# NEW SPECIES 2024

## THE FRESHWATER FISH SPECIES DESCRIBED IN 2024

FFSG Freshwater Fish Specialist Group | Part of IUCN SSC

CALIFORNIA ACADEMY OF SCIENCES

Shoal

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SHOAL would like to thank Felipe Alonso, Flávio Lima, George M.T. Mattox, Heok Hee NG, Jairo Arroyave, Jiajun Zhou, Jörg Freyhof, Riccardo Novaga, Tao Luo, and Valéria N. Machado for their support in the writing of this report.

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Cover image: *Opsariichthys iridescens* © Jiajun Zhou
Above: Gölbasi, Türkiye © Jörg Freyhof
Back image: Tameslouht Morocco © Jörg Freyhof

SHOAL is the global initiative to halt extinctions and recover populations of the most threatened freshwater species around the world. It is hosted by Synchronicity Earth and Re:wild.
Learn more about their work at shoalconservation.org.

The IUCN SSC FFSG has a mission of achieving conservation and sustainable use of freshwater fishes and their habitats through generating and disseminating sound scientific knowledge, creating widespread awareness of their values and influencing decision making processes at all levels.

Eschmeyer's Catalog of Fishes database was begun in the 1980s at the California Academy of Sciences by Bill Eschmeyer. It is the primary resource for current knowledge on the kinds of fishes, and is updated continuously as new species are described[1].

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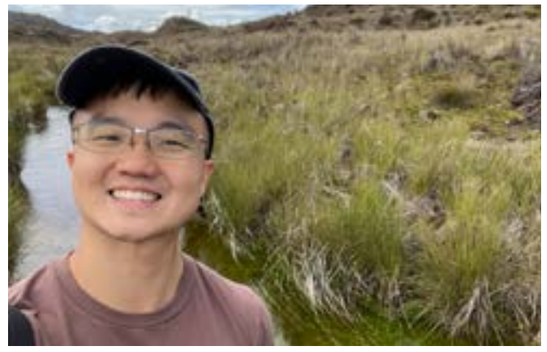
# FOREWORD:
## Chouly Ou and Nathaniel NG



Living as we do in dark times of widespread environmental alteration and ecosystem destruction, when reports of species declines outstrip that of population recoveries, new species discoveries shine a small but optimistic light: an indication that our embattled Earth yet harbours wonder and discovery, and a bracing reminder of the continued need to explore, observe, and protect the priceless biodiversity that sustain us all.

In the 2024 edition of SHOAL's New Species report, we shine a light on new freshwater fishes weird, wonderful, and winsome. Taxonomy, by defining and characterising species, provides the most fundamental basis of biological understanding – the starting blocks from which subsequent scientific investigation can launch. In this report we showcase the results of the unflagging passion of freshwater fish taxonomists all over the world, who with myriad morphological and genetic techniques illuminate the uniqueness of each new species; who simultaneously highlight differences and celebrate similarities, and in doing so weave new threads into the rich and varied tapestry of the planet's Tree of Life.

These recent fish species discoveries reveal not only how much of Earth's biodiversity remains unknown but also underscore the importance of protecting specialised, often-overlooked ecosystems such as subterranean caves, ephemeral wetlands, and isolated streams. Their unique adaptations reflect many years of evolution, yet human-driven threats now place many at high risk of extinction.

Just as taxonomic discovery opens the doors to later scientific research and understanding, we hope that getting to know the stories of each of these new freshwater fish species will help strengthen the desire to protect them and the habitats they need to survive. Sure, conservation news can sometimes be depressing; but there yet remains so much biological richness that is worth fighting for.

Chouly and Nat,

Chouly Ou

Nathaniel NG

# SUMMARY

## 260 FRESHWATER FISH SPECIES DESCRIBED IN 2024

## COMPARED WITH 243 DESCRIBED IN 2023

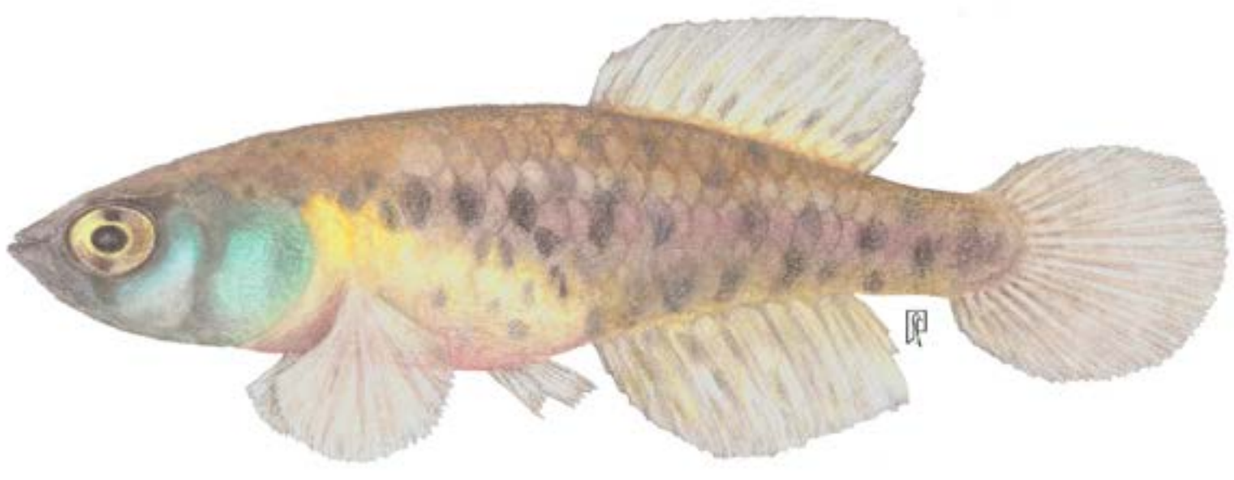
## 201 IN 2022 and 212 IN 2021

New Species 2024, the fourth of SHOAL's annual New Species reports, celebrates the wonder of discovery and reminds us that there is still plenty of biodiversity on our planet yet to be discovered and described. An incredible 260 freshwater fish species were described throughout 2024 – the most since SHOAL started these reports in 2021 – highlighting the boundless diversity of life in aquatic ecosystems. From shimmering rivers and tranquil lakes to shadowy caves and fast-flowing streams, this year's discoveries reveal the resilience, adaptability, and beauty of freshwater fishes across the globe.

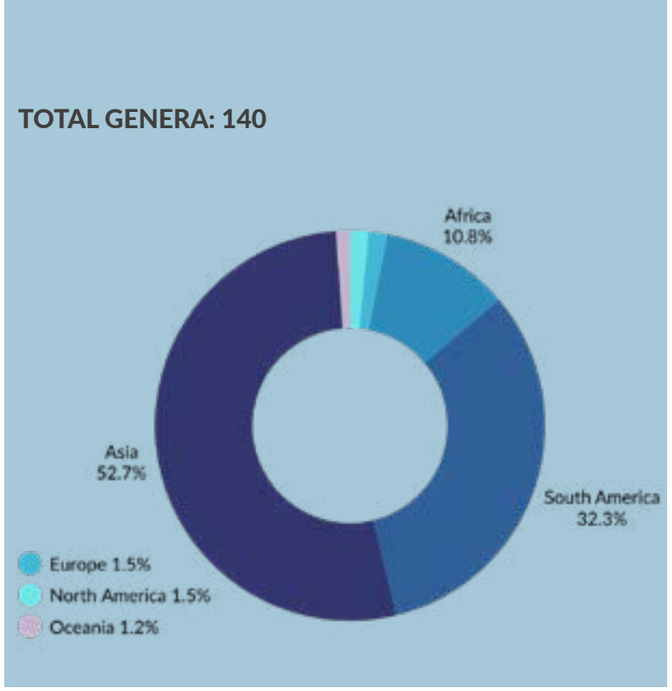
Among the standout species described in 2024 is *Ophisternon berlini*, a blind eel uniquely adapted to life in the mud – that's right, it lives not in water, but in damp earth. The species is so bizarre, you could be forgiven for thinking it's not even a fish. Its elongated body and sensory adaptations speak to the fascinating evolutionary paths that life takes in extreme environments.

The killifish *Argolebias adrianae* was discovered in a tiny temporary pool close to a touristy path near the stunning Iguazú Falls in Argentina. Imagine the tourists' surprise when they watched a new species discovery in real time! Like all killifish, *Argolebias adrianae* has an ephemeral lifestyle, reminding us of the transient beauty of nature.

Two new pacu species – close relatives of the piranha – from South America, the Lord Sauron Pacu and



*Argolebias adrianae* illustration © Samanta Vanesa Faiad




Aylan's Pacu *(Myloplus sauron* and *M. aylan)*, bear a strong vertical stripe down their flank, leading researchers to name the former after the all-seeing Eye of Sauron, the symbol of the Dark Lord Sauron in The Lord of the Rings trilogy.

The diminutive *Priocharax conwayi* and *Priocharax phasma* size up at less than 11mm long, making them among the tiniest of freshwater fishes, and adding to our understanding of miniturised, paedomorphic species in aquatics environments.

This year's report also unveils exciting new genera, with perhaps the most intriguing discovery of 2024 coming from the karst landscapes of Asia, where the newly described *Karstsinnectes* genus has emerged as a significant find. Comprising *Karstsinnectes cehengensis, Karstsinnectes daxinensis,* and *Karstsinnectes longzhouensis*, these cavefish exemplify the incredible adaptations necessary for survival in lightless environments, from reduced pigmentation to heightened sensory capabilities.

While these discoveries are a cause for celebration, they also serve as a reminder of the fragility of freshwater ecosystems. Many of these species inhabit environments under intense pressure from human activities, including habitat destruction, pollution, and climate change. Without urgent conservation efforts, these newly described fishes—and the ecosystems they represent—may face an uncertain future.

The SHOAL New Species 2024 report is more than a catalogue of scientific breakthroughs; it is a call to action. By shining a light on these remarkable species, the report underscores the critical importance of protecting freshwater habitats and the life they sustain. These newly discovered fishes are ambassadors for their ecosystems, reminding us of the interconnectedness of all life and the need for global collaboration to safeguard biodiversity.

Dive into the pages of this year's report to explore the wonders of freshwater life. From the intricate details of tiny tetras to the grandeur of a boldly patterned pacu, each species tells a story of adaptation, survival, and discovery. Together, they paint a vivid picture of the richness of freshwater biodiversity and the urgent need to conserve it for future generations.

# Conway's Miniature Tetra & Miniature Ghost Tetra

**Latin name:** *Priocharax conwayi* & *Priocharax phasma*[2]

**Researchers:** George M.T. Mattox, Flávio C. T. Lima, Ralf Britz, Camila S. Souza, Claudio Oliveira

**Location:** Rio Tapajós, Igarapé do Henrique, Rio Maró, affluent of Rio Arapiuns, and Lago Santana, Ilha de Marimarituba, Santarém, PA, Brazil

**Highlight:** *Priocharax* may be the most paedomorphic fish in South America. Both species are the size of a pencil tip, and Priocharax phasma is transparent – it's remarkable the researchers found it!


*Priocharax* is a genus with 10 species, with all but three species endemic to Brazil. The genus is characterised by its paedomorphic features. Paedomorphy refers to the retention of larval or juvenile characteristics in adulthood. For example, paedomorphy in humans might look like an adult having no hair on their body, or some of their skull sutures remaining unfused. But for some species, paedomorphy is part of what makes them unique and has become a characteristic trait. A famous and well-loved example is the axolotl *(Ambystoma mexicanum)*, a species of salamander that remains in its aquatic larval state into adulthood, keeping its distinctive fluffy gills and reproducing in this form. This is comparable to a frog remaining as a tadpole throughout the duration of its life. It's a fascinating trait that is still widely unexplained, but has a range of potential evolutionary drivers.

For *Priocharax*, their paedomorphic features are what make them so unique, and characterise the genus. They include:

- Having a reduced laterosensory system: fish quite literally have a sixth sense: their lateral system, which is used for sensing vibrations. The lateral line organ is often visible as a faint line of pored scales running along the flank of the body. The rate of development of senses during the larval stage is highly variable between species, but for *Priocharax*, it never fully develops.

- Reduced number of fin rays: bony fishes like tetras have rays made of bone in their fins. If you look at a fish skeleton, you will see lots of tiny bones in their caudal, pectoral, anal, and dorsal fins. But if you were to look at the skeleton of a *Priocharax* species, you would struggle to see any trace of its pectoral fins, because it is entirely rayless! The development of fin rays is usually a marker of the end of a fish's larval stage, but not for *Priocharax*.

- Reduced ossification of parts of the skull: ossification refers to the building of bone. Similar to how the skull of human babies fuse over time, this happens across a wide range of vertebrates.

George Mattox from Universidade Federal de São Carlos, Sorocaba, Brazil, and lead author of the paper describing the two new *Priocharax* species explained to SHOAL that this genus is exceptionally difficult to work with. At less than 11mm long, and with limited identifiable characteristics visible to the naked eye, he suspects it is likely these species have been collected and observed before, but there was simply not enough interest or expertise to describe them. Dissection is essential for identification and description of *Priocharax* species, but trying to dissect an animal whose body length is the size of the tip of a pencil is not an easy task. Thankfully, Ralf Britz, a specialist in the dissection of miniature species, was on hand on support. Mattox partnered with Flávio Lima (see Spotlight on researchers, p.24), who had visited the sites where *Priocharax* had been found in 2014. They ventured to the type locality by boat up one of the small tributaries of the Tapajós, which took 12-14 hours.

On arrival, the team jumped into to the water to catch the small fish, which they would later discover included a new species: *Priocharax conway*i. But for the other new species, its discovery was immediately obvious. Despite *Priocharax* being notoriously hard to identify without dissection, the Miniature Ghost Tetra *(Priocharax phasma)* is one of the only species from the genus that is identifiable by eye: its name refers to its almost ghost-like appearance, because it is completely transparent.

We still know relatively little about these tiny gems, but Mattox suspects that if they were assessed for the Red List, they would all likely be categorised as Critically Endangered due to being highly endemic, occupying only one locality.

The tiny worlds of *Priocharax* are still being unravelled, and we are excited to learn about the lengths taxonomists like Mattox will go to learn more about a group so easily overlooked.


*Priocharax phasma* © George Mattox


*Priocharax conwayi* © George Mattox

# Berlin's Bloodworm Eel

**Latin name:** *Ophisternon berlini*[3]

**Researchers:** Jairo Arroyave, Arturo Angulo, Adán Fernando Mar-Silva & Melanie L. J. Stiassny

**Location:** Las Brisas Nature Reserve, Costa Rica

**Highlight:** One of only a handful of fishes worldwide that lives entirely within subsoil, and not in cave systems or open water. It is a very rare, true endogean troglomorph.


In 2021, during routine excavation work at Las Brisas Nature Reserve in Costa Rica, workers unearthed an unusual, eel-like fish from the muddy subsoil. The discovery immediately piqued the curiosity of the reserve's owner, Erick Berlin, who suspected the specimens were something unique. He sent them to Dr. Arturo Angulo, an ichthyologist at the Universidad de Costa Rica, who recognised that they likely represented a new species.

Following the initial discovery, Dr. Angulo and his colleagues conducted expeditions to Las Brisas in 2022, during which they collected additional specimens. Recognising the significance of the find, Angulo reached out to Dr. Jairo Arroyave, a researcher familiar with blind, depigmented swamp eels from Mexico's Yucatán Peninsula. The two scientists, along with postdoctoral researcher Adan Fernando Mar-Silva from the Universidad Nacional Autónoma de México and renowned fish anatomist Dr. Melanie Stiassny from the American Museum of Natural History, collaborated to describe the species using morphological and molecular data. The final study, published in October 2024, confirmed that *O. berlini* was a new species, marking the seventh known member of the *Ophisternon* genus.

What makes *Ophisternon berlini* truly remarkable is its habitat. Unlike most troglomorphic (cave-adapted) fishes, which inhabit caves, *O. berlini* is endogean, meaning it lives within the subsoil rather than in cave systems or open water. Such an ecological strategy is exceptionally rare among fishes, with only a handful of species worldwide known to be obligate endogean dwellers. Typically, swamp eels (Synbranchidae) exhibit a capacity for burrowing into mud as a survival strategy, but *O. berlini* appears to be a permanent resident of its underground habitat.

The fish was found buried approximately 50–75 cm beneath the swamp's surface. No direct connections to nearby water bodies were observed, suggesting that it does not rely on surface water to survive. This unique adaptation raises questions about its feeding ecology and reproductive behaviours—two aspects of its life history that remain unknown.

Like many other troglomorphic species, *O. berlini* exhibits a suite of regressive traits associated with life in perpetual darkness. It lacks pigmentation, rendering it nearly translucent, and is completely blind. These traits are common among fishes that have adapted to environments where vision is unnecessary. In addition to these reductions, *O. berlini* possesses an elongated body, a characteristic feature of swamp eels that allows for efficient movement through confined spaces.

One of the more intriguing findings in the study was the species' number of precaudal vertebrae being much larger than its closest congeners. This may be related to trophic specialisation, allowing for a longer abdominal cavity and digestive system count. Additionally, the species has larger, more robust teeth than other members of *Ophisternon*, which suggests a specialised diet.

However, because no direct observations of feeding behaviour exist, the exact nature of its prey remains speculative. It is likely that *O. berlini* feeds on micro-invertebrates that share its muddy habitat. The genus *Ophisternon* comprises seven species distributed across various tropical and subtropical regions:

- *O. aenigmaticum* (Middle America)
- *O. infernale* (Middle America)
- *O. berlini* (Middle America)
- *O. bengalense* (South and Southeast Asia)
- *O. candidum* (Western Australia)
- *O. gutturale* (Northern Australia and Papua New Guinea)
- *O. afrum* (West Africa)

Among these, only three (*O. infernale, O. candidum, and O. berlini*) are troglomorphic, exhibiting

*Ophisternon berlini* © Jairo Arroyave

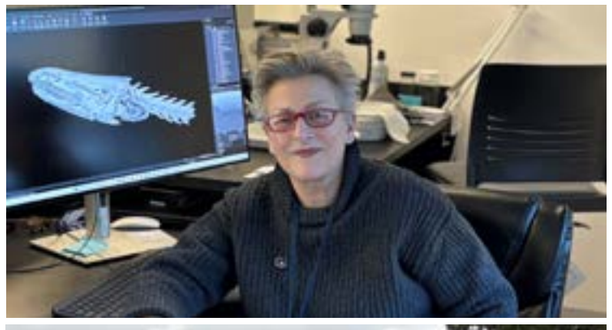
extreme adaptations to dark environments. *O. berlini* is unique in that it is the only endogean species in the genus and is also the smallest, reaching sexual maturity at just 117 mm in length. In contrast, other *Ophisternon* species, such as *O. aenigmaticum*, can grow to over a meter in length.

Despite its unique adaptations, *O. berlini* may already face conservation challenges. The species has an extremely limited known distribution, confined to a swamp measuring approximately 500m x 500m within Las Brisas Nature Reserve. This protected area is surrounded by heavily anthropised landscapes dominated by agriculture. While the reserve itself provides a degree of protection, the fish's reliance on such a restricted and isolated habitat raises concerns about its vulnerability. One of the key criteria for assessing species on the IUCN Red List is range size. Given its highly localised distribution, *O. berlini* could be classified as threatened under IUCN criteria. Although no immediate threats are evident, any habitat alterations—such as changes in hydrology or land use—could have significant consequences for the species. Future research will be essential to determine population size, reproductive behaviours, and habitat requirements to inform conservation efforts.

The discovery of *Ophisternon berlini* underscores the importance of continued exploration of subterranean and endogean ecosystems. Many aspects of the species' life history remain a mystery, including its reproductive strategies, feeding ecology, and population dynamics. Given that the species was discovered only recently, researchers like Dr. Angulo and Dr. Arroyave are eager to conduct further studies to unravel the biology of this enigmatic eel.

Additional sampling efforts and environmental DNA (eDNA) studies may help determine whether *O. berlini* exists beyond the known range within Las Brisas. If the species is a true micro-endemic, conservation measures should be prioritised to ensure its survival. Moreover, understanding its adaptations to an endogean lifestyle could provide valuable insights into evolutionary processes that shape life in extreme environments.

The species represents an extraordinary addition to the known diversity of subterranean fishes. As one of the very few endogean swamp eels, it offers a rare glimpse into the adaptive potential of fishes living in dark, nutrient-poor habitats. However, its restricted distribution and uncertain conservation status highlight the need for further research and conservation planning. As scientists continue to investigate this remarkable species, it stands as a testament to the hidden biodiversity that remains to be uncovered in the world's overlooked and understudied ecosystems.

Images:
This page: *Ophisternon berlini* habitat © Jairo Arroyave
Researchers (left):
Top: Jairo Arroyave © Jairo Arroyave
Middle top: Arturo Angulo © Arturo Angulo
Middle below: Melanie Stiassny © Pedro BragancaBottom: Adan Fernando Mar Silva © Adan Fernando Mar Silva

# SPOTLIGHT ON RESEARCHERS:
# DR. HEOK HEE NG

With 262 species described between 1995 and 2019, Heok Hee is the fifth most prolific fish taxonomist in history. He is an independent researcher loosely affiliated with the Lee Kong Chian Natural History Museum, Singapore. He is also a member of the Freshwater Fish Specialist Group, Species Survival Commission.

**What year were your first freshwater fish descriptions and discoveries?**

My first discovery was made in 1994 (although the results were only published the next year), although I was a second-year undergraduate at that time and was guided to the discovery by my mentors.

**What inspires you about discovering and describing new species**

I am actually less interested in discovering new species now, and prefer to resolve taxonomic problems (e.g., in resolving the usage of wrong names or misidentifiacations). That said, it is still rewarding to continue documenting catfish diversity because we are far from understanding all of it. I also feel it is important to document this diversity, as aquatic habitats are under severe threat from anthropogenic changes, and species continue to disappear. Documenting this diversity can help highlight the plight of this biodiversity loss, I feel.

**What do you find so interesting about catfishes?**
They are one of very few fish groups found throughout the entire world (catfishes are found on every continent except for Antarctia, and they were present on Antarctica before it became an inhospitable environment for them), and in almost every aquatic habitat, save for the abyssal depths of oceans. Because of their distribution and habitat, they are incredibly diverse despite being often thought of as bottom-dwelling fish.



**What are some particularly memorable discoveries?**

I would have to say *Akysis heterurus* (which I described in 1996), because that was the first species I described in which I actually collected the type series myself (during a 1995 field collection in Sumatra). For the same reason, *Sundolyra latebrosa* is equally memorable because it was the first genus I described in which I collected the material myself. Another species I found memorable is *Chiloglanis productus*, which is an African catfish I described with Reeve Bailey in 2006. This was among the few African catfishes I had worked with (nearly all of my work has been on Asian catfishes), and I found the experience working with Reeve interesting. It felt rewarding to finally give a name to the species (Reeve had recognised it as an unnamed species when he collected it in Zambia back in the early 1970s), plus it was one of the last few fish species Reeve named before he passed away in 2011. One last one is *Balantiocheilos ambusticauda*, which is not a catfish (but a carp), if only because the species was already widely recognised as extinct before Maurice Kottelat and I gave it a name.

**How many genera have you discovered?**

Five.

**What's your favourite fish?**

I like all catfishes and don't have a particular favourite, but I do have a soft spot for sisoroid catfishes (these are Asian catfishes of the families Akysidae, Amblycipitidae and Sisoridae often found in rheophilic habitats).

**What changes have you seen to freshwater habitats and species throughout your career?**

It is very worrying that freshwater habitats I have sampled in have become highly degraded or disappeared when I revisited them many years later. As an example, my very first field collection trip was on the fringes of the North Selangor Peat Swamp Forest in 1994, which was being logged even then. When I revisted the sites I sampled less than 10 years later, the portion of the forest where I had sampled was gone, and in its place was an oil palm plantation. Likewise, I have discovered new species from disturbed habitats, which highlight both our poor understanding of catfish biodiversity, as well as the fragility of aquatic habitats

Images:
Top left: Heok Hee during a field collection trip in Sumatra in 2008 in an oxbow lake of the Musi River in Sumatra © Heok Hee

Left: *Pseudolaguvia muricata* © Heok Hee

Above: Forested stream near Prabumulih in the Musi River drainage © Heok Hee

# Pontine Spined Loach

**Latin names:** *Cobitis feroniae*[4]

**Researchers:** Riccardo Novaga, Davide Bellucci, Matthias F. Geiger, Jörg Freyhof

**Location:** Central Italy

**Highlight:** One of only two freshwater fishes described from western Europe in 2024.

The discovery of the Pontine Spined Loach from Italy's Latium and Campania regions, originated in the lack of information about its sister species, the Volturno Spined Loach *(C. zanandreai)*. The Volturno Spined Loach was formerly listed as inhabiting the Volturno River and the Fondi Lake Basin, which gave the authors pause given that the two areas are more than 100km apart and separated by other rivers. They thus decided to unveil the actual range and ecology of the species, firstly by consulting historical documents dating back to the 19th century, which also reported the presence of loaches in the Liri-Garigliano Valley (adjacent to the Volturno Drainage) and the Pontine Plain (adjacent to the Fondi lake Basin). Field surveys confirmed the presence of loaches in these locations too, which greatly expanded their known range.

The authors, acting on some additional insights on ecological features and hydrographic history, decided to compare the morphologies and genetics of the various loach populations. They then found that they were actually looking at two different species of *Cobitis* which presumably diverged between 1.5 to 6.5 million years ago: *C. zanandreai* from the Volturno River and Liri-Garigliano Valley, and new loach species *C. feroniae*, which hails from the Pontine Plain and Fondi Lake Basin, as well as a location on the Sarno Plain.

How did a whole new fish species lie hidden in plain sight only 30km from Rome? There are two main reasons: the first is the scarce attention given to smaller-sized and "uncharismatic" fishes like loaches. The second reason is the great biogeographic confusion generated by the massive introductions and translocations that occurred in Italy in the last century: in fact, several species of Cypriniformes (such as the Po Spined Loach *Cobitis bilineata*) were moved from northern Italy to central-southern Italy, due to fish stocking activities for angling. This resulted in populations of *C. feroniae* being confused with *C. bilineata*, and treated as non-native when found in the past.

The Pontine Spined Loach's habitat nowadays consists of spring-fed rivers and channels with slow flowing water, surrounded by an agricultural and urban matrix. It can also be found in small agricultural ditches connected to the main channels that are only seasonally flooded, or in slightly brackish springs close to the sea mouth. The original habitat of this species, however, was originally a vast system of spring-fed wetlands that occupied the coastal plains of southern Latium (Pontine and Fondi Marshes), which were totally drained at the beginning of the 20th century. This species is perhaps one of the last relics of this lost ecosystem once full of life, by managing to adapt to the strong anthropogenic influences. The specific epithet *feroniae* is a nod to the richness and biodiversity of this lost ecosystem: the word arises from the name of the ancient Italic goddess Feronia, considered the tutelary deity of wilderness, water, springs, and wild animals. Feronia was particularly venerated in the Pontine Marshes, where the remnants of her sanctuary along the Feronia springs are still visible.

In the present day, the Pontine Spined Loach still faces major threats, which together pose considerable danger to its continued persistence. Competition and hybridisation with the alien invasive Po Spined Loach *C. bilineata*, introduced from northern Italy following stocking activities, is the first threat. The second is human-caused habitat alteration and destruction, particularly in the form of hydraulic works periodically performed in its native riverbeds, which cause them to be heavily rectified and artificialised. Yet another threat looms in the twinned forms of lowered water availability and water pollution, the result of intensive agricultural, zootechnical and industrial activities combined with high demographic pressure and insufficient water treatment. Finally, all recorded populations of *C. feroniae* save one are found outside of protected areas, which raises yet more concerns about its long-term conservation.

Images:
Left: *Cobitis feroniae* holotype © Davide Belluci

Below: *Cobitis feroniae* habitat © Riccardo Novaga

# SPOTLIGHT ON RESEARCHERS:
# DR. JÖRG FREYHOF

Dr. Jörg Freyhof is an ichthyologist specialising on the full range of West Palearctic freshwater lampreys and fishes. Freyhof has worked at the Alexander Koenig Research Museum, Bonn, the Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin, the German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, and is now based at the Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity Science, in Berlin.

He has discovered and described a total of 160 freshwater fish species since the year 2000.

© Jörg Freyhof

**What keeps you passionate about continuing to discover and describe new species?**

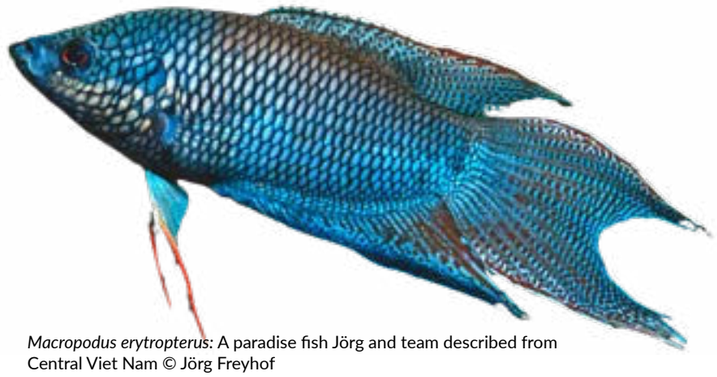
I like the challenge, from the discovery that there should be something, or the surprise of, "what is that in my net – something like this should not be here", to the puzzle of compiling data and information, to the art of developing the manuscript and the debates with reviewers. Also, I like very much the fieldwork and the friendship cooperation with colleagues – it's the best part of the story.

**Have you made any discoveries that have been particularly memorable?**

I remember all my days in the field and all my discoveries as if they were yesterday, and there are many I could highlight. Perhaps I could mention one nice afternoon in Iraqi Kurdistan, where we found five undescribed nemacheilid loaches in one location within just 30 minutes, plus a record of a minnow 1,500km from its known range. Another example was an expedition to Türkiye, when we finally found the gudgeon *Gobio intermedius* after spending hours of searching along desiccated and polluted streams in the Lake Aksehir and Lake Eber basins. We had almost been sure it must be extinct after seeing the terrible terrible state of the habitats, so to finally find the fish was an amazing moment. Sadly, in the meantime that habitat has disappeared.

**Is there a part of the world you are particularly drawn to in your work?**

I have worked all over the Western Palearctic from Morocco and Portugal east to European Russia, Iran and Arabia. It's a large area with a fantastic fauna, still much to be explored and actually about 1,200 species of freshwater lampreys and fishes. It stretches from boreal peat-lakes in the north that host a largely unknown diversity of whitefish, to the large rivers of Europe and West Asia with their highly diverse faunas and great wetland habitats, like the Loire in France or the Danube, south to the Mediterranean basin with its unbelievable high fish endemism and so many fantastic species often just found in very small areas, and to the deserts of North Africa and Arabia with fishes restricted to small headwater streams that represent relics of a more humid past.



*Macropodus erytropterus*: A paradise fish Jörg and team described from Central Viet Nam © Jörg Freyhof

I love the diversity of these places, their uniqueness, and the wonderful biodiversity there, despire the many threats. Fishing at night in the Danube with a large seine net to find the diversity of endemic percid and other fishes is just one unforgettable experience.

**Are there any genera you are most passionate about?**

Not at all – all genera are very interesting and there is so much to learn even in common species. Naturally there are more small fishes to be discovered than large fishes, and it's logistically easier to work with stream fishes than with those in large lakes and rivers. But I love them all equally.

**What is your favourite fish?**

I have no favourite fish. I like loaches as their diversity represents such a challenging puzzle and I have worked a lot with them as there are so many open questions. But there are also many, many others equally nice and cool. Indeed, I like Balitorids but have had no chance to work with them for more than 20 years.

**Is there anything you've not done in your career that you would really like to?**

Definitively! There are so many things I would still like to do, and I cannot wait for the opportunities. The hottest thing would be a fishing trip by boat from Diyarbakir down to Basra all along the Tigris. But this will remain a dream for sure.

**How have the freshwater habitats you've worked in changed throughout your career?**

Good question. Fieldwork is full of pain from the existence of dams, dry or grossly polluted streams and rivers, invasive species in aquatic systems all around the world. All this has increased so much throughout the 30 years I've been going to the field and it's very rare that a place looks better when I visit it a second time. But many places are in a terrible state already on the first visit, and fishes have often not been found again on a second visit.
The good news is that freshwater fish are very resilient, and to date on a few species have gone extinct – they can often still be found somewhere in small remains of their historic range. But the overall situation is deteriorating fast, and there needs to be more action to save them.

A North African field site where Jörg has discovered fish species © Jörg Freyhof

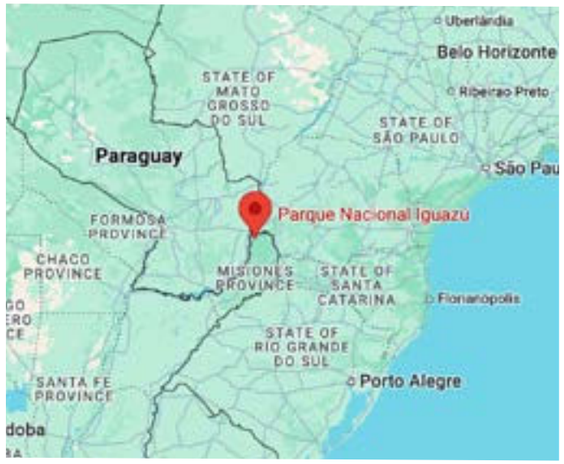
# Adriana's Pearlfish

**Latin name:** *Argolebias adrianae*[5]

**Researchers:** Felipe Alonso, Guillermo Enrique Terán, Pablo Calviño, Wilson Sebastián Serra Alanís,Martin Miguel Montes, Ignacio Daniel García, Jorge Adrián Barneche, Liliana Ciotek, Pablo Giorgis, Jorge Casciotta

**Location:** Iguazú National Park, Argentina.

**Highlight:** Discovered in a temporary pool just meters from a tourist path, close to the famous Iguazú Falls.




Ichthyologists often focus on large rivers and lakes, overlooking ephemeral ponds due to their temporary nature. These shallow pools dry up quickly, leading researchers to assume they lack significant fish biodiversity. However, Felipe Alonso, a researcher at CONICET, the National Scientific and Technical Research Council of Argentina, challenged this assumption. His work led to the discovery of two new killifish species, *Argolebias adrianae* and *Argolebias guarani*, in the temporary pools of Misiones, northeastern Argentina.

"My friends had been conducting fieldwork in the area for decades," Alonso told SHOAL. "I suggested they check some of these transient pools with a net. One day, they sent me a photo of a killifish they caught, and I immediately knew it was a new species." This specimen was later described as *Argolebias guarani*.

Encouraged by this finding, Alonso and his team organised an expedition to explore additional ponds in the region. "On the first evening, as the sun was setting, we fished in a small, clear-water pool near a tourist path by the Iguazú Falls. Within moments, we collected several killifish—another new species, later described as *Argolebias adrianae*."

Seasonal killifish are well known for their ability to thrive in temporary water bodies. *Argolebias adrianae* exemplifies this adaptability, as it inhabits pools that dry up unpredictably due to Misiones' high temperatures. Unlike other killifish, which synchronise their life cycles with regular wet and dry seasons, this species faces erratic water availability.

"Most killifish have predictable wet and dry seasons, but not these ones," Alonso explains. "Their cycles are irregular, making survival strategies crucial." To endure these conditions, they produce drought-resistant eggs that hatch when their ponds refill with rains. But not all eggs hatch simultaneously; some remain dormant as a safeguard against habitat desiccation, ensuring the species' persistence. "Their strategy is simple—never put all their eggs in the same basket," Alonso adds.

The discovery of *A. adrianae* near Iguazú Falls suggests a long evolutionary divergence from *Argolebias guarani*, which inhabits pools below the falls in the Middle Paraná basin. The formation of Iguazú Falls approximately 2.1 million years ago likely contributed to the isolation and eventual speciation of these fish.

*Argolebias adrianae* was found in a small temporary wetland within the Paraná Forest ecoregion, an area where regular water availability is rare. Until

that time, only two species of the Rivulidae family had been recorded from the Iguazú, both from the Araucarian Forest ecoregion . Despite numerous subsequent expeditions, researchers have been unable to locate *A. adrianae* or *A. guarani* outside their initial collection sites, suggesting extreme habitat specialisation.

"We expected to find more new species, but after ten days in the jungle, working through heavy rain, we didn't collect any other killifish," Alonso recalls. "We've returned dozens of times, exploring the region, yet the ponds remain elusive under dense forest cover. However, I believe more species are out there."

Much of Misiones' native jungle has been cleared for plantations, leading to the destruction of temporary wetlands. Although the discovery sites are within protected areas, broader conservation efforts in the region often prioritise terrestrial ecosystems over aquatic habitats.

"There is little government-led conservation here in Argentina," Alonso explains. "The focus is on extracting lithium, gold and copper, and expanding soy plantations for exportation. Conservation strategies in general prioritise land-based species like mammals and birds, but water flows across landscapes, meaning pollution from one area can affect even protected sites."

Deforestation and urban runoff further threaten these delicate ecosystems. Alonso emphasises the need for integrated conservation strategies that protect both terrestrial and aquatic environments.

The discovery of *A. adrianae* and *A. guarani* was made possible through collaboration between researchers, park rangers, and institutions. Alonso worked alongside Argentine ichthyologists Jorge Casciotta, Adriana Almiron and Martín Montes, who specialises in fish parasites— key indicators of ecosystem health. National Park rangers also played an essential role. And Other researchers from CONICET participated in these studies.

Many researchers involved in the project are part of the Killifish Foundation, an organisation working across Argentina, Bolivia, Chile, Paraguay, Brazil, and Uruguay to study and conserve killifishes. Alonso stresses the importance of local scientists leading these efforts.

"We believe it's crucial for researchers from the species' home countries to study and conserve them. Too often, foreign scientists collect specimens, publish descriptions, and leave without engaging local researchers or institutions. We strive to build capacity and promote research within each country."

The discovery of *A. adrianae* and *A. guarani* underscores how much remains undiscovered, even in well-surveyed regions. It also highlights the importance of studying underrepresented habitats. Despite targeted efforts, these species have only been found in their original locations, suggesting other undiscovered species may inhabit similar environments.

However, Alonso notes that progress is often limited by funding shortages and a lack of researchers focused on temporary aquatic habitats. "We need more resources and trained specialists to explore these environments, which are rich in biodiversity but highly threatened."

Reflecting on his experience, Alonso says, "The first net I put in the water yielded a new species. Since then, I've returned 20 times and found only the same species in the same locations—no others, and not even these species elsewhere. It's a fascinating puzzle that we are only beginning to piece together."

The name of the species is a tribute to Argentinian ichthyologist Dr. Adriana Almirón, in recognition of her significant contributions to neotropical ichthyology. According to Alonso, the name "underlines the vital role of women in scientific progress and emphasises the importance of a gender-inclusive scientific environment".

Images:
Previous page: *Argolebias adrianae* © Pablo Calviño

Above: *Argolebias adrianae* © Ignacio Daniel García

Left: National Rangers dipping for fish, Iguazú National Park © Felipe Alonso

Below: *Argolebias adrianae* habitat © Felipe Alonso

# SPOTLIGHT ON RESEARCHERS:
# DR. FLÁVIO LIMA

Flávio César Thadeo de Lima is a Brazilian ichthyologist who has been interested in South American freshwater fishes since his youth. He is specialised in characiform fishes and has published several scientific papers on the systematics of tetra characins, but he has also published extensively on the large-sized characins of the genera *Brycon* and *Salminus* and has described several species of loricariid and corydoradine catfishes. He is currently a research collaborator at the Museu de Diversidade Biológica (MDBio), Campinas State University, Campinas, Brazil.

**How many freshwater fish have you discovered and described?**

I have described (most along with coauthors) 94 species, although two of them have been synonymised, so 92 species currently considered as valid. It is hard to estimate how many species I discovered because we would have to define what we mean by "discovery". If it is meant species that I have discovered doing fieldwork and which were not previously known, they are just a subset of the species that I have described. Some that came to mind are *Knodus geryi* Lima, Britski & Machado, 2004 which was discovered during an expedition funded by Conservation International to the headwaters of the Rio Paraguai basin in Mato Grosso state, Brazil in 2002, *Aspidoras velites* Britto, Lima & Moreira, 2002 and *Hyphessobrycon weitzmanorum* Lima & Moreira, 2003, both discovered during the same field trip to the headwaters of the Rio Araguaia at Mato Grosso state, undertaken with my friend and fellow ichthyologist Dr. Cristiano Moreira, now researcher at the Museu Nacional, Rio de Janeiro, *Corydoras rikbaktsa* Lima & Britto, 2020, discovered during a field trip with Dr. Francisco A. Machado in the Rio Papagaio, a tributary of the Rio Juruena basin, also in Mato Grosso state, and *Pristella crinogi* Lima, Caires, Conde-Saldaña, Mirande & Carvalho, 2021, discovered during an expedition to the Serra Geral do Tocantins Ecological Station, state of Tocantins, Brazil. However, most species are actually discovered in the shelves of fish collections or were already known but were misidentified as a species that was already known. One very interesting example is *Salminus franciscanus* Lima & Britski, 2007, a large-sized (up to 1 meter long) dorado species endemic to the Rio São Francisco basin in eastern Brazil that was scientifically known since 1850, when Achille Valenciennes cited a specimen collected by the naturalist Auguste de Saint-Hilaire around 1820, but that was ever since mistaken for *Salminus brasiliensis* Cuvier, a species that is actually from the La Plata and upper Rio Madeira basins. So the notion that the description of a new species equals its discovery is misleading in the sense that most new species are not actually discovered but rather identified as such after revisionary studies.

**Over a period of how long?**

My first species description was in 2000 (*Brycon vermelha* Lima & Castro), a large (40 cm SL) bryconid fish from the Rio Mucuri, an independent small coastal system from eastern Brazil) and continue to this day, with the latest species described being *Priocharax rex* Mattox, Acosta-Santos, Bogotá-Gregory, Agudelo & Lima, 2025, a miniature (2 cm) characid fish from the Rio Putumayo basin, a tributary of the Amazon River, in the Departamento Amazonas, Colombia, at the border with Peru.

**What is your favourite part of the process of discovering and describing new species, and what is it about the process that keeps you working so hard?**

I see the discovery and description of new species actually only a part of the broader scientific enterprise of understanding the diversity of life on Earth. Consequently, I do not consider the discovery and description of new species as something to be pursued by itself, but rather as a consequence of the

fact that a large proportion of the fish diversity still remains to be known and named. Actually, many species that have already been named are so poorly known that redescribing them within the context of revisionary works is as important as discovering and describing new species, if nothing else by the fact that the identification of a new species relies heavily on the previous knowledge of a given group. With that said, I cannot point to a part of the process of describing a new species or doing a revisionary work as more enjoyable than the other. The whole process - collecting specimens in the field, sorting the collected material in the laboratory, analysing their main morphological features and comparing them with other known species and then proceeding in writing a manuscript in order to report those new findings, as equally intellectually satisfying as each step has its own challenges and questions to be addressed and sorted out. My main drive to continue pursuing my work as an ichthyologist is the feeling that each finished and published contribution is another small building block in our collective effort in understanding the biodiversity of Earth in order to better manage and preserve it.

**What is it about characiform fishes that you are particularly passionate about?**

When I started my career as an ichthyologist, which I date to the early 1990s right at the beginning of my graduate years, characiforms were inevitably a large potential choice due to their sheer diversity in South America. Since my youth I had also the drive to understand what I felt were the more neglected taxonomic groups and characiforms, but above all characids, stood out as a group that was particularly in need of more in-depth studies. Curiously, I started working with the group that would become one of my main specialties, the bryconids, not by my own choice but because my advisor, Dr. Heraldo Britski (Museu de Zoologia da Universidade de São Paulo) told me to do it. I am immensely grateful to him for putting me in my path in contributing with the knowledge of this fascinating group of fishes.

**Do you only work on freshwater fish, or have you been involved in work on any other taxonomic group?**

At the beginning, even before I started my graduate studies, I was also very interested in birds and even

published a few papers on ornithology. But early on I decided that I would pursue ichthyology instead, although to this day I keep being very interested in birds, doing bird watching and reading a lot of ornithological literature, but without any pretensions in publishing again in the field. I am interested in several other taxonomic groups, such as higher plants (especially trees) and some insect groups, especially beetles. I collect whenever possible, alongside fishes, macrocrustaceans as crabs and shrimps, freshwater mollusks as snails and clams, and some aquatic insects (mostly coleopterans and hemipterans) as I feel that it is important to help increase the representativeness of these taxa in zoological collections and consequently aid zoologists working on them.

**What have been some very memorable species discoveries?**

Some of the highlights among the species that I discovered/co-discovered during field expeditions were *Astyanax brucutu*, *Hyphessobrycon eilyos*, *Hyphessobrycon weitzmanorum*, *Inpaichthys nambiquara*, *Moenkhausia cosmops*, *Pristella crinogi*, *Aspidoras velites*, and *Nannoplecostomus eleonorae*. All these species are only known from Brazil and with the exception of *Hyphessobrycon eilyo*s, *Moenkhausia cosmops* and *Nannoplecostomus eleonorae*, were never collected previously by other ichthyologists. *Astyanax brucutu* is known from a single clearwater headwater river belonging to the Rio Paraguaçu basin, Bahia state, northeastern Brazil, and is remarkable among characids from presenting very strong teeth and oral bones that help the species in ingesting and processing the shells of hydrobid snails. *Hyphessobrycon eilyos, H. weitzmanorum, Inpaichthys nambiquara, Bario cosmops*, and *Pristella crinogi* are quite attractively-looking small tetras (now considered within the recently created family Acestrorhamphidae), the first two only known from the upper Rio Araguaia basin in Mato Grosso state, the third from the Rio Aripuanã basin, a major tributary of the Rio Madeira basin, and fourth from upper Rio Paraguai and upper Rio Juruena basins, also in Mato Grosso state, and the fifth from the middle Rio Tocantins basin, Tocantins state and which have recently called the attention of the aquarium hobby due to their bright, unusual colour pattern (*Pristella crinogi* still has not appeared in the aquarium hobby). *Aspidoras velites* is a quite unique callichthyid catfish that possesses a very unusual body shape within the family, which recalls the body shape of a small loricariid catfish, and is restricted to a small portion of the upper Rio Araguaia basin in Central Brazil. Finally, *Nannoplecostomus eleonorae*, from the upper Rio Tocantins in Goiás state, Brazil, is one of the smallest loricariid catfishes known.

**How many genera have you discovered?**

I have authored the description of two new genera, namely, *Phycocharax Ohara*, Mirande & Lima, erected for *Phycocharax rasbora*, a characid fish with a color pattern that is reminiscent to the one present in some rasboras belonging to the genus *Trigonostigma*, and *Nannoplecostomus Ribeiro*, Lima & Pereira, established for *N. eleonorae*, a peculiarly small loricariid catfish.

**What changes have you seen to freshwater habitats and species throughout your career?**

I roughly started my career as an ichthyologist 30 years ago and that coincided with a boom of damming in Brazilian rivers, particularly in the rio Tocantins basin, and a little later on the upper rio Tapajós, rio Madeira, and lower rio Xingu with the infamous Belo Monte dam. Aquatic habitats changed abruptly in all those areas and it is regrettable that in many cases we didn't have the time to obtain sound ichthyological evaluations of these areas before they were permanently changed. Since an early age I understood that producing accurate ichthyological taxonomic works collating all available information about a given species was crucial to inform conservation assessments of these taxa and as such an important contribution that I could make towards the preservation of these species, and to this day I strive to produce informative papers so as to aid, even though minimally, towards the almost impossible goal of conserving as most of the biodiversity as it is feasible given the fact that this enterprise unfortunately is not among the top preoccupations of the majority of humankind.

Images:
Previous page: Flavio on the Kuribrong River, Guyana April 2010 © Pedro Henrique Bernardo

Left: Rio Negro above São Gabriel da Cachoeira, February 2018 © Flavio Lima

Below: Stream tributary of rio Javari Atalaia do Norte Amazonas Brazil November 2017 © Flavio Lima

# Osvaldo's Cory

**Latin names:** *Hoplisoma osvaldoi*[6]

**Researchers:** Felipe Alonso, Guillermo Enrique Terán, Gastón Aguilera, Martin Miguel Montes, Wilson Sebastián Serra Alanís, Pablo Calviño, Héctor Samuel Vera-Alcaraz, Yamila Cardoso, Stefan Koerber, Juan Marcos Mirande

**Location:** Bermejo River basin, Argentina

**Highlight:** The Hoplisoma genus has been reinstalled after merging with Corydoras in 1980.

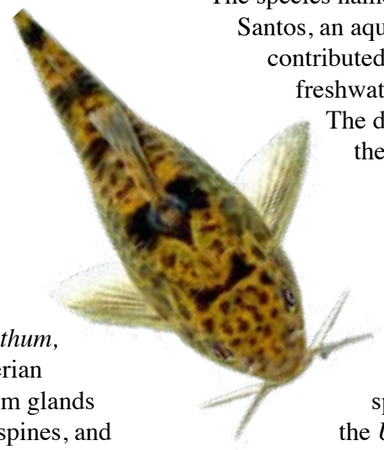

A recent study led by ichthyologist Felipe Alonso has described a new species of armored catfish, *Hoplisoma osvaldoi*, and established a new genus, *Urkumayu*. This study provides additional data on the biodiversity and evolutionary relationships of South American catfishes.

The identification of *H. osvaldoi* began with specimens collected in northwestern Argentina two decades ago. Differences between these fish and known species of the genus *Corydoras*, particularly *Corydoras paleatus*, were noted. *Corydoras paleatus*, recently transferred to the genus *Hoplisoma* in 2024, was first described by Leonard Jenyns in 1842 based on specimens collected by Charles Darwin from Uruguay. Morphological and genetic analyses confirmed that the specimens represented a new species.

*Hoplisoma osvaldoi* is endemic to the upper Bermejo River basin, located in the northwestern Andean portion of the La Plata basin. This region has a complex geological history and a high number of endemic species. The habitats within the Yungas jungle, characterised by rocky bottoms and clear, fast-flowing waters, contribute to species isolation. These conditions contrast with the muddy-bottomed, murky, and slower-flowing waters that dominate these basins as they exit the Andes and transition into the Chacopampean floodplain.

Morphological analyses indicate that *H. osvaldoi* has a more elongated body and shorter pectoral and dorsal spines compared to its closer relatives. These traits are likely adaptations to fast-flowing water conditions. Similar morphological adaptations are also observed in *Urkumayu*, described in the same study.

A key outcome of this study is the establishment of the genus *Urkumayu*, which includes three species: *Urkumayu gladysae*, *Urkumayu micracanthus*, and *Urkumayu petracinii*. These species are endemic to the Andean region of the northwestern La Plata basin and represent a distinct evolutionary lineage. Phylogenetic analyses indicate that *Urkumayu* species are closely related to *'Hoplisoma' flaveolum*, a species from São Paulo, Brazil, within the upper Paraná basin.



In addition, *H. osvaldoi* shares a coloration pattern with *U. micracanthum*, suggesting a potential case of Müllerian mimicry. Both species possess venom glands associated with their bony pectoral spines, and their similar colouration is a convergence that functions as a warning signal to predators.

The genus *Hoplisoma*, recently resurrected in 2024, was reevaluated in this study, and the inclusion of previously unexamined species together to the examination on a phylogenetic context of genetic and morphological data for the first time in this group, challenged its monophyly, and found that the lineage of the species now assigned to *Urkumayu* represented a distinct lineage.

The species name honors Jorge Osvaldo Fernández Santos, an aquarist and fish collector who contributed to the study of Argentine freshwater fish.

The description of *H. osvaldoi* and the establishment of *Urkumayu* add to the understanding of fish biodiversity in the Yungas region. Further ecological studies and conservation measures are necessary to address environmental threats affecting endemic species in this area, given that all the *Urkumayu* species are threatened in some level with extinction according to the International Union for Conservation of Nature (IUCN).

Images:
Above & Left: *H. osvaldoi* © Felipe Alonso
Below: *H. osvaldoi* and *Urkumayu micracanthus* habitat © Felipe Alonso

# Lord Sauron Pacu & Aylan's Pacu

**Latin names:** *Myloplus sauron* and *Myloplus aylan*[7]

**Researchers:** Victória D. Pereira, Rafaela Ota, Valéria N. Machado, Rupert A. Collins, Marcelo Ândrade, James R. Garcia-Ayala, Michel Jégu, Izeni P. Farias, Tomas Hrbek

**Location:** Rio Xingu and Western Amazon basin, Brazil

**Highlight:** Vegetarian pacus, a close relative of the piranha, one named after Lord of the Rings villain.


In Brazil's Rio Xingu, a fish has been described that reminds researchers of The Lord of the Rings' notorious villain, Lord Sauron. But rather than aggressive, as the name suggests, the new species is mostly herbivorous, preferring to feed on plants. The teeth of *Myloplus sauron*, a species of pacu, are also flat and blunt – more like human teeth than the sharp needles of the fearsome piranha family to which it's closely related. The name was suggested by scientists who saw a resemblance between the fish's markings and the evil, all-seeing 'Eye of Sauron'.

"As soon as my colleagues suggested the name for this fish, we knew it was perfect for it," Dr. Rupert Collins, part of the research team and the senior curator in charge of fish at the Natural History Museum, London, told Discover Wildlife[8]. "It looks just like the Eye of Sauron, especially with the red fins and orange patches on its body."

The identification of *Myloplus sauron* and its close relative *Myloplus aylan* stems from the doctoral research of Valéria Nogueira Machado at the Federal University of Amazonia, Brazil. Machado's work involved generating over a thousand DNA barcode sequences to assess the diversity within the Serrasalmidae family, which includes both piranhas and pacus. During this genetic analysis, significant divergences were observed within populations previously identified as *Myloplus schomburgkii*, a species known for its distinctive vertical black bar.

Collaborating with Dr. Collins, Machado identified three distinct genetic lineages: one widely distributed across the Amazon and Orinoco basins, another primarily in the western Amazon, and a third confined to the Xingu River basin. These findings indicated the presence of distinct species within what was previously considered *M. schomburgkii.*

To corroborate these genetic findings, the team conducted detailed morphological analyses. They noted variations in the pattern of the vertical black bar, as well as differences in the number of vertebrae and fin rays among the lineages. These morphological distinctions, alongside the genetic data, confirmed the identification of two new species: *Myloplus sauron* and *Myloplus aylan*.

"Our results reveal the existence of hidden species within *Myloplus schomburgkii,* a species of Serrasalmidae with wide distribution in the Amazon basin," Valéria Machado, lead author of the study with the Federal University of Amazonas in Brazil, told Newsweek.

"The three species were considered a single taxon, when in fact they are very distinct species genetically and morphologically as well," Machado said. "This separation of species is important since these fish are highly appreciated in the aquarium market and also for consumption by riverside populations in the Amazon."[9]

The research was a collaborative effort involving experts in genetics and morphology. Valéria Nogueira Machado and Dr. Rupert Collins led the genetic analyses. They were joined by Victoria Pereira, Michel Jégu, Rafaela Ota, and Marcelo Andrade for the morphological studies. Geneticists Izeni Pires Farias and Tomas Hrbek, Machado's advisors, provided additional expertise.

*Myloplus sauron*: This species is characterised by a distinctive vertical black bar on its flank, tapering at both ends, reminiscent of the Eye of Sauron from J.R.R. Tolkien's "The Lord of the Rings." This unique marking inspired its name. *M. sauron* is endemic to the Xingu River basin in Brazil.

*Myloplus aylan*: Similar to *M. sauron, M. aylan* exhibits a vertical black bar on its flank. However, it can be distinguished by specific morphological features, such as a markedly concave dorsal surface of the parietal bone and a higher count of total perforated scales on the lateral line. This species is found in the upper Amazon basin, including regions in Peru and Brazil. The name honours the late Aylan Moraes Andrade, the young son of one of the authors of the describing paper .

*Myloplus sauron* is restricted to the

Xingu River basin, a region known for its high fish endemism. In contrast, *Myloplus aylan* inhabits rivers draining the western Amazon basin, including the Branco, Negro, Nanay, Jutaí, Juruá, and Madeira rivers. Interestingly, both new species are sympatric with *M. schomburgkii* in their respective ranges, meaning they coexist in the same habitats. During field collections, specimens of *M. schomburgkii* and *M. aylan* were even captured together using the same gillnet.

Both *M. sauron* and *M. aylan* are herbivorous, feeding primarily on aquatic plants, though aquatic insects also constitute part of their diet. This herbivorous tendency aligns them with pacus rather than the carnivorous piranhas, despite being within the same family. The Serrasalmidae family comprises 17 genera, five of which are piranhas and 12 are pacus. While all pacus are herbivores, not all piranhas are carnivores; some feed mainly on scales or pieces of fins from other fish.

The discovery of these species highlights the rich biodiversity of the Amazon basin and underscores the importance of integrative taxonomic approaches in identifying and describing new species. It also emphasises the need for continued research and conservation efforts in these ecologically significant regions. The Amazon basin, with its vast and complex ecosystems, still harbours many undiscovered species, and studies like this contribute to our understanding and preservation of its unparalleled biodiversity.

Images:
Left: *M.aylan* © Lucia Rapp Py-Daniel
Above: *M.sauron* © Machado et al., Neotropical Ichthyology 2024

# Karstsinnectes Cave Fishes

**Latin name:** *Karstsinnectes cehengensis, Karstsinnectes daxinensis, Karstsinnectes longzhouensis*[10]

**Researchers:** Tao Luo, Lina Du, Jiang Zhou

**Location:** Southern Guizhou and western Guangxi of China

**Highlight:** Members of a newly described genus of cave-dwelling loaches


Beneath the rugged mountains of south China, in dark caves, scientists Tao Luo and his team from Guizhou Normal University have discovered an entirely new genus of cave-dwelling loaches, *Karstsinnectes*. These rare fish, adapted to life in deep, groundwater-fed caves, represent a striking example of evolution in extreme isolation. To date, researchers have identified seven species within this genus—*Karstsinnectes cehengensis, K. daxinensis, K. anophthalmus, K. hyalinus, K. acridorsalis, K. parvus,* and *K. longzhouensis*—with the first three newly described in 2024.

These loaches inhabit tiny, groundwater-dependent pools, some no larger than five meters long, 0.5 meters wide, and 0.8 meters deep, where the water moves sluggishly through the darkness. Despite their small size, these ecosystems sustain remarkable yet poorly understood biodiversity.

The discovery of *Karstsinnectes* unveils Earth's hidden biodiversity, showcasing species adaptations to subterranean life. This genus possesses unique traits such as scaleless, unpigmented loaches having reduced or absent eyes, smooth furrowed lips, adjacent nostrils, adipose crests on the caudal peduncle, and a bony swim bladder capsule that opens posteriorly.

Due to their small population size and little is known about their ecology, cave dwellings species are extremely vulnerable to environmental change, making conservation efforts especially challenging. The greatest threats to *Karstsinnectes* come from declining water flow due to groundwater extraction and microplastic pollution. Recognising the importance and urgency of conserving these rare and unique species, China has taken key steps to protect these fish, designating *K. anophthalmus* as a Grade II protected animal and proposing a Karst national park that would safeguard their habitat.

*Karstsinnectes cehengensis* © Tao Luo, Lina Du, Jiang Zhou, 2024



*Karstsinnectes cehengensis* © Tao Luo, Lina Du, Jiang Zhou, 2024

The discovery of *Karstsinnectes* and these species offers a glimpse into Earth's hidden biodiversity, revealing how life has adapted in the most extreme isolated environments. As scientists continue to explore these understudied ecosystems and their species, it is important to emphasize the urgency of raising public awareness, enforcing stricter groundwater regulations, and strengthening policies to protect these fragile ecosystems and their species to ensure they are not lost before they are fully understood.

# Rainbow Makou Fish

**Latin name:** *Opsariichthys iridescens*[11]

**Researchers:** Xin Peng, Jia-Jun Zhou, Hong-Di Gao, Jin-Quan Yang

**Location:** Qiantang and Oujiang rivers in Zhejiang Province and a tributary of the Yangtze River adjacent to the Qiantang River, Southeast China.

**Highlight:** Highly attractive and very popular in the aquarium trade. Serves as an environmental barometer due to its need for good water quality.


*Opsariichthys iridescens* is a striking newly described cyprinid species that expands the known diversity of the genus *Opsariichthys*. Though newly recognised by science, this fish has been familiar to local anglers and aquarium enthusiasts for years.

"About twenty years ago, when I was still a middle school student, I often went fishing in the streams around the city with several friends during holidays, and brought the fish back home to feed. At that time, we noticed that this kind of fish was significantly different from *Zacco platypus* and *Opsariichthys evolans*, and suspected that it was an undescribed new species," recalled taxonomist Jiajun Zhou, who led the research.

The description of *Opsariichthys iridescens* was made possible through collaboration between two key institutions. Jiajun Zhou, based at the Institute of Biodiversity Resources Survey, Zhejiang Forest Resources Monitoring Center, spearheaded the field surveys and sample collection. Meanwhile, the laboratory of Professor Yang Jinquan at Shanghai Ocean University handled data processing and manuscript preparation.

This newly described species is primarily distributed in the freshwater streams of eastern China, particularly in the Qiantang River, the Oujiang River, and the Poyang Lake Basin within the lower reaches of the Yangtze River. Interestingly, despite its long-time recognition by aquarium hobbyists—who referred to it as the 'Zhejiang Makou Fish'—no formal scientific description had been undertaken until now. "In fact, many enthusiasts have also discovered this distinctive fish species, which has even become a very popular ornamental fish, but so far, no ichthyologist has provided a scientific description of it," Zhou explained.

The appeal of *Opsariichthys iridescens* is undeniable. Male specimens display vibrant, iridescent hues, making them highly sought after in the ornamental fish trade. However, beyond their aesthetic value, they also play an ecological role. "As it has relatively high requirements for the water quality of its living environment, it also serves as a barometer of the environmental conditions," noted Zhou.

The genus *Opsariichthys* is widely distributed across East and Southeast Asia, with approximately 16 recognised species. However, Zhou suggests that this number is likely an underestimate. "The diversity of the genus *Opsariichthys* is still underestimated, and there are quite a number of new species yet to be described."

Like many freshwater fish, *Opsariichthys iridescens* faces environmental pressures. Habitat modifications, particularly the construction of water conservancy facilities, as well as commercial fishing, pose significant threats to its populations. Additionally, changing climate conditions, such as prolonged spring droughts, have negatively impacted its reproductive success.

The formal recognition of *Opsariichthys iridescens* underscores both the richness and the fragility of China's freshwater biodiversity. As conservation efforts gain momentum, this shimmering fish serves as both a scientific milestone and a reminder of the ongoing need to protect the ecosystems that support such remarkable species.

Images:
*Opsariichthys iridescens* © Jiajun Zhou

# NOTABLE MENTIONS

*Serrasalmus magallanes*i, Gallo-Cardozo, Maldonado, Careaga & Carvajal-Vallejos 2024: a newly discovered piranha species from the Amazon basin.

*Parauchenoglanis chiumbeensis, P. dolichorhinus, P. ernstswartzi, P. lueleensis P. luendaensis P. megalasma P. patersoni, P. poikilos* and *P. stiassnyae*: Sithole, Vreven, Bragança, Musschoot & Chakona 2024: Previously classified under *Parauchenoglanis ngamensis*, these species were identified as distinct through a combination of genetic and morphological analyses.

*Aphredoderus ornatus* and *A. retrodorsalis*, Muller & Simons 2024: Stout-bodied, large headed perches discovered in the USA.

*Channacoccinea, C. pyrophthalmus, C. rakhinica, C. rubora,* Britz, Tan & Rüber 2024: Very attractive fishes that are highly valued in the aquarium trade. Provisions trophic eggs for its offspring.

*Sinocyclocheilus xiejiahuai*, Luo, Fan, Xiao & Zhou 2024: Cave fish that can be distinguished all 79 other congeners by an absence of horn-like structures, absence of irregular black markings on the body, large eyes with a diameter of 13% of head length.

Wadi Shab, Oman © Jörg Freyhof

# FULL LIST

*Acrossocheilus furongjiangensis*
*Aequidens pirilampo*
*Aliteranodon effusorium*
*Amblyceps crassioris*
*Ancistrus megacanthus*
*Aphredoderus ornatus*
*Aphredoderus retrodorsalis*
*Argolebias adrianae*
*Atlantirivulus enigmaticus*
*Austrolebias ayoreode*
*Barbatula selengensis*
*Bashimyzon cheni*
*Batrochoglanis labrosus*
*Beaufortia granulopinna*
*Beaufortia viridis*
*Brachychalcinus sabaji*
*Bryconamericus misei*
*Cambeva atrobrunnea*
*Cambeva damnata*
*Cambeva difficilis*
*Cambeva galactica*
*Cambeva luteoreticulata*
*Cambeva perobana*
*Cambeva rotundipinna*
*Carasobarbus doadrioi*
*Carasobarbus hajhosseini*
*Carasobarbus saadatii*
*Chaetostoma sacramento*
*Channa coccinea*
*Channa kachina*
*Channa pyrophthalmus*
*Channa rakhinica*
*Channa rubora*
*Characidium itarare*
*Characidium varii*
*Chiloglanis carnatus*
*Chrysobrycon calamar*
*Claea minibarba*
*Cobitis feroniae*
*Corydoras caramater*
*Corydoras iiap*
*Cottus dorofeevi*
*Creagrutus metropolitana*
*Creteuchiloglanis nuthemuensis*
*Curculionichthys monolechis*
*Cyphocharax albiventris*
*Cyphocharax orion*
*Cyprinella leptocheilus*
*Danio dichromatus*
*Dzihunia pseudoamudarjensis*
*Eigenmannia macuxi*
*Eleotris wuhanlini*
*Enteromius cerinus*
*Enteromius gamo*
*Enteromius niggie*
*Enteromius nzigidaherai*
*Enteromius ruforum*
*Eremodon cochleari*
*Eremodon kifuani*
*Exostoma sentiyonoae*
*Formosaneleotris hualienensis*
*Garra dohjei*
*Garra hexagonarostris*
*Garra ngopi*
*Garra phewakholaensis*
*Garra zubzaensis*
*Glossogobius biorbitalis*
*Glossogobius quindecimradiatus*
*Glyptothorax medogensis*
*Glyptothorax pongoensis*
*Glyptothorax punyabratai*
*Glyptothorax rara*
*Glyptothorax siangensis*
*Glyptothorax zeiladensis*
*Gobiobotia bouommatos*
*Gobiobotia incarinatus*
*Hemimyzon luae*
*Hoplisoma osvaldoi*
*Horabagrus obscurus*
*Hyphessobrycon citrus*
*Hypostomus cari*
*Hypostomus caudofasciatus*
*Hypostomus minotauros*
*Hypsancistrus parkateje*
*Ilogton ilogton*
*Indoreonectes amrabad*
*Indoreonectes kalsubai*
*Indoreonectes radhanagari*
*Inpaichthys parauapiranga*
*Kapuasia falaris*
*Karstsinnectes cehengensis*
*Karstsinnectes daxinensis*
*Karstsinnectes longzhouensis*
*Kiunga auromarginata*
*Kiunga filamentosa*
*Kiunga leucozona*
*Lefua nishimurai*
*Lepidocephalichthys balios*
*Leporinus inexpectatus*
*Lethenteron hattai*
*Lethenteron satoi*
*Liobagrus chenhaojuni*
*Listrura bernunssa*
*Loricaria thomasi*
*Luciogobius huatungensis*
*Macropodus minnanensis*
*Malagodon honahona*
*Mastacembelus pani*
*Mastacembelus truttoides*
*Melanorivulus melanopterus*
*Melanorivulus terena*
*Microdous ampliseriatus*
*Microdous hanlini*
*Microdous scharpfi*
*Microglanis lucenai*
*Microphis arrakisae*
*Microphysogobio punctatus*
*Microsternarchus longicaudatus*
*Microsternarchus schonmanni*
*Moenkhausia aurora*
*Monotocheirodon duda*
*Mylochromis durophagus*
*Mylochromis rotundus*
*Myloplus aylan*
*Myloplus sauron*
*Nannocharax skeltoni*
*Neoplecostomus altimontanus*
*Neoplecostomus sapucai*
*Oncorhynchus gorbuschka*
*Ophisternon berlini*
*Opsariichthys iridescens*
*Opsariichthys rubriventris*
*Opsarius siangi*
*Oreichthys warjaintia*
*Oreoglanis brevicula*
*Oreonectes andongensis*
*Oreonectes yuedongensis*
*Oreonectes zhangi*
*Oryzias chenglongensis*
*Oryzias moramoensis*
*Oxynoemacheilus chaboras*
*Oxynoemacheilus fatmae*
*Oxynoemacheilus kottelati*
*Panaqolus orcesi*
*Panaqolus pantostiktos*
*Parachela melanosticta*
*Parachela microlepis*
*Parachiloglanis immaculata*
*Paranemachilus liui*
*Paranemachilus luegvetensis*
*Paratanakia fulvidorsalis*
*Paratanakia haifengensis*
*Paratanakia julongjiangensis*
*Parauchenoglanis chiumbeensis*
*Parauchenoglanis dolichorhinus*
*Parauchenoglanis ernstswartzi*
*Parauchenoglanis lueleensis*
*Parauchenoglanis luendaensis*
*Parauchenoglanis megalasma*
*Parauchenoglanis patersoni*
*Parauchenoglanis poikilos*
*Parauchenoglanis stiassnyae*
*Paravandellia brooksi*
*Paravandellia luna*
*Paravandellia oscarleoni*
*Pareiorhaphis torrenticola*
*Pariolius maldonadoi*
*Pariolius pax*
*Phenacogaster guayupe*
*Phenacogaster nukak*
*Phenacogaster tukano*
*Phenacogaster yari*
*Phenacorhamdia cuspidata*
*Phoxinus adagumicus*
*Phoxinus radeki*
*Physoschistura longibulla*
*Pimelodella guato*
*Pollimyrus ibalazambai*
*Pollimyrus krameri*
*Pollimyrus vanneeri*
*Pollimyrus weyli*
*Poropuntius anlaoensis*
*Priocharax conwayi*
*Priocharax phasma*
*Protocobitis longicostatus*
*Pseudacanthicus nyktos*
*Pseudomugil halophilus*
*Pseudomystus tuberosus*
*Pseudorhinogobius amoniceps*
*Pseudorhinogobius gladius*
*Pseudorhinogobius juno*
*Pseudorhinogobius magnificus*
*Pseudorhinogobius pulcher*
*Pseudorhinogobius retigena*
*Pseudorhinogobius valentulus*
*Pseudotropheus likomae*

*Psilorhynchus kosygini*
*Redigobius fotuno*
*Rhadinoloricaria andaki*
*Rhinogobius baborinisanensis*
*Rhinogobius bufonius*
*Rhinogobius dongfongensis*
*Rhinogobius jangshiensis*
*Rhinogobius lithopolychroma*
*Rhinogobius macromaculatus*
*Rhinogobius nami*
*Rhinogobius phuocbinhensis*
*Rhinogobius rong*
*Rhinogobius sudoccidentalis*
*Rhinotridens britskii*
*Rineloricaria atratoensis*
*Rineloricaria giua*
*Rineloricaria paraibensis*
*Salmo brunoi*
*Salmo ekmekciae*
*Sarcocheilichthys hanjiangensis*
*Schistura sonarengaensis*
*Schizodon unimaculatus*
*Serrasalmus magallanesi*
*Sinobdella longitubulus*
*Sinobdella magnificus*
*Sinocyclocheilus guiyang*
*Sinocyclocheilus xiejiahuai*
*Sinocyclocheilus xingyiensis*
*Sinogobius (Epikalymma) epikalymma*
*Sinogobius (Sinogobius) allornatus*
*Sinogobius (Sinogobius) occidentalis*
*Sinogobius (Sinogobius) qilin*
*Squalius caetobrigus*
*Stiphodon chlorestes*
*Tachysurus flumendraco*
*Tachysurus wuyueensis*
*Telmatochromis salzburgeri*
*Trichomycterus (Cryptocambeva) berthalutzae*
*Trichomycterus (Paracambeva) antiquus*
*Trichomycterus (Psammocambeva) diamantinensis*
*Trichomycterus (Psammocambeva) fabioheppi*
*Trichomycterus caribensis*
*Trichomycterus choroloensis*
*Trichomycterus curitiensis*
*Trichomycterus galvisi*
*Trichomycterus macareguaensis*
*Trichomycterus sanchezi*
*Trichomycterus santuarioensis*
*Trichomycterus simacotaensis*
*Triplophysa shannanensis*
*Triplophysa yaluwang*
*Triplophysa ziyunensis*
*Triportheus claudiae*
*Tukugobius macroura*
*Turcinoemacheilus inexpectatus*
*Vanmanenia duci*
*Yunnanilus polylepis*
*Yunnanilus yangi*
*Zhuquella fasciata*
*Zhuquella instabilis*
*Zhuquella jingae*
*Zhuquella margaritata*
*Zhuquella splendens*
*Zhuquella zhuquella*



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