REPORT OF

WILDLIFE MANAGEMENT STUDY

PROGRESS REPORT (No. 11)

Refuges and Wildlife Resources

Regions 4 and 5

Project: Cape Romain, Chincoteague, and Back Bay NWRs
Code: Chincoteague No. 1
Date: October 31, 1979

Title: An Attempt at the Northward Extension of the Breeding Range of the Atlantic Loggerhead Turtle (Caretta caretta caretta) by Egg Transplants

ABSTRACT

This year, 1979 was the first year of an extension of this study which began in 1969 at Chincoteague NWR and in 1972 at Back Bay and Pea Island NWRs. Each year thereafter these refuges were recipients of loggerhead turtle eggs from Cape Romain NWR.

A total of 30 nests was transferred to Chincoteague and Back Bay NWRs in 1979. The 30 nests averaged 122 eggs per clutch when laid at Cape Romain in early June, were transferred to a Cape Romain nursery within 24 hours, culled 44 to 46 days later and transferred to Chincoteague and Back Bay averaging 95 eggs per clutch.

Hatching success was 44.0 percent at Chincoteague with 544 hatchlings released to the ocean and 63.6 percent with 1,018 hatchlings released at Back Bay. This was a combined hatching percentage of 55.0 percent of the culled eggs and 42.6 percent of the eggs originally laid, up only slightly over the previous year.

Hatching chronology was similar on both areas and also to 1978 in dates and spans but two weeks longer in incubation periods on both areas from the previous year. Again, there appeared to be only minor differences between hatching spans and hatching success.

Hatching success was highest at Back Bay NWR for the fifth consecutive year. Two factors may have influenced the lower success at Chincoteague in 1979. These were location of the Chincoteague nests in the Cape Romain nursery and much cooler minimum sand temperature and greatly wider differences from maximum temperatures.

Natural loggerhead turtle use was lower on Cape Romain in 1979 from the previous year but new predator control and nursery programs contributed to an increase in hatchling production there. Back Bay NWR had its first documented loggerhead nest in at least 20 years. The vicinity of Chincoteague had a nest this year and Pea Island NWR had an increase in nests this year. These increases may be due to requested increased surveillance of turtle activity.

There is a strong possibility that the study may not be approved by the Endangered Species Office in 1980 or that stringent requirements may not be funded and an approved study not be conducted. We recommend the study be continued as in 1979 if approved by the SE Marine Turtle Recovery Team and ES Permit Office and funding is allocated.

The Cape Romain predator control and nursery programs should be continued and the Chincoteague sand temperature collections should be extended to Cape Romain, Pea Island and Back Bay in 1980.

Intense summer beach patrolling should be continued throughout the summer of 1980.

OBJECTIVES

The primary objective of this study which began in 1969 was to experimentally transplant loggerhead turtle eggs from an established colony at Cape Romain NWR, South Carolina to northward coastal NWRs on which these sea turtles originally were located in Virginia and North Carolina. If it could be determined that these experimental egg transplants were successful, an expanded management type transplant program then could probably be set up and conducted annually to re-establish the loggerhead firmly on newly protected ocean beaches. Refined methods of transfer, transplanting, dates, times and monitoring would be developed to increase the success of the program.

INTRODUCTION

The study was begun at the recommendation of Chincoteague NWR Manager J. C. Appel in 1969 following Regional Office approval in 1968. Loggerheads previously had been reported to nest there but extensive beach front development and use plus a reduction in the adult population resulted in only rare nesting attempts on the Maryland, New Jersey, Delaware and Virginia coasts. Slower development of much of the North Carolina coastline resulted in somewhat higher than rare loggerhead nesting there. Back Bay and Pea Island NWRs, at the request of their Managers, Dennis Holland and N. F. Williamson, entered the egg transplant program in 1972 because of the anticipation of additional protected beaches.

The original study outline set the conclusion of the egg transplant study from Cape Romain NWR to Chincoteague, Back Bay and Pea Island NWRs at the end of the 1977 season. However, due to severe natural nest losses at Cape Romain in 1976, no transplants were conducted that year and the study was extended until the end of 1978. Limited production at Cape Romain in 1977 resulted in enough nests only for Chincoteague and Back Bay so that the Pea Island portion of the study could have been extended through 1979. By mutual agreement with Manager Williamson, however, 1978 was the final transplant year on Pea Island.

Due to various reasons as included in the Recommendations section of Progress Report No. 10 (October 31, 1978), the study was extended an additional year. This was at the request of Chincoteague NWR Manager Appel and Back Bay NWR Manager Glenn Bond; Pea Island NWR did not want to be included in the extension. In January, 1979 Manager Appel submitted a three-year extension proposal for the study to begin in 1979 and run through 1981. I modified the proposal to include Back Bay, to include committments from both Chincoteague and Back Bay staffs for increased natural crawl surveillance on the NWRs, satellite and adjacent beaches, and to conduct the extension on an annual review and determination basis rather than for three years. This annual renewal would be dependent on natural production on Cape Romain, funding and yearly evaluations. The modified proposal was submitted through proper channels beginning at the Asheville, N. C. and Annapolis, Md. area offices and to the Endangered Species

Permit Office in Washington, D. C. in May, 1979. They in turn sent a copy of the proposal to the SE Marine Turtle Recovery Team whose co-chairperson, Sally Hopkins commented on the non-detrimental effects of the study for one more year in June, 1979. On this basis, the 1979 study portion was conducted.

On July 1, 1978 the Atlantic Loggerhead sea turtle, by similarity with other endangered sea turtles, was placed on the national "threatened species" list so that it is fully covered by the 1973 Endangered Species Act. In late 1978, the SE Marine Turtle Recovery Team was formed consisting of members and consultants from all southeastern States, the National Marine Fisheries Service, the Fish and Wildlife Service, the Florida Audubon Society, Monitor, Institute of Ecology and several universities. This team has been charged with the writing of a recovery plan to include five species of marine turtles and the first draft of the plan should be completed by late 1979.

METHODS

For the first time since study project beginning in 1969, nests on Cape Romain NWR were put into a nursery prior to transfer. This was done because nesting mortality to raccoons was extreme in both 1977 and 1978 and natural production was very limited. Nests were transferred to the nursery within a few hours of laying on June 9 to 11, 1979 on the Cape Island beach and marked for transfer. Thirty nests were marked and on July 24, thirty nests were transported in styrofoam coolers to Chincoteague and Back Bay personnel.

The Chincoteague NWR eggs from 15 nests were picked up by Ed Britton and transplanted into individual wire enclosures on the beach on July 26, 1979. The Back Bay eggs, also from 15 nests, were transported by Irvin Ailes and buried on the Back Bay beach in enclosures on July 25. Several personnel on both areas checked the transplanted nests twice each day thereafter until the project completion dates of August 31 at Back Bay and September 21 on Chincoteague.

Hatchlings were counted and released into the surf daily in the morning of the night they emerged. Record keeping and other procedures were generally the same as had been utilized in previous years of the study.

Expanded patrolling of both refuge beaches, adjacent private and public beaches and satellite beaches was conducted in the summer of 1979 as prescribed in the aforementioned section.

RESULTS

At Cape Romain NWR during the 1979 loggerhead turtle nesting season a total of 1,263 loggerhead nests was laid of which 1,032 were laid on Cape Island. In addition, there were an estimated 3,816 false crawls. In 1978, there were 1,828 nests and 5,252 crawls so that there was a 30.9 percent decrease in nesting at Cape Romain NWR in 1979. However, raccoon predation was so severe

in 1978 that only 2,200 turtles were reported to have been produced there. This year, 82 raccoons were removed from Cape Island and a predator-proof nursery was operated in which 256 nests were transferred and raccoon depredation was significantly reduced. Then in early September, at the time that the last of the major number of nursery eggs were to hatch, Hurricane David inundated nearly all of Cape Island including the nursery and destroyed the remainder of the nests. At the time 117 nests had successfully hatched 10,483 hatchlings. Total loggerhead turtle production on Cape Romain NWR in 1979 was estimated at 13,500 hatchlings to the ocean. Raccoon predation on nests on Cape Island still was a major factor as 529 nests were known destroyed by this predator plus 352 to tidal flooding.

Following are the hatching results of the 30 nests transferred to Chincoteague and Back Bay NWRs:

Chincoteague NWR:

Fifteen nests were transferred to Chincoteague NWR on July 24, 1979 when seven nests were 45 days old and eight were 44 days old. The nests had 1,798 eggs when laid at Cape Romain on June 10 and 11 for an average of 120 eggs per clutch. When transferred, 539 or 30.0 percent were culled as infertile and 1,259 were actually transferred to Chincoteague. These were transplanted into 15 enclosures on Chincoteague on July 26. All nests produced hatchlings with successes varying between 9.7 and 61.7 percents and an average of 44.0 percent success. A total of 554 eggs hatched of which 544 were released into the ocean compared to 724 in 1978 and 482 in 1977. Of the 544 released this year, eight were observed to have been killed by gulls at the time of release. The individual nest successes are presented in Table 1.

The schedule of hatching times for the 15 Chincoteague nests are presented in Table 4. Hatchlings began emerging from 61 (August 10) to 71 (August 20) days with an average of 64 days (August 13) from being laid on Cape Romain compared to only 50 days (August 12) in 1978 in 11 nests. Completion of hatching per individual nests varied from 67 days (August 16) to 90 days (September 8) with an average of 75 days (August 24) compared to 60 days (August 22) in 1978. The hatching span in 1979 varied from 2 to 29 days with an average of 12 days compared to 6 to 21 days and an 11-day average in 1978 when hatching success was 73.8 percent compared to 44.0 percent this year. These data indicate a much longer (two weeks) incubation period in 1979 and could have been due to several factors including the moving of the eggs a few hours after being laid into the nursery at Cape Romain. Again as in previous years, no correlation seems to be evident between hatching success and length of days to complete hatching nor in success and percentage of hatch completed in a given time.

Back Bay NWR:

A total of 15 loggerhead turtle nests also was transferred to Back Bay NWR on July 24, 1979, 46 days after being laid on the Cape Island beach. The nests had 1,849 eggs for an average of 123 each when laid on June 9. Only 245 or

13.3 percent were culled as infertile on July 24 and 1,604 eggs were packed in sand into 15 styrofoam coolers and transplanted into 15 wire enclosures on the Back Bay beach on July 25. One of these did not produce any hatchlings while the remaining 14 had hatching successes ranging from 33.6 percent to 87.0 percent and an average of 63.6 percent for all 15 nests compared to 87.0 percent for eight nests in 1978 and 76.4 percent in 1977. An explanation can be given to the wide difference between the 30.0 percent and 13.3 percent infertile egg cullings on Cape Romain where seemingly the same treatment was given to the 30 nests transferred to their nursery. Cape Romain Assistant Manager Larry West observed that the row of nests that the Chincoteague nests came from in the nursery was adjacent to a path down the middle of the nursery and that walking on the nests could have influenced viability. Of the 1,020 eggs hatching in the 14 successful nests transferred to Back Bay in 1979, all but two hatchlings were released in the ocean (Table 2) compared to 579 in 1978 and 737 in 1977.

Hatching chronology of the 1979 Back Bay nests is presented in Table 5. Hatchlings began emerging from 65 days (August 12) to 70 days (August 17) and averaged 66 days (August 13) compared to an average of 55 days (August 13) in 1978. The completion of hatching ranged from 67 to 84 days (August 31) with an average of 74 days (August 21) compared to 65 days (August 23) in 1978. The hatching span varied from 2 to 17 days with a 9-day average this year while 6 to 17 days occurred the previous year with an 11-day average. As occurred on Chincoteague, the incubation period was significantly longer in 1979 and may be related to the double moving of eggs which occurred for the first time this year with the establishment of the Cape Romain NWR nursery. Hatching spans do not appear to change appropriately from year to year nor from area to area, although egg incubation lengths do change rather widely. Converse to previous years and to Chincoteague this year, the three Back Bay nests with the longest hatching spans had poorer hatching success. But, at the same time two nests with the shortest hatching spans had lower successes than some longer nests. It should also be pointed out from Table 5 that three nests having the longest period between initial hatching and 75 percent hatchling emergence had lower than average nesting success while only one of eight nests having 75 percent emergence immediately after initial emergence had poor success. This finding is not evident in the Chincoteague chronological data shown in Table 4.

Combined 1979 Data:

For easier comparisons of the 1979 loggerhead egg transplant data, results have been combined in Tables 3 and 6. In Table 3 note that 2,863 eggs or 78.5 percent of those laid in the 30 nests on Cape Romain were transferred to Chincoteague and Back Bay NWRs and transplanted into 30 individual nest enclosures. Of these 1,574 or 55.0 percent hatched and 1,289 or 45.0 percent did not and 1,554 hatchlings entered the Atlantic Ocean. This was a 5.2 percent increase in eggs transferred in 1978 and a 10.2 percent decrease in hatchling production. The 1979 total to the ocean was 42.6 percent of the total eggs laid on Cape Romain NWR in June compared to 40.2 percent in 1978

and 61.6 percent in 1977. Also note that Back Bay's hatching success was nearly 20 percent higher than Chincoteague's as 1979 was the fifth consecutive year of higher success at Back Bay than Chincoteague.

In Table 6 note the similarity of the chronological hatching data between the two areas. The hatching process appears a little more drawn out at Chincoteague although hatchling emergence began at the same time. As already mentioned, the 1979 hatching period involved a longer period than required in 1978 as the average starting time of emergence was 12 days longer this year and ended 13 days longer despite occurring in the same time of the month both years and in the same span of time.

Combined 1969 to 1979 Data:

This year was the eleventh year of the study and tenth year of loggerhead turtle egg transplants since none were sent in 1976. This Progress Report No. 11 deals specifically with the 1979 data with some 1977 and 1978 comparisons. Accumulative data needs to be tabulated and reported but will not be done as a Final Study Report until transplants are completed either this year, 1980 or 1981. Endangered Species Office permit, issuance, requirements and funding will dictate which year the transplanting will be terminated and final data will be reported. A preliminary accumulative report will be prepared prior to the January, 1980 SE Marine Turtle Recovery Team meeting in order to update the Team on the experiment and aid them in forming an opinion as to whether or not to approve the permit application.

Natural Use and Production:

Beach patrolling on Chincoteague and Back Bay NWRs increased this year and adjacent area checks were more numerous and organized also. Chincoteague NWR's beach was patrolled daily by Refuge personnel. Adjacent Assateague Island beach was patrolled daily by National Park Service personnel and the Hook area was patrolled daily by either FWS or NPS people. Wallops Island was patrolled at least once a week by FWS personnel from Chincoteague NWR and daily by NASA cooperators. Results were scarce for all the patrolling done as no crawls were found on the NWR, one was found on Assateague and one nest with 129 eggs was found at Wallops Island. These two crawls and one nest were all increases over last year's negative findings and were the first crawls and nests since one nest of 144 eggs was found at Assateague in 1977 and two nests were found on Chincoteague and a crawl on Wallops Island in 1975. Increased patrolling also resulted in increased findings of dead turtles as eight were found on Chincoteague, two were found at Assateague and one was found at Wallops Island in 1979. This compares to four on Chincoteague only in 1978.

Increased surveillance also occurred on and around Back Bay NWR in 1979 over 1978. The Back Bay NWR beach and False Cape beach were checked daily by Refuge personnel. The Dam Neck beach was checked daily by Department of Defense cooperators and Fishermen Island NWR was checked weekly by either Refuge or

Virginia Institute of Marine Science personnel. As a result of this increased emphasis in the search for marine turtle activity, a crawl ending in a nest was found at False Cape and two crawls and a nest were found on the Back Bay beach. This compares to only one crawl being observed on Back Bay NWR in 1978 and no activity around the Refuge that year while a crawl was observed at False Cape in 1977 and a nest occurred between the Refuge and Dam Neck in 1976. Two dead turtles were found at Back Bay NWR this year while two were found at Dam Neck, one between the areas, two at False Cape and one at Fisherman Island. This compares to four at Fishermen Island and one at Back Bay in 1978. These strandings were received from VIMS because of a special study done in 1979 in which over 200 dead loggerheads were reported from Virginia this year.

Natural sea turtle use from Pea Island NWR and vicinity also is being included here because this area was included in the transplant study from 1972 through 1978. Refuge and Park Service beaches to the north and south were patrolled daily by respective personnel. On the 13 miles of Refuge beach 12 false crawls and 9 loggerhead nests were found in 1979 compared to 7 nests and 7 false crawls in 1978 and 3 nests and a crawl in 1977. In addition, 1 nest was found by the NPS on their beach north of the Refuge and another nest a few miles south of the Refuge compared to 2 nests north in 1978. Six of the Refuge's 9 nests were moved to an enclosed nursery site along with both the NPS nests and produced 632 hatchlings. Of the three NWR nests left in place, two were lost to tides and one produced about 70 hatchlings. These 700 hatchlings released in 1979 were an increase over the 559 released in 1978. Hatching success in 1979 at Pea Island was reported at 71.6 percent compared to 60.1 percent in 1978. There were four dead loggerheads found on the Pea Island beach and one just north and two stranded crippled turtles south in 1979.

Sand Temperatures:

In 1978, Chincoteague NWR personnel undertook a study to collect sand temperature data from the nursery enclosure. This involved using a laboratory dial thermometer placed at six-inch intervals in the sand within the egg transplant cylinders. Readings were taken early in the morning, mid-day and late afternoon. This was repeated in 1979 and following are the data for the two years as reported.

Depth	Maximum °F		Minimum °F		Mean °F	
	1978	1979	1978	1979	1978	1979
Surface	82	92	78	60	NA	77.5
6 inches	82	88	78	63	NA	76.5
12 inches	81	85	78	70	NA	76.3
18 inches	81	82	78	70	NA	75.9
24 inches	80	80	76	70	NA	75.4
Averages	81.2	85.4	77.6	66.6	NA	76.3

Note that 1978 maximum temperatures averaged over four degrees cooler than 1979 but minimum temperatures were only 3.6 degrees cooler than maximum temperatures. In 1979 however, maximum temperatures were considerably warmer but minimum temperatures were 18.8 degrees cooler and 11 degrees cooler than 1978 minimums. Whether or not this contributed to the lower hatching success at Chincoteague in 1979 is not known but less drastic temperature changes are known to occur in more southerly areas where most marine turtle nesting occurs.

Summary and Conclusions:

The hatching success of 30 loggerhead turtle nests containing 3,647 eggs laid on Cape Island of Cape Romain NWR from June 9-11, 1979 and transferred to Chincoteague and Back Bay NWR on July 24, 1979 was 42.6 percent. This was only slightly better than 1978's 40.9 percent which was the poorest year in seven years of egg transplants associated with this study. Hatching success in 1979 was highest at Back Bay NWR for the fifth consecutive year. Natural loggerhead activity appeared to be higher at Chincoteague, Back Bay and Pea Island NWRs in 1979 but may have been due to more adequate surveillance and interest.

Recommendations:

As mentioned earlier, permit restrictions, funding and manpower may prevent continuance of this study into the twelfth year. It is our recommendation that the egg transplant portion of the study be continued for another year from Cape Romain NWR to Chincoteague and Back Bay NWRs. This should be contingent on the assumption that Cape Romain NWR will conduct an active raccoon control program and continue the use of their nursery.

If one of the Permit Office requirements is to provide Chincoteague and Back Bay sand to Cape Romain personnel to gather their eggs in, then this requirement should be funded and carried out. If this is not one of the requirements, it should be conducted on part of the nests (if current funds exist) to measure any difference in hatching success.

In the event the program is extended for another year and the necessary permits are acquired, I recommend a transplant at the capacity of 1979, that is 15 nests each to Chincoteague and Back Bay.

Whether or not the transplant portion of the study is extended to 1980, I strongly recommend that the monitoring of natural sea turtle activity continue not only on the NWR beaches but continued on adjacent private, State and non-FWS Federal beaches. This is encouraged at least at the level of 1979 patrolling and even better at Wallops Island, Fishermen Island and on private beach south of Pea Island.

If the transplant study continues through 1980, I recommend that refuge staffs at Cape Romain, Pea Island and Back Bay collect sand temperature readings from

beach and nursery areas utilizing the same methods currently used on Chincoteague NWR. I will prepare a temperature collection procedures outline and form to encourage uniform data collection.

Distribution of Progress Report No. 11:

Regional Offices, Regions 4 and 5
Area Offices, Asheville, N. C. and Annapolis, Md.
Cape Romain NWR
Chincoteague NWR
Back Bay NWR
Pea Island NWR
S. E. Marine Turtle Recovery Team

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November 9, 1979

Table 1
Hatching Success of Loggerhead Turtle Eggs
Transferred from Cape Romain NWR to Chincoteague NWR
1979

Nest No.	Nest Code	No. Eggs Laid	No. Eggs Tr'fered	Age at Transplant	Hatched No.	Hatched %	Not Hatched No.	Not Hatched %	No. to Ocean
1	S-62	128	72	45 days	7	9.7	65	90.3	7
2	S-63	144	60	45 days	37	61.7	23	38.3	36
3	S-64	110	80	45 days	45	56.3	35	43.7	45
4	S-65	144	132	45 days	71	53.8	61	46.2	70
5	S-66	127	92	45 days	39	42.4	53	57.6	37
6	S-68	111	70	45 days	18	25.7	52	74.3	18
7	S-69	95	101	45 days	59	58.4	42	41.6	57
8	S-70	104	60	44 days	12	20.0	48	80.0	12
9	S-71	58	46	44 days	21	45.7	25	54.3	21
10	S-72	153	94	44 days	53	56.4	41	43.6	50
11	S-73	154	139	44 days	72	51.8	67	48.2	72
12	S-74	95	71	44 days	36	50.7	35	49.3	36
13	S-75	132	112	44 days	21	18.8	91	81.2	21
14	S-77	125	34	44 days	10	29.4	24	70.6	9
15	S-78	118	96	44 days	53	55.2	43	44.8	53
Totals		1798	1259*	-	554	-	705	-	544**
Averages		120	84	44½ days	37	44.0	47	56.0	36

* Cape Romain records show that 12 more eggs were transferred
** Gulls caught 8 after release

Table 2
Hatching Success of Loggerhead Turtle Eggs
Transferred from Cape Romain NWR to Back Bay NWR
1979

Nest No.	Code	No. Eggs Laid	No. Eggs Tr'fered	Age at Transplant	Hatched No.	Hatched %	Not Hatched No.	Not Hatched %	No. to Ocean
1	S-47	109	108	46 days	88	81.5	20	18.5	88
2	S-48	105	82*	46 days	38	46.3	44	53.7	38
3	S-49	105	102	46 days	93	91.2	9	8.8	93
4	S-50	106	99	46 days	40	40.4	59	59.6	40
5	S-51	99	81	46 days	69	85.2	12	14.8	69
7	S-52	153	126	46 days	70	55.6	56	44.4	69
8	S-53	143	123	46 days	107	87.0	16	13.0	107
9	S-54	137	135	46 days	96	71.1	39	28.9	96
10	S-55	146	137	46 days	46	33.6	91	66.4	45
11	S-56	72	72	46 days	0	0.0	72	100.0	0
12	S-57	112	103	46 days	76	73.8	27	26.2	76
13	S-58	131	96	46 days	58	60.4	38	39.6	58
14	S-59	137	104	46 days	70	67.3	34	32.7	70
15	S-60	143	110	46 days	86	78.2	24	21.8	86
16	S-61	151	126	46 days	83	65.9	43	34.1	83
Totals		1849	1604*	–	1020	-	584	-	1018
Averages		123	107	46 days	68	63.6	39	36.4	68

* Cape Romain NWR records show that 33 more eggs were transferred

Table 3
Summary of Loggerhead Turtle Egg Transplants
from Cape Romain NWR
1979

Transferred to	Date	No. Nests	No. Eggs	Avg. Age (Days)	Hatched		Not Hatched		To Ocean		No. Eggs in Orig. Nest
					No.	%	No.	%	No.	%	
Chincoteague	7/24	15	1259	44½	554	44.0	705	56.0	536	42.6	1798
Back Bay	7/24	15	1604	46	1020	63.6	584	36.4	1018	63.5	1849
Totals and Averages	-	30	2863	45¼	1574	55.0	1289	45.0	1554	54.3	3647

Table 4
Chronology of Hatching of Loggerhead Turtle Eggs on
Chincoteague NWR - Transplanted July 26, 1979

Nest No.	No. Eggs	Hatching Dates				Days to Start	Days to Finish	Days Hatching Span	Percent Hatched
		Begin	50%	75%	100%				
1	72	8/12	8/17	8/18	8/20	64	72	9	9.7
2	60	8/13	8/17	8/17	8/18	65	70	6	61.7
3	80	8/11	8/15	8/17	8/19	63	71	9	56.3
4	132	8/10	8/14	8/16	8/27	62	79	18	53.8
5	92	8/14	8/17	8/21	8/31	66	83	18	42.4
6	70	8/18	8/18	8/18	8/19	70	71	2	25.7
7	101	8/11	8/12	8/13	8/16	63	68	6	58.4
8	60	8/20	8/26	8/27	9/3	71	85	15	20.0
9	46	8/16	8/16	8/18	8/26	67	77	11	45.7
10	94	8/11	8/12	8/13	9/8	62	90	29	56.4
11	139	8/13	8/17	8/19	9/3	64	85	22	51.8
12	71	8/11	8/13	8/16	8/21	62	72	11	50.7
13	112	8/12	8/13	8/13	8/19	63	70	8	18.8
14	34	8/10	8/14	8/15	8/16	61	67	7	29.4
15	96	8/10	8/12	8/15	8/22	61	73	13	55.2
Averages	1259	8/13	8/16	8/17	8/24	64	75	12	44.0

Table 5
Chronology of Hatching of Loggerhead Turtle Egg Transplants on Back Bay NWR - Transplanted July 25, 1979

Nest No.	No. Eggs	Hatching Dates				Days to Start	Days to Finish	Days Hatching Span	Percent Hatched
		Begin	50%	75%	100%				
1	108	8/13	8/13	8/13	8/18	66	71	6	81.5
2	82	8/17	8/17	8/17	8/25	70	78	9	46.3
3	102	8/13	8/15	8/15	8/16	66	69	4	91.2
4	99	8/15	8/19	8/19	8/31	68	84	17	40.4
5	81	8/12	8/14	8/14	8/17	65	70	6	85.2
7	126	8/13	8/13	8/19	8/31	66	84	19	55.6
8	123	8/12	8/12	8/12	8/18	65	71	7	87.0
9	135	8/12	8/12	8/12	8/18	65	71	7	71.1
10	137	8/15	8/17	8/17	8/31	68	84	17	33.6
11	72	-	-	-	-	-	-	-	0.0
12	103	8/14	8/14	8/14	8/15	67	68	2	73.8
13	96	8/12	8/12	8/15	8/22	65	75	11	60.4
14	104	8/15	8/15	8/15	8/25	68	78	11	67.3
15	110	8/12	8/12	8/12	8/14	65	67	3	78.2
16	126	8/12	8/12	8/12	8/17	65	70	6	65.9
Averages	1604	8/13	8/14	8/15	8/21	66	74	9	63.6