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## The “Tropical Research Station La Gamba” and the “Association Rainforest of the Austrians” (“Verein Regenwald der Österreicher”)

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In 1991, Michael Schnitzler, a distinguished musician and professor at the University of Music and Performing Arts in Vienna, founded the “Association Rainforest of the Austrians” (“Verein Regenwald der Österreicher”). Over many years, he collected contributions in Austria and forwarded the funds to the Costa Rican government. With those funds, the government purchased large tracts of forest from landowners, thereby saving the Esquinas



View of the Esquinas forest

Rainforest in south-western Costa Rica as part of the “Parque Nacional Piedras Blancas”.

It soon became apparent that this protected area also provided ideal conditions for promoting Austrian rainforest research. The “Association Rainforest of the Austrians” therefore bought an old farmhouse (a finca) in 1993 as a “nucleus” for a tropical field station. This station is now located directly on the border of the National Park, near the small village of La Gamba.



Part of the “Tropical Research Station La Gamba”

With the support of the “Association Rainforest of the Austrians” and the University of Vienna, the “Tropical Research Station La Gamba” flourished and grew. It currently comprises several buildings, efficient living and research facilities, as well as a botanical garden. The field sta-



The natural pool and the rancho in the garden of the "Tropical Research Station La Gamba"

colourful frogs, and the abundant reptile fauna, above all the beautiful gold eyelash pit viper (*Bothriechis schlegeli*)—which Walter Hödl enthusiastically introduced us to, particularly impressed us. At that time, all the above initiatives of the “Association Rainforest of the Austrians” had just begun and the first hectares of valuable tropical forest had just been saved; the doors of the old finca were newly opened for students and scientists. No one would have predicted the

tion is at the threshold of becoming an internationally established research institution and education centre, whose aims are to contribute to the exploration and conservation of tropical forests in the neotropics. Since its foundation, many scientists have conducted their field research at our tropical rainforest in La Gamba. The “Esquinas Rainforest Lodge”, which is located nearby, is also the brainchild of Michael Schnitzler.

I had the pleasure of belonging to a team of biologists and students who visited Costa Rica in 1993. We were all fascinated by the rich natural heritage of this area. The many amphibians – glassfrogs, red eye tree frogs, the many other

resounding success of the land purchases and the tropical station. It is with great pride that, after publication of the internationally recognised “Field Guide of Flowering Plants of the Golfo Dulce Rainforests”, we are now in a position to offer this catalogue of the attractive amphibians and reptiles of the Esquinas Rainforest to the public. It is our hope that this volume will be a source of information and joy for nature lovers, scientific experts and for all our friends of the “Austrian rainforest” and its tropical station.

For detailed information see [www.lagamba.at](http://www.lagamba.at) and [www.regenwald.at](http://www.regenwald.at).



# The rainforests of the Golfo Dulce region in Costa Rica

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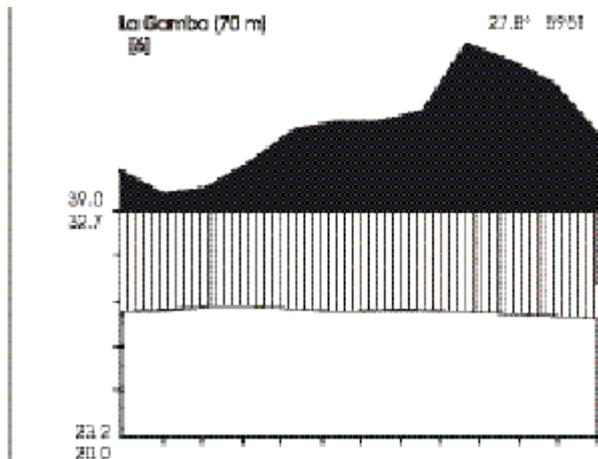


The Golfo Dulce region is located at the southern corner of the Pacific coast of Costa Rica near the border with Panama. The forests of this region are the only moist and wet evergreen lowland forests still to exist on the Pacific side of Central America. Elevations range from sea level to 745 m in altitude on the Cerro Rincón, Peninsula de Osa. The annual precipitation of up to 6,000 mm with a short or nearly absent dry season from December to March, the strongly spatially structured landscape relief with many

microhabitats and niches, the diversity of soil types, high vegetation dynamics and the biogeographical position favour a species-rich forest with about 2,700 species of higher plants, 145 mammals, 50 amphibians, 90 reptiles, 370 birds and numerous insects. In a one-hectare research plot, 179 different species of trees (diameter in breast height  $\geq 10$  cm) were found, representing the highest tree diversity known in Central America. The geographic



Aerial view of the Esquinas forest (Piedras Blancas National Park) with the Golfo Dulce



Climatic diagram of the "Tropical Research Station La Gamba"

location on the 'bridge' between North and South America, and the fact that this was a kind of refuge for tropical animals and plants during the last ice age, lead to remarkable biogeographical patterns. Endemic plants and animals are abundant and many reach their northernmost limits in southern Costa Rica.

The moist and wet evergreen lowland forests contain trees of up to 60 m in height (e.g. *Anacardium excelsum*, *Parkia pendula*, *Carapa guianensis*, *Brosimum utile*, *Caryocar costaricense*). Most trees maintain their foliage throughout the year. Palms (in total



Waterfall - Río Sardinal in the Esquinas forest (Piedras Blancas National Park)

On the coast, the Coconut palm (*Cocos nucifera*) and the “tropical almond tree” (*Terminalia catappa*), and in the mangroves the Red mangrove (*Rhizophora mangle*) and Mangle pinuela (*Pelliciera rhizophorae*), are the most conspicuous plants. In addition to various primary and secondary forests, many other types of habitat such as pasture, pools, rivers, culture land and plantations of different plants (e.g. oil palm, teak, manioc) are found.

about 45 species) such as *Socratea exorrhiza*, *Iriartea deltoidea*, *Welfia regia* and *Asterogyne martiana* are typical. *Heliconia* herbs are conspicuous in streams and gaps. Lianas (e.g. *Bauhinia*, *Entada*), vines and epiphytes (*Bromeliaceae*, *Orchidaceae*) are found on many trees. About 100 species of orchids (e.g. *Vanilla*) and 40 of Bromeliads are present in this region. Hemiepiphytic plants of the genus *Clusia* are abundant in the very wet parts of the forest, while the fig trees (*Ficus*) are more frequent in the drier region (Corcovado plains).

Watching animal life is a unique experience in this region. Four different kinds of monkey, the endangered jaguar, the ocelot and the tapir live in these forests. Pelicans, toucans, manakins, hummingbirds, motmots and other birds make the region around the Golfo Dulce a hotspot for bird-watchers. Frogs and reptiles can be observed in and around the forests – some during the day, others at night. An extensive system of trails in the Corcovado and Piedras Blancas National Parks provides fantastic views of the nature of a tropical rainforest.

Interior of the Esquinas forest (Piedras Blancas National Park) near La Gamba



## Herpetological field trips around the La Gamba Station

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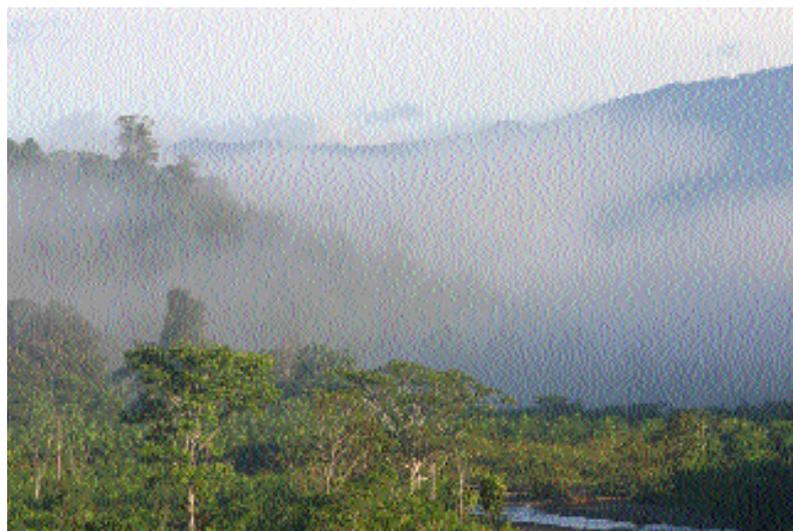
Morning is the best time of day at the station, and at five a.m. it is still dark. The calls of frogs and the sounds of nocturnal insects are growing silent. Tiny droplets of mist condense on the leaves to form a rich dew, which drips slowly to the ground.

By and by we start to hear birdsong. While it is still dawn, the first hummingbirds begin to stock up on nectar. Daybreak, at 6 a.m., is a good time to set out on a walking tour. A particularly pleasant walk goes over the "Fila" trail. This path begins beside the former station, i.e. the first building after our station on the way to La Gamba, leads uphill, and circles the valley in which our station and lodge are situated. Even though most amphibians are nocturnal, we may yet come across one or two of them, usually juveniles. Of the toads, we might meet *Bufo marinus*, *B. melanochlorus* or *B. haematiticus*. There are also diurnal frogs such as *Rana warszewitschii* and the Dendrobatids. They are not abundant, but there is a good chance of glimpsing *Dendrobates auratus* or even a *D. granuliferus*, which often travels some distance from its home brook.

Occasionally we meet salamanders of the genus *Oedipina*, but they are so quick to take refuge under the litter covering the

ground that it is impossible to get a good look at them, let alone take a picture. There are also young of the small, dark, and fast-moving *Mabuia* around. We frequently see *Ameiva* and *Anoles* (*Norops* sp.), and occasionally also the *Helmeted Iguana* (*Corytophanes cristatus*).

Moving very slowly and quietly and keeping our eyes and ears open, we can watch snakes until they become aware of us. During the first sun of the morning is an especially good time for this, because many animals like to bask in the sun after the cool night. If you have enough patience, it is possible to come close enough to take good photos and to see the animals migrating back into the shade of the forest floor. Apart from several colubrid snakes, among them *Leptophis*, *Coniophanes* and *Clelia*, we may also see pit vipers such as *Porthidium nasutum*, or the most abundant snake of the forest, *Bothrops asper*. Usually, when left undisturbed, it remains docile. It can, however, turn aggressive, so it is important to watch where you step and what you hold on to. Likewise, remember to watch out for the camouflaged *Eyelash pit viper* (*Bothriechis schlegelii*), which rests on branches and shrubs.



The Rio Bonito valley at dawn



The way back to the lodge passes by a small waterfall. Near the creek we hear the loud whistling calls of *Colostethus*, representing one of the three genera of poison dart frogs in Costa Rica. If we look carefully at the leaf litter we can see these small brown frogs, which move astonishingly fast and jump over comparatively large distances - which accounts for their German name, "Raketenfrosch" (Rocket Frog). It is amazing how these tiny creatures manage to produce such loud calls.

*Dendrobates granuliferus* and *Phyllobates vittatus* have reportedly also been found at this location. In the Caiman Pond there are some adult Caimans which occasionally reproduce.

There are also several common snapping turtles (e.g. *Chelydra serpentina*), which can be attracted by some slight disturbance at the edge of the pond. The gecko *Gonatodes albogularis* is often found inside and on the outsides of the buildings, as well as in the garden and the forest.

A beautiful drive leads to the Rio Bonito. This river exhibits a rich variety of habitats: A number of banks of sand or gravel; sunny and shady places, either bare or abundantly covered with vegetation; fords and deep pools; and places covered in pieces of driftwood deposited there during floods. We find clutches of frog or toad eggs and many different tadpoles in the shallow water and, on the banks, many freshly metamorphosed froglets or tiny toads. Fallen trees and pieces of driftwood offer good basking and hiding places for juvenile Basiliscs, which take flight by running over the surface of the water. Iguanas deposit their eggs in the sandy banks, and colubrid snakes such as *Clelia*, *Leptophis* and *Pseustes* can occasionally be seen. We might even see a *Boa constrictor*. Even though they are not rare, mud turtles (*Kinosternon scorpioides* and *K. leucostomum*) are only rarely observed.

## Nocturnal trips

Since most amphibians and many reptiles of the rainforest are nocturnal, excursions during the night with a good flashlight are particularly interesting. Amphibians become active at night after the rains. On moonlit nights snakes - especially pit vipers - hide much more carefully than during a new moon, when it is completely dark.

The garden of our station is worthwhile investigating at night. Big *Bufo marinus* come out at this time, which we recognise from the kitchen and other rooms, where they are attracted in by cockroaches and other insects. In the last few years several small ponds have been created in the garden, which are now populated by Red-eyed leaf frogs (*Agalychnis callidryas*) and used by them for reproduction. During and after rainfall the males attract the females with their mat-



ing calls (short single or double “chucks”) from vegetation above the water. The clutches of white eggs are deposited on the upper or lower surfaces of leaves, from where the hatching tadpoles fall into the water after about a week. *Hyla microcephala* and *Physalaemus pustulosus* as well as *Hyla rosenbergi* and other species can be heard and observed around these small ponds.

The most common snakes, juveniles of *Bothrops asper*, are also present in the garden at night, and if you don't watch your step you might get an unpleasant surprise, especially if you are barefoot or wearing sandals.

The pond close to the caretaker's hut, among other places, is home to the Central American bullfrog *Leptodactylus pentadactylus*.

The little stream behind the station (the Quebrada Negra) and the Bird Trail are especially suitable for night trips. During wet weather there is a good chance of encountering frogs such as glass frogs and different Hylids. *Smilisca sila* exhibits a remarkable strategy against frog hunting bats: Several males call simultaneously, thus preventing the bats from locating them. Their voices even appear to start at exactly the same time. For the female *Smilisca sila*, however, this seems to pose no problem.

*Hyla rosenbergi* and *Smilisca phaeota* are very easy to spot, especially in comparison to small tree frog species such as *Hyla microcephala* and *H. ebraccata*. The green climbing toad *Bufo coniferus* is also conspicuous. At the more inaccessible places we can see sleeping young basilisks. Anoles also prefer thin branches for sleeping, which are out of reach for most snakes. With some luck, snake enthusiasts will not be



disappointed. One often finds the brown blunt-headed vine snake *Imantodes cenchoa* searching for sleeping anoles. This distinctive snake is very thin, and it can extend up to half of its body horizontally in order to bridge gaps between branches and detect its prey at the tips of twigs. On the ground, the most abundant snakes are *Bothrops* and the cat-eyed snake *Leptodeira*. There is also the chance of finding a coral snake. *Micrurus*, for example, are very agile and quick to seek shelter in the ground.

In the Quebrada Negra we have sometimes found young caimans originating from the Caiman Pond and using the creek for migration. Herpetologists should also keep an eye out for other animals, such as spiders, whip spiders, scorpions, sleeping birds and, of course, mammals. There are several other rewarding places for nocturnal trips, such as the ponds in the pasture opposite the station. During rainy periods, we can hear a chorus of frogs involving *Hyla microcephala* and *Physalaemus pustulosus*. The Quebrada Gamba also offers good opportunities for night-time herpetological adventures.

Tropical rainforests accommodate a large number of species, but the number of individuals in each is low. Many of them may also be easily overlooked. I have walked the Bird Trail at least 50 times. Once, during the day, I saw a *Bothriechis schlegelii*, and once at night I saw a *Bolitoglossa lignicolor*. This is the special appeal of herpetological excursions: Exciting surprises are always just around the corner. If your tour happens not to involve any special encounters, you can always hope that next time something amazing will turn up.

## Amphibians and reptiles of the Golfo Dulce region – An introduction

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With 174 species of amphibians and 222 species of reptiles, Costa Rica hosts a fascinating variety of frogs, salamanders, caecilians, lizards, snakes and turtles. The high herpetological diversity is based on the region's exceptional geographic situation. This tropical country shows the highest landscape variety of the Central American countries. The habitats where amphibians and reptiles are found reach from coastal regions such as moist lowland forests up to subalpine pluvial paramos. The geologically recent faunal interchange between South and North America has also added to its herpetological richness. Costa Rica has a long tradition of biological research and education, so its fauna and flora are well known. The herpetofauna of this Central American country is one of the best-studied in the world, and attracts large numbers of international scientists and tourists.

Encounters with large reptiles such as caimans, crocodiles, turtles and iguanas are herpetological highlights of any field excursion. Five of the eight marine turtles regularly visit the coasts of Costa Rica to lay their eggs. Mass arrivals (so-called *arrivadas*), with hundreds of adult females reaching specific beaches along the Atlantic or Pacific shore in a single night, belong to the most spectacular events in nature. Caimans and crocodiles are easily spotted with flashlights during the night due to their bright reflecting eye shine. Out of a total number of 133 snake species, only 18 terrestrial and one marine snake possess highly poisonous salivary glands. Tourists are often concerned about snakes and snake bites. In Costa Rica the death rate of those receiving treatment after being bitten by a poisonous

snake is around 3 %, but another 8 to 10 % are left with serious permanent damage. However, the chances of being bitten are low if reasonable precautions, such as wearing boots and watching where you place your hands and feet, are taken. As a tourist you are far more likely to be involved in a car accident than to be bitten by a snake. In his scientific article "A bite to remember", the ornithologist Robert K. Colwell reported that, during 450,000 hours of outdoor activities in OTS (Organization of Tropical Studies) field courses, not one snake bite occurred. The report, however, was written after he himself was bitten by an individual of *Bothrops asper*, the most common venomous snake in Costa Rica, known locally as *terciopelo*, or *fer-de-lance*.

Whereas most of the snakes are nocturnal and hardly ever seen, lizards are commonly encountered. Especially on sunny days, lizards can be seen feeding on the forest floor (teiid lizards), perching on bushes or trees (anolis lizards), or even running across water (Jesus Christ lizards). Male anolis lizards are often seen when demonstrating their conspicuous dewlap display. The species-specific coloured throat fan is often exposed when the highly territorial lizards are approached by a conspecific individual, or even a human observer. At night, one is most likely to see geckos feeding on insects attracted to artificial light in human settlements.

Due to the nocturnal activity of most frog species and the burrowing behaviour of many salamanders and all caecilians, it is most likely that the first amphibians encountered will be calling frogs. In an effort to signal to both rivals and mating partners, frogs have developed a wide repertoire of acoustic communication strategies. Only a few frog and toad calls can be onomatopoeically described as "croaking". The spectrum ranges from ox-like bellowing, plaintive grumbling and metallic hammering to whistling and squeaking. The arboreal tree frogs and glass frogs are exclusively nocturnal and

generally detected by homing in on calling individuals. The nocturnal leptodactylid frogs are extremely diverse in shape and size, and occur in almost all habitats suitable for amphibians. They are found in open areas such as pastures, as well as in leaf litter and trees. Amphibian foam nests are exclusively produced by terrestrial leptodactylid species, and are often found in pasture puddles, forest ponds and road ditches. With more than six hundred species worldwide, the leptodactylid genus *Eleutherodactylus* contains more species than any other genus found within the vertebrates. At present 43 species, which are not always easy to identify, are known from Costa Rica. The group is unique in its larval development, which occurs inside the egg. This makes the eggs independent of water sites, and they can be laid at any moist retreat on the forest floor or in a tree. Similar to the terrestrial leptodactylids, but with webbing between the toes, are the five Costa Rican representatives of the ranid frogs. Toads, especially members of the large cane toad *Bufo marinus*, are frequently found near human settlements. Other toads occurring in leaf litter are well camouflaged to mimic dry leaves. Some members of the dendrobatid frogs, commonly known as Poison dart frogs, are easily recognised by their bright colouration. All of them are small diurnal leaf-litter dwellers. Dendrobatid frogs lay their eggs in the leaf litter on land and, depending on the species, either the mother or the father carries the hatched larvae to an aquatic site. When larvae are brought to tiny water assemblages they are regularly egg fed by their visiting mother until they metamorphose.

Some frog species have received high public interest as their populations have unfortunately drastically declined or even gone extinct during recent years. The most striking and well-known case is that of the Golden toad *Bufo periglones*, which was discovered in 1964. It lived in a minute distribution range of the Monteverde Cloud Forest Preserve until 1989. Despite intensive surveys, not a single individual has been found since. Declines are known for most populations of the colourful toad genus *Atelopus* throughout its neotropical distribution range. Alarmingly, many other amphibian species have disappeared worldwide. Although dozens of sci-

entific papers report each year on declining amphibian populations, it is as yet unclear which of the many facts and theories (fungus disease, depletion of the ozone layer, general climate changes, increase of UV light, etc.) best explain their drastic decline. The amphibia web (<http://www.amphibiaweb.org>), a web site inspired by global amphibian declines, allows free access to information on amphibian biology and conservation and gives an update of the actual knowledge about threatened amphibian species. Additionally, it gives an excellent overview of the present number of amphibian species known throughout the world. Certainly, the numbers given in this booklet will differ from the actual data on the amphibia web. Systematics and taxonomy of amphibians (and reptiles) as well as their conservational status are undergoing rapid changes due to new findings in molecular biology and field work.

Salamanders, frequently found in high altitudes where they reach population densities of up to to 9000 individuals per hectare, are rarely encountered in the lowlands. All Costa Rican salamanders belong to the plethodontid salamanders, which are characterised by the absence of lungs. Some of the species (genus *Oedipina*) are extremely slender and fossorial, others (genus *Bolitoglossa*) are more robust and live in leaf litter, on rocky areas or on trees.

The limbless wormlike caecilians are the least-understood amphibians, and due to their secretive, fossorial behaviour little is known about the life history of the four Costa Rican species.

Most of the information given about the 30 amphibian and 42 reptile species of the Esquinas rainforest treated in this booklet is taken from the comprehensive and excellent book "The Amphibians and Reptiles of Costa Rica", written by the renowned US American herpetologist Jay M. Savage and published in 2002 by The University of Chicago Press. Anybody interested in detailed information on the herpetology of Costa Rica is highly recommended to take a look at this fascinating opus, which covers the subject in extraordinary breadth and depth ranging from zoogeography, morphology and systematics to ecology and behaviour.