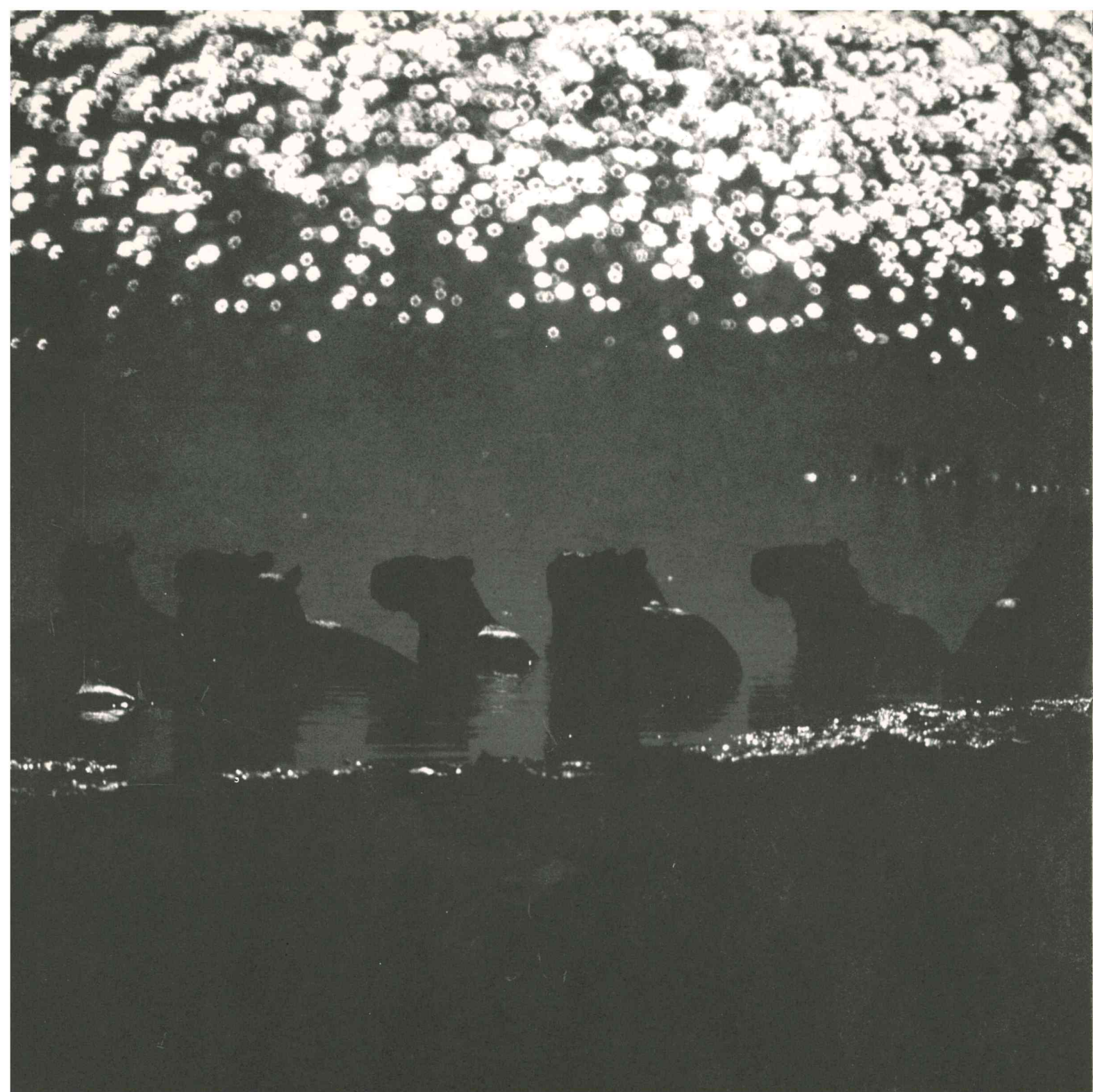
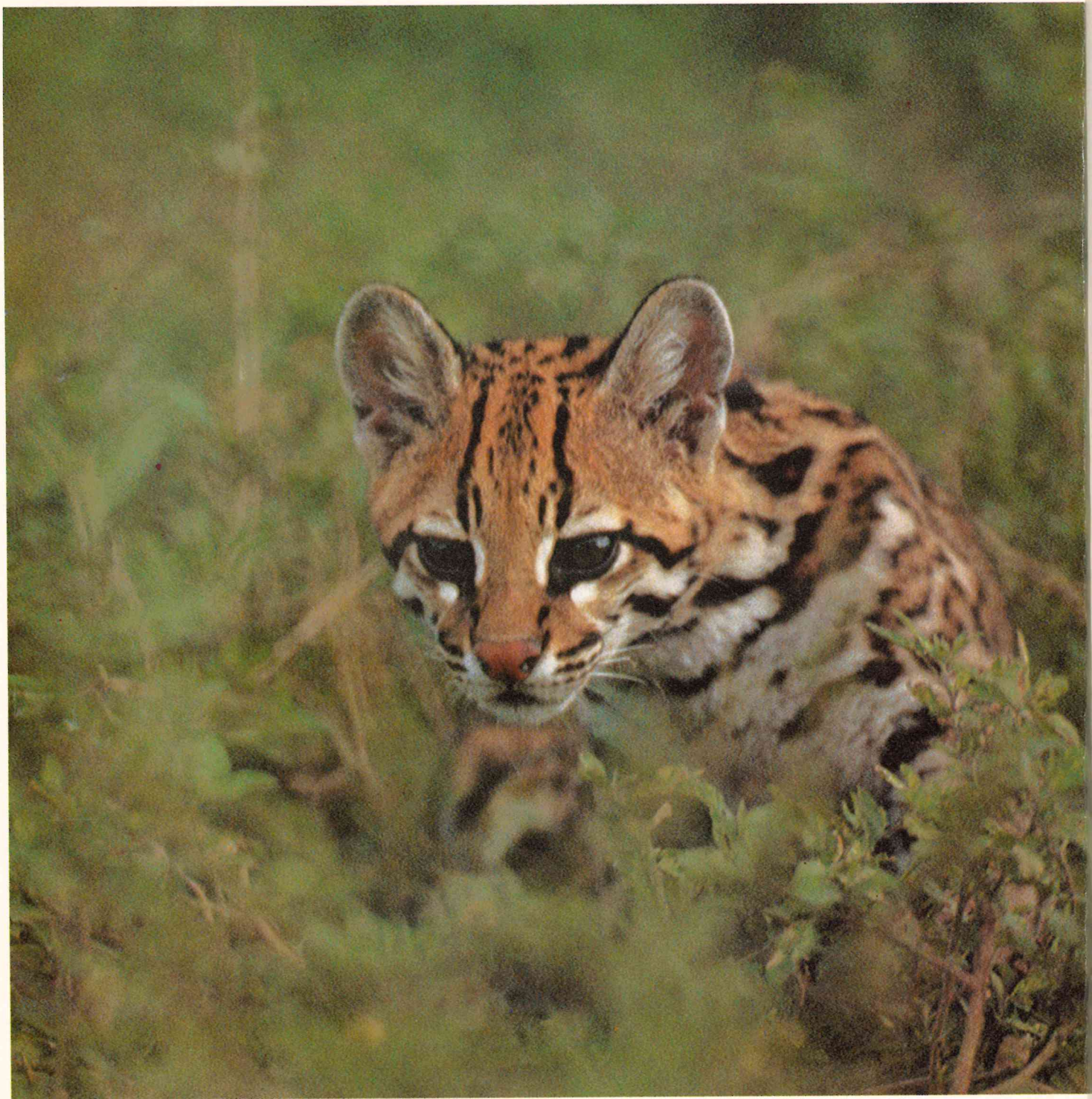


CRISTINA RAMO, JOSE AYARZAGUENA / FAUNA OF THE VENEZUELAN LLANOS

Fauna of the Venezuelan Llanos



FAUNA OF THE VENEZUELAN LLANOS



Ocelot (*Felis pardalis*)

CRISTINA RAMO / JOSE AYARZAGUENA

FAUNA
OF THE VENEZUELAN
LLANOS

*Notes on their morphology
and ecology*

PHOTOGRAPHS BY BENJAMIN BUSTO
DRAWINGS BY GIORGIO VOLTOLINA



LAGOVEN BOOKLETS

CRISTINA RAMO HERRERO

Ph.D in Biology from the University of Navarra (Spain). Her doctoral thesis dealt with the llanos sideneck studied at El Frío Biological Station. She worked at Doñana Biological Station and at present she is a Zoology professor at the Universidad Nacional Experimental de los Llanos Occidentales Ezequiel Zamora, where, along with teaching, she does intensive research at the Natural Science Museum.

JOSE AYARZAGUENA SANZ

Ph.D in Biology. He majored in Zoology at the Universidad Complutense (Madrid). His doctoral thesis dealt with the ecology of the spectacle cayman (*Caiman crocodilus*) in the Apure Plains. He worked at Doñana Biological Station (Spain), at the Institute of Renewable Natural Resources of the Simón Bolívar University and is at present a member of the environmental studies team at La Salle Foundation Special Program Department.

BENJAMIN BUSTO BARRENECHEA

A naturalist who has been able to combine his hobby with his actual profession: photography. He has worked at the Department of Recovery of Birds of Prey at the Barcelona Zoo, and was a field technician at Doñana Biological Station (Spain), at El Frío Biological Station and at Fernando Corrales Module (Apure), cooperating in research on vertebrates sponsored by CONICIT. He has taken part in scientific expeditions in Spain and the North of Africa.

GIORGIO VOLTOLINA RANZATO

A teacher graduated in Venice (Italy), he started to work in Venezuela in 1955. From that moment on, he worked at the National Pedagogic Institute and was a technician in Biology at the Central University of Venezuela. Likewise, he worked with La Salle Society of Natural Sciences, as well as with La Salle Foundation (1955 on), taking part in many expeditions and developing an artistic career through his numerous drawings, sculptures, and other fine art expressions. Now retired from the Central University of Venezuela, he dedicates his time to drawing a collection of Venezuelan Fauna.

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Scarlet Ibis (*Eudocimus ruber*).

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FOREWORD

In the following pages, Cristina Ramo and José Ayarzagüena offer us a remarkably beautiful text, with pictures by Benjamín Busto, dealing with the Llanos fauna, a valuable natural resource, the knowledge of which is essential for its preservation.

The authors display the main features of the Venezuelan Llanos fauna, particularly referring to the fauna of Apure, Barinas and Portuguesa states. The Llanos in these states constitute one of the most potentially rich regions for agriculture and cattle raising in the nation, and they have been employed for such purposes since colonial times. The land development process has been stressed in some sectors during the past few years due to intensive exploitation involving deforestation, use of fertilizers and pesticides, as well as adequate methods of irrigation or drainage depending on the case.

All this process of transformation within the landscape of the Llanos has caused a decrease in the number of many animal species; nevertheless, there are still some areas which maintain their natural characteristics and, by means of a sound planning of land use, may continue to be the habitats of wildlife.

In order to understand the importance of the animals of the Llanos as well as their relation with the environment they live in, it is necessary to study, to research, and to spread the knowledge acquired. Such has been the purpose of the authors when writing this text: instead of contenting themselves to present their works in scientific conferences, or to publish them in special-

ized reviews, they have made a beautiful introduction to the knowledge of such an important resource.

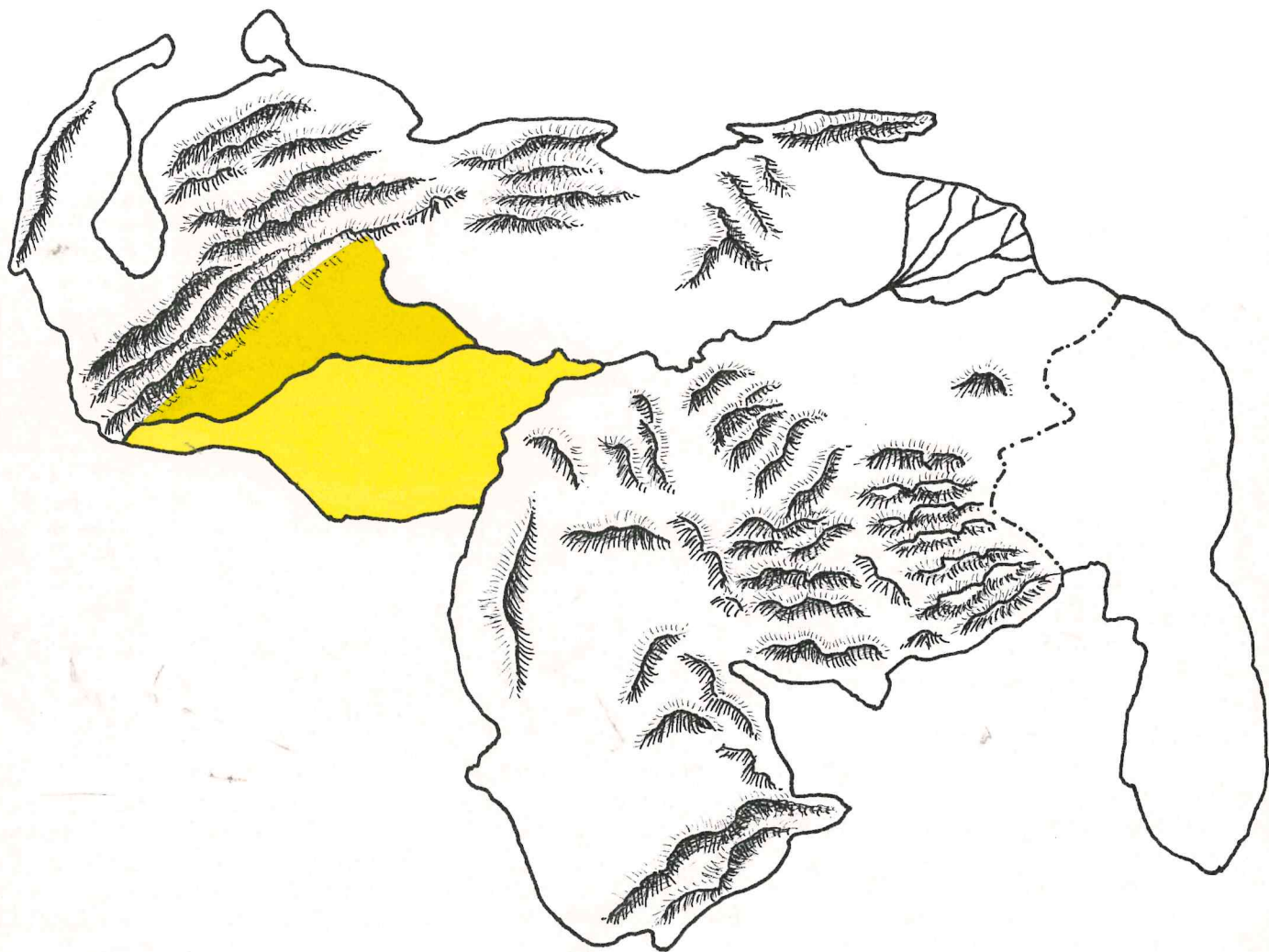
Here you will find the main species of our fauna, from those having the simplest habits to the most capable predators. The whole text has been written in an easy, understandable way, and besides the mystery of biological processes and their relationship to climatic cycles, you will discover the love these young researchers feel for the nature of the Venezuelan Llanos.

I hope this publication will reach many of our fellow-country-men, especially the young and the children of both urban and rural areas: the former will have an idea of the fascinating world of forests and seasonal ponds, of the dry and the rainy seasons in the countryside, which is so different from the urban areas; for the latter, the text will be a way to verify their empirical observations about animal behavior, as well as a guide for a better understanding of their cycles, leading to a better use of fauna resources.

Our acknowledgement to the authors of this work which is the product of sound scientific research; and our congratulations to LAGOVEN, subsidiary of Petróleos de Venezuela, for sponsoring such a beautiful work.

PEDRO JOSE URRIOLA MUÑOZ
Assistant President
Universidad Nacional Experimental de los
Llanos Occidentales Ezequiel Zamora
December 1982

FIGURE 1



Location of Southern and Western Llanos in Venezuela.

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I-PHYSICAL ENVIRONMENT AND VEGETATION OF VENEZUELAN LLANOS

Origin and relief

The Venezuelan Llanos are located in the country's central depression, having the Andes and the Coastal Mountain Range by one side and the Guayana Massif by the other. This wide region extends from the Andes foothills to the Atlantic Ocean through the lowlands of the Orinoco Delta, covering about one third of the Venezuelan territory.

The Guayana Shield can be considered as the most ancient land formation in Venezuela since more than three billion years ago it was already a part of "Pangea", the ancestral continent; all other lands appeared later on, adapting themselves to this original nucleus until the present landscape was shaped. In the geological scale of time, the formation of the Venezuelan Llanos is very recent, being the last inlands to appear only one million years ago, together with the Orinoco Delta's alluvion.

Sedimentary rocks with marine origin found in El Baúl, Calabozo and Mérida, suggest that, by the middle of the Paleozoic age, a wide sea covered the western part of Venezuela. Due to the alternating action

of orogenic activity and erosive processes both the mountain ranges and the lowlands appeared: the former are the product of orogenic activity while the latter were formed by the sedimentation of eroded material coming from such mountain ranges. Thus, according to geomorphologists' definition, the Venezuelan Llanos are a huge alluvial plain formed by the dragging and deposal of material transported by the rivers which have their sources in surrounding mountainous areas. According to Vila, the exposure of ancient rocks in El Baúl divides the Llanos into two parts: to the West, there are what he calls the "true" llanos, since their topography is almost completely flat, rivers may have wandering courses and they overflow during the rainy season, flooding wide areas. On the other hand, to the East there is a more pronounced relief of hills and mesas, rivers are better channeled and only overflow when they empty into the Orinoco and this river has swelled to the point of damming them up.

Due to geomorphological reasons, Vila subdivides Venezuelan Llanos

into four regions: the Eastern Llanos of Anzoátegui and Monagas states (39,900 Km²) with a predominating relief of mesas; the Central Llanos of Guárico and Cojedes (71,400 Km²) with their rises and hills; the Western Llanos of Portuguesa and Barinas (51,200 Km²) with a flat topography and more-or-less channeled rivers; and the Southern Llanos of Apure (74,500 Km²) mainly characterized by floods occurring during the rainy season and where rivers and bayous show wandering courses.

Since our main objective has been to study the fauna of Portuguesa, Barinas, and Apure states, we shall now describe the Western and Southern Llanos. The Western Llanos extend from the Suriapá river to the Cojedes-Portuguesa river, starting at the foothills of the Andes Mountain Range, and ending at the Apure river. The Southern Llanos encompass the belt of land between the Apure and the Meta rivers. Both llanos have alluvial origin but, if we look at the materials deposited by the rivers, we will see that river-beds close to foothills are mainly made up of consid-



The dry and rainy seasons show two different faces of the savanna, which changes from an "inland sea" to an incipient desert where animals survive at the mercy of small, isolated waterholes.



Climate

erably big round pebbles and, as one moves away from the foothills, pebbles disappear, instead, slime and sand are observed. This phenomenon is due to the fact that heavier material deposits faster, while fine particles are transported further away. This is why it is almost impossible to find a pebble in the southern part of Barinas and Portuguesa as well as in Apure.

In spite of the fact that, at first sight, these lands look totally flat, there are slight differences in level which originate a characteristic micro-topography. Llanos' men distinguish between banks and sand banks (high areas which remain dry during the flooding season), swamps (low lands which become water-logged during the rainy season and show characteristic undulations called "tatucos") and seasonal ponds (depressions which stock water most of the year; when permanent, they are called ponds).

As far as climate is concerned, even though temperatures are high and relatively constant all year long, rainfall is, by contrast, remarkably seasonal. There is a rainy period from May to October during which floods occur, transforming the savanna into a true sea, to the point that very often cattle have to look for food literally "in deep water".

There is also a dry season, from December to March, during which one can say that not even a raindrop falls. Pastures become bone-dry, many trees lose their leaves and the earth cracks under a relentless sun. In this "summer time", breeze arises often in the morning, thus contributing, together with sun radiation, to water evaporation. April is considered to be the beginning of the rainy season since it is usually during this month that the first rains fall. Water-thirsty earth absorbs it as a sponge and, in a matter of days, a green carpet of grass covers the dry soil, and new sprouts grow in the branches of the trees. Cows, hungry after the drought, together with their new-born calves, polish these pastures off. November,

on the contrary, brings the end of the rainy season, since downpours are spaced out.

Venezuelan Llanos show a totally different look depending on the period of the year. It is possible that a tourist who visits Apure in "winter" will not be able to recognize the same area in "summer": he will deem impossible that such luxuriant greens and blues may become pale yellow and earth-coloured.

As we shall see further on, the rains lay down the norm for the behavior not only of vegetation, but also of animal species which live in the Llanos.

Vegetation

According to Holdridge's bioclimatic classification based on rainfall, temperature, and evapotranspiration data, Ewel and Madriz include this region into the "tropical dry forest" area, which is the one that covers most of the Venezuelan territory. As this is a very wide classification, vegetation within the area is not uni-



Male White-tailed deer (*Odocoileus virginianus*).

Herbaceous savannas in Apure during the rainy season.



form, and it includes quite different vegetal formations.

One need not be a skilled botanist to realize the changes in vegetation occurring within the area we are dealing with. If we travel from Guanare to Elorza we can see that all along the way North of Apure river there is a predominance of large forests which have been cleared by man for agricultural purposes.

After having crossed the Apure river, a new landscape emerges before us: an enormous plain that disappears into the distance, sometimes spangled with small forest patches which in Venezuelan Llanos are called "matas". If we move southwards, to Elorza savannas, where the Arauca river flows, we find big sandbanks by the moriche palms typical of the area. It is necessary, therefore, to be more specific in the description of the tropical dry forest's vegetation.

The authors mentioned earlier, distinguish three different conditions occurring in this area of life: virgin or climax forests, secondary forests, and savannas.

Virgin forests in this region are lo-

cated in the best lands, that is, in the most fertile ones and, for this reason, they have been drastically reduced in order to use them for agricultural purposes. The agricultural area of Turén (Portuguesa state) used to be a magnificent forest. Nowadays, Caparo forest-reserve (Barinas state) is the biggest extension of virgin forest; the Ticoporo forest (Barinas) is under exploitation, and the San Camilo forest, in the West end of Apure state, is almost completely deforested.

Virgin forests show three arboreal levels: the highest one ranging from 20 to 30 or more meters high; the intermediate one, ranging from 10 to 18 meters; and the lowest one less than 8 meters high. Most species are deciduous and the tops of the trees are either round or semi-flat.

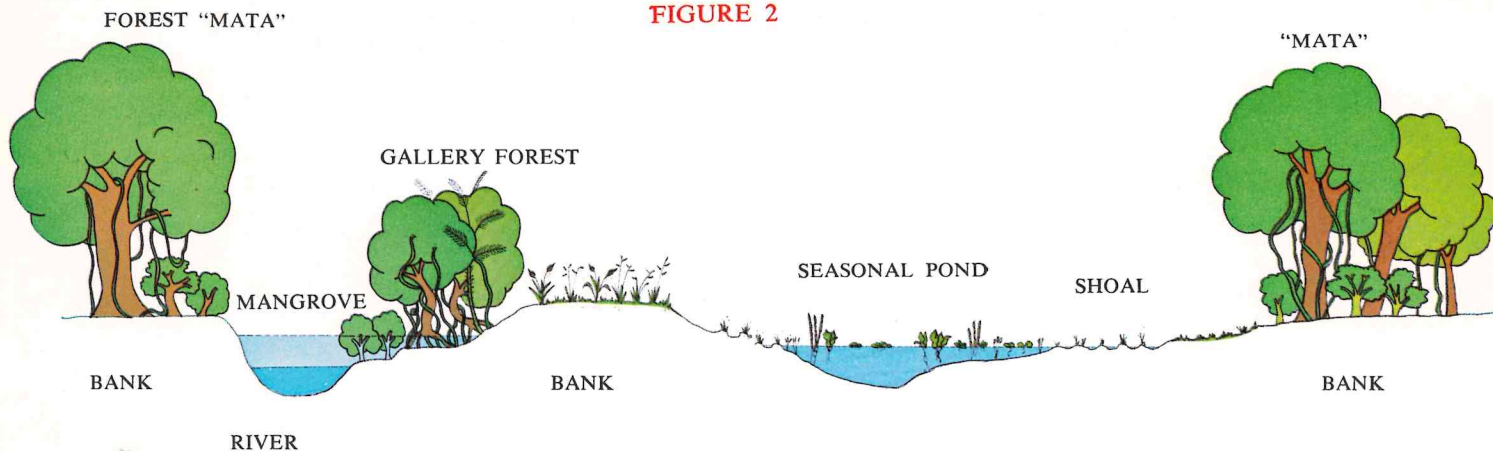
Trees such as Caoba, Cedro and Apamate, which produce valuable woods, are found in this region. This fact has contributed to make of Portuguesa and Barinas states the main centers of forest exploitation.

Secondary forests are much more common than virgin forests, and are formed by the degradation of the



Forest Llanos of Portuguesa and Barinas.

FIGURE 2



Vegetation landscape of Southern Llanos

latter. Such degradation can be caused by several factors: deforestation, fires and the abandoning of lands after having used them for agriculture.

Veillón points out that the forest area in the Venezuelan Llanos had been reduced to a minimum by the beginning of the 19th century, when colonial times came to an end. Most fields were depopulated during the War of Independence, and agricultural as well as cattle-raising activities were given up. Thus, a flourishing secondary forest grew till the 50's when man's action reduced it again for agricultural and cattle-raising purposes.

Depending on their age, these forests may have one, two or three levels, and trees grow up to 30 meters. Large-topped trees, such as the Saman, the Jobo, the Ceiba and the Camoruco trees, are characteristic of these forests. Just like virgin forests,

secondary forests are deciduous ones.

Last, we have savannas, the largest extension of which is located in the Apure state. As fires periodically devastate savannas during the dry season, the trees that grow there are scarce and fire-resistant. Savannas are mainly used for extensive cattle-raising. Small forests called "matas" rise like islands in the banks and swamps. Another type of forest found in these formations is the gallery forest. These forests grow by the bayous which are sometimes several kilometers wide. They are characterized by water periodically sweeping away the organic matter that falls to the ground; leaves and branches for example Moriche palms, Laurel, and "Coco de mono" trees are typical of this forest.

Aquatic vegetation is a focus of interest for certain animal species. Vegetation is usually distributed around seasonal or perennial ponds,

forming different concentric vegetation belts depending on the depth of water. As one goes deeper into seasonal ponds, different types of vegetation appear. First of all, in areas of little depth, there is a belt of rushes; as water depth increases, big water-hyacinths, well-rooted into the soil, are found and, finally, where the depth is such that no plant is able to root into the soil, the main species found are floating plants, ferns, and other water-plants called "repollos de agua". These species are transported by the wind.

In summary, Western Llanos are characterized by huge surfaces covered by forests, while Southern Llanos are characterized by enormous savannas; thus, forest fauna predominates in the former, and other animal species, well adapted to savanna's open spaces and swamped surfaces, live in the latter.

II-FAUNA: HABITS AND HABITATS

The fauna that populates our planet nowadays neither is nor has been permanent. In the course of the evolutionary history of the Earth, living beings have experienced several adaptation processes to fit the changing environmental conditions. Hence, present-day plants and animals are the result of such adaptative evolution. Living beings unable to adapt themselves to environmental changes perished, and only the most apt ones survived.

We will roughly define three important habitats — forests, plains and aquatic environments — into which the different species can be classified. Adaptation to two completely different seasons (the rainy and the dry season) is an interesting feature of plain-land fauna. This adaptation does not occur in the same way for all species: every group shows a particular behavior according to its own requirements.

Amphibians

Of all terrestrial vertebrates, amphibians are the most primitive ones.

It was them who first colonized inland in ancient ages, and who subsequently originated reptiles, birds and mammals.

In spite of having conquered terrestrial habitats, these small, wet- and soft-skinned animals, commonly known as frogs and toads, need very humid environments to subsist. Having partly cutaneous breathing, the drying up of their skin would cause their fast death. For this reason, most of them belong to nocturnal species, so avoiding the danger of desiccation due to sun radiation.

Within this group, there are certain species, adapted to live in arboreal environments, which have therefore developed sort of adhesive disks on their finger tips. These disks segregate a sticky substance which facilitates climbing. Arboreal frogs belong to the Hylidae family. A very well-known species of this family is the plantain frog, also called "milky frog" because it is able to segregate a milky substance through the skin, as a defense from possible predators.

There is also one family which prefers to remain in aquatic habitats.

The fingers of their hind legs, especially adapted to this environment, are longer than those of other species, and are covered by a web. These webbed feet act as fins, impelling the frog when it is in the water. The scientific name of this family is Pseudidae.

In a third section, we find the families adapted to on-land life. The best known group is that of the true toads. Bufonidae family, whose warty skin confers them a repulsive look. Usually, these toads spend the day hidden under rocks or logs and, in the afternoon, they leave their dens and search for food. In the same environment, although somewhat more aquatic, we find the Leptodactylidae, a family of strong-legged frogs, excellent leapers, very frequent and abundant in the Llanos region.

As we said before, amphibia need humid environments to survive. During the rainy season, water is abundant, and air humidity is close to the saturation level; but, how do these animals manage during the dry season, when everything is arid? The answer is easy: they estivate, that is to say, they stay in suitable dens, in





In the nights of the rainy season, choirs of amphibians sing a constant song in order to attract the female and perform the embrace which will lead to egg-laying and fecundation.

a dormant condition, until the favorable season comes back. While forest frogs look for holes in the trees, savanna frogs stay in the muddy beds of waterholes, under a layer of aquatic vegetation which dries up above them.

With the arrival of the rainy season, savanna seems to revive. The dry earth moistens and, during the night, a crowded choir of males croak, inflating their vocal pouches, in order to attract females. Every species must have a different croak so that the female attracted be of the same species. When male and female find each other, copulation takes place. It is external since they have no copulatory organs. Positioning himself on the female, the male embraces her with his powerful forelegs. This embrace, called amplex, is axillary in some species (when forelegs embrace the breast), and lumbar in other (when the male embraces the heels of the female). As the female lays the eggs, the male spreads sperm on them to produce their fecundation. In some cases, these eggs are covered by foam, forming floating nests;



Reptiles

in other, eggs are laid in nests buried into mud and, finally, tree frogs make their nests using the leaves of the trees.

The innumerable ponds formed by the rain shall shelter little tadpoles once they leave the eggs. Their development is fast: at the beginning, they bear more resemblance with a fish than with a frog, since they lack legs and have a powerful tail for swimming; as they grow, legs appear and the tail gradually reduces until they reach adult shape. By the end of the rainy season, they have completed their metamorphoses and reached adult size; at this stage, they can largely do without water. Estivation comes along with the arrival of a new dry season, thuswise closing the reproductive cycle of amphibians.

While adult frogs feed mainly on insects, somehow contributing to their control, tadpoles are mostly vegetal-matter filters or scrapers. For this purpose, they are endowed with a series of horny little teeth in the inner part of their lips, the radula, which serves them as a scraper.

The reptiles we know nowadays are but a pale image of what they used to be in remote ages: a rich and flourishing community of very different morphologies which included species ranging from marine ones as the Plesiosaurus or the Ichthyosaurus, to terrestrial ones like the huge Brontosaurus, and even flying ones like the Pterodactyl. At present, big saurians are extinct, and only fossil debris remain of them.

If we compare them to amphibians, reptiles mean a step forward in evolution since they have developed a hard, resistant skin, covered with scales or dermic plates, which keeps their bodies from losing water. Their eggs are protected with a hard shell, so they can be laid on the earth. Being cold-blooded animals (lacking internal regulation of body temperature), they do not depend on humid environments; nevertheless, they are largely dependent on external sources of heat, mainly the Sun. For this reason, they are more abundant in warm and temperate regions.

When dealing with the species living in Venezuelan Llanos, we find

two groups: one which prefers to live in water environments, and another which, on the contrary, has chosen terrestrial habitats.

Llanos sidenecks and spectacle caymans, followed by anacondas, are the most abundant aquatic reptiles. Caymans, formerly abundant in Venezuelan rivers, suffered an important decrease in number due to commercial hunting caused by the value of their hides. Nowadays, they are rarely seen. Llanos sidenecks and spectacle caymans usually find their habitats in seasonal ponds or in the calmed waters of bayous, being particularly abundant in Apure Llanos.

Llanos sidenecks are shell-covered reptiles which have kept, basically unchanged, the shape they had when they first appeared on the Earth. These essentially aquatic reptiles, one of the most characteristic species in seasonal ponds and bayous, spend most of the day in the sun, by the river banks. Their varied diet includes a lot of vegetal matter: water-straw, water-hyacinths, and rushes, which they cut with their strong, sharp beaks. They complete



The Anaconda (*Eunectes murinus*) is one of the biggest predators.

Llanos sidenecks (*Podocnemys vogli*) sun themselves on small islands and river banks.



The Cayman (*Crocodylus intermedius*), a species in way of extinction, is one of the few animals capable to break the defensive shell of llanos sidenecks.



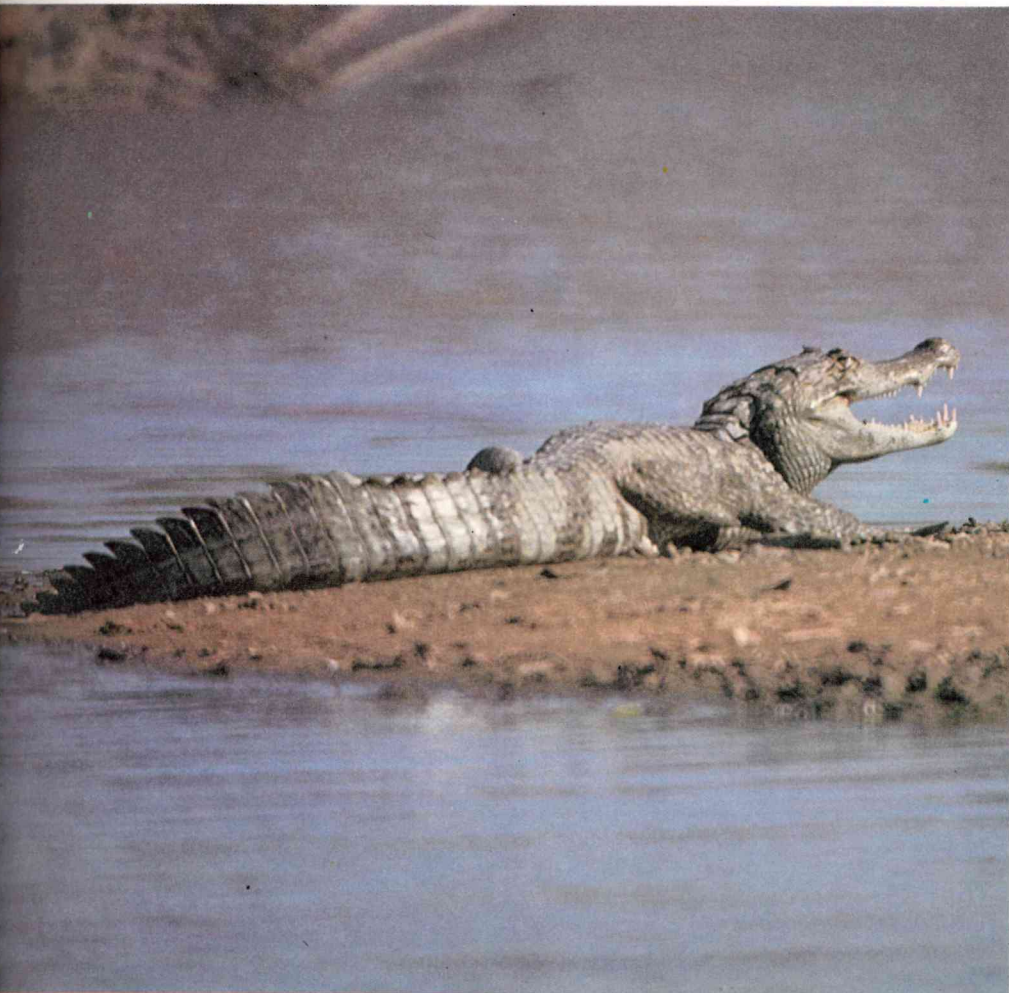
their diet with small animals such as camarons, river crabs and giant snails. Their sexual activity develops during the rainy season, and copula takes place under water; but it is only by the end of the rainy season that the first females leave the water at night in order to fulfil their reproductive function laying the eggs. The egg-laying period starts by the end of November, lasting all summer until the end of February. Each female is capable to perform up to three different layings, with one-month intervals, during this period. The nest is usually placed in the hard slime of seasonal ponds. Nest building starts by opening a hole into the earth which has been previously moistened for such purpose with the water they expel through the cloaca: this is done to soften the earth in order to facilitate the process of digging, something they do using their hind legs. Once the nest is built, the female lays some 10 to 20 elongated eggs, and covers them with a tight layer of mud. When the task is over, she goes back to the water not worrying any longer about the future

of her progeny: the Sun shall brood the eggs. Nests remain in this state until April, when the first rains soften the hard mud, which covers the clutch, and the young come out. If rain lacked, the young would not be able to break with their weak claws the hard wall that separates them from the world outside. Once the young are out, they live in waterholes formed by the rain and, later on, they move to seasonal ponds or bayous.

Eggs, as well as the young, are the victims of a large number of predators. One finds very often open nests where only egg shells have been left; clutches have been eaten by different animals such as foxes, caracaras and great lizards which have caught sight of them or sniffed them out. Men also look for the clutches since llanos sideneck's eggs are delicious when eaten either raw or boiled. When eggs hatch, that is, when birth takes place, the young come out of the nest; but only few of them will reach adult age, as they are subjected to strong predation by egrets and birds of prey. Even spectacle

caymans occasionally eat sidenecks, and it is easy to imagine that some years ago, when caymans were still abundant, many adult llanos sidenecks were eaten by them. Keeping caymans in captivity together with llanos sidenecks, we have observed that these huge reptiles were able of catching and crushing sidenecks with their powerful jaws as if they were walnuts, and easily swallow them. Another natural enemy of llanos sidenecks is the anaconda, which surrounds them with its powerful rings, keeping them under water until they are asphyxiated. After this, the anaconda swallows the sideneck in one piece; its strong gastric juice shall do the rest. Last, there is a sly cat, the impressing jaguar, which hunts llanos sidenecks. It stands on the branches of the trees in the gallery forests, and patiently waits until unaware chelonians come within range, and takes them out of water with a sudden strike. Then, the jaguar devours them, leaving the shell clean.

Llanos sidenecks share habitats with spectacle caymans, which reach a length of 2.70 meters, and which will



become the main aquatic predators when caymans will be extinct. The young of the spectacle cayman are mainly entomophagous, feeding on insects that fall to the water. Their diet changes as they grow and succulent giant snails go into their menu, as well as crabs and fish, especially guabinas and small catfish called "curitos". Big spectacle caymans are even able to attack and capture small capybaras which are away from their mother's watchful eye.

For these species, as well as for llanos sidenecks, the rainy season offers the best opportunities for reproduction. The date for building the nest is, nevertheless, somewhat advanced as compared to the llanos sideneck's. Spectacle caymans choose the height of the rainy season (August) to build their nests. In spite of being very primitive, species belonging to the Crocodylia order are the only ones of all Llanos reptiles in which parents take care of the young.

Courtship begins with the arrival of the rainy season and in August nidification starts. As water level is very high in the savanna during this

Spectacle cayman concentration in the scarce water masses during the dry season.





Spectacle cayman nests in a gallery forest.

month, the female has to choose high places to make the nest: usually herbal banks and "matas". The nest is built with leaves and branches mixed with mud, into which the female lays some 30 elongated and corrugated eggs. Temperature is kept high and constant inside the nest thanks to the heat produced by the putrefaction of humid organic matter. During brooding, the female keeps close to the nest, watching it and showing an aggressive behavior if any intruder gets too close. Egg hatching occurs in November, that is, by the end of the rainy season. When young spectacle caymans are ready to leave the eggs, they make special sounds which the mother understands and so, she starts to dig into the nest in order to help the progeny to come out.

Spectacle cayman's highest death rate occurs, just like for llanos sidenecks, during the first stages of development, that is, when they are young or when they are still in the egg. Skilful great lizards are able to evade the most zealous mother and reach the nest, where

they dig a gallery in the lattice of mud and branches, in order to get the eggs and eat them. Sometimes, certain birds of prey such as Crested Caracaras may become occasional predators of the eggs. After birth, when they are in the water, little spectacle caymans are a choice morsel for Wood-Storks, and egrets. When they migrate it is the fox the one which, using skilful stratagems, tries to keep the mother away from the young in order to capture them easily. Big spectacle caymans are almost safe from predators, with the exception of other big aquatic reptiles, such as the anaconda, which may eat them.

Caymans, the 7-meter long ancient masters of the rivers, have almost disappeared from Venezuelan Llanos, but there are still some places where they can be seen. Unlike the spectacle cayman, caymans prefer water currents and they do not make nests with mud and branches, but burry their eggs in the sandy banks of rivers and bayous.

But, what is the reaction of these eminently aquatic species when their

natural habitats are reduced during the dry season? First of all, when the ponds they live in start to dry, they can migrate considerably far away until they find a bigger pond or bayou having enough water. During this period of the year, it is impressive to see the big concentrations of spectacle caymans and llanos sidenecks in the muddy water ponds and bayous; there are hundreds of them in some places. In extreme conditions, when bayous have no water left, they can burry themselves in the mud until the bad streak has passed or, if there is any "mata" around, they may take profit of the shade of the trees. With the arrival of the rainy season, savannas start to flood, llanos sidenecks and spectacle caymans disperse, and the reproductive mechanisms of the species start to work again.

Something quite alike occurs with terrestrial reptiles: they develop most of their activity during the rainy season, and during the drought most of them stay in their dens estivating.

Among these terrestrial reptiles there is a chelonian, the red-footed

Colourful coral snake of very dangerous bite.
(*Micrurus isozonus*).



tortoise, which is a true walking fortress: not even the jaguar can devour it. This animal lives in “matas” eating the fruits and the leaves that fall to the ground. It lays the eggs in summer when drought is acute, and hides among the roots of the trees or in abandoned dens, waiting for the first downpours.

Dealing now with saurians, guitarero lizards are worth being pointed out because of their flashy colours. They are called “guitar players” because of their habit of moving one of their forelegs as if playing a guitar. Great lizards, which reach one meter in length, are well-known and pursued by peasants; their common name in Spanish, “mato pollero” (chicken-eating-lizard), says something about their tendency to feed, whenever possible, on hen’s eggs and chickens. This predator has a long list of food likes, ranging from small fruits, side-necks’s and spectacle caymans’ eggs, to mice, and other smaller lizards. It is what in ecologic terms is called an opportunist. Iguanas, on the contrary, are vegetarian and feed on leaves provided by the gallery forests





The great lizard (*Tupinambis teguixim*) is an important predator of small vertebrates.

where they usually live. When scared, they may make incredibly high jumps from the tops of the trees to the ground and then run away and plunge into a bayou. In December, busy females are seen digging their nests into the sand of the banks in order to lay their eggs. Just like for llanos sidenecks, it will be in April, with the first rains, when hundreds of young iguanas will flood the savanna, even getting into the houses.

Star-lizards, nocturnal round-eyed saurians, are arboreal and have adapted themselves to live in walls built by man. Their common Spanish name "larga-rabo" (tail-losing lizard) comes from the fact that they easily lose their tail. Thus, when they are attacked, they are able to cast aside the tail which writhes on the ground calling the attention of the predator and leaving them enough time to escape and look for a den.

Ophidians are totally limbless reptiles which move by undulating their bodies in a characteristic way. The rattlesnake and the fer-de-lance, so much feared for their poisonous bite, most of the times lethal, also show

preference for certain environments: while the rattlesnake prefers savanna banks, the fer-de-lance chooses the shadow of the forest.

The rattle or maraca typical of rattlesnakes is made up of a horny material which remains of the successive sloughs the animal has undergone. Thus, as every ring corresponds to a different slough, the eldest rattlesnake is that which has undergone more sloughs and, therefore, the one which has more rings in its rattle.

These species also have a positive aspect worth mentioning: since they mainly feed on mice, they contribute to control rodents, which are pernicious for cultivated fields.

The flashy coloured coral snake, the most poisonous of all ophidia, usually lives within the leaves that cover the ground.

A true legion of inoffensive snakes such as the savanna snake, the house snake, the green snake, and the hunting snake also live in Venezuelan Llanos. Their diet, depending on the species, includes amphibians and mice as the main course.

We fail to mention the beautifully-

skinned boa constrictor, an arboreal species typical of woody environments. Even though it is capable of swallowing a deer, the many stories told by peasants about having found this snake with the antlers of a deer showing in its mouth are probably false. The boa constrictor, as well as the fer-de-lance, are characterized by giving birth to "live" young without laying eggs, since hatching takes place within the mother's body. This process is called ovoviviparism.

With this, we complete a general view of Llanos reptiles and pass to deal with a new group which has been able to conquer the aerial environment: birds.

Birds

Having feathers is the main characteristic of species in this group. Taking a look backwards in evolutionary history during the Jurassic period we find the Archaeopteryx, a bird which shared certain features with reptiles. Its feathers allowed it to fly somehow, but, at the same time, it had the tail and the jaw



Boa constrictor (*Boa constrictor*).

which characterize reptiles. This is the most ancient ancestor of the birds of which fossils are conserved. Further diversification and evolution originated the groups existing nowadays.

The transformation of the forelegs into wings as well as the light frame of hollow bones were the most outstanding adaptations which enabled them to conquer the air. South America is the continent of birds par excellence, and within it, Venezuela holds first place with about 1,300 species.

In Venezuelan Llanos, the huge swamped surfaces South of the Apure river give water species a paradisiac habitat, while big woods North of that river offer more appropriate habitats to forest species.

In accordance with the trends followed in former sections, we shall study birds in function of the habitats they prefer.

Water fowls

Many of the birds that live in Venezuelan Llanos have adapted them-

Wading birds are very abundant in flooded areas.



The Chestnut-bellied Heron (*Agamia agami*), perhaps the strangest wading bird of the Llanos, is also one of the most beautiful.

selves to water habitats, where they find the food and the nidification places they need.

The brightly feathered Neotropic Cormorant is an excellent swimmer which dives into water to get its food, mainly consisting of fish. In summer, these birds are seen forming flocks in the sandy banks of bayous. Then, they make sort of a belt across the bayou and advance while fishing. Llanos' men call this "chinchorrear", which means to fish with a net: fishing seems to be easier and more productive in this way. The long-necked Anhinga also feeds on the fish it catches by using its beak as a harpoon. They are often seen with their wings spread, resting in the sun on the logs that stick out in bayous and in seasonal ponds. These species show a sexual dimorphism in the colour of their plumage: while the feathers that cover the wings of the male are black and white, the head, neck and breast of the female are brown.

Egrets constitute an important group within Llanos' ecosystems. Most of them live in open, swamped





Abundant Cattle Egrets (*Bubulcus ibis*) came from Europe not very long ago.

habitats, even though the Cattle Egret is closely linked to cow and horse herds, and feeds on the insects which these mammals drive away while pasturing. As a curious note, it is worth mentioning that this species is not autochthonous of Venezuela, but came in the 19th century when a storm changed the route of a group of them from Africa to the American continent, where they found an almost empty niche with few competitors. A proof of this is the flourishing population of these birds that can be seen when one goes to the countryside. Two other types of egrets: the Chestnut-bellied Heron of incomparable beauty, and the Cap-ped Heron, belong to forest environments, rather living in small ponds or in seasonal ponds of woody places. All other egrets live in open places.

The immaculately white Common Egret stands out of the green water vegetation. It shows an aggressive behavior when another individual of the same species gets too close to its fishing territory, and pursues the intruder to the limits of the area. The

White-necked Heron, gray and white feathered and capped in black, is more lonesome. Small egrets such as the Snowy Egret and the Little Blue Heron, share the same habitats, although the short length of their legs confines them to areas of smaller depth. The Whistling Heron likes better the banks and the lowlands of not too swampy savannas, while the Rufescent Tiger-Heron tries to live camouflaged within water-hyacinths. All these species occasionally eat certain amphibians and reptiles, in spite of being mainly piscivorous. They practice on-the-watch fishing, that is to say, they stay motionless until an unadvised fish gets within their reach, and then catch it by suddenly strightening the neck and using their strong, sharp beak. Thus, these are species which largely depend on vision for feeding.

There is another group of egrets which are mainly nocturnal since, during the day, they stay in their places of rest and in the evening, when the sun is setting, they go out for food. This group includes the Boat-billed Heron as well as the



Snowy Egret (*Egretta thula*).

Group of Scarlet Ibises.



Next page: above: young of American Wood-Stork (*Mycteria americana*). Right: Boat-billed Heron (*Cochlearius cochlearius*)
Down: Roseate Spoonbill (*Ajaia ajaja*).

Black-crowned and the Yellow-crowned Night Herons. Crustaceans seen to be very important in the diet of these species.

Storks are powerfully-winged strong-beaked birds capable of soaring and gliding at great heights. Contrary to the former group, they are characterized by contact fishing: they trawl in the ponds with their big beaks and, when they touch food, they catch it and eat it. Thuswise, vision does not play such an important role for feeding as it did in egrets. The Jabiru, about 1.5 meters tall, stands out of the group of storks and egrets; its black head and neck as well as the red stripe on the lower part of the neck, and the white tuft on the nape characterize it. Smaller than the Jabiru, the American Wood-Stork, and the Maguary Stork are more abundant; especially the latter which usually fishes in crowded groups.

Ibises and Roseate Spoonbills constitute a different family with its own characteristics. All ibises have a long, fine, curved beak. Invertebrates are the main component of their diet.

Ibises generally use their beaks by way of a pincer, introducing them into water or in muddy places and obtaining their food by contact fishing. The Roseate Spoonbill is often seen with its beak under water, moving its head from one side to the other in a constant swinging. Groups of Scarlet Ibises stand in contrast with the green vegetation or the blue water. Black-feathered Whispering Ibises are also very gregarious, and are always found in flocks. The Sharp-tailed Ibis, on the contrary, usually makes small groups. In dryer places we find the Buff-necked Ibis with its characteristic way of singing. Last, the Green Ibis prefers forest environments, and feeds in seasonal ponds close by "matas".

These long-legged birds must also fit the seasonal changes which take place in Venezuelan Llanos (rain-drought). Being able to fly, these changes affect birds less than amphibians or reptiles: birds can travel a long distance searching for favorable places to feed and nidify.

One of the most spectacular phenomena in Venezuelan Llanos takes

place during the rainy season: the concentration of aningas, egrets, ibises and storks which choose the same place for reproduction. In Venezuela, these concentrations are called "garceros". The rainy season involves two different advantages for these birds: abundant food (fish, amphibians and insects), and safe places for reproduction, in particular flooded places the access to which becomes very difficult for terrestrial predators as the opossum, ocelote and the fox, which are the most dangerous for the community.

Generally speaking, these concentration places are located in the gallery forests of bayous in the Apure state, and in the bushes of seasonal ponds in Portuguesa and Barinas states. In such places, a different distribution of space for nidification can be observed depending on the species. This distribution seems to be in function of the size and aggressiveness of the birds: the biggest and the most aggressive ones take the best places. In another booklet, published in Spanish under the title *Los Garceros de los Llanos*, we set up a differ-



entiation between two nidifying associations within the concentrations taking place in Apure: one of the groups was made up of Yellow-Crowned Night Herons and Whispering Ibis, occasionally joined by Little-Blue Herons, Cattle Egrets and Boat-billed Herons; the other one was made up of Common Egrets, White-necked Herons, Anhingas and Neotropic Cormorants, sometimes joined by Roseate Spoonbills, Maguari Storks and Boat-billed Herons. The nests of the first group are hidden within the branches of the forest trees, while those of the second group are quite visible. Whitenecked Herons, Anhingas and Storks do not nidify in Portuguesa and Barinas states; in return, other species such as the Chestnut-bellied Heron and the Scarlet Ibis are very abundant there.

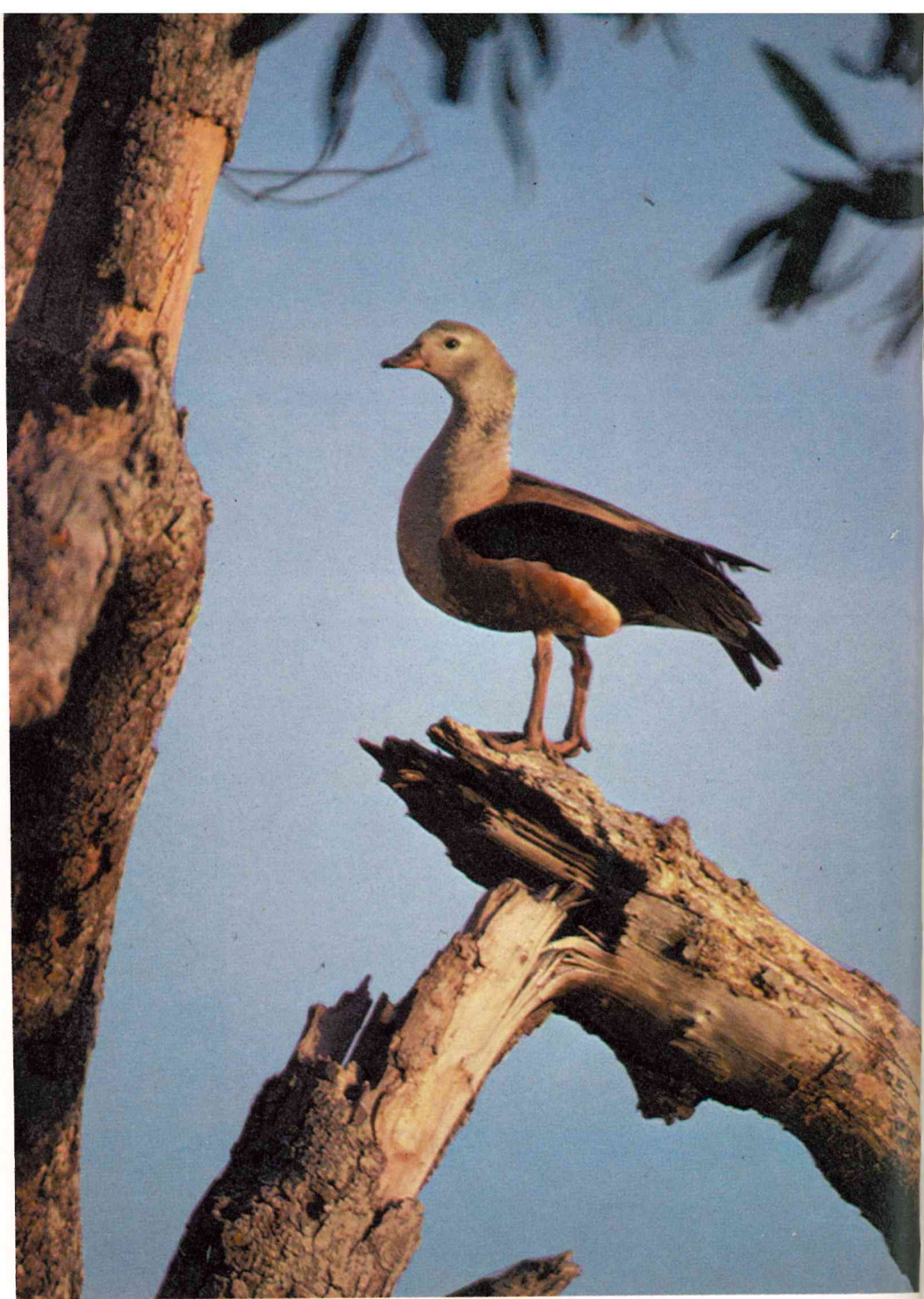
Turning away of general tendencies, the American Wood Stork is the last bird to nidify, starting by the time when other species have almost finished their reproductive process (November-December); the care of the young lasts until summer.

Finally, some species such as the

Orinoco Goose (*Neochen jubata*).
Other page, left: Wattled Jacana (*Jacana
jacana*) on water vegetation. Right:
Black Skimmer (*Rynchops niger*)
with one of its young.

Whistling Heron, the Rufescent Tiger-Heron and the Jabiru, prefer lonely places to nidify. Buff-necked Ibises usually choose palms to make their nests on; sometimes they meet in groups to nidify in the same tree. When the rainy season comes to an end, the progressive desiccation of ponds and bayous forces the fish to crowd certain areas, and in summer, groups of egrets and storks can be seen polishing off the fish which drought has condemned to die.

Ducks, perfectly adapted for swimming thanks to their webbed feet, divide Llanos' environments among themselves: Black-bellied and White-faced Whistling Ducks, Brazilian Ducks and Orinoco Geese live in open areas, while Comb Ducks and Muscovy Ducks prefer forests close by the water. These species have flat bills by means of which they get their food, basically consisting of seeds and water-plant bulbs. Egg laying takes place during the rainy season. Some ducks, such as the White-faced Whistling Duck, build their nests on the ground while others, like the Black-bellied Whistling Duck and the





Muskovy Duck, build them into the holes of the trees.

These species undergo a very interesting process: while in most birds the molt occurs gradually, ducks lose all their feathers at the same time. Thus, there is a period during which the cannot fly because of the lack of feathers. Llanos' men know very well the time of the year when this happens (November-December) and take advantage of it to capture them. Naked ducks have nothing to do but to escape either swimming or diving.

Some ducks have come to be feared plagues in Portuguesa and Guárico rice plantations. For this reason, hunting licenses are granted in order to control ducks population in areas where rice is grown.

Taking profit of the vegetation that floats on the ponds, we find the Purple Gallinule and the Wattled Jacana. These long-fingered and delicate birds can walk on the layers of floating vegetation as if they were on the ground. The Wattled Jacana lays the eggs on a floating platform made with water plants. The newborn young are already able to escape

swimming in case of danger, and to hide among the plants while one of the parents, who pretends to be wounded, tries to keep the predator away from them. The Purple Gallinule is shyer and usually hides among the rushes. By interlacing these rushes, it builds a nest above the water.

In Venezuela, the Black Skimmer is called "picotijera" (pico-beak; tijera = scissors) since the way how it looks for food is by crossing the water with the beak open like scissors and submerging only the lower part of it. During the day, it is commonly seen resting by the bayous. Most of its activity is developed during the evening, when it flies in search of food. This species starts its reproductive process by the beginning of the summer when islands of different sizes appear due to desiccation. Hundreds of these birds meet in flocks and go to the islands to lay their eggs in small holes opened for such purpose. Both, eggs and young, are mimetic and camouflage themselves within the environment to avoid predation as much as possible.

Before the islands be connected to the inlands, due to the progressive desiccation of savannas, the young must be able to fly; otherwise, foxes or other terrestrial predators would find a way to get to the islands and massacre the young.

Kingfishers examine the water from their watching places until a silver reflection reveals the presence of a fish. Then, they suddenly soar and, placing themselves above it, they remain motionless for some seconds, hovering in the sky. Once the position of the fish is accurately fixed, they dive like deadly darts. If they succeed, they shall go back to their vantage points with a delicious prey in their beaks. All species in this family are piscivorous, except for a very small one which, becoming insectivorous, has adapted itself to live in forests. These birds choose the slopes along the bayous to build their nests. These nests consist of a long tunnel with a wide cavity at the end to shelter the eggs. Their nidification time coincides with the ebb of waters since, during this period, the withdrawal of water in bayous leaves ap-

Left: Great Kiskadee (*Pitangus sulphuratus*) by the water. Right: Aplomado Falcon (*Falco femoralis*) in the savanna.

Ruddy Ground Dove (*Columbina talpacoti*) brooding in its nest.



appropriate places for them to nidify. The young, well protected inside their holes, develop very slowly, and feathers take a long time to grow.

The turkey-sized Horned Screamer has a characteristic horny appendix on its forehead. In Venezuela, their onomatopoeic name is "arauco". They are the typical inhabitants of swamp-ed savannas where they feed on the plants they cut with the beak.

Some small insectivorous birds, like the Yellow-throated Spinetail, the Piet Water-Tyrant and the White-headed Marsh Tyrant, nidify in aquatic environments. The Yellow-throated Spinetail builds its tunnel-shaped nest with thorny branches of poppy, by the shore of small ponds and bayous. The other two, on the contrary, build soft and delicate bag-shaped nests with a lateral entrance, on the stems that grow in seasonal ponds. Nests are made of straw and spider's cocoons. Their reproductive process takes place during the rainy season, when food is more abundant.

Certain birds of prey become the masters of the area placing their hunting fields there. The Osprey is



an expert in catching fishes which it distinguishes from the air thanks to its sharp eyesight. To catch them, it plunges feet first into water and remains submerged for an instant. It has a long, featherless tarsus which reduces friction to a minimum so as to enter the water the "smooth way". It is also endowed with long, bent talons to pierce the victim.

Another species, the Snail Kite, flies over the seasonal ponds and is often seen standing on fence posts. As far as food is concerned, it is very much specialized, basically feeding on giant snails. Due to this specialization, it has developed excessively long talons and beak which allows it to manipulate and empty these huge snails.

Savanna Birds

Savannas, extensive open plains covered with grass, show a relatively simple ecosystem as compared to other areas. Places abounding in straw, sometimes scattered with bushes or trees, serve as a frame for bird communities. Most of the birds

which search for food in the savanna, shelter in forests, savanna-specific species being very few.

The abundant production of seeds allows many flocks of grain-eating birds to feed there: bobwhites, doves and other.

When something surprises them, bobwhites fly and hide among vegetation. These funny birds, with their rhythmic way of walking and their small feathered tuft, feed on the seeds of savanna plants. When the rainy season comes, they build their nests on the ground by straw clusters, where they lay many white eggs.

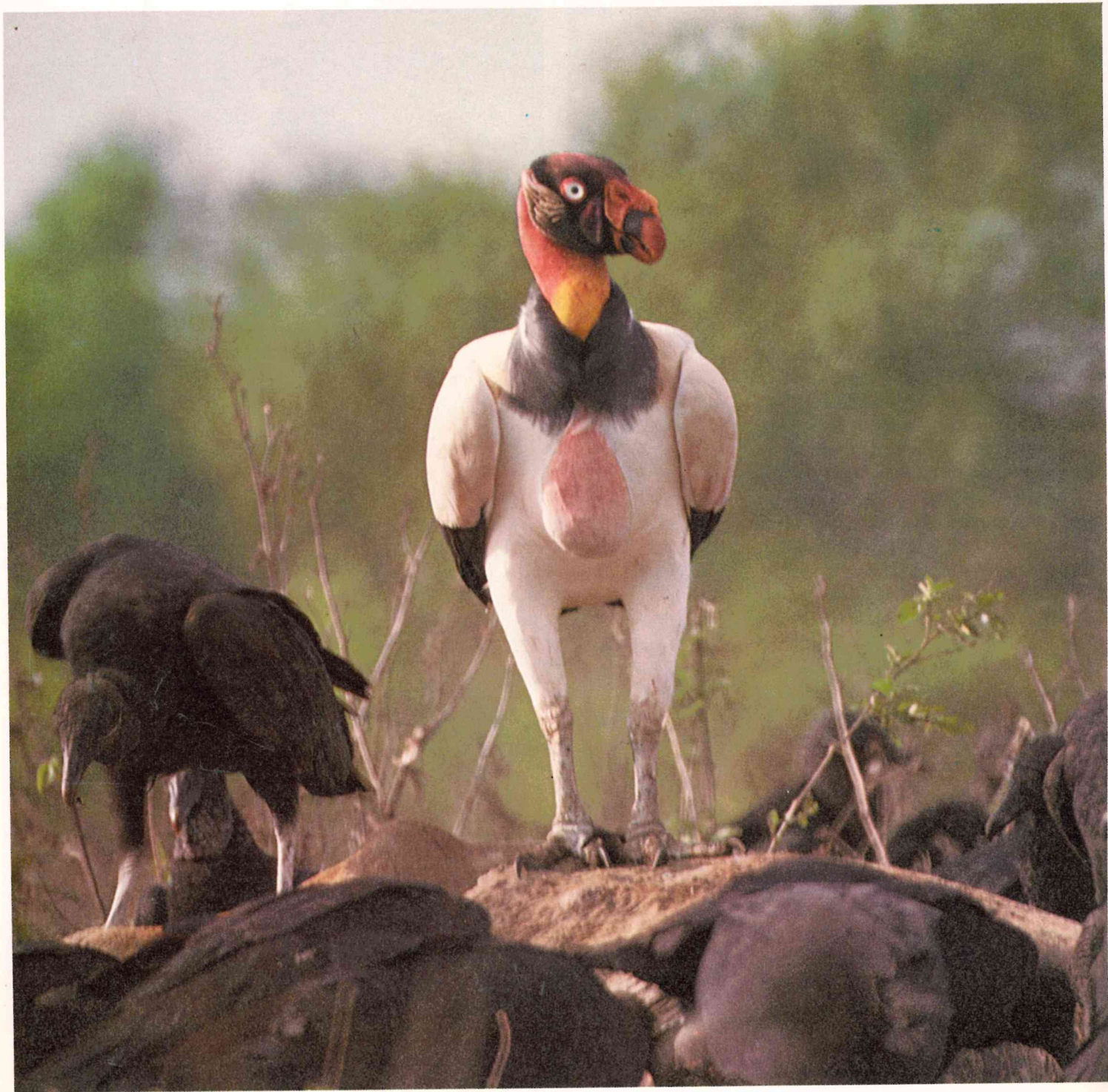
Doves, excellent in flight, reproduce all year long. There are also the muddy-coloured Scaled Dove and the reddish Rudy Ground-Dove, which build their nests in the trees or bushes. A bit bigger than the two former, the Eared Dove rather nidifies on the ground. These species mainly feed on grain and seeds. Great flocks of conical — and hard-beaked birds cross the savanna as well; their strong beaks serve them to break the husk of grains.

But not only grain-feeding birds

live in the savanna; some insectivorous species have their homes there. The Double-striped Thick Knee crosses the fields either in couples or forming small groups. They do not care much about nest-building: they just put two or three branches together and lay the eggs there. They trust their mimetic colour which confounds them with the background, thus camouflaging them. Other small birds build their nests on the ground, hiding them among the weeds. Examples of this are the Yellowish-Pipit and the Red-breasted Blackbird, whose breast contrasts strongly with the black dorsal plumage.

During the night, one can hear the song of the Pauriques which have been hidden all day long. These birds have a relatively short and thin beak; but when they open it, one can see it is enormous since they hunt in flight, sweeping the air for insects.

The Great Kiskadee, the Vermillion Flycatcher and other similar species commonly called flycatchers, use the borders of "matas" to shelter and to build their nests. They feed on insects caught in flight in the savanna. Last,



King Vulture (*Sarcoramphus papa*)
and Black Vultures (*Coragyps*
atratus) standing on a dead animal.



Burrowing Owl (*Speotyto cunicularia*).

there is a parasitic species, the Shiny Cowbird, which takes advantage of the nests built by other species to lay its eggs into them, thus getting rid of the boring task of taking care and feeding the young.

Many birds of prey live in the savanna, since open places with wide visibility grant them optimal conditions for hunting. The almost general rule for this species is a certain opportunism when choosing the prey. Very few of these birds specialize in a type of food. Among the ones which do specialize, there are two falcons: the American Kestrel or Sparrow Hawk, which mainly feeds on insects; and the Aplomado Falcon, a little bigger than the former, whose diet basically consists of small prey such as little birds.

A series of hawks, like the Savanna—, the White-tailed, the Black-collared and the Great Black Hawks, are common in the savanna, where they find their food. Their varied diet ranges from small insects to vertebrates.

The Crested Caracara is a typically opportunistic bird, which does not

waste any food. During the period when llanos sidenecks are laying eggs, the caracara can be seen tracking down the ground in search of clutches. It also likes crabs, frogs and small lizards, but it does not turn its nose up at dead fish or carrion, very abundant in these places during summer.

The Black Vulture is typically necrophagous. Forming big groups, they go around the savanna looking for dead bodies to slake their hunger. It is worth mentioning the sanitary function these birds fulfil by cleaning the carrion from the areas where they live. Although fewer in number, the red bold-headed Turkey Vultures are also carrion-eaters.

Reproduction in these birds takes place during the dry season, when places abounding in straw are dry and prey are easier to discover, thus granting food for the young. Another advantage of summer is the absence of storms and strong winds, which would jeopardize the nests. By the end of the rainy season, vultures are the first birds to nidify, laying the eggs in the holes of the trees. Except



Savanna Hawk (*Heterospizias meridionalis*).

Hoatzin (*Ophisthocomus hoazin*)
in a gallery forest.

for the American Kestrel, which very often lays the eggs in the holes of wooden posts, birds of prey make their nests with small branches, in the tops of the trees. In the evening, little Burrowing Owls, that live in burrows that belonged to armadillos, get ready to go hunting. Insects and frogs seem to be their favorite menu. After night-fall, the Barn Owl is on the watch of mice, which pullulate in the savanna when darkness comes.

Forest birds

The forest, with its different arboreal levels and its tangle of lianas, shelters a varied and rich fauna. Being more complex, forest ecosystem encompasses many different niches and, therefore, many different birds.

Starting by the birds which live on the ground, we find the shy Gray-necked Wood-Rail, difficult to distinguish among the forest thickets, but easy to detect by its characteristic song. The Sunbittern likes to walk along the banks of the bayous and ponds protected by the trees. At first



sight, it looks somehow flashy, but when it spreads the wings, the fan of harmoniously arranged colors leaves an impression which is difficult to forget. In August, it builds its nest on the branches of the trees using mud covered by leaves. The pink eggs are laid in it. When the adult bird is not there, the nest can be passed by without being seen, as it looks like the juncture of a broken branch. Once the brooding period is over, the young are born showing black spots on the head and, sometimes, stripes of the same colour along the neck. During the first days, they remain in their nests, totally motionless. Only when they are surprised, they stand, spreading their small wings and performing sort of a dance in which the head and the legs do not move, while the body swings from one side to the other. At the same time, they chatter their beaks and hiss. When they are ready to make their first flights around the nest, the effort leaves them exhausted and defenseless before their enemies. If they are attacked, the only thing they can do is to perform an

even more ostentatious dance than the above described: spreading their wings and tail, they change their shape and look bigger; meanwhile, they swing their heads and necks and emit frightening sounds, very much as a snake's, in defensive attitude. And, what can a fox, an opossum, or any other predator do but to hesitate and remain motionless for some minutes when it sees a snake where there should be a bird? These are precious minutes for the Sunbittern, which takes advantage of the situation to escape and reach a safe place.

On the branches of the forest trees, we find friendly chachalacas, whose stentorian voices denounce them in spite of the distance. They move in groups across the forest and can sometimes descent to the ground in order to feed or to get rid of dust by taking a bath. Their vegetarian diet consists of leaves, fruits and seeds of the forest. Hoatzins, as noisy as chachalacas, prefer to shelter in the gallery forests that grow by bayous. Being vegetarian, they mainly feed on leaves. Nidification starts with the arrival of the rainy season. Eggs are

laid into a rustic nest. Hatching occurs after brooding, and the little birds which are born are covered with a thin black down. After four or five days they show two small nails in the wings which serve them for climbing the branches of the trees in order to reach a safe place, away from their enemies. If this is not enough, they still have a last resource: they let themselves fall and submerge into the water which is usually under the nest. This would be suicide for any other young bird lacking feathers; but here, this bird surprises us again: from the very moment when the little birds touch the water, they are capable of swimming and diving perfectly, using their small wings as if they were oars. Thus, they approach the branches which are in touch with the water and climb them with their small wing-nails until they find a place better than the one they have abandoned. When they are five or six weeks old, they reach adult shape and their plumage is almost complete. At this age, feathers floatability keeps them from diving and they have to content

themselves with swimming whenever necessary.

Woodpeckers use logs, not only for searching food, consisting of the insects that live in the bark, but also to build their nests, which they carve with their strong beaks.

Forests also provide many fruits to feed frugivorous birds. This group includes the magnificently coloured Scarlet Macaw, as well as parrots and parrotlets. All of them have powerful hooked bills to open fruits with. Toucans, frugivorous birds of disproportionately big bills, also live in the llanos, in spite of being more abundant in Bolívar and Amazonas forests. Other small birds, like the Blue-gray and the Silver-beaked Tanagers, feed on fruits as well.

Flowers are visited and sucked by hummingbirds, which perform true feats of acrobatics in their zigzagging flights. They are the smallest of all birds; their characteristic way of flying, with a constant humming of the wings, involves a high metabolism, thus requiring lots of food, to the point that, when resting during the night, some of them fall into a state

of lethargy to save energy. These birds build small, delicate nests on the forks of the trees and bushes.

The Troupial is the national bird of Venezuela. Beautifully coloured in black and orange, they sing a tuneful song. They are a bit lazy and, instead of building nests, they prefer to wait until another bird has left its own, in order to use it to lay their eggs.

Colonies of Yellow-rumped Caciques are easy to see in this areas, since their bag-shaped nests hang ostentatiously from the trees. It would be a hard task to mention and, even more, to describe, all of the small singing birds which live in the forest. Wiretailed Manakins, Barred Antshrikes and Thrushes are only some of them.

Among birds of prey, we find many hawks: the Gray Hawk, which hunts mice, snakes and insects; the Bicolored Hawk, an expert in hunting small birds, which it follows across the thickets, surprising them with its fast and graceful flight; and the Laughing Hawk, a specialized reptile-catcher. Bigger than the former, the Ornate Hawk-Eagle hunts big birds and

mammals. On the top of the trophic pyramid, we find the biggest of all necrophagous birds in the Llanos: the King Vulture with its coloured head.

During the night, the Great Horned Owl watches and waits for prey, while potoos catch all the insects that fall into their huge mouths and sing a mournful song.

Mammals

Mammals are mainly characterized by having hair covering their bodies, and milk-secreting glands to feed their offspring during the first stages of development. These animals were the last to appear on the face of the Earth, originating from a reptile ancestor 200 million years ago. The first mammals were small in size and usually insectivorous. This group developed to originate the mammals we know nowadays, which can be either insectivorous, herbivorous, carnivorous or omnivorous. An important characteristic in mammals is the diversification and specialization of teeth according to feeding habits. At present, we can find them in all en-

The biggest owl in the Llanos:
the Great Horned Owl (*Bubo
virginianus*). Photograph by
Karl Weidmann.

vironments, especially in terrestrial ones, where they exercise their supremacy. Like in birds, their body temperature is kept high and constant, a feature which makes them more independent from environmental conditions.

In Venezuelan Llanos some species have returned to water, where they develop. Such is the case of the manatee and the amazon dolphin. Also aquatic but less dependant on this environment is the giant otter. Manatees and giant otters are almost extinct in Venezuela. Hunting has caused an alarming decrease in the number of them. In the case of the manatee, its flesh and fat have awoken human cupidity, and the same has happened with the fine and shiny skin of the giant otter.

Amazon dolphins are still abundant. They have a spindle-shaped body, and their limbs have developed into fins. Living in the rivers, and bayous, they basically feed on fish. The fact that their eyes are small is not unexpected since vision is not very important in the cloudy waters where they live. This disadvantage is com-

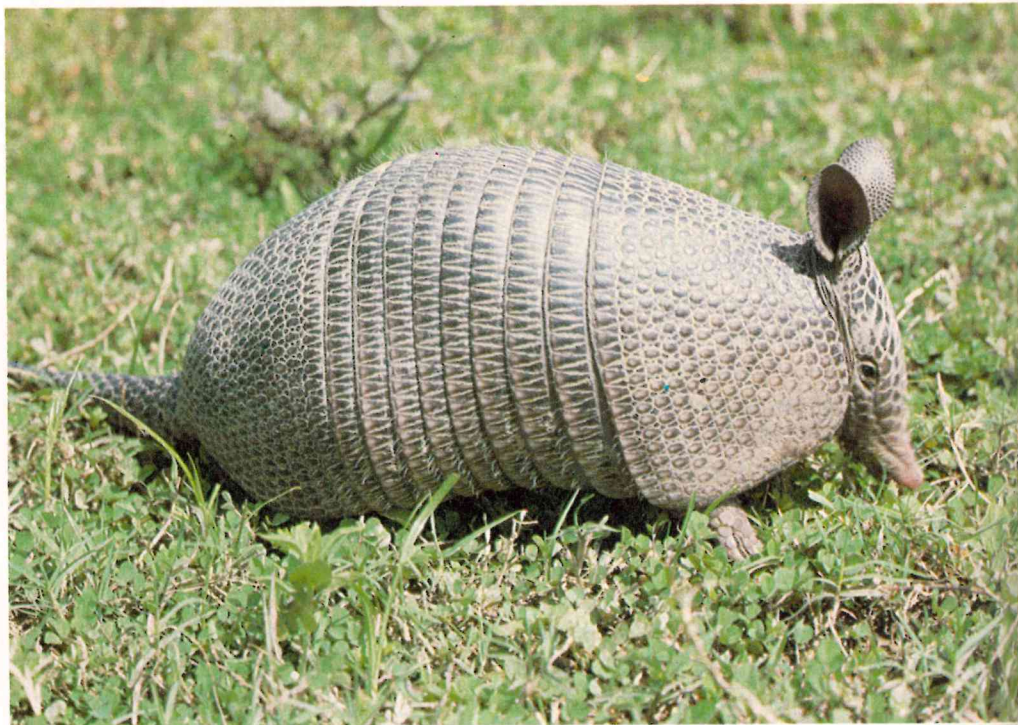


Above: Capybara (*Hydrochaeris hydrochaeris*) resting in a small swamp. Down: Savanna armadillo (*Dasypus sabanicola*) an endemic species of the Venezuelan Llanos.

pensated by their echo-ranging capacity.

Fatter than the former, manatees have also fin-shaped limbs. Seemingly, they live among water-hyacinths, feeding only on vegetal matter, thus contributing to clean the bayous. Last, the giant otter feeds on aquatic prey such as fish, crustaceans and molluscs. Its palmate feet helps it to swim.

Living in savanna banks, we find the armadillo, protected with an armor-like bony shell. This species shelters in dens which the animal digs very fast with its strong claws. Once inside the den, it is almost impossible to draw it out since, pressing its feet against the ground and curving its back, it literally embeds itself into the hole. Whenever we have tried to draw it out by pulling its tail, our efforts have been useless. Llanos'men say that in order to capture an armadillo it is necessary to be in front of the animal and not behind it; otherwise, it will run away at once. The logic explanation of this is that armadillo's eyes are so much laterally oriented that their field of vision is





Great Anteater (*Myrmecophaga tridactyla*).

wider backwards than forwards; thus, if a sly predator tries to hunt an armadillo while it is eating approaching it from behind, it will be detected at once, faster than if it had made a face-to-face attack. This strange animal is also very peculiar in what concerns to reproduction: they give birth to four identical young, as all of them come from the same fecundated ovule. This phenomenon is called poliembryogeny. In spite of living in holes, they build straw nests for their young. These nests are often seen by the beginning of the rainy season (April). Though most of their activity is developed early in the morning or in the evening, they are often seen during the day when it is cloudy.

Strongly linked to savanna water masses, we find the popular capybara: the biggest rodent in the world. Being herbivorous, it looks for food — mainly consisting of gramineous plants — in swamps or in seasonal ponds. They usually live in herds, which disperse during the rainy season, when seasonal ponds are abundant, and concentrate again dur-

ing the dry season in those places where there is water left. They can reproduce at any time of the year, but, by the end of the rainy season and the beginning of the dry one (September-December), the number of births attains the top rate. They show sexual dimorphism: adult males have a very conspicuous gland on the muzzle, which they rub against the bushes to mark their territory. As far as predators are concerned, the newborn young are often eaten by caracaras. The main predators of adult capybaras are big cats (scarce nowadays) and wild dogs. Capybaras are commercially exploited in Venezuela. Hunting starts before Easter: llanos men, riding on their horses, force the herd to meet so that other men, provided with sticks, can wipe them out with accurate blows. Their salted meat is very appreciated and, according to the use, it is eaten during Easter.

Belonging to the same family as the capybara, although much smaller than it, we find small rodents, such as rats and mice, whose habits are mainly nocturnal. Among them, the

rice rat is unfortunately well known. Being aquatic, rice fields constitute the perfect habitat for it to feed and make its nest, with disastrous results.

Sleeping in "matas" and feeding in savannas we have the great anteater. While resting, it covers itself with its thick tail, which camouflages it among the bushes. Being very specialized as far as food is concerned, its diet basically consists of ants and termites which it catches with its sticky tongue, taking advantage of night to wander through the savanna in search of termite nests. It is a difficult prey even for the jaguar: when it feels hounded, it stands on its hind legs and opens its arms, endowed with powerful claws, adopting the attitude of a wrestler. If the jaguar keeps trying to catch it, they fight and hurt each other with the claws. Llanos' men say that there is no winner in such fights, since both of them die in each other's arms.

The silhouette of white-tailed deers pasturing in the savanna is characteristic in Venezuelan Llanos. They mainly feed on gramineous plants, but shoots and leaves play also a very

Left: One of the most characteristic carnivores: the jaguarondi (*Felis yagouaroundi*). Right: paca (*Agouti paca*).

important role in their diet, particularly in summer, when pasture is too dry. Just like the capybara, it reproduces at any time of the year, even though there is a breeding period from February to April during which many males exhibit their antlers. Male's antlers do not last all year long; their cycle being closely linked to the reproductive one, antlers are shed at the end of the breeding period. After seven months of gestation, a number of spotted little deers can be seen following their mothers.

These autochthonous species live together with other herbivores such as cows, horses and asses, which have been introduced by man. It is interesting to know that, in the course of evolution, an ancestor of the horse appeared in South America, but, for an unknown reason, it is extinct. After having been re-introduced by colonizers, many horses became wild, and nowadays it is possible to see many herds of these wild horses. They live in groups consisting of a stallion (the leader of the herd), its females, and their young colts. When male colts grow up, they are rejected by the

White-tailed deers (*Odocoileus virginianus*) in the dry season.





stallion; thus, they have to leave the herd and form their own.

Two predators abound in the savanna: the fox and the jaguarondi. The fox is an opportunist which eats fruits as well as small prey: mammals, amphibians, reptiles, birds and insects. They are nocturnal animals which cross the savanna in couples or in family groups. Seemingly, they use urine marking to keep the cohesion of the group when they go hunting. The jaguarondi hunts during the day, and feeds on small prey, particularly birds.

In dealing with forest habitats, we will start by mentioning the mammals which live on the ground. The rabbit, of nocturnal habits, often lives in "matas" or in gallery forests. It feeds on vegetal matter which it cuts with its sharp incisors.

Within the group of herbivores, but basically feeding on the fruits that fall to the ground, we find the agouti, developing most of its activity during the day; the paca, with nocturnal habits; and the peccary, which usually lives in herds. The tapir as well, feeds on fruits, but it

can also eat grass and leaves. With the exception of the peccary, which is very prolific, these species have only one young at the time; nevertheless, knowledge about their reproductive processes is very scarce.

Another herbivore which lives in the "matas" is the bracket deer. It is smaller than the white-tailed deer, and much shyer, thus being very difficult to see.

The mountain armadillo, bigger than the one that lives in the savanna, feeds on invertebrates and shows the same phenomenon of polyembryony. It is called the "nine-banded armadillo" because of the nine stripes it shows between the scapula and the pelvic girdle. Maybe a small number of giant armadillos still live in Ticoporo and Caparo forests.

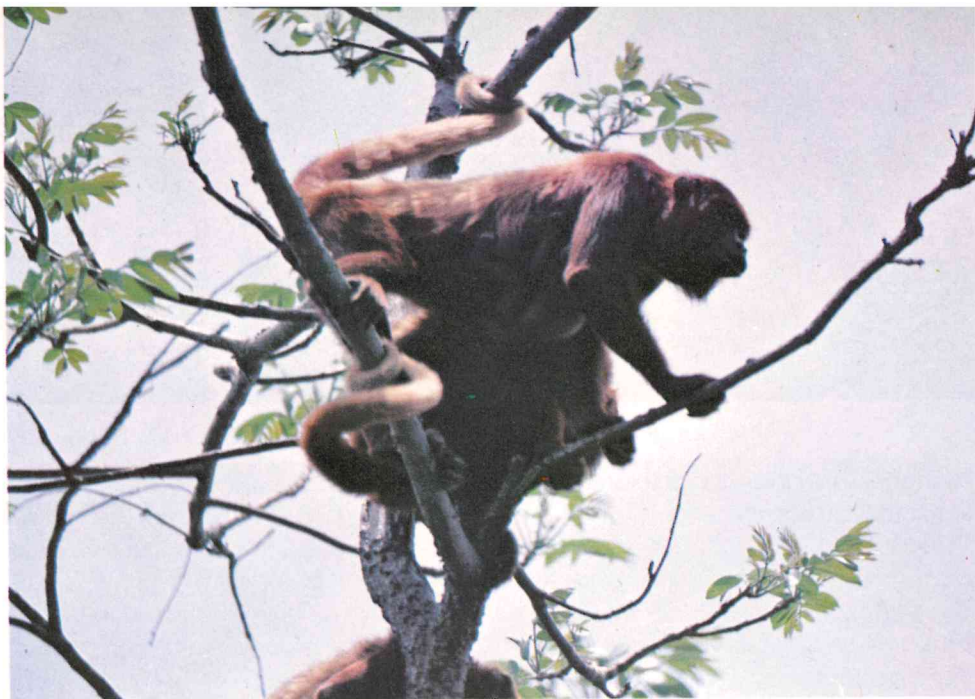
The skunk feeds on invertebrates. Its capacity to expel a liquid of sickening smell that comes from two glands located on the basis of its tail is very well known. The only time when we found one, we were standing by the door of its den, built in a red-ant nest. Thinking that the mother was not there, we took out

of the nest two young skunks which had not open their eyes already. Suddenly, and awful smell flooded the air, while a small head showed through the hole. We retired ourselves a prudential distance, but, as the mother was coming out of the den, we decided to put her children where we had found them.

Other animals have chosen the arboreal covering to live in. The raccoon only goes down to the ground in order to get its food, consisting of fish and crabs; but as far as shelter is concerned, it prefers the trees. The thick-tailed squirrel jumps and climbs the branches of the trees with great skill, and only goes down to the ground in very few occasions. The nest it builds on the branches of the trees to protect its young is made of leaves.

Other species have developed prehensile tails which serve as a fifth limb helping the animal to move through the forest. The opossum is one of them. Its tail has no hair: this is the origin of its Spanish name "rabipelado" (rabo = tail; pelado = hairless). Being a marsu-

Family of howlers (*Alouatta seniculus*).



pial, it has a ventral bag to carry the new-born. They live stuck to the mother's nipple until they reach complete development.

The unmistakable porcupine, bristly in quills, and the tamandua also have prehensile tails and live on the trees.

Apes, the true acrobats of the forest, are represented in Venezuelan Llanos by different species. Living in groups, they have developed the most complex behavior of all animals. Very common in the area, the red-skinned araguato, also called howling monkey, can be heard several kilometers away, especially at daybreak and at dusk. The gray capuchin monkey is more lively and clever than the araguato. And last, we have the spider monkey with its disproportion-

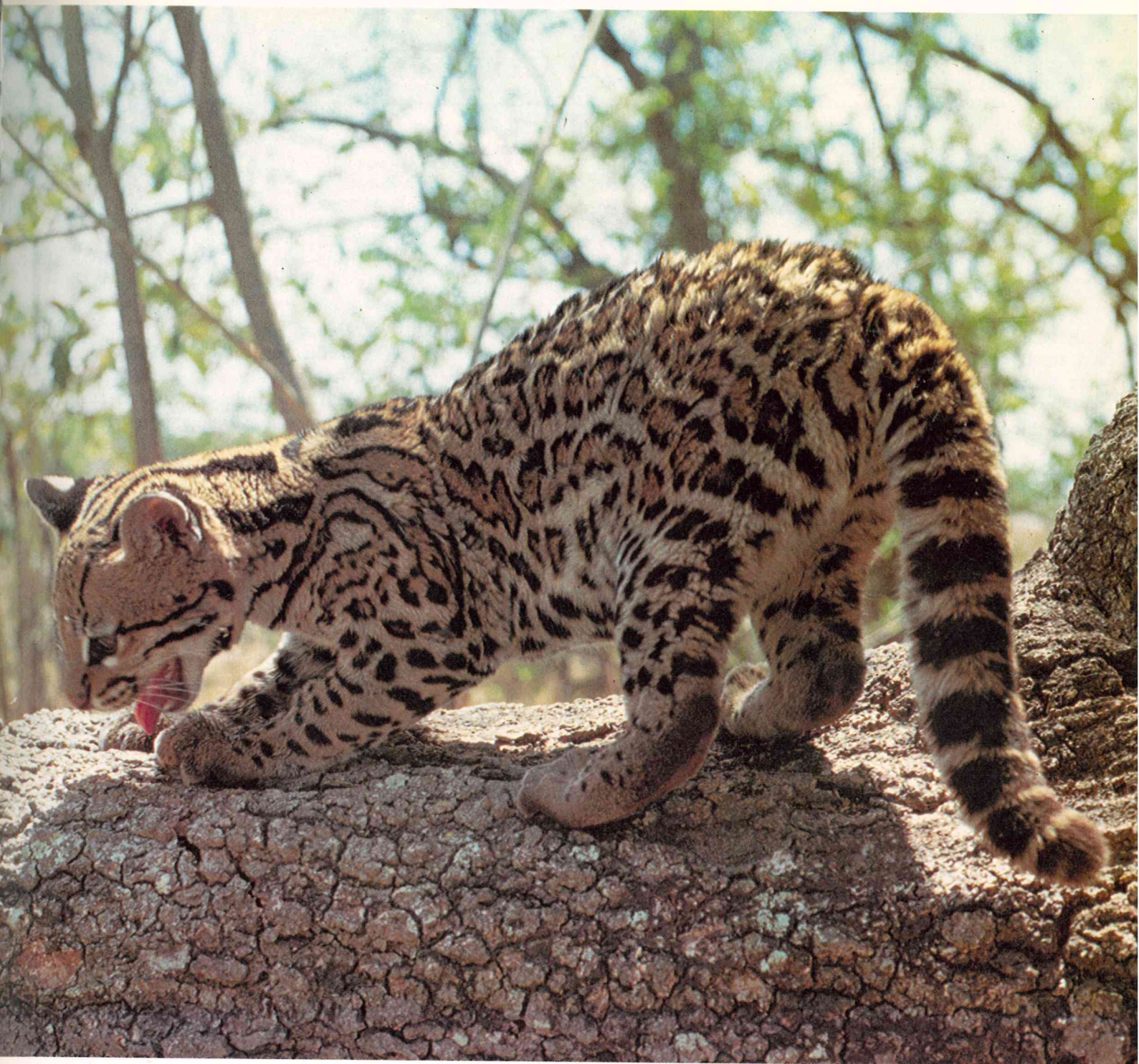
ately long limbs.

There are other predators such as the jaguar and the ocelot, whose habits are mainly nocturnal. The prey they hunt is in function of their size: jaguars attack big prey, including tapirs, while ocelots choose small vertebrates. All these hunters are endowed with powerful claws and fangs, which they use to tear their prey.

We have left for this final section the only mammals which have conquered the air: bats. Their wings are formed by a thin membrane called patagium, which unites the limbs and the body.

Being nocturnal, they have few competitors: only the Pauraque and nocturnal birds of prey. Their diet is quite diversified, and may be based on fruits, nectar — pollen

arthropods, terrestrial vertebrates, fish or blood. Depending on the type of food, there are different groups with different hunting techniques. There are insectivorous bats which catch their prey in flight. When they live in forests, their flight is slow, because of the many obstacles they have to evade; when they live in open areas, their flight is fast. Other bats catch their prey on the ground or in the trees; piscivorous ones cut through the water with their long feet, while hematophagous ones are specialized in what concerns to food, and have very sharp teeth to tear flesh, and lick the blood that flows from the wound. They adjust their reproductive cycles to the period when food is more abundant according to the specific diet of each group.



Ocelot (*Felis pardalis*).

III-FOOD CHAINS

It is well known that big animals eat small ones, and this is the best way to explain the food chains.

If we consider that living beings, as machines, are able to carry out various functions, ranging from blood or sap pumping to locomotion, logically, we may think that, in some way, they must obtain the necessary energy for their functioning. In fact, this is one of the most relevant events of life on the Earth: all living beings' activities make use, directly or indirectly, of the solar energy. The speed of a deer, the mouth press of a cayman, or the slight movements that man makes while writing make use of solar energy transformed into chemical energy, and accumulate it in different parts of the body as fat and glycogene molecules.

This process starts with vegetables, which, through a complex chemical process called photosynthesis, build organic molecules carrying the energy obtained from solar photons. This represents the beginning of the chain.

This is the way in which certain animals, that feed on vegetal matter, obtain transformed solar energy. Part

of this energy is used for their own functioning, and the rest is accumulated in the tissues. When these animals are eaten by predators, part of this solar energy taken by plants is absorbed by new organisms. The chain continues with the superpredators and carrion animals. The flesh decomposition made by microorganisms is the last step, after which molecules return to their primitive stage. Other vegetables will combine them using solar energy, and turn them into carriers of vital energy. In this way, energy goes back to food chains.

In Figure 3, we show a general view of the Llanos' food chains, dividing them into the three main habitats: forests, savannas, and aquatic environments.

With regard to the kind of vegetal matter which fauna may find, there are profound differences among the three environments. On the one hand, forests provide a great variety of fruits as well as leaves and flowers, while the savanna, on the other hand, offers basically gramineae (straw and

grain). The aquatic environment presents vegetal nourishment in the rushes, aquatic gramineae and waterhyacinths (bulbs and leaves). These differences of vegetal nourishment condition the fauna in such a way, that fruit-eating species, as well as nectar-suckers and leave-eaters find their food in the forests, and herbivorous species manage in the other two environments.

In a higher link of the chain we find animals which feed on invertebrates. Insects play an outstanding role, among invertebrates, in the three environments. As for the aquatic environment, annelids (earthworms), crustaceans (specifically, crayfishes and camarons), and molluscs (giant snails and clams) are of special importance.

Going into the branch of predators — or animals which include small and medium-sized vertebrates in their diet — we also find differences. Fish and amphibians constitute an important food line in the aquatic environment, and reptiles, birds, and mice in the terrestrial medium.

Some few Llanos' species can be

<i>King Vulture</i>	<i>Black Vulture/Turkey Vulture</i>		NECROPHAGOUS
<i>Jaguar</i>	<i>Lion</i>	<i>Orinoco Cayman</i>	SUPERPREDATORS
<i>Boa constrictor</i> <i>Laughing Hawk</i> <i>Gray and forest falcons</i> <i>Ornate Hawk Eagle</i> <i>Great Horned Owl</i> <i>Ocelot</i>	<i>Snake</i> <i>Great Lizard</i> <i>Aplomado Falcon</i> <i>White-tailed Hawk</i> <i>Savanna Hawk</i> <i>Great Black Hawk</i> <i>Caracara</i> <i>Owl</i>	<i>Spectacle Cayman</i> <i>Kingfisher</i> <i>Anaconda</i> <i>Osprey</i> <i>Egrets</i> <i>Amazon dolphin</i> <i>Giant otter</i> <i>Storks</i> <i>Cormorants</i> <i>Black Skimmer</i>	PREDATORS
↑ <i>Opossum</i> <i>Raccoon</i> ↓ <i>Gray-necked Wood Rail</i> <i>Sunbittern</i> <i>Woodpeckers</i> <i>Birds</i> <i>Potoos</i> <i>Mountain Armadillo</i> <i>Skunk</i> <i>Tamandua</i>	↑ <i>Burrowing Owl</i> ↓ <i>Lizards</i> <i>Birds</i> <i>Swifts</i> <i>Cattle Egret</i> <i>Double-striped thick knee</i> <i>Pauraque</i> <i>Armadillo</i> <i>Great Anteater</i>	↑ <i>Roseate Spoonbill</i> ↓ <i>Amphibians</i> <i>Scarlet Ibis</i> <i>Snail Kite</i> <i>Ibis</i>	VEGETAL MATTER - EATERS
<i>Red-footed tortoise</i> <i>Iguana</i> <i>Chachalaca</i> <i>Hoatzin</i> <i>Macaw</i> <i>Toucan</i> <i>Curassow</i> <i>Yellow-knobbed curassow</i> <i>Hummingbird</i> <i>Tapir</i> <i>Parrot</i> <i>Rabbit</i> <i>Paca</i> <i>Peccary</i> <i>Agouti</i> <i>Bracket Deer</i> <i>Squirrel</i> <i>Porcupine</i> <i>Monkey</i>	<i>Bobwhite</i> <i>Dove</i> <i>Grass-eating birds</i> <i>Rodents</i>	<i>Llanos</i> <i>Sideneck</i> <i>Ducks</i> <i>Horned Screamer</i> <i>Manatee</i>	INVERTEBRATE - EATERS

◀ Deer ▶

◀ Capybara ▶



FIGURE 3

considered as superpredators — that is to say — animals which feed on big prey, and practically have no natural enemies, except man. The jaguar in the forest, the puma in the savanna, and the cayman in the water are kings of their environments.

Finally, at the end of the chain, there appear the necrophagous, carrion-eating animals such as Black Vultures, Turkey Vultures, and King Vultures in addition to other occasional predators. This is the case of spectacle caymans, llanos side-necks, some egrets, and Crested Caracaras which, in dry summer ponds, can catch dead or dying fish.

Some species show very wide nourishment preferences which range from fruit and small vertebrates to insects and carrion. The fox, the great lizard, and the Crested Caracara are some of these species. These animals are called “opportunists”, since they know how to take advantage of any kind of food easy to reach, without being very selective.

Fer-de-lance (*Bothrops* sp.), a very dangerous snake which lives in Llanos forests.



IV-ENVIRONMENT AND LOCOMOTION

The genetic endowment of an individual is expressed, among other aspects, in its anatomical-physiological phenotype, and also in its behavior, giving it a certain degree of adaptation to a determined environment. The individuals that integrate the population of a species bear very similar genomes, although with certain differences (with the exception of very particular cases), that result in different adaptative degrees in the face of Natural Selection.

Natural Selection acts, therefore, on genetic combinations, rejecting some and perpetuating others, in consecutive replications. In the same way, mutations or spontaneous changes in the genetic material must also go through the selection process that favors with replication and progeny changes which are advantageous, and eliminates those reflecting disadvantageous situations. Thus, we have as a result a species that, superficially and without going into greater detail, can be defined as a group of individuals that may exchange genes, forming new mixed combinations capable of producing

new individuals, and an environment that selects such genes through the carriers, setting an evolutionary direction.

The outstanding role that environment plays in evolution is evident, for, as mentioned before, individuals that present greater adaptative achievements shall be selected positively, and their genes shall be kept by duplication and interchange, whereas the less advantageous shall be, in some way, eliminated.

But not all environments are alike. For example, in the Western Llanos region alone, we have: distinct forest habitats; non-flooding savanna areas; large swamps; seasonal ponds subjected to consecutive periods of puddling-drought; and perennial masses of water such as rivers, ponds, and bayous.

In all, to habit these environments requires different kinds of adaptation, and thus, to exploit a source of nourishment such as the vegetable one that grows so well in both aquatic and terrestrial media, appear mammals adapted to the aquatic medium such as the manatee; the capybara,

of intermediate adaptation; and others completely adapted to the terrestrial medium such as the white-tailed deer.

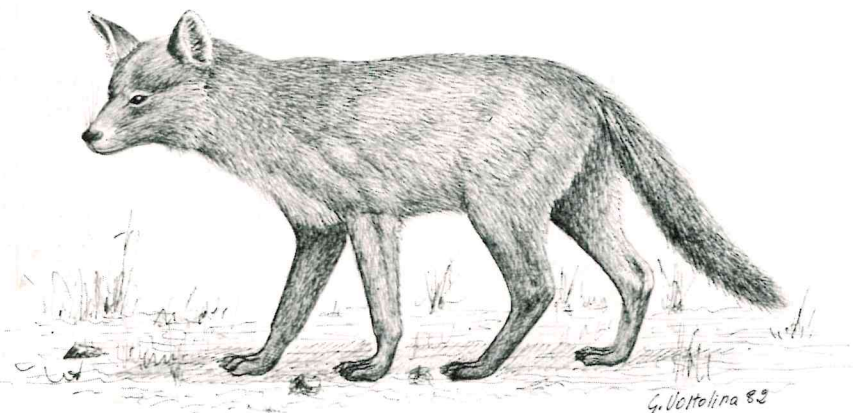
Environment selects many structures that are unquestionably determinant, such as those for locomotion, and a group of characteristics that will serve a wide range of purposes, such as defense against predators, or selection of concrete periods within the annual cycle to carry out determined processes.

The aim of this chapter is to point out the locomotive adaptations that Llanos' fauna exhibit. Adaptations were acquired outside the Llanos, and species, once having the aptitudes for the different environments, colonized these young quaternary lands, which, before, were part of a large inland sea. This is the reason why there are only few Llanos-endemic terrestrial vertebrates.

Perhaps one of the most valuable aspects of this work is that it frames adaptations within the Llanos region and then relates them to a national fauna.

This work does not only imply

FIGURE 4



Locomotion in the terrestrial medium. Greater relative length of the limbs and smaller support surface are the characteristics of the most rapid animals. This morphology-velocity relation is shown in the comparison among the White-tailed deer, the fox and the opossum.

giving the public biological knowledge deeper and less classical than simple descriptions, but also evolutionary concepts, and aspects regarding morphological variety and its function, together with details about diversity.

Mobility is one of the most remarkable characteristics of the vertebrates, and it demands a good locomotive system according to the requirements of the habitat they live in. However, neither adaptations to locomotion are limited to the morphology of the motor limbs, nor its nerve coordination to movement. Adaptations to locomotion are also present in other kinds of corporal formations. So, for example, medium-sized and slow mammals, easy prey for the most common predators, may show differentiated dermic structures, such as the scales or spines of the armadillo and the porcupine, minimizing in this way the problem of their low velocity. In order to make clear which are the special morphological adaptations acquired for one or the other purpose, we have built three schematic

Tamandua (*Tamandua tetradactyla*), animal adapted to the arboreal environment.



archetypes that correspond to a terrestrial, an aquatic, and an air vertebrate, respectively, and which will be used as a reference of adaptations to each environment.

Velocity and slowness of the Llanos mammals

As a terrestrial archetype we propose an elongated animal with: head and trunk from which four motor limbs derive; each limb with five fingers provided with nails; a more-or-less long tail; and, in general, well-formed bones.

Adaptations in the limbs related to velocity have been shown in the length of the legs, and in foot position. As a general rule, we can say that the more rapid a mammal is, the longer are its limbs, and smaller is the surface of them that touches the ground. Let us see three Llanos examples where this relation can be observed: the opossum; the fox; and the white-tailed deer. The opossum uses the soles of its feet (fingers and tarsus) to walk; it is a plantigrade with very short limbs in relation to

its body. The fox touches only the points of its digits to the ground, being therefore a digitigrade; the tarsus size is part of the total size of the limb and not part of its support. The white-tailed deer is the one with the longest limbs in relation to its body. It has a cloven hoof on each leg that is the modified nails of the fingers. Therefore, the length of the fingers should be added to the length of the tarsus to obtain the total size of the limbs. In order to minimize the contact surface of all ungulates, and specifically of the white-tailed deer, the other three fingers have been reduced.

Among the medium-sized vulnerable mammals, two examples have been pointed out, the armadillo and the porcupine, that, unlike the rabbit, present a slow pace. In these cases other structures appear which allow them to survive from predation: dermic scales and spines. It would be interesting to analyze the armadillo's structure since its morphology is unique in the Llanos and it is the consequence of the habitat where it lives. This peculiar animal

is the result of a double adaptation, that is to say, adaptation to two different environments, for it is a subterranean animal that usually goes out to the surface searching for food. Subterranean life demands very concrete morphotypes, such as tube-shaped bodies, and very strong and short limbs to virtually drag its body; the limbs expand and contract within the burrows as required. If these locomotor characteristics of the armadillo are to be selected, it would be difficult for it to develop a high velocity on the surface, and therefore it needs another defense tool — the armor plate.

Adaptations to arboreal life

In the Venezuelan Llanos we can find a fair number of animals belonging to different taxonomic groups that present prehensile tails. These differences in the taxonomic categories, as in the primates (the capuchin and the howler), edentates (the tamandua), various rodents (the porcupine among others), and some marsupials (the opossum and the

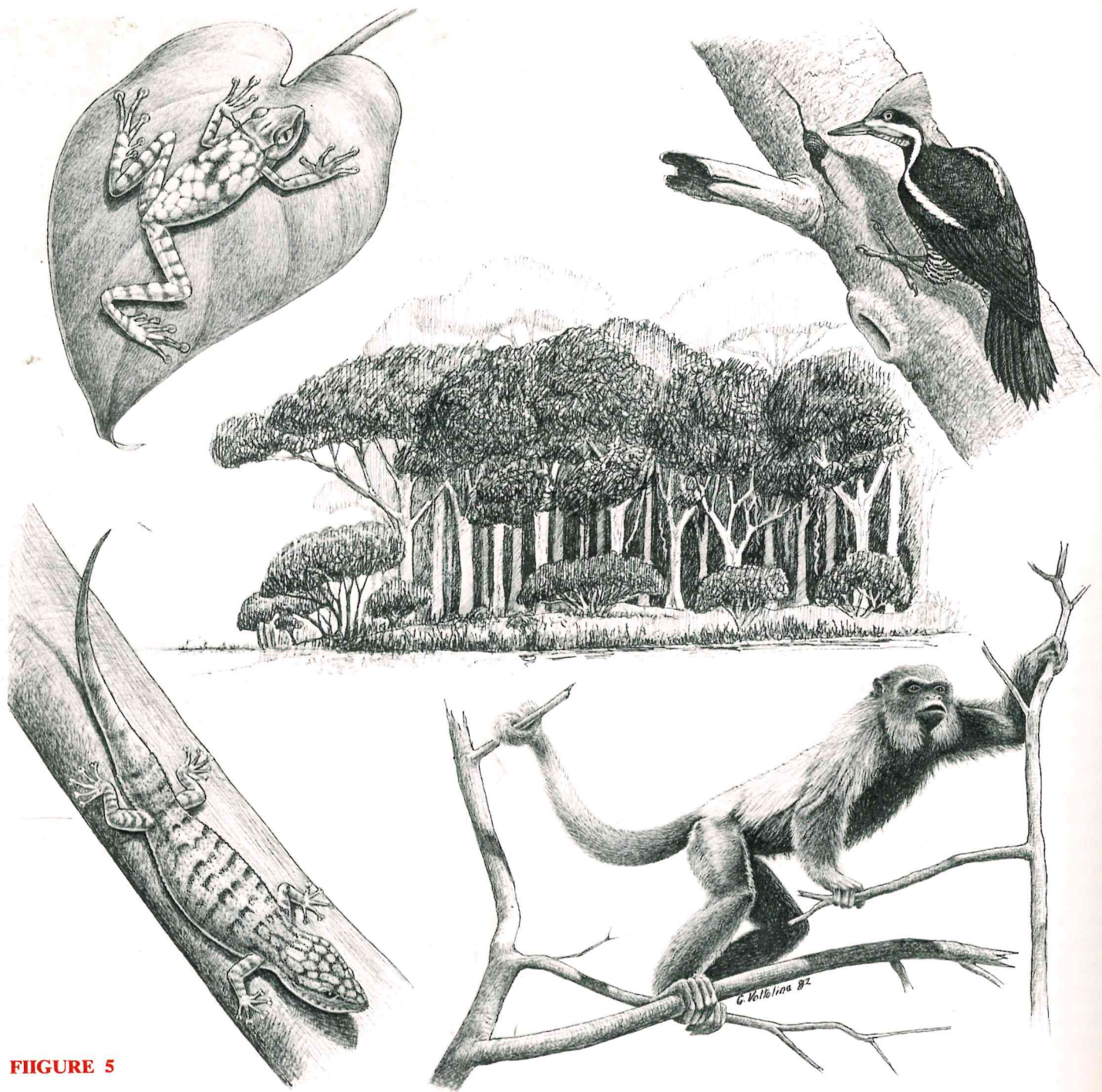


FIGURE 5

Adaptations to arboreal life can be seen in some details such as limbs with opposable great toe, prehensile tails, well-developed nails, adhesive disks, setae in the finger-tips, etc. The drawing shows llanos species with these characteristics.

weasel), indicate that this is not a character inherited from their common ancestors, but that adaptation was achieved by each group independently to obtain an end pursued by all of them — the arboreal environment. This process is known in biology as “convergent adaptation.”

However, arboreal life in the Llanos also presents other important adaptations that we will now see. If adhesion to branches and stems has produced a group of animals with prehensile tails, then the limbs must also attain this goal. The arboreal primates and marsupials mentioned before have an opposable great toe, that is to say that four fingers contract in opposite direction to the fifth, providing an articulate nipper for grasping. In the case of the tamandua, its very long nails play a very similar role. Anatomic well-adapted nails can be used for climbing, as in the case of squirrels, and some birds (the Wood-pecker, or the Hoatzin).

One should pay special attention to the Hoatzin, in as much as it presents nails in the modified fore-

limbs during youth. This bird nests on the flooded trees of gallery forests. Nestlings dive into water when they feel any danger and then climb with the help of the wing-nails through the branches to get to the nest. Later on, with the development of feathers and independence from the nest, this bird loses the nails, possibly because they no longer have a practical function and they might become a hindrance to movement. The Wood-Peckers and climbers (Piciformes) not only present robust legs provided with four opposable fingers, 2 to 2, and nails that allow adhesion to stems, but they also use their tail as support, putting it downwards to the stem; in this way it is easy for them to climb vertical trees with surprising ability, resting at any height.

Another remarkable adaptation to arboreal life is the attainment of adherent structures in the limbs. Arboreal frogs have acquired some disk-like surfaces located on the finger tips. These surfaces present glands having a sticky secretion, that are also present in the ventral part and give the frogs a wide adherent sur-

face to glue themselves to leaves, branches, and trees.

The bat Thyropteridae family is another case where there appears a true sucker on the wings at the level of the knuckles, and it is used to adhere to leaves while resting; certain glands keep the sucker moist to establish an hermetic seal. Perhaps the most singular case of adhesion is shown in the star-lizards which have some scales or lamellae on the feet with thousands of microscopic setae, that at the same time enclose thousands of hair-like setae ending in saucer-like endplates that adhere to any irregularities of the surface. This system permits dry adhesion even to vertical glass.

Return to aquatic medium and its adaptations

Evolution of amphibians, reptiles, birds and mammals started with the Crosopterygian fish. The conquest of these fishes was very big since it displaced vertebrates from the aquatic medium, and led in this way to the exploitation of the terrestrial me-

Interdigital webs as an adaptation to aquatic environment have been acquired independently by many terrestrial vertebrates of different groups. In the Llanos alone, we have numerous examples such as the Giant otter (mammal), the White-faced Whistling Duck (bird), the Spectacle Cayman (reptile) and a frog (amphibian).

dium. However, the aquatic medium with its wide possibilities of nourishment and displacement was once again invaded by some reptiles such as the sea snake, birds like the penguin, and mammals, namely the whale. These neocolonizers that we will call "returnants" evolved from terrestrial morphology and obtained again and independently adaptations fit for swimming.

In the Venezuelan Western Llanos, subjected to long flooding periods, there emerged a plentiful variety of examples, that, seen as a group, provoke admiration and excite curiosity. Locomotion in the fish, perhaps the best archetype of an aquatic vertebrate, is carried out in two ways: limbs are moved roughly forward-backwards and shortened almost without any friction.

This mechanism works like an oar. In other aquatic vertebrates locomotion is achieved through body-oscillating movements that propel it forward. As will be seen, these kinds of displacements are present in Llanos' vertebrates that returned to aquatic life. There are some other types pos-

sibly less fitting such as the long legs of the egret, which also are very useful for other purposes.

Perhaps among the group of returning species that inhabit the Llanos, such as the manatee, and the amazon dolphin, the more extreme aquatic adaptations appear. Both of these mammals from different orders are so highly adapted to the aquatic medium that they have lost the possibility of living in the terrestrial one. This is shown in their anatomy, which is so similar to that of the fish that they even have been misidentified. Their bodies are virtually hairless, and their locomotor limbs have been transformed into fins. They inhabit great rivers, usually, the bayous.

There are also adaptations to the aquatic life among the Llanos' reptiles, that, although remarkable, are not so extreme as the ones mentioned earlier.

Two crocodile species inhabit the Western Llanos: the cayman and the spectacle cayman. Crocodiles have nose and eyes located on the upper part of the head, being the first things that appear when they raise

their heads out of the water, allowing breathing and vision when almost all the body is submerged. The nose is formed by two holes provided with a muscular sphincter that closes the holes when the animal submerges. The upper position of the eyes acts as a submarine periscope. Locomotion is also adapted with both systems already described in fish, namely: the hind limbs provided with long digits covered by an interdigital web able to function like an oar; and a long tail with strong muscles and flattened sides that allows continuous movement in the water through oscillations. Crocodiles resemble a submarine that is also capable of moving in a terrestrial medium.

This represents a great achievement of natural technology in the face of an environment with strongly-marked floodings and seasonal droughts which only permits aquatic animals three responses to the lack of water: death, as in the case of many fish; estivation or lethargy periods burrying themselves into mud which keeps a certain grade of vital humidity; or migration to other



FIGURE 6

places with water. Crocodiles respond principally to the third choice, although they can also burrow into mud, or wait for the rain at the mercy of a near forest with some freshness and protection against sunbeams.

But crocodiles are not the only aquatic reptiles. Among chelonians there are some species that also present characteristics very similar to those of the crocodiles. This is the case of the Llanos sideneck, which usually lives in water and can travel on the ground. Like small and medium-sized mammals, slow and in short vulnerable, they are protected against many dangers by an armor plate.

Another singular aquatic chelonian, known as the Scorpion-mud turtle, has an articulate ventral armor to reduce the holes from which head, legs and tail come out. Logically, chelonians do not use undulating movements as locomotor mean, but only their paddle-like limbs which act as oars.

*Interdigital webs:
an easy adaptation with great results*

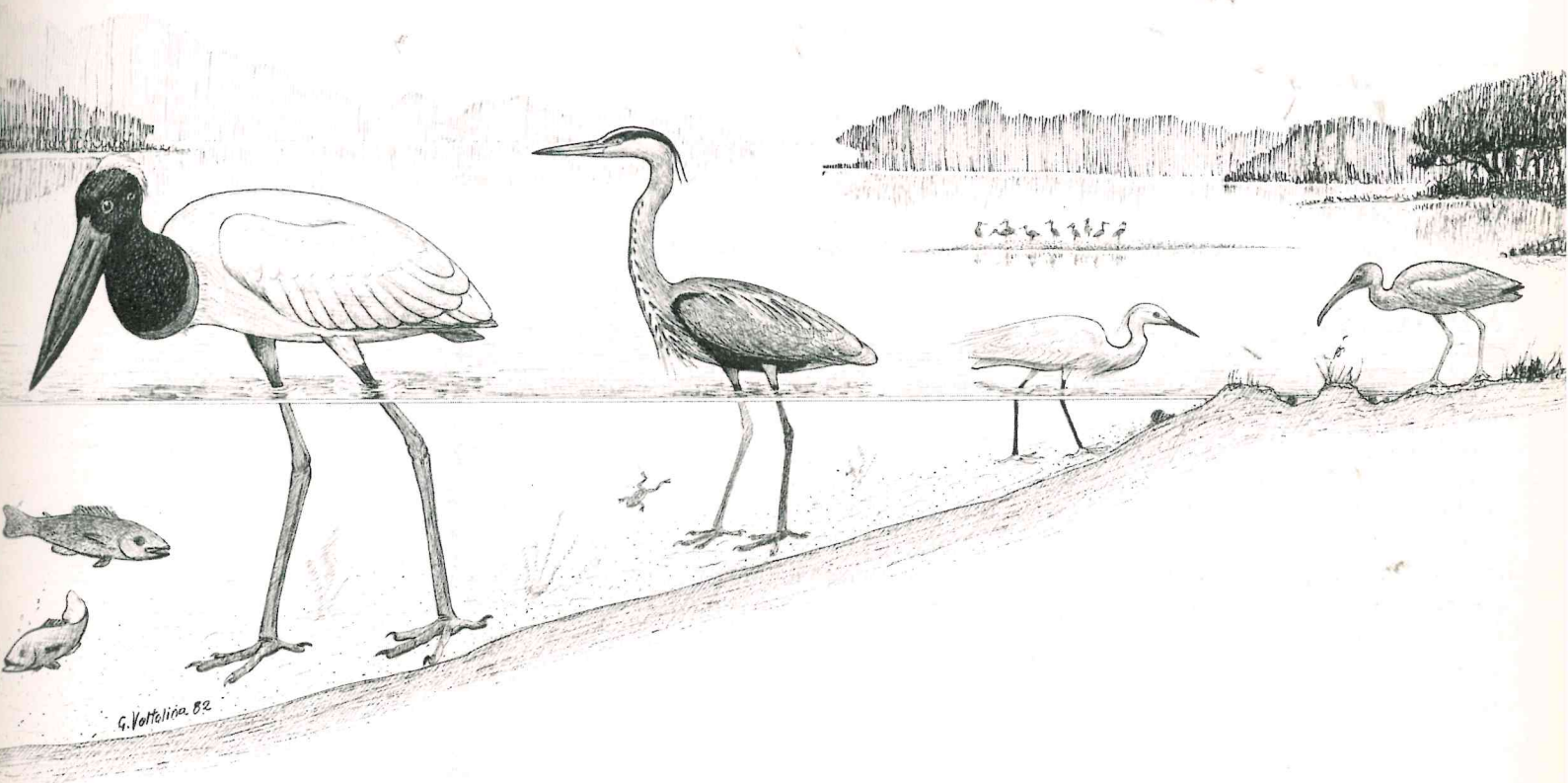
Analyzing the foregoing part, we can observe the transition from: species with limbs transformed into fins (oars) and undulating movements (amazon dolphin, and manatee), to species bearing feet provided with interdigital webs and undulating movements (crocodiles) that can therefore travel on a terrestrial medium, and finally to some aquatic chelonians that move in the water with oar-like limbs. The use of paddle-like hands or feet or both for swimming is the easiest system that can be acquired since it does not demand any special transformation of the nervous system for specific movements. For example, the undulating movement of the body could affect negatively terrestrial or aerial functioning. Furthermore, this system only needs a wide surface to act on, and it is obtained by the simple evolution of the finger skin towards an interdigital web. The majority of frogs and toads provide a good example to observe this functionality. These animals, after a completely aquatic larval stage with locomotion through oscillating movements of the

tail, lose their caudal limb as their legs develop in order to be able to travel in a terrestrial medium. The hind limbs, usually provided with interdigital webs, act as oars. In this case, the function of the limbs, moving as well on the ground as in the water, is the same, for which reason the nervous system does not require a highly-sophisticated transformation.

Just as we have found only a few species that, returning to the aquatic medium, use body-oscillating movements for displacement, so a wide majority of them show only interdigital webs. By this means, each group by itself and independently achieved the same end; for example, carnivores, such as the giant otter; rodents, such as capybaras; anatidae like ducks; different reptiles, such as crocodiles and chelonians; and, of course, frogs and toads. All of them present paddle-like feet or, in other words, interdigital webs. They use the aquatic environment without renouncing others like the terrestrial and aerial ones.

Only small morphological changes

FIGURE 7



The different length of the limbs in the Llanos wading birds confines species to a certain water depth. Since water depth is related to different types of aquatic fauna, egrets show a great variety of beak morphologies and hunting systems.

that confer great abilities can help to achieve this goal, and the human being, inventor of mechanisms which enable him to move in a foreign medium, learned quickly how useful a flipper can be when swimming about. Was this invention a result of human imagination, or just mere observation? (Figure 6)

Wading birds and aquatic medium

There is a Spanish expression which says "swimming without getting one's clothes wet", and it is applied to people that try to get something without risking certain things essential for that purpose.

The best example of this phrase is offered by the wading birds, whose long-necked tarsus allow them to exploit, without getting wet, the resources of the aquatic medium that sometimes are found at certain depth.

These birds, which at first sight may let us place them among the Ciconiiformes (order which includes ibises, egrets, Black-crowned Night Herons, storks, and Wood-Ibises) are far greater in number and are locat-

ed also among other orders with aquatic habits, such as the Gruiformes (Limkin), Anseriformes (Horned Screamer), and Charadriiformes (Wattled Jacana and Piet Water-Tyrant), among other Llanos' birds.

Wading birds show a tarsus size consonant with the depth of the waters where they inhabit, which determines their particular kinds of nourishment.

This fact can be well observed in the case of the Ciconiiformes which will be used as example (Figure 7).

The kind of nourishment varies with the water depth. Thus, in flooded seasonal ponds abound earthworms, little crustaceous, and tadpoles that are hunted by ibises with very long-curved beaks which, stirring into the mud like a nipper, search for these little animals.

In deeper waters there appear frogs and little fish which constitute the main diet of little egrets with long-pointed beaks which are moved rapidly by neck movements. The same adaptation is found in large-sized egrets, such as the Great Egret and the White-necked Heron that

feed from larger fish living in deeper waters. Finally, storks and Wood-Ibises are the largest birds showing the longest beaks.

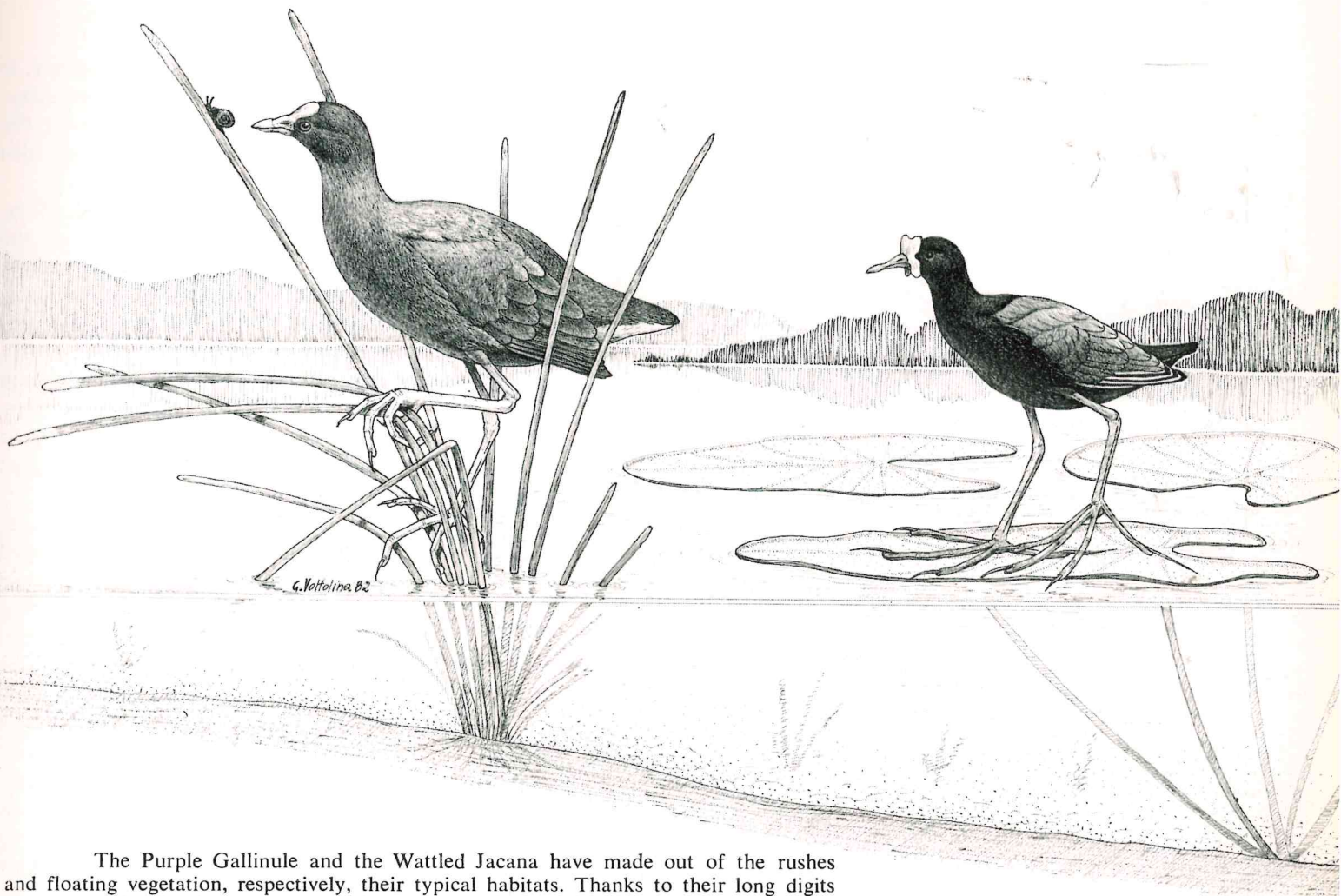
Many aspects have varied in unison, ranging from shorter limbs and beaks able to search for little animals in puddled places, to very long legs and big prey that inhabit deeper waters. Nevertheless, these long-legged birds have their main representative in the Jabiru, whose height reaches 1.30 meters.

Fish, which live in waters deeper than 0.50 m approximately, cannot be reached by wading birds, but by diving species, such as the cormorants and otters, or the amazon dolphin, which is the most sophisticated adaptation of a predator to the Llanos' aquatic environment.

Fingers and nails in the aquatic environment

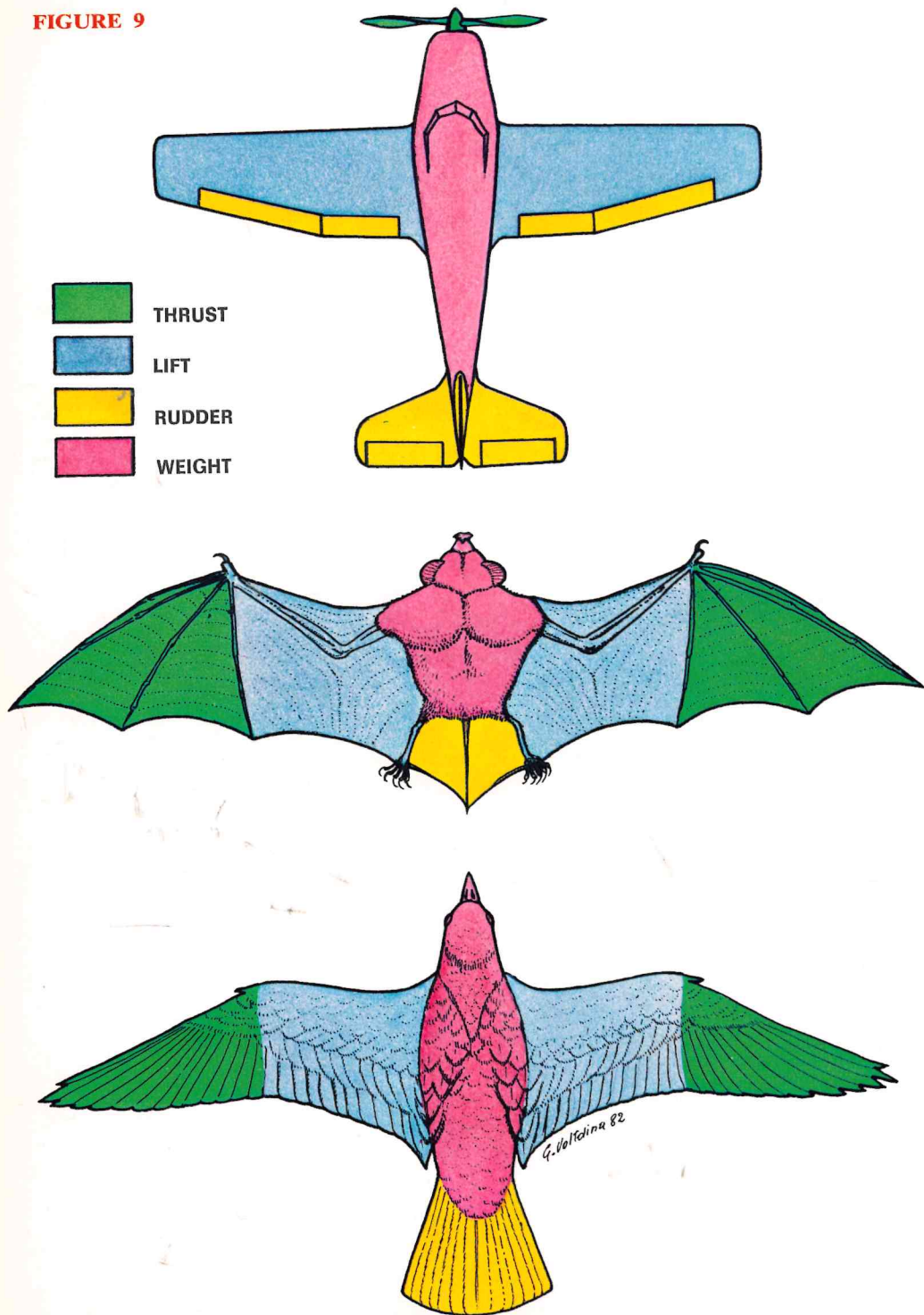
It has been shown, in a specific section reserved for that purpose, the importance of the interdigital webs in the aquatic environment. Therefore, we are not going to deal here with

FIGURE 8



The Purple Gallinule and the Wattled Jacana have made out of the rushes and floating vegetation, respectively, their typical habitats. Thanks to their long digits and nails, they can support themselves in these kinds of aquatic environments.

FIGURE 9



Scheme which shows the four characteristics of a flyer: weight, lift, thrust and rudder. Living-being flights are very complex, and flight organs are multifunctional, therefore, this is a simplified scheme.

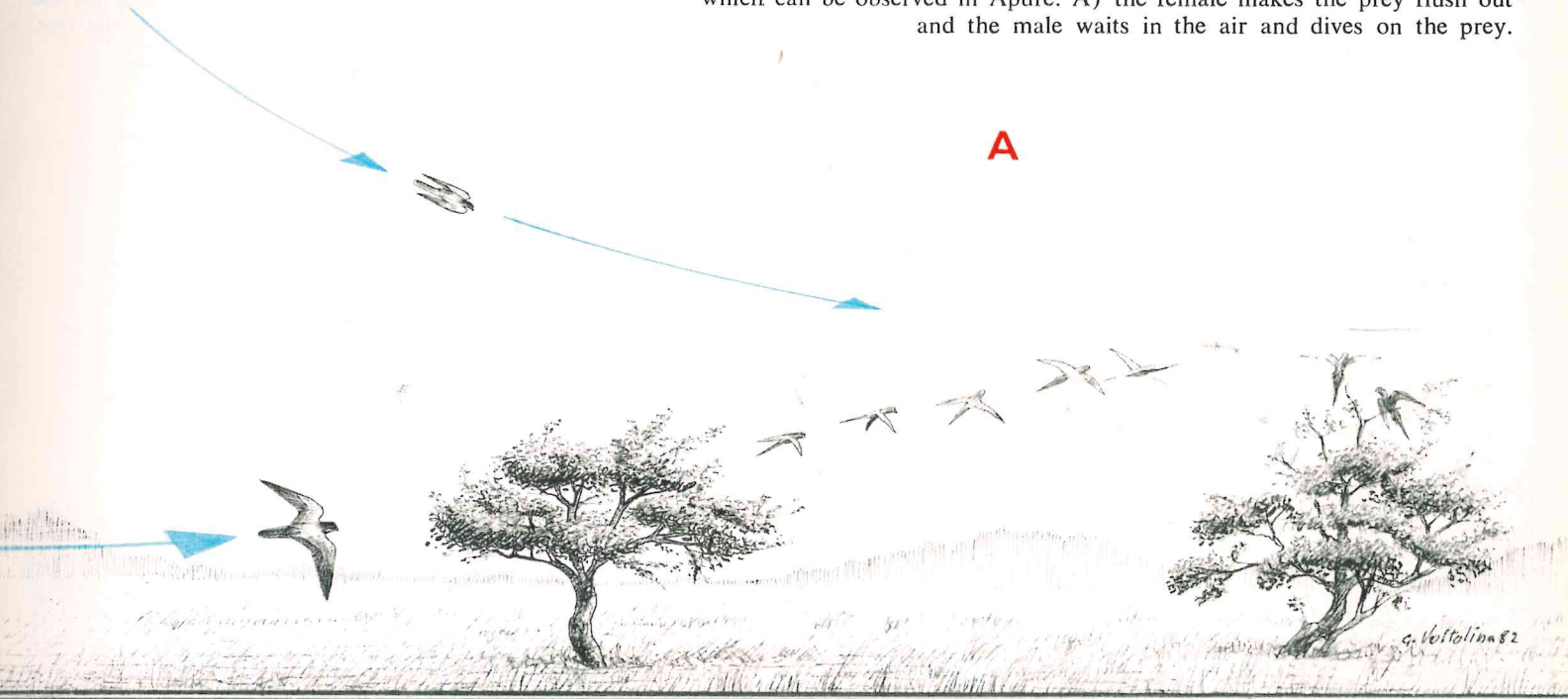
this kind of adaptation. However, it is convenient to analyze other adaptive advantages that occur in the same environment and are also located in nails and fingers.

The Purple Gallinule and the Wattled Jacana, really numerous on the Llanos, belong to different orders (Gruiformes and Charadriiformes, respectively) and evolved independently in the same direction to obtain long digits that could allow them to stay on the water surface, supporting themselves on various aquatic plants at the same time, and thus floating (Figure 8).

Each group has looked for this required support in a determined aquatic group of plants: the Wattled Jacana inhabit floating plant groups, such as those formed by water-hyacinths, ferns and other water plants. The Purple Gallinule, however, is found in the rushes. This adaptation consists of very long fingers and nails which permit the animal to support itself on various floating plants at the same time, or to grasp onto some rushes that maintain it on the surface.

FIGURE 10

Aplomado Falcons are open-space rapid hunters which generally need to find their prey in mid-air. This figure (pages 65, 66, 67, 68) shows three hunting techniques which can be observed in Apure. A) the female makes the prey flush out and the male waits in the air and dives on the prey.



Certainly, this adaptation is related to a long tarsus, which places these birds among the group of wading birds.

Conquest of air

Just as birds and mammals obtained adaptation fit for the aquatic environment through the process we have called "the return", they also achieved the ability to exploit a more difficult medium, namely the aerial, through functional structures for flying.

For birds, this singular ability, and

their feathers, are their most remarkable characteristics. Although there are some very concrete species which are not able to cut across the air, we may say that birds are flying animals ("volants").

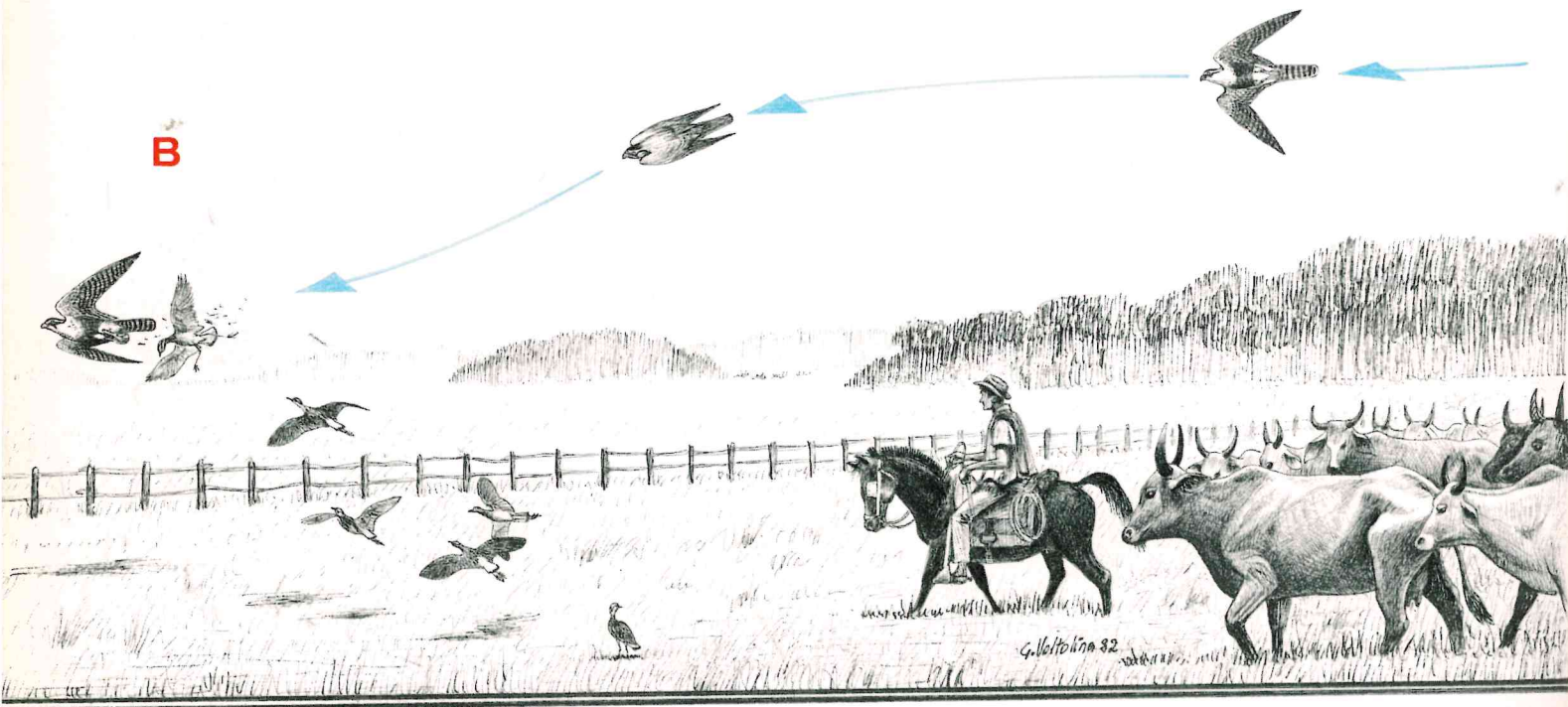
On the other hand, mammals are basically terrestrial, but they include one class, the bats (Chiropterous), which are well-equipped for flying. There are also gliding mammals, like certain squirrels, which cannot be considered flying animals.

The morphology of an aerial animal requires certain basic conditions. The most important is to have lift-

ing structures according to their weight which maintain them in the air. Such structures are called wings. The bigger the wing surface is, the better is the lift, while weight is inversely proportional to flying ability. Thus, we already have two characteristics to select in a flying animal: wing surface and weight. Now, two questions remain to be cleared: the thrust, which birds as well as bats obtain with the hand-wing; and the rudder, controlled by the tail and the uropatagium, respectively.

With this group of features, we can make a comparison between birds

- B) Falcons take advantage of the cattle mobilization the llanosmen make and travel with them waiting for birds that flush out when cattle get close.
 C) Falcons fly very high over a tree where other birds stand, waiting for the moment when birds leave the tree.



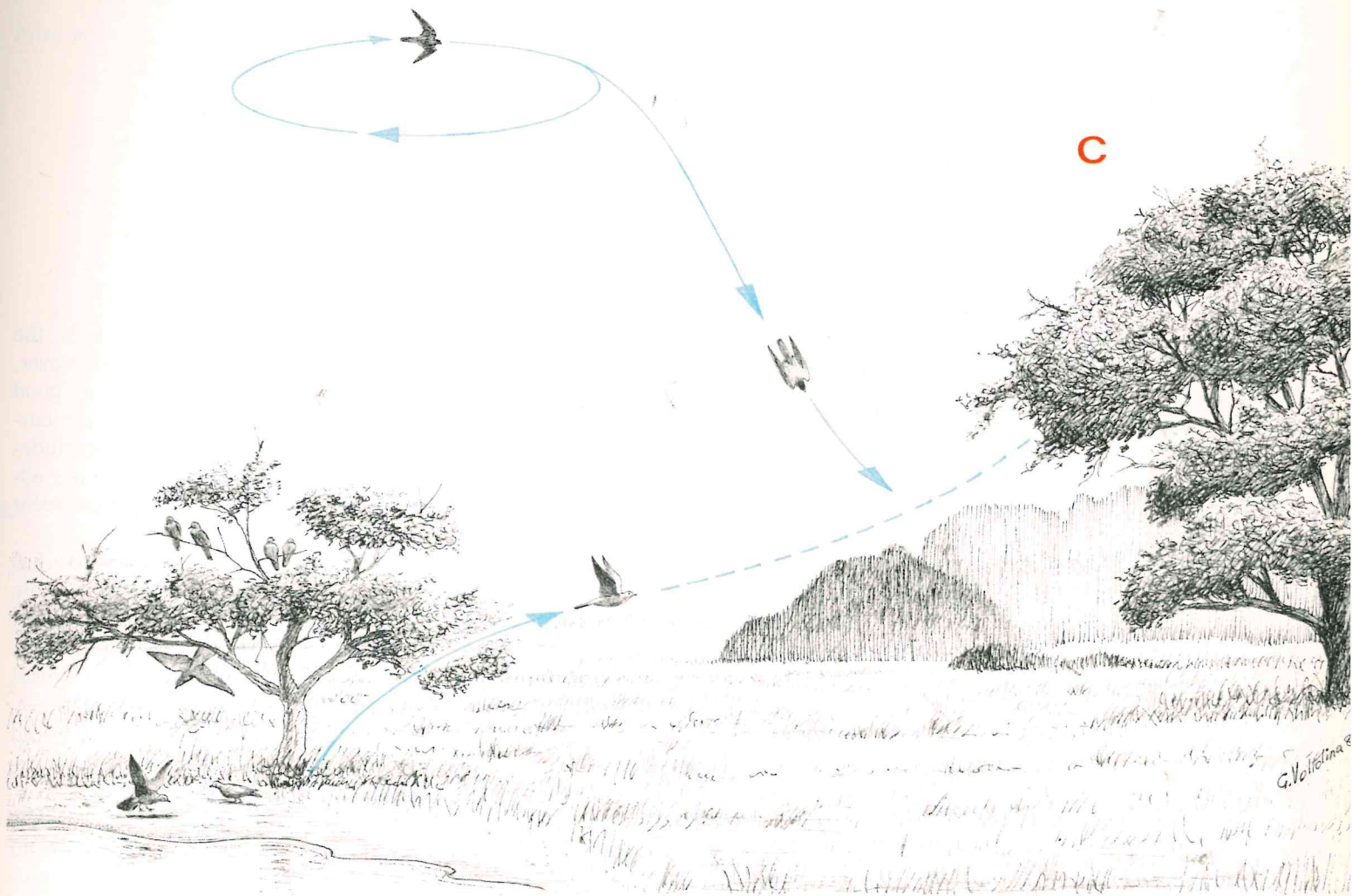
and bats and an airplane, thus better understanding the basic archetype of a flying vertebrate. (Figure 9)

Flight in open savannas

Great savannas with herbaceous vegetation without obstacles for fly-

ing make possible high speed flight movements. In these places, the most-rapid birds are found. But, which is the most suitable aerial morphology for high speeds? If we should answer this question with human artificial structures, we would look for those represented by skyrockets, missiles,

and high-speed airplanes — that is to say, those with a very small wing surface and powerful propulsion. The advantages and disadvantages of this are small drag in the thrust, since wings are very reduced, and therefore also the lift they provide. In these cases, lift is obtained through a huge



thrust which maintains the aircraft in the air thanks to high speed.

Very rapid bats and birds show these same characteristics that lead to the attainment of high speeds. Wings are slender and short in the lifting part and very long in the thrusting one (Figure 12).

Falcons, perhaps the best aerial hunters with the highest speeds, show this kind of wings, which taper to a slender tip and have a very narrow surface.

Very similar morphologies are found in swifts, smallows, ducks, parakeets, and hummingbirds, the lat-

ter having such a strong thrust that equals its weight, and when the wings stroke the wind forward the body is held in mid-air like a helicopter.

Actual falcons (genus *Falco*) hunt, according to their size, birds and insects. Their sinking speed is so high that humans use them for hunting.

There is a whole culture around falconry, which is the name of this sport. Perhaps the most famous is the Peregrine Falcon, whose formidable sinking speeds have been timed — Brawn, a world-wide authority on birds of prey, estimates 280 km/h. Some others claim even 400 km/h. Besides, they have received nicknames such as “the living missile”. In summer, Peregrine Falcons come to this region migrating from high northern latitudes of the continent with groups of migratory birds. The Aplomado Falcon, specialist in bird seizure, is the biggest native falcon which lives in this region. High speed insectivorous bats also show long slender wings like many Moloosids.

Gliding is another kind of flight which can be seen in the savanna. The term glider is used in aerodynamics to refer to motorless airplanes — in other words — structures that can fly without having their own propelling power. Thrust energy is obtained principally by losing height. Ascending thermal currents or vertical winds of a certain magnitude

can raise the glider again, turning flight into a sequence of slow ascending and descending movements (Figure 11).

Some birds which need to fly a long time searching for food show glider characteristics in order to avoid expenditure of energy while flying. This is particularly true of the Turkey Vultures, carrion birds, which have a high lifting surface with long soaring wings. With these wings they go into ascending columns of air produced by thermal differences at distinct air levels. Thus, they can maintain a soaring flight with high lift without flapping of the wings. There are some hawks which also use this flight technique, although less improved than the Turkey Vulture's perhaps because gliding is slow and hawks are living-prey predators that sometimes need higher speeds.

Forest flyers

Doubtless the forest is the most difficult environment for flying. Multiple obstacles such as leaves and branches appear to be a contradic-

tion for good flight, which is the fastest locomotion known. However, forest is also a habitat for good flyers. The lack of thermal air currents within the vegetation precludes gliders, and falcons cannot take advantage of their most prominent characteristic.

The selecting environment has changed its patterns, and only those structures which show the fittest abilities will be favored. In general, common forest birds present elliptical wings.

This kind of wing is short and broad, capable for high maneuverability and precise movement control. It is usually associated with slow flight, but the flyer is able to ascend and descend rapidly. Tails and uropatagia are well developed in the forest environment, since they constitute the required rudder.

Fruit-eating and insectivorous bats also present elliptical wings. The structures of some forest birds of prey may be considered to be the greatest achievement of this kind of flight, for they do not lose the required characteristics to travel within the

Gliding is typical of Turkey Vultures, which use thermal currents to ascend flying in circles, and then, by losing altitude, go to another thermal current where this process starts again. This is a slow flight, with low expenditure of energy.

FIGURE 11

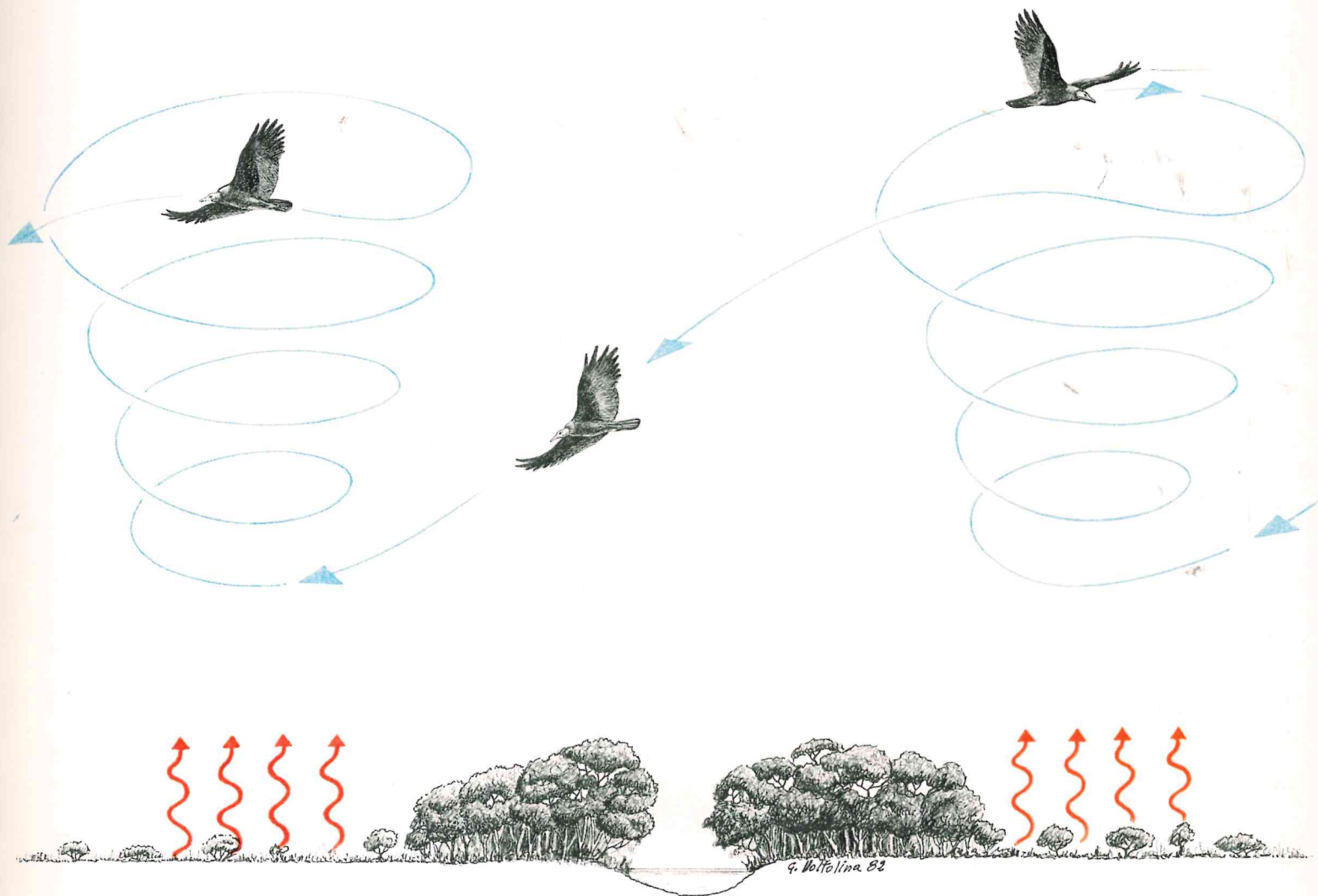


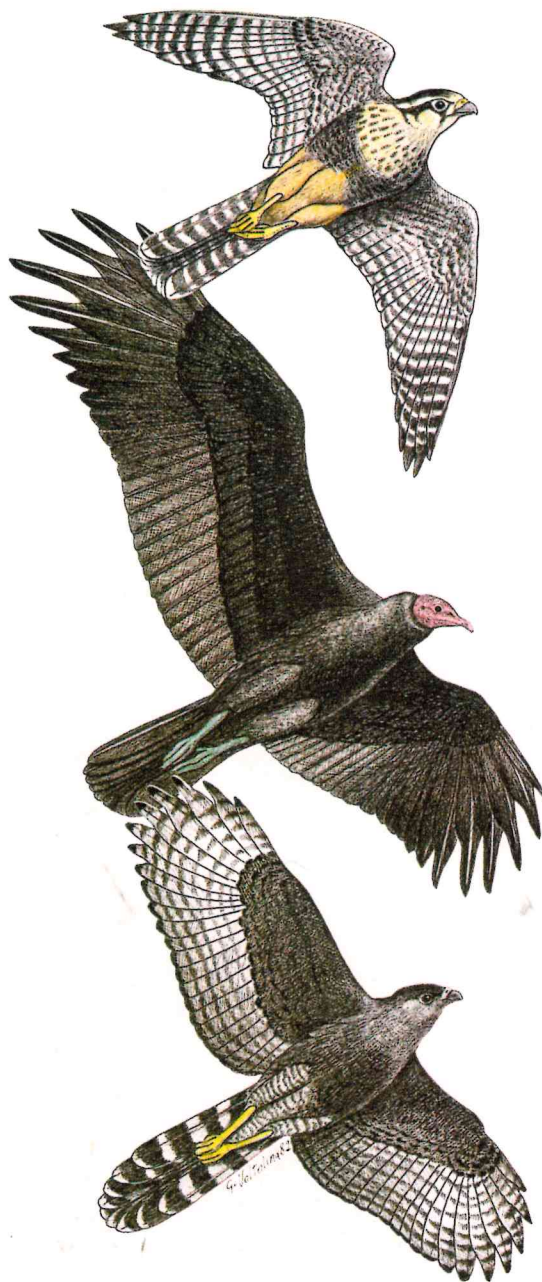
FIGURE 12

foliage, and in addition develop the necessary speed for the capture of their prey.

The most perfect Llanos-forest flyers are represented in two orders of birds of prey belonging to two different families, the Micrastur and the Accipiter.

The Micrastur is not a well-known order of birds of prey, and it is found only on the American continent. They are falconidae, or in other words, they are closely related to the swift hawks and can be considered as their form of forest adaptation. Their wings like the Accipiter are round-edged, short, and broad, and their tail is long and narrow (Figure 12). Their incalculable flying ability leads them to pursue birds among the trees at huge speeds. Possibly, they act in confined hunting spaces they know perfectly, which allows them to develop this skill.

The Accipiter, in turn, is known for its ability to seize terrestrial mammals, clearing obstacles at high speeds during flight. Perhaps Micrastur enjoys these same privileges



High-speed wing

Broad soaring wing

Elliptical wing

V-LLANOS ANNUAL CALENDAR

During the year there appear some characteristic variations of the environmental parameters in every part of the world. When annual differences are very marked and take place during determined months, we talk about seasons. Every region has its own seasons characterized by certain temperatures, photoperiods (duration of the day light), rainfall, winds, etc. In every geographic region, different parameters determine the seasons. So, in the Llanos, annual temperature or photoperiod variations are not so noteworthy as to unchain appreciable environmental differences that could distinguish two annual periods. However, rainfall, excessive during certain months and absent during the rest, does mark two different landscapes and environments during the year. This is the reason why we, in the Llanos, talk about a bi-seasonal climate with two divisions of the year, rainy and dry, which definitely influence all the biotic community (see Climate).

The fauna, according to these environmental variations, find certain moments more suitable to carry out

determined vital processes, and if it is positively selected, there will arise a close relationship between the activities and behavior of each species and the seasons. By this means, there will be: a determined moment for males and females to meet and form couples; high mortality periods; alternate group-forming behavior and territoriality all during the year; breeding months; periods of greater growth because of nourishment increase; variation of basic diets related to the seasons; etc. This represents an annual calendar of activities referred specifically to every single species, where reproduction is the most outstanding event.

Seasonal activities demand the synchronization of all specimens in a given community in order to obtain a seasonal pattern or annual cycle. But, how does this synchronization take place?

For the vital processes to occur in a determined moment, individuals should have a "natural measurer" which lets them know the variation parameter that unchains the activity. Hormones usually play an important

role in these processes. Species synchronism may lie in the Natural Selection action upon the "measurer" and its fitting, favoring those individuals that carry out the process within the optimal period.

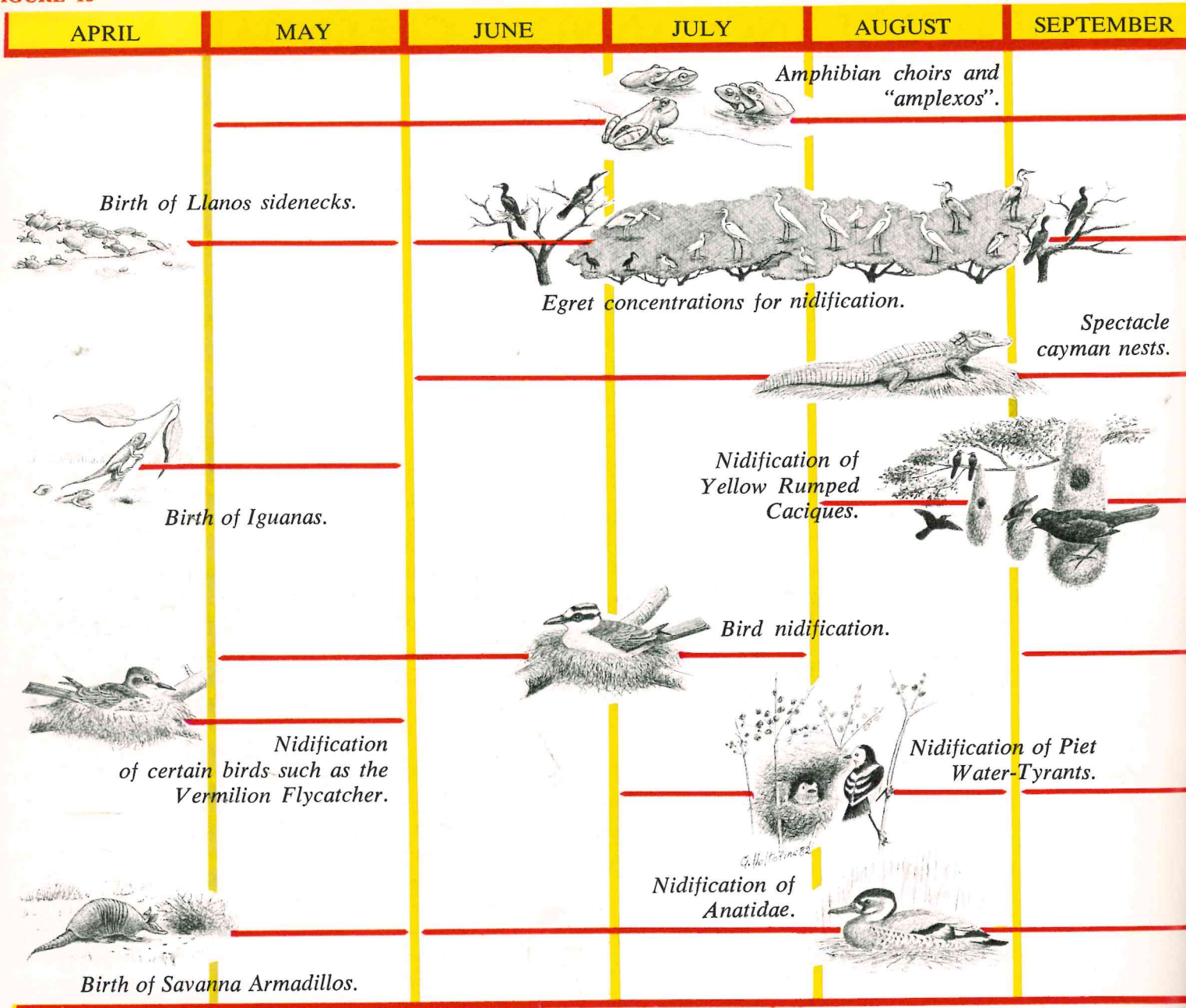
The purpose of this chapter is to elaborate a general calendar of the Llanos fauna, and therefore it will include only the most abundant species whose seasonal variations are most evident.

The first April heavy showers announce the beginning of the Llanos year, and all the fauna that until this moment lived at the mercy of water bodies consumed by the drought realizes that a new cycle has come.

The egrets, gathered in big groups around muddy clay ponds which offered them numerous dying fishes, start to disperse to the newly-formed pools. Something similar happens with the ducks, llanos sidenecks, spectacle caymans and capybaras, which living in poor summer waters, scatter throughout the savanna. Young hawks welcome the first rains with their first flights.

All the Llanos landscape varies;

FIGURE 13



OCTOBER

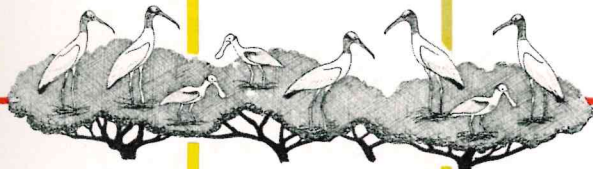
NOVEMBER

DECEMBER

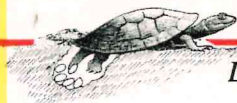
JANUARY

FEBRUARY

MARCH

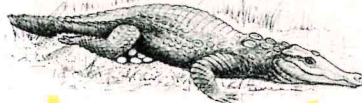


Arrival of Storks to egret concentrations.



Llanos sideneck egg-laying.

Cayman egg-laying.



Groups of Spectacle caymans with young.



Fauna concentration by the poor water left at the end of the dry season

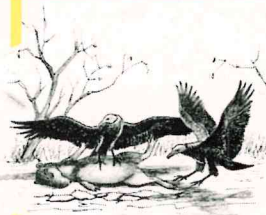


Capybara top birth-rate.



Iguana egg-laying.

Vertebrate high death-rate due to drought.



Nidification of birds of prey.

White-tailed deer top birth-rate.



Nidification of Black Skimmers.

J. G. Collins 88



the savanna changes its yellowish colour for new green shades; the forests, formed by many deciduous species, bud again with the miraculous water.

May and June present the largest freshet; little by little seasonal ponds heap up allowing the swamps to be full of water and lose their sterile appearance. It is then when amphibians start their infinite chorus night after

night, looking for females to carry out the copulation. Insects which are also inhabitants of small waterholes in the swamps, end their summer estivation and start an increasing activity. Crustaceous and little fishes, together with tadpoles and insects, transform swamps into an important source of food for wading birds such as ibises and snipes.

It is also during this period wher

the hard mud plugs, which hide Llanos sidenecks' nests, soften with water and let many of them see light for the first time. Iguanas are born likewise with the beginning of the rains.

Hawks, which start to become independent from the nest, find plenty of food easy to reach.

For little birds this period is also favorable for reproduction thanks to

the abundance of insects which are the main diet of the young.

A great number of Purple Gallinules, which have disappeared from these environs, arrive and start their reproduction process in well-developed rushes; Wattled Jacanas, on the other hand, cover the floating plants on the water.

July and August are characterized by the maximum water height. In extraordinary rain years, it is during these two months when devastating inundations take place. However, for fish, this means many more kilometers to travel, and they take advantage of it laying their eggs in isolated places. Once again egrets can get an incomparable abundance of food in shallow waters, capturing fish and tadpoles without any problems, since their narrow steps in the water act as a trap for these little animals.

The advantages offered by the abundance of food make egrets initiate their concentrations. Spectacle caymans also start to build their nests during this period.

September and October are rainy months, although less intense; waters begin to come down and some small seasonal ponds become muddy. During these months, the bright colours of the variegated wading bird concentrations start to lose their intensity because many birds abandon the place.

Some birds use this period for a second nidification and amphibians reduce their nocturnal chorus.

Sunny days are more frequent and slime seasonal ponds start to appear when the wind blows. A seasonal change is coming.

During November and December the same climatic process continues, and the decrease in water level becomes more evident.

Again, certain egret concentrations can be seen in which the young are the majority. Capybaras show, during this period, the highest birth rate. Purple Gallinule practically abandon their winter territories and disappear from the Llanos; and Wattled Jacanas start to join other groups without showing the marked territoriality of

the past few months. Cormorants, egrets, Black-crowned Night Herons, and ibises leave the concentrations, and the American Wood-Ibis takes possession of its nest being the last species that nidifies.

Black and Turkey Vultures, before other birds of prey, also start to build their nests in the caves formed by old trees, and on the ground, at the foot of the trees.

During this time, llanos sidenecks come out of the water and start their egg-laying in dry swamps, which lasts till the end of February.

January and February are summer months in which nidification and breeding of most of the birds of prey take place. Wading bird concentrations disappear and the place is also abandoned by the last American Wood-Ibis.

In March, when water reaches its lowest level, aquatic fauna concentrate, and many herbivorous animals and fish die. At the same time, young carrion birds undertake their first flights. April rains will initiate a new year in the Llanos.

VI-MAN AND LLANOS FAUNA

Forest zone transformed for agriculture.



During the course of history, man has maintained an interaction with his environs, modifying them according to his possibilities. Some of many past and present civilizations achieved a certain balance within the ecosystem they lived in. A good example would be the Venezuelan primitive Indian tribes. The majority of these men were hunter-fisherman-harvesters who lived subjected to the restrictions of their environment. The only real powerful weapon they had was fire which permitted them to devastate wide regions. Nowadays, there is a controversy about the origin of some Llanos savannas, from which it is unknown if they are a result of nature's action or man's action.

Later on, with the arrival of the Spanish colonizers, cattle and agriculture came to these regions, increasing land utilization. The introduction of cattle was probably determinant for the settlement and development of cattle egret populations.

With regard to agricultural activities, trees were felled, fields were

broken up, and earth was cultivated. This affected principally Portuguesa and Barinas, since their rich soils were excellent for agriculture. As we have mentioned earlier in the section "Vegetation", by the end of colonial times, these fields were depopulated and many of them remained uncultivated until the 50's. In these days, a new colonization took place, which, with modern methods (agrarian machinery, and chemical products), was able to transform more quickly the landscape. Large extensions were reserved for agriculture. Rice, sugar cane, cotton, and corn were sowed producing very good harvests. In Apure this was not possible since its poor soil and huge inundations did not allow agricultural development; however, an extensive cattle-raising activity started in this region with native cattle bred with zebu.

In these three states, the main problem for agriculture and cattle-raising development consists in the irregular distribution of rains during the year; there is a period characterized by excessive rains, followed by



In spite of legal bans, trade with protected species hides continues to exist. Picture taken in 1981.



another whose main characteristic is the lack of water.

In view of this situation, many projects were developed aiming to modify, as much as possible, the annual hydric cycle. One of the main projects is the Guanare-Masparro Project in Portuguesa and Barinas, which through a series of dams to control the water volume of the rivers Guanare, Masparro, Boconó, and Tucupido, tries to transform more lands into cultivatable ones. These dams, located at the foothill along with some drainage channels in the lowlands, are capable of emptying rapidly the excess water in the Apure river. The project Módulos de Apure, on the contrary, aims to keep water for cattle during droughts and also to maintain the green pastures through dikes which dam the water of the bayous.

In summary, these are the projects that have been carried out in the Western and Southern Llanos.

Undoubtedly, as time goes by, we transform the landscape. Until now, we have not talked about the fauna's reaction to these changes. Influence

of human activities on the fauna, through the modification of the landscape, is indirect, but certainly determinant. Not all species respond in the same way to changes in their habitats; some of them show a great vulnerability with regard to these changes. For example, the tapir, which, accustomed to living in virgin forests, cannot adapt itself to secondary forests. Other species, such as little birds, lizards, opossums, etc., on the contrary, have adapted themselves to man's presence, and man-made environments.

Some extensive cultivated lands have led to the proliferation of some species such as rodents, and ducks, which have become pests. Last, it is also important to take into account the competition for food between cattle and wild herbivorous animals.

We can say that the general foreseeable trend is a decrease in forest fauna, and a change in distribution and abundance of aquatic species.

There is also a direct human influence on fauna, that is, hunting. This can be considered under two aspects. First of all we find the sub-

sistence hunting, which has been practiced since the remote past. Although this, some time ago, did not imply a loss of balance, since primitive hunters and their prey were probably subjected to a sort of predator-prey regulation. Nowadays, with the population increase, this balance has been broken, affecting the fauna negatively. As population grows and public roads are built, more regions may be influenced by man. Deers, peccaries, ducks, and in general, species usually hunted will be the most affected.

There is another kind of hunting which mainly affects those animals whose skin has commercial value, and is used to make wallets, purses, overcoats, etc. Here we can mention the almost extinct Orinoco cayman, the river otter, and spotted felines. In spite of the ban on the trade of these hides, there are still some saddleries where one can find them.

On the other hand, we have hunting as a sport. Presently, the most important is duck hunting. This sport helps control its population, since only ducks which constitute pests in

rice fields can be killed.

The capybara is one of the few cases of allowed commercial exploitation. This is a good example of how wild fauna can be exploited in a reasonable manner.

In turn, fauna also influence man, principally his folklore, for it is strongly linked to his songs, proverbs, nicknames, etc.

We would like to end by pointing out that, although it is true that we need to develop regional economies, it should be done in a rational way. It is necessary to make the required plans according to research on the consequences of our actions on the ecosystem, in order to avoid, as far as possible, a negative impact on it.

We should like to recommend as priority research on fauna the following:

- Study of biological and population status in areas where there are species in danger of extinction such as the river otter, the Orinoco cayman, the jaguar, the Necked-tailed armadillo, and the manatee in order to look for a way to preserve them.
- Localization and study of egret concentrations and colonies of Cormorants, ibises, egrets, and Wood-Ibises, species that, although not threatened, are very

vulnerable when gathered in certain places for reproduction purposes.

- Finally, it is necessary to establish preserves, where the main Llanos' ecosystems should be represented: forests, savannas, and aquatic environments.

During the last centuries, not less than twenty mammal species and approximately one hundred and fifty bird species have disappeared from the Earth. We cannot allow ourselves to lose anymore species, and we have to make all efforts to preserve those we still have.

INDEX OF COMMON AND SCIENTIFIC NAMES

TREES

Apamate	<i>Tababuia pentahylla</i>
Camoruco	<i>Sterculia apetala</i>
Caoba	<i>Swietenia macrophylla</i>
Cedro	<i>Cedrela mexicana</i>
Ceiba	<i>Ceiba pentandra</i>
Coco de mono	<i>Lecythis</i> spp.
Jobo	<i>Spondias mombin</i>
Laurel	<i>Nectandra pichurini</i>
Mirty palm	<i>Mauritia minor</i>
Saman	<i>Pithecolobium saman</i>

AMPHIBIANS

Plantain frog	<i>Phrynohyas venulosa</i>
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REPTILES

Anaconda	<i>Eunectes murinus</i>
Boa constrictor	<i>Boa constrictor</i>
Cayman	<i>Crocodylus intermedius</i>
Coral snake	<i>Micrurus isoazonus</i>
Fer-de-Lance	<i>Bothrops</i> spp.
Guitarrero lizard	<i>Cnemidophorus lemniscatus</i>
Great lizard	<i>Tupinambis teguixin</i>
Green snake	<i>Chironius carinatus</i>
House snake	<i>Leptodeira annulata</i>
Hunting snake	<i>Spilotes pullatus</i>
Iguana	<i>Iguana iguana</i>
Llanos sideneck	<i>Podocnemys vogli</i>
Rattlesnake	<i>Crotalus durissus</i>
Red-footed tortoise	<i>Geochelone carbonaria</i>
Savanna snake	<i>Lygophis lineatus</i>
Scorpion-mud turtle	<i>Kinosternon scorpioides</i>
Spectacle cayman	<i>Caiman crocodilus</i>
Star-lizard	<i>Hemidactylus</i> sp., <i>Phyllodactylus</i> sp.

BIRDS

American Kestrel	<i>Falco sparverius</i>
American Wood Ibis	<i>Mycteria americana</i>
Anhinga	<i>Anhinga anhinga</i>
Aplomado Falcon	<i>Falco femoralis</i>
Bare-faced (or Whispering) Ibis	<i>Phimosus infuscatus</i>
Barn Owl	<i>Tyto alba</i>
Barred Antshrike	<i>Thamnophilus doliatus</i>
Bicolored Hawk	<i>Accipiter bicolor</i>
Black-bellied Whistling Duck	<i>Dendrocygna autumnalis</i>
Black-collared Hawk	<i>Busarellus nigricollis</i>
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>
Black Skimmer	<i>Rynchops niger</i>
Black Vulture	<i>Coragyps atratus</i>
Blue-gray Tanager	<i>Thraupis episcopus</i>
Boat-billed Heron	<i>Cochlearius cochlearius</i>
Brazilian Duck	<i>Amazonetta brasiliensis</i>
Buff-necked Ibis	<i>Theristicus caudatus</i>
Burrowing-Owl	<i>Speotyto cunicularia</i>
Capped Heron	<i>Pilherodius pileatus</i>
Cattle Egret	<i>Bubulcus ibis</i>
Chestnut-bellied Heron	<i>Agamia agami</i>
Comb Duck	<i>Sarkidiornis melanotos</i>
Crested Caracara	<i>Polyborus plancus</i>
Crested Bobwhite	<i>Colinus cristatus</i>
Double-striped Thick Knee	<i>Burhinus bistriatus</i>
Eared Dove	<i>Zenaida auriculata</i>
Gray Hawk	<i>Buteo nitidus</i>
Gray-necked Wood Rail	<i>Aramides cajana</i>
Great Black Hawk	<i>Buteogallus uribitinga</i>
Great Horned Owl	<i>Bubo virginianus</i>
Great (or common) Egret	<i>Casmerodius albus</i>
Great Kiskadee	<i>Pitangus sulphuratus</i>
Green Ibis	<i>Mesembrinibis cayenensis</i>
Hoatzin	<i>Ophisthocomus hoazin</i>

Horned Screamer	<i>Anhima cornuta</i>	Wire-tailed Manakin	<i>Teleonena filicauda</i>
Jabiru	<i>Jabiru mycteria</i>	Yellow-crowned Night-Heron	<i>Nyctanassa violacea</i>
King Vulture	<i>Sarcoramphus papa</i>	Yellowish Pipit	<i>Anthus lutescens</i>
Laughing Hawk	<i>Herpetotheres cachinnans</i>	Yellow Rumped Cacique	<i>Cacicus cela</i>
Little-blue Heron	<i>Florida caerulea</i>	Yellow-throated Spinetail	<i>Certhiaxis cinnamomea</i>
Maguari Stork	<i>Euxenura maguari</i>		
Muskovy Duck	<i>Cairina moschata</i>		
Neotropic Cormorant	<i>Phalacrocorax olivaceus</i>		
Orinoco Goose	<i>Neochen jubata</i>		
Ornate Hawk Eagle	<i>Spizaetus ornatus</i>		
Osprey	<i>Pandion haliaetus</i>		
Peregrine Falcon	<i>Falco peregrinus</i>		
Piet Water-tyrant	<i>Fluvicola pica</i>		
Purple Gallinule	<i>Porphyryla martinica</i>		
Red-breasted Blackbird	<i>Leistes militaris</i>		
Roseate Spoonbill	<i>Ajaia ajaja</i>		
Ruddy Ground-Dove	<i>Columbina talpacoti</i>		
Rufescent Tiger-Heron	<i>Tigrisoma lineatum</i>		
Rufous-vented Chachalaca	<i>Ortalis ruficauda</i>		
Savanna Hawk	<i>Heterospizias meridionalis</i>		
Scaled Dove	<i>Scardafella squammata</i>		
Scarlet Ibis	<i>Eudocimus ruber</i>		
Scarlet Macaw	<i>Ara macao</i>		
Sharp-tailed Ibis	<i>Cercibis oxycerca</i>		
Shining Cowbird	<i>Molothrus bonariensis</i>		
Silver-beaked Tanager	<i>Ramphocelus carbo</i>		
Snail Kite	<i>Rostrhamus sociabilis</i>		
Snowy Egret	<i>Egretta thula</i>		
Sunbittern	<i>Eurypyga helias</i>		
Thrush	<i>Turdus spp.</i>		
Troupial	<i>Icterus icterus</i>		
Turkey Vulture	<i>Cathartes spp.</i>		
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>		
Wattled Jacana	<i>Jacana jacana</i>		
Whistling Heron	<i>Syrigma sibilatrix</i>		
White-faced Whistling Duck	<i>Dendrocygna viudata</i>		
White-necked Heron	<i>Ardea cocoi</i>		
White-tailed Hawk	<i>Buteo albicaudatus</i>		

MAMMALS

Agouti	<i>Dasyprocta agouti</i>
Amazon dolphin	<i>Inia geoffrensis</i>
American lion	<i>Felis concolor</i>
Araguato (or howler)	<i>Alouatta seniculus</i>
Bracket deer	<i>Mazama americana</i>
Capybara	<i>Hydrochaeris hydrochaeris</i>
Capuchin monkey	<i>Cebus nigrivittatus</i>
Giant otter	<i>Pteronura brasiliensis</i>
Great anteater	<i>Myrmecophaga tridactyla</i>
Jaguar	<i>Panthera onca</i>
Jaguarondi	<i>Felis yagouaroundi</i>
Manatee	<i>Trichechus manatus</i>
Mountain armadillo	<i>Dasybus novemcinctus</i>
Necked-tailed armadillo	<i>Priodontes giganteus</i>
Ocelot	<i>Felis pardalis</i>
Opossum	<i>Didelphis marsupialis</i>
Paca	<i>Agouti paca</i>
Peccary	<i>Tayassu tajacu</i>
Porcupine	<i>Coendou prehensiles</i>
Rabbit	<i>Sylvilagus floridanus</i>
Raccoon	<i>Procyon cancrivorus</i>
Rice rat	<i>Holochilus brasiliensis</i>
Savanna armadillo	<i>Dasybus sabanicola</i>
Savanna fox	<i>Dusicyon thous</i>
Skunk	<i>Conepatus semistriatus</i>
Spider monkey	<i>Ateles belzebuth</i>
Squirrel	<i>Sciurus granatensis</i>
Tamandua	<i>Tamandua tetradactyla</i>
Tapir	<i>Tapirus terrestris</i>
White-tailed deer	<i>Odocoileus virginianus</i>

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A photograph of a sunset over a body of water. The sun is low on the horizon, creating a bright, glowing reflection on the water's surface. The sky is a deep orange-red. In the foreground, several birds are silhouetted against the water and the bright reflection of the sun. The overall scene is peaceful and scenic.

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