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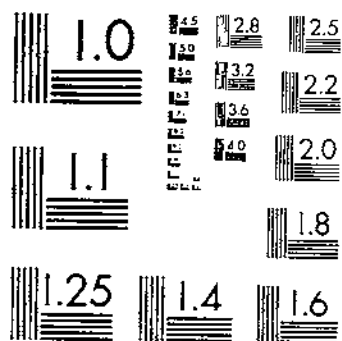
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THE HABITS AND ECONOMIC IMPORTANCE OF ALLIGATORS

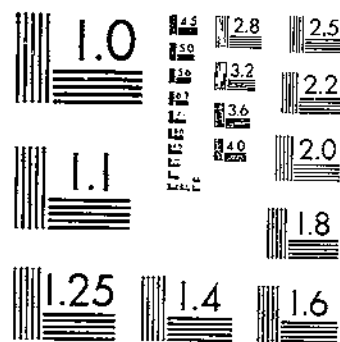
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NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

UNITED STATES DEPARTMENT OF AGRICULTURE  
WASHINGTON, D. C.

# THE HABITS AND ECONOMIC IMPORTANCE OF ALLIGATORS

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## INTRODUCTION

Alligators (*Alligator mississippiensis* [Daudin]) have long been familiar inhabitants of southern swamps in the United States, yet their habits are not so fully known as those of many less conspicuous animals. Their presence in this country was more or less thrillingly recorded by the earliest explorers, and since that time fiction has largely predominated over fact in the popular lore associated with these large saurians. There is reason (39)<sup>2</sup> to believe that the word "alligator" is a corruption of the Spanish "el lagarto," since Hawkins (in Markham, 25, p. 263) in 1594 employed the name "alagarto" for crocodiles occurring in the Guayaquil River, Ecuador, and Sloane (34, v. 2, p. 332) spelled the name "allagator," but likewise applied it to *Crocodylus acutus* Cuvier, which occurs in southern Florida and the Greater Antilles and along both coasts of Central America from Mexico to Ecuador.

The present study has for its object the recording of such facts as have an intimate bearing on the economic relations of alligators, in-

<sup>1</sup> The manuscript of this report was prepared while Doctor Kellogg was a member of the Bureau of Biological Survey.

<sup>2</sup> Italic numbers in parentheses refer to "Literature cited," p. 34.

cluding their relation to other forms of wild life as shown by their food habits and their value to certain industries for their hides, teeth, and other products, as well as the presentation of a brief outline of the essential phases of their life history. In determining the nature of their food habits an attempt has been made to supplement the laboratory examination of the stomach contents of 157 alligators obtained along the Gulf coast of the United States with such reliable published and unpublished information as is available. Various phases of the natural history, anatomy, and development of the alligator have been discussed by Dowler (14), True (39), Clarke (11), and Reese (30), but no adequate study has ever before been made of its food habits and relations to other forms of wild life.

Alligators are more or less aquatic reptiles, belonging to the great subclass Diapsida, which includes all reptiles that have a skull with two temporal openings separated by a postorbito-squamosal arch and a shoulder girdle with a single coracoid, but no cleithrum. They belong to the order Crocodilia, the known geological history of which extends from the Jurassic to the present time. All their relatives have 2-headed dorsal ribs that articulate with the arch only of the vertebra; the skulls have a secondary palate, but lack palatal teeth; no parietal foramen is present; and the external nares are terminal. The Crocodilia have no close living relatives and are far removed from all other living reptiles, with the possible exception of the rhynchocephalian genus *Sphenodon*, which frequents Stephens Island, New Zealand. (Pl. 1.)

The evidence seems fairly clear that alligators evolved from crocodiles, from which they are distinguished by their broader snouts. Fossil remains of the Pleistocene Age and identified as *Alligator mississippiensis* are reported by Hay (20, 21) from the following localities: Ashley River, S. C.; Peace Creek and Vero, Fla.; and Blanco River, 15 miles above San Marcos, on the Edwards Plateau and also in McLennan County, Tex.

It would appear that the Middle Miocene *Alligator thomsoni* (28) found in the lower Snake Creek beds near Agate, Nebr., is a direct ancestor of the Chinese alligator (29). This fossil alligator exhibits peculiarities that are supposedly intermediate between both of the living alligators and certain older Eocene fossil crocodiles (*Allognathosuchus*) from the Wasatch and Bridger formations of Wyoming.

#### GEOGRAPHIC DISTRIBUTION

The genus *Alligator* has two living species, one of which (*Alligator mississippiensis*) occurs solely within the boundaries of the United States and the other (*Alligator sinensis*) in eastern China. The Chinese species frequents the lower Yangtze River Valley and its tributaries, from Kiukiang to Nanking in the Provinces of Anhwei and Kiangsu. The habits of this alligator seem to be quite similar to those of the American species. According to Clifford H. Pope (in Schmidt, 33, p. 477), Chinese alligators were dug out of holes on a treeless, sparsely grassed plain by the side of the Ching Sui Ho, the river that flows south through Wuhu and into the Yangtze. Alligators also exist in Poyang Lake, as well as along the muddy banks of the Yangtze.



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A.—Adult alligators in Zoological Park, New York City  
B.—Old adult alligator, showing arrangement of integumentary scutes, shape of head and jaws, position of nostrils and eyes, and peculiarities of fore and hind feet. (Photos reproduced by courtesy of the New York Zoological Society)

The American alligator (*Alligator mississippiensis*) frequents the low coastal plain from Albemarle Sound, N. C., southward through South Carolina and Georgia, to and including peninsular Florida, westward through Alabama and Mississippi to Louisiana, and thence northward along the Mississippi River into Arkansas and the Red River along the northern border of Texas. The western limits of the range of the alligator fall short of the one-hundredth meridian in Texas, while the Rio Grande seems to form the southern boundary.

Continued drainage and encroachment of agricultural interests on the natural habitat of alligators, coupled with the wanton manner in which they have been hunted, have caused a decrease in their numbers in many parts of their former range. Most of the large fresh-water streams that traverse the south Atlantic and Gulf coastal plains supported at one time large numbers of these reptiles. Although the alligator in former years was undoubtedly common in the larger rivers and lakes of the Southern States, and they even have ventured short distances into salt water (8, p. 134), they have now retreated to the more unfrequented parts of large marshes and to inaccessible areas of extensive swamps. Ideal conditions for alligators are still present in the recesses of the Okefenokee Swamp in Georgia and Florida, the saw-grass country of the Everglades, the overflowed cypress swamps of Florida, the marshes and bayous around Mobile Bay in Alabama, the inundated lands of the coastal counties of Mississippi, and the watercourses of the open prairie, as well as in the bayous that traverse the cypress swamps in Louisiana. (Figs. 1 and 2.)

The collection of eggs, the sale of the young, and the more or less reckless destruction of adults for belly skins would eventually result in the extermination of alligators were it not for the fact that large areas in such breeding places as the Okefenokee Swamp, the Everglades, and the coastal marshes of Mississippi and Louisiana, like the Rainey, the Rockefeller, and the Louisiana State wild-life refuges, probably will never be reclaimed.

Far north of these places surprising occurrences of alligators have been reported. In June, 1926, seven alligators ranging in length from less than 2 feet to 4 feet, the longest weighing about 75 pounds, were captured in the Potomac River near Washington, D. C., and press accounts record the frightening of New Jersey bathers during the same summer by alligators of some size. On August 15, 1899, an alligator 3 feet in length was caught in Mile Run Brook, near New Brunswick, N. J., and on August 22, 1901, an alligator 3 feet 9 inches in length was found in the cellar of a house in Jersey City. In California, Chester A. Pinkham, at Salt Creek Bridge on the Salton Sea, reported the capture of a 13-inch alligator in Salt Creek; another individual 2 feet in length was taken in July, 1910. Alligators are not indigenous to these States, however, and it is probable that the individuals reported had either escaped from captivity or had been liberated by their former owners. In all instances where no publication is cited, the details of distribution hereinafter given are based on data from the files of the Bureau of Biological Survey.

In North Carolina, according to C. S. Brimley, of Raleigh, Albemarle Sound is probably the northern limit of the natural range of

the alligator, as specimens have been taken in Hyde County and the animals are still common in suitable situations from the Neuse River estuary southward. Under favorable conditions alligators in North Carolina are most common near the seacoast, but occasional individuals ascend the rivers for 50 or 60 miles; there are records for Robeson, Bladen, and Lenoir Counties.

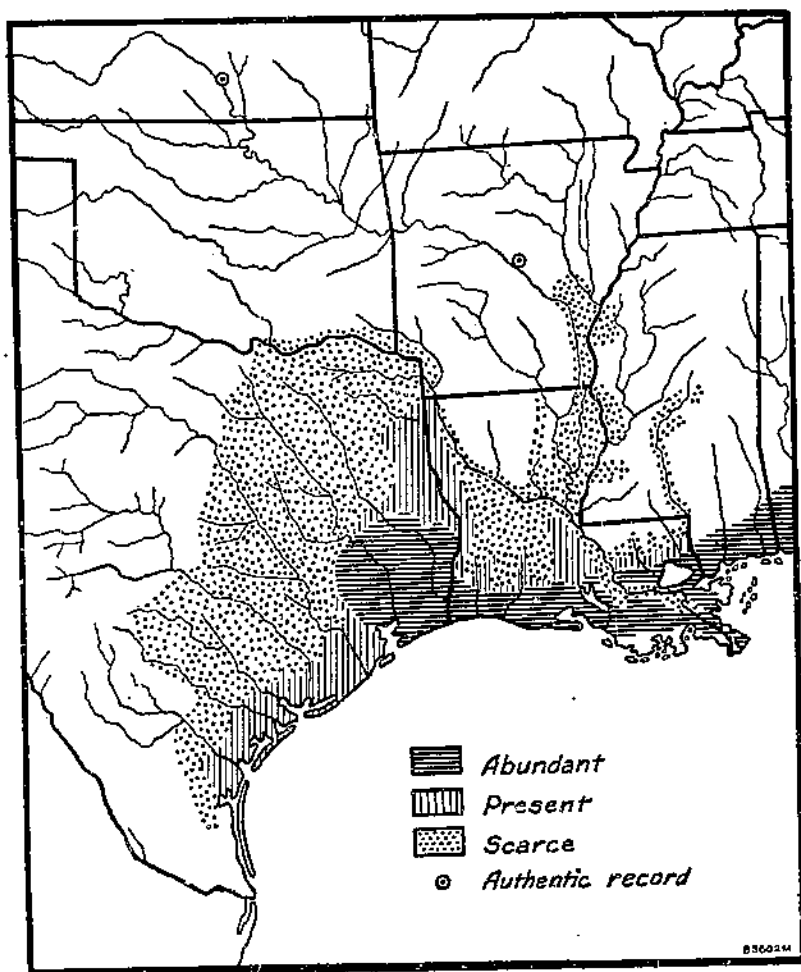


FIGURE 1.—Distribution of the alligator in the western Gulf Coast States and adjacent areas (Mississippi, Louisiana, Texas, and Arkansas)

According to Arthur T. Wayne, of Mount Pleasant, S. C., alligators occur in all the lower fresh-water rivers of South Carolina as well as in the inland rice reservoirs, and ascend the Savannah River and its tributaries to reach their western limit in the State. C. G. Turner, manager of the Combahee plantation, located on the Combahee River and about 4 miles south of Whitehall, Colleton County, S. C., informed F. M. Uhler of the Biological Survey that approximately 2,000 alligators were killed for their hides by one man on that



plantation and adjacent marshland in 1926. During 1927, two colored laborers killed about 200 alligators in an abandoned 2,000-acre rice field known as the long view field of the Combahee plantation. Alligators were fairly abundant on this field at the time of Mr. Uhler's visit on May 10, 1928. During the same month alligators were found to be plentiful on the Willtown Bluff plantation, about

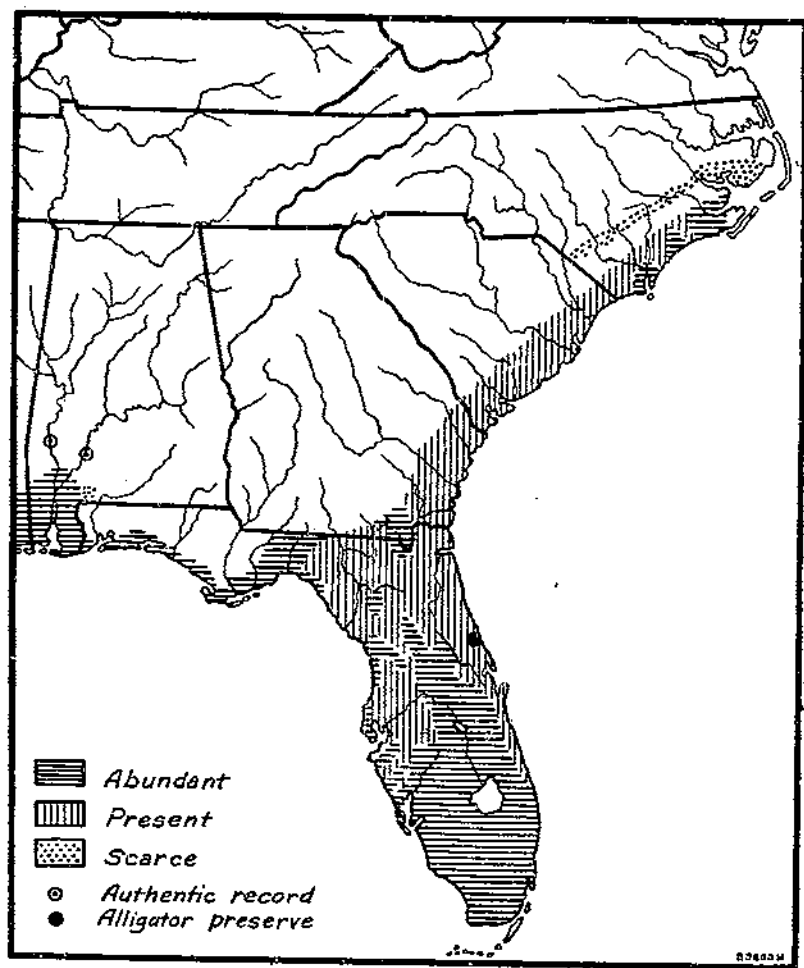


FIGURE 2.—Distribution of the alligator in the eastern Gulf and Atlantic Coast States (North Carolina, South Carolina, Georgia, Florida, and Alabama)

12 miles southwest of Adams Run, Charleston County, S. C. Approximately 15 alligators ranging from 3 to 8 feet in length were noted on May 11, 1928, in one 90-acre abandoned rice field. In former years their center of abundance in South Carolina appears to have been in Hampton County, Breekfield Backwater, and the Recess rice plantation.

In southern Georgia alligators have a coastal distribution and are common throughout the Okefenokee Swamp.

In Florida, according to data obtained by O. C. Van Hyning, of Gainesville, B. M. Kinser and E. J. Brown, of Eustis, and by A. H. Howell, of the Biological Survey, alligators may be found along the whole coast line and inland, and are especially numerous from Lake County southward, occurring abundantly in the Everglades at the southern end of the State. On the western side, they are probably most numerous in Leon and Jefferson Counties. Extreme western Florida is characterized by rolling pine hills, and has no swampy areas suitable for alligators.

The following statement from H. P. Loding, of Mobile, Ala., covers observations on alligators in Alabama over a period of 20 years:

The present center of abundance will be found in the lower delta of Mobile, Tensaw, and Spanish Rivers, the mouths of the larger creeks and rivers running into Mobile Bay, such as Dog, Fowl, and Deer Rivers, Clear Creek, and Fish River in Baldwin County, as well as their marshes and bayous. This district has, I believe, been their center of abundance in Alabama for ages. In the Alabama and Tombigbee Rivers, we find the northern limit in a western and eastern direction, respectively. In only four counties have we personally found the species: Mobile, Baldwin, Washington, and Clarke, and only in the most southern part of the latter. Escambia County may be included through the Escambia River and possibly parts of Monroe County.

From our own observations alligators occur only 40 or 45 miles north of Mobile. A river boat captain observed one 180 miles up the Tombigbee river in Choctaw County. P. H. Gosse (18, p. 34), in his letters from Alabama published in 1859 gives a good account and I believe the first authentic general natural history of the region at Kings Landing on the Alabama River, which is about 10 miles south of Selma, but does not mention the alligator.

The distribution of the alligator in Alabama and States to the east and north is shown in Figure 2.

In Mississippi, according to E. N. Lowe, of University, Miss., alligators are practically limited to the counties of the Mississippi Delta and to the marshes and lagoons of the Gulf coast, whence the hides are marketed mainly in Memphis, Tenn., and New Orleans, La. Miss Fannye A. Cook, of Crystal Springs, Miss., has observed large alligators (6 to 8 feet long) in the Mississippi River and adjacent swamps as far north as 15 miles above Natchez, and says that they are of common occurrence in the Pearl River from its mouth to a point east of Terry in Hinds County. They have been observed also in Madison and Leake Counties. In 1925 a large individual was taken at Gatesville, and in 1926 two others were observed north of that place. Information obtained by Miss Cook from reliable sources indicates that a little more than 10 years ago alligators were common in the Pearl River as far north as Canton, and that they were always more plentiful in that river than in the Big Black. In the Pascagoula River, they occur as far north as the mouths of the Black and Red Rivers. In Bayou Pierre they have been reported as far north as Dentville in western Copiah County.

In Louisiana alligators are abundant in the marshes of the coastal parishes, but appear to avoid areas where there is too much salt water. Information from Percy Viosca, jr., of New Orleans, indicates that they are fairly common above the coastal marshes in the drainage of the Sabine, Calcasieu, Mermentau, and Atchafalaya Rivers, and that they occur more frequently in the upper reaches of the Mississippi in Louisiana than in either the Ouachita or Red River basins.

In 1885, Cragin (12, p. 111) stated that alligators were reported to have come up the Arkansas River as far north as Wichita, in Sedgwick County, Kans., but that they were undoubtedly rare stragglers in Kansas. In recent years alligators have been found from time to time in southeastern Arkansas, chiefly in the drainages of the Mississippi and Arkansas Rivers. The following item appeared in the Arkansas Gazette of May 21, 1928:

An alligator which measured 11 feet in length was caught in the rear of Mr. Rorer's house, opposite this place (Little Rock), on Tuesday of last week. Nine rifle balls were shot into his eyes and other parts of his head before he was overpowered. These animals are frequently found lower down the Arkansas, but they seldom ascend the river as high as this place.

The present center of abundance of the alligator in Texas, according to John K. Strecker, of Baylor University, is in the bayou counties in the southeastern corner of the State, though in former years they were very abundant a little farther north, chiefly between the Nueces, Sabine, and Red Rivers. Their northern limits in Texas were reached by ascending the Red, Trinity, and Brazos Rivers, and there are records for Grayson, Lamar, and Bowie Counties. The most southwestern published record rests on the statement of Mearns, that "*Alligator mississippiensis* Daudin has once been taken about 32 km. (20 miles) south of Fort Clark [Kinney County], and the species is said to exist in lagoons of the Rio Grande a short distance to the eastward" (26, p. 76). A specimen from Brownsville, Tex., on the Rio Grande, recorded by Baird (5, p. 5), appears to be the most southern occurrence for the region west of the Mississippi River. In northern and central Texas the western limits of the alligator's range fall short of the one-hundredth meridian, the most western occurrences being in Denton and Blanco Counties. (Fig. 1.)

## DESCRIPTION AND HABITS

### SIZE AND GROWTH

Alligators of extraordinary size may not have been uncommon when certain sections of the South were first colonized and even for some years afterward, but whether they ever attained the proportions given by some of the early writers is an open question. While visiting the present site of New Orleans in 1718, du Pratz (15, v. 2, p. 102) says that he killed an alligator 19 feet long and  $3\frac{1}{2}$  feet in width at the widest part, and that another one 22 feet in length was killed by a friend. Audubon (4, p. 277), in relating some of his own field experiences, states that he killed an alligator that measured 17 feet in length. "The longest alligator that I ever saw," according to J. D. Mitchell, of Victoria, Tex.,<sup>3</sup> "was 17 feet and 4 inches long. He was brought down from the Lavaca River during a freshet and got lost in Lavaca Bay. This alligator was killed at Point Comfort, across the bay from Port Lavaca, Tex." An alligator (23) that measured more than 18 feet in length was killed in September, 1897, on the Santee River, S. C. Apparently apprehensions for his personal safety kept Bartram (6, p. 126) from making more than hasty excursions into Florida lagoons, where alligators were fairly plentiful, and due allowance must be made for his assertion that they reach a length

<sup>3</sup> Manuscript report in the files of the Bureau of Biological Survey.

of 20 to 23 feet. The accumulated testimony of travelers and naturalists does not support Bartram's statement, and as late as 1876 an anonymous writer (*l. p. 84*) says that—

The largest alligator killed in Florida for many years was shot last spring by Dr. De Marmon, of Kingsbridge, N. Y. The animal measured 12 feet 6 inches in length when spread on the dock. It was 6 feet 10 inches round the body, 5 feet 10 inches around the jaws, and weighed about 700 pounds. The head, which is now in the doctor's possession, is 30 inches long. It was killed on the Homosassa River, about 2 miles from Alfred Jones's grove.

According to recent reports a large alligator, the length of which is estimated by experienced observers as 16 feet, was still living in 1927 in an inaccessible part of a swamp in northern Lake County, Fla. Allowing 1 foot total length for each inch of the distance between the eyes and the nostrils, one can estimate the approximate length of the submerged body, for the alligator holds the top of the head at the surface of the water when floating or swimming.

Beyer (*7, p. 46*) in 1900 stated that the largest alligator taken in Louisiana during the preceding 20 years was killed in Bayou Lafourche in July, 1884, and measured 14 feet 9 inches in length. In 1900 an alligator 14 feet long was caught on a baited hook in the Nueces River above Corpus Christi, Tex., by Vernon Bailey of the Bureau of Biological Survey. On the other hand, it is learned that before 1850, 15-foot alligators were fairly common in some parts of the South, but shortly afterwards the dictates of fashion resulted in the slaughter of thousands of these animals to supply the demand for shoe material, traveling bags, music rolls, and the like. Few alligators as long as 12 feet are to be found alive to-day.

In captivity, when kept under favorable conditions in water the temperature of which is maintained at about 90° F., the alligator will grow, according to measurements taken by Ditmars (*13, p. 85-86*) in the New York Zoological Park, at the rate of about 1 foot a year for the first 10 years. Under favorable conditions in nature the rate of growth may be more rapid, and conversely under unfavorable conditions growth may be extremely slow.

At the time of hatching, the young are about 8 inches long and weigh less than 2 ounces. One year after hatching they average 18 inches in length and less than 10 ounces in weight. Records kept for three series of alligators in the New York Zoological Park furnished the basis for the figures in Table 1 (*40, p. 334-335*) by Ditmars of the rate of growth by alligators:

TABLE 1.—Rate of growth of alligators

Age	Length	Weight	Age	Length	Weight
On hatching..	8 inches.....	Less than 2 ounces.	8 years.....	6 feet 11 inches...	650 pounds, estimated.
1 year.....	1 foot 6 inches...	Less than 10 ounces.	9 years.....	8 feet 2 inches...	
2 years.....	2 feet 2 inches...	3 pounds.	10 years.....	9 feet 3 inches...	
3 years.....	3 feet 1 inch.....	15 pounds.	11 years.....	10 feet 11 inches...	
4 years.....	4 feet 0 inches...		12 years.....	11 feet 3 inches...	
5 years.....	4 feet 10 inches...		13 years.....	11 feet 5 inches...	
6 years.....	5 feet 4 inches...	50 pounds.	14 years.....	11 feet 8 inches...	
7 years.....	6 feet 2 inches...		15 years.....	12 feet 0 inches...	

Leech (24, p. 224) writes that an alligator 11 feet 8 inches in length, killed in Blue Creek, 18 miles southeast of El Campo, Wharton County, Tex., weighed 185 pounds. Males attain larger size than females.

Alligators probably reach sexual maturity at from 4 to 6 years of age. One kept in the London Zoological Gardens lived 34 years 10 months and 27 days, and another lived for 40 years in the Brighton aquarium, according to Flower (17, p. 938).

#### STRUCTURAL PECULIARITIES

Immature alligators are protected more or less effectively by their habitat and by their dermal armor. The body, tail, and limbs are incased in a tough integument divided into quadrangular figures by deep longitudinal and transverse furrows. The back is covered with rows of osseous integumentary plates, or scutes, each of which is surmounted by a high, sharp ridge. The adults have few, if any, natural enemies except man.

The alligator has no lips, and its teeth, especially those in the lower jaw, are naked and prominent, even when the mouth is shut. The teeth are conical, lack roots, are hollowed out at the base, and when lost are replaced. The alligator is truly tongue-tied, for the flabby, wrinkled tongue is adherent for most of its length. The posterior portion of the tongue can be thrown up against the roof of the mouth, just in front of the palatine arches, to function as a valve, completely closing the passage to the pharynx when the mouth is opened wide.

The eyes, which may remain open even during apparent sleep, are prominent but not protruding and have vertical slitlike pupils. There are both upper and lower eyelids, and the eyes are further protected under water by a dense, semitransparent nictitating membrane.

The shape of the head is the most constant external difference between the alligator and the crocodile (27), the former having a very broad snout. The following technical description will distinguish the skull of the alligator from that of related genera:

The skull is broad and flat, with small supratemporal fenestrae; snout broad, with bluntly rounded extremity; external narial aperture divided medially by a bony septum, which is formed by a pair of anteriorly directed processes of the nasals and posteriorly directed processes of the premaxillary bones; 17 to 20 teeth in each upper jaw; 18 to 20 teeth in each lower jaw; a pit in each upper jaw for accommodation of the fourth mandibular tooth; lacrymals separated from nasals by greatly elongated anterior processes of prefrontals; maxillaries in contact with prefrontals; quadratojugal lacks sharp anterior process.

Whether progression in water be leisurely or hurried, the powerful tail furnishes the necessary motive power. During caudal propulsion the legs are held close to the body so as not to impede progress. Alligators can swim for considerable distances faster than a man can paddle a canoe. Their agility in the water is quite remarkable, as anyone will bear witness after observing one of them swerve from side to side, turn abruptly, or shoot ahead in a short spurt in pursuit of a fish. When disturbed in the water, an alligator will sink to the

bottom and remain there for some time. Better adapted for an aquatic than for a terrestrial mode of life, an alligator when surprised basking in the sun is very awkward in its movements, plunging head-long toward the water; they are a decided contrast to the ease with which it dives out of sight. The weight of the body and the shortness of the limbs increase the alligator's difficulties on land.

The jaws and the tail of an alligator 6 feet or more in length are formidable weapons and may be employed simultaneously. Unable to turn its head upon the short thick neck to any appreciable extent, the animal bends the whole body like a bow and, while reaching for the victim with its jaws, sweeps the tail forward with surprising force. Sweet (38) records that a supposedly dead alligator 9 or 10 feet in length once snapped its tail against a man weighing about 200 pounds, breaking one of the victim's legs and throwing him several feet. The man was picked up unconscious. Experienced hunters affirm that a blow from the tail of a large alligator will break the trunk of a tree several inches in diameter.

#### VOICE

The male alligator is unique among reptiles in being able to produce a loud noise or bellow that may be heard at a distance of a mile or more. On cloudy days or evenings of spring and early summer the bellowing of these creatures is most surprising to one unaccustomed to it. Even if one disregards obvious embellishments of the ideas that Brickell and Bartram (8, 6) have wished to convey, it is nevertheless plain that both these men were greatly impressed by the incredible loudness of the call. Opinions differ as to the purpose of the raucous bellow of an old bull alligator, some considering it a challenge or a warning to near-by bulls, and others a call to attract the attention of females. At the time of bellowing fine jets of a musky-smelling fluid are ejected from glands on the chin of the male, and this ejection is commonly associated with the period of courtship. The voice of the female is less tremulous, and that of the young may be described as a weak grunt, which is readily imitated by hunters who wish to lure the reptiles from their hiding places. When alligators in captivity are annoyed they show their displeasure by taking deep inspirations, inflating their bodies beyond their usual proportions, and discharging the air through the throat with a hissing bellow that may be repeated several times a minute.

#### WINTER HABITS

Alligators are heat-loving saurians and are rarely seen in cool weather. At the approach of winter they take refuge in some deep pool or else burrow into the mud and remain dormant until spring. As far north as central Florida and southern Louisiana they do not appear to hibernate all through the winter and, while less active than during the warmer months, may be seen occasionally on warm days throughout the winter. After the weather becomes warm enough to draw them from their winter quarters, they are torpid or sluggish for the first few days. During sultry days of May and June they may be seen basking in the sun along the sandy shores of lakes and streams, but they are most active during the hot days of

July and August. When not disturbed alligators are fond of sunning themselves, but their presence in localities where they are relentlessly sought after by hide hunters is more often revealed only by a snout protruding here and there above the surface of some stream or lagoon.

Through the cold weather of winter adult alligators sleep buried in the mud, although the younger ones in mild winters move about to some extent. When a cold spell catches them away from their dens, they lie in a torpid condition as long as the low temperature prevails. Alligators thus unable to move have been found on the edge of their dens, on banks near water, or in shallow water. An interesting account of the alligator's habits during the winter months is contained in a manuscript report of the late J. D. Mitchell. His observations were made during Christmas week of the mild winter of 1893-94 on a body of water known as Traylor's Lake, covering about 500 acres in the Guadalupe River Valley about 12 miles below the town of Victoria, Tex. This lake had an average depth of about 4 feet and was normally filled by overflows from the river. Mitchell prefaces his account by saying that the years of 1892 and 1893 had been dry in southern Texas and the sloughs and ponds had not been filled by the usual overflow from rivers. All natural water holes with the exception of running creeks and rivers had dried up.

From a bluff Mitchell saw that the lake was dry, except for two small adjoining patches of about 10 acres each near the east side that were covered by a slight scum of water. The weather was warm and the sun was shining. Alligator gars (*Lepisosteus platostomus*) and turtles appeared to be the sole inhabitants of the first pool, and alligators of the second, the two having apparently separated by mutual consent. Mitchell estimated that there were at least 1,000 alligators in the second pond, and among them was a particularly large one afterwards found to measure 15 feet 2 inches in length.

Arrangements made with some friends to assist him in the capture of this large alligator were interfered with by a cold norther coming up in the night with a little rain and promise for bad weather the next day. On again reaching the bluff, Mitchell remarked that the scene had changed. The alligator gars and the turtles were quiet, and the alligators had buried themselves in the mud, "the places where the larger ones had gone down were marked by small mounds, which looked like graves, the mud being pushed up through the thin film of water." The soft liquid mud was fully waist deep.

#### MIGRATORY HABITS

Alligators sometimes wander for considerable distances over dry land, possibly journeying from pond to pond, and they are occasionally observed crossing dusty roads in sparsely settled areas. In some sections of Florida (10) they are said to be found occasionally during early summer partially buried in the warm sand of public highways near lakes and rivers. Holbrook (22, p. 56) is authority for the statement that—

such alligators as dwell in ponds and streams out of the influence of tidewater wander much farther from the banks and are not infrequently seen a mile or more from water; this happens, however, most commonly when they migrate for some reason or other from one pool to another.

Old settlers say that alligators were once abundant as far west as the sources of the Brazos River in Texas. There is an Indian legend, recorded by Strecker (37, p. 7), to the effect that large numbers of these reptiles were driven out of northwestern Texas by long-continued drought and that they came overland in immense droves headed in the general direction of the Gulf coast, but Mr. Strecker considers that this legend may refer to the large tiger salamander (*Ambystoma tigrinum*), the habits of which were misunderstood by the aborigines.

J. D. Mitchell\* observes:

\* \* \* should the lake or creek residence dry up, which sometimes happens, the alligator retires to his den, and should that fail he will travel a long distance in search of water. Several times during long droughts, I have found them in a cow trail in the prairie, several miles from water, lumbering along, with their heads pointing toward water. Those I met made little resistance, and all were under 7 feet in length. An old breeding female usually provides herself with a den big enough and deep enough to carry her through an ordinary drought.

#### BREEDING SEASON AND NEST

One would infer from the literature that the observations indicated a late mating season, and yet Arthur (2, p. 174-175) has ascertained that in Louisiana, at least, the alligators mate in the latter part of February or early in March, depending upon the prevailing weather and the preceding winter. The period of copulation, however, is rather protracted, extending through March and April until some time in May. In Florida and along the Atlantic coast, the breeding season is said to extend from May until July, varying in length according to locality. During the breeding season the males are especially active and travel considerable distances. Exceptionally noisy and quarrelsome at this time, they participate in fierce battles with rivals and not infrequently suffer the loss of a limb or some less serious mutilation. One forefoot of a 11-foot 8-inch alligator taken in Texas was entirely gone.

Some native hunters state that the egg-laying season continues from January to September, but others consider June the favorite month. Nests may be found in small numbers before June, but it is quite certain that the females wait until climatic conditions are favorable before laying the eggs, for during prolonged drought the swamps are dried up and the alligator holes are reduced to mere puddles. Usually dry weather will retard laying, and the eggs are not deposited until after the occurrence of heavy rains.

A slight elevation near the hole prepared by the female is usually selected as the site for the nest, although in large swamps suitable places may be at a considerable distance from their place of refuge. The female apparently constructs the nests without assistance from the male. Dead leaves and twigs, bulrush, cat-tails, saw grass, and other marsh plants, together with quantities of humus, are scraped together into a low mound, which may be 3 feet in height and 8 feet in diameter at the base. The eggs are laid near the top of the nest, usually within 8 inches of the surface and often four or five layers deep, and each layer is generally separated from those above and below by vegetation. The number of eggs found in these nests

\* Mitchell, J. D. Manuscript report in the files of the Bureau of Biological Survey.



varies from 20 to 60. The eggs are from 2 to  $3\frac{1}{2}$  inches in length (11).

Although it is generally accepted that the adults do not show any special consideration for the young after they are hatched, it would appear from the narrative of Bartram (6, p. 124-125) and the life-history notes published by Arthur (3, p. 180) that such may not always be the case.

In reporting on the habits of the alligator in Texas, Mitchell\* found that the female adapts herself to surroundings and uses such material as she finds convenient. The following are abstracts from observations on the nests of alligators in Mitchell's manuscript report:

A nest that was found near Cox Creek, Jackson County, in the prairie region, among some short live-oak runners, contained 32 eggs and was composed of grass, dried cow chips, and live-oak twigs \* \* \*

Another nest containing 40 eggs, located on a low place in the Natividad Bottom, Jackson County, was composed of dead moss and leaves mixed or plastered together with mud, the outside being protected with sticks ranging from the size of one's finger to 3 inches in diameter, and from 2 to 6 feet in length. This nest resembled natural drift so closely that it would readily escape the casual observer. \* \* \*

A third nest found in the marsh region near the mouth of the Guadalupe River, where only saw-toothed rushes (*Cladium*) and bulrushes (*Scirpus*) were available, was composed of material of this sort, cemented together with mud to retain the moisture. Freak nests are sometimes built by female alligators. A nest of this sort was found among saw-toothed rushes and bulrushes in a marsh in the valley of the Guadalupe River, fully 50 yards from land and in knee-deep water. The female had collected rushes and matted them down until she had built a platform 14 feet in diameter, which not only was elevated above the surface of the water but also was strong enough to bear her weight. In the middle of this platform she built her nest out of rushes and mud. Two other nests constructed in the same manner, but in different marshes near the Garcitas River, Victoria County, were somewhat smaller than the one found in the Guadalupe River \* \* \*

The nest is usually built as near the mother alligator's den as possible, generally within 20 feet, provided a suitable location can be found. Average outside measurements indicate that the nest is generally about 4 feet in diameter at the base and usually pyramidal in shape; the cavity containing the eggs is about 1 foot in diameter and rather smooth on the inside. When the nest is nearly completed, the female alligator deposits her eggs, dropping them from the top. Eggs are frequently found in the lower part of the nest that are indented or slightly crushed from falling on the first ones laid, but such accidents do not prevent them from hatching, if the tough inside lining has not been ruptured. Live embryos have been found in indented and crushed eggs. My observations lead me to believe that all the eggs are deposited at one time. In finishing the nest a small spiral passage located at the top and invisible from the outside is left open for the young to escape. The prevailing idea that the mother destroys the nest to let the young escape is erroneous. I have seen dozens of nests from which the young had escaped and the small hole in the top was the only opening. \* \* \* Thirty eggs was the smallest clutch and 60 the largest that I ever saw taken from one nest \* \* \*

When the newly hatched alligators emerge from the nest, they instinctively start for water, squealing or grunting. The mother on watch calls them to her den, which then becomes their home until they can take care of themselves.

In general it may be said that under natural conditions the eggs of alligators are deposited and hatched in masses of decaying vegetation, chiefly the marsh grass and cat-tails used in the construction of the nest. In building the nest the alligator piles the vegetable material into a rounded heap and mats it down by crawling over it. In

\* Manuscript report in the files of the Bureau of Biological Survey.

fermenting and decomposing this pile of vegetation produces sufficient heat to incubate and hatch the eggs. Moisture is necessary, as the porous shell allows such rapid evaporation that the embryos would be killed if the eggs were allowed to dry. The complete process of incubation extends over a period of about eight weeks.

The following statement taken from a report by Arthur (3, p. 178) is of especial interest in this connection:

Our observations tend to show that a 5-foot alligator will lay about 25 eggs; a 6-footer will lay about 35 eggs; and a 7-footer will lay up to 40 eggs; this seems to be the maximum number laid, although a trapper in the Atchafalaya River country reports having taken 72 eggs from one nest on a small island in the river.

The precise period of incubation has not been worked out. Our figures show that a nest was first observed July 5, when the eggs had not been laid more than a few days; the hatching commenced September 7, making the incubation period about nine weeks. Eggs taken from the nest and hatched away from the place where laid take longer. The percentage of fertile eggs is as a rule very high, most of the infertile eggs being found in the nests of the 5 and 6 footers.

#### SUBTERRANEAN CAVES

In the habitat of the alligator, throughout the sloughs or marshes filled with rank growths of waterlilies, saw grass, or other aquatic plants, narrow and winding trails lead off in every direction through the grass and flags and usually end in a "gator hole." A typical hole (30, p. 11-13) is rarely more than a few yards in diameter, but under one of the banks and below the surface of the water is an entrance to a large subterranean cave, which is excavated backward at almost right angles to the sides and may be 15 or 20 feet in length. Alligators are becoming quite wary and quickly take refuge in their caves at the approach of a hunter. Although available data are conflicting, it is possible that such caves as are not completely filled with water are used for winter retreats. A female alligator 9 feet in length occupied a hole in Aguilar Creek, Keeran's Ranch, Victoria County, Tex., for several years. She had a dry den under the bank to which she retired when disturbed. The pool of water in the creek bed was about 5 feet wide and 15 feet long.

Local conditions, particularly the natural water level, undoubtedly determine the type of these subterranean caves. In some regions they are said to be excavated to a depth of 15 or 20 feet, and elsewhere are said to end about the water level. John Brickell, one of the earliest writers on natural history in the South, stated in 1737 (8, p. 133-134):

\* \* \* they make their dwellings in the banks on the river sides, a great way under ground, the entrance whereof is generally two or three feet under water, which rises gradually as they burrow under ground, 'till it rises considerably above the surface of the water, where they lie dry all the winter, at which season they never appear abroad, but as it is supposed, sleep all that time without any manner of provision, which some report to be the space of three score days.

#### ALLIGATOR HUNTING

Alligators are generally sought at night by one or more hunters using a skiff or other easily maneuvered boat, with some sort of a light in the prow. A bull's-eye carbide light, an oil lamp, or even a pine knot, may be employed to shine into the alligator's eyes to locate the animal. The hunter tries to get within 50 feet, or even closer if

possible, and then shoots the victim between the eyes with a small-caliber rifle or with a shotgun loaded with heavy shot. At close range the top of the animal's head is sometimes blown off. Experienced alligator hunters are skillful in their work, and in Louisiana, at least, they may take three dozen or more of the animals in the course of a night. (Pl. 2, A.)

Various tactics have been employed by hunters to bring the alligator from its subterranean retreats. A most interesting method is described by Brimley (9) who says:

\* \* \* the party looking for them searched around the edge of the marsh or of an island until a place was found where it was evident from the muddy water that an alligator had gone into his hole. One man with a fish gig thereupon probed about through the surface layer of roots and grass until he found the alligator's body, when he stuck in the gig and held on. A second man with a spade then dug a hole through the marsh as near as was convenient, making sure, of course, of digging into the alligator's run. A pole was then procured and the animal prodded with it until he not only bit but held on. He was then dragged to the surface until sufficient of his head was visible to allow the man with the rifle to finish him with a bullet through the brain.

In many cases the hole or cave that serves as a refuge is so far below the water level that it would be impracticable to reach the animal by digging. Under such conditions a pole is employed, and to one end of it is attached either a strong hook or a wire noose to bring the alligator to the surface, where it can be killed with an ax or shot. A flexible pole, usually about 16 feet long and tipped with an iron hook, is used by hunters in some parts of Louisiana. Old individuals generally frequent some deep cave in the bank of a small pool or a deep hole in some stream, but not infrequently they have to make the best of whatever refuge they can find.

An instance of this sort is described in a letter from J. D. Mitchell, who while visiting the Keeran Ranch in the eastern part of Victoria County, Tex., during July, 1920, was informed that a 9-foot alligator had laid its eggs in a nest built in a marsh about 10 miles distant. This nest, said Mr. Mitchell—

\* \* \* was made of grass, scratched and scraped from a circular area; the site was about 6 inches above the water and only a few feet from the edge of a hole used by the alligator as a den. This hole was about 4 feet deep, and extended 10 or 12 feet in the marsh under the cat-tails. Mr. Webb cut a long ash pole, to one end of which he attached a noose made of a large copper wire, and after probing around for about half an hour he slipped the wire noose over the head of the alligator. A strong rope was slipped over the pole and the copper wire before he persuaded the alligator to come to the surface and put its head in the rope noose. When this rope was drawn tight, the alligator \* \* \* rolling, floundering, and snapping \* \* \* was easily dragged out to open ground and killed.

The following description of methods employed by alligator hunters is given by Wright (41, p. 137) in his account of the alligator in the Okefenokee Swamp:

The methods of hunting the alligator, as practiced by the \* \* \* inhabitants of the region, consist mainly of going out at night in small boats and locating the animals by means of a lamp fastened to the head of one hunter in the bow of the boat. Another hunter in the stern paddles or poles and uses the sharp end of the push pole to "stick" the body after the animal has been shot and has sunk to the bottom. According to these hunters, who every year take out a large number of skins, the eyes of the small alligators appear red by the light thus used, while those of the large specimens are yellow. The hunter carrying the light swings his head from side to side through an arc of 180 degrees, and when an alligator is sighted shoots it by the light of the lamp on his head. The

common supposition that the skin of an alligator will turn the bullet of a gun is, of course, unfounded. Since, however, only the head of the animal is usually exposed when it is in the water, they are commonly shot through the eyes. The hunters generally use a shotgun loaded with buckshot. That a large number of alligators are annually secured in this manner is evidenced by the fact that the fields \* \* \* are strewn with the skeletons and dorsal strips of skin which have been thrown away after each expedition. Only the ventral part of the skin is saved, the upper portions being too thick and spongy to admit of the primitive methods of tanning, and therefore the crest and dorsal scales are not retained.

#### ANNUAL CATCH OF ALLIGATORS

Alligator hides have been used for one purpose or another in the United States since about 1800. It was not until about 1855, according to Stevenson (36, p. 343-345), that the use of alligator leather became fashionable and then only for a short period. Nevertheless, the following quotation from an article by Audubon (4, p. 271) indicates that alligators were killed in large numbers at a much earlier date:

In Louisiana, all our lagoons, bayous, creeks, ponds, lakes, and rivers, are well stocked with them,—they are found wherever there is a sufficient quantity of water to hide them, or to furnish them with food, and they continue thus, in great numbers, as high as the mouth of the Arkansas River, extending east to North Carolina, and as far west as I have penetrated. On the Red River, before it was navigated by steam-vessels, they were so extremely abundant, that, to see hundreds at a sight along the shores, or on the immense rafts of floating or stranded timber, was quite a common occurrence, the smaller on the backs of the larger, groaning and uttering their bellowing noise, like thousands of irritated bulls about to meet in fight, but all so careless of man, that unless shot at, or positively disturbed, they remained motionless, suffering boats or canoes to pass within a few yards of them, without noticing them in the least. The shores are yet trampled by them in such a manner, that their large tracks are seen as plentiful as those of sheep in a fold. It was on that river particularly that thousands of the largest size were killed, when the mania of having either shoes, boots, or saddle-seats, made of their hides, lasted. It had become an article of trade, and many of the squatters and strolling Indians followed for a time no other business. The discovery that the skins are not sufficiently firm and close-grained, to prevent water or dampness long, put a stop to their general destruction, which had already become very apparent. The leather prepared from these skins was handsome and very pliant, exhibiting all the regular lozenges of the scales, and able to receive the highest degree of polish and finishing.

Alligator hides were extensively used during the Civil War, and many thousands of these reptiles were slaughtered to supply shoe material. Smith (35, p. 343) estimated that not less than 2,500,000 alligators had been killed in Florida alone between 1800 and 1891. A good market was developed for hides of alligators about 1870, and as late as 1902 Stevenson reported that the output of the tanneries of the United States approximated 280,000 skins annually, worth about \$420,000, and that about half of these were furnished by Mexico and Central America.<sup>a</sup> At that time it was estimated that Florida supplied 22 per cent and Louisiana 20 per cent of the total 280,000 skins used in the United States each year.

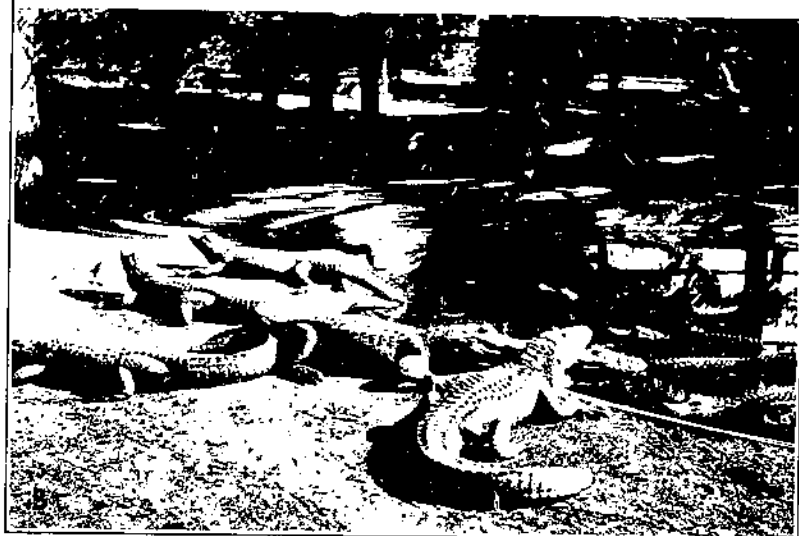
Apparently overlooking Stevenson's report, a writer in the Brooklyn (N. Y.) Eagle for June 15, 1902, states:

Their skins when tanned make excellent leather for the manufacture of such articles as trunks, traveling bags, purses, pocketbooks, and all kinds of leather novelties. Books are bound with it and it is even utilized for upholstering

<sup>a</sup> These skins must have been those of *Crocodylus acutus*.



A



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A.—Part of a one-night's kill of alligators by alligator hunters in Louisiana. Alligator hunting is responsible for an alarming decrease in the numbers of these reptiles. (Photo by Stanley F. Arthur)  
B.—Alligators on farm in California. A wooden barrier surrounds the space about the concrete-margined pool. (Photo by George Loukin)

chairs. Dade County, on the east coast of Florida, sends to market about 50,000 skins annually, while the number from the counties on the west coast reaches fully 125,000 each year. There is one firm in New Orleans that handles over 500,000 skins annually.

Large numbers of live and mounted young alligators are disposed of each year to the tourist trade in Florida. The demand for such articles does not appear to have diminished in recent years, and it would appear that the trade in such articles was profitable as early as 1890, as shown by the following quotation from an article by Smith (35, p. 345):

Live and stuffed alligators enter largely into the trade in Florida curiosities. In Jacksonville there are 12 dealers in alligators and 18 other dealers in shells, fish-scale jewelry, alligator teeth, etc. In 1890 about 8,400 alligators were disposed of to tourists in Jacksonville. The taking of small alligators to be sold as curiosities is now a prominent feature of the business; large numbers are annually secured and disposed of at prices, varying with the season, supply, and size, ranging from \$20 to \$35 per hundred, although as low as \$10 has at times been received. The price for stuffed alligators is about 25 cents more than for live ones. Alligators from 6 to 12 feet long bring from \$12 to \$14 each. It is estimated that about 450 pounds of alligator teeth were sold in 1890. Of the best teeth about 70 make a pound, but from 150 to 200 of the smaller ones are required. The teeth of alligators have some commercial value to the hunter, but in many places of late not much attention has been given to them on account of the difficulty of extracting them and the low price received (\$1 to \$2 per pound). They are removed by burying the head and rotting out the teeth. The stuffing of alligators and the polishing of alligator teeth give employment to about 40 persons in addition to the regular dealers.

With the exception of small individuals, which are made up into novelty articles, there is no appreciable demand for the entire alligator hide, and the trade utilizes the belly skin alone. The hide is removed in the following manner: Two longitudinal incisions are made just below the platelike back, and then the belly skin is partly pulled and partly cut off, care being taken not to cut the hide, since such cuts reduce its market price. The hide is generally removed as soon as convenient, since putrefaction sets in quite soon in any warm climate. A quantity of salt is rubbed into the flesh side of the raw hide before it is rolled up preparatory to being shipped to some dealer. Any injury or defect that detracts from the appearance of the finished article, or adds an additional burden on the work of the tanner, will lower the market price for a raw alligator hide. The marketability of any alligator hide is also adversely affected by the presence of embedded horny tissues known as "buttons" on the underside of the scutes.

It is difficult to obtain reliable statistics on the annual catch of alligators within recent years. Information received from a Georgia hide and fur company indicates that the average annual catch in that State for the 5-year period, 1922-1926, has been in the neighborhood of 10,000 skins. Unusually large numbers of alligators were killed in Louisiana during the drought seasons of 1924 and 1925. It appears, according to Arthur (3, p. 165) that more than 21,885 belly skins were bought by raw-pelt dealers in 1925 and a severance tax thereon paid the State of Louisiana through the department of conservation. In 1926 returns were made on 36,041 skins of alligators. The total number of alligator hides taken in the United States during the past few years can hardly exceed 50,000 a year.

The prices paid for belly skins vary according to locality and to condition of hide. The figures given below were compiled for the season 1925-26 for green salted alligator skins and are believed to be reliable. The over-all length, or the distance from the tip of the under jaw to the tip of the tail, is the measurement generally used for grading alligator hides according to size, and no account is taken of a fraction of a foot, a hide measuring 5 feet 11 inches in length being graded as a 5-foot hide.

TABLE 2.—Prices paid for green salted alligator skins in Georgia, Florida, and Alabama during the season 1925-26, and average prices in Louisiana from 1916 to 1928. (Arthur, 3, p. 185)

State	2-foot skins	3-foot skins	4-foot skins	5-foot skins	6-foot skins	7-foot skins
Georgia.....		\$0.60	\$0.90	\$1.40	\$2.00	\$3.00
Florida.....		.50		1.25	1.85	2.70
Alabama.....	\$0.35			1.75	2.50	3.00
Louisiana:				2.00	2.75	3.25
1916.....	.65	.10	.20	.40	.60	.90
1917.....	.15	.25	.45	.65	.90	1.35
1926.....	.40	.95	1.75	2.00	3.00	4.00
1927.....	.50	1.15	2.00	2.25	3.25	4.65
1928.....		.35	.65	1.25	2.25	3.25

#### LEGAL RESTRICTIONS ON THE CAPTURE AND SALE OF ALLIGATORS

Replies to questionnaires sent by the Bureau of Biological Survey to fish and game commissions of the several States within the range of the alligator indicate that only Florida and Louisiana have imposed either local legal restrictions or taxes on the capture of alligators.

#### FLORIDA

In Florida, alligators are protected by local laws (31, 32) from March 1 to November 19 in Collier, Dade, Glades, Highlands, and Monroe Counties. A trapper's license is required to hunt alligators in these counties, for which a resident pays for county of residence, \$5; for county other than county of residence, \$10; for the State, \$25. Only county licenses are issued to nonresidents, the fee for which is \$25 for each county. No taxes are levied on alligator hides in Florida.

In Hendry County a close season for alligators is provided from March 1 to December 1. In this county a trapper's license is required, for which a bona fide six months' resident pays \$5.25, while trapping license for a nonresident of the county issued to a resident of the State costs \$10.25. The close season for alligators in Brevard and Volusia Counties extends from February 1 to December 1. A close season on alligators from February 21 to October 31 is provided for in acts of 1927 covering Martin County. Similar legislation provides for the closing at all times of certain areas in Lake and Marion Counties to alligator shooting. The clause of the game and fresh-water fish law (32, p. 32) of 1927 covering these counties reads as follows:

It is unlawful for any person or persons to capture, kill, catch, maim, injure, shoot at, or destroy alligators or alligator nests in any of the following enumerated waters, lakes, canals, rivers, and marshes located either in whole or in

part in the counties of Marion and Lake, in the State of Florida, to wit: Lake Dora and marsh adjacent thereto, the Dora Canal and marsh adjacent thereto, Dead River and marsh adjacent thereto, Lake Eustis and marsh adjacent thereto, Haines Creek and marsh adjacent thereto, Lake Griffin and marsh adjacent thereto, Silver Springs Run and marsh adjacent thereto, the Ocklawaha River and marsh adjacent thereto, south of where Silver Springs Run empties into the Ocklawaha River.

#### LOUISIANA

There is practically no close season on alligators in Louisiana, although an open season was prescribed as from November 20 to February 5. Alligators have been outlawed in all the coastal parishes and are now being rapidly depleted in numbers. The following severance taxes are imposed on alligator hides taken in the State: Skins not exceeding 5 feet in length, 1 cent; skins over 5 feet in length but less than 10 feet in length, 2 cents; and all skins over 10 feet in length, 3 cents.

#### ALLIGATOR RESERVES AND FARMS

The State Alligator Reservation on Tomoko Creek and River in Volusia County, Fla., has been designated and set aside by the State as a permanent refuge where this fast-disappearing reptile can not legally be captured, killed, or molested. The mouth of Tomoko Creek is situated about 10 miles north of Daytona Beach, and the stream flows north by east. Here it is hoped that the alligator will thrive under the very favorable natural conditions.

At least one of the economic phases of the alligator industry is an outgrowth of the at first rather haphazard method of impounding live alligators preparatory to or while waiting for orders for shipment to circuses and side shows, zoological parks, and less frequently for window displays of commercial establishments. With the increase in the number of winter tourists to the South and West, particularly in Florida and California, added diversions for these people gradually made their appearance, and among those of an exhibitional type were alligator farms. In a comparatively few instances it was found that suitably located alligator farms, properly managed, could derive a satisfactory revenue from paid admissions. While the number of such existing establishments is very limited, there are several located for the most part in Florida and in California that have been in existence for a number of years. In the case of one of these farms, the records show that at least half the total income was derived from the gate receipts, a quarter from the sale of manufactured merchandise, a tenth from the sale of live alligators, a tenth from the rental of live alligators, and not more than a twentieth from the sale of hides taken from animals raised in captivity. (Pl. 2, B.)

That those engaged in alligator farming are not propagating these reptiles on an extensive scale is apparent from the interviews with the owners. On one of these farms it has been observed that the captive females do build nests and lay their eggs therein, but with no degree of regularity. Of 50 females, as many as 5 may lay eggs during the season, and then again none of them may. At this farm the few alligators that were hatched were from eggs left in the nest as the female placed them. The embryos of eggs placed in incubators died when about half developed.



As might be expected, the largest alligator farms in the United States are in Florida, and one of them reports having 12,000 animals on hand, of which about 150 are more than 11 feet in length and approximately 400 measure from 6 feet to 11 feet in length. J. V. Kelsey, of the Biological Survey, ascertained that something like 3,000 young alligators are purchased each year by the manager of this farm from South Carolina, Georgia, Florida, and elsewhere along the Gulf coast. More than 3,500 small live alligators are sold by the Florida farms each year. Many of these find their way into private homes, and a lesser number are used for demonstrations in nature-study courses.

Those engaged in alligator farming generally have at least one building for displaying and for selling alligator products. The articles on display include cheap post-card pictures of alligators, miniature alligators of various materials, small mounted alligators, and various kinds of leather goods, ranging from small novelty articles to more expensive handbags and suitcases. Tanned hides and mounted specimens also are offered for sale by some of these concerns. In the past none of those engaged in alligator farming manufactured the goods on display in their showrooms, but acted merely in the capacity of retailer for some leather-goods firm. Recent developments have led one or two of these alligator farms to attempt the manufacture of some of their own goods.

Although an alligator pen is a somewhat elastic term as at present applied, what is generally meant is some sort of an artificial contrivance containing water. These pens may be either of a temporary nature to care for unusually large incoming shipments or of a more permanent construction for long-continued use. Semipermanent pens have been constructed by driving rows of strong wooden stakes into the ground to prevent the alligators from burrowing or escaping through the surrounding soft mud and earth. The pens used in alligator farming are of various forms, and most of them are merely concrete-lined pools inclosed or fenced in with cheap poultry-wire netting.

Wooden pens 12 to 14 inches high, with a cement or preferably a natural earth bottom, have proved satisfactory for raising young alligators. Pens of this type are fenced in with wire netting, and the inclosure may cover from 50 to 100 square feet.

In the so-called breeding pens with cement-lined walls, where the larger individuals are kept, the excavation or pool may be 50 feet long, 5 to 6 feet wide, and about 5 feet deep. The number of such tanks varies according to the size of the farm, and on some of the larger farms several thousand square feet of ground may be fenced in. These concrete pens have their upper rim level with the surface, and as an added precaution against the escape of any of the alligators, a fence constructed of wire netting above and with a wooden base about 2 feet in height, is built around the pool. In crowded inclosures, however, the alligators invariably mutilate or kill one another. Palm trees, pepperwood trees, or other common shade trees may be found within these inclosures, but almost without exception the pens are noticeably devoid of any brush, grass, or other small vegetation. Such vegetation is simply worn away by the many bodies dragged across it.

Alligators in captivity are not all particular in their choice of food swallowing bones, hide, and hair, whole carcasses of smaller animals, and occasionally the feet, legs, or tail of a companion. The kind of food fed by the Florida alligator farms varies according to season and locality, but for the most part consists of fish unfit for the market and horseflesh. A farm at South Jacksonville, Fla., reported to J. V. Kelsey that about 3 tons of food daily was required to feed their stock of 12,000 alligators, while from 700 to 800 pounds daily was required for some 6,000 alligators at St. Augustine. The owner of a Los Angeles, Calif., alligator farm reported to George Tonkin, of the Bureau of Biological Survey, that from the 1st of April to the end of September from 500 to 1,500 pounds of horse meat was fed weekly to approximately 1,500 alligators. During the warm weather of July and August, larger quantities of meat were required than at other times. Alligators less than a year old are fed two or three times a week, but the older ones are generally fed only once a week. Feeding may be more expensive on farms located within the limits of large cities, because of the numerous sanitary restrictions more necessary there than on country farms.

#### FOOD OF THE ALLIGATOR

For a study of the food of alligators in the wild, 157 stomachs were available, all but 12 of which were obtained in Vermilion and Cameron Parishes, La., 3 of the others coming from Thomas County, Ga., and 8 from near-by localities in Florida. Of the 139 stomachs collected by hunters on the Rainey Wild-Life Refuge, 73 were obtained through the interest of Richard Gordon, in charge of the refuge, and 62 and 4, respectively, by C. C. Sperry and J. R. Greeley, of the Bureau of Biological Survey. G. W. Raborn and Leon Hebert, of the Orange-Cameron Land Co., furnished the stomachs of 6 rather large alligators taken in Cameron Parish. One stomach obtained from an alligator taken in St. Mary Parish, La., was submitted for examination by Arthur Svihla. Those taken in Georgia and Florida were submitted by H. L. Stoddard and C. O. Handley of the Biological Survey. Eight of the 157 stomachs were so nearly empty that they were disregarded in tabulating percentages of food eaten.

On the basis of this series of stomachs, it appears that crustaceans contribute about 47 per cent of the annual food, vertebrates 29 per cent, insects 20 per cent, and spiders nearly 3 per cent, and miscellaneous items the remainder. Crabs, crawfishes, fishes, and water beetles, in quantity in the order named, contribute about 70 per cent of the food eaten during summer and fall. The contents of stomachs of alligators taken in Florida and Georgia suggest that in these regions the food consists to a large extent of reptiles (such as turtles and snakes) and fishes. Most of the stomachs examined were taken during or shortly after a period of prolonged drought, and the interpretations placed on the food ratios may not be applicable to the food habits under more normal conditions. An unidentified nematode was found in one stomach, but this is to be considered as a parasite rather than as food of the alligator.

## CRUSTACEANS

Crabs, crawfishes, and shrimps comprised 47.03 per cent of the total food eaten by 149 alligators, ranging from 2 feet to 9 feet 8 inches in length. Large shrimps (*Peneus*) occur in immense numbers along the Gulf coast and are of commercial importance. They live in shoal water on sandy flats or among the weeds on bottoms of bayous, in both salt and brackish water; hence they form a convenient food item for alligators. Shrimps comprised 2.59 per cent of the total food, and were eaten by 10 alligators—in one case 41 individuals were taken and in another 15, the majority of these in the month of July.

Crawfishes (*Cambarus*) are not usually regarded as a staple article of food for man in the Gulf coast region. They have some value as scavengers, but their burrowing habits may occasion serious breaks in levees and dams protecting the lowlands in the Southern States; and they are sometimes destructive to crops. This series of stomachs would indicate that crawfishes contribute nearly 20 per cent of the total food of the alligator. Forty-six of the alligators taken in the seven months, April to October, had fed on crawfishes, but 38 was the largest number of individuals in any one stomach.

Predatory swimming crabs (*Callinectes*) comprise an important item in the diet of alligators, and, while 14 was the largest number of individuals noted in any one instance, their remains were identified in 80 stomachs. These crabs occur in great abundance along the Gulf coast, swimming up streams with the flood tide and retreating with the ebb. It is just as well that alligators act as one of their natural checks, for these crustaceans destroy the eggs and young of fishes. The commercial utilization of crabs in the Gulf coast area has not reached the proportions where alligators in any way interfere with the industry. In the entire series of stomachs examined, crabs constitute about 20 per cent of the food, and practically all of this is made up of swimming crabs. Two other kinds of small crabs that are frequently utilized as bait, but apparently have no other economic importance, however, were found in eight of the stomachs—the little fiddler crabs (*Uca*), which congregate in immense numbers and live in holes they excavate above the reach of the tides, and the less active wood crabs (*Sesarma*), which are associated with fiddler crabs in the salt marshes and fresh-water bayous.

## SPIDERS

Spiders were eaten mainly by alligators that were from 2 to 3 feet in length, and were present in 62 stomachs. In the entire series of 149 stomachs spiders contributed 2.86 per cent of the food, and in the food of thirteen 2-foot alligators taken in July they averaged about 10.15 per cent. In July spiders comprised 1.46 per cent of the food of twenty-six 3-foot alligators, and in September 4.73 per cent of 22 of the same size. A large predatory wolf spider (*Lycosa carolinensis*) occurred most frequently in those taken in Louisiana, and was present in at least 32 of the stomachs.

## INSECTS

Insects, chiefly water beetles and leaf chafers, comprised 20 per cent of the food found in the series of alligator stomachs examined.

Of these, water beetles of one kind or another alone contributed 11.25 per cent. Several thousand stone-fly larvae formed 77 per cent of the stomach contents of a small alligator taken in September. Eight dragon-fly nymphs were found in another small alligator's stomach, and adults were noted in six instances.

#### ORTHOPTERA

Roaches, grasshoppers, katydids, and crickets are found occasionally in the food of these reptiles, but constitute only a fraction of 1 per cent of the total. Although one of the most conspicuous grasshoppers in the southern parishes of Louisiana, the large lubber grasshoppers (*Romalea macroptera*) do not abound in the marsh areas, and their remains were not found in the stomachs examined.

#### HEMIPTERA

Giant water bugs (*Belostoma*), the main item in the hemipterous portion of the alligator's food, occurred in 30 instances, and as many as 13 were found in a single stomach. Bugs were eaten most frequently by small alligators from 2 to 3 feet in length, and averaged 1.58 per cent for the series of 149 stomachs. The greatest consumption was in July.

#### DIPTERA

Larvae of soldier flies (*Stratiomyidae*) were identified in 12 stomachs, in one of which, that of a 3-foot alligator taken in Louisiana during September, 290 individuals were counted. Flies and their larvae, judged from this series of stomachs, are an important item in the annual food.

#### COLEOPTERA

##### CARABIDAE

Predatory ground beetles, as *Pasimachus*, *Scarites*, and *Chlaenius*, were more frequently eaten by alligators than were such vegetarian forms as *Amara*. In one stomach 14 and in another 23 *Scarites* were noted. *Scarites* are thought to feed upon soft-bodied worms and the like, and probably local conditions were favorable for their abundance in the coastal marshes. Ground beetles constitute a little more than 1 per cent of the total food, and in July they amounted to 2 per cent.

##### DYTISCIDAE

Predacious diving beetles were eaten more frequently than ground beetles. The large water beetle (*Cybister*) was found in 67 stomachs, and in one the remains of 16 individuals were noted. The smaller dytiscids were eaten much less frequently than the small hydrophilids. Large and small larvae of these beetles were occasionally eaten, and in one stomach 59 were sorted out, but all were not identified below family.

##### HYDROPHILIDAE

Water-scavenger beetles were taken a little more frequently and in larger numbers than the dytiscids. Eighty-six of the alligators had fed on small species of the genus *Tropisternus*, the numbers

counted in four instances being 150, 109, 104, and 101. Large scavenger beetles, like *Hydrous* and *Dibolocelus*, apparently were less plentiful than *Cybister*, for it is doubtful whether the alligator shows any particular preference.

## SCARABAEIDAE

A leaf chafer locally known as the rice beetle (*Dyscinetus trachypygus*) was found in 60 stomachs, and in 5 of these 10 or more individuals were noted. This beetle pupates in moist places, and the adults attack rice, but so far as known they are not injurious to any other crop. A little more than 5 per cent of the total food comes from this source.

## CURCULIONIDAE

Inasmuch as weevils never amounted to as much as 1 per cent of the food in any of the months for which stomachs were available, their destruction by alligators is a matter of no great importance. Nevertheless a number of weevils that are considered quite destructive to cereal and forage crops were identified in some of these stomachs. The clay-colored billbug (*Sphenophorus aequalis*), a swamp-inhabiting weevil, destructive to corn, was eaten by 6 alligators, and in 1 stomach 5 individuals were found. Billbugs that feed to a large extent on corn, such as the curlew bug (*S. callosus*) and the cat-tail billbug (*S. pertinax*), were each eaten by 2 alligators. The Y-marked billbug (*S. venatus*), which occurred in 7 of the stomachs, is injurious to wheat and corn.

## HYMENOPTERA

An occasional hymenopterand is taken along with other insect food, but little or no discrimination is shown as to species. Three species of ants, including 44 *Ponera*, 5 *Pheidole*, and 43 *Crematogaster*, were found in the stomach of an alligator measuring 3 feet 6 inches in length and taken on September 21 in Louisiana. Another alligator taken at the same time and place had eaten ants of these genera and in addition individuals of the genus *Solenopsis*.

## FISHES

Fishes of one kind or another formed 14.04 per cent of the total food eaten during the spring, summer, and fall months by 149 alligators of various sizes. About 580 fishes, ranging in size from minute silversides (*Menidia* sp.) to a mullet (*Mugil cephalus*), 8½ inches in length, were found in 52 of the stomachs. In July fishes were eaten in the largest quantity and formed 16.12 per cent of the total food. An alligator gar (*Lepisosteus platostomus*) formed part of the food of an alligator taken in June. These voracious alligator gars are a nuisance in so far as man is concerned, for they are active enemies of other fishes living in the same waters. A larger series of stomachs might show a larger proportion of alligator gars, for the late J. D. Mitchell found remains of these fishes in the stomachs of a number of alligators taken in Texas. Mitchell says, in a letter written on September 12, 1920, that the stomach of one alligator examined contained two alligator gars, freshly swallowed.

One large fellow over 3 feet long was rolled into a compact ball, as you would wind a leather strap; the other one about 18 inches long was straight. Neither gar was badly mangled by the alligator's teeth.

The same observer opened the stomach of an alligator measuring 15 feet 2 inches, taken in Traylor's Lake in the Guadalupe River Valley, and found a gallon or more of alligator-gar scales and broken-up turtle shells. The scales were worn smooth, and some were thin as paper.

Fourteen of the alligators had eaten young menhaden (*Brevoortia tyrannus*), and one 6-foot individual taken in July had eaten at least 101 of these fishes in addition to other items. Adult menhaden have important commercial uses, chiefly for oil and fertilizer but not for food. Small fishes are quite plentiful in the eelgrass that abounds in the inundated coastal lands of Louisiana and elsewhere, all of which are of prime importance as food for larger edible fish. As many as 42 of the little carnivorous killifish (*Cyprinodon variegatus*) were found in a single stomach, while the mud-feeding *Mollienia* were noted in two. The little carnivorous silversides (*Menidia*) were also identified in two instances. These small fishes occur in countless numbers in brackish waters and mouths of fresh-water streams emptying into the Gulf, and the depletion of their numbers by alligators is of little consequence. Alligators do some harm in feeding upon fishes, for some of the small ones eaten are active destroyers of the larvae of mosquitoes, and some of the others have commercial value. Two alligators captured in Georgia and one taken in Florida had each eaten a fair-sized large-mouthed black bass (*Micropterus salmoides*). Small sunfish (*Lepomis*) were eaten by three alligators killed in Louisiana.

That alligators are fond of fishes has been known for many years, and it is possible that they feed more extensively on them in times of drought. Dowler (14, p. 21) says:

\* \* \* in midsummer, when the inundation is subsiding, and swamps, lakes, lagoons, and bayous, are becoming dry or too shoal, for not only alligators, but the fish \* \* \* a general migration commences. When thousands of square miles, submerged for several months of the year, are about to become desiccated, these knowing animals begin to travel. When the water subsides rapidly, there are currents through narrow channels, from the higher to the lower basins and streams, to which the alligators repair, in great numbers, and turn their heads up stream. The large buffalo, and still larger catfish, with many other fishes of the lower Mississippi, in their migrations, through these straits, are thus devoured; often, very few escape.

John Brickell in 1737 reported that alligators were very destructive to weirs made for catching fish, for they would follow the fish into the trap and then tear the trap apart in their efforts to escape.

#### AMPHIBIANS

A small alligator taken in July on the Rainey Wild-Life Refuge had eaten one narrow-mouthed toad (*Gastrophryne carolinensis*) in addition to a snake, several fishes, and a little fiddler crab. Other species of amphibians are undoubtedly eaten whenever the opportunity presents itself.

## REPTILES

## CROCODYLIA (ALLIGATORS AND CROCODILES)

Adult alligators are not averse to eating the young of their own kind, and instances have been reported in which some that were well grown have been swallowed by larger individuals. Charles Hallock (19, p. 87) records an alligator 8 feet long in the mouth of a larger one, and in the same article he calls attention to balls of feathers, fish, and large moccasin snakes that are found in the stomachs. F. M. Uhler, of the Bureau of Biological Survey, reports that on April 26, 1928, he observed an alligator about 7 feet in length housed in the municipal zoo at Sanford, Fla., in the act of swallowing a smaller individual that measured about half its length. The smaller alligator was swallowed whole, but he could hear the bones being crushed by an occasional snap of the jaws. The process of swallowing was closely watched for about half an hour, and at the end of that time a little more than half of the smaller individual had disappeared in the captor's gullet. About a dozen alligators varying from 3 to 10 feet in length were kept in the same cage. Three partially digested alligator eggs were found in the stomach of an alligator taken at Morgan City, La., on June 1, 1926.

## EQUAMATA (LIZARDS, SNAKES, TURTLES)

A little ground lizard (*Leiolopisma laterale*) was the only lacertilian found in the stomachs, but any kind coming within reach would undoubtedly be eaten. Ten of the stomachs examined contained each a single snake, five of which were identified as water snakes (*Natrix*) and one as a garter snake (*Thamnophis*). Turtles, on the other hand, enter more extensively into the diet of these reptiles, constituting 2.67 per cent of the food of 149 alligators taken between June and October. Cooters (*Pseudemys*) and terrapins (*Malaclemys*) were found only in stomachs of alligators taken in Florida and Georgia. Soft-shelled turtles (*Amyda*) were eaten by alligators taken in Leon County, Fla. In the case of six alligators ranging in size from 5 feet to 8 feet 9 inches, killed during the month of June, turtles comprised 68 per cent and fishes 32 per cent of the stomach contents. Turtles also formed 11.55 per cent of the total food of nine alligators taken in August. The late J. D. Mitchell was of the opinion that the principal food of adult alligators is gars and hard-shelled turtles. He remarks that he cut open a great many alligators, and in almost every instance found the remains of one or the other, or of both.

## BIRDS

In the contents of the 149 stomachs examined, birds formed about 5 per cent of the total animal matter. Other data, however, are available that indicate that the alligator's annual diet may include a greater percentage of birds. J. B. White, of Waterlily, N. C., in a letter dated April 3, 1924, states that an alligator shot on the preserve of John Maybank, at Green Pond, S. C., during the previous season had remains of five mallards (*Anas platyrhynchos*) in its stomach.

Corroborative evidence that alligators feed on ducks and other water birds is found in the report on stomach examinations by Leon

Hebert, of the Orange-Cameron Land Co., Louisiana, during the winter and early spring of 1926. Ten alligators taken during February and March and ranging from 5 to 10 feet in length had eaten a total of 55 coots or poule d'eau (*Fulica americana*), and 6 ducks. Of three alligators taken during February, one 7 feet long had eaten 3 ducks and 4 coots; one 7½ feet long, 9 coots; and one 8 feet long had eaten a marsh owl. The stomach of a 10-foot alligator taken on March 2 contained 7 coots; one 8 feet long taken on March 9 likewise contained 7 coots; and one 11 feet long taken the same day had eaten 5 coots and 2 ducks. Of two 8-foot alligators taken on March 11, the stomach of one contained 8 coots and 1 duck, and the other 9 coots. Two 5-foot alligators killed on March 13 had each eaten 3 coots, and the stomachs of two 7-foot alligators killed on March 17 were full of coots. On the same day the stomachs of 24 alligators, ranging in size from 3 to 11 feet, were examined and were found to contain remains of short-eared owls (*Asio flammeus*), rails (*Rallus elegans*), and coots.

Remains of birds were found in 10 of the 149 stomachs examined in the Biological Survey. Birds as alert as the horned grebe (*Colymbus auritus*) and the pied-billed grebe (*Podilymbus podiceps*), as secretive as the king rail (*Rallus elegans*), or as good climbers as the least bittern (*Ixobrychus exilis*) were victims of these alligators. Hallock (17, p. 87) found that alligators would take a hook baited with the body of a bird, such as a coot, and this would seem to indicate that they may play a useful rôle as scavengers. J. D. Mitchell states that in stomachs he examined were found remains of such birds as ducks, coots, and jackdaws.

#### MAMMALS

Mammals comprised 5.56 per cent of the total food of alligators in the series of 149 stomachs representing the period from April to October, inclusive. It was a matter of considerable interest to find that muskrats (*Ondatra rivalis*) were eaten by not more than 4 of these alligators and in each instance only by a single individual. Persistent reports were circulated that muskrats were being depleted in numbers by alligators and that the latter were a decided nuisance in marshlands under development for their fur resources. The present investigation fails to substantiate these reports. It is worth while to note, however, that Richard Gordon, of the Rainey Wild-Life Refuge, reported that the stomach of a 12-foot alligator contained 11 muskrats, a chicken, and a pig. In his weekly report for June 28 to July 4, 1925, Mr. Gordon reports that more than 30 alligators had been killed on the refuge during the preceding 10 days and the stomachs of 22 examined, of which 6 contained muskrats, 1 a rabbit, and the remainder fishes, crabs, and crawfishes. These alligators were nearly all females from 3 to 7 feet in length, and at this season were coming out of the marsh into the bayous and ponds. One of the most active enemies of the muskrat, the mink (*Mustela vison vulgiva*), was found in the stomach of a 6-foot alligator killed in Louisiana during July. One swamp rabbit (*Sylvilagus aquaticus littoralis*) formed 67 per cent of the stomach contents of an alligator taken in October, and remains of this species were found in two other



stomachs. Rice rats (*Oryzomys palustris texensis*) were noted in three stomachs and a cotton mouse (*Peromyscus gossypinus*) in one.

Many instances are on record where alligators have devoured dogs, hogs, and especially pigs. Alligators, according to Brickell (8, p. 134-135)—

are never known to devour men in Carolina, but on the contrary, always strive to avoid them as much as they possibly can. Yet they frequently kill swine and dogs, the former as they come to feed in the marshes and at the sides of the rivers and creeks, and the latter as they are swimming over them. \* \* \* They are very crafty and subtle in taking their prey in waters, whereon they float as if dead, or like a log of wood, 'till they come within reach of their prey, which they will most nimbly seize by leaping upon them, and then dive under water with it, which they quickly devour.

Conflicting and in many cases unreliable versions of alligators killing human beings appear in the books by early travelers in the Southern States. The sympathy of the reader is gained for the victim by a recital of horrible and gruesome details, as is the case in Mrs. Trollope's story of the sleeping wife and her five babes killed and mangled by alligators. An early French traveler and writer, M. de la Coudrenière, asserted that alligators in Louisiana "feed on men, chiefly negroes." Passing from these traditional and possibly fictional happenings to those of reliable observers, one finds that an alligator will usually defend itself when attacked, and that there have been instances of their injuring and killing human beings. That alligators may attack persons is shown by the following incidents furnished by the late J. D. Mitchell,<sup>1</sup> as related by his mother:

When my mother was a little girl, about 5 years old, she was playing on the bank of Cedar Creek, Brazoria County, Tex., with two other small girls. They were standing at the water's edge, when an alligator struck at them with his tail from the water, drenching them and tearing out the front of my mother's dress and petticoat. They scrambled up the slope and then looked around, and saw that the alligator had come to the shore line, but did not attempt to follow them on land.

In the "great runaway" of 1836, when Texas settlers were fleeing toward Louisiana before the Mexican Army, a large crowd had reached the Trinity River above Anahuac, where they were waiting to cross. Since but one ferryboat was available, each family had to wait its turn, and my mother and other children were sitting on the bank watching the proceedings. A man named King, who had just put his family and goods on the ferry, found that it was necessary to force the boat away from the bank with a piece of timber; he then waded into the river, pushing the boat in water about waist deep, when he suddenly screamed and disappeared below the surface, leaving a few bloody bubbles to tell his fate. There were alligators in sight both above and below the ferryboat.

Later when these same settlers crossed the Sabine River near Niblett's Bluff they landed on an island bounded by the river on one side and a deep slough on the other, and camped there for the night. My grandfather, Dr. James Kerr, pitched his tent about 100 feet from the river, and his waiting boy, Jack, slept just outside of his tent. Doctor Kerr was aroused during the night by the screams of the negro boy, and on investigation found that an alligator was dragging him by the foot toward the river. He ran to the fire and, seizing a burning faggot, thrust it into the alligator's eyes, when the animal released the boy and escaped to the river.

A party of the young men, of whom Gen. Ben McCulloch, then a boy of 18, was one, were bathing in the shallow water of the Brazos River, near St. Felipe, when a large alligator seized one boy by the thigh and started backward with him toward deep water. McCulloch jumped astraddle the alligator's

<sup>1</sup> Manuscript report in the files of the Bureau of Biological Survey.

neck and jabbed a thumb into each one of the eyes, causing it to release its grip on the victim. The injured boy had several tooth punctures and McCulloch lost a large patch of skin.

According to Dowler (14, p. 23), the Jacksonville (Fla.) Courier published in 1835 the details of—

the case of a young man named Norton, who was bitten by an alligator in the hand and arm, one of the bones of which was broken. The man gouged the animal, causing it to let go of its hold. It was killed and measured 10 feet in length.

R. N. Lobdell, of the State Plant Board of Mississippi, in a letter dated September 20, 1926, writes that about 10 years before in Alligator Lake in Bolivar County, a large alligator came to the shore and carried off a small negro child from within a few feet of its mother. The mother was washing clothes, but was attracted by the shrieks of the child as it was being knocked into the water by the tail of the alligator.

One may infer from the narrative of Ellicott (16, p. 277) that as early as 1800 alligators were thought to be quite dangerous. Here is what he has to say on this subject:

\* \* \* alligators appear much less dangerous, than has generally been supposed, particularly by those unacquainted with them. And I do not recollect meeting with but one well authenticated fact of any of the human species being injured by them in the country (where they are very numerous), and that was a negro near New Orleans, who while standing in the water sawing a piece of timber, had one of his legs dangerously wounded by one. My opinion on this subject is founded on my experience. I have frequently been a witness to Indians, including men, women, and children, bathing in rivers and ponds where those animals are extremely numerous, without any apparent dread or caution; the same practice was pursued by myself and people, without caution, and without injury.

Alligators, however, sometimes attack animals even larger than man. On St. Vincent Island, Fla., R. V. Pierce, the late proprietor, related to a Biological Survey representative that when crossing a small stream one of a team of mules hitched to a vehicle was seized by the foreleg by an alligator.

Reports have appeared in the press from time to time of attacks on persons by alligators, but these incidents are by no means of common occurrence. Alligators are wary of man under present conditions and during the period of settlement found other food ample and more readily obtainable.

#### VEGETABLE MATTER

Vegetable matter of various kinds occurs in the stomachs of alligators of all sizes, though the item is by no means constant. The rough, woody tubers of the large, leafy, three square *Scirpus robustus* were identified in 15 stomachs, and tubers and pieces of the stalk of an unidentified *Scirpus* were found in 4 others. Burnt wood and other vegetable debris were sorted out of the stomach contents in 5 instances.

Hard, broken shells of hickory nuts were found in one stomach and seeds of several water plants in seven. It has been supposed that these substances assist in reducing the quantity of food required to fill the stomach and that they serve to keep the stomach distended

while the animal is hibernating. This opinion was held by many naturalists. In the narrative of Andrew Ellicott (16, p. 276), for instance, who while United States commissioner to determine the boundary between Florida and Georgia in 1800 made some interesting observations on alligators seen on his trip up the St. Marys River with the Spanish commissioner in the interval between January 23 and March 8, appears the following:

This being the season that the Alligators, or American Crocodiles, were beginning to crawl out of the mud and bask in the sun, it was a favorable time to take them, both on account of their torpid state, and to examine the truth of the report of their swallowing pine knots in the fall of the year to serve them (on account of their difficult digestion) during the term of their torpor, which is probably about three months. For this purpose two Alligators of about eight or nine feet in length were taken and opened, and in the stomach of each were found several pine or other knots, pieces of bark, and in one of them some charcoal; but exclusive of such indigestible matter, the stomachs of both were empty. So far the report appears to be founded in fact; but whether these substances were swallowed on account of their tedious digestion, and therefore proper during the time those animals lay in the mud, or to prevent the collapse of the coats of the stomach, or by accident owing to their voracious manner of devouring their food, is difficult to determine.

#### MISCELLANEOUS MATTER

The alligator is not so discriminating in choice of food as many other reptiles and swallows strange things. Several of the stomachs Mitchell examined resembled the proverbial "small boy's pocket" in the variety of their contents, including bones and scales of various fishes, turtles, birds, and small animals, pebbles, bulrush roots, and bits of dead wood. Dowler (14, p. 17) relates that a gentleman of Mississippi had been on a hunting excursion when—

one of the party finding that the whiskey bottle, which he had been carrying, was now empty, threw it to an Alligator which was swimming near, in a lagoon. The animal suddenly seized and crushed it. On returning to the same place in a few days after, the animal was found dead, with its abdomen greatly distended and turned upward. A physician being present, it was determined to make a post mortem examination. Broken fragments of the bottle, with putrid fish, were found in the stomach and bowels.

Audubon (4, p. 280) says that when alligators were opened—

\* \* \* to see the contents of the stomach, or take fresh fish out of them. I regularly have found round masses of a hard substance, resembling petrified wood. [These probably were bulrush tubers.] These masses appeared to be useful to the animal in the process of digestion, like those found in the craws of some species of birds. I have broken some of them with a hammer, and found them brittle, and as hard as stones, which they resemble outwardly also very much. And, as neither our lakes nor rivers, in the portion of the country I have hunted them in, afford even a pebble as large as a common egg, I have not been able to conceive how they are procured by the animals, if positively stones, or by what power wood can become stone in their stomachs.

Water-worn pebbles, stones, or gravel were noted in six of the stomachs examined. Cinders left by dredging machines were encountered in 14. Empty shotgun shells are surprising items to be mistaken for food and probably were taken floating on the water. Brass shells were found in two stomachs. The gastric juices are seemingly strong enough to dissolve even metal, for the base of one shell was largely eaten away, and in other instances the metal showed evidence of acid action.

TABLE 3.—List of items identified in 157 stomachs of Alligator mississippiensis with number of occurrences for each item and number of individuals noted

Kind of food	Occurences	Indi-vidu-als	Kind of food	Occurences	Indi-vidu-als
<b>Animal Food</b>			<b>COLEOPTERA (Beetles)—Contd.</b>		
<b>CLASS CRUSTACEA (Crustaceans)</b>			<b>Carabidae (ground beetles)—Contd.</b>		
Peneidae (shrimps):			Pasimachus marginatus.....	1	1
Peneus sp.....	1	1	Poecilus sp.....	1	1
Peneus brasiliensis.....	8	71	Scarites sp.....	11	61
Peneus setiferus.....	3	3	Scarites substriatus.....	9	23
Astacidae (crawfishes):			Scarites subterraneus.....	12	91
Cambarus sp.....	2	6	Dytiscidae (predacious diving beetles):		
Cambarus clarkii.....	44	175	Unidentified larvae.....	10	95
Portunidae (swimming crabs):			Cybister sp.....	2	2
Callinectes sp.....	12	15	Cybister sp. (larva).....	10	21
Callinectes sapidus.....	68	166	Cybister fimbriolatus.....	66	241
Grapsidae (wood and weed crabs):			Dytiscus sp.....	1	1
Sesarma sp.....	2	6	Hydaticus sp.....	1	1
Sesarma (Sesarma) reticulatum.....	1	3	Hydaticus bimarginatus.....	1	1
Ocypodidae (fiddler crabs):			Rhantus sp.....	1	1
Uca sp.....	3	3	Thermonectes sp.....	1	1
Uca mixta.....	2	2	Thermonectes basilaris.....	7	32
<b>CLASS ARACHNIDA (Spiders, Scorpions, and Mites)</b>			<b>Hydrophilidae (water-scavenger beetles):</b>		
<b>ARANEIDA (Spiders)</b>			Unidentified water beetles.....	2	2
Unidentified.....	14	16	Berosus sp.....	5	6
Argiopidae (orb weavers):			Berosus striatus.....	4	15
Tetragnatha sp.....	1	1	Dibolocelus ovalis.....	1	1
Lycosidae (wolf spiders):			Eupocterus sp.....	7	37
Unidentified.....	35	127	Hydrophilus castus.....	1	1
Lycosa sp.....	6	15	Hydrous sp.....	1	6
Lycosa carolinensis.....	33	94	Hydrous triangularis.....	8	24
<b>CLASS INSECTA (Insects)</b>			Tropisternus sp.....	76	894
<b>PLECOPTERA (?) (Stone Flies)</b>			Tropisternus nimbus.....	10	124
Larvae.....	1	(1)	Tropisternus striolatus.....	1	1
<b>ODONATA (Dragonflies)</b>			Eratylidae: Languria sp.....	1	1
Unidentified adults.....	6	6	Coccinellidae (ladybirds): Naemia serata.....	1	1
Unidentified nymphs.....	2	11	Tenebrionidae (darkling beetles):		
<b>ORTHOPTERA (Grasshoppers, Crickets, etc.)</b>			Blapstinus fortis.....	1	1
Blattidae (unidentified roach).....	1	1	Scarabaeidae (dung beetles and leaf chafers):		
Aceriidae (unidentified grasshopper).....	1	1	Atacius sp.....	3	3
Tettigoniidae (katydids):			Dyscolmetus trachypygus.....	60	200
Unidentified.....	4	4	Ligyris gibbosus.....	1	1
Homocoryphus multivolans.....	3	3	Chrysomelidae (leaf beetles): Haltica sp.....	1	1
Neoconocephalus sp.....	1	1	Curculionidae (weevils):		
Neoconocephalus fasciatus.....	1	1	Listronotus obliquus.....	1	2
Gryllidae (crickets): Gryllus sp.....	7	7	Sphenophorus sp.....	12	18
<b>HEMPTERA (True Bugs)</b>			Sphenophorus aequalis.....	6	12
Gerridae (unidentified water-striders).....	2	2	Sphenophorus callosus.....	3	4
Notonectidae (back-swimmers): Notonecta undulata.....	1	1	Sphenophorus cariosus.....	4	6
Belostomatidae (giant water bugs):			Sphenophorus pertinax.....	2	3
Belostoma sp.....	30	100	Sphenophorus venustus.....	7	10
Lethocerus sp.....	9	10	<b>HYMENOPTERA (Wasps, Ants, Bees, etc.)</b>		
<b>LEPIDOPTERA (Butterflies and Moths)</b>			Unidentified wasp.....	1	1
Unidentified.....	1	1	Formicidae (ants):		
<b>DIPTERA (Flies)</b>			Crematogaster sp.....	2	44
Unidentified.....	1	1	Fieldale sp.....	2	11
Stratiomyidae (soldier flies):			Ponera sp.....	2	47
Unidentified larvae.....	4	7	Solenopsis sp.....	1	2
Odontomyia sp. (larvae).....	8	333	Apidae (bees): Bremus sp.....	1	1
Asilidae (unidentified robber fly).....	1	1	Scelididae (scold wasps): Tiphia sp.....	1	1
<b>COLEOPTERA (Beetles)</b>			Mutillidae (velvet ants): Mutilla sp.....	1	1
Carabidae (ground beetles):			<b>CLASS GASTROPODA (Snails)</b>		
Amara sp.....	14	25	Unidentified.....	2	2
Bembidion sp.....	1	2	Maetridae: Rangaia sp.....	1	1
Chlaenius sp.....	2	2	Mytilidae: Modiola sp.....	1	1
Chlaenius erythropus.....	2	4	Physidae: Physa sp.....	1	1
Harpalus sp.....	1	1	Hydrobiidae (unidentified).....	1	39
<b>SUBPHYLUM VERTEBRATA (Vertebrates)</b>			<b>Unidentified.....</b>		
<b>Unidentified.....</b>			<b>1</b>		

1 Several thousand.

TABLE 3.—List of items identified in 157 stomachs of *Alligator mississippiensis* with number of occurrences for each item and number of individuals noted—Continued

Kind of food	Occur- rences	Indi- vidu- als	Kind of food	Occur- rences	Indi- vidu- als
<b>CLASS PISCES (Fishes)</b>			<b>CLASS AVES (Birds)—Contd.</b>		
Unidentified	17	154	Anatidae (ducks): <i>Anas fulvigula maculosa</i>	2	2
Lepisosteidae (gars): <i>Lepisosteus platostomus</i>	1	1	Ardeidae (herons, bitterns): <i>Isobrychus exilis</i>	1	1
Amiidae (bowfins): <i>Amia calva</i>	1	1	Rallidae (rails): <i>Rallus elegans</i>	4	4
Clupeidae (herrings, etc.):			Scelopacidae (sandpipers, etc.): <i>Pisobia maculata</i>	1	1
<i>Brevoortia</i> sp.	1	48	<b>CLASS MAMMALIA (Mammals)</b>		
<i>Brevoortia tyrannus</i>	14	211	<b>CARNIVORA (Carnivores)</b>		
Poeciliidae (killifishes):			Mustelidae (minks, etc.): <i>Mustela vison vulgiva</i>	1	1
<i>Cyprinodon variegatus</i>	9	90	<b>RODENTIA (Rodents)</b>		
<i>Mollinia</i> sp.	1	1	Cricetidae (mice, rats, etc.):		
<i>Mollinia latipinna</i>	6	48	<i>Ondatra rivalis</i> (muskrats)	4	4
Syngnathidae (pipe-fishes): <i>Syngnathus</i> sp.	1	1	<i>Oryzomys palustris texensis</i> (rice rats)	3	3
Mugilidae (mullets): <i>Mugil cephalus</i>	6	7	<i>Peromyscus gossypinus</i> (cotton mouse)	1	1
Atherinidae (silversides, etc.): <i>Menidia</i> sp.	4	9	<b>LAGOMORPHA (Rabbits)</b>		
Centrarchidae (sunfishes, bass, etc.):			Leporidae (rabbits): <i>Sylvilagus aquaticus littoralis</i>	3	3
<i>Lepomis</i> sp.	2	5	<b>Vegetable Débris</b>		
<i>Lepomis auritus</i>	1	1	Vegetable debris	50	
<i>Micropterus salmoides</i>	3	3	Burnt wood	2	
<b>CLASS AMPHIBIA (Amphibians)</b>			Cyperaceae (sedges):		
<b>SALIENTIA (Toads and Frogs)</b>			<i>Scirpus</i> sp.	5	
Brevipetidae: <i>Gastrophryne carolinensis</i>	1	1	<i>Scirpus robustus</i>	15	
<b>CLASS REPTILIA (Reptiles)</b>			Juglandaceae (hickory, etc.): <i>Hicoria</i> sp. (shells)	1	
<b>CROCODYLIA (Alligators and Crocodiles)</b>			Nymphaeaceae (waterlilies):		
Crocodylidae: <i>Alligator mississippiensis</i> (eggs)	1	3	<i>Castalia</i> sp. (seeds)	1	14
<b>SQUAMATA (Snakes and Lizards)</b>			<i>Castalia odorata</i> (seeds)	1	1
<b>SAURIA (Lizards)</b>			<i>Nelumbo lutea</i> (seeds)	1	5
Scincidae (skinks): <i>Leiolopisma laterale</i>	1	1	<i>Nymphaea</i> sp. (seeds)	1	12
<b>SERPENTES (Snakes)</b>			Hamamelidaceae (witch-hazel):		
Unidentified	3	3	<i>Liquidambar styraciflua</i> (sweet-gum seed pod)	1	1
Colubridae (colubers):			Leguminosae (legumes)		
<i>Natrix</i> sp.	1	1	<i>Strophostyles</i> sp.	1	1
<i>Natrix clarkii</i>	1	1	<i>Strophostyles helvola</i> (seeds)	2	3
<i>Natrix fasciata</i>	3	3	<b>Miscellaneous Débris</b>		
<i>Thamnophis</i> sp.	1	1	Water-worn pebbles, stones, gravel	6	
<b>TESTUDINATA (Turtles)</b>			Coal	1	
Kinosternidae (musk turtles):			Cinders	14	
<i>Kinosternon subrubrum hippos</i>	2	2	Sandstone	1	
<i>Sternotherus minor</i>	2	3	Sand	6	
Testudinidae (tortoises):			Metal-base shotgun shell	1	
<i>Malaclemys pileata macrospilota</i>	2	2	Metal-base 10-gauge shotgun shell	1	
<i>Pseudemys floridana</i>	3	3	Metal-base 12-gauge shotgun shell	2	
<i>Pseudemys scripta</i>	1	1	Metal-base 20-gauge shotgun shell	1	
Trionychidae (soft-shelled turtles):			Metal .32 shell	1	
<i>Amyda ferox</i>	2	2	Empty brass .24-.35 shell	1	
<b>CLASS AVES (Birds)</b>			Fragment of clamshell	1	
Unidentified feathers	4	4	Shed lining of stomach	1	
Colymbidae (grebes):					
<i>Colymbus auritus</i>	1	1			
<i>Podilymbus podiceps</i>	2	2			

## SUMMARY

The geographic range of the alligator in the United States is being steadily reduced by human settlement, drainage operations, and hide hunting. Indiscriminate slaughter for their hides has exterminated these saurians in many parts of their original range, and at present they are most abundant in fresh-water marshes, swamps, and bayous adjacent to the Gulf and South Atlantic coasts from eastern Texas to Florida, and locally in coastal areas of Georgia and North and South Carolina.

Alligators receive legal protection only in Florida and Louisiana. Their perpetuation for their interest as wild-life forms and for commercial uses is dependent upon the preservation of such areas as the Okefenokee Swamp and the Everglades, Fla., and the State wild-life refuges along the Gulf coast of Mississippi and Louisiana, and the establishment of alligator preserves and farms elsewhere.

Alligators more than 12 to 15 feet long are now rarely found. To attain a length of 10 feet takes as many years, and when of greater length the reptiles must be considerably more than 10 years old. The breeding season extends usually from May to July, and most of the eggs are laid in June, depending upon seasonal conditions of moisture and drought. When hatched, the young alligators leave the nest at once and start for water, and the mother, watching for them, guides them to her den, where they remain until they can take care of themselves. In winter alligators hibernate in deep pools or mud, except in very warm climates, and are most active in the hot periods of July and August. They are rarely seen in cool weather.

The food of the alligator is made up chiefly of crustaceans (47 per cent), fishes, turtles, and other vertebrates (29 per cent), and insects and spiders (23 per cent), consisting for the most part of crabs, crawfishes, fishes, turtles, and water beetles. It does not appear that they are seriously destructive of useful forms of wild life, as muskrats and turtles, and important food fishes do not bulk large in their diet. Their depredations on crabs and shrimps are not sufficient at present to cause fishermen any difficulty in meeting the market requirements. The insects they consume mostly are economically unimportant, and any influence they may have on the control of objectionable species of animals and plants is for the most part negligible. They undoubtedly are beneficial, however, in feeding upon the voracious alligator gars, which destroy food fishes; and upon crawfishes, which are burrowing pests of agriculture.

Alligators individually are as valuable as other forms of wild life in general, especially to unreclaimed southern marshlands for the commercial value of their hides. Measures should be taken wherever possible to insure their continued existence as an interesting species, in numbers sufficient for their perpetuation, consistent with reasonable utilization and any necessary control.

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