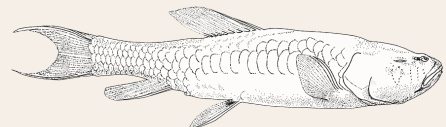
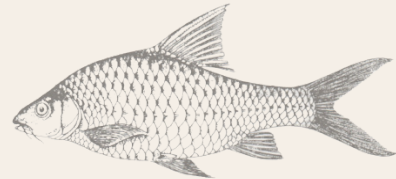


SHOAL

Working together to conserve freshwater species

SEARCH FOR THE LOST FISHES



Shoal is a programme of Synchronicity Earth and Re:wild. Synchronicity Earth is a charity registered in the UK and Wales No: 1132786 and a company limited by guarantee No: 06952204. Re:wild is a U.S. based 501(c)3 non-profit corporation.

What is the Search for the Lost Fishes?

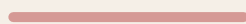
All around the world, freshwater fish face multiple stressors that have caused populations to plummet and, for all kinds of reasons, once discovered species have fallen off our radar. These Lost Fishes are species that have gone unseen for years – even decades – and are feared possibly extinct. In order to save these species, we first need to find them.

Shoal have worked closely with Re:wild to launch a freshwater fish-focused extension to their tremendously successful Search for Lost Species campaign. In collaboration with Re:wild and the IUCN-SSC Freshwater Fish Specialist Group, Shoal has compiled a list of more than 300 fish species that are currently missing to science.

Shoal's partners will head out on research expeditions to some of the planet's most far-flung freshwaters, from former war zones to the world's highest lake, to find species that haven't been seen in over a decade. Once a species is rediscovered, we will launch a conservation project to ensure populations are protected and given full opportunity to recover.

But this is about much more than the expeditions Shoal is directly involved in. We're calling on others to join the search and conduct their own expeditions for the Lost Fishes. Shoal, with expert input from Re:wild, is working with teams and individuals around the world to publicise their stories of rediscovery and adventure as part of this shared campaign of hope and celebration.

Read on to learn more about the initial 10 Most Wanted Lost Fishes and the stories that make each of them so interesting, and take a look at the FAQ section at the end of this report to find answers to common questions about the campaign.



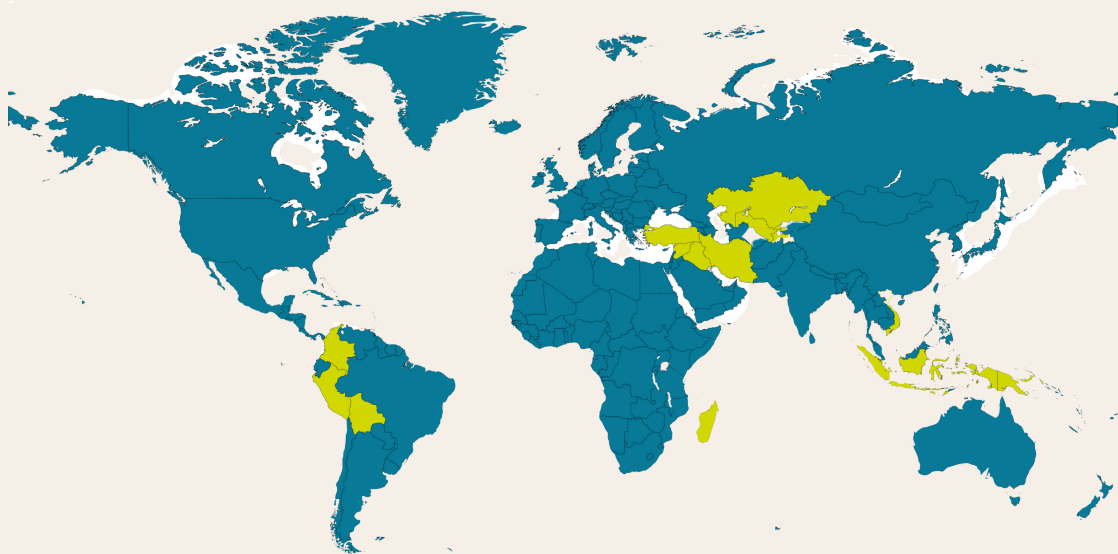
Top 10 Most Wanted Lost Fishes

From an original master list of more than 300, we narrowed down our focus to the top 10 'most wanted' fishes in the world. Each is remarkable in its own right, and each has fascinating and wonderful stories to tell. Take the Haditha cavefish for example, which has only ever been recorded in an underground sinkhole directly underneath a shrine near Haditha, Iraq. To gain access, scientists and explorers must head through a slit on the floor of a quarry, enter a cavern and find a natural well five meters below the quarry's stony floor. Only there, as far as science tells us, can the cavefish be found.

Or the wonderfully named 'fat catfish', a true anomaly: with its fatty folds of tissue circling its body like onion rings, it's reminiscent of the Michelin Man and looks like no other species ever recorded. Or the Syr Darya shovelnose sturgeon, one of the smallest sturgeon species ever recorded: this elegant and prehistoric species sports a surprising whip-like tail filament that's nearly as long as its body and head combined.

The Lost Fishes campaign is about adventure and exploration, about seeking out surprising places to find quirky and elusive species. It's about telling the stories of creatures that have been hidden from view. And it's about giving them a second chance at survival.

The countries (in green) where the species have previously been observed



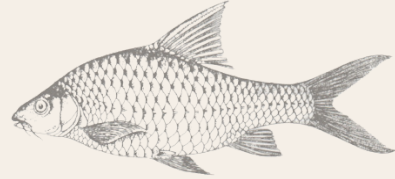
Syr Darya shovelnose sturgeon
Kazakhstan, Tajikistan,
Uzbekistan



Fat catfish
Colombia



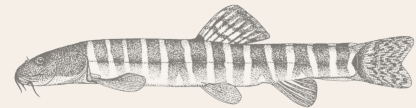
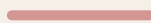
Annamite barb
Vietnam



Mesopotamian barbel
Eastern Turkey, Eastern Syria,
Iran, Iraq



Diyarbakir (Batman River) loach
Turkey



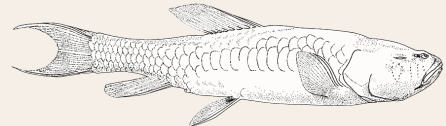
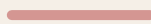
Spinach pipefish
Papua New Guinea



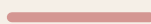
Titicaca orestias
Peru, Bolivia



Haditha cavefish
Iraq



Itasy cichlid
Madagascar



Duck-billed buntingi
Indonesia



How this relates to Shoal's mission

Shoal are a leading conservation organisation that focuses entirely on the conservation of the world's most threatened freshwater species. Our mission statement is: 'Halt extinctions and recover populations of threatened freshwater species in the wild', and the Lost Fishes campaign will help ensure that some of the planet's most at risk freshwater fish are given a second chance at survival.

The idea of inspiring people about the wonders found in freshwaters is core to our strategy. The media love stories about rediscovered species and this flagship campaign will put a spotlight internationally on the species that we have highlighted for the campaign.

Funding

Funding will of course be instrumental in enabling us to direction the necessary work to find these species, and implement a conservation programme to recover populations as and when they are rediscovered.

The search for funds will thus support the search for the species.

SYR DARYA SHOVELNOSE STURGEON

Scientific name: *Pseudoscaphirhynchus fedtschenkoi*

Range: Tajikistan and Uzbekistan, where it is endemic to the Syr Darya River

When last seen: 1960s

Suspected reason for disappearance: Huge water abstraction from the Syr Darya River and Aral Sea led to the Aral Sea drying up by more than 60 per cent between 1973 and 2000. Habitat loss and fragmentation are likely, as damming is common in its range. Polluted waters are also likely to be a contributing factor.¹

IUCN conservation status: Critically Endangered

Facts: A previous Re:wild supported expedition team from the Tennessee Aquarium, Eurasian Regional Association of Zoos and Aquariums, and Kazakhstan Fisheries Research and Production Center went to rediscover the species on a December trip to Kazakhstan.

Size: It's among the world's smallest sturgeon species and grows up to only 65cm, including its long tail filament.²



FAT CATFISH

Scientific name: *Rhyzomichthys totae*

Range: Lake Tota basin, Colombia

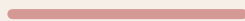
When last seen: 1957

Suspected reason for disappearance: In 1936, 100,000 rainbow trout eggs, imported from North America, were released into the lake. Cecil Miles – the man who first described the species – claimed this would cause the extinction of the fat catfish. In 1990, Colombian ichthyologist José Iván Mojica claimed the trout and the fat catfish lived in different parts of the lake, lending dispute to Miles' claim.³

IUCN conservation status: Critically Endangered

Facts: Possesses remarkable rings of extensive adipose tissues surrounding the body – the only freshwater catfish in the world that has fatty rings of this kind. It's so greasy that it's sometimes referred to as the 'greasefish', and locals to Lake Tota used to impale it on sticks, set it alight, and use it as a torch. Only 10 specimens have been recorded.⁴

Size: Grows up to 15 cm.



ANNAMITE BARB

Scientific name: *Hypsibarbus annamensis*

Range: Unknown, but possibly central Vietnam

When last seen: 1969

Suspected reason for disappearance: The location was severely impacted in the 1970s by deforestation, though it is not known whether this is responsible for the population decline.

IUCN conservation status: Data Deficient

Facts: The species is only officially known from three specimens: one collected in 1936, and two collected in 1969 (without location recorded).



MESOPOTAMIAN BARBEL

Scientific name: *Luciobarbus subquincunciatus*

Range: Tigris-Euphrates river system in Eastern Turkey, Eastern Syria, Iran, Iraq

When last seen: Six fish were caught in the 1990s

Suspected reason for disappearance: Overfishing, habitat loss, eutrophication, dam construction and water abstraction.

IUCN conservation status: Critically Endangered

Facts: Uniquely characterised by its quincunx -like pattern of spots, it is also known as the leopard barbel or spot barb. Was once abundant in certain locations but has declined rapidly over the past 30 years or more.⁵

Size: Grows up to 60cm.



Illustration by Susan Laurie-Bourque

DIYARBAKIR (BATMAN RIVER) LOACH

Scientific name: *Paraschistura chrysicristinae*

Range: Batman River, Upper Tigris, Turkey

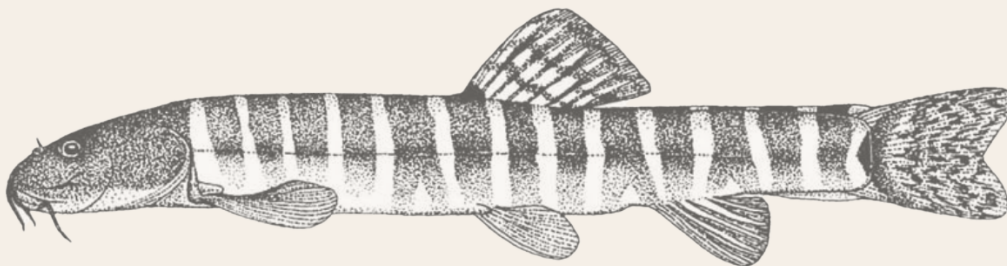
When last seen: 1974

Suspected reason for disappearance: Unknown: the habitats in the localities it has previously been recorded appear to be of good quality, though the construction of the Batman Dam between 1986-1999 would likely have had negative impacts on the species.

IUCN conservation status: Critically Endangered

Facts: Individual specimens were collected from the Batman and Ambar rivers on 10 May 1974 by Ali Demirsoy and Ali Kelle. Kelle completed the first detailed faunistic study on the fishes of Tigris in 1978 but did not list any new species, including *Paraschistura chrysicristinae*. Later, he contacted Teodor T. Nalbant who was an expert on loaches, who described the species in 1998.

Size: The species is a dwarf loach, with a standard length of up to 36 mm.⁶



SPINACH PIPEFISH

Scientific name: *Microphis spinachioides*

Range: Endemic to the Ramu-Sepik river system in Papua New Guinea.⁷

When last seen: 1985

Suspected reason for disappearance: Not known.

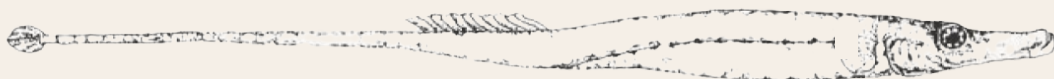
IUCN conservation status: Data Deficient

Facts: It's unsurprising that so little is known about this species: The terrain on Papua New Guinea is extremely difficult to negotiate, distances are huge, roads are few and far between, and air travel is expensive and often non-existent to remote locations. The holotype was stored in the Hamburg Museum, but destroyed during World War II.

As a pipefish, it is closely related to seahorses. Most species of pipefish are inhabitants of tropical and temperate seas, but a few species in the Indo-Australian Archipelago are largely restricted to freshwater.

Aside from their idiosyncratic looks, pipefishes display some extraordinary behaviour: females deposit their eggs on the underside of the male's trunk, or tail, where the male incubates them for several weeks either partly or fully concealed in a pouch.⁸

Size: The species is so poorly known that scientists aren't really sure, but it grows to at least 15cm and possibly up to 22cm.



TITICACA ORESTIAS

Scientific name: *Orestias cuvieri*

Range: Lake Titicaca

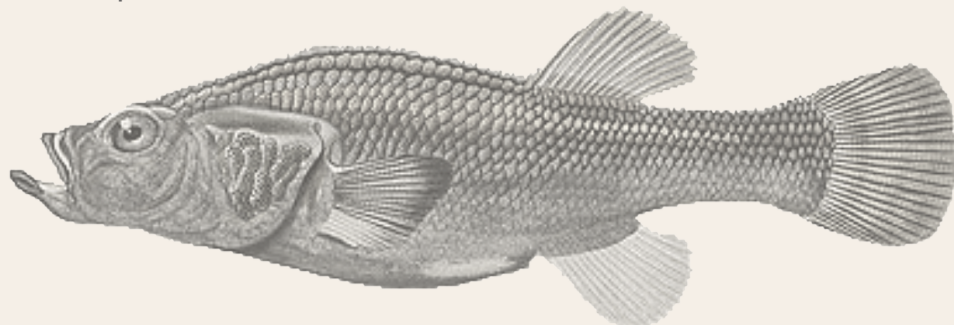
When last seen: 1952

Suspected reason for disappearance: In 1937, 500,000 trout eggs were sent to Lake Titicaca, irreversibly altering the native ecosystem. There has been severe competition from introduced trout, including lake trout, brown trout, and rainbow trout, as well from Argentinian silverside from the 1930s to the 1950s. Pollutants have contaminated the water and traces of metals, such as zinc and copper have been found in the tissues of fishes. In addition, runoff from fertilisers and pesticides used in agriculture has been extremely toxic to the fish.

IUCN conservation status: Data Deficient

Facts: It was common in the lake until the end of the 19th century and was an important part of commercial fishing there. It is the largest member of the pupfish genus *Orestias* and, despite its name, it is not the only *Orestias* fish from Lake Titicaca. *Orestias cuvieri* is thought to be as old as 5 million years and is specifically adapted to its closed lake environment.⁹

Size: Grows up to 27cm.



HADITHA CAVEFISH

Scientific name: *Caecocypris basimi*

Range: A subterranean system in a sinkhole at the Sheik Hadid shrine, near Haditha, Iraq.

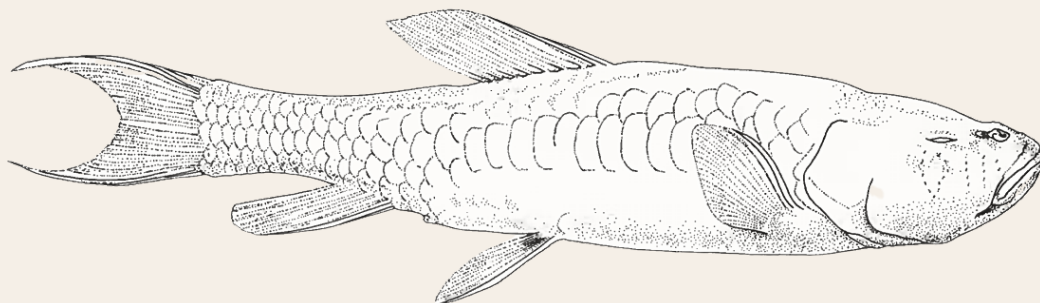
When last seen: 1983

Suspected reason for disappearance: Water abstraction from the well itself has lowered the groundwater level, which appears to be a major threat. It is also thought that reduced groundwater levels due to water abstraction and hydrological modifications caused by the construction of a large dam near the Euphrates may have negatively impacted the site.¹⁰

IUCN conservation status: Critically Endangered

Facts: The subterranean system where the species has previously been recorded is accessed via a well approximately five meters below the shrine. A comprehensive survey of the site in 2012 did not find the species.

Size: The holotype is a mature female at 49mm.



ITASY CICHLID

Scientific name: *Ptychochromoides itasy*

Range: Lake Itasy and environs in the central highlands of Madagascar.

When last seen: 2010

Suspected reason for disappearance: A decline in water quality due to human mediated disturbances, specifically unregulated overfishing and the introduction of exotic species into the Lake Itasy basin, led to the swift decline of native fishes throughout the region.

IUCN conservation status: Critically Endangered

Facts: Until it was rediscovered in a pond at a tributary of the Tsiribihina River in late 2010, it was only known from Lake Itasy, where it had last been seen in the 1970s. It was considered extinct until the rediscovery.

Its coloration is jet black and the local name for the fish is 'trondro mainty', which translates as 'blackfish'.

It differs from its close relatives in having a pronounced occipital hump, even in small fishes that aren't yet sexually mature, and in females.¹¹

Size: Around 12cm.



DUCK-BILLED BUNTINGI

Scientific name: *Adrianichthys kruyti*

Range: Lake Poso, Sulawesi, Indonesia

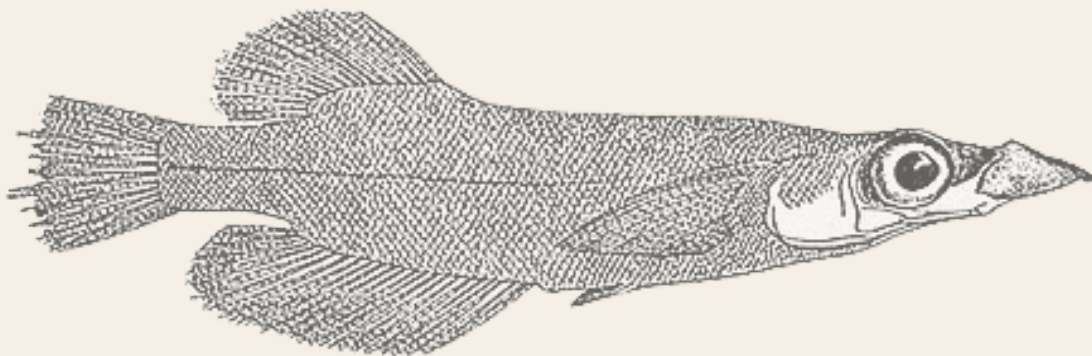
When last seen: 1983

Suspected reason for disappearance: Local fishermen believe its decline it is related to the eruption of the nearby Colo Volcano in 1983.^{12, 13, 14, 15} Invasive species have likely also played a part, and introduced diseases and parasites are also possible explanations.¹³ Overfishing has also likely caused numbers to plummet.

IUCN conservation status: Critically Endangered

Facts: N/A

Size: Grows up to 16 cm, though usually closer to 11cm.



FAQ

Q: What makes a species “lost”?

There is no international standard that defines what constitutes a “lost” species, or a rediscovery, and the criteria varies by taxa. We are working with Re:wild’s Lost Species criteria and have collaborated with experts from the IUCN SSC Freshwater Fish Specialist Group to nominate species. At minimum, a species has to have been lost to science (unseen by scientists) for at least a decade for it to make it on our list of nominations.

Q: How did these species become lost?

Species become lost for a variety of reasons. In some cases, species that once existed in healthy populations are now possibly extinct as the result of any number of threats, including the usual suspects for freshwater fish populations: habitat loss and fragmentation, invasive species introduction, dam construction, pollution. Occasionally, scientists haven’t had access to the species because they are in hard-to-reach wilderness or conflict-ridden regions. And in some cases, these species were very rare to begin with, existing in low numbers in small geographical areas where a single disturbance could easily wipe out the entire population.

Q: What do you consider proof of a rediscovery?

Again, we are working with Re:wild’s criteria on this: we will confirm the rediscovery of a species if scientists have verified—and have evidence—that it is still alive in the wild. Ideally the scientists would see the animal themselves and get photo and video evidence. A photograph verified by DNA or eDNA evidence would suffice as proof of a rediscovery.

Q: Are you at all worried that announcing these species will put them in more danger?

Our goal with the Search for the Lost Fishes is to elevate our top 10 most wanted species to flagships for conservation to catalyse action on the ground with local partners. The only way for those species to become flagships, however, is if we tell their stories and reveal to the world that they do, indeed, still exist. That said, we try to be as strategic as possible with these announcements to ensure that we reduce any and all risks to the species. We might hold off on an announcement until strong protections for the species can be put in place. We may use these announcements themselves to encourage protection at various levels of government in the species’ native countries. And we never reveal the exact locations where these animals are rediscovered.

Q: Is Shoal really going to go out and look for all these species?

The core Shoal team will not be the ones in the field looking for the fish. Rather, Shoal will work with local partners and expert teams to go on fish-finding expeditions. The Search for the Lost Fishes is also designed as a call to action, spurring individuals and teams to go out and search for these species themselves. We see this as a global movement to inject hope into the stale doom-and-gloom narrative of species extinction, and as a way for conservationists to raise the profile of some long-forgotten species to flagship status for conservation action. Shoal and Re:wild are working with teams and individuals the world over to publicise their stories of rediscovery and adventure as part of this shared campaign of hope and celebration.

Q: How did you narrow down the original list to 10?

Selecting a top 10 list was challenging, given the hundreds of potential species on the original list. We decided to focus in on species that represent diverse taxonomy, a range of geographies, face a variety of threats, and that represent good stories to inspire broader conservation.

Q: Do you think you'll find most of the species on the Top 10 list?

The top 10 species all have different likelihoods of being found, as the time passed since their last observations and data on their known distributions vary widely. For several species on the list, a lack of surveys might explain why the species is considered lost, giving them a good chance of being found.

And if there's any one theme for this initiative, it's hope. Hope that maybe, by some chance, these species are still out there. Hope that once we rediscover them, we'll be able to work with partners to conserve them, along with the species that share their habitats. Most conservationists will say that hope is what drives them, against all odds. That's what this initiative is all about.

Q: What happens if you don't find one of the species during an expedition?

As we embark on these expeditions, we'll be learning about the habitats these species once called home and will be looking for conservation opportunities even if we discover that the flagship species is no longer there. As this initiative grows, we will be adding expeditions and working with partners to find additional lost fishes. For some of our target species, we may launch additional expeditions to continue the search.

Q: After a species is rediscovered, then what?

First, we celebrate. Then we get to work with local and international partners on developing the best conservation strategies for this species, its habitat, and the species it shares its home with. This could involve working with communities to protect it, when appropriate establishing a new protected area, understanding how a species has survived and applying that knowledge to help other species, working with local governments to enact laws that protect the species, etc. The conservation strategy will depend on the natural history of the species, its habitat and the threats causing it harm.

Q: How can I learn about the outcome of an expedition?

The easiest way is to head over to Shoal's website and sign up to receive our newsletter. We'll announce when an expedition launches, the results of that expedition, and other important or interesting Lost Fishes news.

Q: As you rediscover species on the Top 10 list, will you replace them with others?

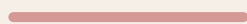
We will! And we will announce the new additions as we go. The new additions will follow the same criteria for the original most wanted list: span taxa, represent various ecosystems, have cultural or scientific value, represent opportunities for conservation action, and have an interesting story for us to tell.

Q: Has any organisation ever done anything like this before?

Re:wild has been running their Search for Lost Species campaign since early 2017. In that time, they have rediscovered six of their original list of 25 most wanted species. Before this, in 2010, their conservation scientists launched a global Search for Lost Frogs, a joint Re:wild partnership with Conservation International. Re:wild Communications Director Robin Moore, then at Conservation International, was leading the team, which included Re:wild President Dr. Don Church, Re:wild Associate Scientist Nikki Roach, and other Re:wild team members. The project was supported by various sources such as the US Fish & Wildlife Service, and Re:wild scientists participated in expeditions. The team developed a list of lost frog species that developed into an entire campaign that involved sending groups of scientists out into various habitats around the world to try to find the "most wanted" frog species. Other groups, such as BirdLife International, have ongoing expeditions to look for specific bird species, but no other organisation has launched an initiative to look for lost fishes.

Q: How can I get involved?

There are lots of ways to get involved! We welcome donations to undertake these expeditions in search of lost fishes, but there are so many other ways for you to get involved. Become an institutional partner or a corporate sponsor. Get out in the field on your own quest and report an observation on iNaturalist, though be sure to let us know! Drop us a message if you have any addition fish species that you would like to see on the list. Follow the search on Facebook, Twitter and the scrolling news section on the campaign page, and then share our stories. And be sure to sign up to our newsletter at the link on our website to receive updates on all things Lost Fishes.



References

1. Nedoluzhko, A.V., Sharko, F.S., Tsygankova, S.V. et al. 2020. Molecular phylogeny of one extinct and two critically endangered Central Asian sturgeon species (genus *Pseudoscaphirhynchus*) based on their mitochondrial genomes. *Sci Rep* 10, 722 (2020). <https://doi.org/10.1038/s41598-020-57581-y>
2. See www.fishbase.se/summary/8763
3. See micoom88.wixsite.com/ictiologiaycultura/finding-the-fat-fish
4. Scott A. Schaefer and Luis Fernández. 2009. Redescription of the Pez Graso, *Rhizosomichthys totae* (Trichomycteridae), of Lago de Tota, Colombia, and Aspects of Cranial Osteology Revealed by Microtomography. *Copeia* 2009(3), 510-522, (3 September 2009). <https://doi.org/10.1643/CI-08-186>
5. Coad, B.W. 2009. Threatened fishes of the world: *Luciobarbus subquincunciatus* (Günther, 1868) (Cyprinidae). *Environmental Biology of Fishes* 86: 323
6. Freyhof, J. 2014. *Paraschistura chrysicristinae*. The IUCN Red List of Threatened Species 2014: e.T19889076A19967270. <https://dx.doi.org/10.2305/IUCN.UK.2014->
7. Allen, G.R. & D. Coates. 1990. An ichthyological survey of the Sepik River system, Papua New Guinea. *Records of the Western Australian Museum Suppl.* 34: 31-116.
8. Dawson, C.E. 1984. Review of the genus *Microphis* (Pisces: Syngnathidae). *Bulletin of Marine Science* 18: 117-181.
9. See www.extinction.photo/species/lake-titicaca-orestias/
10. Banister, K.E; Bunni, M.K. 1980. A new blind cyprinid fish from Iraq. *Bulletin of the British Museum (Natural History) (Zoology)* 38: 151-15
11. Sparks, J. S., P. V. Loiselle, and Z. H. Baldwin. 2012. Rediscovery and phylogenetic placement of the endemic Malagasy cichlid *Ptychochromoides itasy* (Teleostei: Cichlidae: Ptychochrominae). *Zootaxa* 3352: 17-24
12. Larson, H., M. Geiger, R. Hadiaty and F. Herder. 2014. *Mugilogobius hitam*, a new species of freshwater goby (Teleostei: Gobioidi: Gobiidae) from Lake Towuti, central Sulawesi, Indonesia. *The Raffles bulletin of zoology* 62: 718-725
13. Harrison, I.J. and Stiassny, M.L.J. 1999. The Quiet Crisis. A preliminary listing of the freshwater fishes of the world that are Extinct or "Missing in Action". In: R.D.E. MacPhee (ed.) *Extinctions in Near Time*, pp. 271-331. Kluwer Academic/Plenum Publishers, New York.
14. Larson, H.K. 2001. A revision of the gobiid fish genus *Mugilogobius* (Teleostei: Gobioidi), and its systematic placement. *Records of the Western Australian Museum* 62: 1-233.
15. Parenti, L.R. 2011. Endemism and conservation of the native freshwater fish fauna of Sulawesi, Indonesia. *Prosiding Seminar Nasional Ikan V1:1-10*.

Acknowledgements

This campaign would not be possible without the help and support of the people and organisations that have collaborated, given guidance, and provided necessary resources.

A most grateful thanks goes to: Andrew Storey, Brian Zimmerman, Charles Fusari, Conservation Optimism, Cüneyt Kaya, Damien Brouste, Daniel Lumbantobing, Gerald Allen, Bui Huu Manh, Ian Harrison, Ictiología y Cultura, iNaturalist, Instituto de Ciencias Naturales, IUCN Asian Species Action Partnership, Jörg Freyhof, Mick Grant, Susan Laurie-Bourque, Universidad Nacional de Colombia, Valentin de Mazancourt, and Vincent Haÿ

And a special thanks to our partners Re:wild and Synchronicity Earth for their continued collaboration.

