Sarawak’s Earless Monitor Lizard
(Lanthanotus borneensis)

This is the 1878 illustration of the earless monitor from Steindacher’s original description. A photograph of the holotype in Vienna is shown for comparison. Tom Harrison, one of the first scientists to see a live specimen, claimed that the original illustration of this lizard, depicting it with a “piggy little eye” was misleading. Judge for yourself.

One of the world’s rarest and most evolutionarily intriguing reptiles becomes a little better known.
by Robert George Sprackland, Ph.D.

Herpetology has come a long way since Francois Daubin wrote the first purely herpetological text in 1802. Reptiles and amphibians have proven to be excellent model animals for studying most aspects of general zoology, from reproduction and development to anatomy and behavior.

Published information about herpetology has grown, and pertinent papers now find copious avenues for publication in hundreds of journals, newsletters, yearbooks and magazines. On the other hand, some species leave a record based on the spotty observations made now and again over a great span of time, in which case the literature may be obscure and out of print, leaving modern researchers scrambling to find clues to the nature of the animal.

A case in point is the earless monitor lizard from Borneo, *Lanthanotus borneensis* ("hidden ear from Borneo") was described in 1878 by Austrian zoologist Franz Steindachner based on a single large specimen that remains remarkably well preserved at the Naturhistorisches Museum in Vienna. In the intervening years, we have learned a considerable amount of detail about the anatomy of *Lanthanotus*, a bit about its captive husbandry and far less about its natural history.

For many years, *Lanthanotus* was considered an odd relative of the Gila monster, and later was believed a primitive ancestor to snakes. Its apparent rarity makes the availability of even small tissue samples, for molecular analysis, difficult. Recently, new specimens have begun to show up in collections, but with exorbitant price tags that make private ownership very difficult. Earless monitors are seen as difficult to maintain in captivity, yet specimens collected in the 1960s lived for nearly 18 years under crude conditions.

In this article, *Lanthanotus borneensis* will be examined in light of the past 127 years of observation.

Because of superficial anatomical similarities between the American beaded lizards and the Bornean earless monitor, all were long considered members of the same family, the *Helodermatidae*. This is a Gila monster, *Heloderma suspectum*.

Additionally, hundreds of books are available, with dozens of new titles coming out each year.

This information deluge has forced herpetologists to become specialists, if for no other reason because it is humanly impossible to keep up with all the literature and still have time to conduct research (and teach, and write for grants and talk to your spouse...). Despite this information saturation, relatively few syntheses are published on given species (though for excellent examples, see any of Auffenberg’s works on Komodo, Gray’s and Bengal monitor lizards), leaving a considerable chore for the person trying to get solid data when, for example, a rare species turns up after a long hiatus. In some cases, as when the first live specimen of the rare Sumatran tree agama, *Harpesaulus (=Harpsaurus) becarrii*, was discovered in the 1980s, no prior literature record existed; the species had been known for about 100 years from just a handful of preserved specimens.
Discovery and Description

Steindachner immediately recognized his new species as being quite different from any other known Bornean lizard—in fact, he was sure that Lanthanotus was distinct enough from any lizard to justify placing it in its own family, the Lanthanotidae. The body and tail are subcylindrical, covered with a heterogeneous mix of large and small scaly tubercles. The larger tubercles form longitudinal rows that begin on the neck and extend the length of the tail. Four or five large tubercles run along the temples. The head is flat, blunt and covered with tiny scales. Their tiny eyelids have translucent white “windows,” and the tiner nostrils are directed dorsally. The tongue is forked, as it is in monitors and tegus, and the single specimen was preserved with the mouth forming a wry smile. There is no sign of an external ear opening, and Steindachner used this character to give his new genus its name. The legs of Lanthanotus are short and stocky, but each terminates in five well-developed and clawed digits. The holotype measures about 17 inches (435 millimeters) overall, but a record specimen measuring 20 inches was collected in the mid-1960s. We have since learned that a broken tail does not regenerate.

In color, Lanthanotus is orange-brown dorsally and beneath the head, lacking any pattern of spots or bands. The belly is mottled with rusty orange and ochre. Overall, the average person would probably see an earless monitor, shrug, and move on, for it is not what one would normally consider an impressive animal.

Despite intense interest in Lanthanotus, it remains a poorly understood species. It is not, however, as rare as some accounts suggest, for most major natural history museums have specimens. Nevertheless, it is a hard animal to find, and the frustration of several generations of seekers has added to the lizard’s mystique.

Relationships: Fossils and Snakes

Ever since “biodiversity” replaced “ecology” as the new life-science buzzword, there have been many questions about the value of making inventories of living things and studying rare or ob-
secure creatures. However, such basic research is the foundation upon which other studies must be built, for applied sciences often are inspired by incidental observations made by scientists who are interested in nature for its own sake. Thus, the basic science of taxonomy lead pharmacists from a rare California tree that possesses a chemical that treats some cancers to a distant, but related tree in Europe, which is more common and contains much higher quantities of the life-saving substance. We do not always know where “mere” observation

**WHAT IS A FAMILY?**

A family represents a cluster of similar genera, which in turn represent clusters of closely related species. However, biologists are far from concordant about what a species is, so the subject of families becomes rather ethereal. A major point of confusion (and antipathy) revolves around the difference between a phylogeny (q.v.) and a classification.

A phylogeny attempts to show the pattern of relationships between and among living things, and as such is really a chart of the origins of species. In contrast, a classification is an attempt to organize such data so that it is retrievable for further study. Ideally, the classification reflects phylogeny, so that as species clusters become larger new “families” are invented to collect them together. There is no such thing in nature as a genus or family, but they serve as sophisticated call numbers for the library of living things.

Is *Lanthanotus* to be included in the Varanidae or the Lanthanotidae? It really doesn’t matter. Its phylogenetic position places it between beaded lizards and monitors, so wherever it is placed, it should be with its closest relatives (it is generally held to be a bit more monitorlike than beaded lizardlike). The hierarchical system of family and higher names is often so subjective that many biologists are suggesting they be discarded altogether.

and luck will bring us. In some cases, they may lead to a better understanding of ancestors.

Steindachner’s prize did not become an obscure footnote like many other species named from a lone specimen. A few years after the Austrian description of the lizard, Belgian herpetologist George Albert Boulenger began working on a catalogue of lizards for the British Museum (Natural History). The publication was intended to update earlier works listing the museum’s holdings, but Boulenger decided to list all the known species in the world, with the request that species listed but not represented in the museum should be considered on the museum’s “wish list.” Boulenger hoped that travelers and museum colleagues would send specimens to fill in the gaps.

When Boulenger had to catalogue *Lanthanotus*, he was unsure how to include it. Was Steindachner’s family to be recog-

paper was ambiguous, and he left *Lanthanotus* with Heloderma. A generation of zoogeographers would use this odd example of Asian-American distribution to support and refute theories of land bridges and drifting continents. As recently as 1946, Hobart Smith would note that a third venomous lizard species might inhabit Borneo.

The picture changed drastically in 1954 when Samuel McDowell and Charles Bogert dissected the only American (known at the time) specimen of *Lanthanotus* and compared its anatomy with a wide variety of other lizards. Bogert had been working on a major study of beaded lizards (published in 1960 with R.M. del Campo as *The Gila Monster and its Allies*, reprinted by the Society for the Study of Amphibians and Reptiles), and resolving the relationships of *Heloderma* with *Lanthanotus* was an important part of that work. The footnote study became a major mono-
Lanthanotus, it was quickly demonstrated, lacked grooved teeth or venom glands. It was superficially beaded-lizardlike, but this was due to evolutionary convergence. In fact, the two genera lived in quite different habitats, and the convergence was shown to be less remarkable than anticipated. The Bornean enigma was compared with the other lizard families, and obviously belonged within the Anguimorphan lineage, the group that includes beaded lizards, monitors, alligator lizards, xenosaurs and California legless lizards.

Furthermore, its anatomy placed Lanthanotus square between beaded lizards and monitors (the Platykona, now called Varanoidae), and McDowell and Bogert suggested that it just might be a survivor of the otherwise extinct Aigia-losaur group (an idea later discarded). The real innovation, however, was the suggestion that Lanthanotus possessed the various features necessary for a modified subterranean existence, including reduced family, Lanthanotidae, as proposed by its describer in 1878.

Lanthanotus had been thrust into the limelight of evolutionary biology's search for the origins of snakes, and the Bornean lizard would be fixed in that role for decades. The biggest problem for students of snake origins is that snakes make lousy fossils. The few decent fossils are relatively recent Tertiary specimens less than 40 million years old, but snakes are known to have lived side-by-side with Mesozoic animals at least 80 million years ago. Those older fossils are fragmentary and lack the telltale bones that would help answer evolutionary questions. Deprived of such direct evidence, scientists turn to available materials to look for probable (or at least possible) ancestors. By 1954, the earless monitor seemed to answer the job description for such a relative. Consequently, the subsequent fame, interest and research into Lanthanotus since then has largely revolved around the presumed snake-earless monitor relationship.

**PHYLGENETIC METHODS**

A phylogeny is really nothing more frightening than a genealogy of species, purporting to show the relationships between ancestors and descendants. In reality, we cannot be certain of most ancestors, though we can closely predict the group that is most likely ancestral to another, later species (and we do know that descendants did have ancestors).

To do this, evolutionary biologists employ a comparative method that examines individual characters, such as anatomy, genetics or DNA sequences, that are most likely part of an ancestor-descendant sequence. Such shared characters are called homologies, or synapomorphies. The wings of birds and bats are homologous, being formed from the same embryonic tissues of bones (five fingers) and muscles; the bae's wing is not homologous, however, as it derives from quite different back tissues (a situation called analogy).

It is never simple to determine if characters are homologous. Consider the reptilian forked tongue. Monitors, earless monitors, beaded lizards, tegus and snakes all possess this character, but only the first three seem to share it from a common ancestor, while tegus and snakes may have "invented" their tongues independently.

As zoologists learn more about developmental biology, new homologies are discovered, analogies discarded and phylogenies will improve. With each new breakthrough, we get a better view of the history of life through time.

eyes, no external ear, recurved teeth, a forked tongue and elongated body, that seemed to be indicative of an ancestor to snakes. The Lanthanotus-snake link replaced the heloderm link, and has predominated in earless monitor studies to this day (with, not surprisingly, little consensus at this time). The unusual position of Lanthanotus warranted its own

The bulk of those ensuing studies corroborated both the unique familial status and snake-like morphology of Lanthanotus. But in the late 1970s, herpetology was embracing a new tool for studying relationships among organisms, a method called phylogenetic systematics, or cladistics. The method had been proposed by German entomolo-
Some contemporary herpetologists have cited the many evolutionarily related similarities (synapomorphies) between the earless monitor and true monitors (Varanus) and combined the lizards together into the family Varanidae. Others maintain that the Lanthanotidae remains justified. So long as the relationships are understood, agreement on family rank is really of minor importance.

Life History
Lanthanotus borneensis, the only known living species in its group, is widely distributed in Sarawak along the northwest third of Borneo, and all museum records for the lizard come from Sarawak. More recently, reports have come from Indonesia that specimens are being found in the border country of Kalimantan (the Indonesian bulk of Borneo) near Sarawak. These reports have not been confirmed, but they are not improbable. Lanthanotus is probably not rare, just rarely collected. Most major museums have at least one specimen, while many have three or more, and “new” specimens are still being discovered.

While examining lizards at the Royal Museum of Scotland in Edinburgh in 1994, I chanced upon such a lizard on display in the reptile gallery. It had been purchased some 90 years ago from a London animal dealer and had long been thought to be only a cast! It seems that rare specimens are still likely to turn up in the most unexpected places.

At times, such as during periodic spring floods, several specimens may turn up in traps in a single village. The relative rarity of the species probably...
The island of Borneo is divided among four nations, Sabah, Brunei, Indonesian Kalimantan and Malaysian Sarawak. The only confirmed locality records for *Lanthanotus* are from riverine areas of Sarawak (lightened area on map), though recent reports have claimed specimens originating from Kalimantan. The latter reports, concerning specimens collected by an Indonesian animal dealer and subsequently sold to an American zoo, have yet to be confirmed.
reflects three causes. The first is lack of economic importance. An earless monitor doesn’t provide much of a meal, nor are they plentiful enough to be a reliable food source. They are useless for fashioning leather goods. Consequently, they may go unnoticed even where they might be common. Despite large rewards for the capture of specimens, western researchers often reported that they had failed to find a local who had even seen a specimen. One herpetologist suggested that earless monitors had not been brought in to the Sarawak Museum because the illustration with the reward-for-capture notice, a copy of Steindachner’s 1878 illustration, did not resemble the lizard closely enough for local people to recognize it. Actually, Steindachner’s artist did an excellent job; the preparator, however, may have posed the specimen in a more dynamic pose than ever seen in a live specimen.

Second, they are fossorial and semi-aquatic, habits that make any search laborious, and incidental discovery unlikely. Most of the roughly 100 known specimens were collected serendipitously during seasonal flooding, when lizards would be washed out of the ground and caught in baskets and fish traps. During the rest of the time, they are probably deep underground in burrows, for they are rarely turned over when gardens are tilled. So far as I can tell, no one has succeeded in deliberately searching for and finding a live Lanthanotus.

Finally, Sarawak is not a country that permits commercial export of live animals. For most of this century, limited scientific collecting has been permitted, but not the broader, economy-linked collecting that would make hunting and selling of the lizards valuable to local people. Commercial collecting would probably have resulted in the discovery of many more specimens over the years, and would most likely be the only way to motivate a lot of people to seek an otherwise valueless animal. Fortunately for Sarawak’s unusual fauna, such collecting virtually ceased by the start of World War I. Were it not for the voluminous logging currently deforesting Sarawak, its protection and research policy over wildlife would be most admirable.
The life of Lanthanotus is generally well known, but many details are still missing. Once basic details of husbandry were worked out (around 1963), subsequent captives in competent hands seemed to thrive. It is known that the lizard is a burrower that prefers moist soil near river banks. The blunt snout is a functional digging tool, and the tiny legs fold against the body, providing little resistance. The lizard also can swim, and may remain submerged for at least an hour, during which time the eyes are covered by the translucent lower lid, and valves tightly constrict to shut the nostrils. Specimens have been observed to initiate a kind of metabolic reduction, in which breathing and movement cease for as long as a day. To the uninitiated, this state may be taken for coma or death. A similar ability has been observed in the Chinese crocodile lizard, Sphenodon punctatus, which is similar in appearance and, to the degree that it is also semiaquatic, habits. Such an ability is beneficial to an animal that lives in burrows that can occasionally flood with water. Reduced breathing and heartbeat can make it possible to survive until waters recede or escape is possible. Earless monitors have been induced to climb, aided by a highlyprehensile tail, but have not been observed to do so voluntarily.

The natural diet is unknown. Captives readily accept fish fillets, earthworms and an occasional beaten egg, and have been known to subsist on this diet, with no ill effects, for more than a decade.

Gender can be determined by the shape of the jaw. Males have blunt, rectangular jaws (as viewed ventrally), while females have acute, pointed jaws. Males are also thicker at the tail base, while in females the tail becomes distinctly narrower just posterior to the hips.

Reproduction of earless monitors may involve copulation while in the water and may last for an hour or more. Eggs, which were reported as early as 1912, have not been laid by captives, but have been taken from preserved specimens and number three or four. They are medium-sized (1.25 inches long), oval and leathery-shelled.

Captive earless monitors require little leg room, because they are rarely active. Robert Mertens kept a pair of these lizards for many years in a terrarium about the size of a 10-gallon aquarium. The lizards prefer a deep substrate of moist (not wet) potting soil and soft moss in a consistency that allows burrowing. A large dish of water is essential, and the lizards regularly swim, or remain quietly submerged. Daytime air temperature should be kept between 78 and 85 degrees Fahrenheit, dropping to 70 to 75 degrees at night. Indirect, full-spectrum lighting is recommended, with a fluorescent tube kept over the area with the water dish. Animals typically refuse food the first month or so, but once they begin feeding should be offered food three times per week. There is no report of problems keeping several specimens together.

Acknowledgements

My research into the natural history of this unusual lizard would have been impossible without the help of three curators of the Sarawak Museum, the late Tom Harrison, the late Benedict Sandin and Lucas Chin. The late Robert Mertens also corroborated hypotheses from his observations of captive Lanthanotus. This article is dedicated to the memory of my father, Joseph Francis Smith (1919-1994), in recognition for his continued support and encouragement of my study of this enigmatic animal.

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RIGHT: The earless monitor is a burrowing species that inhabits moist environments, which may be part of the reason it is so elusive to humans.

LEFT: Lanthanotus borneensis is a drab lizard that would easily escape the notice of anyone but a specialist.
References


