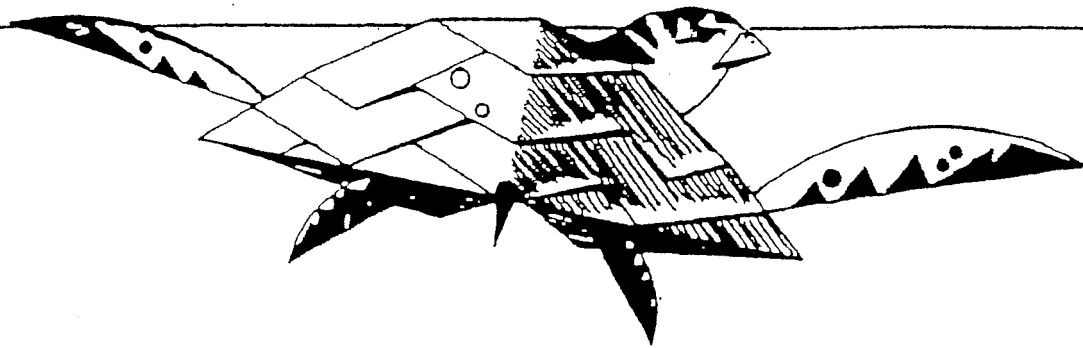


**BUCK ISLAND REEF NM
SEA TURTLE RESEARCH PROGRAM**



**PROTOCOLS FOR THE RESEARCH &
MONITORING OF SEA TURTLES IN A
CORAL REEF HABITAT**

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PREFACE

This protocol provides details for monitoring sea turtles in a coral reef habitat. Field-testing of the described methods was conducted at Buck Island Reef National Monument (BUIS), St. Croix, USVI, but the protocols are applicable to numerous other locations. The methods and materials described are not the only means to accomplish this monitoring. The use of different tools, methods of capture, cameras, scales, software and techniques may be substituted to meet the needs of each individual situation. For instance, the capture method may differ depending on the habitat. Nets may be utilized in bays or lagoon areas, or SCUBA equipment might be used if it is found that the turtles are approachable and able to be captured, but these methods were found not to be applicable at BUIS.

Although this protocol deals primarily with juvenile and sub-adult hawksbill sea turtles, it is not meant to restrict the species or size class others may choose to study at other locations. At the time of writing this protocol, the project at BUIS has been ongoing for 7 years and there have been over 635 hawksbill turtle sightings and only 27 green turtle sightings. Green turtles at BUIS tend to flee as soon as they see someone nearby and only 3 have been captured. However, during a visit to Virgin Islands National Park, St. John, USVI, 2 juvenile green turtles were easily captured using the methods described in this protocol. As for adult turtles, one adult male hawksbill has been captured and tagged, but no adult female hawksbill has ever been captured during the project at BUIS. If an adult turtle is seen, capture will be attempted with the understanding that, as always, diver safety is the first consideration; remember these animals are very strong swimmers. The captured turtle will be brought to the surface; if it is a tagged adult female captured during peak nesting season (July-October), she will be released at the capture site once the tag(s) is read and noted. She will not be brought back to the boat for a work-up; this will minimize any possible stress to the eggs she may be carrying at the time. It has, however, been documented on the BUIS nesting beach study, that neither the female nor the eggs she is carrying are adversely affected by being worked on or even placed upside down in a plastron up position for a short period of time prior to nesting. She may leave the beach after the workup without nesting, but she returns either that same night or within a few nights and nests successfully and the hatch successes of the nests have been the same as other nests. Any untagged turtle will be brought back to the boat to be tagged and given a full workup as described in these protocols.

Disclaimer

The use of brand names such as Ohaus®, Rite in the Rain®, ExacTech®, Vacutainer®, Uni-punch®, and AVID® is not meant to be nor should it be taken as an endorsement or recommendation of a product or service. The authors believe the inclusion of explicit and detailed instructions for specific equipment is valuable for those using identical or even similar products.

Buck Island Reef National Monument

In-water Sea Turtle Research & Monitoring Protocols

INTRODUCTION:

Buck Island Reef National Monument (BUIS) is an uninhabited island with a surrounding coral barrier reef. The Monument lies 2.4 kilometers northeast of the island of St. Croix in the U.S. Virgin Islands (17°47' N, 64°37' W) and was designated by President Kennedy in 1961 to preserve and protect one of the most significant coral reef areas under U.S. jurisdiction (BUIS General Management Plan 1983). BUIS is administered by the National Park Service (NPS) and serves as a developmental habitat for hawksbill sea turtles (*Eretmochelys imbricata*), a feeding area for both juvenile and adult green turtles (*Chelonia mydas*) and is a nesting site for several endangered and threatened species including, hawksbill, green, and leatherback sea turtles, the brown pelican, and least tern. The Monument is also the most popular tourist destination on St. Croix where visitors come to enjoy the water, sand beaches, picnic areas, and overland hiking trail. They can experience the beautiful turquoise waters and coral reef by snorkeling through the underwater trail located off the eastern tip of the island. The underwater trail leads snorkelers out through coral grottos to the forereef and "haystacks", large elkhorn coral patch reefs which rise to the surface from a depth of up to 13 meters. The barrier reef that surrounds the northeastern tip of the island creates a lagoon between the backreef and the island. This lagoon is protected from strong wave action, and depths seldom exceed 4 meters (Figure 1).

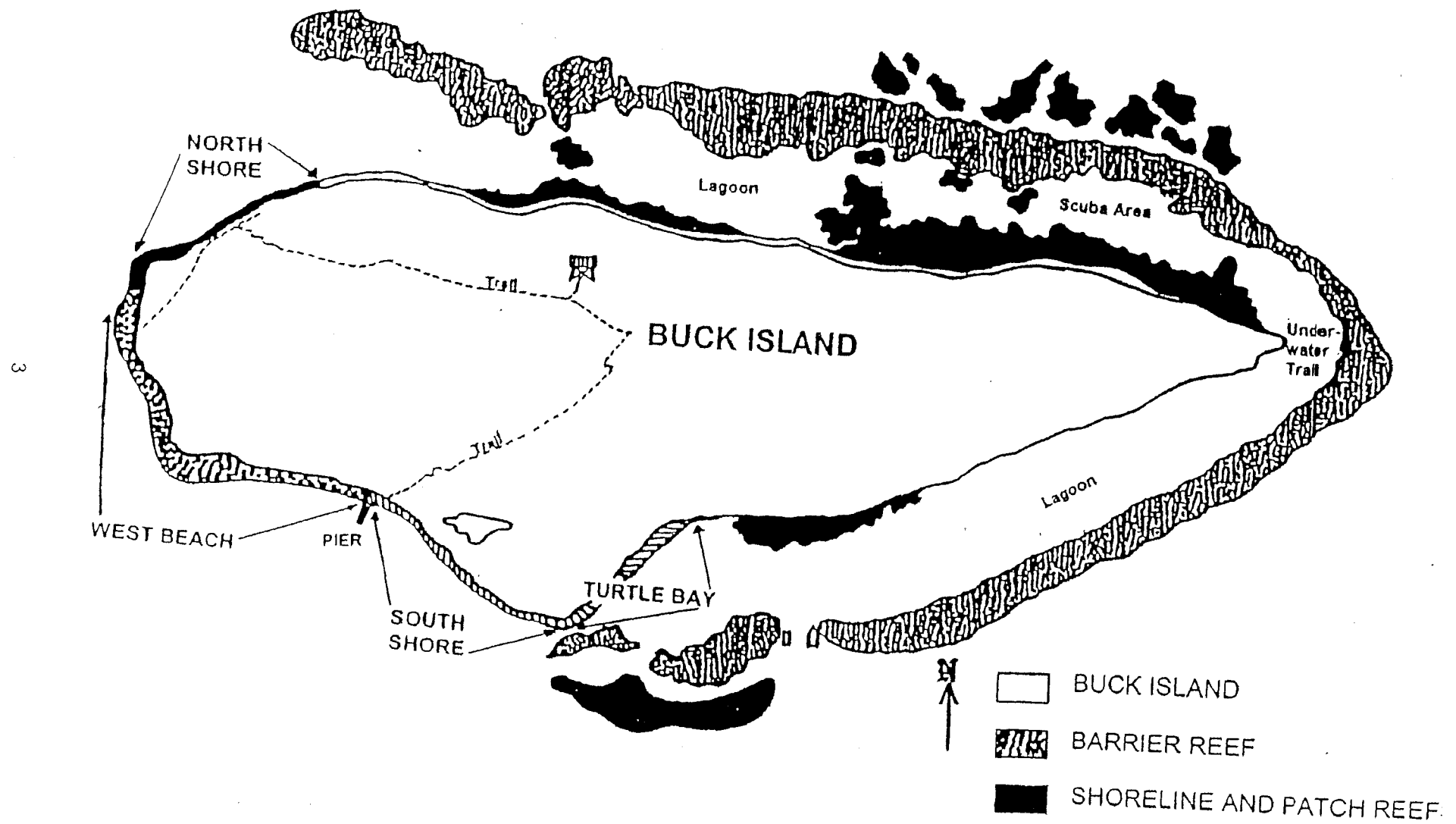
Program Overview:

Sea turtle nesting activity has been monitored at Buck Island since the early 1980's. At that time, park rangers conducted daytime beach patrols and recorded nesting activities (Zullo, 1986). The Buck Island Sea Turtle Research Program (BISTRP) was initiated in 1988. The National Park Service's Division of Natural Resources, under the supervision of Buck Island Reef National Monument's Superintendent, directs this year-round program, which primarily studies the biology of the endangered hawksbill sea turtle. The annual monitoring and research project is funded by the BUIS Natural Resource Management (NRM) budget with past assistance also from NPS Natural Resource Preservation Program, NPS and U.S. Geological Survey's Inventory and Monitoring Program (NPS/USGS I&M Program), US Fish and Wildlife Service, Non-Governmental Organizations, and a local hotelier.

In May 1994, the National Park Service expanded BISTRP to include a population survey of hawksbill turtles in the coral reef system surrounding BUIS, which serves as a developmental habitat, providing both food and shelter for turtles while they grow to sexual maturity.

There are very few studies of sea turtles in developmental habitats. One of the few long-term studies of immature *Chelonia* occurs along the Great Barrier Reef in Australia. That study reports that some species spend a large period of their lives

Figure 1. Buck Island Reef National Monument



within the developmental habitat. Their association with a site may last for decades until they reach sexual maturity at 20-30 years of age, at which time they leave these areas for adult foraging grounds. Once settled into an adult foraging habitat, they leave only for reproductive migrations (Limpus, 1994).

There are a vast number of coral reefs around the Virgin Islands which all have the potential to serve as developmental habitat for the hawksbill turtle. It is essential for resource managers to determine if these endangered animals are exhibiting a similar timeline and utilizing near shore coral reefs as developmental foraging grounds for 20-30 years. In view of the concentration of human activities in these areas, such as snorkeling, diving, and boating, this information is critical to the development of appropriate management plans for these areas.

The only prior study to census the hawksbill population inhabiting the near shore waters in the Virgin Islands was by Boulon who captured and tagged thirteen hawksbill turtles between 1981 and 1983 in Magans Bay, St. Thomas, and sixty-three hawksbills between 1981 and 1986, in various areas around St. Thomas and St. John (Boulon, 1994). Boulon reported that juvenile hawksbills recruit out of the pelagic environment and into the coral reef habitat in the Virgin Islands at 20 to 25 cm straight carapace length (SCL-measured with calipers) (Boulon, 1994). Additional long-term recapture data for immature turtles are critical to determine management needs for these endangered species during this life stage in the various reef habitats present in the Virgin Islands and worldwide.

The data collected through this study, under an endangered species research permit, will provide the information critical to meeting the recovery goals for this species as outlined in the Endangered Species Act and the Hawksbill Turtle Recovery Plan (NMFS, 1993). The Hawksbill Turtle Recovery Plan states that we need to know the abundance, and spatial and temporal distribution of hawksbills in the marine environment as well as information on the genetic relationships among Caribbean populations if we are to adequately protect and ensure the survival of hawksbill turtles (NMFS, 1993). To address some of these needs, the BUIS in-water sea turtle study has identified the following objectives:

- ❖ Identify as many individuals as possible within the population through tagging
- ❖ Determine length of residency with long term monitoring and recapture program
- ❖ Identify genetic association of individuals with other Caribbean populations
- ❖ Ascertain growth rates and size class distribution
- ❖ Determine gender composition of the tagged population
- ❖ Chronicle habitat-utilization and behavior of hawksbill turtles

The BUIS in-water study was modeled after on-going research by Colin Limpus, Queensland Turtle Research Project, Australia (Limpus, 1992), and a study by Robert van Dam and Carlos Diez at Mona Island, Puerto Rico (van Dam, 1994). Due to the complexity of the reef structure at BUIS, captures by boat or by net would be nearly impossible and may damage the reef structure or potentially harm the animals by

entanglement and drowning. This study captures turtles by hand during free dives. Hand capture has proven effective and harmless to the turtles. Snorkel surveys are conducted and upon sighting a hawksbill, observations as to time of day, location within the reef system, and activity of the turtle are noted.

Endangered Species Research Permit:

Each year, the BUIS Sea Turtle Research Program submits a permit request to the Virgin Islands Department of Planning and Natural Resources (VIDPNR). Although permits for research on threatened and endangered species in the water are usually issued by the National Marine Fisheries Service, VIDPNR's Division of Fish & Wildlife (DFW), a territorial agency, has been delegated Section 6 authority under a US Fish and Wildlife Service Cooperative Agreement for Threatened and Endangered Species and issues all endangered species permits in the US Virgin Islands.

A letter is sent requesting an endangered species permit renewal that includes an outline of the planned research activities for that year. The Territory's Endangered Species Coordinator reviews the permit request. Any questions the coordinator may have are usually answered by phone. After approval the permit is sent to the Commissioner of Planning and Natural Resources for signature, and the letter/permit is sent to BUIS. The permit is good for one year. An annual report is submitted to VIDPNR/DFW as required under the permit.

A list of all BUIS staff and research volunteers involved in the research program is sent to VIDPNR. Each person on the list is issued a copy of the permit. The permit must be carried on their person any time they are working with sea turtles for the BUIS Sea Turtle Research Program.

Study Site Description:

The bank-barrier reef that surrounds the eastern two thirds of BUIS is dominated by the branching formations of elkhorn coral (*Acropora palmata*). Today over 80 percent of the reef structure is dead from a combination of white band disease, which started in the 1970's, and a series of severe hurricanes between 1979 and 1999. However, large individual colonies of elkhorn coral with branches up to a meter in diameter and several meters long are not uncommon, and the eastern forereef represents one of the densest living stands in the Virgin Islands. This shallow-reef structure tends to be more continuous to the south and east, but breaks up into a series of contiguous patch reefs to the north and west. The north side is also characterized by the development of many isolated patch reefs, both within the lagoon and seaward of the barrier reef. The seaward patch reefs, known locally as "haystacks", are present between the inner fringing reef around Buck Island and Buck Island Bar, a submerged bank-barrier reef approximately 500 meters to the north. The dominant coral species of the barrier reef and the patch reefs include *Acropora palmata*, *Montastraea annularis*, *Porites astreoides*, *Diploria* sp., *Porites porites*, and *Acropora cervicornis*. Other dominant organisms include *Zoanthus sociatus*, *Millepora* sp., octocoral/gorgonians, various algae, and sea grasses (Bythell *et al.*, 1989).

In order to conduct standardized snorkel surveys for sea turtles in the waters around Buck Island and document the locations of sightings and captures, the study area was divided into equal sections or "sectors". Each sector defines an area approximately 0.25km² extending from the shoreline to the outside reef. There are a total of 18 sectors, labeled A through R (Figure 2). These sectors were further subdivided into zones. The 6 zones from the shoreline out beyond the barrier reef are, 1) shoreline reef- the reef system directly adjacent to the shoreline, 2) lagoon pavement- a shallow (1-4 m depth) limestone pavement with scattered live coral heads and/or coral rubble and open sand patches, 3) backreef- the landward side of the barrier reef, 4) emergent reef crest, 5) forereef- the seaward side of the barrier reef including the contiguous reef, and 6) large patch reefs known as "haystacks" (Bythell *et al.*, 1989).

DATA COLLECTION PROCEDURES: (Listed in order performed)

Field Preparation:

Before departing for BUIS to conduct sea turtle surveys, be sure all of the essential equipment is operational and packed including data sheets, the scale, and the "turtle kit" which includes the camera, and blood, tissue, tagging, and measuring equipment (Appendix 1).

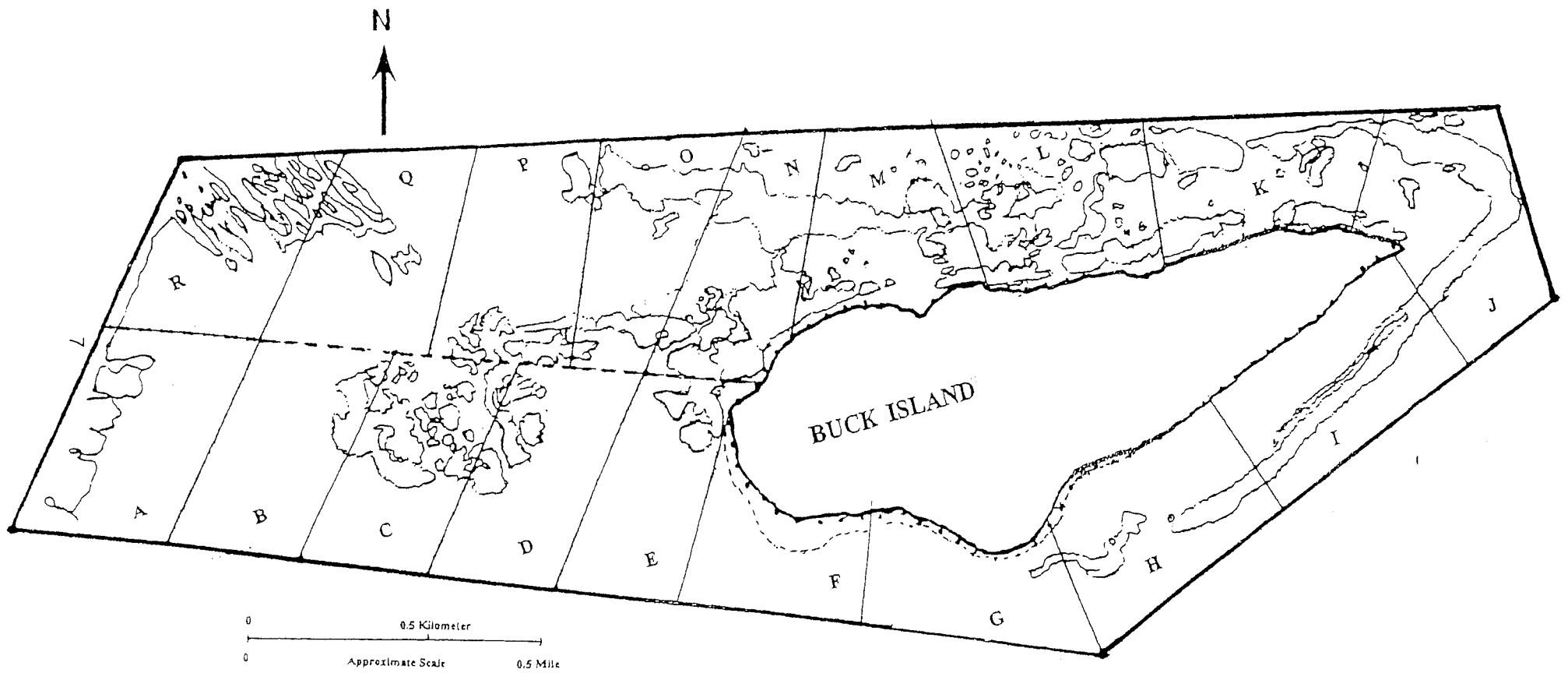
Access to Study Site:

The turtle survey team travels to the study site via the BUIS Resource Management boat. A Department of Interior (DOI) certified motorboat operator captains the boat, however, each team member is trained in boat handling and safety procedures and tested for competency in these areas by the Chief of Natural Resources or the Superintendent. Once inside the lagoon, the boat is either moored near the underwater trail (sector J), at SCUBA cut (sector K), Turtle Cut (sector L), or anchored in sand in any of the other sectors, depending on the sectors to be surveyed as well as weather and sea conditions that day.

Snorkel Surveys:

In order to meet the primary objectives of this project, two types of surveys are conducted: distribution and capture surveys. Distribution surveys are a visual census of turtles sighted in a given sector and no attempt is made to capture the turtles. This survey provides a count of turtles by species present in a given sector at the time of survey. Capture surveys are conducted with the specific objective being to capture turtles that are seen. Captured hawksbills are brought to the boat to be weighed, measured, tagged, have tissue samples taken for genetic analysis, blood samples collected for testosterone analysis, and photographed to aid in future identification. To increase likelihood of capturing turtles, effort should be focused in sectors where turtles are most often observed. Data collected during 1994 through 1999 surveys indicated that hawksbill turtles are more likely to be found where there is substantial reef structure and especially where the carpet anemone *Zoanthus sociatus* is associated with the reef (sectors J to O, Figure 2) (Pemberton *et al.*, 2000). Sponges, although noted in the literature as the primary food source for hawksbill sea turtles (Meylan, 1988), are very

Figure 2. Buck Island Reef NM Sea Turtle Survey Sectors



limited in their distribution around the Monument and have only recently been noted in the Western spur and groove reef system (pers observation Phillips, 2000). *Zoanthus sociatus* was shown to be the dominant food item found in esophageal lavage samples collected during two separate studies in which the objective was to determine what hawksbills are feeding on at BUIS (Mayor *et al.*, 1998, Allen, 1998).

Initial Observations:

For each capture and sighting, observations upon initial sighting are recorded including: date, time of sighting, sector, habitat zone, approximate water depth and turtle depth, activity upon sighting, sea conditions, and visibility. This information is mentally noted by the primary technician (the person who first sees the turtle) and recorded on a BISTRP In-water Sea Turtle Study Data Sheet (Appendix 3) upon returning to the boat.

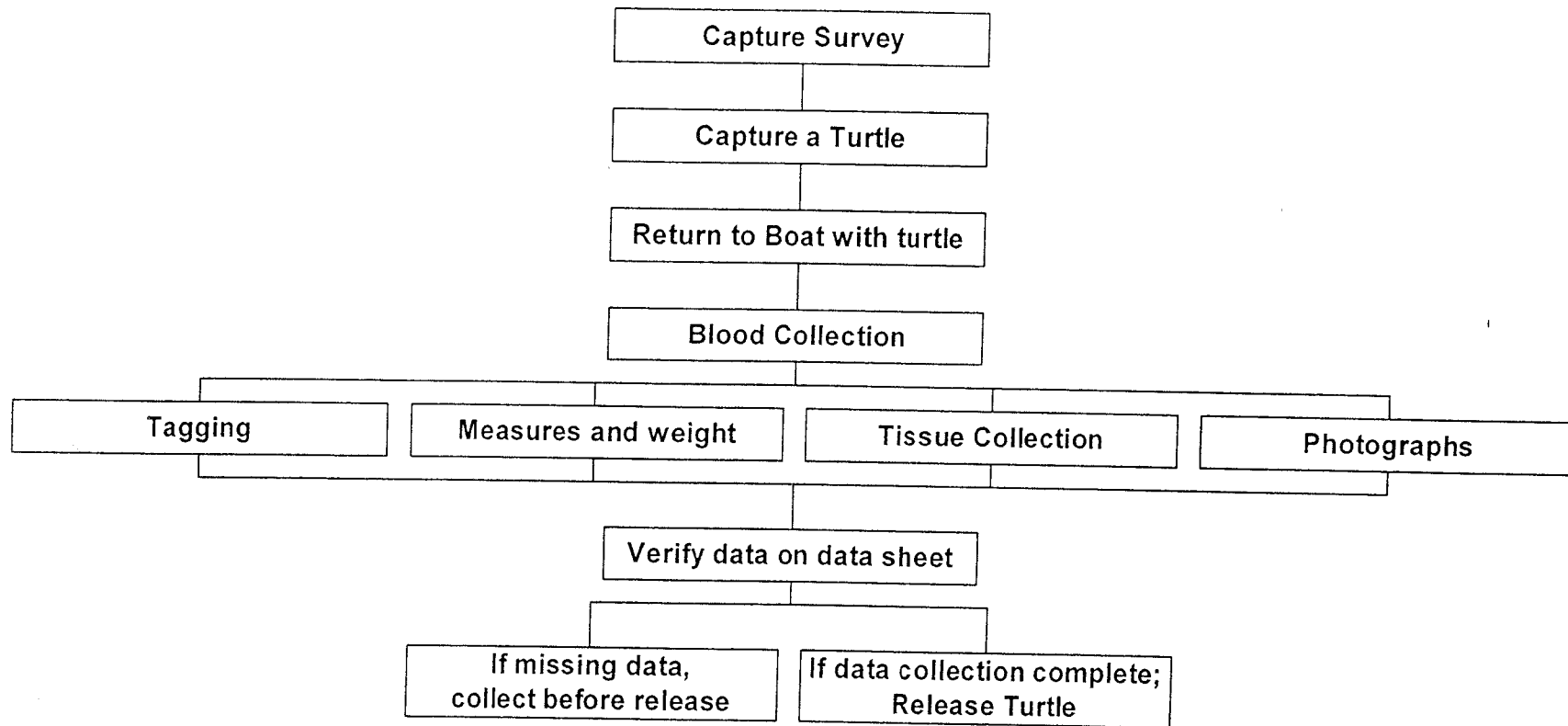
Distribution Surveys:

This is a visual census of turtles present in a sector and no physical capture is attempted. The corners of the sectors are temporarily marked with buoys. Two or three snorkelers conduct surveys either by snorkeling or by being towed behind a boat if there are no obstacles. The number of transects needed to survey the sector will depend on visibility. Each transect should not overlap the previous line by more than a few feet, but there must be some overlap to insure the entire sector is surveyed. Initial observation data noted above is recorded for every turtle seen. These data will identify population distribution throughout the study area, i.e. greater Catch Per Unit Effort (CPUE) will show that there are higher densities of turtles in certain sectors. After annual calculation of CPUE, if there are sectors that show statistically higher rates, capture survey efforts could be focused in those areas. Surveys will be conducted once every two weeks (Appendix 2). Adjoining sectors are not surveyed on the same day to minimize boat/diver interference while performing surveys, although the setting of markers, boat tows, and snorkeling on the surface have not shown signs of disturbing the turtles in previous survey sessions.

Capture Surveys: (Refer to Sequence of Events in Figure 3)

Capture surveys are conducted by teams of 2-6 snorkelers. The team members swim about 10 to 15 feet apart depending on visibility to ensure they are as far apart as possible while within sight of each other, forming a line across the area to maximize coverage. They look from side to side as they swim, looking for turtles and checking that the team members on either side of them are still visible. If team members lose sight of each other, he or she is to surface and reestablish visual contact. Should a team member get separated from the rest of the team, they are to return to the boat and stand on the deck of the boat so that the other team members can see them and know they are okay. Each survey is limited to 2 hours maximum with a minimum 30-minute rest period between surveys. This limit is in place to reduce snorkeler fatigue and loss of body heat. Although the schedule outlined in Appendix 2 should be followed, weather and sea conditions determine which sectors can be safely surveyed on any particular day, and the schedule is adjusted accordingly.

FIGURE 3. Sequence of Events for Turtle Capture and Work-up



When a turtle is seen, the snorkeler gets the attention of at least one other team member and then attempts to capture the turtle. They point at the turtle so that as other members approach they can locate the turtle. If the turtle is focused on one member of the team, that person is designated as a distraction diver, diving part way down and trying to keep the turtle's attention focused on them without seeming a threat that could cause the turtle to flee. Another team member acts as the capture diver, diving behind the turtle and approaching for the capture. If that capture attempt is unsuccessful, the entire team pursues the turtle and tries to maneuver the turtle toward the reef structure until it settles and another capture attempt can be made. In many cases, if the turtle gets near reef formations and the team stays a short distance away, the turtle will settle into the reef and just look up at the snorkelers. When a capture dive is made, the turtle will watch the diver's entire descent but usually not flee. The divers often get within arms reach before the turtle tries to move and by then the team member is close enough to catch the turtle. Captures are made by diving down over the turtle and grabbing the carapace. One hand is placed at the nuchal scute behind the neck and the other on the supracaudal region above the tail. Both hands should be placed simultaneously because the turtles' first reaction to feeling a hand on it is to spin. If the diver does not have a tight grasp with both hands the turtle could escape and the sharp marginal scutes could cut the hands of the diver. Once the diver has a secure hold on the carapace, the turtle is pointed head up and slowly brought to the surface. It is held near the surface, allowed to breathe as needed, and swum back to the boat for data collection.

CAPTURED TURTLE DATA COLLECTION PROCEDURES: (Listed in the order performed): Before the team goes on survey, they review a list of all turtles captured within the last 30 days. Analysis of data collected thus far shows that little detectable growth occurs during this short time period. If a recently captured turtle is recaptured, there is no need to return to the boat for workup unless required data or tests were not collected previously. Once the tag number has been verified, the turtle is released and the team continues the survey.

Turtle Handling Procedures:

After a capture is made, the turtle is guided back to the boat. If the team consists of 4 or more members, at least 2 members will return to the boat with the turtle and the rest of the team continues to survey. No one is allowed to continue to snorkel alone for safety reasons. The members returning to the boat can look for turtles on the return and attempt capture of any additional turtle seen without risking accidental release the turtle that is being returned to the boat. The NPS boat has a removable side door that facilitates getting the turtle into the boat safely and with ease. As the team approaches the boat, one team member swims ahead to the boat, removes the door (if it was not left open upon departure), wets down the deck and a towel, and prepares the blood collection equipment before the other team members arrive with the turtle. When the team reaches the boat, the turtle is carefully lifted on board. The team member aboard the boat grasps the front flippers at the shoulders and lifts the turtle as the person in the water pushes the turtle out of the water. The turtle's head and body are covered with the wet towel while team members get on board and in position to start data collection.

The door is replaced and data collection begins. The turtle is covered with a wet towel when not being worked on to reduce stress (at times there can be two or more turtles on board at a time) and the deck of the boat is kept wet to keep it cool.

Blood Collection:

BISTRP's in-water study is conducting analyses of testosterone and blood glucose levels through the collection of blood samples from hawksbill turtles. Testosterone analysis identifies the sex of the turtle, which cannot be determined visually until the animal becomes sexually mature. At sexual maturity, male sea turtles have an elongated tail that extends well beyond the end of the carapace; the females' tail will either extend beyond the carapace slightly or not at all. The objective of the blood glucose experiment is to determine what is a "normal blood glucose level in a "healthy, wild" sea turtle. Baseline glucose data from "healthy" sea turtles in their natural environment will be useful to rehabilitation facilities. It will give caretakers a relationship between their patient's glucose levels to that of a turtle not stressed, ill, or diseased.

A 4-5 ml blood sample is collected for glucose and testosterone analysis (Appendix 4). Blood collection is done as soon as possible after the turtle is brought aboard the boat to reduce the influences of stress related impacts to the blood analyses. The sample is split for the two different analyses. One drop of whole blood is immediately analyzed for a blood glucose level using an ExacTech® Glucometer and Glucose strip. The remaining blood is placed in a cooler with ice and allowed to clot. Back in the office, the clotted blood is centrifuged and the serum drawn off and placed in a 1 ml cryotube and labeled with the turtle's primary tag number, the date, location (BUI), "In-water Study", and the initials of the person who collected the blood. The serum is then frozen until testosterone evaluation. All testosterone serum samples collected are sent to Dr. Thane Wibbels of the University of Alabama at Birmingham each September for analysis.

Tissue Sample Collection:

BISTRP is conducting genetic analysis through the collection of tissue samples from hawksbill turtles. Genetic analysis determines the relationship of the hawksbill turtles at Buck Island to other genetically identified populations in the Caribbean. A small piece of tissue approximately 1cm² is cut from the rear flipper (Figure 6) and placed in a container with tissue buffer (Appendix 5). This sample is labeled and sent for genetic analysis to the current geneticist working with the program.

Tagging Hawksbill Turtles:

To identify individual turtles on subsequent captures, each turtle is tagged with National Marine Fisheries Service (NMFS) external inconel flipper tags and if there is sufficient muscle mass, they also receive an AVID® Passive Integrated Transponder (PIT) microchip. Some of the very small turtles may not have enough muscle in which to inject the PIT tag so one is not given. The first inconel tag applied to a turtle becomes the primary identification (ID) number. It becomes that turtles' name even if that tag is lost or removed. One inconel tag is placed in the scale closest to the body in the left

front flipper (L3 position) and another in the right hind flipper tissue using an NMFS inconel tagging tool (Figure 6). PIT tags are injected anterior to the R2/R3 scales (Figure 6). Turtles under 30 cm CCL may not have sufficient muscle mass to inject a PIT tag, but they still receive at least one inconel flipper tag in the right hind flipper (Appendix 6).

Measurements:

To monitor growth rates, standardized measurements are collected on each captured turtle and include curved carapace length and width, plastron length and width, and tail measurements (Appendix 7). All of these measurements are taken using a nylon measuring tape. Straight-line carapace length and width are measured using 1-meter tree calipers, and head length and width measurements are taken using a 6" dial caliper. One technician restrains the turtle while the primary technician takes the measurements. All measurements are recorded in centimeters on the data sheet along with the initials of the technician that took the measurements.

Diagnostic Records:

A standard set of photographs are taken of each captured turtle using either a 35mm automatic camera with zoom lens, and 100-200 ASA slide film or a digital camera (Appendix 8). Photos are taken to document physical characteristics and ectobiota. Pictures are taken of the overall carapace, anterior carapace, posterior carapace, overall plastron, anterior and posterior plastron and the tail. A dorsal view of the head, and left and right profile photos of the head and beak are taken as well as any unusual markings, ectobiota, notches, or damage. To augment these photos, drawings are made of all notches, scars, and algal cover on the carapace, plastron and flippers. This documentation was developed so that future sightings of individuals from a short distance might be matched to a drawing or photo for identification when the tag number was not read.

Weight:

The turtle is weighed using a load cell suspended from a pole or held by hand. The load cell is connected via electronic cable to a digital Ohaus electronic scale (model I5S) that displays the weight in kilograms ($\pm 0.5\text{kg}$). Once the scale is turned on, the carabineer and nylon ropes are attached to the load cell and the reading is reset to zero, meaning that when the turtle is weighed, the true weight of just the turtle will be displayed. The ropes and carabineer are removed from the load cell. The turtle is placed on its carapace and the smooth nylon ropes are secured around all four flippers as close to the body as possible. The ropes are then attached to a carabineer clip and connected to the load cell. Two technicians lift the pole, suspending the turtle completely off the deck of the boat and the weight is displayed and recorded in kilograms. The turtle is gently lowered back onto the deck, the ropes are removed, and the turtle is returned to the upright position (dorsal side up).

Turtle Release:

When data collection is complete, the turtle is released from where the boat is anchored/moored, which is usually within 500 meters of where the turtle was captured. The turtle is carefully lifted over the side of the boat and gently released into the water. The turtles' departure is closely observed until it is out of sight to be sure the turtle is acting normal. The total work-up time, from capture to release, is approximately one hour.

DATA MANAGEMENT:

BISTRP collects a tremendous amount of data on sea turtles. All data must be accurate and managed properly if they are to be useful to managers in understanding the turtles' requirements during this critical developmental phase of the life cycle. The following is a list of the quality assurance and quality control measures in place to ensure accurate data collection, recording, and archiving.

Data Collection:

1. **Data sheets.** Data sheets have been designed to fit the different types of sea turtle data collection and research at BUIS. Before releasing the turtle, the data sheet must be checked to insure that all information has been collected and recorded. The program manager updates data sheets as needed to meet the changing requirements of the research program.
2. **Field Data Accuracy.** When one person is collecting data, he or she must double-check each measurement and number. This is to insure accuracy in reading of the measurements and recording of the numbers.
3. **Quality Control.** When two or more people are collecting data, one person takes the measurements and clearly states the numbers to the person recording data. The person recording data must repeat the number out loud to insure that it was heard and recorded properly.
4. **Field Data Management.** All completed data sheets are turned into the lead biologist and reviewed for any missing data. Any omissions are brought to the attention of the data collector for completion before the turtle is released.
5. **Office Data Management.** The information from the "In-water Sea Turtle Study Data Sheet" is entered into the BISTRP In-water Sea Turtle Study database. Each data entry must be verified before saving the file to the database.
6. **Archiving Data.** Original data sheets are photocopied and filed in a three-ring binder by primary tag number in chronological order to allow for easy review of an individual turtle's history. This book is kept in the NRM office. The photocopied data sheets are filed in order of activity number in another three ring binder as a backup copy of all data sheets for that year. The photocopies are not

kept in the same area as the original data to increase the chances of one copy surviving an unforeseen disaster, such as fire or hurricane.

7. **Field Reference Books.** "Rite in the Rain"® spiral notebooks are used as quick reference guides in the field. Each capture is entered into the book with basic data on the turtle including: date, tag numbers, measurements, and location of capture. This information is used when a turtle is recaptured, allowing quick reference for existing tags and to see what tests need to be taken such as genetics or testosterone, or the results of tests already completed.
8. **Physical specimens.** Physical samples, such as blood and tissue samples collected in the field are preserved as necessary (Appendices 4 & 5). Each sample is labeled with the primary tag number of the turtle, the date of collection, species, "BUIS In-water", the initials of the person who collected the sample, and a description of the sample contents. When being shipped for analysis, if there are duplicate samples from any turtle, one is archived at BUIS NRM Office as a voucher sample.

Photographic Archive:

Several standard photographs are taken of each turtle at least once each year that it is recaptured. Photographs are taken of any unusual findings (i.e., injuries, deformities, etc.). If a digital camera is used, the photos are downloaded to a computer. Each turtle should have a folder with the primary tag number as the folder name. The photos are labeled with the date and subject (example: may4'01OC would be the file name for a photo taken May 4, 2001 of the overall carapace) and placed in the appropriate turtles' folder. The photos are then printed out and/or written to a CD for archiving.

If a 35 mm camera is used and the roll of slide film is completed, it is removed from the camera, labeled with the date and the last photos taken (turtles' primary tag number if possible). The roll of film is then turned into the lead biologist who is responsible for mailing the film, including getting a film mailing envelope (each has a unique number) from the NRM office and filling out the shipping label. On the receipt tab the information on the date and last photos taken (turtle's primary tag number if possible) is copied. The film is mailed for developing and the receipt tab is filed until the film returns. When the developed film returns, the receipt tab, with the matching number from the film is pulled. Both are then given to the technician labeling the photos along with the data book for the season. Turning to the date matching the last photo taken in the pack, the technician starts with the last photo and matches it to those frame numbers recorded as taken on the data sheet. Each photo is labeled with the following information: BUIS, month/day/year, turtles' primary tag number, activity number, and a brief description of what the photo is of (i.e. overall carapace photo, deformity in right front flipper, etc.). Proceeding backwards in the data book, the technician continues to match and label the photos with those recorded for the various activities. The slides are then stored in archival 2x2-20B 35mm slide preserver sheets. The sheets are then stored in a three ring binder: general slides in the BISTRP book, and turtle slides are placed with the corresponding section for each individual turtle.

Sea Turtle Research Program Computer Database:

BISTRP developed a relational database using Visual Fox Pro to track all sea turtle activities. This database allows data to be entered into a Windows driven database in a user-friendly environment. All data are linked, allowing for reports to be created and generated by the user. Queries can be run on individual turtles, the tagged population, the entire population, size classes, time of sightings, turtle's activity at time of sighting, habitat first observed in, etc., and any combination of these and other criteria. Accurate data entry is vital to accurate reports. To decrease the number of data entry errors, many quality control measures have been implemented within the program (Hillis-Starr, et al, 1997).

The following is a list of some of those measures:

- ❖ Each activity is given a unique Aactivity number≅ that the program will not allow to be duplicated.
- ❖ Each tag number is unique and cannot be duplicated in the program.
- ❖ To avoid possible entry error, wherever possible, once data have been entered, it is carried over to other areas where it needs to be viewed so it does not need to be typed in again.
- ❖ Numerical fields have been limited to the number of spaces appropriate to that measurement.
- ❖ To avoid mathematical errors the computer does all calculations.

Note: Copies of the Visual Fox Pro database executive file may be requested by contacting:

Zandy Hillis-Starr
Chief of Natural Resources
Buck Island Reef NM
2100 Church Street #100
Christiansted, VI 00821.

Data Analysis and Reports:

An annual In-water Study summary report (Appendix 9) is compiled at the end of each calendar year for use by resource managers and to answer information requests from outside researchers, organizations, students, and environmental groups. To obtain the figures for this summary the BUIS In-water Sea Turtle Study Database report generator is used. Every time a report is run, the generator scans the entire database so that all data in the database at the time of the report are available for query. Filters can be applied to obtain only certain data sets as desired. Specific reports have been designed to address each question so that you simply access the report with the name as designated next to each statement below and the numbers are extracted directly from that generated report.

To access the database, click on the "BUIS In-water Sea Turtle Database" icon. This will open the program and a note will appear that says, "You are about to work on Foraging Turtles". Once in the BUIS In-water Sea Turtle Database, click "OK" to

continue. An "Open Form" will appear that has a list of sections of the database. Since you will not be doing data entry or manipulation, you can click on "Cancel" to close this window. Click on the "Report Generator" button on the tool bar at the top of the page. This opens the Request Manager and shows a list of all report requests that have been written to date. To access a specific report scroll down the alphabetized list and find the name of the desired report, click on it once to highlight it and then click the "Preview" button on the bottom of the page. This runs the query and produces a report that is visible on screen and if desired, can be printed out. Report names (ex. *ANNPTAGS*) are listed below in *ITALICS* before the statement being addressed. The statements are set up as fill in the blanks. Enter the correct study year (YEAR), and the proper numbers (X#) as derived from the report.

Captures and Recaptures:

- ❖ Number of hawksbill turtles tagged since the inception of the project in May 1994.

<i>ANNPTAGS</i>	As of December 31, YEAR, the In-water Sea Turtle Study has tagged X# hawksbill turtles at Buck Island Reef NM since the inception of the program.
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- ❖ Number of turtles encountered during the study year and breakdown by species.

<i>ANNCAPTS</i>	During the YEAR distribution and capture surveys there were X# encounters with sea turtles, X# of these were with hawksbill turtles and X# were with green turtles.
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- ❖ Number of turtles physically captured; broken down by species, number of untagged turtles at time of capture and newly tagged (P-Primary tagging) during this study year, captures of turtles tagged in previous study years (ISRC-inter-season recapture), and the number of recaptures during the study year of turtles already captured in this study year (WSRC-within season recapture). The numbers are taken from the total number of records found for each species in the report. Then using the breakdown of the data, the comments are completed.

<i>ANNDATA</i>	X# of hawksbill and X# of green turtles were physically captured for data collection in YEAR. X# of the hawksbill and X# of the green turtles physically captured were Untagged and subsequently tagged for identification (" <i>P</i> "-primary capture and tagging of a turtle), another X# hawksbills and X# greens were turtles that had been tagged at BUIS in previous years of the in-water study (" <i>ISRC</i> "-interseason recapture of a turtle tagged previously). The remaining X# captures were recaptures of these X# animals (" <i>WSRC</i> "-within season recapture of a turtle previously captured during this study year).
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Behavioral Observations:

- ❖ Observed activity of the turtle at the time of initial sighting. In the database these are noted as secondary activities (the primary activity being an in-water capture). From the report, take the individual number of each secondary activity and divide it by the total of all records used in the report and multiply that number by 100 for the percentage.

SECACTS

Behavioral observations have found that X% of the turtles were swimming at the time of sighting, X% were resting, X% were feeding, X% were sighted while they were at the surface to breathe, and X% of the turtles were observed mating.

Genetic Composition of the Population:

- ❖ This is a breakdown of the haplotypes as determined by genetic analysis. This includes all results since the inception of the program.

GENETICS

Genetic analyses of X# hawksbill turtle samples from the BISTRP in-water study have been completed to date. The BUIS population is a mixed stock including (*as shown on the report; example A,B*).... haplotypes.

Gender Composition of the Population:

- ❖ This is a breakdown of the gender of turtles as determined by testosterone analysis and includes all results since the inception of the program.

TESTOST

X# hawksbill blood serum samples have been analyzed to determine the testosterone level and gender of hawksbill turtles at BUIS. The results show the tagged BUIS In-water hawksbill population is known to include X# females (F) and X# males (M). X# samples are pending analysis (P).

Length of Residency:

- ❖ This report gives the capture history of all tagged turtles since the inception of the study. It shows dates of captures, weight, and curved and straight carapace measurements taken at time of capture. Review the history for each animal and calculate the length of known residency to date for each tagged turtle.

RECAPTUR

The longest known residency is X# months. A short history of size and weight on first and last capture is included for the reader's general information.

Example:

Two turtles have been in the study for X length of time.

- QQD 605 was first tagged on 09/01/94 and last seen on 07/29/98 and is a male. His first CCL was 64.6 cm and weight of 27 kg. His last CCL was 72 cm and weight of 39 kg.
- The other turtle is QQD 610, a female first captured on 10/11/94 with a CCL of 35.5 cm and weight of 4 kg. She was last seen on 08/07/98. Her last measurements were taken on 01/04/97 and were 49.6 cm CCL and 12.5 kg weight.

Size Class Distribution:

- ❖ This report shows the breakdown of the number of turtles within each 10cm size class (i.e. 20-29.9cm, 30-39.9cm, etc.). These data are derived from the CCL measurements taken from each animal during its last capture for the study year being examined.

SIZECLAS

Number of turtles per size class and weights as of December 31, YEAR (X# recaptured turtles were not weighed or measured during YEAR). Run this report for each size class, you will be prompted to enter the size class you wish to get information on (i.e. 20-29.9cm, 30-39.9cm, etc.). See Appendix 9 for sample charts and graphs.

Catch Per Unit Effort:

To monitor Catch Per Unit Effort (CPUE), information about every capture and distribution survey is recorded on the "CPUE Tracking Sheet". This information is used to determine the distribution of turtles within specific sectors and monitor time spent on both distribution and capture surveys. Remember, a capture survey is done with the intent of capturing any turtles sighted thus some turtles in the area may not be noticed while pursuing another turtle. Notations on the type of survey (capture or distribution), date, time spent conducting the survey, numbers of snorkelers present, sector(s) surveyed, and any sightings or captures of turtles are recorded. These data are entered into either a spreadsheet or statistical software program for calculation of the CPUE.

Example data notation:

- ❖ 10/17/2000- a team of 2 conduct a capture survey (C) for 1.5 hours and sight 2 hawksbill turtles and 1 green without any captures, they return to the boat for a rest, go back out on another capture survey (C) and in 45 minutes, sight 1 hawksbill and capture another hawksbill before returning to the boat
*Note how each survey is recorded separately even though conducted on the same day.
- ❖ 10/18/2000 a team of 2 conduct a capture survey (C) for 1 hour and do not see any turtles
- ❖ 10/21/2000 a team of 3 conduct a distribution survey (D) which takes 1 hour and they see 1 hawksbill and 1 green turtle

CPUE Tracking Sheet BUIIS In-water Sea Turtle Study

Unique Survey ID #	Survey Type	Date	In H2O	Out	Survey time (hrs)	# Snorkelers	Sector(s)	Species	Sightings	Captures	Survey ID #
1	C	10/17/00	13:30	15:00	1.5	2	L	HB	2	0	1
								GR	1	0	1
2	C	10/17/00	15:30	16:15	0.75	2	K	HB	1	1	2
3	C	10/18/00	10:30	11:30	1	2	J	--	0	0	3
4	D	10/21/00	0930	1100	1	3	A	HB	1	0	4
								GR	1	0	4

The basic formula to calculate CPUE is:

$$\frac{\# \text{ of encounters (sightings + physical captures)}}{(\text{length of survey time (hrs)} \times \# \text{ of snorkelers})}$$

Population distribution:

To monitor population distribution within the study area, pair-wise mean comparisons of Catch Per Unit Effort (CPUE) can be analyzed annually using the CPUE data collected from the distribution surveys. In this instance, Catch Per Unit Effort refers not to physical captures but to sightings. These data are used exclusive of the capture surveys, so that almost equal amounts of effort time are expended in each sector if the distribution survey schedule is followed (Appendix 2). Sort the data set by "Survey Type" (i.e. C=capture survey, D= distribution survey) and then isolate the distribution survey data for analysis. Since there should be approximately equal survey effort in each sector, a Tukey-Kramer HSD (Honestly Significant Difference) (Tukey 1953, Kramer 1956, Tukey, 1991) analysis can be performed to determine if there is any statistical difference in the distribution of turtles within various sectors of the study area. If analysis shows that there are sectors that have statistically significant higher CPUE, then those sectors may be where snorkel effort would be concentrated for future "Capture" surveys. Also, comparison of the mean CPUE for each sector over time could reveal possible shifts in distribution within the study area and/or possible changes in habitat preference or activity.

The above-mentioned reports and data analysis are those that are evaluated annually. They provide information on a wide range of questions however; they represent only a fraction of the possible ways to examine the data. The database report generator can be used to pull any data combination from the data set and statistical analysis is limited only by the imagination of the researcher posing the questions. For more information on various forms of data analysis on sea turtle populations refer to Research and Management Techniques for the Conservation of Sea Turtles (Eckert, et al, editors, 1999) and Proceedings of a Workshop on Assessing Abundance and Trends for In-water Sea Turtle Populations (Bjorndal and Bolten, editors, 2000).

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APPENDIX 1

FIELD EQUIPMENT LIST

Before departing for BUIS to conduct in-water sea turtle surveys, you must make sure you have all of the following equipment (use of equipment will be described in greater detail in pertinent sections).

From the Office:

- Clipboard w/ 1-2 sharp pencils and in-water sea turtle study data sheets
- Mask, fins, snorkel, and dive skin or wet suit if desired
- Personal gear (ie. water, sunscreen, swimsuit, lunch, etc.)
- Ohaus electronic scale (model I5S)
- Tree calipers (usually left on the boat but check to be sure)
- The turtle kit: a canvas bag that should contain the following equipment:
 - Field Notebooks
 - 35 mm camera and film or digital camera
 - Nylon tape measure (150cm/60 in long)
 - 6" Dial Calipers
 - Tagging tool, inconel tags, and needle nose pliers
 - Rubbing Alcohol or Betadyne Solution
 - Cotton balls or gauze
 - Hazardous Waste Container
 - "Extra Fine Point" permanent marker for labeling tubes and containers
 - Blood collection kit
 - Vacutainer holders
 - Sterile 22Ga 1" Vacutainer needles
 - 5ml Vacutainer tubes (untreated red top tubes)
 - New/unused 1 ml plastic pipettes
 - ExacTech bG (blood glucose) Card and bG (blood glucose) test strips
 - Tissue collection kit
 - Sterile Disposable 8.0mm Uni-Punch Biopsy Punches (Primer Medical Products phone 1-888-Prem-USA)
 - Container with tissue buffer or 90% Ethanol (ETOH)
 - One lighter
 - One sharp pair of tissue scissors
 - One pair of tissue forceps
 - AVID Passive Integrated Transponder (PIT) tagging equipment
 - AVID Mini Tracker Multi Mode Reader model #AVID1002
 - Betadyne Solution and Triple Antibiotic ointment
 - AVID Passive Integrated Transponder Chips either;
 - pre-loaded in sterile syringes
 - or to be loaded into a set up with
 - Sterile 3/4" 12 gauge needle
 - 3cc implanter syringe

APPENDIX 2

In-water Sea Turtle Distribution Survey Schedule For Buck Island Reef National Monument

The BUIS study area is divided into 18 sectors, each approximately 0.25 km² (Figure 2). The following schedule should be followed for at least one year, possibly two, to determine if there is any greater Catch Per Unit Effort (CPUE) in various sectors. At the end of one year more effort could be dedicated to surveying those sectors that show higher Catch Per Unit Effort rates. However, to monitor possible changes in distribution and address population trends and movements due to seasonality, the remaining sectors would be surveyed on a semiannual basis. At least one day every two weeks is dedicated to sea turtle distribution surveys. Adjoining sectors are not surveyed on the same day to minimize boat/diver interference while performing surveys. The schedule is flexible within each 12-week period and a sector not accessible due to weather and/or sea conditions can be substituted with one that needs to be monitored and the original sector will be monitored on the next calm day.

Week of the Year	Sectors to Monitor	Week of the Year	Sectors to Monitor
1	A,C,E	27	A,C,E
2		28	
3	B,D,F	29	B,D,F
4		30	
5	G,I,K	31	G,I,K
6		32	
7	H,J,L	33	H,J,L
8		34	
9	M,O,Q	35	M,O,Q
10		36	
11	N,P,R	37	N,P,R
12		38	
13	A,C,E	39	A,C,E
14		40	
15	B,D,F	41	B,D,F
16		42	
17	G,I,K	43	G,I,K
18		44	
19	H,J,L	45	H,J,L
20		46	
21	M,O,Q	47	M,O,Q
22		48	
23	N,P,R	49	N,P,R
24		50	
25	Any- make-up day	51	Any- make-up day
26		52	

APPENDIX 3

N-WATER SEA TURTLE STUDY DATA SHEET BUCK ISLAND REEF NATIONAL MONUMENT, USVI

Date: ____ / ____ / ____
Month / Day / Year

Activity No. _____

Primary ID #: _____

Time: ____ / ____ / ____
OBSVD / CAPTURED / ON BOAT / RELEASED

Species: HB GR LB LH Sector _____ PTag / Recapture / Sighting

Activity (upon initial sighting): Feeding Swimming Resting Mating Surface/Breathing

Other activity: _____

If eating, what type of food? _____ Was food sample taken? Yes No

Location/ Dive Site: BUIS Other : _____

Reef / LGN / BRP / RCR / FRF / HSK Specific Landmarks: _____

Water Depth: _____ Turtle Depth: _____ Visibility: _____ Weather/Seas: _____

Shark/Elasmobranchs Present: _____

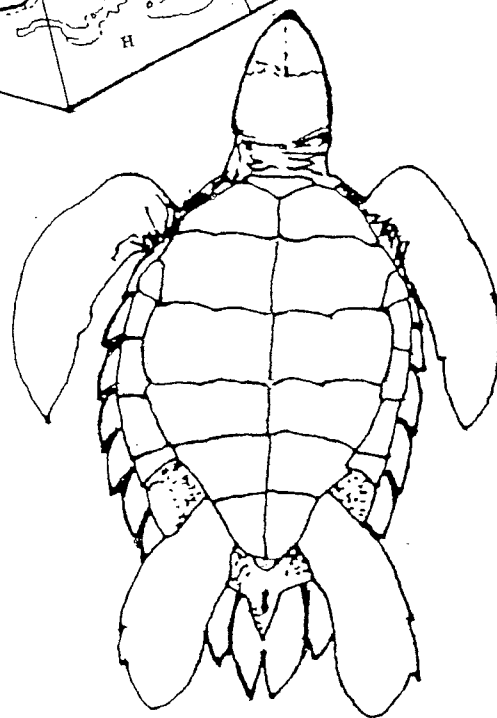
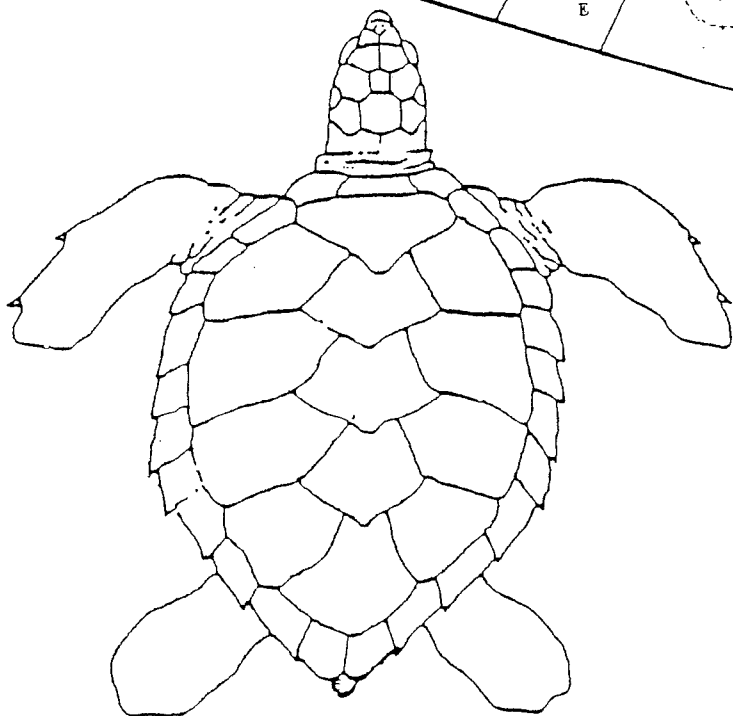
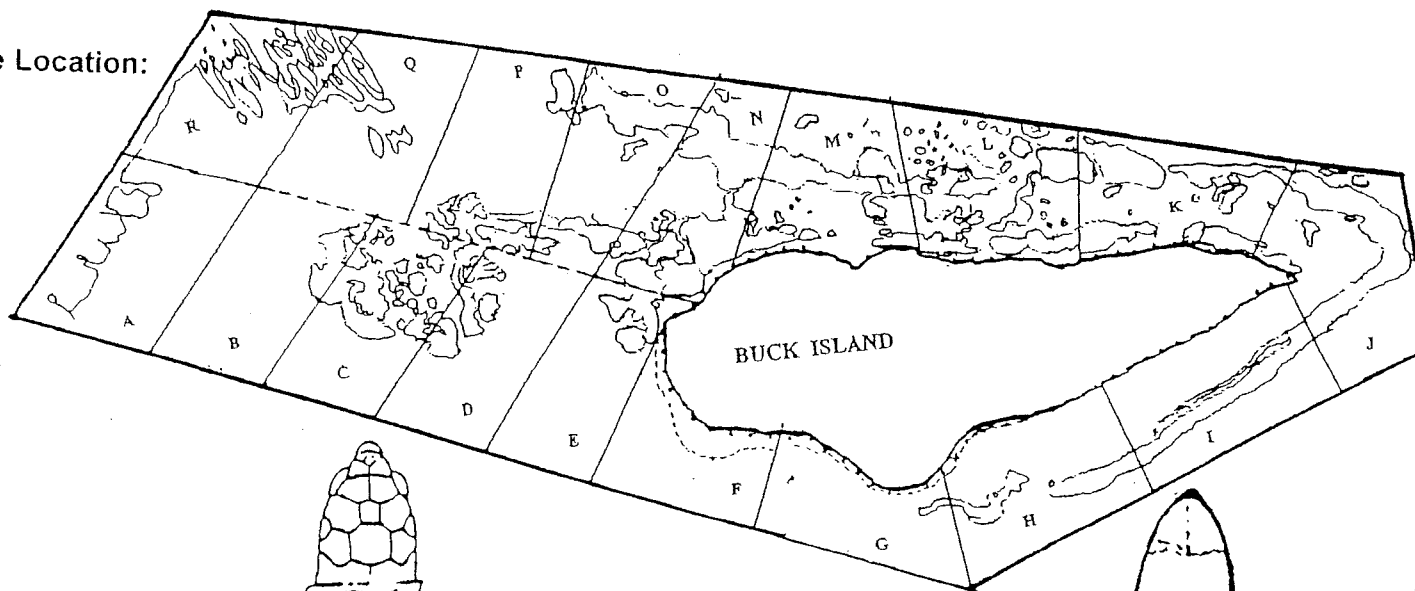
Habitat: Reef Sand Rocks Grass bed Cave Wreck Other: _____

Size Estimate: ____ (in / cm) Tail longer than shell? Y N Tags present? Metal Plastic None Unknown

Special Identifying marks: Shell Damage (notches): _____
(Please describe) Flipper Damage: _____
Scars: _____
Algae: green red calc _____
Other: _____

Observation/Comments: _____

Capture Location:



Existing Tag(s): LF _____ () RF _____ () LH _____ () RH _____ ()
New Tag(s): LF _____ () RF _____ () LH _____ () RH _____ ()

Pit Tag#: _____ New Y N Tag Observations: _____

Carapace (cm): CCL NC-N _____ NC-T _____ L R Notch-T _____ CCW _____

SCL NT-T(max) _____ L R SCL NC-T _____ L R SCW _____ SHW _____ SHL _____

Weight (Kg) _____ Color: Blonde Brown Black Shape: Round/ Slender Ridge/ Smooth

Measured Over Barnacles? Y N Supracaudals: Fused Serrated Measured By: _____

Plastron (cm): L _____ W _____ Tail: P-V _____ P-T _____ V-T _____ N-T _____

Blood Taken ? Y N Amount: _____ (mls) Blood Glucose: _____ Blood taken by : _____ Time: _____ : _____

Experiments: Genetics: Y N Testosterone: Y N Gastric Lavage: Y N Glucose: Y N

Photos: RP LP HD OC SC OP Other _____ Frame #'s _____ Camera: _____

"IN-WATER SEA TURTLE STUDY DATA SHEET" TERMINOLOGY KEY

In order as appear on the data sheet.

Date: Record the date the turtle was observed and/or captured. Month/Day/Year

Activity No.: Activity Number: This is the sequential number of the activity within a given year (January 1 to December 31). This number is not filled out in the field, but assigned in the office while data sheets are being reviewed. Before assigning activity numbers, all data sheets for the day are put in order of occurrence by time observed, then the first activity observed that day receives the next sequential number. For example, Activity Number 98-058F, would be the fifty- eighth activity observed in 1998. The first two digits represent the year of the activity, the last three numbers represent the sequential order of the activity for that year, and the "F" stands for Foraging/In-water study.

Primary ID #: Primary Tag Number: Record the Primary tag number of the turtle. The first flipper tag ever applied to a turtle becomes the primary ID number. It becomes that turtle's "name" even if that tag is ever lost or removed. All subsequent tags applied to that turtle are cross-referenced to the primary tag in the BUIS sea turtle database, and on the BUIS tag list. If the primary tag is not present, any of the current (secondary) tags can be cross-referenced to obtain the Primary ID #.

Time: Record the time of initial sighting of the turtle. If the turtle is physically captured record the time of capture, the time the turtle is brought aboard the boat, and the time the turtle is released back to the water. Time is expressed in 24hour time.

Species: Circle the letters for the species of sea turtle this data sheet refers to, HB=hawksbill, GR=green, LB=leatherback, and LH=loggerhead.

Sector: Enter the corresponding letter to the area in which the turtle was first observed. Refer to the map on the back (pg 2) of the data sheet.

Ptag/ Recapture/ Sighting: Circle the appropriate definition of this activity. Ptag=First time the turtle is captured and tagged for identification. Recapture= recapture of a tagged turtle. This can be either a physical or visual capture as long as the animal is identified as having tags. Sighting= Visually seeing a turtle but not being able to see if it has tags or positively identify it in any way.

Activity (upon initial sighting): Circle the behavior of the turtle when it was first observed. If it was not doing any of the listed activities, describe what it was doing when first seen in space provided for "Other activity".

If eating, what type of food?: If the turtle was eating when first observed and someone dove down and identified what the food source was, it is entered here.

Was food sample taken? Yes No: Circle the appropriate answer.

Location/ Dive Site: If sighting occurred at Buck Island Reef NM circle "BUIS". If the sighting occurred elsewhere, write the location as specifically as possible next to "Other".

SRF / LGN / BRF / RCR / FRF / HSK: This refers to the habitat zone in which the turtle was first seen. **SRF**- shoreline reef, **LGN**- lagoon, **BRF**- backreef, **RCR**-reef crest, **FRF**- forereef, **HSK**-haystack. Circle the appropriate abbreviation.

Specific landmarks: Write a description of the site in reference to known location points and coral formations.

Water Depth: Enter the depth of the water (in feet) at the site of first sighting.

Turtle Depth: Enter the depth of the turtle within the water column (in feet) upon first sighting.

Visibility: Enter the horizontal visibility distance (in feet) at the time of sighting.

Weather/Seas: Enter the general weather conditions and sea conditions / wave height at the time of first encounter.

Snorkelers Present: List the snorkelers that assisted in the pursuit and/or capture of the turtle in order of most involved too least involved. This ensures a way to verify data recording questions that may arise when the data sheet is reviewed.

Habitat: Circle the appropriate benthic habitat designation, or describe in "Other", the habitat in which the turtle was first observed.

The following four comments are made on turtles that are only sighted, not captured:

Size Estimate: Estimate of the curved carapace length recorded in inches or centimeters with the proper unit circled.

Tail longer than shell? Y N: Circle the appropriate answer. Y=Yes, N=No.

Tags present?: Circle the appropriate answer. **Metal**- inconel flipper tags, **Plastic**-plastic flipper tags, **None**- flippers were clearly visible and no tags were present, **Unknown**- the flippers were not seen clearly enough to make a positive determination to presence or absence of tags.

Special Identifying marks: Describe any identifying characteristics so that either a match might be made with existing photos or future sightings of the same turtle can be cross-referenced.

Observation/ Comments: Write a brief description of the sighting, pursuit, animal behavior, and capture. This has been extremely helpful in refreshing memories when looking back at data sheets and trying to recall a particular event or capture. Include the persons involved and the events and record the details in chronological order.

Capture Location: On the map, indicate the spot where the turtle was first sighted, and the route and site of capture or end of pursuit as needed.

Turtle Diagrams: Draw in all marks, scars, deformities, algal patterns, etc. This should be done for both the carapace and plastron. These diagrams are used to follow changes over time as well as help with photo identification labeling.

Existing Tag(s): Record the number of all tags found on the turtle at the time of the capture. The National Marine Fisheries Service inconel tags consist of three letters and three numbers separated by a hyphen (example: ABC-123). Record the number and the location of the tag in the space designating the corresponding flipper. The number is written on the line and the position code is written inside the parentheses (example: ABC-123 (L3)). Flipper and position codes are as follows: **L**=left, **R**= right, **F**=front, **H**=hind, **1**= third scale out from the body on a front flipper, **2**= second scale out from the body on a front flipper, **3**= first scale out from the body on a front flipper, **S**=scale tab on a hind flipper, **T**= tissue on a hind flipper (Refer to BUIS Sea Turtle Tagging Protocol Appendix 6, Figure 6).

New Tag(s): Record the tag number and location of any new tags applied during this activity. All codes are the same as mentioned above.

Pit Tag#: Scan the front flippers and neck with the AVID® Mini Tracker™ Multi Mode Reader model #AVID1002. If present, the chip located within the turtle will activate the reader and display an AVID tag number (ex. AVID*123*456*789). Record this number on the data sheet. The reason for scanning both front flippers and the neck region is that the turtle may have been PIT tagged by another project that may place the tag in a different location.

New Y N: Circle "Y" if the PIT tag was inserted today. Circle "N" if the PIT tag was already present from a previous activity.

Tag Observations: Record the condition of the tags (i.e., any tags removed, algal growth, tag scars, overgrown with tissue, tags cleaned, etc.).

Carapace: The hard dorsal shell of a sea turtle. The individual plates that make up the carapace are called scutes.

(cm): All measurements are recorded in centimeters to the nearest tenth. All measurements are taken with a nylon or fiberglass tape measure. The tape measure must be calibrated along a measuring stick or caliper at least annually to determine if the tape has stretched. If the tape measure is stretched, get one that is not. The zero end metal tab is held at the starting point, while the tape is stretched to the end measuring point. Once the tape is straight and taut, check the starting point position to be sure it hasn't been pulled out of place, then place the thumb of the hand at the end point at the location on the tape that marks the measurement. Hold this point until you lift the tape measure, read the number, and verify that it has been recorded properly. Refer to the Measurement Diagrams for start and end points of the various measurements (Appendix 7).

CCL: Curved Carapace Length. Various measurements of the carapace are taken with a fiberglass tape measure following the curve of the carapace.

NC-N: Nuchal Curve to Notch. Measure from the skin/carapace junction at the curve of the nuchal scute at midline, straight down the midline of the carapace, to the anterior point of the notch between the supracaudal scutes.

NC-T: Nuchal Curve to longest supracaudal Tip. Measure from the skin/carapace junction at the curve of the nuchal scute, in a straight line, to the posterior point of the longer of the two tips of the supracaudal scutes. Since the supracaudal tips are off center, the tape will run a little off the midline of the carapace. Circle the letter that identifies which supracaudal scute was used in the measurement, L=left, R= right.

Notch-T: Notch of the supracaudal scutes to the Tip of the longest supracaudal scute. Measure from the anterior junction of the notch between the two-supracaudal scutes to the tip used for the NC-T measurement.

CCW: Curved Carapace Width. Measure from left to right across the widest portion of the carapace, this is usually across the third vertebral scute, from the point at which the marginal scute curves under on the left, straight across the third vertebral scute, to the equivalent point on the right side of the turtle.

SL: Straight Line. Straight Line measurements do not take into account the curve of the carapace, just the flat linear measure. All Straight Line carapace measurements are taken with a forestry tree caliper and all head measurements are taken with a 6" dial caliper.

SCL NT-T(max): Straight Carapace Length, Nuchal Tip to supracaudal tip. Measure from the longest supracaudal tip to the tip of the nuchal scute on that same side of the body. Circle the letter that identifies which supracaudal scute was used in the measurement, L=left, R= right.

SCL NC-T: Straight Carapace Length, Nuchal Curve to supracaudal tip. Measure from the longest supracaudal tip to the curve of the nuchal scute. Circle the letter that identifies which supracaudal scute was used in the measurement, **L**=left, **R**=right.

SCW: Straight Carapace Width. Measure the width of the carapace at the widest point (usually across the third vertebral) while turtle is resting on plastron.

SHW: Straight Head Width. Measure the widest point of the head using the 6" dial calipers. Note: These calipers measure in millimeters so you will have to move the decimal by one place to the left to convert to centimeters (i.e. a measurement of 71.7mm is recorded as 7.17cm).

SHL: Straight Head Length. Measure the midline length of the head from the tip of the nose to the last hard scute before the soft neck tissue.

Weight (kg): Enter the weight of the turtle as displayed on the Ohaus electronic scale in kilograms.

Color: This is a reference to the general overall color of the turtle's carapace. It will take some time for the technicians to become comfortable determining the color because it takes the experience of having seen the different color variations. Circle the most applicable color. **Blonde**- very light yellow. **Brown**- brown coloration with possibly some yellow and some black. **Black**- very dark scutes overall.

Shape: This refers to the general body shape of the turtle as seen while it was swimming through the water and the presence or absence of a ridge down the center of the carapace.

Round/Slender: When in pursuit of the turtle notice if the body appears round/torpedo shaped or if it seems slender/compressed dorso-ventrally. Circle the appropriate characteristic.

Ridge/Smooth: Look at the carapace of the turtle and determine if there is a noticeable ridge down the center of the shell. If so, circle "**Ridge**". If not, "**Smooth**".

Measured Over Barnacles?: Circle the appropriate letter. Answer the question; "Are there barnacles under the line of the tape measure during carapace measurements"? **Y** = yes, **N** = no.

Supracaudals: Fused/ Serrated: Circle the appropriate description for the outer edges of the marginal scutes. **Fused**= the tips of the scutes are not pointed, they are rounded to the body and mostly smooth. **Serrated**= the tips of the marginal scutes are pointed, if you were to rub your hand posterior to anterior along the side of the body, it would get caught on the tips of the scutes.

Measured by: Record the initials of the technician that measured the turtle.

Plastron: The ventral or abdominal plate/shell of a turtle. The individual plates that make-up the plastron are also called scutes. All plastron measurements are taken using a nylon tape measure while the turtle is upside down, lying on its carapace with the plastron up.

L: Plastron **Length.** Measure along the midline of the plastron from the anterior skin/plastron junction to the posterior skin/plastron junction of the interanal scute.

W: Plastron **Width.** Measure across the widest point of the plastron from the point on each side where the plastron and carapace join.

Tail: Measurements taken of the **Tail.** All tail measurements are taken with the turtle upside down, lying on its carapace with the plastron up.

P-V: Plastron to Vent/cloaca. Measure from the posterior midline tip of the interanal scute to the middle of the vent/cloaca.

P-T: Plastron to Tip of the tail. Measure from the posterior midline tip of the interanal scute to the tip of the tail. If the turtle has its tail tucked, it may be necessary to put the tape measure in place, and wait a few minutes with minimal contact until the turtle relaxes. Measure following the curve of the tail.

V-T: Vent to Tip of the tail. Measure from the middle of the vent/cloaca to the tip of the tail. Measure following the curve of the tail.

N-T: Notch of the supracaudal scutes to the **Tip** of the tail. Measure from the anterior junction of the supracaudal notch to the tip of the tail. This may be expressed as a negative number if the tail does not extend to the junction of the supracaudal scutes.

Blood Taken? Y N: Circle the appropriate letter. Was a blood sample collected?
Y= yes, N= no. If tried but unsuccessful, write "**unsuccessful**".

Amount: Enter the number of milliliters of blood collected to the nearest whole number.

Glucose: Enter the result of the glucose test as displayed on the ExacTech® Glucose Card. It is usually a two or three digit number, or it may read "LOW".

Blood Taken by: Enter the initials of the technician that took the blood sample.

Time: Enter the time the blood was collected (in 24 hour military time).

Experiments: Circle **Y** for yes or **N** for no to note if **Genetics**, **Testosterone**, **Gastric Lavage**, and/or **Glucose** experiments were done during this work-up.

Photos: Standard photos are taken of every turtle. Circle the codes for the photographs that were taken during this work-up. Photo Codes: **RP**= right profile of the head/face. **LP**= left profile of the head/face. **HD**= head diagnostics, taken looking straight down at the top of the head. **OC**= overall carapace, **SC**= supracaudals of the carapace, **OP**= overall plastron, **Other**= any other photos taken with a brief description of what the photo is of.

Frame #'s: Frame numbers. Record the first and last photograph frame numbers used during this work-up.

Camera: Note which camera was used to take the photographs. The NPS Olympus 35-70 mm camera should always be used unless it is not functioning. If someone also uses their personal camera, this should be noted incase one set of photos does not turn out the others can be duplicated.

APPENDIX 4

BUIS HAWKSBILL SEA TURTLE BLOOD COLLECTION PROTOCOL

HISTORY:

BISTRP is conducting analyses of testosterone, and blood glucose levels through the collection of blood samples from hawksbill turtles. The testosterone analysis identifies the sex of the turtle, which cannot be determined visually until the animal becomes sexually mature. The objective of the blood glucose experiment is to determine what is a "normal" blood glucose level in a "healthy, wild" hawksbill sea turtle. This baseline information will be useful for rehabilitation facilities in knowing where their patient's glucose level is in relationship to a "healthy" turtle. The blood glucose experiment is done within a minute of blood collection. The instrument used is an ExacTech® Card. This is the same instrument used by diabetic people to measure their blood glucose. This test result is determined 30 seconds after the blood is applied to the glucose strip. Total Blood required is 3 to 5ml for both tests. One drop for ExacTech® bG field test, and 2-4 ml for testosterone analysis. Blood collection is done as soon after the turtle is brought aboard the boat as possible to reduce the influences of stress-related impacts to the blood analyses.

BLOOD COLLECTION:

Before leaving the boat to go on patrol, place the blood glucose kit and blood collection kit on the captains' seat so it is readily accessible when you return with a turtle.

1. Tear the wrapper from the blood glucose test strip in half and remove the portion covering the contact bars and insert the strip into the ExacTech® card. Leave the sample site covered by the wrapper. Have the pipette at easy access to apply the drop of blood to the test strip.
2. The turtle is placed in a head down position either resting in a technician's lap or on a boat fender. The turtle's head should be in a downward position allowing blood to fill the cervical sinus. Position yourself directly in front of the turtle.
3. Wipe the neck with a disinfectant such as alcohol or Betadyne to cleanse the area.
4. Attach the needle to the Vacutainer holder. The 5 ml Vacutainer tube is positioned inside the holder but DO NOT pierce the stopper with the needle yet (Figure 4).

Note: These instructions are for a right-handed person.

5. With your left hand, hold the head just behind the skull and pull it outward and down. This will expose the cervical sinus so you can see the midline. Hold this position. If there is another person available, they can hold the head in this position for you.
6. Find the pair of tendons running down the center of the neck.

7. Blood can be collected from two areas of the dorsal cervical sinus. One is midline between the tendons, and the other is lateral to the tendons (Figure 5). With practice, each person will develop a feel for what works best for them.
 - The midline site is about two inches below the carapace/skin junction and is located midway between the two tendons.
 - The lateral site is located about 1/4 inch outside the right-hand (or left-hand) tendon, and 1 to 1.5 inches from the carapace/skin junction.
8. Remove the protective cap from the needle. With the bore of the needle upwards, insert the needle into the skin at the desired point. Insert the needle to at least half the length of the needle shaft, and then push the Vacutainer tube onto the collection needle inside the holder. This inner and smaller needle should pierce the rubber stopper. This allows the vacuum within the tube to draw the blood automatically once the sinus is found. If the needle is pulled from the turtle's neck before the Vacutainer tube is removed from the collection needle, the vacuum will be lost and the tube must be discarded and replaced with a new one. Remove the cap from the old tube so everyone will know the vacuum has been lost
9. While holding the assembly as one unit, slowly move it outward. **DO NOT PULL THE NEEDLE OUT OF THE SKIN.** Continue to reposition the needle until the sinus is found. The needle may need to be rotated, moved in or out, or the angle changed. However, all of this can be done without removing the needle from the skin. When the sinus is found, a strong stream of blood will begin to fill the Vacutainer. If the sinus is not hit after a few seconds, it may be necessary to move the needle higher or lower on the neck. First remove the tube from the collection needle so that it no longer pierces the stopper, then the needle can be extracted from the tissue and moved to a new location to try again.
10. It may take several attempts to find the sinus. If the needle is reinserted more than twice, it will get dull and need to be replaced. If after two attempts blood has not been collected, let someone else try one or two times at a different site and then if blood has still not been collected give up for this session- the turtle wins!
11. When the sinus is found, a strong stream of blood will fill the Vacutainer tube. Collect a full 5 ml of blood if possible.
12. When the Vacutainer is full, pull it off the collection needle and then remove the needle from the turtle's neck. Usually no bleeding occurs at the point of insertion, but if bleeding does occur, have another team member pinch the puncture site between two fingers to apply pressure for a few seconds until the bleeding stops.

**Never use a needle on another animal once it has been used !!
Discard it in the Hazardous waste container.**

HAWKSBILL SEA TURTLE BLOOD COLLECTION DIAGRAMS

Figure 4.

BLOOD COLLECTION EQUIPMENT

1. Needle Assembly
2. Vacutainer Holder
3. Vacutainer, 5ml-10ml

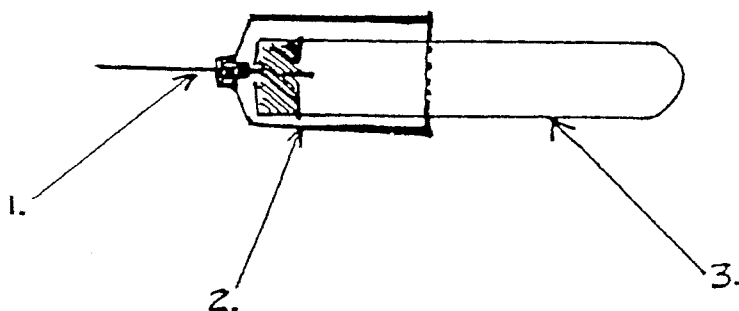
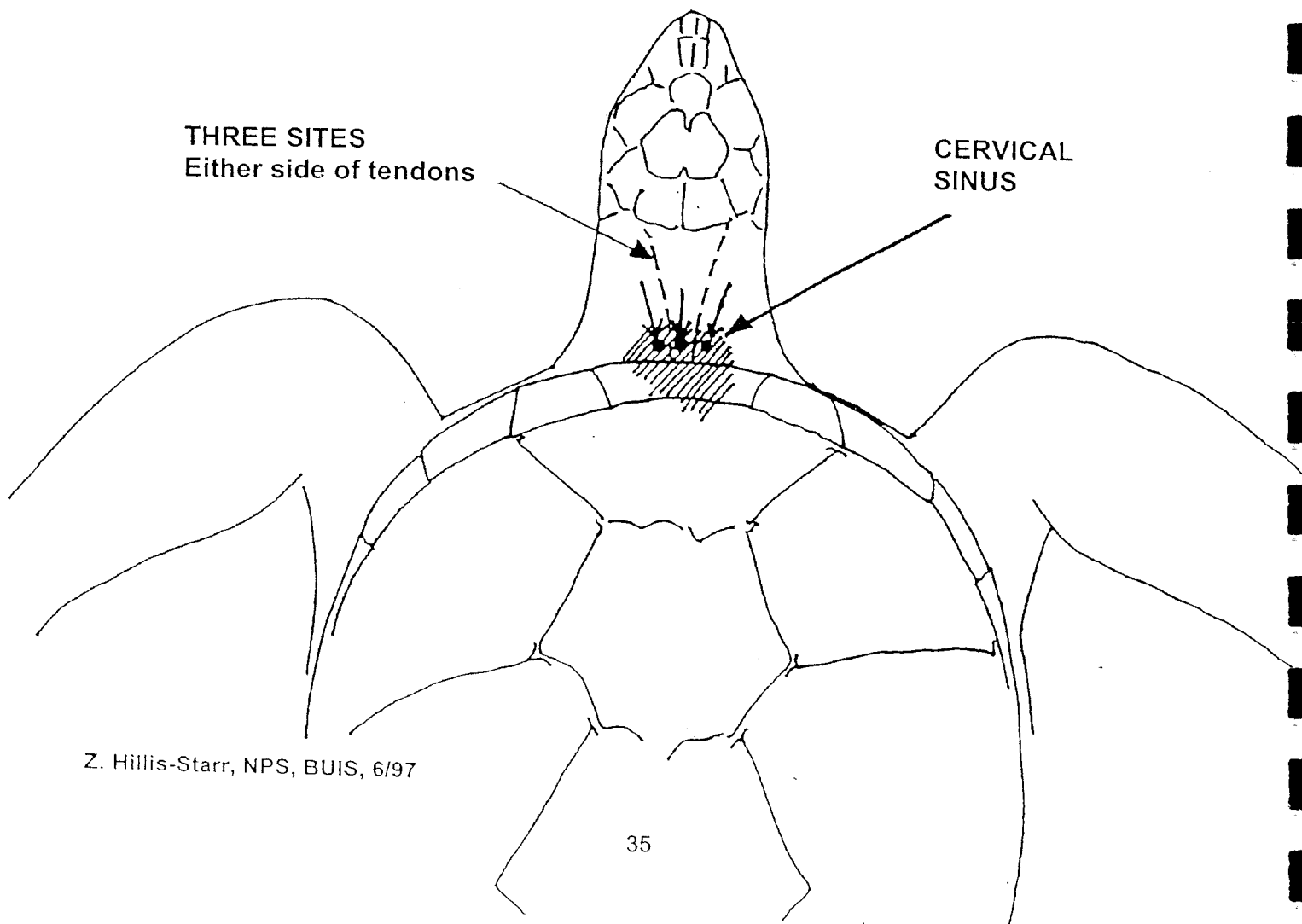


Figure 5.

BLOOD COLLECTION LOCATIONS ON HAWKSBILL TURTLE'S NECK (View looking down onto hawksbill's head. Needle in line with cranial tendons.)



13. Take the blood sample to where the blood glucose kit is set up. Remove the stopper from the 5 ml tube containing the blood and immediately draw a sample of blood into a new pipette. Remove the wrapper from the sample site of the ExacTech® Card test strip and apply one full drop (no bubbles) to the sample site. Press the button until 88.88 is displayed then release it, the Card will count down from 30 seconds to 0 and then the result will be displayed. Record the result on the data sheet.
14. Replace any unused blood from the pipette into the 5 ml tube and place the stopper back on the tube.
15. Label all tubes with the date, turtle's primary tag number, species, the initials of the technician that collected the blood, and "BUIS In-water Study".
16. Place the 5 ml sample tube in a cooler with ice until you reach the office.
17. Detach the needle from the Vacutainer holder and dispose of the needle, cap, pipette, and any malfunctioned tubes in the Hazardous Waste container on the boat.

Back at the office:

18. Remove the blood samples from their field storage places.
19. Set up the centrifuge on the worktable and plug it in. Place the 5ml sample tube in one of the holders in the centrifuge and place a counter weight tube across from the sample. Close the lid and set the timer to spin for 2-3 minutes. Open the lid and remove the sample tube, if the blood cells are well separated from the serum, there will be a clear layer of serum and a lower layer of the red blood cells. If the serum layer is not clear or very light pink, spin the sample for an additional 2 minutes.
20. Pipette the serum from the spun sample and place it into a 1 ml cryotube. Discard the pipette into the hazardous waste container.
21. Label the cryotube as you did the sample vacutainers and then place the cryotube in the container in the freezer marked "In-water HB Serum". Place the 5 ml tube into the container in the specimen refrigerator labeled "In-water HB Blood Samples".

After successfully collecting blood from a few turtles, it will get easier. The total time for blood collection, once practiced, is less than one minute and is not traumatic to the turtle or the technician!

PERSONNEL:

A person can collect blood alone, but it is sometimes helpful to have someone else hold the turtle still and/or hold the head in position for blood collection.

EQUIPMENT:

One clean Vacutainer holder

Sterile 22Ga 1" Vacutainer needle, with extra available if needed.

Sterile 5ml Vacutainer tube (untreated red top tube), with extra available if needed.

Two new 1 ml plastic pipettes

One ExacTech® bG (blood glucose) Card and bG (blood glucose) test strip

Hazardous Waste Container

One centrifuge (electric or hand operated)

One new 1ml cryotube

One extra fine point permanent marker for labeling tubes

Betadyne solution or Alcohol

Cotton balls or gauze

APPENDIX 5

PROTOCOL FOR TISSUE SAMPLE COLLECTION FOR GENETIC ANALYSIS

1. Have a team member extend a hind flipper and place it on top of a clipboard for support as a cutting surface. Refer to Figure 5 for possible sample sites.
2. Open a sterile Uni-Punch 8.0 mm biopsy punch packet and grasp the yellow handle.
3. Place the outside edge of the biopsy punch at the edge of the flipper at the chosen site and firmly press down on the punch and twist. This motion will make a clean cut and the sample should come cleanly away from the flipper. If the turtle flinches while making the cut be prepared to pull the punch away from the turtle to minimize the chance of unwanted injury to the turtle or technicians. When the turtle settles down reposition the punch over the same site and try again.
4. If bleeding occurs, hold the site with a cotton ball and apply pressure until the bleeding stops.
5. Place the tissue sample in a container with either tissue buffer or 90% Ethanol. If the sample will not come out by tapping the punch on the inside of the container, use tissue forceps to remove it from the punch and place it in the container. To avoid contaminating the sample, never use your fingers. Discard the biopsy punch in the hazardous waste container once the tissue has been removed.
6. Label the container with the tissue sample with the turtles' primary tag number, the date, species, initials of the technician that cut the sample, and "BUIIS In-water Study".
7. Store the container in the "Blood Collection kit" until reaching the office.
8. At the office place the labeled container in the NRM cabinet that is labeled "In-water Study Genetic Samples". These will later be shipped for analysis.

Alternate Method using scissors and forceps if no biopsy punch is available:

1. Rinse the ends of a sharp pair of tissue scissors and tissue forceps with alcohol.
2. Hold the instruments in the flame of a lighter to burn off the alcohol and sterilize the instruments then allow a few seconds for the instruments to cool.
3. Have a team member extend a hind flipper. Refer to Figure 5 for sample sites.
4. If the turtle flinches while making the cut be prepared to pull the scissors away from the turtle to minimize the chance of unwanted injury to the turtle or technicians. When the turtle settles down reposition at the same site and try again.

5. Use the tissue forceps to grab hold of the tissue you plan to cut. Cut an approximately 1cm² tissue sample as cleanly and quickly as possible. This will reduce the chance of the turtle pulling and creating ragged edges or possibly a deeper cut than desired.
6. If bleeding occurs, hold the site with a cotton ball and apply pressure until the bleeding stops.
7. Place the tissue sample in a container with either tissue buffer or 90% Ethanol
8. Label the container with the turtle's' primary tag number, the date, species, initials of the technician that cut the sample, and "BUIS In-water Study".
9. Store the container in the "Blood Collection kit" until reaching the office.
10. At the office place the labeled container in the NRM cabinet that is labeled "In-water Genetic Samples". These will later be shipped for analysis.

PERSONNEL:

Two people are needed for this procedure. One person will restrain the turtle and extend the flipper while the other person collects the sample.

EQUIPMENT:

One sterile Uni-Punch 8.0mm biopsy punch
Container with tissue buffer or 90% Ethanol (ETOH)
One pair of tissue forceps
Cotton balls
Fine tip permanent marker to label the container
Hazardous Waste Container

Additional equipment if no biopsy punch is available:

One sharp pair of tissue scissors
Rubbing alcohol
One lighter

APPENDIX 6

BUIS IN-WATER SEA TURTLE STUDY TAGGING PROTOCOL

Each turtle over 30cm CCL is tagged with both National Marine Fisheries Service inconel tags and an AVID® Passive Integrated Transponder (PIT) tag/chip. One inconel tag is placed in the scale closest to the body in the left front flipper (L3 position) and another in the right hind flipper tissue using an inconel tagging tool (Figure 6). All inconel tag numbers (ex. ABC-123) and AVID PIT tags (ex. AVID*123*456*789) are recorded on the data sheet and then entered into the database and a cross-reference tag list. The first inconel tag applied to a turtle becomes that individual's primary tag number (PTag) and that number in all future encounters refers to that turtle, even if that first tag is ever lost or removed. If a captured turtle has a tag that is loose or too tight, the tag should be removed and a replacement tag applied adjacent to the site of removal. Return all tags to the Chief of Natural Resources for archiving and confirmation of tag numbers. Be sure to draw the position of the tag scar on the turtle diagram on the data sheet. Tagging tools are disinfected with alcohol after each turtle has been tagged.

BUIS TAG APPLICATION PROCEDURE with NMFS INCONEL TAGS

1. Spread tag wide so it fits snug in the tagging tool.
2. Gently close the tagging tool to see if tag point aligns with hole, but do not crimp tag. Use needle nose pliers to adjust point of tag as needed to get alignment with hole.
3. Remove tag and spread it again.
4. Make sure tag is placed in tagging tool so the hole of the tag matches up with the depression located on the bottom jaw of the tagging tool.
5. Make sure tag is seated all the way into the notch at the back of the tagging tool.
6. Hold the turtle's flipper in opposite hand from tagging tool.
7. Place tagging tool in position and apply tag:
 - a. Tagging front flipper -
 - i. Place tip of tag 2/3 up the L3 or R3 scale (the first large scale out from the body) so that only 1/8" of the tag is hanging beyond the edge of the flipper.
 - ii. Crimp tagging tool firmly. People with smaller hands may have to use both hands to crimp tag completely closed.
 - b. Tagging hind flipper -
 - i. Tag is placed on the interior edge of the tissue above the fifth flange and scales.
 - ii. After positioning the tagging tool, crimp it firmly.

8. Check that the point of the tag has crimped through the hole and is securely folded over. It should be tight against the tag -- you should barely be able to get your fingernail under the point.
9. If tag fails to crimp fully it may be possible to crimp it with pliers. If tag has still not crimped properly, remove it and set up a new tag in the tagging tool and try again. Try to position the new tag into the hole created on first attempt.
10. Disinfect tagging tool and pliers (if used) after turtle has received all tags.

**IF YOUR TAG MALFUNCTIONS DURING TAGGING DO NOT DISCARD IT:
KEEP IT FOR OUR RECORDS.**

**DOUBLE CHECK ALL TAG NUMBERS AND TAG LOCATIONS AND MAKE SURE
THEY ARE RECORDED PROPERLY BEFORE RELEASING THE TURTLE !!!!!**

EQUIPMENT:

Tagging tool
Needle nose pliers
Alcohol to disinfect tagging tools and pliers after they are used to tag a turtle
National Marine Fisheries Service (NMFS) Inconel tags

Application Procedure for AVID® Passive Integrated Transponder (PIT) Tags:

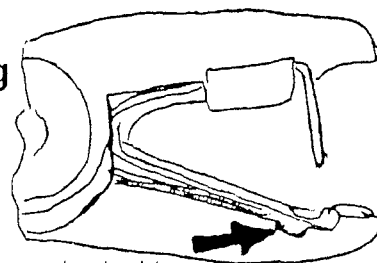
1. If using a pre-loaded syringe, go to step #4. If using loose PIT tags, attach supplied sterile 3/4" 12 gauge needle to the 3cc implanter syringe.
2. Place The AVID chip into the bevel of the needle.
3. Retract the chip into the needle and cover the needle tip with triple antibiotic ointment. The ointment serves both as an antibiotic to the injection site and to keep the transponder from falling out of the needle before application.
4. Scan the chip with an AVID® Mini Tracker™ Multi Mode Reader model #AVID1002 to insure activity and record the number on the data sheet.
5. Scrub the turtle's right flipper around the R2 and R3 scales, from the scales to the anterior portion of the flipper with a cotton ball and Betadyne solution.
6. Have another technician hold the flipper extended for you while injecting the tag.
7. Inject the PIT tag into the prepared site anterior to the R2 / R3 scales (Figure 6). The skin is very tough so it will take some pressure to pierce the skin. The needle should be almost completely covered in the tissue before starting to depress the plunger. As the plunger is depressed it may start to back out of the tissue, this is ok.

8. Once the plunger is fully depressed, remove the needle from the flipper. Hold a cotton ball on the site of injection and apply gentle pressure. This will stop any bleeding and also help to seal the hole with the antibiotic ointment.
9. Scan the site to confirm that the AVID Chip had been delivered correctly and double check the number on the data sheet.
10. Allow the flipper to relax and observe for approximately 2 minutes to insure that any bleeding has completely stopped.

EQUIPMENT:

New Sterile 3/4" 12 gauge needles
Sterile 3cc implanter syringes
AVID® Passive Integrated Transponder chips
AVID® Mini Tracker™ Multi Mode Reader model #AVID1002
Triple antibiotic ointment
Cotton balls
Betadyne solution

Figure 6. Sea Turtle Tagging



Depression in tagging tool to line up with hole in tag.

Left Front Flipper

All tags should be carefully inspected after being attached with the tagging tool.

BISTRP uses the Right Front Flipper for the site of PIT tagging. The site is located in the same relative place on the flipper.

PIT Tag Site

L1 L2 L3

Scale

Leave a small amount of overhang to allow for growth.

Tag

Site of Tissue sample collection for genetic analysis.

Tissue

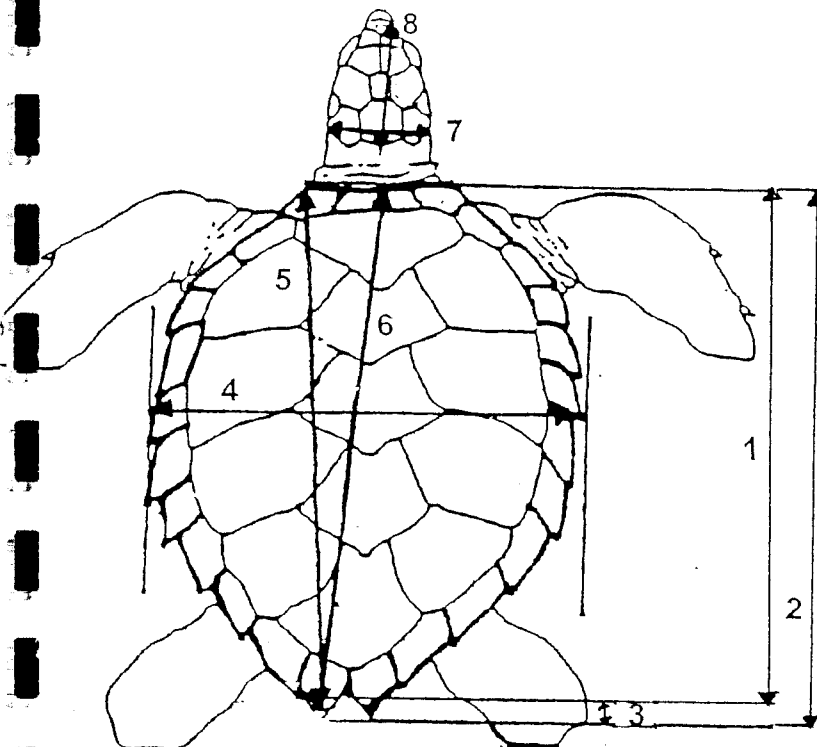
Tag

If necessary, gently bend the piercing tip over with pliers so the tag will be fully locked.

Fully locked tag

Right Hind Flipper

APPENDIX 7 Sea Turtle Carapace and Plastron Measurements

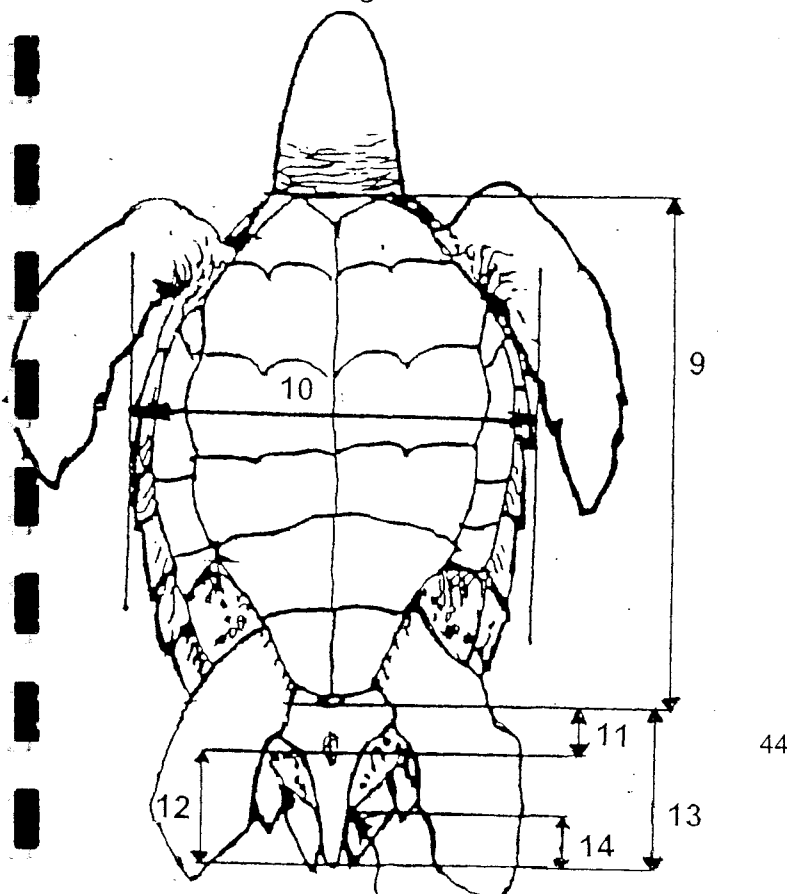


Curved Carapace Measurements

1. **CCL NC-N**, Nuchal Curve to Notch.
2. **NC-T**, Nuchal Curve to longest supracaudal Tip (Left or Right).
3. **Notch-T**, Supracaudal Notch to longest Tip.
4. **CCW** and **SCW**, Width across third vertebral scutes at widest point.

Straight Line Measurements

5. **NT-T (max)**, Nuchal Tip to longest supracaudal Tip (both tips on same side of body).
6. **NC-T**, Nuchal Curve to longest supracaudal Tip.
7. **HW**, widest point of head, usually near back of the head.
8. **HL**, from edge of soft nostril tissue to the head/neck scute junction.



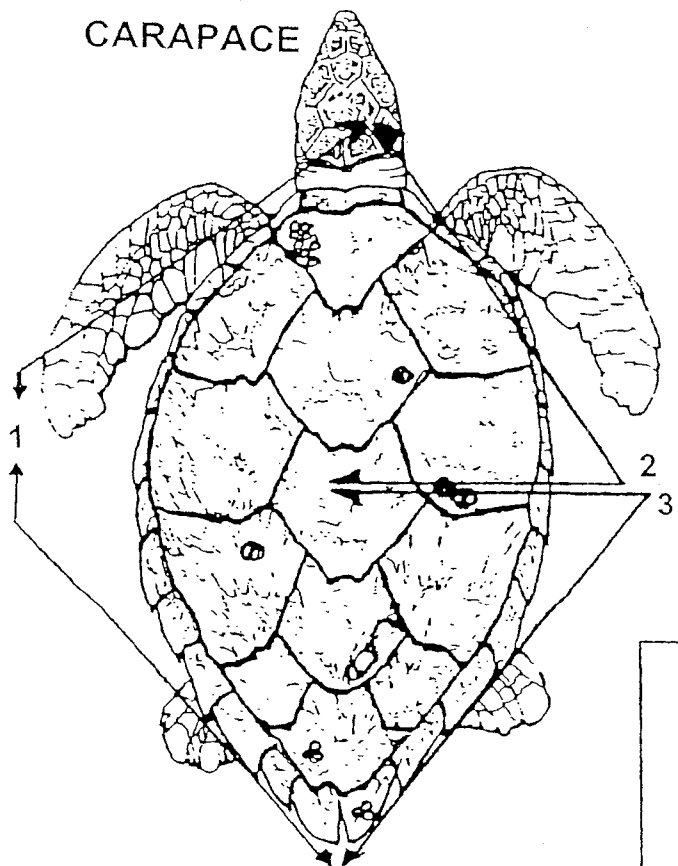
Plastron Measurements

9. **L**, plastron length including interanal scute.
10. **W**, width at widest point.
11. **P-V**, posterior skin/interanal scute junction to middle of vent/cloaca.
12. **V-T**, middle of vent/cloaca to tip of tail, following curve of tail.
13. **P-T**, posterior skin/interanal scute junction to tip of tail following curve of the tail.
14. **N-T**, anterior most point of supracaudal notch to tip of tail.

APPENDIX 8

BUIS In-water Sea Turtle Study Photographs

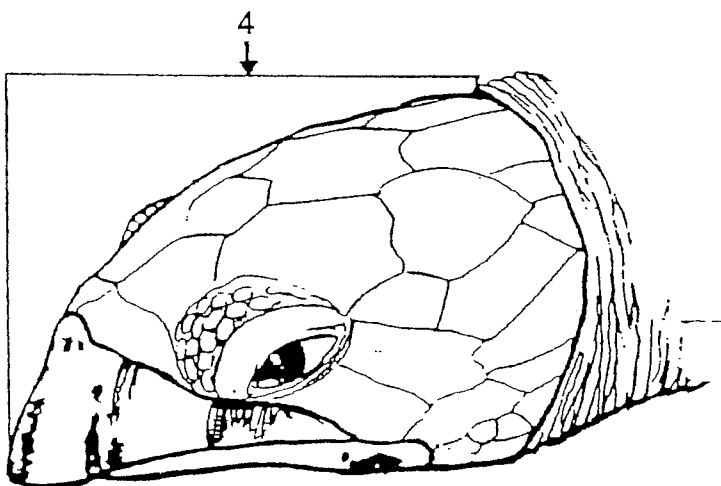
CARAPACE



Standard Photos of Carapace

1. Overall Carapace-barnacles, algae, etc.
2. Anterior Carapace
3. Posterior Carapace
4. Head Diagnostics, dorsal view of the head

Please also photograph any unusual markings, notches, or damage to shell or tissue.



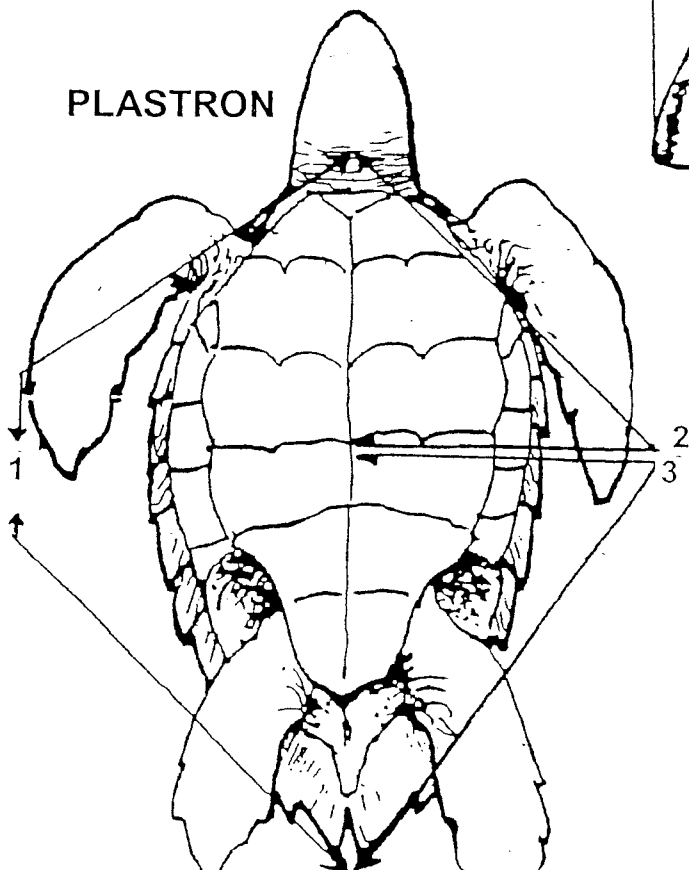
Head/Beak Profile

Photograph the pattern and color on the face and beak. Take both left and right profiles.

Standard Photos of the Plastron

1. Overall Plastron
2. Anterior Plastron
3. Posterior Plastron and Tail

PLASTRON



APPENDIX 9

2000 Summary Report for Sea Turtles in the Coral Reef Environment at Buck Island Reef National Monument

Captures and Recaptures:

- ❖ As of December 31, 2000 eighty-seven juvenile hawksbill sea turtles have been tagged at Buck Island Reef NM.
- ❖ During the 2000 snorkel surveys there were 24 encounters with sea turtles, 23 of these were with hawksbill turtles and 1 was with a green turtle.
- ❖ There were 8 captures of hawksbill turtles for data collection. No greens were captured.
- ❖ 2 of the juvenile hawksbill turtles captured were untagged and subsequently tagged for identification; another 4 were juvenile hawksbills that had been tagged at BUIS in previous years of the study. The remaining 2 captures were recaptures of 2 of these 6 animals.

Behavioral Observations:

Behavioral observations have found that 62.5% of the turtles observed during 2000 were swimming at the time of sighting, 12.5% were resting in the reef structure, 17% were feeding, 8% were sighted while they were at the surface to breathe, and 0 % of the turtles were mating when observed.

Genetic Composition of the Population:

Genetic analysis of sixty-six juvenile hawksbill turtles from BUIS has been completed to date. The BUIS juvenile population is a mixed stock including A, B, F, N, Q, Alpha, Gamma, East Atlantic, a variant of A, and a variant of F haplotypes.

Gender Composition of the Population:

To date, 35 hawksbill blood serum samples have been analyzed to determine the testosterone level and gender of juvenile hawksbill turtles at BUIS. The results show the tagged BUIS juvenile hawksbill population is known to include 24 females and 11 males. Seven samples had levels in the mid-range that were not high enough or low enough to definitively determine if the animal was male or female. Forty-nine samples are still pending analysis.

Length of Residency:

The longest known residency to date is 5.8 years by QQD 617. QQD 617 is a male hawksbill that was first tagged on 12/13/94. His CCL (nuchal curve to longest supracaudal tip) at the time was 29.8 cm and his weight was 3.5 kg. He was last seen on 10/04/00 and he had grown to a CCL of 64.6 cm and weight of 28 kg. He has been recaptured 17 times since his initial capture in 1994.

Size Class Distribution:

This is the breakdown of all measurements taken from the inception of the program through December 31, 2000.

BUIS Hawksbill Size Class/ Weight

Size Class	Number of measurements	Average CCL (cm)	Average Wt. (kg)
20 to 29.9 cm	13	27.2	2.1
30 to 39.9 cm	39	35.4	4.8
40 to 49.9 cm	24	46.0	9.6
50 to 59.9 cm	34	55.7	18.2
60 to 69.9 cm	20	64.2	27.4
70 to 79.9 cm	4	73.0	40.0

**Size Class Distribution
of BUIS' tagged population**

