

TIME OF EGG DEPOSITION FOR THE AMERICAN ALLIGATOR

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Abstract: Ambient temperature was significantly correlated with alligator (*Alligator mississippiensis*) nesting activity. Nesting occurred earliest when March-April-May ambient temperatures were highest. Rainfall had no significant relationship with time of nesting activity although water levels did affect the degree of nesting. Egg deposition occurred when diurnal period was at its maximum. The bulk of egg laying took place within a 2-week period each year.

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Recent alligator studies in Louisiana, Georgia, and Florida dealt with the biology of nesting (Joanen 1969; Metzen 1977; Fogarty 1974; Goodwin and Marion 1978; Deitz and Hines 1979). These studies were primarily concerned with evaluating nesting ecology and factors affecting productivity. In the Louisiana study time of nesting was reported to vary by as much as 13 days from year to year.

An understanding of the factors influencing time of nesting should assist management agencies in coordinating nest surveys, impoundment drawdowns, and harvest regulations, especially when time and degree of egg deposition can be predetermined through analyses of environmental characteristics.

The primary objective of this study was to determine the relationships between alligator nesting chronology and environmental factors such as temperature, rainfall, and photoperiod. A second objective was to determine the relationship between water levels and nest production.

Sufficient alligator nesting data were available on 2 areas over a long enough period of time to permit this investigation. Rockefeller Refuge is located in the coastal marsh zone of southwest Louisiana near Grand Chenier, latitude 29° 40' and longitude 92° 50'. Okefenokee National Wildlife Refuge, predominately a swamp area, is located in southern Georgia near Waycross, latitude 31° 10' and longitude 82° 20'.

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METHODS AND MATERIALS

Field observations of freshly deposited eggs were made annually for 2 wild alligator populations in Louisiana and Georgia. Observations were initiated at the onset of nest construction and followed through the egg laying period. The time of peak nesting was determined from these observations. Rockefeller Refuge data provided coverage for 10 years; 1964-68, 1973-77. Nests were observed on Okefenokee National Wildlife Refuge from 1973 through 1977 (W. Metzen 1978, pers. comm.). The number of nest observations fluctuated annually from 20 to 50 for the 2 study areas.

Average ambient temperature and rainfall were determined for the 3-month period prior to egg deposition (U.S. Weather Bureau 1964-68, 1972-77). These data were analysed for correlations with time of nesting. Comparisons were made of the relationship between annual alligator production and water levels. March-July photoperiods were analysed for relationship with time of nesting (Nautical Almanac Office 1965).

RESULTS AND DISCUSSION

Egg deposition at Rockefeller Refuge occurred from 5 June to 5 July (Fig. 1) during 10

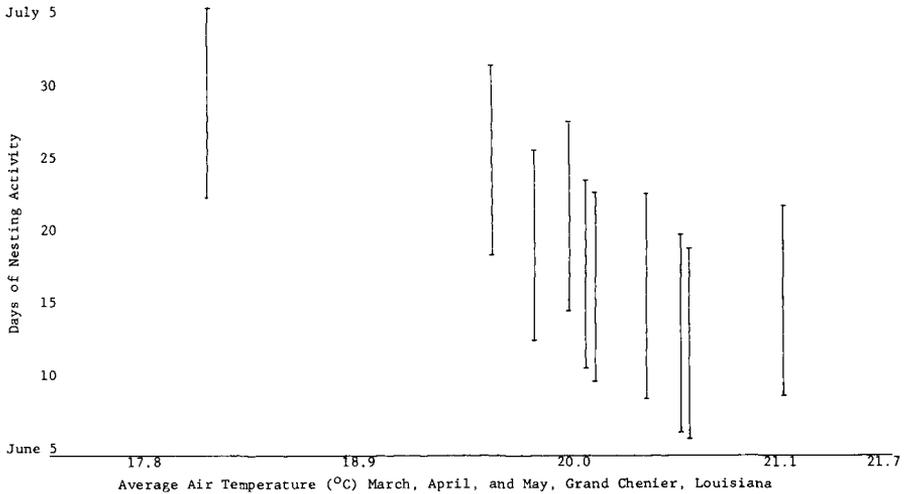


Fig. 1. Nesting periods related to average air temperature for March, April, and May, Rockefeller Refuge, Grand Chenier, Louisiana.

years of study. Most eggs were laid between 11 June and 28 June. Five years of data from Georgia indicated egg deposition occurred from 8 June to 12 July with most nesting activity between 20 June and 5 July (Fig. 2) (Metzen 1977). Observations indicate a single female deposits all of her clutch at 1 time, usually at night. Collectively, all individuals in a population will require about two weeks to complete nesting. As described by McIlhenny (1935), alligators lay once in a season and deposit all of their eggs at one time, without any material being placed between the eggs.

Ambient temperatures for the 3 months prior to nesting in Louisiana showed a progressive warming trend; March averaged 17.3° C, April 19.8° C and May 23.9° C. Late June-early July egg deposition occurred on the coolest year when temperatures for the 3 months averaged 18.3° C. Conversely, the earliest nesting recorded, early to mid-June, was for the warmest year when temperatures averaged 21.1° C. Air temperatures for Georgia averaged 17.8° C for March, 19.5° C for April and 23.2° C for May.

When the Louisiana data were subjected to statistical analysis a highly significant negative partial correlation was determined between time of nesting and temperatures ($r = -0.904$, $df = 7$, $P < .01$). Rainfall, the other independent variable, was nonsignificant ($r = -0.500$, $P > .05$). The 5 years of data collected from Georgia and analyzed similarly revealed no significant relationship for either temperature ($r = -0.507$, $df = 2$, $P < .05$) or rainfall ($r = 0.765$, $df = 2$, $P < .05$). When data from Louisiana and Georgia were combined, the partial correlation was significant for temperature ($r = -0.543$, $df = 12$, $P < .05$) and not for rainfall ($r = 0.228$, $df = 12$, $P > .05$).

Ambient temperature for Rockefeller Wildlife Refuge was consistently more moderate and did not experience the extremes (high-low daily fluctuations) as did the temperatures of the Okefenokee National Wildlife Refuge in Georgia. Also, a larger sample size from Georgia may have been more meaningful.

While rainfall did not affect time of nesting, our observations indicate that rainfall and its related effect on accrued surface water definitely affects the degree of nesting. Extremes in water levels reduced overall nesting effort (Joanen and McNease 1975 and 1978). In southwestern Louisiana coastal marshes, local rainfall had a rather direct

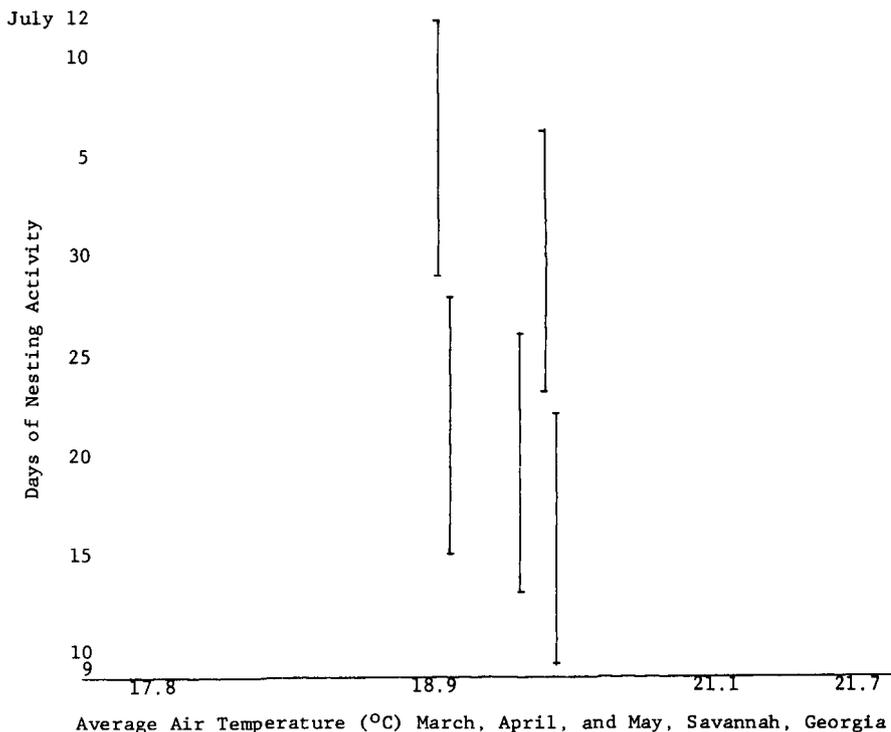


Fig. 2. Nesting periods related to average air temperatures for March, April and May, Savannah, Georgia.

influence on marsh water levels. Annual nest index surveys showed a reduced nesting effort, except in 1976, when rainfall departure from normal was negative for March-May (Table 1). In marsh areas prone to serious overflow flooding, such as the Mississippi and Atchafalaya distributary systems, flood conditions reduced available nesting habitat and consequently reduced alligator production for any flood year. In south central and southeast Louisiana, a drastic decline in nesting effort was recorded in 1973 due to flooding caused by river overflow. Moderate declines were recorded in 1974 and 1975, years when flooding was prevalent but not as severe as in 1973.

Examining the relationship between photoperiod and egg deposition revealed that egg deposition occurred when diurnal period was at its maximum. Photoperiod was constant year to year; therefore, no analysis was attempted for this parameter. Nesting activity in Louisiana usually began in early June with 14 hours of daylight. Day length was at its maximum in mid-June (14 hrs. 6 min.) and this was when egg deposition normally peaked. Daylight decreased to 14 hours during the first week of July, at which time egg deposition ceased. Nesting began in Georgia in early June with 14 hours 12 minutes of daylight and continued through early July when daylight accounted for 14 hours 10 minutes.

Physiological functions which lead to egg deposition may be keyed by increasing day length as well as temperature. A poikilothermic animal must certainly be affected by the interrelationship between maximum day length and heat budget buildup.

TABLE 1. Alligator nest production for southwest Louisiana, 1970-1978 aerial censuses.

Year	Rainfall Departure from Normal	Projected Number of nests	Relationship of water levels to nest production
1970	- 5.18	2691	First survey
1971	- 14.76	1640	Drought-sharp decline
1972	+ 2.86	2903	Normal water-average production
1973	+ 2.99	2662	Flooded-slight decline
1974	+ 8.45	3675	High water-sharp increase
1975	+ 0.32	4813	Normal water-sharp increase
1976	- 9.96	5463	Drought-slight increase
1977	- 2.75	5396	Low water-moderate decline
1978	- 8.10	4325	Drought-sharp decline

SUMMARY

Average ambient temperature and rainfall for March, April, and May were analysed for 2 study areas to determine if a correlation existed with nesting activity. Wild populations were studied in different habitat types in Louisiana and Georgia.

Ambient temperatures were found to affect the timing of nesting and egg laying. There was a significant correlation with ambient temperature and nesting activity. Egg deposition occurred in early June for the years with the highest March-May temperature. Conversely, egg deposition occurred in late June and in some cases the first week in July when average springtime temperatures were the lowest.

Most nesting activity occurred in June when diurnal period was at its maximum, allowing for maximum daytime heating. Peak egg deposition activity took place at 14 hours and 6 minutes of daylight for Louisiana, and 14 hours 17 minutes for Georgia. Egg laying activity for any given year lasted 2 weeks.

Rainfall had no significant relationship with time of nesting activity although accrued water levels did affect degree of nesting.

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