MARINE TURTLE TRAWL SURVEYS OFF SOUTH CAROLINA NESTING BEACHES, 1979

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INTRODUCTION

The increasing concern for the survival of marine turtle species has focused attention on the need for additional information on the life histories and population dynamics of these species. Existing data on marine turtle populations has been obtained almost exclusively from beach surveys of nesting females or aerial surveys of nesting beaches. One of the major obstacles facing efforts to achieve recovery of marine turtle populations is the lack of data on present population size and information on the important sub-adult and male segments of the populations. Nesting beach surveys can only provide an estimate of the number of mature females in the population and at present it is unknown what these numbers represent in terms of the total population. It is extremely important to develop an understanding of the age and sex composition of marine turtle populations if we are to effectively manage them and insure recovery of these species.

The impact of incidental catch by commercial fisheries, particularly shrimp trawling, has been noted as one of the factors responsible for declining numbers of some sea turtle populations. Of particular interest was the possible impact of trawling activities on mature female turtles in the vicinity of a major nesting beach. Previous incidental catch studies in the southeastern United States (Hillestad, et al. 1978; Ulrich, 1978) found that mature females made up less than 20 percentof the incidental catch and mortality, however, a more thorough investigation was needed to determine if this ratio is applicable for vessels working primarily near a major nesting beach.

One of the goals of this project was to determine the effectiveness of a trawl survey for obtaining data on abundance, size/age composition and

sex ratios for marine turtle populations. Such surveys have not been previously attempted and the findings of this study should be viewed as a preliminary attempt at developing suitable methodology and identifying problems associated with this technique.

OBJECTIVES

The objectives of this study were as follows:

1. To obtain information by research trawling on the abundance and distribution of sea turtles offshore of a major South Carolina nesting beach.
2. To determine the speices, size (age group) and sex composition of marine turtles off such a beach.
3. To determine the probability of capture for mature female turtles and impact on the breeding colony by commercial shrimp trawlers.
4. To assess the feasibility of trawl surveys for collecting population data on marine turtles.

STUDY AREA

The study area was located immediately to the north and south of Cape Romain shoals, offshore of Cape Island and Raccoon Key - Sandy Point. These barrier islands have been identified by other investigators (Steven Stancyk, pers. comm., Hopkins, 1978) as some of the most densely nested loggerhead beaches in South Carolina. Figures 1-3 (transparent overlays) in conjunction with U.S.G.S. Chart 11531 show the location of the study area and the trawl distribution for each of the three cruises.

SURVEY METHODS

Trawling was conducted in two depth strata; 10-20 feet and 20-30 feet,

with approximately equal distribution between the strata, as efficient allocation of effort dictated. Vessel draft restricted our ability to trawl directly adjacent to the beaches but an effort was made to work as close to shore as possible in early morning and evening to attempt to catch mature females that might be leaving or approaching the nesting beach.

The R/V ATLANTIC SUN, a 72 foot, double-rigged shrimp trawler was used for all sampling. Sixty foot, two-seam flat trawls with 8' x 40" doors was the sampling gear employed throughout the study.

Three, three-day sampling cruises were conducted to coincide with the beginning, peak and end of the nesting season. Cruises were made on the following dates: 28-31 May, 10-13 July and 14-16 August, 1979. Trawling was done primarily during daylight hours, with night sampling only on the second cruise. Initially, trawl tows were 30 minutes long but were extended to one hour during the latter part of the first cruise to make more efficient use of available sampling time. One hour tows were made during the remainder of the sampling except when gear damage required an earlier termination of a drag.

LORAN C readings were made at the beginning and at 10 minute intervals throughout the trawl to allow accurate plotting of the areas covered. The white line fathometer was operated during each tow to determine if turtles captured during drags might present a distinctive trace that would enable us to identify what time during the tow the turtle was caught. Depths were recorded at the beginning and end of each drag.

Carapace lengths and widths (straight-line) were taken on captured turtles using an aluminum tree caliper (Forestry Suppliers, Inc.). Turtles were tagged on the right front flipper MONEL ear tags (U.of Fla.14000).

The use of a stainless steel carapace tag as initially proposed was not adopted due to unavailability during the early part of our study. After tagging, turtles were held on deck and periodically sprayed with the deck hose until their release when the nets had been hauled back from the drag in progress. Turtles were not released while the nets were fishing to preclude their immediate recapture.

RESULTS

Cruise No. 1: During the first cruise (28-31 May 1979) 28 trawl stations were made, seven of these were one hour drags and the remaining 21 were 30 minute tows for a total trawl time of 17.5 hours. The area offshore of Raccoon Key was trawled for 7.5 hours and Cape Island for 10.0 hours. Table 1 shows that station data for the first cruise including LORAN C positions, depths and turtle capture data.

The area surveyed, lying between latitude 32°54.0'N and 33°10.0'N and delineated on the east and west by the seaward shoreline of the barrier islands and the 30 foot depth contour, comprises approximately 90 square miles. Coverage of this area based on area-swept calculations was estimated to be 0.9 percent during the first cruise. Area-swept calculations were based on the following approximations: 1. 75 percent spread for the two 60 foot nets or a bottom sweep of 90 feet; 2. the average one hour drag covered three miles.

One turtle was captured on this cruise, a mature female loggerhead (*Caretta caretta*). This turtle had a carapace length of 89 cm and a width of 66 cm. She was tagged with number 14351 and relased in good condition. Capture location is indicated on Figure 1 by drag number 1-3.

Cruise No. 2: The second cruise was scheduled to coincide with the peak of nesting activity in the Cape Romain area and was made from 10-13 July 1979. A total of 19 stations were made during this cruise, six in the vicinity of Sandy Point-Raccoon Key, 10 offshore of Cape Island and three off of South and Sand Islands. The South and Sand Island stations were made because the vessel was working out of Georgetown, S.C. during this cruise and we thought it would be worthwhile to set the nets as we were steaming to the primary sampling locations. Both of these islands support substantial loggerhead nesting.

Night trawling was conducted on 10 July at the suggestion of the COTR, Larry Ogren. Lack of a relief crew did not allow further night activity. Area coverage during the second cruise was 1.0 percent. No turtles were captured during this cruise.

A substantial amount of trawling time was lost due to severe net damage encountered on 11 July. The net was damaged too badly to repair on-board. We returned to port in Georgetown, S.C. and then drove to Charleston where we were able to borrow a replacement net from another project. Trawling was resumed on the morning of 12 July. Table 2 and Figure 2 show station data and trawl distribution for this cruise.

Cruise No. 3: The third cruise, coinciding with the end of the South Carolina loggerhead nesting season was conducted from 14-16 August 1979. Six stations were made off Cape Island and the remaining 17 off of Raccoon Key-Sandy Point. We concentrated more of our effort in the latter area because of the low level of coverage during the second cruise. Total trawl time for this cruise was 22.5 hours with an estimated area-swept coverage of 1.3 percent

See Table 3 and Figure 3 for station data and trawl location.

Two turtles were captured during this cruise. The first, taken during station number 3-13 (Figure 3) was a juvenile, Kemp's ridley (*Lepidochelys kempi*) weighing four kg, carapace length 31 cm, width 28 cm. This turtle wad closely examined for tags or tagging scars to determine if it was one of the head-started ridley's from the Galveston project. No evidence of prior tagging was noted. We tagged it with number 14371 and released it at the termination of station 3-14.

The other turtle captured was sub-adult loggerhead (probably female) which was taken at station number 3-18 (Figure 3). Carapace length was 70 cm, width 58 cm and the affixed tag number was 14369.

Catch Per Unit Effort Values: Catch per unit effort values for each cruise and a cumulative value are shown in Table 4. Cruise No.1, with one turtle capture in 17.5 hours of trawling produced a turtle per hour rate of .057. No turtles were caught on the second cruise during 18.6 hours of trawling. The turtle/trawl hour rate for the third cruise in which two turtles were caught in 22.5 hours of sampling was .089. The cumulative figure for all cruises combined; three captures in 58.6 hours of trawling was .051.

Table 1. Station Data for Marine Turtle Survey Cruise 28-31 May, 1979

Date and Time		Duration of Tow	LOCATION LORAN C Start	LOCATION LORAN C End	Depth(ft) Start End	Turtle Captures and Comments
5/28/79	(1301)	30 min.	15256.3/71442.1	15271.4/71453.0	25 - 25	Starboard net's bag twisted
"	(1450)	"	15279.6/71460.2	15293.9/71470.1	24 - 22	" " " "
"	(1512)	"	15300.0/71477.0	15290.0/71465.4	16 - 20	Mature female loggerhead CL 89 cm CW 66 cm #14351
"	(1617)	"	15293.7/71455.7	15283.9/71444.0	15 - 14	
"	(1657)	"	15280.7/71439.8	15270.8/71427.7	14 - 15	
"	(1748)	"	15280.1/71427.9	15293.9/71438.0	13 - 12	
"	(1830)	"	15297.9/71438.2	15280.5/71426.7	10 - 10	
5/29/79	(0727)	"	15294.4/71441.2	15297.9/71450.7	10 - 11	
"	(0806)	"	15298.6/71452.1	15295.8/71442.6	12 - 10	
"	(0853)	"	15282.5/71439.3	15274.3/71428.6	15 - 13	
"	(0934)	"	15273.6/71427.6	15285.7/71437.2	13 - 15	
"	(1011)	"	15291.6/71443.1	15301.5/71454.3	14 - 13	
"	(1106)	"	15292.3/71466.8	15281.0/71457.8	20 - 20	
"	(1144)	"	15276.8/71454.5	15266.7/71443.4	21 - 20	
"	(1245)	"	15239.6/71439.3	15252.9/71450.8	30 - 28	Moving to Cape I. after completion of this drag
"	(1429)	"	15332.9/71516.5	15348.1/71517.6	25 - 25	
"	(1511)	"	15358.6/71518.5	15373.5/71520.1	25 - 25	
"	(1600)	"	15375.7/71510.2	15359.2/71504.6	15 - 15	
"	(1640)	"	15352.5/71503.1	15336.9/71500.1	12 - 15	
"	(1722)	60 min.	15333.3/71498.6	15350.5/ ?	14 - 20	No 71000 LORAN position during storm
5/30/79	(0748)	30 min.	15347.9/71499.0	15353.2/71494.9	10 - 10	
"	(0825)	"	15347.9/71493.2	15334.9/71490.0	10 - 10	
"	(0912)	60 min.	15336.0/71498.1	15369.5/71504.0	15 - 18	
"	(1025)	"	15382.5/71505.7	15342.3/71504.9	22 - 20	Large piece of "coral" rock in stbd. net; approx. 3-400 lbs.
"	(1207)	60 min.	15347.2/71511.3	15387.9/71528.9	35 - 26	Engine stalled on last five min. of drag
"	(1447)	"	15301.3/71502.8	15291.8/71470.3	35 - 23	Trawling off Raccoon Key
"	(1611)	"	15294.0/71457.0	15280.3/71434.7	15 - 14	
"	(1720)	"	15278.4/71428.9	15292.1/71440.2	13 - 12	Seas getting rough, last drag, proceeding to Fort Johnson.

Table 2. Station Data for Marine Turtle Survey Cruise No. 2, 10-13 July 1979

Date and Time		Duration of tow	LOCATION LORAN C Start	LOCATION LORAN C End	Depth(ft.) Start End	Turtle Captures and Comments
10/7/79	(2051)	60 min.	15487.0/71571.9	15452.0/71557.8	20 - 25	
"	(2200)	"	15444.3/71555.7	15418.5/71534.0	25 - 20	
"	(2334)	"	15410.4/71529.4	15377.3/71509.6	18 - 17	
"	(0022)	"	15370.0/71503.5	15337.1/71500.5	15 - 16	
"	(0132)	"	15335.0/71504.3	15361.8/71507.8	15 - 23	
11/7/79	(0933)	"	15360.9/71520.0	15394.4/71523.6	30 - 21	
"	(1043)	"	15399.5/71523.8	15382.5/71504.9	18 - 12	
"	(1153)	"	15376.4/71501.7	15343.6/71495.8	11 - 11	
"	(1303)	35 min.	15341.6/71497.9	15330.7/71489.9	12 - 10	Tore net too badly to repair on-board. Proceeding to Georgetown to obtain replacement net.
12/7/79	(1005)	60 min.	15444.8/71549.2	15416.1/71529.5	20 - 15	
"	(1112)	"	15410.7/71525.5	15387.5/71508.0	15 - 12	
"	(1220)	"	15382.7/71503.0	15350.0/71497.0	8 - 15	
"	(1340)	"	15355.0/71512.6	15386.2/71516.9	25 - 23	
"	(1550)	"	15304.0/71496.8	15280.1/71473.4	17 - 25	Raccoon Key-Sandy Point area.
"	(1655)	"	15274.6/71468.8	15271.8/71446.1	24 - 17	"
"	(1812)	"	15270.9/71436.7	15289.8/71437.0	15 - 10	"
13/7/79	(0730)	"	15281.8/71434.9	15301.3/71456.1	12 - 15	"
"	(0838)	"	15299.4/71458.9	15285.2/71436.0	15 - 14	"
"	(1039)	"	15335.4/71502.9	15363.2/71500.9	20 - 17	"

Table 8. Station Data for Marine Turtle Survey Cruise No. 3, 14-16 August 1979

Date and Time		Duration of tow	LOCATION LORAN C Start	LOCATION LORAN C End	Depth(ft.) Start	Depth(ft.) End	Turtle Captures and Comments
14/8/79	(0526)	60 min.	15245.8/71430.1	15272.0/71448.9	20	17	Raccoon Key-Sandy Point area
"	(0634)	"	15278.3/71453.8	15298.4/71472.9	17	15	" "
"	(0743)	"	15301.1/71473.8	15300.4/71451.1	13	8	" "
"	(0848)	"	15300.0/71446.1	15276.2/71426.7	7	8	" "
"	(1001)	"	15265.5/71427.7	15284.6/71449.9	15	16	" "
"	(1105)	"	15287.9/71452.8	15304.7/71474.7	15	15	" "
"	(1232)	"	15298.3/71486.1	15282.0/71466.1	23	25	" "
"	(1334)	"	15278.4/71462.0	15260.4/71441.6	24	25	" "
"	(1455)	"	15246.1/71425.8	15277.0/71440.0	21	18	" "
"	(1600)	"	15283.1/71442.9	15304.3/71464.6	16	13	" "
"	(1710)	"	15306.1/71466.7	15294.8/71445.3	10	11	" "
"	(1820)	"	15290.9/71440.7	15266.1/71429.8	10	14	" "
15/7/79	(0708)	"	15266.6/71434.1	15293.2/71443.2	20	10	Kemp's ridley wt. 4 kg, CL 31 cm CW 28 cm, Tag No. 14371.
"	(0832)	"	15292.6/71443.4	15309.3/71465.2	11	10	
"	(1002)	"	15307.5/71475.2	15292.4/71454.0	14	17	
"	(1119)	"	15290.0/71446.3	15273.5/71424.5	15	17	
"	(1235)	"	15261.5/56073.3	15280.9/71458.2	20	21	
"	(1429)	"	15331.5/71513.3	15366.0/71523.1	21	30	Loggerhead(female) CL 70 cm CW 58 cm, Tag No. 14369 Cape Island area.
15/8/79	(1542)	"	15376.8/71525.4	15404.7/71529.6	27	19	
"	(1714)	"	15384.8/71505.9	15359.8/71503.5	12	17	
"	(1825)	"	15258.3/71501.9	15386.0/71506.6	14	10	
16/8/79	(0700)	"	15374.6/71498.4	15340.1/71492.0	6	8	
"	(0807)	30 min.	15333.1/71490.8	15320.8/71494.6	10	8	Lost rudder, almost aground, had to terminate trawling, move offshore and await tow to dock in McClellanville.

Table 4. Catch per unit effort values for marine turtle cruises off major South Carolina nesting beaches.

Cruise	Number and Species	No. of Stations	Total Trawl Hours	Turtle Capture per trawl hour
No.1(28-31 May 79)	1(C.caretta)	28	17.5	.057
No.2(10-13 July 79)	0	19	18.6	.000
No.3(14-16 Aug.79)	2(C.caretta) (L.kempi)	23	22.5	.089
Cumulative results	3	70	58.6	.051

DISCUSSION

The relatively low level of sampling effort imposed by budget constraints, resulted in an area coverage of approximatley three percent of the total study area for the combined cruises. Coverage at this level precludes the development of statistically valid population estimates. In addition, the small number of turtle captures does not enable us to define population parameters such as species, size/age and sex composition for sea turtles in the Cape Romain area. The use of trawling surveys to provide information on population size and other population parameteres does not seem advisable unless the intensity of sampling is substantially expanded. Given the labor and capital intensive nature of research trawl surveys, the expansion of a survey of this type to a level capable of providing statistically reliable results may prove to be prohibitively expensive. The use of observers on commercial shrimp trawlers could provide much of the same information at a lower cost.

A study of this type can be valuable to verify incidental catch data obtained by other methods (i.e. on-board observers) in areas of critical concern such as major rookeries of Cape Canaveral-type areas. One of the objectives of this study was to verify the findings of the 1976 and 1977 incidental catch study (Ulrich, 1978) which indicated that turtle capture rates were no higher in areas with major breeding concentrations that in lightly nested areas of the state. Although our observers had sampled vessels fishing in the present study area we thought it was necessary to concentrate our efforts immediately offshore of the major South Carolina beaches to see if the breeding colony was at particular risk from commercial fishing activities.

The turtle catch/ trawling hour was .022 and .033 in 1976 and 1977, respectively in the area corresponding to the present study area. The cumulative value obtained during this study was .051 turtles per trawl hour which although somewhat higher is in reasonably close agreement. The .051 capture rate is in closest agreement with the 1976 and 1977 Charleston area values of .038 and .053, respectively. It is unfortunate that budget considerations did not allow any direct comparisons to be made between low and high density nesting areas. However, I feel that the present findings support our previous judgement that incidental catch is not significantly higher in high density nesting areas. Although the number of turtles captured during the present study is not high enough to definitively show that mature female turtles are a relatively minor component of incidental catch, our previous work and that of Hillestad (1978) has shown this to be the case.

Sampling problems encountered: In a preliminary survey such as the present study, it seems worthwhile to cover some of the problems that arose during our sampling efforts, in the hope that it will allow others to avoid them or at least be prepared for their occurrence.

As previously noted, gear damage on the second cruise resulted in considerable loss of trawl time until a replacement net could be obtained. Gear damage also occurred on both the first and third cruises, although not nearly as severe. We were able to repair minor tears in the trawl but the result was still a reduction in time available for sampling. A project of this nature, working waters that with respect to "hangs" and bottom topography were totally unknown, should expect a substantial amount of gear damage or loss. It seems advisable for a vessel conducting research of this type to carry two spare nets and one set of doors as back-up gear.

Another problem that should be considered by vessels that may engage in this type research, particularly in areas where the vessel captain has no special knowledge of the area, is the danger of running aground. The shoreline and bottom topography in many areas having large turtle nesting concentrations is particularly dynamic and the existing charts are often of little value when approaching shoal areas. Depths indicated on the charts should certainly not be depended on in such areas.

The poor LORAN C reception that we often experienced in our study area is also related to the problem of maintaining a safe distance from hazardous areas. During storms we were unable to get positions at all from LORAN and during good weather we often found that the 71000 line was 10 microseconds in error. Fortunately, this error was reasonably consistent and by using the radar we were able to confirm our position. Hopefully, the problems with the LORAN C will be alleviated with the new station locations and improved transmitters.

Examination of white-line fathometer recordings from stations at which turtles were caught and comparison with the other station recordings, showed no traces that seemed characteristic of turtles. There were dense echo traces on virtually all of the trawl stations; the majority of these traces presumably made by fish schools.

If future studies of this type are conducted, they should be done with realization that even when trawling effort is directed toward catching turtles, we should not realistically expect catch rates to be significantly higher than those obtained from commercial trawlers working similar areas. The exception to this would be in areas such as the Canaveral ship channel where large concentrations of turtles have been located. The relatively low catch

rates for turtles under normal conditions should be considered when determining the level of effort necessary to make reliable estimates of population parameters.

LITERATURE CITED

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