THE ALLIGATOR AND ITS ALLIES

CHAPTER I

THE BIOLOGY OF THE CROCODILIA

Classification

AS in most groups of animals, there is considerable difference of opinion as to the proper classification of the Crocodilia.

One of the older textbooks (Claus and Sedgwick) divides the order Crocodilia into three sub-orders: the *Teleosauria*, *Steneosauria*, and *Procœlia*, the last only being represented by living forms. The Procœlia or Crocodilia proper are divided into three families,—the *Crocodilidæ*, the *Alligatoridæ* (including the caiman as well as the alligator), and the *Gavialidæ*.

This division into families seems to be based mainly on the shape of the head, or, at any rate, it throws those forms together that have heads of the same outline.

It is this outline of the head that Ditmars (*Reptiles of the World*) uses in classifying the Crocodilia, which, he says, are all included in the single family —*Crocodilidæ*. The following list, taken from his *Reptiles of the World* (pp. 68–69), will give a clear idea of the number, distribution, and maximum size of the members of the order Crocodilia. More will be said of some of the members of this list later.

	Habitat	*Max. Size*
A. Snout extremely long and slender, extending from the head like the handle of a frying pan		
Gavialis gangeticus, Indian Gavial	Northern India	30 ft.
Tomistoma schlegeli, Malayan Gavial	Borneo and Sumatra	15 ft.
B. Snout very sharp and slender; of triangular outline		
Crocodilus cataphractus, Sharp-nosed Crocodile	W. Africa	12 ft.
Crocodilus johnstoni, Australian Crocodile	Australia	6–8 ft.
Crocodilus intermedius, Orinoco Crocodile	Venezuela	12 ft.
C. Snout moderately sharp; outline distinctly triangular		
Crocodilus americanus, American Crocodile	Fla.; Mexico; Central and S. America	14 ft.
Crocodilus siamensis, Siamese Crocodile	Siam; Java	7 ft.
Crocodilus niloticus, Nile Crocodile	Africa generally	16 ft.
Crocodilus porosus, Salt-water Crocodile	India and Malasia	20 ft.
D. Snout more oval; bluntly triangular		
Crocodilus robustus, Madagascar Crocodile	Madagascar	30 ft.
Crocodilus rhombiferus, Cuban Crocodile	Cuba only	7 ft.
Crocodilus moreletti, Guatemala Crocodile	Guatemala; Honduras	7 ft.

	Habitat	*Max. Size*
E. Snout short and broad; conformation barely suggesting a triangular outline		
Crocodilus palustris, Swamp Crocodile	India and Malasia	12 ft.
Osteolæmus tetrapis, Broad-nosed Crocodile	W. Africa	6 ft.
D'. Outline of head similar to that of Section D		
Caiman trigonotus, Rough-backed Caiman	Upper Amazon	6 ft.
Caiman sclerops, Spectacled Caiman	Central and S. America	7–8 ft.
Caiman palpebrosus, Banded Caiman	Tropical South America	7–8 ft.
F. Snout very broad; bluntly rounded at tip		
Caiman latirostris,[1] Round-nosed Caiman	Tropical South America	7–8 ft.
Caiman niger,[2] Black Caiman	Tropical South America	20 ft.[2]
Alligator mississippiensis, American Alligator	Southeastern United States	16 ft.
Alligator sinensis, Chinese Alligator	China	6 ft.

Gadow in the *Cambridge Natural History* (p. 450) agrees with Boulanger in believing that the recent Crocodilia cannot be separated into different families, yet he describes seven families of Crocodilia, two of which, the *Gavialidæ* and *Crocodilidæ*, include the living members of the order; the former includes the gavials, of course, and the latter the crocodiles, alligators, and caimans.

Though "doctors disagree" thus in regard to the scientific classification of this small group of

[1] These species are exceptions in their genus. The snout is blunt like that of the genus *Alligator*.

[2] Alleged to grow to this size by competent observers.

animals, this fact does not in the least diminish the intense interest in the individual members of the order.

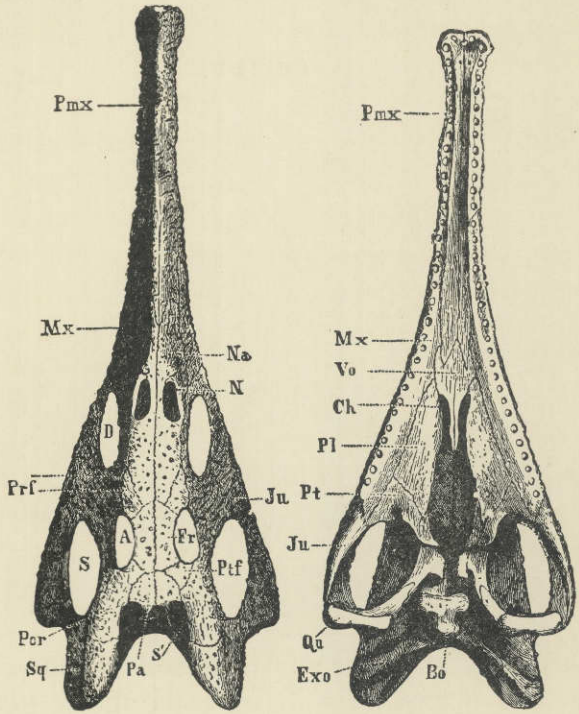
Ancestry

Although the huge dragon-like dinosaurs or "terrible reptiles," some of which were probably more than one hundred feet long, became extinct during the Mesozoic epoch, perhaps millions of years before man made his appearance upon earth, we have one group of reptiles still living in certain parts of the earth of which the Mesozoic lords of creation need not feel ashamed. While most of the living Crocodilia are mere pigmies in size, compared to the Atlantosaurus, there are a few representatives of the living group, to be discussed later, that are said to reach a length of thirty feet, which length makes pigmies, in turn, of most of the other living reptiles.

Considering the extinct as well as the living Crocodilia, Gadow says it is very difficult to separate them from the Dinosauria. In the Mesozoic Crocodilia the fore limbs were much shorter and weaker than the hind limbs, as was often the case with the dinosaurs; they were almost entirely marine, but gave indications of descent from terrestrial forms.

Various facts point, thinks Gadow, "to some Theropodous Dinosaurian stock of which the Croc-

odilia may well form an aquatic, further developed branch" (*Cambridge Natural History*, p. 432).



Skull of **Belodon**. A, from above; B, from below. *A*, orbit; *Bo*, basi-occipital; *Ch*, internal nares; *D*, pre-orbital fossa; *Exo*. exoccipital; *Fr*. frontal; *Ju*. jugal; *La*. lacrymal; *Mx*. maxilla; *Na*. nasal; *Pa*. parietal; *Pl*. palatine; *Pmx*. pre-maxilla; *Por*. post-orbital; *Prf*. pre-frontal; *Pt*. pterygoid; *Qu*. quadrate; *S*, lateral temporal fossa; *S'*, superior temporal fossa; *Sq*. squamosal; *Vo*. vomer. (From Zittel.)

FIG. A. A TRIASSIC ANCESTOR OF THE CROCODILIA.
From Parker & Haswell, *Textbook of Zoölogy*.

The direct ancestors of the Crocodilia, Gadow says, are still unknown.

Geographical Distribution

As will be seen by examination of the table (p. 2) from Ditmars, and of Figure 1, the recent

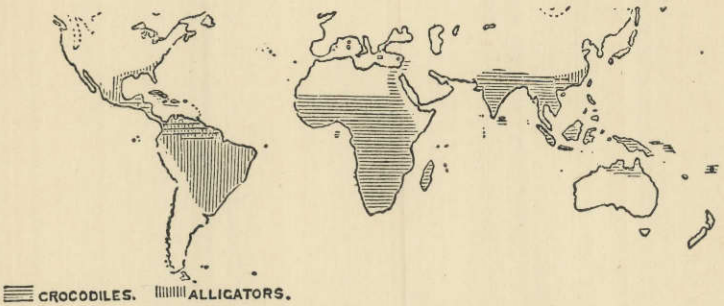


Fig. 1. Map Showing Present Distribution of Crocodilia. (After Gadow.)

Crocodilia are found in all of the great continental areas except Europe; mainly in the tropical or subtropical regions.

The alligator is found in the southwestern United States and in China.

The crocodile is the most numerous in species and is the most widely distributed of the group. It is especially characteristic of Africa and Madagascar, but is found also in Florida, Mexico, Central and South America, the West Indies, South Asia, the East Indies, and Australia.

The gavial is found in India and some of the islands of the Orient, especially Borneo and Sumatra.

The caiman occurs in southern Mexico, Central and South America.

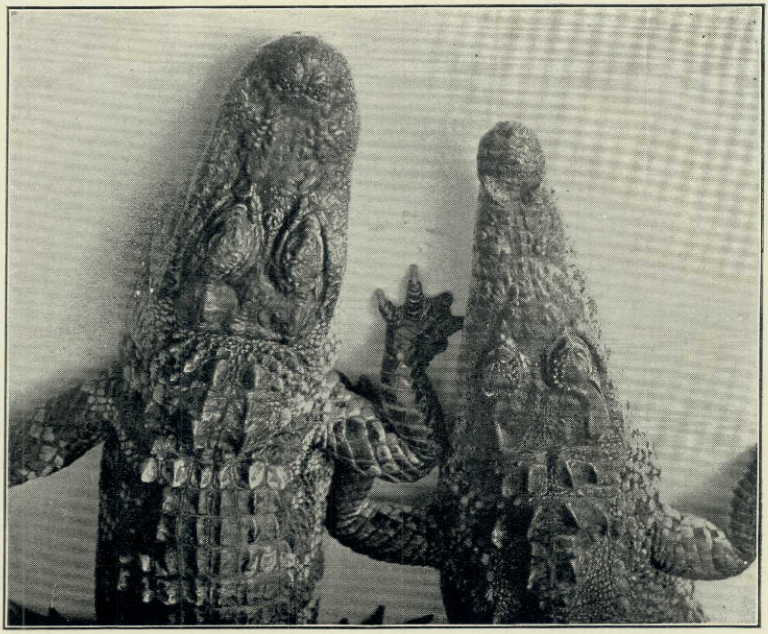


FIG. 2. HEADS OF AMERICAN ALLIGATOR AND AMERICAN CROCODILE; ALLIGATOR ON LEFT. (After Ditmars.)

The distribution of individual forms will be mentioned again when they are discussed in detail.

Alligator Mississippiensis

Since this animal, generally known as the American or the Florida alligator (formerly *A. lucius*), is the one upon which most of the facts of this book are based, it will be discussed first.

At this point it may be well to answer the question that is sure to be asked by someone early in any conversation upon the Crocodilia. The writer, and doubtless every other zoölogist, has been asked countless times, "What is the difference between an alligator and a crocodile?" As a matter of fact there is, perhaps, no absolute distinction between the two groups, but there are certain features that make it easy to distinguish, say, between the American alligator and the American crocodile.

The most striking difference is in the outline of the head; the alligator has a broad, rounded snout, while that of the crocodile is narrower and more pointed (Fig. 2). Again, in the crocodile the fourth tooth from the front projects slightly outwards and fits into a notch in the side of the upper jaw, while in the alligator (also in the caiman) the corresponding tooth on each side fits into a socket in the upper jaw and hence is hidden, except in some old animals with very long teeth, in which it may pierce the upper jaw and show from above.

According to Ditmars, the crocodile has, as a rule, larger and more exposed teeth than the alligator. Finally, as will be brought out later, the crocodile is usually more quick and active, and also more vicious, than the alligator.

Very young alligators are nearly black, with distinct, yellow cross bands; as they grow older these markings become less distinct until in maturity the animals are of a uniform gray or dirty black color.

Habitat. The American alligator is found in the rivers and swamps of the Southern States, from the southern part of North Carolina to the Rio Grande, though Florida is usually thought of as being the region in which they particularly abound. Years ago, before the rifle of the ubiquitous tourist and so-called sportsman had gotten in its deadly work, the alligators were probably very abundant in the Southern States; but they have been so ruthlessly destroyed by native hunters for their skins, and by others for mere wanton sport, that one may travel, perhaps, for days along the rivers of the South without seeing a single 'gator.

The account quoted by Clarke from Bartram's travels of more than one hundred years ago, while probably exaggerated, gives an idea of the abundance of the alligators at that time: "The rivers at this place from shore to shore, and perhaps near a half mile above and below me, appeared to be one solid bank of fish of various kinds, push-

ing through the narrow pass of San Juans into the little lake on their return down the river, and the alligators were in such incredible numbers, and so close together from shore to shore, that it would have been easy to have walked across their heads, had the animals been harmless." At the present time it is usually necessary to travel far from the usual routes of the Northern tourists to find alligators in any abundance.

At Palm Beach, Florida, lived, a few years ago, and probably still lives, a well-known hunter and guide, "Alligator Joe." Just what nationality he may be is difficult to determine, but that he knows that trackless waste, the Everglades, at least in the region of Palm Beach, is evident. He has an "alligator farm" near the great hotels of that famous winter resort, at which he keeps, or did a few years ago, a large number of alligators of all sizes, as well as a number of crocodiles. For a consideration (by no means a modest one) he would take out a party of tourists for a day into the Everglades, guaranteeing that he would find an alligator for them to shoot. It was rumored by the natives that an accomplice was always sent ahead to free the alligator at the psychological moment, after the hunters had been paddled by a devious course to the selected spot, but whether this were true or not the writer was not able to determine. It is true, however, that he and the writer paddled in a rather graceful canoe, dug out

of a single cypress log, and waded through the Everglades for several days, searching for alligator eggs, and that we found only one nest and saw only one or two alligators (Fig. 3).

Doubtless in more remote parts of the Everglades the alligators are much more numerous.

During another summer the writer, with a guide, penetrated the very center of the State, to the region southeast of Lake Kissimmee, forty miles from the nearest railroad; here the alligators, and in consequence their nests, are fairly abundant, though the native hunters are, even in this remote region, rapidly thinning their ranks.

A still greater number of alligators was found, the following summer, in the Okefinokee Swamp in southern Georgia. In the center of this great waste, ten miles or more from dry land, nearly one hundred alligators, ranging from about four to eight feet in length, were killed within a week by a small party of native hunters with whom the writer was traveling (Fig. 4).

Whether this wholesale destruction by sportsman and native hunter will eventually exterminate our giant reptile, as has been the case with the buffalo and other game animals, it is impossible to say. Unless the Everglades and the Okefinokee are largely drained it seems probable that a few alligators will always remain in the most inaccessible regions.

The collection of eggs for sale and for hatching

FIG. 3. ALLIGATOR JOE IN THE EVERGLADES.
(From a Photograph by the Author.)

FIG. 4. ALLIGATOR HUNTER IN THE OKEFINOKEE.
(From a Photograph by the Author.)

purposes, as well as their destruction for food by bears and other animals, will also tend towards the annihilation of the species in the course of time. The economic importance of the alligator will be discussed later.

While in the old days, as has been said, the alligator was common in the larger rivers and lakes, and may even have ventured short distances into salt water, he must now frequently be satisfied to hide his great body in a "'gator hole" that is scarcely more than a puddle. These "holes" (Fig. 7) are common in central Florida and are sometimes scarcely large enough to allow the alligator to dive into them to seek the underground cave in which he hides. It is on the edge of such a hole that the nest is built, as will be described later.

Often from a small swamp or slough alligator "trails" lead off in different directions. These trails are narrow, winding gullies such as might be made by cattle in a damp pasture. If followed from the main slough the trail will usually be found to end in a "hole," in which an alligator will probably be found (Fig. 7). In a great swamp like the Everglades or the Okefinokee such holes would naturally not be found.

On one side of the hole is usually a smooth place where the vegetation is worn away; it is here that the 'gator "pulls out" to sleep in the sun; and wary must the hunter be to approach within sight

of the animal before being seen or heard by him. At the first alarm he slides quietly or plunges quickly into the muddy water, and the hunter must wait long if he expects to see the 'gator come to the surface.

The opening of the cave is always below the surface of the water, but it is possible that there may be a subterranean chamber that is not completely filled with water. How the animal is gotten from his cave will be described later. According to some writers the alligator retires to his cave to hibernate during the cooler winter months. This is possibly true in the more northerly limits of his range. It is well known that if kept in cool water the alligator will lie dormant and refuse all food for months at a time. The writer has had young alligators in captivity, under these conditions, that refused food from late in the autumn until nearly the first of April.

The proprietor of one of the largest alligator farms in the country says: "Our alligators stop eating the first week in October and do not begin to eat until the latter part of April. We have experimented with our stock to see if we could get them to eat in the winter, and found that by keeping the water in the tanks at a certain temperature they would eat, but we found out that the warm water would make their bowels move, and that they would not eat enough to keep themselves up, as in the summer, and as a result they would be-

come very poor and thin, so we do not force them to eat any more." The effect upon the growth of an animal of these two methods of feeding will be noted later when the age and rate of growth are discussed. The same writer says, in answer to a question about hibernation: "In their wild state they go into their dens under water and remain dormant all winter." Whether this statement is the result of actual observation the writer is not able to say, but, judging by some other statements from the same source, it is probably from hearsay. The writer, having visited the alligator haunts only in late spring and summer, has had no opportunity of studying the habits of the animal in its natural habitat during the winter season. During the heat of summer the animal does not seek the sun as he is said to do during cooler weather, but spends more time on the bank at night and during the cooler parts of the day.

That he sometimes wanders over dry land, perhaps going from hole to hole, is evident from the tracks that are sometimes seen crossing a dusty road or path. These trails are easily recognized by the clawed footprints with a line, made by the dragging tail, between them. Although most awkward on land, he can, if necessary, move very quickly. It is, however, in the water that he shows to best advantage; he is an active, powerful swimmer, his tail being used as a propeller as in the fishes. When swimming actively the legs

are held close against the body in order that they may retard the animal's motion as little as possible. While swimming in a leisurely way the top of the head is at the surface of the water, perhaps just the nostrils and eyes projecting above the surface, so that the size of the animal can be estimated by the distance between these projecting points. One afternoon the writer and a guide, while paddling along an old canal that was dug years ago into the Okefinokee Swamp, were preceded for perhaps half a mile by a large alligator that swam just fast enough to keep out of our reach until he came to the place where he wanted to turn off into the swamp.

Although so awkward on land, the alligator is said to be able to defend himself very effectively with his tail, which he sweeps from side to side with sufficient force, in the case of a large specimen, to knock a man off his feet. Although the writer has seen captured and helped to capture alive several alligators up to eight feet in length he has never seen this vigorous use of the tail as a weapon of defense.

While the alligator, like most other wild animals, will doubtless defend itself when cornered, it will always flee from man if possible, and the writer has frequently waded and swam in ponds and lakes where alligators lived without the least fear of attack. This might not have been possible years ago when the animals were more numerous and had not been intimidated by man and his weapons.

Food. The food of the adult alligator consists of fishes, birds, mammals, and possibly smaller individuals of its own species. The young eat small fish, frogs, insects, or worms.

If the animal be too large to swallow whole it is shaken and torn, the shaking being so vigorous that, according to Ditmars, the entrails of the prey may be thrown to a distance of twenty feet or more. Should two alligators seize the same prey at the same time they whirl about in opposite directions so violently that the prey is torn apart. This action may be illustrated by giving two small captive alligators a piece of tough meat; they hold on with bulldog tenacity, and each, folding its legs close to its body, will use its tail like a propeller until the animal whirls around with remarkable speed. The commotion that two ten-foot alligators would cause when thus struggling can easily be imagined. That a large alligator, if it tried, could easily drag under the water and drown a man or possibly a much larger animal is evident.

While the alligator has a valve-like fold of skin in its throat that enables it to open its mouth and crush its prey under water, it is said that it must raise its head above water in order to swallow its food. A young alligator on land will usually throw back its head when trying to swallow a large piece of meat, so that it may be simply this motion that brings the head of the alligator above the surface of the water.

Ditmars thus describes the fate of a dog that approached too near a very large alligator: "As a dog, weighing about fifty pounds, unwarily approached the edge of this creature's tank, it was suddenly grasped and before completing its first yelp of terror was dragged beneath the surface. A few minutes later the twelve-foot saurian appeared at the top, holding the dead canine in its jaws. The dog was shifted about, amid the sound of breaking bones, and swallowed head first, and entire, after a few gulps."

Size and Growth. Although, years ago, alligators of fifteen feet length may have been common in favorable localities in the South, it is probable that few if any such monsters now exist. A twelve-foot alligator, owing to its great girth, is a huge animal and but few of this size are to be found in captivity. The largest specimen the writer has ever seen is the one in the Bronx Zoo, which is barely thirteen feet in length. At hatching the alligator is about eight inches in length.

Clarke (17) says: "The largest specimen I saw measured twelve feet in length; and none of the many hunters and natives of Florida I have met have seen any longer than thirteen feet. All the hunters agree that it is only the males that acquire the great size; no one had ever seen a female that measured over eight feet, and the majority are not over seven. The male has a heavier, more power-

ful head, and during the breeding season especially is more brilliantly colored."

It is a very common belief, even among those who should be most familiar with their habits, that the growth of the alligator is remarkably slow, so that a large specimen may be described by the exhibitor as more than a century old. The same dealer in alligators quoted above says upon this subject: "You can figure about two inches a year to their growth." He also says: "We judge that an alligator about twenty-five to thirty years old will breed." Even scientific writers of reputation have not been free from this error in their writings. That the alligator may live to an extreme age, as seems to be true of some of the tortoises, is quite possible, and it is probable that after reaching a length of twelve or fifteen feet the growth is very slow.

In captivity, when kept in warm water and other favorable conditions, the alligator will grow, according to measurements taken at the New York Zoölogical Park, at the rate of about one foot a year, for about the first ten years. Under unfavorable conditions the growth may be exceedingly slow. Under favorable conditions in nature the rate of growth may exceed that given above.

Instead of requiring twenty-five to thirty years to reach sexual maturity, as quoted above, it is likely that the female may lay eggs at five to ten years, though such a fact is difficult to determine of animals in their native haunts.

Voice. The alligator, unlike most other members of its class, the *Ophidia*, *Chelonia*, and *Lacertilia*, has a voice, which, in an adult bull, may be heard for a mile or more. This bellowing is difficult to describe; it is something between a moan and a roar, and may be to attract the opposite sex or to serve as a challenge to other large animals. It is usually ascribed to the male, but whether confined to him or not the writer is unable to say.

In younger animals the voice is, of course, less deep and in very young individuals it is a squeak or grunt, easily imitated by hunters for the purpose of luring the animals from their hiding places.

Breeding Habits. Judging from the statements of native hunters the laying season of the alligator might be thought to be at any time from January to September. As a matter of fact the month of June is the time when most, if not all, of the eggs are laid. S. F. Clarke gives June 9th and June 17th as the limits of the laying season in Florida, but I found at least one nest in which eggs were laid as late as June 26th: no eggs were found before the first date given by Clarke. It seemed quite certain that the laying, during the season in question, had been delayed by an extreme drought that had dried up the smaller swamps and reduced the alligator holes to mere puddles. Nests were found in considerable numbers as early as June 8th, but no eggs were laid in any of them until the end of the dry period which occurred nearly two weeks later.

Almost immediately after the occurrence of the rains that filled up the swamps eggs were deposited in all of the nests at about the same time. From the fact that all of these completed nests had stood for so long a time without eggs, and from the fact that all of the eggs from these nests contained embryos in a well-advanced state of development, it seemed evident that the egg-laying had been delayed by the unusually dry weather. Eggs taken directly from the oviducts of an alligator that was killed at this time also contained embryos that had already passed through the earlier stages of development. Thus it was that the earliest stages of development were not obtained during this summer.

It is said that during the mating season, which precedes by some time, of course, the laying season, the males are noisy and quarrelsome, and that they exhibit sexual characteristics of color by which they may be distinguished from the females. Never having been in the alligator country at this season, the writer has made no personal observations along these lines, but from the frequency with which alligators with mutilated or missing members are found it is evident that fierce encounters must sometimes take place, whatever the cause. During June and July, at least, and probably during most of the year, the alligators are very silent, an occasional bellow during the very early morning hours being the only audible evidence that one has that the big reptiles are in the

neighborhood. Whatever may be the sexual differences during the mating season, at ordinary times the two sexes are so much alike that I have, on more than one occasion, seen experienced hunters disagree as to the supposed sex of an alligator that had just been killed.

Although I have never seen a nest actually during the process of construction, it is easy to imagine, after the examination of a large number of freshly made nests, what the process must be like.

The alligator, probably the female, as the male, after the mating season, takes no interest whatever in the propagation of his species, selects a slight elevation on or near the bank of the "hole" in which she lives. This elevation is generally, though not always, a sunny spot, and is frequently at the foot of a small tree or clump of bushes. Where the alligator is living in a large swamp she may have to go a considerable distance to find a suitable location for her nest; when her hole is scarcely more than a deep, overgrown puddle, as is often the case in the less swampy regions, she may find a good nesting place within a few feet of her cave. That the female alligator stays in the neighborhood of her nest after she has filled it with eggs seems pretty certain, but that she defends it from the attacks of other animals is extremely doubtful: certainly man is in very little danger when he robs the nest of the alligator, and, according to the statement of reliable hunters, bears are

FIG. 5. A NEST OF C. POROSUS; PALAWAN, P. I.
(From a Photograph by Rowley.)

FIG. 6.—JACKSON SLOUGH; NEAR LAKE KISSIMMEE, FLORIDA.

In the vicinity of this pond several alligator nests were found, either within a few yards of the edge, or on the banks of smaller "holes" which were connected with the larger pond by narrow "trails." (From a Photograph by the Author.)

very persistent searchers for and eaters of alligator eggs. Having selected (with how much care it is impossible to say) the location for the nest, the alligator proceeds to collect, probably biting it off with her teeth, a great mass of whatever vegetation happens to be most abundant in that immediate vicinity. This mass of flags or of marsh grass is piled into a conical or rounded heap and is packed down by the builder repeatedly crawling over it.

There is a great deal of variation in the size and form of the different nests, some being two meters or more in diameter and nearly a meter in height, while others are much smaller in diameter and so low as to seem scarcely more than an accidental pile of dead vegetation. It is probable that the nests are under construction for some time, perhaps to give time for the fresh vegetation of which they are composed to ferment and soften, and also for the material to settle into a more compact mass. The compactness of the alligator's nest was well illustrated one day when the writer used an apparently deserted nest as a vantage ground from which to take a photograph: on opening this nest it was found, after all, to contain eggs, and though some of the eggs were cracked, none of them were badly crushed. This nest although it was so low and flat that it was thought to be one that had been used during some previous season, contained forty-eight eggs, a greater number than

was found in any other nest; while in other nests that were twice as large as this one were found less than half as many eggs, showing that there is no relation between the size of the nest and the number of eggs. The average number of eggs per nest, in the twelve nests that were noted, was thirty-one. One observer reported a nest that contained sixty eggs, but this, if true, was a very unusual case. Reports of still larger numbers of eggs in one nest probably refer to crocodiles, which are said to lay one hundred or more eggs in a nest. Although crocodiles may be found in certain parts of Florida, the writer has had no opportunity of observing their nesting habits.

The eggs are laid in the nest without any apparent arrangement. After the nest has been prepared, and has had time to settle properly, the alligator scrapes off the top, and lays the eggs in a hole in the damp, decaying vegetation; the top of the nest is again rounded off, and it is impossible to tell, without examination, whether the nest contains eggs or not.

As to whether the same nest is used for more than one season there is a difference of opinion among alligator hunters, and the writer has had no opportunity of making personal observations.

While it is usually stated that the eggs are incubated by the heat of the sun, it is held by some observers that the necessary heat is derived not from the sun but from the decomposition of the

FIG. 7. A TYPICAL 'GATOR "HOLE."

Only a few yards across, and surrounded by a dense growth of vegetation. On the far side is seen an opening in the surrounding grass and flags where the ground is worn smooth by the alligator in crawling out of the hole. Under the bank, probably near the place where the alligator "pulls out," is the deep cave into which the inhabitant of this hole quickly goes on the approach of danger. As this cave may be fifteen or twenty feet deep it is not an easy matter to get the animal out. When a female alligator inhabits such a hole, a nest may often be found within three or four yards of the water, though it is sometimes at a greater distance. Such a hole as this may be connected by narrow, winding "trails " with larger ponds, as noted under Fig. 6. (From a Photograph by the Author.)

vegetable matter of which the nest is composed. Possibly heat may be derived from both of these sources, but it seems likely that the conditions that are especially favorable to normal incubation are moisture and an even, though not necessarily an elevated, temperature. Moisture is certainly a necessary condition, as the porous shell allows such rapid evaporation that the egg is soon killed if allowed to dry. The inside of the nest is always damp, no matter how dry the outside may become under the scorching sun, so that this condition is fully met. The eggs of the Madagascar crocodile, according to Voeltzkow,[1] offer a marked contrast to those of the alligator. Instead of being laid in damp nests of decaying vegetation, they are laid in holes that are dug in the dry sand, and are very sensitive to moisture, the early stages, especially, being soon killed by the least dampness. A crocodile's nest containing eggs is shown in Figure 5. In this species of crocodile, probably *C. porosus*, the nest resembles that of the Florida alligator. The photograph was taken by Mr. Rowley on the edge of a small lake on the Island of Palawan, P. I.

The daily range of temperature in the Southern swamps is sometimes remarkably great, so that if the eggs were not protected in some way they would often pass through a range of temperature of pos-

[1] Voeltzkow, A., "The Biology and Development of the Outer Form of the Madagascar Crocodile," *Abhandl. Senckberg. Gesell.*, Bd. 26, Hft. I.

sibly fifty degrees or more; while in the center of a great mass of damp vegetation they are probably kept at a fairly constant temperature. Unfortunately no thermometer was taken to the swamps, so that no records of the temperatures of alligator nests were obtained, but it was frequently noticed that when, at night or very early in the morning, the hand was thrust deep into the center of an alligator's nest the vegetation felt decidedly warm, while in the middle of the day, when the surrounding air was, perhaps, fifty degrees (Fahrenheit) warmer than it was just before sunrise, the inside of the same nest felt quite cool. It is probable, then, that the conditions of temperature and moisture in the center of the nest are quite uniform. One lot of eggs that had been sent from Florida to Maryland continued to incubate in an apparently normal way when packed in a box of damp sawdust, the temperature of which was about 80 degrees Fahrenheit. Another lot of eggs continued to incubate, until several young alligators were hatched, in the ordinary incubator, at a temperature of about 95 degrees Fahrenheit.[1]

The fact that eggs taken directly from the oviducts of the cold-blooded alligator contain embryos of considerable size seems to indicate that no such elevation of temperature as is necessary with avian eggs is necessary with the eggs of the alligator.

[1] Reese, A. M., "Artificial Incubation of Alligator Eggs," *Amer. Nat.*, March, 1901, pp. 193–195.

FIG. 8. A TYPICAL ALLIGATOR'S NEST, MADE CHIEFLY OF GRASS.

The guide is feeling for eggs without disturbing the outside of the nest. Being made of the same material as the background, the nest does not stand out very sharply, though in nature the contrast is somewhat more marked, owing to the fact that the surrounding grass is green while the grass of which the nest is built is dead and brown. (From a Photograph by the Author.)

The complete process of incubation probably extends through a period of about eight weeks, but no accurate observations along this line could be made. For some hours previous to hatching the young alligators make a curious squeaking sound inside the shell, that may be heard for a distance of several yards: this sound may be for the purpose of attracting the attention of the female alligator, who will open the top of the nest in time to allow the just hatched alligators to escape: unless thus rescued, it would seem impossible for the little animals to dig their way out from the center of the closely packed mass of decaying vegetation.

At the time of hatching the alligator is, as already noted, about eight inches in length, and it seems impossible that it should have been contained in so small an egg.

The size of alligator eggs, as might be expected, is subject to considerable variation. In measuring the eggs a pair of brass calipers was used, and the long and short diameters of more than four hundred eggs were obtained. A number of eggs of average size, when weighed in mass on the scales of a country store, gave an average of 2.8 oz. per egg.

There was more variation in the long diameter of eggs than in the short diameter.

The longest egg of all those measured was 85 mm.; the shortest was 65 mm. The widest egg (greatest short diameter) was 50 mm.; the narrowest egg (least short diameter) was 38 mm.

The average long diameter was 73.742 mm.; the average short diameter was 42.588 mm.

The greatest variation in long diameter in any one nest of eggs was 15.5 mm.; the greatest variation in short diameter in the eggs of any one nest was 11 mm.

The average variation in the long diameter of the eggs from the same nest was 11.318 mm.; the average variation in the short diameter of the eggs from the same nest was 5.136 mm.

It will be seen from the above that the average variation in the long diameter of eggs from the same nest is between one sixth and one seventh of the long diameter of the average egg; while the average variation in the short diameter of the eggs from the same nest is less than one eighth of the short diameter of the average egg.

S. F. Clarke[1] gives the limits of the long diameter as 50 mm. and 90 mm., and the maximum and minimum short diameters as 45 mm. and 28 mm. No such extremes in size were noticed among the eight hundred or more eggs that were examined.

Economic Importance.[2] More than one hundred years ago attempts were made to utilize the skin of the alligator, but it was not until about 1855 that these attempts were successful and alligator leather became somewhat fashionable and some

[1] *Journal of Morphology*, vol. v.

[2] The following figures are from an article by C. H. Stevenson in the Report of the Bureau of Fisheries, 1902, pp. 283–352.

FIG. 9. AN ALLIGATOR'S NEST, SOMEWHAT SMALLER THAN THE ONE REPRESENTED IN FIG. 8, BUILT CHIEFLY OF FLAGS.

The nest has been opened to show the irregularly arranged mass of eggs inside. The size and shape of the egg are shown by the one in the guide's hand. (From a Photograph by the Author.)

thousands of hides were converted into leather. The demand was short-lived, however, and was not again felt until the demand for shoe-leather during the war between the States revived the business. At the close of the war the business again failed, but about 1869 the demand became greater than ever and has continued unabated to the present time. The supply of skins from our own States proving inadequate, large numbers of skins were soon imported from Mexico and Central America. The skins from South America are so heavy that they are of little value in making leather. Of the States of the Union, Florida has been the chief producer, the most important centers for hides being Cocoa, Melbourne, Fort Pierce, Miami, and Kissimmee. Ten men at the first-named place took, in 1899–1900, 2500 skins; one man took 800 skins in one year; another man collected 42 skins in one night. At Fort Pierce twelve men took 4000 skins in 1889. In 1899, three firms at Kissimmee handled 33,600 hides. After this time the total number of hides taken and the average per man diminished greatly.

Besides being killed for their hides, the alligators have been destroyed by the thousands merely for wanton sport, so that in 1902 it was estimated that their numbers in Florida and Louisiana were less than one fifth of what they were twenty years before that time, and unless steps be taken to prevent it, the alligator hide, as an article of

commerce, may cease to exist in our Southern States.

It has been claimed that the destruction of the alligator has allowed the cane rat and muskrat to increase to a serious extent, the former doing great damage to crops, the latter often injuring the levees to a dangerous extent. Legislation to forbid the killing of alligators of less than five feet in length has been suggested and should be passed, since animals of less size have almost no commercial value for leather.

In 1902, the annual output from the tanneries of the United States approximated 280,000 skins, worth about $420,000. Of these about fifty-six per cent. came from Mexico and Central America, twenty-two per cent. from Florida, twenty per cent. from Louisiana, and the remaining two per cent. from the other Gulf States. South American hides are not handled by the United States markets.

In 1908, there were marketed from the South Atlantic and Gulf States 372,000 pounds of alligator hides, valued at $61,000.

According to the United States Bureau of Fisheries the hunter in 1891 averaged about 60 cents for the skin, while in 1902 the price averaged about 90 cents, varying between 15 cents and $2.00, depending on the size and condition of the skin. "Prime hides five feet long, with no cuts, scale slips, or other defects, are worth about 95 cents each, in trade, when the hunter sells them at the

country stores, and about $1.10 cash, at the tanneries. Those measuring seven feet are worth $1.55, six feet, $1.12; four feet, 52 cents, and three feet, 25 cents. Little demand exists for those under three feet in length" (Report Commissioner of Fish and Fisheries, 1902, p. 345). Hides of seven feet are in most demand, those over ten feet are not much used. The income of the hunters is largely increased by the sale of otter, bear, deer, and other skins.

The different varieties of skins are described by Stevenson (74) as follows:

"There are several distinct varieties of alligator skins on the markets, the most important being the Floridian, Louisianian, and Mexican; each differs from the others in certain well-defined characteristics, and owing to these differences each variety has its special uses.

"The Florida skins are longer in the body—that is, from the fore legs to the hind legs—than those from Louisiana and Mexico, and consequently they are largely in demand by manufacturers of large handbags. They also have a number of so-called 'buttons' or 'corn marks' on the inside or under surface of an equal number of the scutes resulting from imbedded horn-like tissues in the center of those scales. These increase the difficulty in tanning the skins and detract somewhat from the appearance of the finished article, and for this reason the Florida skins are ordinarily the cheapest

on the market. The farther south the skins are secured in Florida the greater the number of 'corn marks,' and those from the vicinity of Key West are almost valueless for this reason.

"The Louisiana skins differ from those of Florida in the absence of the 'corn marks' above noted, and from both the Florida and Mexican skins in being more pliable and in having the scales more artistically curved and shaped. Consequently they are preferred for such small articles as card-cases and pocketbooks, and usually sell at the highest prices. Skins obtained in Mississippi and Texas are similar to those secured in Louisiana, while those from Georgia and South Carolina are similar to those from Florida, except that the 'corn markings' are not so numerous. All the Florida and Louisiana skins show greater uniformity of coloring, being of a bluish black on the upper surface and a peculiar bluish white on the under side.

"In addition to an absence of the characteristics above noted the Mexican and Central American skins are distinguished by having from one to four small dots or markings like pin holes near the caudal end of each scale. The length of the Mexican skins varies greatly in proportion to the width, sometimes equaling that of the Florida skins. Those from the east coast of Mexico are the best, being lighter in color and with neat and attractively shaped scales. The west coast skins are yellowish

in color when in the green state, and the scales are larger and not so artistically formed. The Florida and Louisiana skins are almost invariably split down the back, or rather along each side of the back, so as to preserve the under side in a solid piece, but most of the Mexican skins are split down the middle of the abdomen, keeping the back intact, making what is commonly known as 'horn alligator.' (See Fig. 15.)

"The skin should be removed soon after death as, in warm climates, putrefaction sets in very early and the value of the skin is depreciated. After removal, the flesh side of the skin is thoroughly rubbed with fine salt, and the skin is carefully rolled up with the salted side inside and is ready for shipment, but must be kept in a dry, cool place. Great care must be taken not to cut the hide since small cuts that are not noticeable in the raw skin may be so conspicuous in the dressed skin as to render it of much less value; a large percentage of the hides received in the markets are thus damaged.

"Formerly only the 'belly skin' was removed, by two longitudinal incisions just below the horny portion of the back; but it was later found that the thick horny skin of the back could be tanned nearly as well as the thinner belly skin, so that the entire skin is now usually removed by a longitudinal incision along the mid-ventral line, with lateral incisions along each leg to the foot (Fig. 15).

The entire skin is more commonly taken in Mexico and Central America than in our States.

"Although the raw skins are sold according to length, the tanned hides are sold by the width of the leather at the widest part. Standard hides sell for $1.00 to $1.65 per twelve inches of width. Some skins tanned and dyed in a superior manner sell for $2.00 or more for single skins of 2½ feet in length. As a rule the Louisiana skins fetch the highest prices, and those from Florida the lowest. Imitation alligator leather is now prepared in large quantities, principally from sheepskins or the buffing from cowhides. These are tanned according to the usual process, and before the skins are finished they are embossed with the characteristic alligator markings by passing them between two rollers." (Above-mentioned report, p. 346.)

Very little of the leather is now used in making shoes, the chief demand being for handbags, music-rolls, etc.

In hunting alligators for their hides two methods are usually employed, in our Southern States at least. The common method is "fire-hunting" at night; the hunters here go, either singly or in pairs, usually in boats, sometimes on foot, with shotgun and torch. The torch may be fastened to the hunter's hat, after the manner of the miner's lamp. One more progressive hunter that I knew had, as a torch, an acetylene lamp, attached to his hat, with the tube for the gas extending down his

back to the generator in his pocket. This lamp threw a blinding beam of light far across the swamp into the eyes of the unsuspecting 'gator, which usually remained fascinated until it could be approached to within easy range. A shotgun at close range, of course, blows off nearly the entire top of the animal's head and kills it instantly; it is then seized before it sinks out of reach and is either taken into the boat or dragged upon the bank to be collected with others in the early morning.

In daylight, with no glaring light to hypnotize it, the alligator is difficult to approach within range and it usually disappears into its cave before the hunter can get a shot at it. The daylight hunter, then, should be supplied not, of course, with a light, but with a ten- or fifteen-foot pole with a large iron hook at the end. If the alligator be vigorously prodded with this mammoth fishhook he will usually finally seize it with his mouth and can be pulled out of his hole alive. It is then an easy matter to kill him with a bullet through the base of the brain. I have seen an eight-foot alligator thus killed with a little .22 calibre "cat" rifle. An eight-foot alligator will often be all that two men can manage to drag out of his cave in this way; and, in the torrid heat of the Southern swamp, this violent exercise is not to the liking of the usually not very energetic hunter.

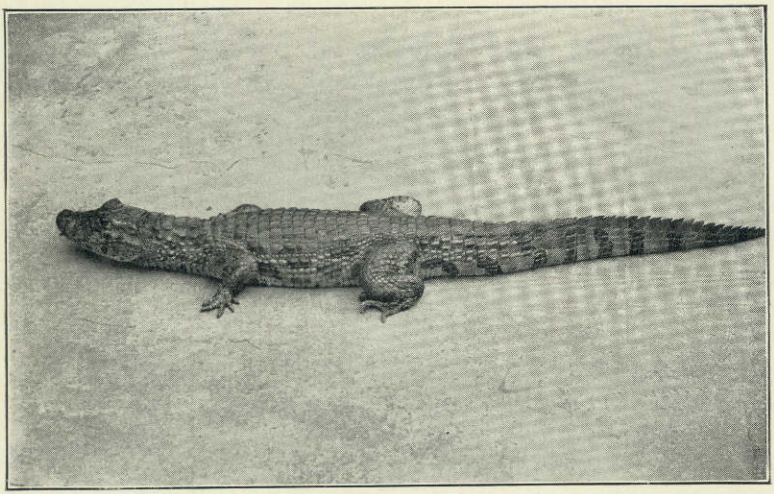
While the manufacture of leather gives the chief

value to the alligator there are other ways in which it has some economic importance. Chief of these is probably the sale of alligator goods to tourists. In 1891 there were in Jacksonville, Florida, twelve dealers in live and stuffed alligators. In 1890, 8400 alligators were sold to tourists, the price for the live animals varying from $10.00 to $35 per hundred. For individual animals of the smallest size (less than twelve inches long) the price is usually from 50 cents to $1.00. For a three-foot alligator the price is generally $3–$5.00; for sizes over three feet $2.00 per foot may be charged, though for *very* large specimens the price may be from $50 to $300 each.

Besides the live and stuffed animals the teeth are polished and sold as souvenirs; about 450 pounds of teeth were sold in 1890, at a price varying from $1.00 to $2.00 per pound. From 75 to 200 teeth will make a pound.

In 1891 about forty people, in addition to the regular dealers, were engaged, in the United States, in stuffing alligators, polishing teeth, etc. The teeth are extracted by burying the head until decomposition sets in.

The tiny alligators that are most commonly sold to tourists, to be brought North, perhaps, and allowed to freeze or starve to death, may either be caught by a wire noose at the end of a fishing rod, or they may be hatched from eggs that are taken from the nests shortly before they are



Broad-Nosed Caiman. (*Caiman latirostris.*)
Distribution: Tropical South America.
Attains a length of about seven feet. (After Ditmars.)
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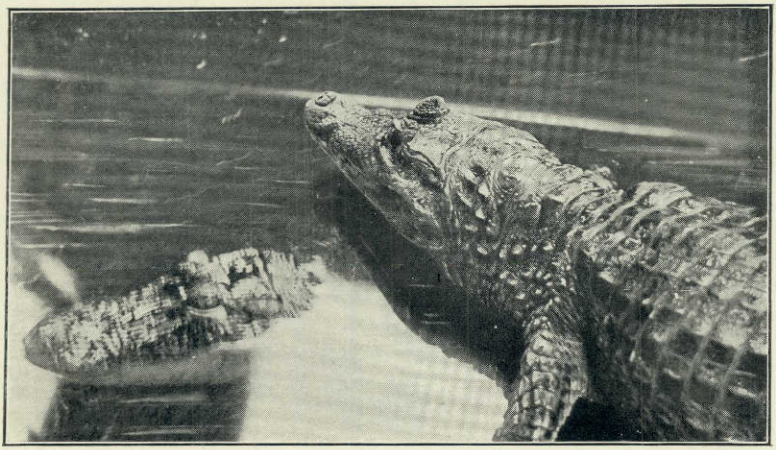


Fig. 10. Spectacled Caiman. (*Caiman sclerops.*) Tropical America.
The length of an adult is about eight feet. (After Ditmars.)
(Reproduced by Permission of Sturgis & Walton Co.)

ready to hatch. Such eggs may readily be hatched by simply keeping them moist and at a fairly constant temperature, as has been previously noted. Besides the above uses Ditmars says: "The eggs are eaten in many portions of the South, and the search for eggs at the proper season furnishes profitable employment for many persons, as each nest contains a large number of eggs."

Never having eaten an alligator egg I cannot speak from personal experience of its flavor; but it has always seemed strange to me that more use is not made of the flesh of the alligator. This flesh is often said to have too strong a flavor to be palatable; I have eaten it when it had no such rank taste but was decidedly agreeable, being, as might perhaps be expected of so amphibious an animal, somewhat like both fish and flesh, yet not exactly like either. Perhaps greater care should be taken in skinning an animal that is to be used for food in order that the flesh be not tainted with the musk. It may be a lack of care in preparation that has given rise to the impression that alligator meat is too strong to be pleasant. It is perhaps, also, the "idea" of eating a reptile that makes the meat unpopular. A half-grown boy, who was once in the swamps with me, had expressed a great aversion to alligator meat, so the guide, one day, offered him a nicely fried piece of alligator meat, saying it was fish; the meat was eaten with evident relish and the diner was not told until after a

second piece had disappeared what he had been eating. It always seemed strange to me that the poor people of the South should not more often vary the monotony of fat pork and corn bread with alligator steaks. Whether the meat could be smoked or salted so that it would keep in a hot climate I do not know; I am not aware of any experiments along this line.

The Chinese Alligator

Beside the American form, *Alligator mississippiensis*, the only other species of alligator is found in China, along the Yang-tse-Kiang River; it is *Alligator sinensis*. It reaches a length of six feet and externally resembles its American relative; it is greenish black above speckled with yellow; grayish below.

The Caiman

This is the nearest relative of the alligator and is found in Central America and tropical South America. As seen by the table on page 2, it is usually a small animal, though one species, the black caiman, is said to reach a length of twenty feet (Fig. 10). The nasal bones do not form a bony septum as in the alligator and the ventral armor consists of overlapping bony scutes. The canine teeth of the lower jaw fit into a pit in the upper jaw, as in the alligator.

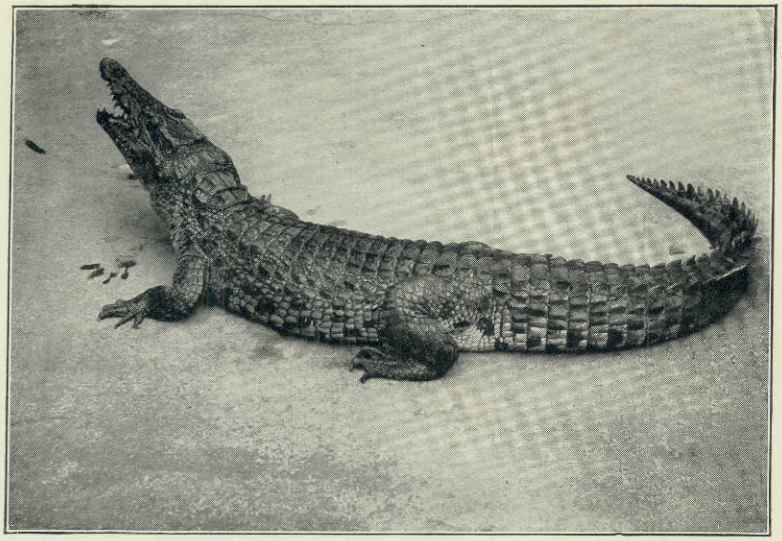
They are said by some writers to be extremely abundant in the waters of the upper Amazon, migrating to the flooded forests during the rainy season and returning to the streams on the approach of the dry season. According to Ditmars there are five species of caiman of which the spectacled caiman, *C. sclerops*, and the black caiman, *C. niger*, are the most striking. The former is so named because of the spectacled appearance due to the swollen and wrinkled upper eyelids; it reaches a length of eight feet and is said to be of a treacherous disposition. The latter has a blunt snout like the alligator and is the largest of the New World crocodilians.

The American Crocodile

Of about a dozen existing species of crocodile, but one, the American crocodile, *C. americanus*, is found in the United States, and it is limited to the swamps and coast of southern Florida below Lake Worth; its greater sensitiveness to cold is doubtless the cause of its not being found so far north as the alligator. Its range extends south through Mexico and Central America into South America. It was first found in Florida by Dr. Hornaday in 1875. It sometimes reaches a length of fourteen feet.

As has already been noted there is, besides certain structural differences, a marked difference in

the dispositions of the Florida alligator and crocodile. While an alligator may snap its jaws, hiss, and swing its tail from side to side, it is not difficult for a couple of men with ropes and a pole to safely tie up a large specimen. The struggles of a crocodile are of a more serious nature. Ditmars thus describes an encounter with a captive Florida crocodile: "The writer well remembers his first acquaintance with a big fellow from Florida. Driven out of the crate the crocodile looked the picture of good nature. Standing away from what he thought to be the reach of his tail, the writer prodded the apparently sluggish brute with a stick to start it for the tank. Several things happened in quick order. With a crescentic twist of the body utterly beyond the power of an alligator, the brute dashed its tail at the writer, landing him such a powerful blow that he was lifted completely from the ground. As he left *terra firma*, an almost involuntary inclination caused him to hurl his body away from a pair of widely-gaping, tooth-studded jaws swinging perilously near. Landing with a thud on one shoulder, though otherwise unhurt, the writer threw himself over and over, rolling from the dangerous brute that was actually pursuing him on the run, body raised high from the ground. For an instant it seemed as if the crocodile would win. As the writer sprang to his feet and glanced backward, he beheld the brute throw itself flat on its belly, open the jaws widely,



NILE CROCODILE. (*Crocodilus niloticus.*)

Distribution: Africa generally; Madagascar.

Grows to a length of sixteen feet. (After Ditmars.)

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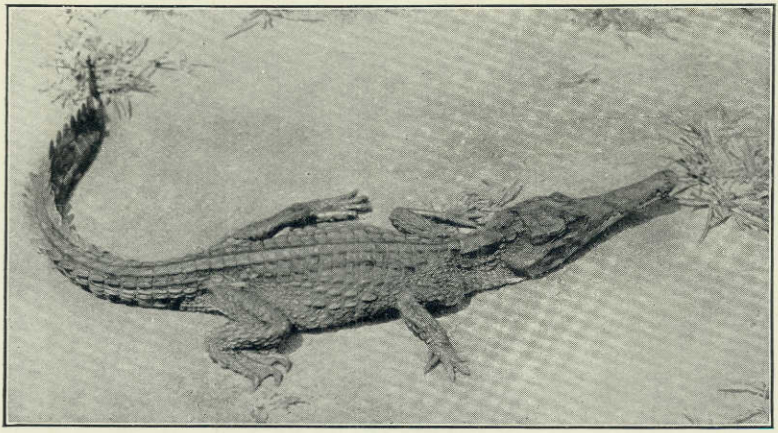

FIG. 11. WEST AFRICAN CROCODILE. (*Crocodilus cataphractus.*)

Distribution: West Africa.

Does not attain so large a size as the Nile Crocodile. (After Ditmars.)

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then remain motionless as a statue. Such is the average crocodile—an active, vicious and, above all, treacherous brute." Ditmars says again, in the same book: "When the keepers of the reptile house of the New York Zoölogical Park clean out the big pool of the crocodilians, they actually walk over the backs of some of the big 'gators, so tame are these. They never become unduly familiar with the crocodiles, finding it necessary to pen the latter behind heavily barred gates—and in the process the men are often chased from the enclosure."

In contrast to this ferocious aggressiveness in captivity the American crocodile is said to be very timid and retiring when in its native habitat.

Young animals are greenish with black marking; as they become older they are of an olive color, and old specimens are dull gray.

The Orinoco Crocodile, *C. intermedius*

This is a species with a very narrow snout that is not quite so large as the preceding. It is said to be abundant in the Orinoco River and its tributaries.

Besides the two above mentioned there is a small species, *C. rhombifera*, found only in Cuba and hence known as the Cuban crocodile.

The African or Nile Crocodile, *C. niloticus*

This well known and much feared species is found throughout the continent of Africa, and is

very common on the island of Madagascar (Fig. 11). In the lower waters of the Nile it is now nearly exterminated. It has always been a conspicuous animal in Egypt and was one of the animals held sacred by the Egyptians and preserved by them as mummies. It is discussed by Herodotus, and the "leviathan" mentioned in the Book of Job is doubtless this crocodile. In fact the name is said to be derived from the ancient Greek for lizard, just as the word alligator is said to be derived from the Spanish for lizard—*el lagarto;* the resemblance in form between these big saurians and their smaller relatives is evident. The alligator, being confined to America and a small part of Asia, was probably not known to the ancients.

An excellent account of the development and habits of the present species is given by Voeltzkow (78), who says it is, perhaps, the most common vertebrate in Madagascar. The largest specimen measured by this observer was thirteen feet; Ditmars gives sixteen feet as the maximum size. This *man-eating* crocodile, according to Ditmars, destroys more human lives than any other wild animal of the dark continent.

The story told by Herodotus of the bird, probably a species of plover, which enters the gaping mouth of the crocodile to pick off the leeches found there may be true, since there is such a bird that may be seen perching on the backs of crocodiles, and as the Crocodilia frequently lie with their

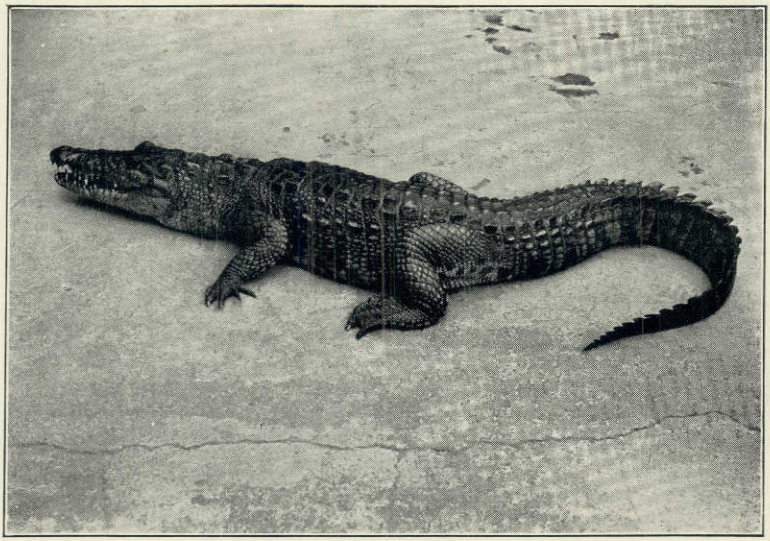

FIG. 12. SALT-WATER CROCODILE. (*Crocodilus porosus.*)
Distribution: India to North Australia. Occurs at sea.
Grows to a length of twenty feet. (After Ditmars.)
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mouths wide open it is quite possible that these birds may pick off the worms that are often found within. It is also possible that the alertness of these birds to danger may serve as a warning to the crocodiles with which they associate.

According to Voeltzkow these crocodiles dig caves of thirty-nine to forty feet length in the banks of the streams they inhabit, into which they retire on the approach of danger. The caves open under water and slope upward towards the surface of the ground where a few small air-holes are found. The natives locate the caves by means of the air-holes and dig out the hidden animal, first stopping up the entrance.

In Madagascar the eggs are laid in August and September and hatch in about twelve weeks; they are laid at night, usually shortly before day-break. From twenty to thirty eggs are laid in one nest, which is merely a hole dug in the dry sand. As was said in connection with the Florida alligator, the habits of the two animals are quite different in this respect,—the moisture that is so important in the one case is fatal to the embryo in the other. When the eggs are laid the nest is filled in with sand so that there is nothing to indicate its position except that the female crocodile is in the habit of lying on the spot where her eggs lie buried.

Like the alligator the young crocodile makes a squeaking noise shortly before hatching and the

mother doubtless opens the nest, at this time, to allow the young to escape. A fence that Voeltzkow built around a nest was repeatedly broken down by the mother in attempting to get back to her eggs.

The character of the crocodile's egg is discussed, in comparison with that of the Florida alligator, on page 23.

The Marsh Crocodile or Mugger, *C. palustris*

Found in India, Ceylon, Burmah, the Malay Peninsula, and many of the islands in that region. It has a rather broad snout, and reaches a length of twelve feet. It is a timid form and is harmless to man. It is frequently venerated by the Hindoos and is kept in a semi-domesticated condition in ponds where it is fed and becomes very tame.

In the dry season when the natural ponds are empty they sometimes migrate overland in search of water, but generally they bury themselves in the mud and lie dormant until the rains begin again.

The Salt-Water Crocodile, *C. porosus*

This is one of the largest if not the largest of living reptiles (Fig. 12). It is said by Ditmars to reach a length of twenty feet and there is a record of one specimen that was thirty-three feet in

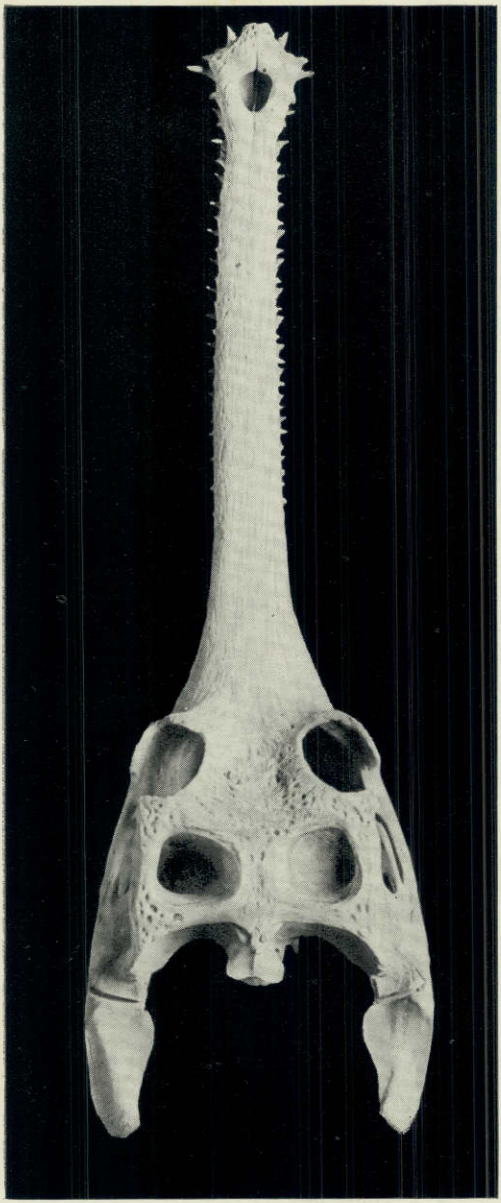

FIG. 13. SKULL OF GAVIAL.
(Dorsal View.)

(Photograph from U. S. National Museum.)

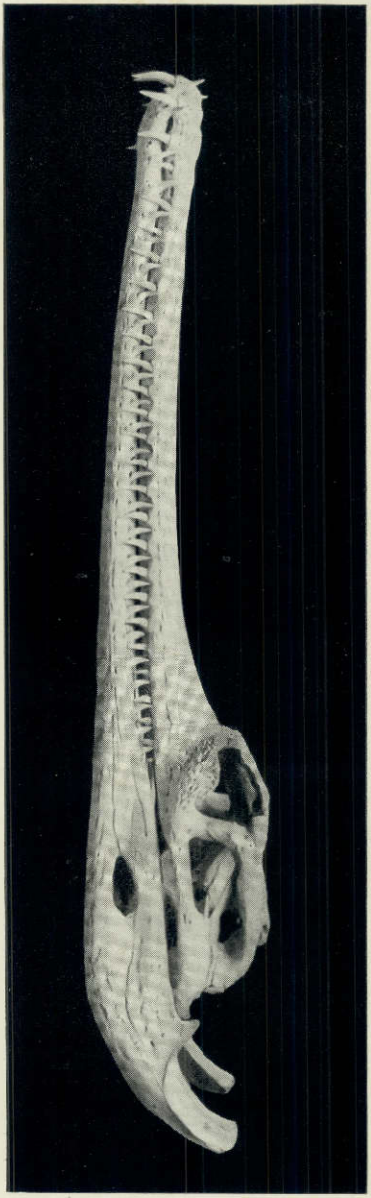

FIG. 14. SKULL OF GAVIAL.
(Lateral View.)

(Photograph from U. S. National Museum.)

length. It is said to be easily recognized by the prominent, longitudinal ridge that extends in front of each eye, over the prefrontal bone, and by the absence of the suboccipital scutes.

It is typically an inhabitant of tidal waters and is sometimes found swimming at sea, out of sight of land; it seldom goes inland to any great distance from the sea. It is a *man-eating* species and many human lives are said to be destroyed by it in India and surrounding countries. A British "blue book" states that in British India 244 deaths were caused by Crocodilia in the year 1910.

In captivity it is savage and untamable. Ditmars, in speaking of three specimens that he had in captivity, says they were "positively the most vicious reptiles" he had ever seen.

The Indian Gavial, *Gavialis gangeticus*

This animal, which inhabits the Ganges and other rivers of northern India, is, with the possible exception of the preceding species, the largest of the Crocodilia; it is said to reach a length of thirty feet, which is twice that of a very large Florida alligator. As previously noted its snout is extremely long and narrow (Figs. 13 and 14), with a large, fleshy hump at the tip, that projects above the muddy water in which the animal lies concealed.

It is a timid animal and, in spite of its huge size, dashes quickly into the water on the approach of

man, to whom it is seldom or never dangerous. Its Indian name, *gharial*, from which its generic name has been corrupted, means fish-eater, since its food consists, it is said, largely if not entirely of fish.

Considering its huge size and the character of its jaws and teeth as shown in Figures 13 and 14, it is fortunate that it prefers fish to human flesh.

Anderson (2) describes the eggs and young of the Indian gavial. He found forty eggs in a nest of sand; they were in two layers, with a foot of sand between them. The young were 15.8 inches long at hatching. He says: "The young run with amazing rapidity the moment they are out of the shell. . . . Some of them actually bit my fingers before I had time to remove the shell from their bodies." The following quotation from Oldenburg (46), for which I am indebted to Dr. Hussakof, is perhaps the earliest reference to the egg of the American alligator. It also mentions the habit that is practiced by some of the recent Crocodilia of swallowing stones to aid in digestion, as was apparently done by some of the large extinct reptiles.

"The eggs of *Crocodiles* and *Alligators* are little bigger than a Turkey's. I thought to bring one to England, but it was lost. I never broke any to see the Yolk and White; but the Shell is as firme and like in shape to a Turkey's, but not spotted. I inquired into the Stone in the Stomach of a

Cayman or *Crocodile*, and I found by the inquiry of a very observing gentleman there, that they were nothing but several Stones, which that Creature swallows for digestion. He took out of one a piece of a Rock as big as his head: out of others he had taken sixteen or twenty lesser. None regards them much there, whatever *Monardes* relateth."