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Report on
Sea Turtle Nesting, Sighting, Eggs and
Hatchlings for 1978 in the U.S. Virgin Islands
and a recommended research methodology
for dealing with hatchling disorientation
on the beach (with specific reference to
leatherback nests at Sandy Point St. Croix)

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SURVEY OF AVAILABLE ST. CROIX DATA ON SEA TURTLE NESTING BEACHES AND OFFSHORE SIGHTINGS

This summary contains information derived from personal records of Michael Kennedy and Theodore Skov, records kept by Dr. Caroline Rogers of West Indies Laboratory at Kennedy's request, records of the National Park Service, and interviews by Kennedy with 9 divers and dive-tour operators, 3 charter-boat operators, and 10 fishermen.

A. Nesting Beaches

(1) Data from personal records of T. Skov and M. Kennedy, DCCA conservation enforcement officers, are presented in Table A. Numbers represent their best estimates of numbers of nests per year, as recorded from their incidental (i.e., non-systematic) observations between 1976 to the present. Note that the species in most cases were inferred from such indications as size of tracks, size and location of nest pits, etc. Figure I shows the location of these beaches on a map of St. Croix.

If one lists as "major" nesting beaches those areas where 10 or more nests are observed per year, the following ranking is obtained:

Major leatherback nesting beaches:

1. Sandy Point - tip and Northwest
2. Punnett Bay (Shoy's)
3. Coakley Bay
4. Sandy Point - Southeast
5. Manchioneel Bay
6. Prune Bay - (actually only 9/year listed)

Major Hawksbill nesting beaches:

1. Jack Bay
2. Green Cay Beach
3. Manchioneel Bay
4. Coakley Bay

Major Green Nesting Beaches:

1. Manchioneel Bay

One should keep in mind the "softness" of the above data and use caution in drawing conclusions from it, but it is felt that it does give a fairly reliable indication of which beaches are most heavily nested.

Kennedy sighted a group of 27 leatherbacks of the NW corner of St. Croix, and 10 turtles of undetermined species along the south shore from Turner Hole to Watch Ho while making a circuit of the island by helicopter on May 23, 1978. These sightings are indicated on Figure II by the symbols K_1 and K_2, respectively.

(2) Data on Buck Island from records of Robert Thomas, National Park Service ranger, are presented in Table B. Since the park service rangers attempt to erase the tracks of nesting turtles so the nests will not be poached, no species data is available. Diedrich's Point on the south shore appears to be the major nesting beach with 19 recorded nests, followed by the west end beach with 12 nests, and the north shore with 7 nests.

B. Offshore Sightings

(1) Data from interviews with fishermen are plotted as Figure II and summarized below; all data are for 1978:

Fishermen

1. Robert Vertichio (vessel, Capt. Ross) - saw about 7 good-sized turtles (3'-4') on Lang Bank, 3-6 miles due east of East Point. Saw about the same number (7) on southern part of bank (good-sized) from Great Pond eastwards.

2. Jim Vertichio (vessel, Capt. Ross) (not interviewed personally, communication with Robert V., above) - saw mating just off reef at Yellowcliff Bay. Also saw a couple of small turtles inside reef.

3. Joe Christmas (vessel, Capt. Ross) - has seen all kinds including loggerhead. About 50 between Estate Anquilla and Texaco storage tanks west of airport.

4. Teddy Skov - saw about 100-150 turtles all along south shore from East Point to Sandy Point, hawksbills and greens 18"-4'. Hawksbills seen between Salt River and Cane Bay, unidentified species north point of Lang Bank. Saw 3 greens mating east of Buck Island, 1 hawksbill mating SE of Lang Bank.

5. Robert MacAuliffe (vessel, Miss Bertha) - saw 150-200 greens and hawksbills on Lang Bank east of Buck Island around to Grapetree Bay. All sizes; no mating.

6. Michael Lombard (vessel, Kali) - has seen about 200 greens and hawksbills, primarily on southern half of Lang Bank - 18" - 3'; no mating.

7. Vladimir Prince - saw about 1 or 2 green or hawksbills each trip on Bayside of Sandy Point; no mating.

8. Valentino Lugo, Jr. - saw between 50-100 what he called whitebacks (greens) by bank south of Sandy Point. Sizes range from hatchlings to 3'-4'; no mating. About 5 years ago, he saw about 2000 leatherback hatchlings just offshore (1/2 mile south side of Sandy Point).

9. Hank Jones - saw 30-40 hawksbills from Butler Bay around to Ham's Bluff, Mostly NW of (3-6 miles) Ham's Bluff; no mating.

10. Jay Huber (Captain, C-J) - has seen a few (3-5) green turtles west of NW corner of Buck Island in deep water.

(2) Data from interviews with charter-boat captains and divers are shown on Figure III and summarized below; data are for 1978:

Dive Operators/Charter Boat Captains

1. Brian Friedman (Operator, Pressure Ltd. Dive Charters) - has seen about 30 turtles that looked like greens, sizes from 18" to 4', between the North Cut and the trail at Buck Island. Also saw about 30 on Scotch Bank. No matings this year, 1 mating last year east of White Horse.

2. Brian Bishop (Diver, Aqua Engineers) - has seen about 6 hawksbill from 1'-3' long on Lang Bank, southern side. Also saw 8 leatherbacks off Mannings Bay. No mating. Saw 1 green about 3' at Anally Bay.

3. Don Bishop (Diver, Aqua Engineers) - has seen about 6 hawksbill off East Point around to Jack's Bay, 1'-3'. No mating.

4. Michelle Pugh (VI Divers) - has seen more than 30 hawksbill between North Star and Cane Bay; usually only sees 1' or 3' turtles. Not many in-between sizes. Has seen a hawksbill on Buck Island trail at night. Some of the large turtles had barnacles. No mating.

5. Bill Walker (Diving Manager, VI Divers) - has seen about 10 at Cane Bay, all near shore inside of dropoff. No mating.

6. Junie Bomba (Capt. of vessel North Star) - has seen between 150-200 greens or hawksbills. Says there seems to be two main groups: one north of Green Cay on the dropoff, and one south of Dietrich's Point Buck Island. Also 1 leatherback west of Buck Island in deep water. Has seen newly-born leatherbacks in trail at Buck Island. Saw 1 mating north of Green Cay.

7. Teddy Clark (Teddy's Charter Service) - has seen 150-200 between C'sted Harbor and Buck Island. Heaviest north of Green Cay and south of Buck Island. Seen especially when it's calm. Mostly large (3'). Saw about 12 newborn leatherbacks inshore near beach on north side of Buck Island at one time. Has seen 3-4 matings in past 5 years.

8. Edward Wendt (Co-operator, Above & Below Dive Shop) - has seen about 100 turtles, mostly hawksbill, from Kings' Reef (SW of F'sted Pier) to Butler Bay, 18"-4', 1 big 5' hawksbill at Butler Bay. No leatherbacks. No mating.

9. Gene Tepe (Co-operator, Above & Below Dive Shop) - has seen about 50 green and hawksbills at Cane Bay. About 10 greens by sunken barge off F'sted Pier. No mating.

10. Peter Winnicki (Diver) - has seen about 30 green or hawksbills, mostly hawksbill, 18"-4'. No mating. Sighted at Butler Bay and along west coast from F'sted Pier north.

11. Robert Butcher (Diver, Carribean Sea Adventures) - saw 20-30 turtles this year off Pull Point, about 5 off Scotch Bank. 1-2 matings last year. A group off Diedrich's Point and a group off Pull Point.

(3) Data on turtle sightings by West Indies Lab personnel have been collected by Dr. Caroline Rogers since July 15, 1978, and are presented in Table C and Figure IV. About 10 turtles of undetermined species were sighted during a flight between Christiansted and the eastern tip of the island on August 15, 1978.

(4) The only data available (for St. Croix) from the Department of Conservation and Cultural Affairs for 1978, is for the one week period, July 14-20, during which DCCA officers and National Marine Fishery Service agents mounted a turtle surveillance at Sandy Point, Shoy's Beach and Prune Bay. No nesting females or hatchlings were seen. Aside from this joint operation, no official DCCA nesting surveillance has been carried out on St. Croix during 1978

TABLE A - Turtle Nesting Beaches, St. Croix, U.S. Virgin Islands[1]

Location	Approximate No. Nests/Year
1. New Fort	3 Green and 2-3 Leatherback
2. Beauregard Bay	Historical Green and Hawksbill
3. Shoy's Point	1-2 Leatherback
4. Punnett Bay (Shoy's Beach)	25 Leatherback, 2-3 Green or Hawksbil
5. Green Cay Beach	15 Hawksbill and 2 Leatherback
6. Prune Bay (Pull Point)	9 Leatherback and 2-3 Hawksbill
7. Coakley Bay	15-20 Leatherbacks and 5-10 Hawksbill
8. Roebuck's Beach (Solitude)	3 Green
9. Teagues Bay (West)	2-3 Hawksbill
10. Smuggler's Cove	2-3 Green and 2-3 Hawksbill
11. Knight Bay	3-5 Green
12. Boiler Bay	1-3 Hawksbill
13. Teytaud's Beach	1-3 Hawksbill
14. East End Bay	3 Hawksbill
15. Isaac Bay	7-8 Hawksbill and 1-2 Leatherback
16. Jack Bay	25 Hawksbill and 1-2 Leatherback
17. Grapetree Bay	3-5 Hawksbill and 3-5 Green
18. Turner Hole	1-2 Hawksbill and 1-2 Green
19. Rod Bay	5 Hawksbill and Green
20. Robin Bay	5 Hawksbill and Green
21. H'Penny Bay	5 Hawksbill
22. Manchioneel Bay	10 each Hawksbill, Green & Leatherbac
23. Canegarden Bay	4-5 Hawksbill
24. Manning's Bay	1-2 Green
25. Hope & Carlton Land	2-3 Hawksbill
26. Sandy Point (Southeast)	15 Leatherback and 3-4 Hawksbill
27. Sandy Point (tip & NW)	80 Leatherback and 3-5 Green and Hawksbill
28. La Grange	3-5 Green
29. Prosperity to Sprat Hall	5 Green
30. Sprat Hole	1-2 Hawksbill
31. Butler Bay	1-2 Hawksbill
32. Ham's Bay	1-2 Hawksbill
33. Maroon Hole	5 Hawksbill and 5 Green

Page 2 - Table A - Turtle Nesting Beaches, St. Croix - Cont.

Location	Approximate No. Nests/Yr.
34. Annaly Bay	1-3 Green
35. Davis Bay	3 Hawksbill, 3 Leatherback, 4 Green
36. North Star	5 Hawksbill
37. Cane Bay	3 Hawksbill
38. Rust Op Twist	3 Hawksbill
39. Salt River (West point)	3-5 Hawksbill or Green
40. Tourquoise Bay	5 Hawksbill or Green
41. Judith's Fancy (St. John)	5 Hawksbill or Green
42. Buck Island[2]	49 (no species given)

[1]Source: M. Kennedy & T. Skov, incidental observations between 1976-1978. Species inferred from size of tracks and characteristics of nest pit.

[2]Buck Island data from National Park Service, for 1978 only.

FIGURE I

TURTLE NESTING BEACHES, ST. CROIX

1976-1978

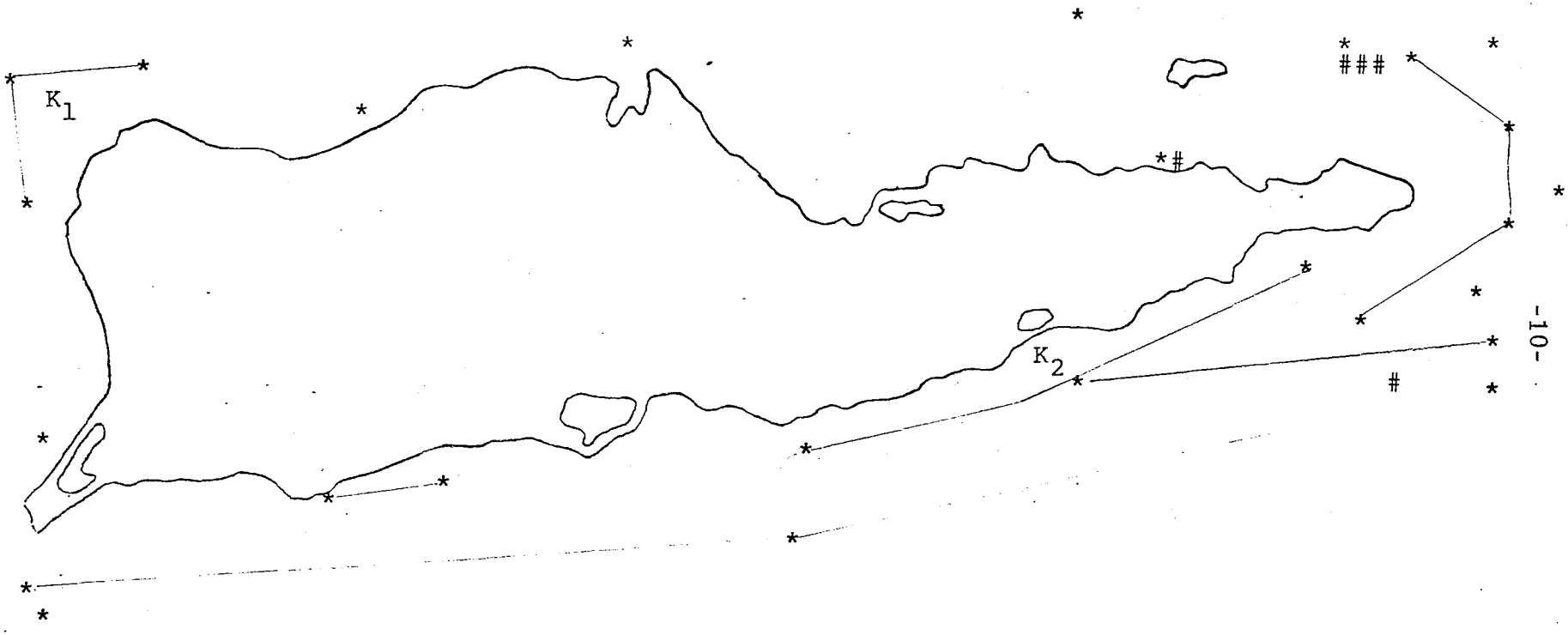
NOTE: NUMBERS CORESPOND TO BEACHES LISTED ON TABLE I

Source: M. Kennedy, T. Skov, N.P.S.

TABLE B - NATIONAL PARK SERVICE, BUCK ISLAND

July 1978	17 new nests
	1 recorded hatch - hawksbill
	3 nests destroyed by poachers
August 1978	12 new nests
	2 recorded hatches - green
	2 nests destroyed by poachers
	1 nest destroyed by mongoose
September 1978	9 new nests
	2 recorded hatches
	2 nests destroyed by unknown sources

FIGURE II
1978 Turtle Sightings/Fishermen

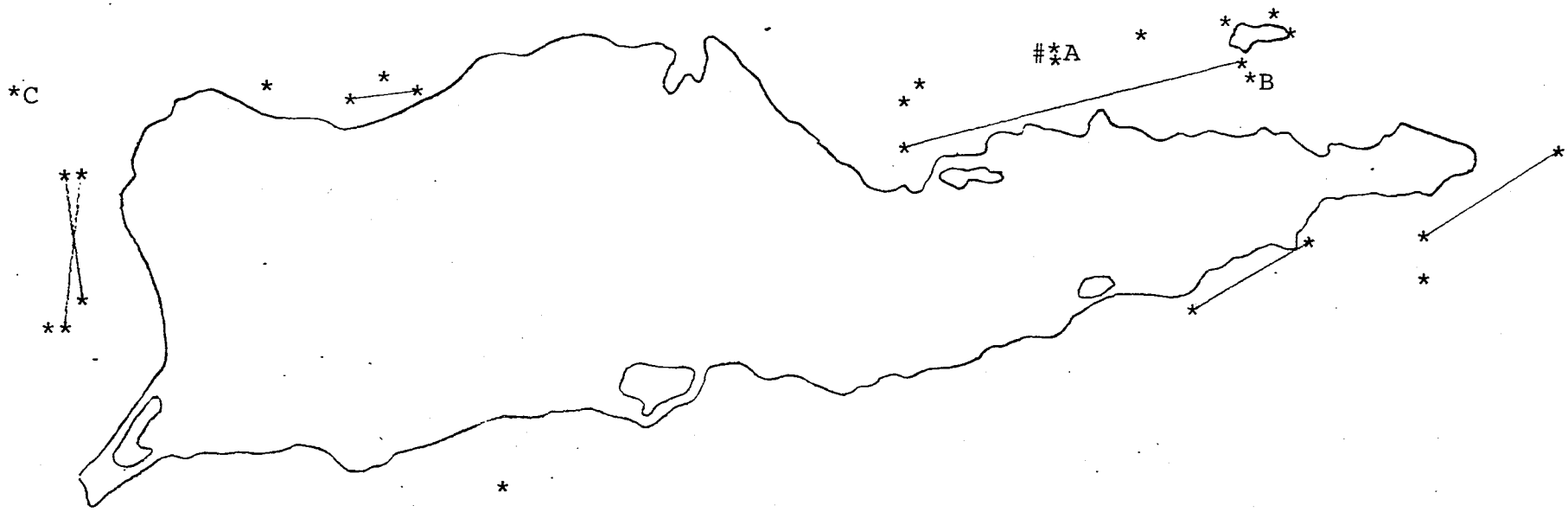


KEY

* SIGHTINGS
\# MATINGS SIGHTED
----- SIGHTINGS OVER AN AREA

FIGURE III

1978 TURTLE SIGHTINGS/CHARTER CAPTAINS-DIVERS



KEY

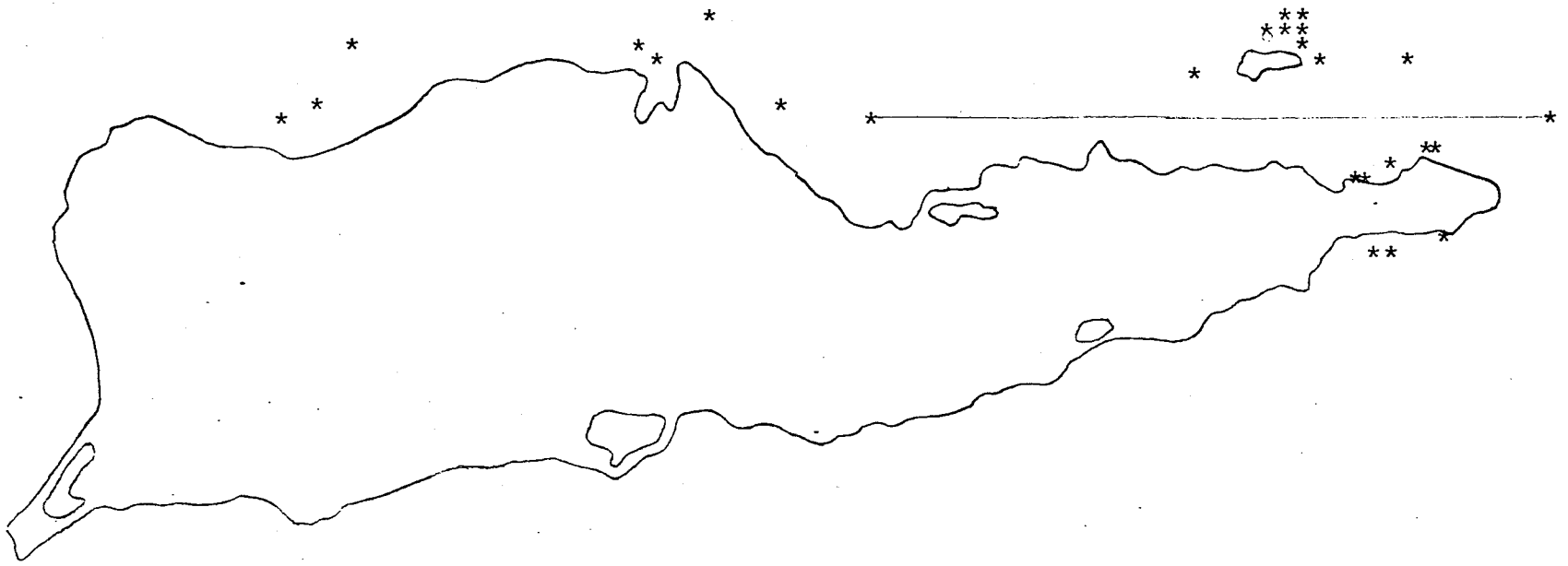
* SIGHTINGS
—— SIGHTINGS OVER AN AREA
*A,*B,*C GROUPS OF TURTLES
MATINGS

TABLE C - WEST INDIES LABORATORY SIGHTINGS SINCE 6/15/78
(Dr. Caroline Rogers)

Date	No.	Location	Kind	Approx. Size
6/15	1	Smuggler's Cove	?	12"
6/19	1	Patch Reef #1	Green	18"
6/21	2	White Horse	Hawksbill	2'
6/29	1	Smuggler's Cove	Gr. or Hawks.	2'
6/30	1	Boiler Bay	Hawksbill	3'
7/13	1	Boiler Bay	Gr. or Hawks.	2'
7/14	1	Buck Island	Gr. or Hawks.	2'
7/15	1	Salt River	Gr. or Hawks.	4'
7/19	1	Buck Island	Hawksbill	18"
7/22	1	North Star	Hawksbill	3'
7/21	1	Outside Jacks Bay	?	3'-4'
7/16	1	Grapetree Bay	?	3'
7/25	1	Grapetree Bay	?	1'-1 1/2'
8/4	1	Buck Island	Hawksbill	1 1/2'
8/4	1	Judith's Fancy	Hawksbill	1 1/2'
8/5	1	NorthEast Cane Bay	Hawksbill	2'
8/12	1	West End Buck Island	Green	3'
8/13	1	North Shore,Buck Island	Hawksbill	1'
8/15	10	C'sted to East Point (flight)	?	?
8/18	1	West Wall, Salt River Cnyn.	?	3'
8/15	1	North Shore, Buck Island	?	2 1/2'
8/20	1	North Star	?	2'
9/6	1	East Shore, Buck Island	Hawksbill	18"
9/16	1	East Buck Island	Hawksbill	10"
9/29	1	North Cut Buck Island	Hawksbill	18"

FIGURE IV

1978 TURTLE SIGHTINGS [1]



KEY

* SIGHTINGS

—— AERIAL FLIGHT 8/15/78

[1] SOURCE: DR. CAROLINE ROGERS , Data on incidental sightings since 6/15/78

SUMMARY OF AVAILABLE DATA ON 1977-78 TURTLE NESTING BEACHES IN ST. THOMAS-ST. JOHN

Data for this summary of sea turtle nesting and sightings on St. Thomas and St. John was acquired through interviewing 63 commercial fishermen and 6 recreational fishermen, one Park Ranger, and one government Shoreline Management staff member. Most of the fishermen were not aware of any turtle nesting activities since most of their fishing activities took place offshore. In all we had 15 respondents who had observed some sort of nesting related activity. The results presented contain several possible biases which must be considered. The first bias involves the failure of most of the fishermen to remember anything but recent nesting activity within the 4 months preceeding the interview. Only one fisherman had any information for the 1977 nesting year. There were several cases where dates were obviously confused (for example "end of April, first of October" was given for a nesting observation which later was described as about 2 weeks ago). There were also several cases where the same nesting activity was reported by different respondents so that the results may reflect slight redundancy of nesting activity. Therefore, these data are probably over-estimates of the turtle population in that multiple reporting of the same nesting activity and multiple nestings by the same turtle are not distinguished. The final bias in the results came from an obvious reluctance to admit any predation. One of the respondents admitted to catching one of the nesting turtles but there may have been additional unreported predation.

Five respondents reported that mongooses (Herpestes auropunctatus) prey on the nests. Dr. David Nellis of the Department of Conservation and Cultural Affairs, who has undertaken research on mongooses says that they would be secondary predators in that they would not dig the eggs from the sand, but would prey on already opened nexts. Ten different respondents said that turtles are not nesting as frequently as before because there are too many lights around the nesting beaches.

At least 35 of the fishermen interviewed said that there were more turtles in the waters than in previous years.

Turtle sightings covered most of the inshore from Lameshur Bay on St. John, to Savanna Island, west of St. Thomas. Turtles were sighted on the Atlantic side of the islands from West Cay to Leinster Bay on St. John. Turtles are frequently sighted throughout the bays and waters comprising Pillsbury Sound. The absence of reports from outside the previously described areas is probably a function of the fact that the persons interviewed don't fish outside of these areas. For example, the author has seen turtles (Hawksbills and Greens) in Coral Bay, although none were reported during the interviewing process. Most of the fishermen agreed that Hawksbills were more abundant than Green turtles although no quantitative data could be derived from the interviews. No one reported any other species except for the leatherback nesting in Magen's Bay.

One of the fishermen interviewed reported butchering one turtle. There were two additional reports of turtles being

butchered and one nest opening reported. Curiously, most of the fishermen stated that they did not care for turtle products.

TABLE D. Summary of Interviews Reporting Turtle Nesting Activity for Leatherback and Hawksbill Turtles in St. Thomas and St. John, U.S. Virgin Islands.

INTERVIEW: Place	Date	Nesting
#1		
Little Hans Lollik	August 21-25, 1978	4 Hawksbills
Big Hans Lollik (Dry Bays)	August 23-30, 1978	6 Hawksbills
Inner Brass	August 23-30, 1978	3 Hawksbills
Caret Bay	August 23-30, 1978	6 Hawksbills (1 butchered, 1 nest opened)
Neltjeberg Bay	September 1-6,1978	1 Hawksbill (1 butchered)
Mermaid's Chair	September 1-6,1978	1 Hawksbill
Salt Cay	September 1-6, 1978	1 Hawksbill, no sand on beach, didn't nes
West Cay	September 1-6, 1978	2 Hawksbills
Magens Bay	October 9, 1978	1 Hawksbill
Little Hans Lollik	October 27, 1978	4 Hawksbills
#2		
Little Hans Lollik	October 2, 1977	5 Hawksbills
Big Hans Lollik	October 2, 1977	9 Hawksbills
Magen's Bay	May 5, 1978	1 Leatherback
West Cay	July 13, 1978	1 Hawksbill
Inner Brass	July 19-22, 1978	2 Hawksbills
Little Hans Lollik	July 19-27, 1978	6 Hawksbills
Big Hans Lollik	July 19-27, 1978	7 Hawksbills
Frenchman's Bay	July 19, 1978	1 Hawksbill
Penn Bay	July 20, 1978	1 Hawksbill
Bordeaux Beach	July 19-28, 1978	4 Hawksbills
Caret Bay	July 21, 1978	2 Hawksbills
Neltjeborg Bay	August 3, 1978	2 Hawksbills
Magen's Bay	August 19, 1978	1 Hawksbill
Bordeaux	August 19, 1978	2 Hawksbills
Inner Brass	August 22, 1978	2 Hawksbills
Caret Bay	August 22, 1978	2 Hawksbills
Caret Bay	October 18, 1978	1 Hawksbill (butcher
#3		
Salt Cay	August, 1978	1 Hawksbill
#4		
Little Hans Lollik	October 18, 1978	1 Hawksbill
Inner Brass	October 18, 1978	2 or 3 Hawksbills
Salt Cay	October 18, 1978	2 Hawksbills (mating observed)

TABLE D. Continued.

INTERVIEW:

Place	Date	Nesting
#5		
Pelican Beach	? (in past)	-------
Smith Bay	? (in past)	-------
Great Bay	? (in past)	-------
Grass Cay (South Side)	October 2-5, 1978	1 Hawksbill
Mingo Cay (Southwest End)	September 30, 1978	1 Hawksbill
#6		
Little Coculus Bay	September, 1978	1 Hawksbill
Fortuna Bay	September, 1978	1 Hawksbill
#7		
Mingo Cay (Southwest End)	End of September, 1978	1 Hawksbill
#8		
Sandy Cay (BVI)	August, 1978	numerous
	September, 1978	numerous
#9		
Sandy Cay (BVI)	August, 1978	numerous
#10		
Great St. James (Bare Ass Bay)	late summer, 1977	nest hatching observe
#11		
Trunk Bay (St. John)	summer, 1978	nest hatching observe
Hawksnest Bay (St. John)	summer, 1978	nest hatching observe
#12		
Trunk Bay	June, 1978	1 set tracks observed
Trunk Bay	July-August, 1977	8-10 tracks observed
#13		
Bordeaux	September 10-20, 1978	3 Hawksbills
Caret Bay	September 10-20, 1978	2 Hawksbills
Dog Island	September 10-20, 1978	4 Hawksbills
Little Coculus	September 10-20, 1978	1 Hawksbill

TABLE D. Continued.

INTERVIEW:

Place	Date	Nesting
#14		
Bordeaux	October 20, 1978	2 Hawksbills
Caret Bay	October, 1978	1 Hawksbill
Hans Lollik (either)	Late October, 1978	several
Stumpy Bay	Late October, 1978	2 Hawksbills
#15		
Jumbi Bay, St. John	Late July, 1978	2 Hawksbills

TABLE E. Summary of Reported Recent Turtle Nesting Activities in St. Thomas, U.S.V.I., Listed by Nesting Beach.

Nesting Beach	Number of Nestings
Little Hans Lollik	15 (5 in 1977)
Big Hans Lollik	13 (9 in 1977)
Inner Brass	10
Caret Bay	14
Neltjeberg Bay	3
Salt Cay	2
West Cay	3
Magen's Bay	2
Penn Bay	1
Frenchman's Bay	1
Bordeaux Beach	11
Grass Cay	1
Mingo Cay	2
Little Coculus Bay	2
Fortuna Bay	1
Sandy Cay (BVI)	numerous
Great St. James	nest hatching
Trunk Bay, St. John	nest hatching
Hawk's Nest, St. John	nest hatching
Fish Bay, St. John	reported (time indefinite)
Dog Island	4
Mermaid's Chair	1
Stumpy Bay	2
Jumbi Bay, St. John	2 (8-10 in 1977)

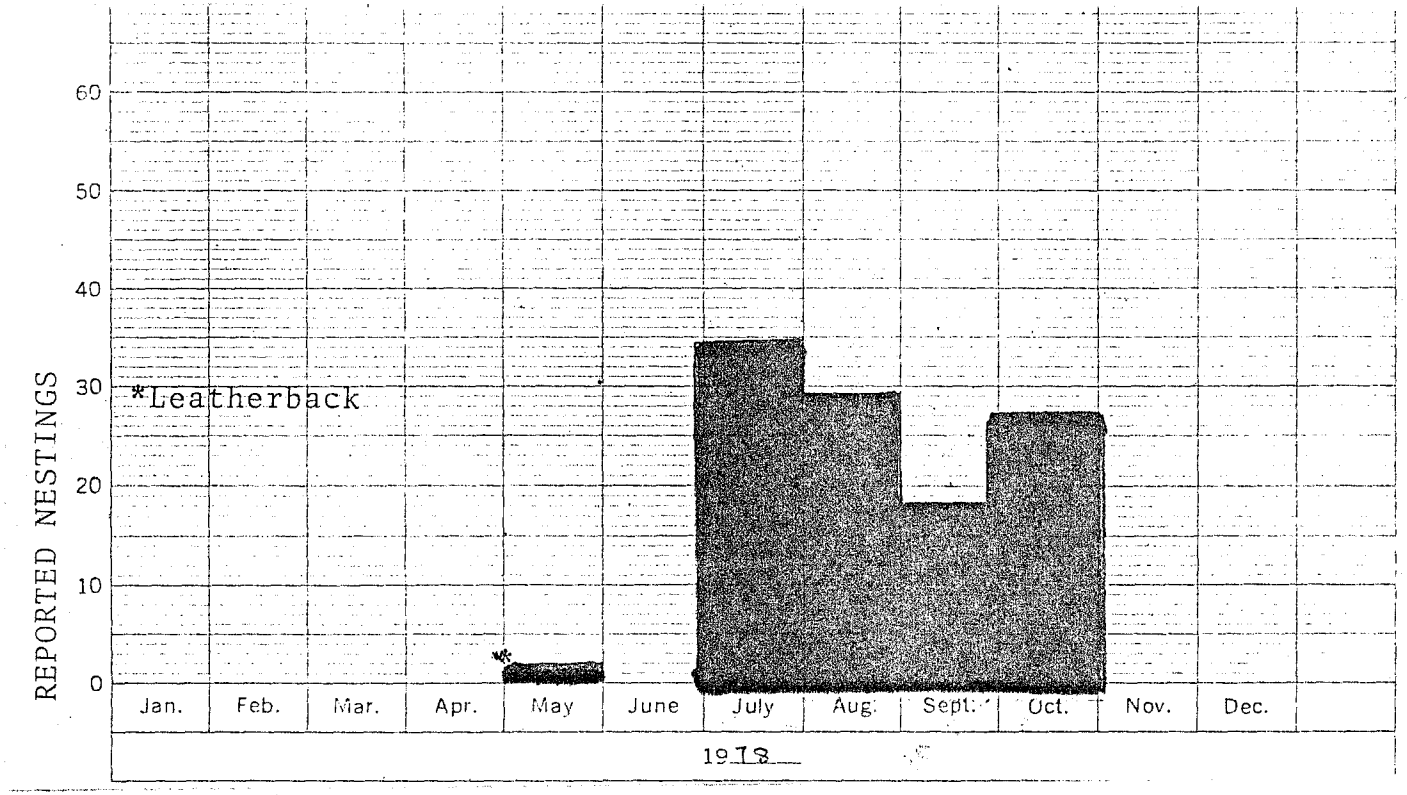


FIGURE V. Summary of 109 Hawksbill and Leatherback Turtle Nesting Reports for 1978 in St. Thomas and St. John, U.S. Virgin Islands.

→ 1978 nesting activity on previously reported beaches.
n→ 1978 nesting activity on previously unreported beaches
p→ Previously reported beaches (Rainey, 1976) not reported in 1978.
r→ Reported beaches used in past. Year not given by interviewee.
h→ Hatching observed in 1978.

FIGURE VI. Location of St. Thomas and St. John Turtle Nesting Beaches.

DISORIENTATION AND RELATED MORTALITY IN LEATHERBACK (*Dermochelys coriacea*) HATCHLINGS AT SANDY POINT, ST. CROIX, U.S. VIRGIN ISLANDS

A. Background and Statement of the Problem:

Information regarding the mortality of hatchling sea turtles is crucial to any proposed management program, yet it is not available for any population in the Virgin Islands. There is some evidence that at Sandy Point a significant number of leatherback hatchlings may fail to locate the sea after emerging from the nest and die on the beach, either by predation or as a result of dessication.

In order to find the most direct route to the sea, hatchlings depend on a tropotactic visual orientation system that has been well described by Mrosovsky (1,2,3), Mrosovsky and Carr (4), Mrosovsky and Shettleworth (5), Ehrenfeld (6), and Ehrenfeld and Carr (7) for the Green and Hawksbill turtles. Mrosovsky and Shettleworth (8) studied the significance of circling movements observed in leatherback hatchlings, and Mrosovsky (11) reported on individual differences in their sea-finding mechanism. Aside from these two studies, there seems to be little quantitative experimental work on the water-finding orientation of leatherback hatchlings. It is generally assumed that the orientation system of leatherbacks is similar to that described for green turtles.

In all cases studied, sea-finding orientation seems to depend on the fact that there is nearly always a massive brightness differential between the seaward and landward horizons under natural conditions, with the seaward horizon being the brighter.

During the 1977 surveillance of the nesting beach at Sandy Point by NMFS and DCCA it was observed that sometimes entire groups of leatherback hatchlings would leave the nest pit and travel parallel to the surf line for long distances, or even go inland, instead of going to the water by the shortest route. Many became entangled in the underbrush and died of dessication. No data is available on the percentage of hatchlings displaying this aberrant behavior, but the problem was felt to be so serious that the NMFS and DCCA officers took to collecting all the hatchlings they could find and hand carrying them to the water's edge.

Those present soon became convinced that the hatchlings were being attracted to the sky glow created by the lights of Hess Oil Refinery and the lights of the town of Frederiksted, which quite noticeably brighten the horizon in a landward direction. This hypothesis is supported by the observation of MacFarlane (9), who reported disorientation in loggerhead hatchlings as a result of artificial lights near the nesting beach in Florida, and by the fact that green turtle hatchlings can be attracted by handheld lanterns (5). On one occasion, Hawksbill hatchlings in St. Croix were found crossing a road near the nesting beach and heading towards a nearby ballpark where a game was in progress under the lights (10). A similiar event has been reported at Bolongo Beach on St. Thomas where Hawksbill hatchlings headed for lighted tennis courts adjacent to the beach.

Any attempt to assess leatherback hatchling mortality on the beach at Sandy Point must therefore take into account the possibility that a major contributing factor in mortality may be a tropotactic response to artificial lights. This response could prove to be very damaging to the stock because: (a) a rigidly programmed piece of behavior which evolved under natural conditions as an effective survival response is perverted so that the behavior becomes anti-survival, (b) the severity of the problem is expected to increase over time as development proceeds, and (c) it is difficult to find an effective solution for management. It is proposed to establish a critical habitat for the leatherback at Sandy Point, which would extend two-tenths of a mile inland. However, should development take place on Sandy Point itself (and at present this seems very likely) then an increased amount of artificial light from, say, a condominium development, could well precipitate mass mortalities of hatchlings with possibly serious impact on the viability of the stock.

A first approach to assessing the significance of disorientation as a factor in beach mortality of the hatchlings at Sandy Point could be made by combining an experimental analysis of orientation with measurements of the horizontal radiance distribution. This data would be augmented by observations of actual mortality. Such information would be useful in designing a management strategy for the stock, and it would also serve as a benchmark by which to guage the effects of the anticipated increase in artificial lighting in the future.

Various courses of action to ameliorate the problem could then be explored in the light of this study.

B. Suggested Experimental Approach

Hatchlings would be collected at Sandy Point as they emerge from the nest, given various orientation tests, and then released into the sea on the same night. Orientation arenas as described in (4) and (5) would be used to quantify the responses of the turtles. Before each test the radiance distribution of the horizon from hatchling-eye-level at the center of the arena would be quantified by suitable instrumentation. An attempt would be made to relate the preferred orientation direction of hatchlings under various experimental and control procedures to the radiance distribution recorded by instrument. Brightness cues could be manipulated during experimental runs by screening various portions of the horizon (from the viewpoint of the hatchlings) with black plastic, in a manner similar to the methods of Mrosovsky and Shettleworth (5).

Since leatherbacks nest in two different situations at Sandy Point (a) on the lower beach, and (b) on top of the berm, it would probably be necessary to replicate each experiment at both locations.

"Dry runs" using this experimental procedure have been carried out at Sandy Point, and it is estimated that a team of 4-5 persons could collect enough data for statistically

significant results in a total of about 100 hours of field work, (400 to 500 man hours) provided that the nest locations and the approximate date of hatching were determined ahead of time by a daily nesting survey in the peak of the nesting season. If no nesting survey were undertaken, then collection of adequate numbers of hatchlings would be much more of a hit-or-miss procedure, and the estimated time in the field for the entire team would have to be significantly increased. It would be more economical to employ one person to make a daily nest count throughout the nesting season, thereby enabling the team to predict the approximate dates of hatchling emergence.

As the opportunity arose, naturalistic observations would be made of the orientation of undisturbed hatchlings as they emerged from the nest, for comparison with the experimental data. Observations on predation of hatchlings on the beach would also be made. It is sometimes possible to deduce the paths taken by hatchlings even when the actual emergence was not observed, from the tracks which they make in the sand, and it may be possible to estimate the relative numbers involved. Finally, a special effort should be made by the person doing the daily nest count to find evidence of the fate of disoriented hatchlings in order to get some idea of the numbers which actually succumb, and the causes of death.

Using these methods, one can extrapolate from the experimental data the percentage of hatchlings which under "normal" conditions would be expected to orient in a direction that would

lead them away from the sea. Combined with opportunistic observations on the orientation of undisturbed hatchlings and by actual counts of dead ones, it should be possible to arrive at a first approximation of beach mortality due to artificial-light orientation at Sandy Point.

C. Options for Management Action

Since it is not feasible to physically screen off the entire beach from the offending lights, it would appear that the options for management action are three: (a) do nothing, and accept the additional hatchling mortality resulting from artificial-light disorientation, (b) establish a nightly patrol during the hatching season to collect disoriented hatchlings and hand-carry them to the water's edge. (It may be possible to enlist volunteer help to aid in such an effort), (c) conduct experiments with erecting a number of artificial lights at the water's edge along the entire beach, in order to attract hatchlings in the seaward direction. Such lights would have to be specially designed so that they would not exert a trapping effect on the hatchlings and increase their exposure to predators, and also so that they would not prevent females from coming ashore to nest -- it is not easy to see how this could be accomplished.

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