

IN-WATER SEA TURTLE SURVEY
OF THE
BROWARD COUNTY AUDUBON SOCIETY
SEA TURTLE CONSERVATION PROJECT

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NOVEMBER 20, 1986

The current study was undertaken by the Broward County Audubon Society to observe, tag, and record data on sub-adult green and hawksbill turtles present on the first reef area of Broward County. Divers frequently encountered these animals during the day, although attempts to capture them proved futile. Night diving, however, provided us with an opportunity to observe, capture, tag, and measure these turtles. It is hoped that through this ongoing study, we will be able to gather sufficient data to determine growth, migration, and feeding habits of the population.

STUDY AREA

The area upon which this study concentrated was that of the first reef area of Broward County, Florida. A mile area at the north center of this reef system was chosen for ease of access and frequency of sightings. The primary dive team is quite familiar with the Broward County reef systems, having spent more than 1500 hours underwater from Hollywood to Deerfield Beach since 1975.

The area off the Galt Ocean Mile, our primary area, appeared to have a good population of turtles, with excellent shelter provided by high profile limestone ridges and numerous large heads of Montastrea cavernosa. It is also proximate to lower profile substrate with considerable algae growth, which appears to provide good foraging habitat for the turtles (see Map 1).

Thirty-four (34) turtles were captured and tagged in the Galt Ocean Mile study area. Two (2) were tagged on the Deerfield Beach 1st reef area, while the remaining two (2) were captured on 2nd reef areas one to two miles south of the primary study area.

Due to the presence of hard corals throughout the area, netting of the animals is not feasible. The first reef system is quite extensive, beginning south of Hollywood, and becoming of insignificant profile north of Deerfield Beach. Second and third reef systems do continue north into the Palm Beach area, however, relatively few sightings of sub-adult green turtles have been made in these areas. The first reef area also allows for access from the beach, as it lies 200 to 300 yards from the shore and runs in a continuous north-south line.

METHODOLOGY

The study area was surveyed by divers using SCUBA gear. These dives took place primarily at night so that turtles could be captured, brought to the surface, measured, tagged with #681 Inconel tags provided by the National Marine Fisheries Service, and released. Turtles were tagged on the right front flipper. All measurements taken were standard curved carapace length and width. Measurements were taken by the same dive team member throughout the study to limit the amount of error inherent in a change of observer. An innertube fitted with a plastic laundry basket was used to carry tagging equipment and allowed the containment of the animals once

Single
Only 2

brought to the surface. The dive team would attempt to cover as extensive an area of reef as possible, frequently drifting with the current to cover a full mile of hardbottom.

Turtles encountered while sleeping under ledges proved to be easiest to capture. Swimming animals presented more difficulty, however disorientation by dive lights caused the animals to change course and orient to the light, allowing for capture.

A minimum of three night dives were attempted per week during the period of March 3, 1986 through November 6, 1986. While rough surf conditions precluded diving on several occasions, we did maintain this pattern throughout the period. Ninety-three (93) dives were completed by the team of Wershoven, Wershoven, Wheeler, and Steinlage during the above-mentioned time period. Eighty-six (86) of these dives were conducted at night, with the remainder undertaken at various times during the day. Entry was generally made at dusk.

The study was also augmented by the collection of sightings from other divers in the area. A standardized form (see attachment A) was completed and mailed to the Broward County Audubon Society.

RESULTS AND DISCUSSION

A total of thirty-eight (38) turtles were tagged during the period from March 3, 1986 through November 6, 1986. All of these were sub-adults, with the smallest turtle, a green, measuring 27.4 cm curved carapace length, and the largest, also a green, measuring 60.5 cm curved carapace length.

Two (2) of the thirty-eight (38) animals were hawksbills. NNY 702, the first hawksbill captured, provided us with some interesting data on growth rates. This turtle, originally captured on March 8, 1986, was measured at 34 cm curved carapace length (ccl) and 31 cm curved carapace width (ccw). The turtle was subsequently recaptured about 30 meters from the original capture site on April 12, 1986. It was not measured at this time. The next recapture was made in the same area on May 3, 1986. Measurements taken at this time indicated a ccl of 35.2 cm and a ccw of 31.5. Another recapture, again within 30 meters of the original capture site, was made on June 14, 1986. A curved carapace length measurement was taken at this time. This measurement was 38.5 cm. A final recapture was made on July 9, 1986. The turtle measured 39 cm ccl and 34 cm ccw. The animal has not been observed since July 9 of this year. It appears that this turtle underwent a tremendous surge of growth from May 3 to June 14. While curved carapace measurements are subject to error, it should be noted that the same observer took measurements on each occasion, and that more than one measurement was taken during each capture session for verification.

Six (6) of the thirty-six (36) green turtles tagged were recaptured within one mile of the original capture site. The longest interval between recapture was 138 days. This turtle was recaptured approximately 1/2 mile from the original capture site. Growth for this particular animal appears to be 1 cm in length during this time period. Growth for most of the green turtles recaptured falls within this range (see Table 1).

Papillomae were not observed on any of the captured turtles. Barnacle growth on the carapace appeared to be minimal. Turtles captured were free from algal growth on their carapaces.

SCUBA diving at night allowed us to make several interesting observations on behavior. Attraction to underwater lighting was evident, as previously noted. Swimming turtles could be drawn towards the divers by shining dive lights directly on their heads from the front or side. The brighter the light, the more obvious the orientation towards it.

Green turtles appeared to be much more difficult to capture than the two hawksbills encountered, displaying a much higher energy level. This was true even for sleeping green turtles. The 3-4 meter swim to the surface proved to be quite strenuous, with most of the greens attempting evasive maneuvers during the ascent. Once in the containment basket, with heads upright and above the surface, the turtles were, for the most part, docile, which made for ease of tagging and measuring.

One interesting occurrence of sexual behavior took place on July 22, 1986. After a sub-adult green repeatedly bumped an anchored boat, one of the divers entered the water to observe the turtle more closely. The turtle, evidently a male, approached the diver from behind, and proceeded to mount him. This encounter lasted for several minutes (Wheeler, unpublished report). The full report on this turtle (NNY 954) is attached.

Feeding behavior was not observed among any of the turtles, however, stomachs of green turtles recently killed by boats were removed and presented for analysis. This procedure was conducted by personnel of the Broward County Sea Turtle Monitoring Project under their salvage permit. It appears that algae figured heavily in their diets, with gelidiales, gracilaria, and codium being present. One specimen contained pods of thalassia testudinum, another was found with sponge of the chondrilla nucula type present (Wheeler, personal communication). Balazs' (1979) study of sub-adult green turtles indicates similar food preferences dependent upon algae present within that area.

The dive team capture of a sub-adult green (NNY 723) with a fishing hook embedded in its lip indicates somewhat diverse feeding habits for the animals. It is interesting to note that this particular turtle was recaptured within 50 meters of the original capture site, and that these sites are, of all the captures, among those closest to a commercial fishing pier. Capture of sub-adult greens by recreational fishermen appears to be somewhat common, particularly near the Dania fishing pier (Steinlage, personal communication). This area also contains a significant population of sub-adult green turtles, according to recent reports from divers (Wilkes, personal communication).

The continuity of Broward County's reef system may allow for considerable movement of the green turtle population. The presence of suitable feeding and resting areas is almost continuous throughout its range. Captures and sightings of large numbers of these turtles

indicate that the area may serve as an important developmental habitat in line with the model presented by Carr, Carr, and Meylan (1978). It should be noted that only one observation of an adult green was made offshore on the first reef system. This animal, captured on videotape, was observed during the peak of nesting season (Steinlage, personal communication).

The current study has covered a small section of the total hardbottom areas of Broward County. Future surveys and tagging efforts will continue within this area, with frequent samplings to the north and south of the main area. We hope to utilize a small inflatable dingy for these drift surveys. Such a stable platform would allow for straight line measurements, weights, and photographs to be taken of each animal. A video documentation of the turtles, habitat, and the capture method is planned for the future.

In conclusion, we feel the study will continue to produce useful data regarding a significant population of sub-adult sea turtles.

Literature Cited

- Balazs, G. H. 1979. Growth rates of immature green turtles in the Hawaiian Archipelago. *Biology and Conservation of Sea Turtles*. K. Bjorndal, Editor. pp 117-132.
- Carr, A. F., M. H. Carr, and A. B. Meylan. 1978. The ecology and migration of sea turtles, 7. The west Caribbean green turtle colony. *Bull. Amer. Mus. Nat. Hist.* 162: 1-46.

TABLE 1: CAPTURE AND TAGGING RESULTS FOR 1986

TAG #	DATE	SPECIES	SIZE (cm)	LOCATION*	TIME	CURRENT
NNY 703	Mar 03	Cm	53.0 ccl 47.0 ccw	Zone 1	6:30 pm	S
NNY 702	Mar 08	Ei	34.0 ccl 31.0 ccw	Zone 1	6:30 am	N
NNY 704	Mar 17	Cm	55.0 ccl 47.0 ccw	Zone 2	6:15 pm	S
NNY 702 (Return)	Apr 12	Cm	N/A	Zone 1	5:30 am	S
NNY 707	Apr 12	Cm	40.8 ccl 35.2 ccw Plastron-32.2 length 35.2 width	Zone 1	6:30 pm	S
NNY 708	Apr 15	Cm	49.0 ccl 44.8 ccw	Zone 1	6:45 pm	N
NNY 710	Apr 29	Cm	49.0 ccl 44.8 ccw	Zone 2	7:30 pm	S
NNY 702 (Return)	May 03	Ei	35.2 ccl 31.5 ccw	Zone 1	7:00 pm	S
NNY 713	Jun 01	Cm	48.5 ccl 41.5 ccw	Deerfield Bch 1st reef	7:35 pm	N
NNY 714	Jun 07	Ca	55.0 ccl 50.0 ccw	Zone 2	8:00 pm	N
NNY 715	Jun 12	Cm	44.0 ccl 37.0 ccw	Zone 2	8:30 pm	N
NNY 716	Jun 12	Cm	50.0 ccl 44.00 ccw	Zone 2	8:45 pm	N
NNY 717	Jun 12	Ca	51.0 ccl 47.0 ccw	Zone 2	9:00 pm	N
NNY 702 (Return)	Jun 14	Ei	38.5 ccl	Zone 1	8:00 pm	S

*Location refers to Map 1: Study area unless otherwise specified

TABLE 1: CAPTURE AND TAGGING RESULTS FOR 1986

TAG #	DATE	SPECIES	SIZE (cm)	LOCATION*	TIME	CURRENT
NNY 718	Jun 17	Ei	60.0 ccl 54.5 ccw	Zone 2	8:00 pm	S
NNY 721	Jun 17	Cm	58.5 ccl 54.0 ccw	Zone 2	8:20 pm	S
NNY 720	Jun 21	Cm	39.5 ccl 34.0 ccw	Zone 2	8:15 pm	S
NNY 719	Jun 23	Cm	34.5 ccl 28.0 ccw	Zone 2	8:30 pm	S
NNY 724	Jun 24	Cm	30.0 ccl 25.0 ccw	Zone 1	9:00 pm	S
NNY 722	Jun 24	Cm	45.5 ccl 43.0 ccw	Zone 2	9:20 pm	S
NNY 707 (Return)	Jun 26	Cm	41.0 ccl 36.0 ccw Tail-6.8cm	Zone 1	8:30 pm	S
NNY 723	Jun 26	Cm	35.0 ccl 30.6 ccw	Zone 1	8:40 pm	S
NNY 725	Jun 26	Cm	59.5 ccl 54.5 ccw	Zone 2	9:00 pm	S
NNY 723 (Return)	Jul 02	Cm	35.0 ccl 30.6 ccw	Zone 2	8:15 pm	S
NNY 702 (Return)	Jul 09	Ei	39.0 ccl 34.0 ccw	Zone 2	8:00 pm	S
NNY 723 (Return)	Jul 10	Cm	35.0 ccl 30.6 ccw	Zone 2	8:00 pm	S
NNY 966	Jul 14	Cm	57.0 ccl 46.0 ccw	Zone 2	8:30 pm	S
NNY 970	Jul 18	Cm	47.5 ccl 42.0 ccw	Deerfield Bch 1st reef	8:30 pm	S
NNY 971	Jul 20	Cm	60.0 ccl 54.0 ccw	Zone 2	8:30 pm	S

*Location refers to Map 1: Study Area unless otherwise specified

TABLE 1: CAPTURE AND TAGGING RESULTS FOR 1986

TAG #	DATE	SPECIES	SIZE (cm)	LOCATION*	TIME	CURRENT
NNY 955	Jul 20	Cm	40.0 cc1 37.5 ccw	Sunrise 2nd reef	1:00 am	S
NNY 954	Jul 22	Cm	54.6 cc1 51.5 ccw	Oakland Park 2nd reef	11:00 pm	N
NNY 975	Aug 03	Cm	60.0 cc1 55.0 ccw	Zone 2	8:30 pm	S
NNY 982	Aug 17	Cm	37.0 cc1 32.0 ccw	Zone 2	8:30 pm	N
NNY 972	Aug 28	Cm	42.3 cc1 35.0 ccw	Zone 3	8:00 pm	N
NNY 979	Aug 28	Cm	35.0 cc1 approx	Zone 3	8:00 pm	N
NNY 721 (Return)	Sep 08	Cm	60.5 cc1 54.5 ccw	Zone 3	8:00 pm	S
NNY 980	Sep 13	Cm	60.0 cc1 54.0 ccw	Zone 4	9:00 pm	N
NNY 981	Oct 03	Cm	N/A Lost Tape	Zone 4	7:30 pm	N
NNY 987	Oct 06	Cm	42.0 cc1 34.0 ccw	Zone 3	8:15 pm	S
NNY 988	Oct 06	Cm	48.7 cc1 43.0 ccw	Zone 4	7:50 pm	S
NNY 989	Oct 06	Cm	27.4 cc1 23.6 ccw	Zone 4	7:35 pm	S
NNY 990	Oct 10	Cm	51.0 cc1 43.0 ccw	Zone 4	8:45 pm	N
NNY 991	Oct 11	Cm	58.7 cc1 51.0 ccw	Zone 3	8:50 pm	S
NNY 716 (Return)	Oct 28	Cm	51.0 cc1 44.0 ccw	Zone 3	6:20 pm	N

*Location refers to Map 1: Study Area unless otherwise specified

TABLE 1: CAPTURE AND TAGGING RESULTS FOR 1986

TAG #	DATE	SPECIES	SIZE (cm)	LOCATION*	TIME	CURRENT
NNY 994	Oct 28	Cm	58.4 cc1 51.2 ccw	Zone 4	7:00 pm	N
NNY 992	Oct 28	Cm	48.3 cc1 41.4 ccw	Zone 4	7:10 pm	N
NNY 994 (Return)	Oct 30	Cm	N/A	Zone 4	6:30 pm	S
NNY 993	Nov 05	Cm	54.0 cc1 46.0 ccw	Zone 3	6:30 pm	S

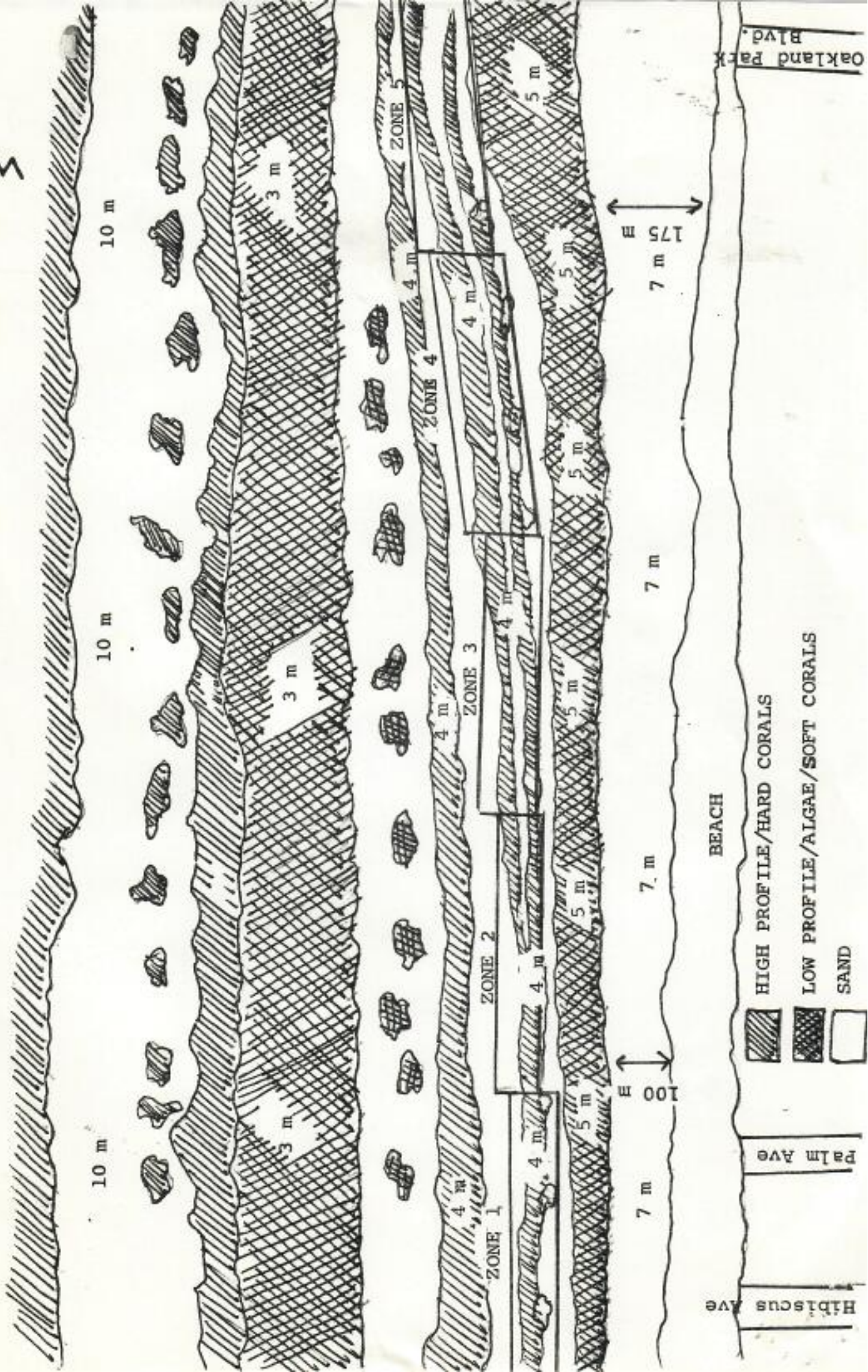
*Location refers to Map 1: Study area unless otherwise specified

TABLE 2: RECAPTURES FOR 1986

TAG #	DATE CAPTURED	MEASUREMENTS	LOCATION	DATE RECAPTURED	MEASUREMENTS	LOCATION
NNY 702	Mar 08	34.0 cc1	Zone 1	Apr 12	N/A	Zone 1
		31.0 ccw				
NNY 707	Apr 12	40.8 cc1	Zone 1	Jun 26	41.0 cc1 36.0 ccw	Zone 1
		35.2 ccw				
NNY 716	Jun 12	50.0 cc1	Zone 2	Oct 28	51.0 cc1 44.0 ccw	Zone 3
		44.0 ccw				
NNY 721	Jun 17	58.5 cc1	Zone 2	Sep 08	60.5 cc1 54.5 ccw	Zone 3
		54.0 ccw				
NNY 723	Jun 26	35.0 cc1	Zone 1	Jul 02	35.0 cc1 30.6 ccw	Zone 2
		30.6 ccw				
NNY 994	Oct 28	58.4 cc1	Zone 4	Oct 30	N/A	Zone 4
		51.2 ccw				

MAP 1: STUDY AREA 1




(includes offshore areas of Lauderdale-by-the-Sea south, and Galt Ocean Mile area, Broward County, Florida)



Hibiscus Ave

Palm Ave

BEACH

-  HIGH PROFILE/HARD CORALS
-  LOW PROFILE/ALGAE/SOFT CORALS
-  SAND

100 m

7 m

7 m

175 m

Oakland Park Blvd.

On July 28, 1986 during a lobster/night dive, an interesting behavioral phenomenon was observed in a sub-adult green turtle.

Due to equipment problems this writer was forced to abort the second dive. Divers from the first dive reported encounters with two sub-adult green turtles. The boat was anchored over a ledge system on the outer edge of the first reef tract. Depth ranged from 10' to 18' and there was a minimal current out of the South. The wind was from the West and the seas were flat. The boat was located between 30 St. and 27 St. off the private homes of Ft. Lauderdale Beach.

At 11:15 PM the writer heard something bumping the boat on the rear starboard side directly under the anchor light, which was lit. The source of the clamour was a sub-adult green turtle. The turtle was facing South and was using his right flipper to keep his body parallel to the boat. After viewing the animal, the writer quickly reached into the water and captured the turtle. On board the boat, tag number NNY 954 was affixed to the turtle's right flipper. Carapace length was recorded at 54.6 cm, carapace width at 51.5 cm. The turtle bore no unusual marks, except the usual barnacles on the neck. After being released at 11:19 PM the turtle reappeared along side the boat again. This time the writer entered the water and approached the turtle. The animal confronted the swimmer, placed his front flippers straight out and used his rear flippers to support himself in the water. After this the turtle dove under the writer

and emerged behind him. The turtle carefully locked his flippers under the writer's arm pits and remained there for approximately 10 minutes until the animal was removed. The turtle swam off after the writer removed it.

Submitted by

Ryan Wheeler

**BROWARD
COUNTY
AUDUBON SOCIETY**

MEMBER
National Audubon Society
Florida Audubon Society

December 10, 1986

George Balazs
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii 96822

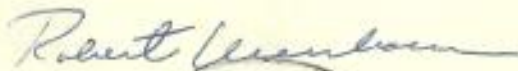
Dear Mr. Balazs:

Please find enclosed a copy of our survey and tagging report for Broward County. This project involved tagging of sub-adult green and hawksbill turtles on a small section of the first reef area off the Southeast Florida coast. Capture and tagging of the animals was accomplished at night using SCUBA gear.

We hope to continue this survey during the next several years to form a more complete picture of Broward County's green and hawksbill population. Our survey team consists of a small group of volunteer divers affiliated with both Broward County Audubon Society and a local dive club.

We would appreciate any questions or comments you may have on our activities. We have obtained papers on your work with greens and found them to be most helpful in structuring our project. We look forward to hearing from you in the near future.

Sincerely,



Robert Wershoven, Chairman
Endangered Species Committee