NESTING ECOLOGY OF ALLIGATORS IN LOUISIANA

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INTRODUCTION

According to McIlhenny (1935) the alligator, *Alligator mississippiensis*, with the exception of the crocodile, *Crocodylus acutus*, of southern Florida, is by far the largest reptile inhabiting the United States. This species is found throughout Louisiana, with the bulk of the population located in the coastal marshes of the state.

During the late 1950's concern for the survival of this species arose due primarily to excessive hide hunting. So numerous were these reptiles that old hunters speak of having seen their eyes in the glare of the headlights shining on the bayou waters as thickly as stars overhead. In the spring the bellow of the male was one of the most characteristic sounds of the marshes.

In the middle of the 1920's the coastal marshes were beginning to open up primarily for trapping of fur bearing animals. Canals were dug through the remote areas, trapping camps built as strategic intervals, and systematic exploration of the natural resources begun.

Fur was trapped in the winter and alligators were hunted during the remained of the year. During the extremely dry years, such as 1925 and 1926, many gators were forced to leave their dens and make new ones wherever they could find water. At this time the marshes were burned and many thousands of alligators were killed by hide hunters. McIlhenny (1935) estimated that from 3 to 3½ million were harvested in Louisiana between 1880 and 1933.

Today, probably the only remaining sizable population of alligators are located throughout the refuges which are both state and federally owned. Also, large tracts of land which are privately owned support good populations of alligators. Large swamps and marshes that are inpenetrable to man also possess good populations of alligators.

Very little is known about the life history of this ancient reptile and in the past management of the alligator was limited to regulating the harvest. In 1963, the season was closed statewide and concentrated efforts were made by the Louisiana Wild Life and Fisheries Commission to re-establish this population.

Rockefeller Refuge serves as one of the last strongholds of the alligator in the state and with this in mind the project under report was begun to better enable the Commission to more efficiently re-establish this valuable species. The refuges comprises approximately 85,000 acres of coastal marshland of which 25,000 acres are under the impoundment system of management. These marshes provide excellent nesting habitat for alligators although certain marsh types are preferred over others. However, information was needed on the factors associated with reproduction such as nesting success, nest predation, and habitat preferences before definite plans could be formulated for the management of these reptiles.

During the summer of 1964 a study was initiated on the nesting ecology of alligators on Rockefeller Refuge. The objectives of the study were: (1) to determine activities of the female associated with nesting, especially during the incubation period, (2) to determine the nesting temperatures inside and outside the nest, (3) to determine the preferred nesting habitat, nest dimensions, number of eggs present in each nest, and reproductive success, (4) to determine the kind and amount of nest losses on alligator eggs due to predation and other causes.

DESCRIPTION OF STUDY AREA

This study was conducted on Rockefeller Refuge in Southwestern Louisiana. The refuge is owned and operated by Louisiana Wild Life and Fisheries Commission and encompasses some 85,000 acres of coastal marshland. It is bounded on the south by the Gulf of Mexico and on the north by the Grand Chenier-Pecan Island stranded beach ridge complex.

Rockefeller Refuge as a whole, excluding the impounded areas, in a wiregrass, *Spartina patens*, marsh.

Marsh elevation averages 1.1 feet above mean sea level. Tide water enters the refuge from the Gulf of Mexico through five separate channels and then spreads out to all parts of the refuge with the exception of the impounded areas. The average tidal variation is one foot, however, high tides frequently inundate the marshes with salt water.

The fresh marsh, a narrow belt adjacent to the Chenier, possesses the maximum water depths. Removal of water on the fresh marsh during the summer permits the germination of annual grasses. As a result, large stands of *Echinochloa walteri, Leptochloa fascicularis, Panicum dichotomiflorum* frequently grow on exposed or shallow mudflats on the fresh marsh and produce seeds which are eaten in quantity by waterfowl.

More than 75 per cent of the vegetation of the refuge is growing on brackish sites. This brackish area is dominated by wiregrass, *Spartina patens*, but contains some *Distichlis spicata*. The subclimax species, leafy three-concerned grass, *Scirpus robustus* and three-cornered grass, *Scirpus olneyi*, are present, but the area occupied by these species is very small.

The aquatic communities are composed chiefly of wigeon-grass, *Ruppia maritima*, dwarf spike rush, *Eleocharis parvula*, and *Potamogeton sp.* Wigeongrass is the only aquatic found in the salt marsh ponds. Some moist sites are dominated by sea purslane, *Sesuvium portulacastrum* (Joanen and Glasgow, 1965).

STUDY METHODS

During this study, eleven alligator nests were equipped with the Stephens Model F Recorder used to record movement of the female over the nest and four were equipped with the Taylor Model 76J temperature recorder. The Taylor recorder had two remote thermocouples and the temperature of each was recorded on a clock driven chart. One thermometer was placed inside the nest to record continuous nesting temperatures, the other was located outside to record air temperature and was used for comparison. The movement recorders were equipped with a trip wire stretched across the nest to record movement of the female.

For locating alligator nests, an airplane and marshbuggy equipped with radio communications were used. When an alligator nest was located communications were made with the marshbuggy and the ground crew would then locate and flag the nest. After the nests were located, weekly checks were made throughout the incubation period. Information recorded from each nest consisted of nest location, marsh or levee, marsh type, number of eggs present, nest dimensions, egg cavity dimensions, vegetation used in nest construction, size of the female, presence of the female, distance of the nest from permanent water, date eggs hatched, water level in marsh, water salinity, distance to other alligator nest, per cent of eggs hatched, and predation on the nest.

During the 1968 study, two Short and Manson Hair Hygrographs were inserted into two nests. These instruments were used to record relative humidity inside the egg cavity. One hygrograph was used as a control and mounted on a stand adjacent to the gator nest. Humidity was recorded from 0 to 100 per cent on an even scale over a weekly chart. These instruments were placed inside the nest just adjacent to the egg cavity and covered over with nesting material. The instruments

were protected from the nest material by placing the hygrographs in a small wooden box. This box was perforated to permit air exchange from the nest to the hair hygrographs.

For classifying the movements of the females over the nest, each day was broken down into four separate periods. These periods were set according to the light intensity.

Period 1 began an hour before sunset and extended one hour after sunset. This period was two hours long.

Period 2 began one hour after sunset and extended through the night ending one hour before sunrise. The time for this period was 10 hours and 10 minutes.

Period 3 began one hour before sunrise and terminated at one hour after sunrise. This period extended through the dawn and covered two hours.

Period 4 extended from one hour after sunrise to one hour before sunset and included the daylight hours. The period was 9 hours and 50 minutes. (Chabreck, 1962.)

DISCUSSION OF RESULTS

Activity of the Female at the Nest

Although eleven nest were equipped with movement recorders, only four nest produced live young. The remainder of these nests were either destroyed by raccoons, *Pyrocyon lotor*, high water, or contained infertile eggs and were later abandoned by the female. The information from these seven nests were not included in the movement data.

As shown in Table 1, alligator crossings for the various periods followed the same general trend throughout the study. In subjecting the data to a statistical analysis on the effect of rain and day periods

TABLE 1. Number of alligator nest crossings as affected by rain and day periods during incubation, 1965-1968, Rockefeller Refuge.

Year of Study	No Rain				Rain				
	Periods				Periods				
	1*	2**	3†	4‡	1*	2**	3†	4‡	Total
1965	0	11	0	1	0	6	0	0	18
1966	1	4	4	3	1	6	2	4	25
1967	0	4	1	0	0	2	0	1	8
1968	0	9	0	1	0	4	1	0	15
Total	1	28	5	5	1	18	3	5	66

upon alligator nest visits a factorial arrangement with orthoginal comparisons (Table 2) was used assuming years to be replications (Snedecor, 1956).

Data analyzed revealed that rain periods showed no statistical significant difference at the 0.05 level of probability and that day periods were significant ($P<0.01$) in affecting nest visits. A closer analysis of the periods revealed that only Period 2 (night) was significantly different from Periods 1, 3, and 4 (daylight) in affecting these visits ($P<0.01$).

Our two other logical comparisons were Periods 1 and 3 (sunset and sunrise) against Period 4 (day), and Period 1 (sunset) verses Period 3 (sunrise). These both proved not to be significantly different in affecting alligator nest visits at the 0.05 level of probability.

Interactions of periods and rainfall were not significant at the 0.05 level of probability; differences of rainfall and periods did not change

* Period 1—one hour before sunset to one hour after sunset.
** Period 2—one hour after sunset to one hour before sunrise.
† Period 3—one hour before sunrise to one hour after sunrise.
‡ Period 4—one hour after sunrise to one hour before sunset.

with each other or it can be restated that the periods were constantly high or low regardless of rain. Periods and rain were not related to each other.

A review of Table 1 indicates that alligator movement over the nest was greatest during Period 2 or at night. Period 4 which covered daylight hours was second with only one-fourth the number of crossings recorded as compared to night time hours. Period 3, which extended through sunrise ranked third in the number of visits and the least amount of movement occurred during Period 1 which covered the 2-hour period of one hour before sunset to one hour after sunset.

Since Period 1 and Period 3 represents the dusk and dawn hours respectively, both periods show drastic changes in light intensity. Also, both periods were of two hour durations. However, as previously stated

TABLE 2. Analysis of variance of the number of alligator nest crossings as affected by rain and day period during incubation, 1965-1968, Rockefeller Refuge.

ANOV Source	Degrees of Freedom	Sum of Squares	Mean Squares	"F" Values
Replication	3	18.63		
Rain	1	4.50	4.50	1.55
Period	3	149.38	49.79	17.17**
P_2 vs P_1 P_3 P_4	1	145.04		50.01**
P_4 vs P_1 P_3	1	2.08		0.72
P_1 vs P_3	1	2.25		0.78
Period-Rain Interaction	3	8.50	2.83	0.98
Error	21	60.87	2.90	
Total	31	241.88		

the movements for these periods were found not to be statistical significant at the 0.05 level of probability. This could be due to the fact that only one year recorded crossing in Period 1 and three years recorded movement in Period 3 for the four year study.

Although alligators crossed the nest at all hours of the day, the study clearly shows that activity is far greater at night.

It was common belief that the female alligator crosses the nest daily during the incubation period and with each crossing wets, adds material, or repairs the nest. McIlhenny (1935) states that the female slides across her nest after each rain backwards and forwards to slick down the top material that may have been roughed by the action of the raindrops. He also states that the alligator crawls over the nest and evacuates a considerable amount of water on top of the nest so as to keep the nest material wet and the eggs damp. He farther stated that this wetting down was done with great regularity each day or night during periods of drought.

During this study it was found that alligators pay little attention to their nest after the eggs were deposited. The four nests which produced live young and were equipped with the movement recorders tallied 66 visits during the incubation period. Each nest varied in the number of crossings with one nest recording as few as 8 visits and one nest as many as 25 during the 65-day period. The majority of the crossings occurred during the first, second, third, and ninth weeks of incubation. Of the total number of visits recorded 18.2 per cent were made during the first week, 21.2 per cent were made during the second week, 15.1 per cent in the third week, 9.1 per cent for the fourth week, 1.5 per cent in the seventh week, 7.6 per cent in the eighth week and 27.3 per cent in the final week. No movements were recorded during the fifth and sixth weeks of incubation.

** Highly significant at the 0.01 level of probability.

Temperatures in the Egg Cavity

Temperatures within the egg cavity for the four year study averaged 82.8°F. with 73.9°F. being the lowest temperature recorded and 91.0°F. the highest. Air temperatures outside the nest during this same time interval averaged 87.2°F., however, temperature extremes of 68.7°F. and 106.7°F. were recorded. There was only 4.4 degrees difference between the average inside and outside temperatures, however, outside temperatures showed a much broader temperature fluctuation. Temperatures within the egg cavity remained fairly constant throughout the entire incubation period. These nests were constructed almost entirely of vegetation with *Spartina patens* being by far the most important plant species. McIlhenny (1935) reports the inside heat was produced from the decaying vegetation of which the nest is composed.

Modha (1967) reports similar temperatures inside the nests of Nile Crocodiles. These measurements were made 15 cm. below the surface of the nest.

Relative Humidity of Nest

Relative humidity in the nest ran extremely high and relatively constant throughout the incubation period. As would be expected, the control unit showed extreme daily fluctuations. During the 1968 study, rainfall was fairly evenly distributed throughout the nesting period. On each weekly visit to these nest, by persons conducting this study, nesting material surrounding the egg cavity was visibly moist. However, during the 1967 study vegetation surrounding the egg cavities of the majority of the nests under observation were dry and brittle. Modha (1967) reports this dryness in crocodile nests resulted in very low hatching success. Low hatching success as a result of dryness in the egg cavity was not demonstrated in this study. However, no extreme drought was experienced over any extended periods. Moisture is essential in the hatching and development of the egg and it could be possible that an extreme drought could reduce the hatching success.

Relative humidity in Nest 1 equipped with the hair hygrograph showed an overall average of 98.4 per cent with a high of 99.8 per cent and a low of 98.0 per cent. Nest 2 showed and overall average of 95.9 per cent with a high of 97.8 and allow of 94.0 per cent. The control unit averaged 78.2 per cent with a high of 99.7 and a low of 56.6 per cent.

Locating Nest

Locating alligator nests was begun in early June of each year by using a light aircraft. However, it was not until mid-June or late June, depending upon temperatures, that the bulk of the nesting took place.

Muskrat, *Ondatra zibethicus*, houses were numerous in the study areas, but a freshly constructed alligator nest was easily distinguished from the hills by the large bare area surrounding the nest. This vegetation was apparently uprooted or torn away by the female as she gathered material for nest construction. The bare area may extend some 8 feet around the nest. Also, muskrat houses were found to have the root systems on the bed, whereas alligators seemed to tear off the grass at ground level leaving the root systems in the ground. An alligator nest usually had a well defined trail leading away from the nest to the nearest water hole or canal. These trails were probably the most distinguishable character as seen from the air.

The marsh which supported the bulk of the nesting was the natural marsh. This marsh was made up primarily of wiregrass, *Spartina patens*, with scattered ponds and potholes. Of the 315 nests followed during the course of this study 79.7 per cent were located in the natural marsh, 13.6 per cent were found in the impounded marsh, and 6.7 per cent found on the leeves. Nest located inside the impoundments were found in isolated stands of wiregrass. Some of the alligator nests located on the levee system of Rockefeller Refuge were built on the slope while

others were constructed on the top of the levee itself. A den or hole was usually located at the base of the nest or nearby.

McIlhenny (1935) states that fully matured alligators would frequently renest on the same site year after year, building each nest on top of the old one until quite a mound accumulated. This renesting on the previous year's nest site was demonstrated in this study, but to only a limited extent. Although the majority of the nests were located within 100 to 200 yards of the old nest site only 1.3 per cent of the total number of nests found were located on or immediately adjacent to the nest site of the previous year.

Nest Size

There was a great variation in the size of the nest found during this study with the largest being 107 inches in diameter and 33 inches in height from the marsh floor. However, the average nest was found to be 71.5 inches in diameter and 23.7 inches from the marsh floor. McIlhenny (1935) states some nest constructed by old fully grown females may be as much as ten feet across the base and four feet in height at the center. He further states the usual size of an alligator's nest is about five to seven feet at the base with a two and one-half to three foot cone.

Nest Material

Wiregrass is the dominate plant species on Rockefeller Refuge and all nests found were at least partially constructed from this material. In areas where coco, *Scirpus robustus*, roseau cane, *Phragmites communis*, hog cane, *Spartina alterniflora*, and three-square, *Scirpus olneyi*, were abundant, parts of these grasses were found intermixed with wiregrass. Also, in the nest constructed on or near the levees, *Baccharis helimifolia* was used along with wiregrass.

Large clumps of wiregrass were placed on the outside of the nest. Generally, an area within eight feet of the nest was stripped clean of all vegetation, as this was the vegetation used in the nest construction. The inside of the nest, or more specifically, the area of the nest surrounding the egg cavity, was composed of wiregrass, but was made up of a much finer consistency than the vegetation near the nest surface. Mud was used in the construction of only a few nests. This mud was evidently pulled up by the female as she gathered vegetation for the nest because the mud was intermixed with the grass.

Nest Construction

Several dens were located prior to the onset of nesting and notes were made regarding the activity of the female during the period of nest construction. There was a considerable increase in activity by the female in an area surrounding the den site, just prior to nest construction. This activity involved mashing down vegetation in various locations. Well worn trails would begin to take shape leading from the den site to these flattened areas. This activity was usually observed about one week before actual nest construction began. Flattened areas measuring 10-20 feet in diameter were seen as many as 4 times around one den site. Nests were later constructed on these matted sites. Usually, several attempts were made at nest construction before the final nest was built. However, these incompleted nests were easily distinguished from nests which had eggs as all incompleted nests lacked the cone shaped appearance.

In building a nest, the female would first gather up a mass of this vegetation biting it off at the roots and loosely placing it in a small pile. Nesting material was added sporadically for a period of approximately two weeks. On each visit, the female would add additional material, while shaping and giving the nest a cone shaped appearance. Approximately two days before the eggs were laid the egg cavity was formed. This cavity was a small opening made by the female in the top center of the nest. After the eggs had been deposited additional material was added in order to cover the eggs.

Egg Cavity

The egg cavity, or the hollow of the nest in which the eggs were deposited, was found to be located in the top center of the nest. The depth from the top of the nest surface to the bottom of the egg cavity averaged 13.7 inches for all of the nests checked during this investigation. The egg cavity had an average diameter of 9.5 inches by 9.0 inches. The average depth from the top of the nest to the top of the clutch of eggs was found to be 6.8 inches and the depth of the egg cavity averaged 6.9 inches.

Nest Protection

The alligator supposedly protects the nest from predators and intruders, but this was not demonstrated during this study. Several nests were destroyed by raccoons with the female present at the nest site. Of the 315 nests examined during the study only 29 females or 9.20 per cent made any attempt to protect their nest when visited by persons conducting this study. Weekly checks were made on each nest and it was found that these alligators were the only permanent residents at the nest site in the early weeks of incubation. As the incubation period progressed only 24 or 7.6 per cent were seen at the nest site on the weekly visits. The majority of the females pay only an occasional visit to the nest as indicated by the movement recorders and also seen by the fresh trails leading to and away from the nest site. Reese (1915) doubts that the alligator defends the nest but bases his opinion on the fact that they do not attack man or bears disturbing the nest. Whether she actually guards this nest is not clearly understood, but the fact that she stays with the nest is indirect evidence that she assumes a protective role.

Clutch Size

There was considerable variation in the number of eggs present in each nest. Of the total number of nests examined during the five year period the average number of eggs found per nest was 38.9, ranging from 2 to 58. Of this 52.5 per cent of the nests examined contained eggs that were cracked. This varied from one to as many as 48 eggs in a single nest. One particular nest contained 53 eggs of which 48 were cracked. These eggs were evidently cracked by the female during the laying process. It was found as long as the inner membrane (or the shell membrane) was not broken, these eggs would hatch normally. However, if this membrane was punctured ants would enter the egg and render it hollow. Of the total number of nest examined which contained eggs the average number of eggs cracked per nest was found to be 6.1.

The size of the nesting females was found to be between six feet and as large and 8-1/2 feet and no correlation could be made between the size of the female and the number of eggs laid. Due to the high water which prevailed in the marsh during this study, only a limited number of hind foot measurements could be taken. One female captured at the nest site measured 68-1/4 inches (total length). This was the smallest female found to have nested during this study, with 28 eggs present in the nest. The nests of two eight foot females were examined (hind foot measurement taken from tracks of female and related to total length) with one containing 51 eggs and the other 21 eggs.

McIlhenny (1935) also found a considerable variation in the number of eggs laid by alligators. He states 29 to be the smallest number found and 68 the largest. Also, his chief warden reports opening a nest in the marshes just back of Chenier au Tigre in Vermilion Parish that contained 88 eggs. Giles and Childs (1949) report the number of eggs examined in freshly killed females varied from 1 to 38, averaging 25. The smallest numbers were usually recovered from the smallest females, or those which had just attained maturity. Modha (1967) found the clutch size in crocodiles varied from 14 to 46, giving a mean of 33 eggs per clutch.

Predation of Eggs

The amount of predation by raccoons was found to vary from one year to the next. However, predation followed much the same pattern for all nests except a few which were destroyed in the early weeks of incubation. Of the 266 nest followed from 1965-68; 44 or 16.5 per cent were destroyed by raccoons. Of the eight nests located on the levee system of Rockefeller Refuge four or 50 per cent of these nests were lost to raccoons.

Predation was found to occur just after the eggs began to crack along the longitudinal axis, usually at the end of the seventh week of incubation.

Once a nest was located, raccoons would usually pay three or four visits, eating eggs on each visit. It would return to the nest every few days until all the eggs had been eaten. Only on a few occasions did the raccoons leave a portion of the eggs uneaten. However, these eggs were exposed to direct sunlight for several weeks. This was apparently enough to kill the developing embryo as these eggs did not hatch.

No attempts were made by the female to protect these eggs and in one case the female was present at the nest site.

Ants, *Formicidae*, were present in all the nests although they were found not to harm the good eggs or the young alligators in any way. Ants were observed feeding on the eggs that were cracked by the female during the laying process. Also, maggots were observed in several nests which had white fecal material deposited in the egg cavity.

Hatching of Young

When young alligators begin hatching they simultaneously begin calling. This in turn alerts the mother and she removes with her mouth the nest material covering these young animals.

As the eggs began to hatch the shell would first swell and develop cracks along the longitudinal axis. This was caused by the rapid growth of the alligator inside the egg. After this had taken place those cracks would be joined by cracks along the diagonal axis and then this outer shell would begin fluffing off usually around the head region and at various parts of the egg. Next, the inner membrane would be punctured by the "egg tooth" of the alligator and thereby liberating itself from this encasement. This process usually took one week to ten days.

During a visit to one nest, I apparently arrived shortly after the young had hatched. Five newly hatched alligators did not wait for the mother to release them from the nest, but came out of the nest through a small hole which they apparently opened themselves. The female did not return until one week later to release the remaining alligators from the nest. Apparently, she was too far to hear the calls of the young at the time of hatching. I witnessed this identical occurrence only on one other occasion.

The females did not return at all to two nests and over 50 per cent of the young liberated themselves from these nests. The remainder of the eggs in these two nest did not hatch and upon opening these nests the young were found fully matured, but dead inside the eggs.

The hatching process was observed on one nest. Upon our approaching this nest, the female was seen at the nest site and estimated to be about 6-1/2 feet long. The nest was located on a levee in a dense stand of roseau cane with a well defined trail going from the nest to the canal. The nest had already been opened by the female and three eggs had hatched. The female made no attempt to protect the nest from our intrusion. We observed several alligators emerge from the egg. The young alligator would push its head out of the egg, pause for several minutes, and then with one movement slide from the shell still attached by the membrane. As soon as the young hatched it would immediately begin moving out of the nest and down the trail to the water. The egg shell would then separate from this cord as the alligator made its way from the nest to water. I returned the following evening and found all

eggs had hatched except three, which had cracked and would probably hatch within the next 24 hours. Ants were present in this nest but did not seem to harm the eggs or the young alligators.

Peak Laying and Hatching Periods

Data on laying periods was obtained from the periodic aerial flights made throughout the month of June. It was interesting to note the bulk of the nesting took place within a two-week period each year with very few nests being located prior to or after this period.

Peak nesting activities were correlated with air temperatures for the months of March, April, and May. The three month average was then related to nesting activity for each year (Table 3).

Nesting was found to occur from the first week of June and extended to the first week of July. However, only a few freshly constructed nests

TABLE 3. Peak nesting periods for 1964-1968 related to average air temperatures for March, April, and May, Rockefeller Refuge

Peak Nesting Activity	Average Temperatures
June 15	68.8° F.
June 16	68.2° F.
June 20	68.0° F.
June 24	67.2° F.
June 28	64.7° F.

were found in July. The bulk of the nesting activity for the five year period was found to occur between June 12 through June 30 directly relating to temperature.

Only a limited number of records were obtained on the length of the incubation period. Again this data was provided from the nests equipped with the movement recorders.

The writer feels that opening the nests in the two study areas on a weekly basis served to alter the temperatures within the egg cavity somewhat and resulted in an extended incubation period. Some nests which were opened frequently, took as long as 75-80 days to hatch.

Information obtained from the movement recorders indicate the incubation period was from 63 to 65 days. Giles and Childs (1949) report from observations on only one nest an incubation period of eight weeks. McIlhenny (1935) states the average incubation period for alligator eggs to be sixty-two to sixty-four days.

Salinity at Nest Site

Water samples were taken at the nest sites at the beginning of the nesting season and also at the time of hatching. Due to the excessive amount of rainfall during the study, standing water was present in both study areas during the entire incubation period. As the incubation period progressed, rainfall increased and at the termination of the nesting season water was as high as two to four inches over the marsh floor.

Salinity showed a decrease as the season progressed, with readings as high as 8,390 ppm at one nest site with an average of 3,776 ppm. However, at the time of hatching salinity averaged 1,341 ppm.

Nesting Success

Nesting success was calculated for the four year period, 1965 through 1968. Of the 266 nests followed throughout this period, 68.3 per cent hatched successfully, 7.3 per cent were partially infertile, 5.8 per cent were infertile, and 18.6 per cent were either destroyed by predators or lost due to high water.

Nests were classified as hatched successfully if the female returned and released the young from the nest. Certain nests which were classified as partially infertile in some cases produced live young. All these partially infertile nests were abandoned by the female and the young

were either released by persons conducting this study, or in some cases the young were found to have liberated themselves from the egg cavity through a small hole and with no assistance from the female.

This partial infertilization could be a result of copulation at the end of ovulation of the female resulting in just a few fertilized eggs.

The nest classified as infertile contained eggs which were soft shelled and some hard shelled, however, no embryonic development was present.

The yolk of the infertile eggs after the allotted time for incubation had a black, thick, chalky appearance. The albumen was thin, transparent and watery.

Also, 32.3 per cent of the nest examined were classified as incomplete nesting attempts and contained no eggs.

Hatching Success

Hatching success was determined from 154 nests followed throughout the incubation periods of 1967 and 1968. Hatching success was found to be 58.2 per cent for the two year average.

Modha (1967) reports hatching success for six crocodile nests varied from 68.6 per cent to 96.4 per cent. He further states five other nests were dug up and were found to have total egg failure.

SUMMARY

From 1964 through 1968, a study was underway to gather information on the factor associated with alligators nesting on Rockefeller Refuge. During this study, nests were equipped with Stephens Model F Recorders, Taylor Temperature Recorders, and Short and Manson Hair Hygrographs. These instruments were used to record movement of the female over the nest, nesting temperatures inside the egg cavity, and relative humidity of the egg cavity. Data from the movement recorders indicates alligators pay little attention to their nest after the eggs were deposited. Each nest varied in the number of crossings with one nest recording as few as 8 visits and one nest as many as 25 visits during the 65 day incubation period. The majority of the 66 visits tallied were recorded in the first, second, third, and ninth weeks of incubation.

Temperatures and relative humidity inside the egg cavity remained fairly constant throughout the incubation periods. However, outside recordings, or the control units, showed extreme daily fluctuation.

Of the 315 nests followed during the course of the study, 79.7 per cent were located in the natural marsh, 13.6 per cent were found in the impounded marsh, and 6.7 per cent found on the levees.

The alligator supposedly protects the nest from predators and intruders, but this was not demonstrated during this study. Several nests were destroyed by raccoons with the female present at the nest site. Of the 315 nests examined, only 29 females, or 9.2 per cent made any attempt to protect their nest when visited by persons conducting this study. Weekly checks were made on each nest and it was found that these alligators were the only permanent residents at the nest site in the early weeks of incubation. As the incubation period progressed, only 24 or 7.6 per cent were seen at the nest on the weekly visits.

The average clutch size was found to be 38.9, averaging from 2 to 58 eggs per nest. Of this 52.5 per cent of the nest examined contained eggs that were cracked. This varied from one to as many as 48 eggs in a single nest. It was found as long as the inner shell membrane was not broken, these eggs would hatch normally.

The size of the nesting females was found to be between 6 feet and as large as 8-1/2 feet (hind foot measurement taken from tracks of female and related to total length), and no correlation could be made between the size of the female and the number of eggs laid.

The amount of predation by raccoons was found to vary from one year to the next. However, predation followed much the same pattern for all nest except a few which were destroyed in the early weeks of incubation.

Predation was found to occur just after the eggs began to crack along the longitudinal axis, usually at the end of the seventh week of incubation.

Nesting was found to occur from the first week in June and extended to the first week of July. However, the bulk of the nesting took place within a two week period each year with very few nest being located prior to or after this period.

Nesting success for 266 nests showed 68.3 per cent hatched successfully, 7.3 per cent were partially infertile, 5.8 per cent were infertile and 18.6 per cent were either destroyed by raccoons or lost to high water. Also, 32.3 per cent of the nest examined were classified as incomplete nsting attempts and contained no eggs.

Hatching success was determined from 154 nests followed throughout the incubation periods of 1967 and 1968 and found to be 58.2 per cent for the two year average.

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