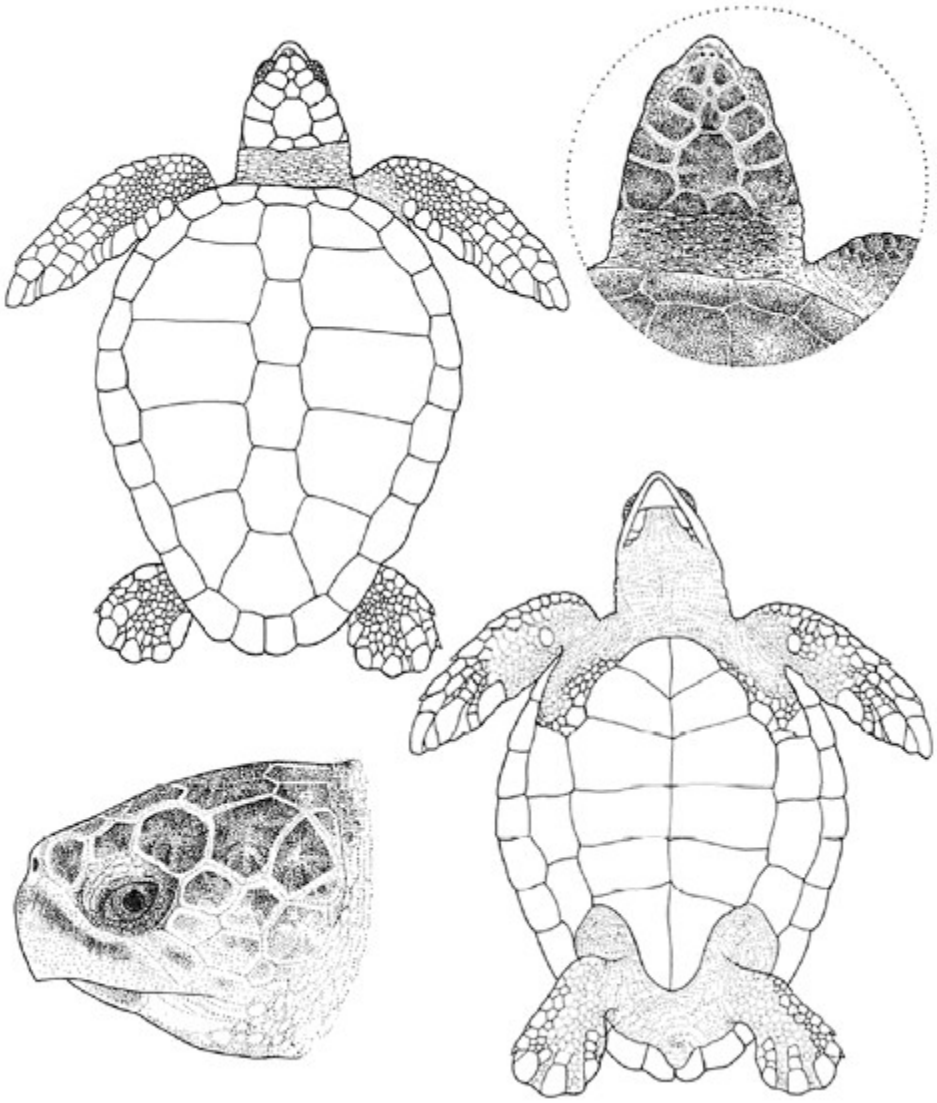
GREEN TURTLE (Eckert et al, 2000)
Chelonia mydas



Carapace: broadly oval, margin sometimes scalloped but not serrated, and not incurved above hind limbs; four pairs of costal scutes; straight carapace length (SCL) to about 120 cm. Head: anteriorly rounded; width to 15 cm; one pair of prefrontal scales; four pairs of postorbital scales. Limbs: single claw on each flipper (rarely, two in some hatchlings).
Coloration: dorsally black in hatchlings, becoming brown with radiating streaks in immatures, very variable in adults (generally brown, buff, and other earth tones; plain streaked or spotted); underside white in hatchings, yellowish in adults.
Weight: to about 230 kg in the Atlantic and western Pacific Oceans, less in the Indian Ocean and the Caribbean.

LOGGERHEAD TURTLE (Eckert et al, 2000)

Caretta caretta



Carapace: moderately broad; lightly serrated posterior margin in immatures; thickened area of the carapace above the base of the tail (at the fifth vertebral) in sub adults and adults; five pairs of costal scutes, the first (anterior) pair the smallest; straight carapace length (SCL) to about 105 cm in northwestern Atlantic, smaller in some other areas, the smallest adults being in the Mediterranean (to about 90 cm).
Head: large and broadly triangular in shape; width to 28 cm; two pairs of prefrontal scales.
Limbs: front flippers relatively short compared to other species; two claws on each flipper.
Coloration: dorsally light to dark brown in hatchlings, generally unmarked reddish-brown in sub adults and adults; underside brown in hatchlings, yellow to orange in sub adults and adults. Plastron: three pairs inframarginal scutes.
Weight: to about 180 kg in the western Atlantic and to about 150 kg in Australia; less than 100 kg in the Mediterranean.

REFERENCES AND SUGGESTED READING

Bjorndal, K.A., 2000. Priorities for studying in foraging habitats. In Eckert, K. L., Bjorndal, K. A., Abreu-Grobois, F. A., and Donnelly, M. (eds.). 1999. *Research and Management Techniques for the Conservation of Sea Turtles*. IUCN/SSC Marine Turtle Specialist Group Publication

Bjorndal, K.A., Bolten, A.B. 2000. Proceedings of a workshop on assessing abundance and trends for in-water sea turtle populations. U.S. Dep. Commerce. NOAA Tech. Mem. NMFS-SEFSC-445, 83p.

Bjorndal, K. A., 1997, Foraging ecology and nutrition of sea turtles, in P. L Lutz and J. A. Musick (eds) *The Biology of Sea Turtles* (Boca Raton: CRC Press), pp. 199–232.

Chacón, D., N. Valerín, V. Cajiao, H. Gamboa y G. Marín. 2001. Manual para mejores prácticas de la conservación de las tortugas marinas en Centroamérica. PROARCA-CAPAS. 139pp.

CITES, 2002 Report to the range states on the development of hawksbill (*Eretmochelys imbricata*) population monitoring protocols for the Wider Caribbean. Second CITES Wider Caribbean hawksbill turtle dialogue meeting Grand Cayman (Cayman Islands), 21–23 May 2002

Chaloupka, M., Limpus, C. 2001. Trends in the abundance of sea turtles resident in southern Great Barrier Reef waters. Biological Conservation 102: 235 –249.

Eckert, K. L., Bjorndal, K. A., Abreu-Grobois, F. A., and Donnelly, M. (eds.). 1999. *Research and Management Techniques for the Conservation of Sea Turtles*. IUCN/SSC Marine Turtle Specialist Group Publication
No. 4. 235 pp.

FitzSimmons, N., Moritz, C., Bowen, B. W. 1999. Population identification. p. 72-79. In: Research and Management Techniques for the Conservation of Sea Turtles. Eckert, K.L., Bjorndal, K. A.,

Gerrodette, T., Brandon, J. 2000. Designing a monitoring program to detect trends. p. 36-39. En: Bjorndal, K.A., Bolten, A.B. (eds.) Proceedings of a workshop on assessing abundance and trends for in-water sea turtle populations. U.S. Dep. Commerce. NOAA Tech. Mem. NMFS-SEFSC-445, 83p.

Houghton, J.D.R., Callow, J.C. and Hays, G.C. 2003. Habitat utilization by juvenile hawksbill turtles (*Eretmochelys imbricata*, Linnaeus, 1766) around a shallow water coral reef. Journal of Natural History, 37, 1269–1280

Meylan A., Meylan P. (2003) Bermuda Project Volunteer Manual

Meylan, A. B. 1982. Estimation of population size. In: Bjorndal, K.A. (Ed.). Biology and Conservation of Sea Turtles. Washington, D.C.: Smithsonian Institution Press, pp. 135-138.

Meylan, A. B. 1999b. Status of the hawksbill turtle (*Eretmochelys imbricata*) in the Caribbean region. *Chelonian Conservation and Biology*. 3 (2): 177-184.

Musick, J. A. and Limpus, C. J. 1997. Habitat utilization and migration in juvenile sea turtles. In: Lutz, P.L. and J.A. Musick (eds.). The Biology of Sea Turtles. CRC Press, Boca Raton, FL.

Shanker K., Pandav B., Andrews, H.V. 2003. Sea Turtle Conservation: Research and Management Techniques. A GOI- UNDP Project Manual. Centre for Herpetology/ Madras Crocodile Bank Trust, India

Troeng, S., Dutton, P., Evans, D. 2005 Hawksbill sea Turtle Migration from Tortuguero. Ecography 28 (3): 394 - 402

CONTACT INFORMATION

Project Coordinators

Joana Hancock
Sea Turtle Conservation Program of the South Caribbean
WIDECAST
Biologist
Email: carey.cahuita@gmail.com
Tel. +506 7550302 (ranger´s station) or +506 8415039 (mobile phone)
Cahuita National Park

Didiher Chacon
Asociación ANAI/WIDECAST
Director Marine/Wetlands Program
Email: tortugas@racsa.co.cr
Tel. +506 2243570
WIDECAST Headquarters

POSTAL ADDRESS

Proyecto Carey – Cahuita
Asociación ANAI
Apto 170 – 2070
Sabanilla de Montes de Oca
Costa Rica

EMERGENCY CONTACT

Joana Hancock
Tel. +506 8415039