

Amazon Adventure

In the late-1930s, **Harald Sioli**, who would later become a Director at the **Max Planck Institute for Limnology**, traveled to Brazil to study toads. He planned to stay for 18 months – and remained for 19 years. His research work in Amazonia made a decisive contribution to our understanding of tropical ecosystems and laid the foundation for the establishment of a Max Planck branch in Manaus.

TEXT **ELKE MAIER**

Finally, on the evening of September 3, 1938, the moment had arrived: the Hamburg-Süd line passenger steamer *Monte Rosa* slipped her moorings and departed her home port en route to the New World. Among those on board was 28-year-old zoologist Harald Sioli who was traveling to Brazil where, at the Instituto Biológico in São Paulo, he was to study the physiology of estivation in toads. His return ticket was undated – but he never dreamed that it would be 19 years before he was to see his homeland again.

In his youth, Harald Sioli had devoured the accounts related by the great scientific explorers. In 1934, shortly after completing his doctorate, an opportunity finally presented itself for him to follow in their footsteps. As an assistant at the Kaiser Wilhelm Society Institute of Hydrobiology in Plön, he was invited to accompany an expedition to Brazil to investigate the reservoirs in the dry northeast of the country with the scientist Friedrich Lenz.

It was on this occasion that Sioli became acquainted with the amphibian species *Bufo marinus*, the South American cane toad. In a rock fissure, he and his companion came upon estivating toads that were barely able to move. This strange phenomenon aroused his curiosity: How did the cold-blooded creatures manage, despite the high ambient temperature, to so reduce their energy consumption as to be able to survive the dry season by sleeping through it?

It was this engrossing question that the zoologist aimed to pursue on his second journey to Brazil. In the laboratory in São Paulo, he set about artificially inducing estivation in order to compare the toads' basic metabolic rate with that of their wide-awake conspecifics. But the objects of his research let him down: "The toads that I 'dried out' preferred to desiccate and die rather than estivate," Sioli complained. To resolve the problem, the young scientist decided to study sleeping toads, not in the laboratory, but in their natural habitat. And in any case, with the outbreak of war, his return to Germany was postponed indefinitely.

With a suitcase full of equipment, Harald Sioli boarded a coastal steamer in November 1939 and, for a second time, headed for the dry lands in the northeast of Brazil – where he was astonished to find that, against all the rules of climatology, it had rained. As a result, "The otherwise leafless vegetation was green, and the toads were unwilling to sleep while there was life-giving water to enjoy, leaping about and chanting their mating songs (...)."

After this further setback, Sioli gave up researching toads. Instead, he traveled northward: "I wanted to at least have seen the Amazon, the object of desire for so many naturalists," he wrote. In Belém, he encountered Swiss zoologist Gottfried Hagmann and journeyed with him for 900 kilometers along the Amazon onboard an old river steamer – a trip that was to shape his future: "When I saw the vast river with its shallow shorelines and endless forests, I suddenly knew: this is my country." And so he resolved, upon expiration of his contract with the Instituto Biológico in São Paulo, to return to the Amazon to study the limnology of the Earth's largest river system, which at that time was largely unknown.

In the years that followed, Harald Sioli journeyed throughout Amazonia. He observed, collected, took pictures and analyzed water samples. He also kept a meticulous journal to record his impressions. Neither the damp tropical heat nor the swarms of mosquitoes, malaria or dysentery could dissuade him from researching the natural history of this vast stretch of land. His interests rapidly extended beyond the waters to include the land-based flora and fauna, the geology and the climate.

Brazil's entry into the War in the fall of 1942 had a sudden and dramatic effect on Sioli's work. One night he was arrested, and af-

Evergreen forests – named Igapó – cover the floodplains that border the nutrient-poor blackwater rivers of Amazonia. This photo is a historic image taken by Harald Sioli.





Green laboratory: Harald Sioli in October 1948, working on hydrobiological material on the Rio Cupari.

ter a brief interlude in a police cell, he was taken to an internment camp south of Belém, where he spent a full three years. With no medical training, he nevertheless assisted the doctors and even took on the management of the camp hospital and pharmacy. In the process, he became familiar with almost all the tropical diseases prevalent in that hot and humid climate. "Even those years were not idly wasted," he recalled. He later made his own contribution to the study of bilharzia, a worm-borne disease transmitted via freshwater snails that act as a temporary host.

Harald Sioli spent the years following his release in September 1945 as a researcher at various institutes in Brazil, including the Instituto Nacional de Pesquisas da Amazônia (INPA), which

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Dr. Sioli expressed the view that anything that could not be harmonized with the balance of nature was to be avoided (...). European colonizers have thus far used European methods to cultivate overseas lands. The effects in some cases have been highly detrimental to the territories concerned. Science must counter the ruthless exploitation of the primeval forests with enlightened education.

had just recently been established in Manaus by Brazil's National Research Council. It was here, shortly before Christmas 1956, that a letter reached him from Germany that was to mark a turning point in his career.

It was written by Otto Hahn, the President of the Max Planck Society, offering Sioli the post of Managing Director of the Institute of Hydrobiology in Plön, later to become the Max Planck Institute for Limnology.

Sioli accepted, but the Amazon would not release its grip on him. He continued his tropical studies in northern Germany and, in 1966, succeeded in establishing his own department of tropical ecology. On their expeditions, he and his colleagues collected more and more pieces of the puzzle that they one day hoped to assemble into a comprehensive image of the ecosystems of Amazonia. In 1969, the Max Planck Society and the Brazilian National Re-

search Council signed an agreement that set the seal on cooperation between the institute in Plön, which is now the Max Planck Institute for Limnology, and the INPA in Manaus, thus creating new research opportunities for German scientists in Amazonia.

This cooperation continues to this day, having been taken over by the Max Planck Institute for Chemistry in Mainz in 2007 when work at the institute in Plön was refocused on evolutionary biology. Subjects that scientists from Meinrat Andreae's Department of Biogeochemistry in Mainz study in Manaus include the climatologically significant trace gases and the way these are exchanged between soil, vegetation and atmosphere.

Harald Sioli, too, gave some thought to the interrelationship between the biosphere and the atmosphere. In an interview in 1971, he prophesied that felling the tropical rainforests would lead to a rise in the concentration of carbon dioxide in the air. The Brazilian press promptly coined the phrase "green lungs of the planet." The journalists ignored Sioli's misconception that a forest in equal balance between the formation and decomposition of organic matter consumes just as much oxygen as it produces. Despite this, Sioli succeeded almost 40 years ago in raising public awareness of the importance of tropical forests for the climate.

Among his pioneering achievements was the scientific classification of the rivers of Amazonia. Using the terms whitewater, blackwater and clearwater, he studied the association between water quality and soil chemistry. From the extreme lack of nutrients in many rivers, he concluded that the soils in their catchment areas must also be nutrient-poor.

He explained the apparent paradox of lush forest on poor soil as a "closed, continuously repeated cycle in which the same nutrients circulate through countless organisms – plants, animals and microbes – in the Amazon forest ecosystem." The forest did not live from the soil, but simply on it. His conclusion that the region had only minimal agricultural potential earned him vehement criticism from Brazilian sources, as the government at the time had plans to open up the Amazon basin and introduce farming on a large scale.

After his retirement in 1978, Harald Sioli continued to travel to Brazil, on one occasion inaugurating a floating field station that was named after him. Research into tropical ecology continued at the Max Planck Institute for Limnology under the leadership of Wolfgang J. Junk. Harald Sioli, who would have celebrated his 100th birthday in August this year, died in 2004. With his holistic view of the Amazon region as a unified whole comprised of water, forest, soil and climate, he made a fundamental contribution to our understanding of tropical ecosystems. His life of adventure is documented in his extensive memoirs published in German under the title *Gelebtes, geliebtes Amazonien (Amazonia lived and loved)*. His research work was punctuated by numerous publications and awards. Only one thing eluded him: the secret of the summer-sleeping toads. ◀