

THE MOVEMENT OF ALLIGATORS IN LOUISIANA

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The alligator (*Alligator mississippiensis*) is a very important member of Louisiana's wetland fauna. This species is found in practically all portions of the state but, because of an indiscriminate killing of the animals, large numbers are found only on areas providing rigid protection. The high value of alligator skins, coupled with the animals vulnerability to hunting, has been the primary cause of the heavy kills.

In an effort to rebuild the state's alligator population, the 1960 Louisiana Legislature established a size limit and maximum season length on alligators and gave the Louisiana Wildlife and Fisheries Commission authority to set the season. In 1963 the season was closed statewide, and enforcement efforts increased in order to reduce the kill.

Because of the high value of alligators, landowners along the Louisiana coast have expressed keen interest in rebuilding alligator populations. However, only general management procedures are known for the Louisiana marshes. Protection has been the main tool of managing alligator populations in recent years, mainly because little information has been available on other aspects of management such as habitat manipulation, selective harvesting, the effects of restocking and so forth.

In order to obtain information useful in managing the species, a study was begun on Rockefeller Refuge in 1959. The study was later expanded to include other areas in the state.

This paper reports a segment of the study regarding alligator movement and includes both normal movement and the movement of animals transferred from their normal range.

A knowledge of alligator movement and the factors effecting movement is important in habitat management, particularly where an area is managed for more than one species such as alligators and ducks. Also, this information is very valuable in planning an alligator restocking program. Likewise, in planning a harvest operation alligators can be selectively harvested when the movement habits of a particular area are known.

THE STUDY AREA

Most of this study was conducted on the Rockefeller Wildlife Refuge in Southwestern Louisiana. The refuge is owned by the Louisiana Wildlife and Fisheries Commission and encompasses 84,000 acres of coastal marsh. The area borders the Gulf of Mexico for 25 miles and extends northward to the Grand Chenier ridge complex, a stranded beach ridge located seven miles inland from the Gulf. The entire area consists of low marshland with an average elevation of 1.1 feet above mean sea level.

Marsh conditions range from fresh to saline with a network of bayous, canals and shallow ponds. The refuge has 12 impoundments, as described by Chabreck (1960), ranging from 120 to 5,680 acres and totaling 23,600 acres. Also, another 13,500 acres have been protected with a tidewater barrier.

A portion of the data was collected on the 147,000-acre Sabine National Wildlife Refuge located 35 miles northwest of Rockefeller Refuge. Marsh conditions on Sabine Refuge were similar to those on Rockefeller Refuge.

During the study, alligators were removed from Rockefeller Refuge and Sabine Refuge and released in various other marsh areas in Cameron Parish. Marsh conditions in these areas were similar to those on Rockefeller Refuge and Sabine Refuge.

STUDY METHODS

The study was begun in 1959 and considerable time spent devising techniques for capturing, marking and handling alligators. The methods used were described by Chabreck (1964) and capturing involved night hunting with small boats and a wire noose mounted on a heavy pole. Alligators were marked by toe clipping, tail notching and tagging.

From 1959 through 1965, a total of 2,024 alligators was captured, marked and released. Of these 131 or 6.47 per cent were recovered or recaptured. Eighteen animals were recaptured twice and two were recaptured three times.

Numerous observations were made on alligator movement at Rockefeller Refuge during the time of this study. Many of these observations are herein included.

RESULTS AND DISCUSSION

Movement of Immature Alligators

Most authorities agree that the alligator reaches sexual maturity when six feet long. McIlhenny (1935) stated that they nested at Avery Island, Louisiana, when six feet long which was usually at age five. Giles and Childs (1949) reported that of all female alligators examined internally on Sabine Refuge only one was less than six-feet long, but even that individual was approaching six feet. During this study, I have not seen any females less than six feet long with nests. Also, of females examined internally prior to the nesting season, only those over six feet and longer contained eggs. Therefore, for the purpose of this study immature alligators are classed as those less than six feet long. This size is inclusive of males as well as female alligators.

Newly Hatched. Immediately after escaping from the nest, young alligators rapidly make their way to deep water. Often this distance is not over ten feet, since the mother usually has an underground den or "hole" near the nest. However, some young must travel much farther, and one nest was found where the young traveled 300 feet from the nest to a canal. The mother usually has a well-worn trail covering this route and the young have no difficulty following it.

The young hatch in late August or early September and once they reach deep water near the nest, remain there throughout the following winter. They feed aggressively even at this young age, but at this season insects and small fish are abundant and they seldom wander over 50 feet away.

First Winter to Age One. When cold weather approaches, the young retreat to their mother's den and remain there in a semi-dormant state until the following spring. On exceptionally warm winter days, they may venture out and crawl upon the bank or grass nearby, but return again when the temperature drops.

As the weather warms in April, the young alligators become active and again begin feeding. Throughout the following spring, they grow rapidly and travel about in search of food. Still, their movement is limited and early in this season they remain in the close proximity of the nest.

Two nesting situations occur which, after summer begins, cause a variation in the movement of first-year young. A certain segment of the adult females nest in dense marsh, away from water bodies. These females will make several dens in the marsh then nest nearby. Young reared from such nests move to these "holes" after hatching and remain there throughout the first year, and their range may be limited to not more than 20 to 50 feet.

Other females will select a location on the edge of a water body as a territory. This water body may be a bayou, canal, lake or even a marsh pond. Generally she will make a den under the bank and nest nearby. Young produced from such nests have more opportunity to move about. The mother enters the breeding season in late April or May leaving the young fairly well on their own.

Throughout the summer, they wander about the general area of the "hole," but seldom venture over 200 feet away, and even then, return periodically.

Second Year. Young alligators begin their second year by early September and are from 20 to 25 inches long. The mother may have a new group of young at this time, but many of the one-year-olds remain in the vicinity of the nest throughout the second winter.

As the weather warms the following spring, the remaining second-year young of a female nesting along a water body depart from the nest area. At this point, their bond with the nest is broken and they seem to swim about aimlessly as they feed. At this stage, alligators are very curious and will investigate noises or movement which attracts their attention.

However, the situation is different with alligators nesting in dense marsh. The arrival of warm weather the following spring finds many one-year-old young still at nest. But, as the weather grows warmer they venture away from the nest into the surrounding marsh. If high water occurs, all one-year-olds will leave, but if drought conditions occur, they will remain in the "hole." In fact dens were checked in dense marsh which contain the mother and three age classes of young.

Third Year to Maturity. After the first 18 months, immature alligators move about a great deal. When two years old, they are approximately three feet long and practically free of natural enemies. McIlhenny (1935) stated the alligator is a great traveler in a local sense and will often desert one locality and move to another considerable distances away, frequently moving overland.

This study revealed that the distance moved by immature alligators was progressive and proportional to time. Tagged alligators, as shown in Table 1, moved farther and farther from the capture and release site as time progressed.

Table 1. Distance Moved by Tagged Alligators¹ Which Were Captured and Promptly Released At the Same Site.

Time Interval ² (Months)	No. of Alligators	Ave. Distance Moved (Miles)	Range of Movements (Miles)
0 - 2	44	.06	0 - 0.125
2 - 6	11	.20	0 - 1.00
6 - 12	19	.63	0 - 3.50
12 - 24	21	1.50	0.125 - 7.00
24 - 36	8	1.02	0.125 - 2.50
36 - 48	3	3.00	0.75 - 10.00
48+	4	2.81	1.25 - 4.00

¹ All alligators were less than 6 feet long and captured between 1960 and 1965.

² The time interval is the period between the original capture and recapture.

Alligators between three feet and six feet long apparently move at equal rates. The data from all size classes were tabulated separately, but no difference was noted; therefore, all data for immature alligators were combined and listed in Table 1. Also, only alligators released at the same site where captured were used in Table 1.

As expected certain individuals move greater distances than others within the same size class. However, no difference was found between the movement of immature male and female animals.

Of alligators recaptured within two months after tagging, 98 per cent had moved less than 700 feet from the release site. But from two to six months over 50 per cent had moved one-quarter mile or more. Of the animals recaptured six months to one year after tagging, 80 per cent had traveled one-quarter mile or more and 40 per cent had moved one-half mile or more. During this period, one individual moved two miles and one 3½ miles from the release site.

After one year the tagged alligators, which were released at the same location where captured, continued their dispersal from the

release site, and of those recaptured or recovered from 12 to 24 months later 63 per cent had traveled over one-half mile and 42 per cent over one mile. During this period, one alligator had traveled 7 miles. Between 24 and 36 months, 50 per cent of the animals recaptured had dispersed more than one mile.

All alligators recaptured three years after tagging had moved more than one-half mile and during the period from 36 to 48 months 67 per cent had moved over one mile. One alligator recovered during this period had traveled 10 miles from the release site. After four years the rate of movement decreased yet all captured after four years had moved from $1\frac{1}{4}$ to four miles from the release site. This includes one animal which was recovered 63 months after being tagged and released.

Movement of Adult Alligators

Although all alligators listed in Table 1 were immature when first captured, three reached maturity (6 feet) before recapture and a large number were approaching maturity. The fact that the rate of movement decreased after four years and that most tagged animals were approaching maturity at that time indicates that adult alligators move less than immatures and tend to remain in one locality.

Adult Females. Once female alligators reach maturity they establish a territory from which they seldom depart for great distances. Although a segment of the adult females do not nest, those which do, spend a great deal of time with nesting activity and caring for the young.

The greatest movement by adult females is during the spring (April and May). As the breeding season begins they leave their den and may wander as far as one-half mile away. Even those with young at the den move about at this time. Marsh nesters will break a trail through dense vegetation and seek out large water areas. Females with dens along bayous, canals or lakes will travel about on these.

Even though the female travels about a great deal during the spring, she will return to her den periodically, particularly those with young still at the den.

After the breeding season, the female remains close to her den. Even after the nest is built and the eggs laid, the female stays nearby. However, after several weeks she may venture farther and farther from the nest, perhaps going 400 to 500 feet away. In this regard there is considerable variation among individuals. Some females guard the nest closely, others do not.

After the young hatch in late summer, the mother alligator remains very near the nest. She provides the young with close surveillance for about two months, then gradually begins to venture away from the nest short distances, perhaps upward to 400 to 500 feet.

Then with the arrival of cold weather the female retires to her "hole" where she remains throughout the winter. At each den an alligator has one or two locations where she crawls from the water to sun. On warm days during the winter she may come out for several hours, but returns as the temperature drops.

Adult Males. Unlike the female, the adult male alligator moves about throughout the warm weather months. He has a territory covering perhaps 50 to 100 acres and wanders about over it.

The greatest movement by adult males is probably in the spring during the breeding season. At that time the male emits a loud call or roar so that other alligators may know his position. McIlhenny (1935) believed that this roar was a challenge to other males and not to attract females. Oliver (1955) stated that the male bellows to notify other males as well as attract females. However, Howard Dupue on Rockefeller Refuge observed a large male calling during the breeding season and his call was answered repeatedly by an adult female in an enclosure. The male made numerous attempts to break through a fence to reach the female.

I have made numerous airplane flights over the marshes on

Rockefeller Refuge during the late spring and in areas of heavy nesting the marsh will be a network of alligator trails. Invariably, each trail will lead to a "gator hole" in the marsh. A large male weighs from 200 to 300 pounds and when he crosses a wiregrass (*Spartina patens*) marsh, his trail is well marked.

In response to the answer of a female the male will travel in almost a straight course to join her. He will remain with the female at her den for several days, then depart from the den to join another female that responds to his call.

As part of an alligator nesting study on Rockefeller Refuge, we used an airplane to locate nests. Early in this work we learned to follow these trails in the marsh and in most cases a nest was situated along the trail.

With the termination of the breeding season in May the adult male resorts to a deep water area for the remainder of the warm weather months. He moves only short distances and remains in one general area.

With the arrival of cold weather the male goes into a semi-dormant state. McIlhenny (1935) noted that the adult male used both winter quarters and summer quarters. The winter quarters were an underground den and the male moved to the den in October, just prior to cold weather. He remained in this den throughout the winter and ventured out only when the air temperature was warmer than the water temperature.

McIlhenny also observed that an old male used the same den year after year, but departed from it during March or April to more open waters and did not return until the approach again of cold weather.

FACTORS AFFECTING NATURAL MOVEMENT

A number of factors influence the movement of alligators. Some of these factors are normal and recur annually such as temperature changes and the breeding season. Other factors as excessive flooding and droughts are exceptional conditions but greatly affect movement. Although these factors all affect movement, the influence of each varies considerably.

Temperature Factors. The seasonal movement of alligators is largely in response to temperature changes. All alligators go into a partial hibernation during the winter, but venture out on warm days. In fact 29 small alligators (2 to 3 feet long) were captured on Rockefeller Refuge on the night of December 5, 1961. Although the temperature was in the mid-60's, the alligators were quite active.

During periods of low temperature, alligators go into a state resembling hibernation; still they must surface periodically to breathe. After a heavy freeze on the refuge in January, 1962, a number of alligators were found dead, apparently suffocating beneath the ice. They ranged from 2 to 10 feet in length. I observed captive alligators during the same period in a concrete pool and their heads were simply frozen into the ice with the snouts protruding slightly above the surface. The captive alligators were unaffected by the freeze.

McIlhenny (1935) described the movement of adult males from the winter quarters to summer quarters in March, then back to winter quarters in October. However, Giles and Childs (1949) noted a condition which they believed was typical and perhaps unique to Sabine Refuge regarding summer movement. All alligators moved from open water to the marsh in June because the open water became excessively hot. Water was impounded in the marsh and tall vegetation offered some protection from the sun, thus improving the marsh as a summer habitat. They observed that in natural tidal marsh, summer movement was from the marsh to open water in response to low water levels and high temperatures in the marsh.

Breeding Season. As discussed earlier, the breeding season for alligators takes place in April and May and adults of both sexes move much more than normally during that period. With the termina-

tion of the breeding season, adult animals remain in one local area throughout the following summer.

High Water Conditions. Whenever the marshes are flooded as a result of excessive rainfall or storm tides, alligator movement increases. The degree to which flooding affects movement depends upon the water depth, currents and duration. Normally immature alligators respond to flooding more than adults, but under severe conditions all size classes are affected.

During Hurricane "Audrey" in June, 1957, the marshes on Rockefeller Refuge were flooded to a depth of 10 feet and the water pushed by 125-miles-per-hour wind produced strong currents. As a result, alligators were swept northward from the refuge for distances ranging from three to ten miles.

During Hurricane "Carla" in September, 1961 tides five feet deep blanketed the marshes on Rockefeller Refuge. Winds ranged upward to 70 miles per hour and currents were much less than during "Audrey." When the water receded, alligators formerly inhabiting the marshes were concentrated in bayous and canals, but few were moved any distance from the refuge.

Giles and Childs (1949) reported that if water levels in the marshes are abnormally high during the nesting season, mature females seek out the margin of ridges for nesting sites. During certain years a high percentage of the adult females on Rockefeller Refuge nest on levees. However, I have noted no relation between nesting and water levels.

Droughts. Although alligators can survive on dry ground for long periods of time, they prefer to be in deep water and travel considerable distances to find it during exceptionally dry periods. Oliver (1935) stated that alligators sometimes exhibit seasonal movement associated with changes in water levels and will move from drying up water holes to deep water. This is particularly true of immature alligators and adult males. However, marsh dwelling females will usually remain at their den during such periods. The den extends four to five feet below the ground and long after marsh ponds have dried will contain water. In late May, 1962, after several months of practically no rainfall, I traveled through a dry impoundment on Rockefeller Refuge on a marsh buggy. Although the marsh was dry and cracked, alligators remained in their "holes" even though the water in most was a foot below the surface.

When droughts are broken and water returns to the marsh, alligators return with it and make a grand exit from deep water areas such as canals and bayous.

Food Supply. Like most wild animals, alligators are attracted by an abundant food supply and will remain in an area as long as it is available. One tagged alligator, five feet long, remained at a boathouse on Rockefeller Refuge for three years until killed by a boat. A work crew ate lunch at the boathouse each day and threw scraps to the alligator. The animal stayed around just because of the supply of food.

To what extent alligators will travel to other areas in search of food is not known. However, I doubt that hunger is a very strong motivating force causing alligators to travel considerable distances.

Water Salinity. While the exact relationship between water salinity and alligator habits is not known, the animals are mostly found in areas with fresh to slightly brackish water. Alligators are rarely seen in salt water if a fresh water source is nearby.

On Rockefeller Refuge an estimated 90 per cent of the alligators are found on the northern one-half of the area. On the southern half salinities increase as one approaches the Gulf of Mexico, ranging upward to 20,000 p.p.m. Alligator concentrations have been found in impoundments with salinities ranging between 3,000 and 4,000 p.p.m.

During summers with a lack of rainfall, water salinities increase in canals and bayous on Rockefeller Refuge. I have noted a general northward drift in tagged alligators toward fresher water as Gulf water intruded inland through the drainage systems.

ALLIGATORS TRANSPORTED TO NEW LOCALITIES

During this study a large number of alligators were captured, then transported to other locations and released. This provided valuable information on the rate of movement and degree of homing under such conditions.

Rate of Movement. When comparing Table 1 with Table 2 it is obvious that tagged alligators released at the capture site move much less than those transported elsewhere and released. In fact those released elsewhere dispersed at a rate three to four times greater than normal.

Although alligators are more at home in the water, they can move quite rapidly on land. An alligator running can move about the speed of man walking fast. However, in normal movement they make their way very slowly. Oliver (1955) stated that Cowles, Colbert and Bogert made observations on the speed of walking and found that a 32-inch alligator walked at 0.6 miles per hour. He assumed that large alligators walked even faster and all swam very much faster.

Table 2. Distance Moved By Tagged Alligators¹ Which Were Captured and Released At Locations Other Than the Capture Site.

Time Interval ² (Months)	No. of Alligators	Ave. Distance Moved (Miles)	Range of Movements (Miles)
0 - 2	4	2.94	.25 - 8.00
2 - 6	5	.50	.25 - 1.00
6 - 12	8	1.88	.50 - 6.00
12 - 24	7	5.21	1.00 - 20.00
24 - 36	5	8.20	2.00 - 12.00
36 - 48	1	12.00	

¹ All alligators were less than 6 feet long and captured between 1960 and 1965.

² The time interval is the period between the original capture and recapture.

As shown in Table 2 alligators recaptured within two months after being released in a new area had averaged almost three miles movement from the release site. These individuals showed unusual movement and were unequalled by even many alligators captured at a later date.

Animals recaptured two to six months after released (Table 2), had moved an average of one-half mile. From this period the distance moved was proportional to time and from six to 12 months 75 per cent had moved one mile or more. All recaptured from 12 to 24 months after released had moved one mile or more with one individual moving as far as 20 miles.

Of alligators released in new localities then recaptured from two to four years later, 83 per cent had dispersed eight miles or more from the release site. Of alligators released at the same site as captured (Table 1), then recaptured after two years only 27 per cent had moved over two miles.

Homing. Of the alligators released at new locations, 29 were recaptured. They had been transferred distances ranging from one-half mile to 55 miles from the capture site and all were immature (less than six feet long).

Most of the movement was in the general direction of the area from which they were originally removed (Table 3). Of the alligators recaptured, 59 per cent had traveled in the same direction as the area from which they were removed and 21 per cent traveled at 45 degrees of the same direction and 21 per cent at 90 degrees. Only two animals of the 29 recaptured traveled in the opposite direction from the area where it was originally captured.

Ten alligators were recaptured in the same area from which they had been transferred. One individual had moved 20 miles in returning. Another was captured on June 26th in Lake 8 on Rockefeller Refuge and transported eight miles away for release, then on July 13th (three weeks later) the same animal was recaptured in

Table 3 Distance and Direction Traveled by Tagged Alligators Released Away from the Capture Site.

Specimen No.	Sex	Total Length (In.)	Date Captured and Released	Dist. and Direction Transported From		Date Recaptured	Dist. and Direction Traveled From Release Site	
				Capture Site	Direction		Release Site	Direction
1	F	53	6-24-60	8 mi. - W		7-6-61	1 mi. - SE	
2	F	64 1/2	6-24-60	8 mi. - NW		7-13-60	8 mi. - SE	
3	M	31	10-11-61	6 mi. - W		7-10-62	1-1/2 mi. - N	
4	M	42 1/2	10-9-61	1 mi. - N		5-4-62	1/2 mi. - SE	
5	M	27 3/4	3-30-62	1 mi. - N		5-4-62	1/4 mi. - S	
6	M	21 1/2	8-7-61	1/2 mi. - NE		7-10-62	1 mi. - SE	
7	F	38 1/2	6-22-61	1 1/2 mi. - E		6-6-63	1 1/2 mi. - W	
8	M	42 1/4	6-1-62	1/2 mi. - E		6-29-62	1 mi. - E	
9	F	20 3/4	8-7-61	1/2 mi. - NE		7-10-62	1 mi. - SE	
10	M	30 1/4	12-5-61	6 mi. - W		7-10-62	2 mi. - NE	
11	M	30 1/4	12-5-61	6 mi. - W		7-1-64	9 1/2 mi. - E	
12	M	38 1/2	6-29-62	1 mi. - E		9-4-62	1 mi. - W	
13	F	26	12-5-61	6 mi. - W		8-28-62	2 mi. - NW	
14	F	47 1/2	6-1-62	1/2 mi. - E		9-4-62	1 mi. - NW	
15	M	30 1/2	10-11-61	6 mi. - W		3-28-63	1 1/2 mi. - S	
16	F	38	5-10-62	10 mi. - SW		6-28-63	10 mi. - NE	
17	M	48	6-29-62	8 mi. - NW		7-26-63	1 mi. - SE	
18	M	32	7-10-62	1 mi. - W		7-26-63	1 mi. - E	
19	M	33 1/4	6-28-63	50 mi. - SE		11-6-63	1/4 mi. - N	
20	F	22 3/4	12-5-61	6 mi. - W		4-14-64	2 mi. - S	
21	F	51 1/2	10-3-61	55 mi. - W		4-25-64	10 mi. - E	
22	F	50	6-28-63	6 mi. - SE		5-17-64	6 mi. - NW	
23	M	58 1/2	9-14-62	20 mi. - E		5-22-64	20 mi. - W	
24	M	23 1/2	12-5-61	6 mi. - W		7-11-64	7 1/2 mi. - E	
25	M	38	6-22-63	10 mi. - SW		4-27-65	10 mi. - NE	
26	M	34	8-7-61	12 mi. - W		5-14-65	12 mi. - E	
27	F	53 1/2	9-14-62	20 mi. - SE		5-19-65	12 mi. - NW	
28	M	46	6-28-63	20 mi. - SE		7-7-63	2 1/2 mi. - NW	
29	M	34	5-10-62	10 mi. - SW		6-27-63	10 mi. - NE	

Lake 8. Another was recaptured in the same area almost four years after its release in another area 12 miles away.

SUMMARY

From 1959 through 1965, 2,024 alligators were captured, marked and released in Southwestern Louisiana. The alligators were captured on Rockefeller Wildlife Refuge and Sabine National Wildlife Refuge. The data from tagged animals plus numerous observations on the refuges provided information for this paper.

Movement was greater among immature alligators (less than six feet long) than adults. However, no difference was noted in the movement of tagged immature alligators from three to six feet long.

Tagged alligators captured and released at the same site moved farther and farther from the site as time progressed. Of those recaptured after three years, 67 per cent dispersed over one mile from the release site.

The factors listed as having an effect on natural movement were temperature changes, the breeding season, high water conditions, drought, food supply and water salinity.

Tagged alligators transported elsewhere for release moved three to four times greater than normal and showed strong homing instincts. Of those recaptured two years or more after release, 83 per cent had dispersed eight miles or more from the release site.

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INTERPRETATION OF SOME ALABAMA DEER TRAPPING DATA

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(A contribution from Federal Aid in

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During the winter seasons from January 1960 through February 1965, Alabama Department of Conservation personnel trapped 1,983 deer on two privately owned areas. This paper is an attempt to interpret the catch per trap-night, sex ratios, fawn ratios, population densities and movements from records kept during the several trapping periods.

The trapping of deer for restocking purposes in Alabama was confined to state-owned lands prior to 1960. The records of trap-nights or