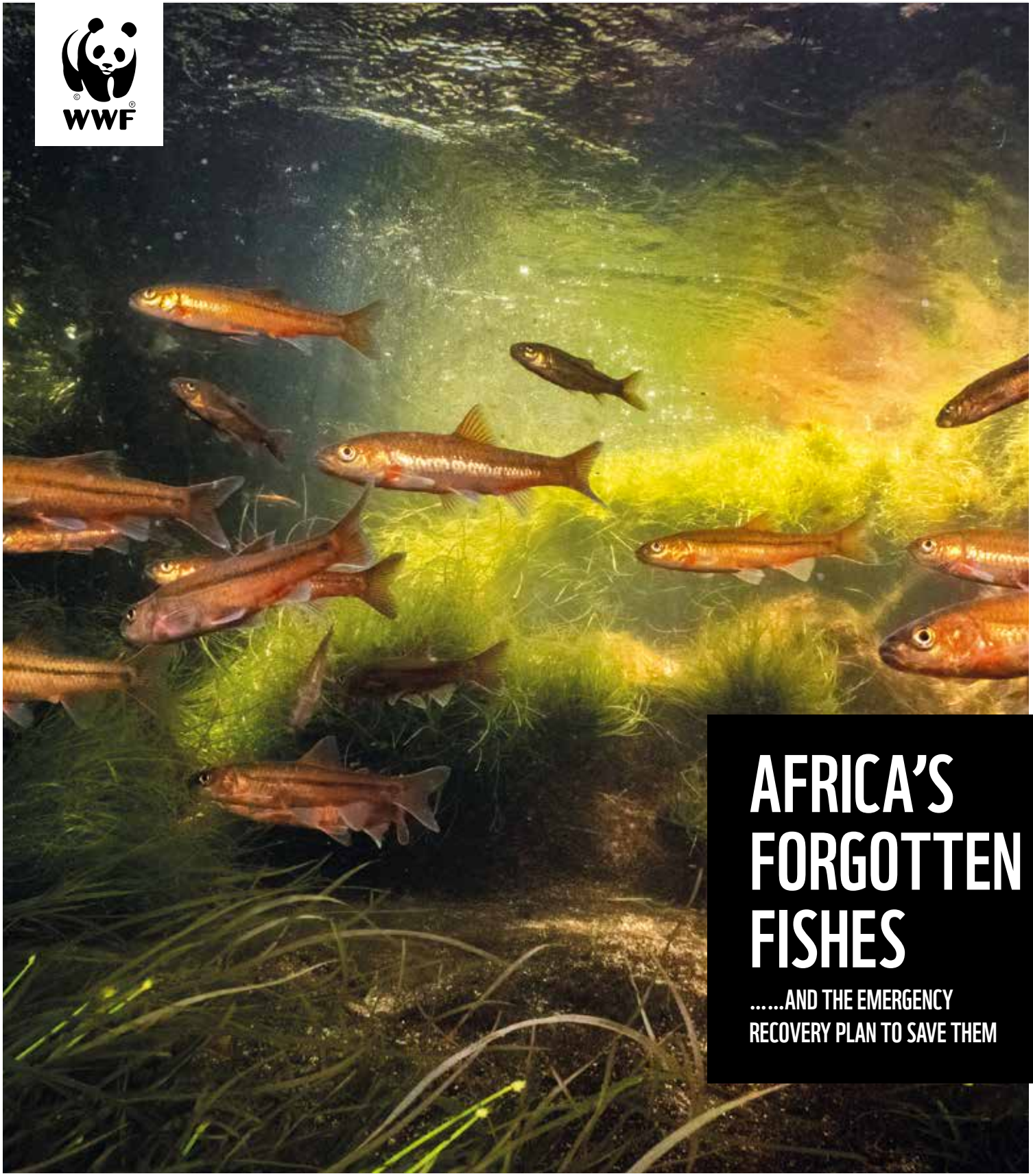

AFRICA'S FORGOTTEN FISHES

.....AND THE EMERGENCY RECOVERY PLAN TO SAVE THEM

WWF

Alliance for Freshwater Life

Conservation International

Freshwater Research Centre

IWMI International Water Management Institute

InFish

IUCN SSC Species Survival Commission

FFSG Freshwater Fish Specialist Group

re:wild

Shoal

NRF National Research Foundation | SAIAB South African Institute for Aquatic Biodiversity

Synchronicity Earth

The Nature Conservancy

Nature Metrics

WorldFish

WWT

Wetlands International

This report is dedicated to the memory of Dr Paul V. Loiselle, whose tremendous knowledge of the freshwater fishes of Africa and Madagascar has significantly contributed to their conservation.

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About this report and its collaborators

Promoting thriving populations of freshwater fishes and the ecosystems within which they thrive is a priority for WWF and the 17 organisations and alliances that produced this report.

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EXECUTIVE SUMMARY

What is the first thing that comes to mind when you think about Africa and biodiversity? It's probably the continent's iconic wildlife species – from elephants to lions, chimpanzees to crocodiles.

Or perhaps it's the vast Congo rainforest. Or great white sharks hunting off South Africa. Few people will think about Africa's astonishing diversity of freshwater fishes, yet they have swum through the continent's communities and cultures for millennia, and are still critical to the daily lives of tens of millions of people – as well as to the overall health of their freshwater ecosystems.

Africa's rivers, lakes and wetlands are home to at least 3,281 freshwater fish species (IUCN Red List, 2025-1) – a figure that includes Madagascar and that is almost certainly a significant underestimate since so many species have not yet been described by science and new species are being discovered in Africa every year – including 28 in 2024 alone (Edmondstone et al., 2025). These fishes are vital for people and nature, supporting ecosystem functionality and the provision of ecosystem services across the continent, enhancing food security and nutrition for millions, and supporting countless livelihoods, particularly in vulnerable communities and landlocked countries.

Over 3 million tonnes of freshwater fish are caught each year in Africa, representing almost 30 per cent of the reported global freshwater fish catch – and this figure is definitely a major underestimate due a lack of data, especially for small scale fisheries. The continent boasts 12 of the top 25 inland fish producing countries in the world, with Uganda coming in highest in sixth place (FAO, 2024). The annual catch feeds the highest per capita consumption of freshwater fish of any continent in the world and employs over 3 million people (FAO, 2024) as well as playing a central role in the cultures of many Indigenous Peoples. In addition, some fishes are economically important either as the lure for recreational anglers or as dazzling aquarium fishes.

But Africa's freshwater fishes are much more than just food or economic resources. They are extraordinary. From the tiny galaxiids of South Africa to the 2m-long Nile perch, *Lates niloticus*, they've evolved to thrive in a vast array of freshwater habitats across this geographically, climatically and topographically diverse continent. They're found from sediment-rich rivers and shallow ponds to the world's greatest lakes, from caves and canyons to mountain streams and flooded forests.

Possibly the most famous of Africa's freshwater fishes are the incredibly diverse cichlids, with at least 1,600 endemic species found in the Great Lakes – Victoria, Tanganyika, and Malawi. These cichlids are one of the most spectacular examples of speciation in the world and provide scientists with a unique opportunity to better understand the drivers of species evolution. Cichlids exhibit a diverse range of parental behaviours. Many are mouthbrooding, protecting their eggs and fry in their mouths, while some Daffodil cichlids, *Neolamprologus pulcher*, forgo the opportunity to breed at all and choose instead to help parent the offspring of relatives (Wong and Balshine, 2020). Livingstone's cichlid or kalingono, *Nimbochromis livingstonii*, from Lake Malawi has developed a unique hunting style; it plays dead to attract other fish to eat it, then it turns the tables by 'coming alive' and eating the would be predator.

But there are so many other weird and wonderful species to discover. Have you heard of Africa's elephantfishes (Mormyridae), which use electrical pulses to communicate with others about sex, size, predators and prey? Or the African turquoise killifish, *Nothobranchius furzeri*, the vertebrate with the shortest life-span (with most living less than 3 months)? Or the African tigerfish, *Hydrocynus vittatus*, which can leap from the water to catch barn swallows

in flight? Or the cuckoo catfish, *Synodontis multipunctatus*, which gorges itself on the eggs of cichlids in Lake Tanganyika? Like its famous avian namesake, this fish tries to palm off parental care on an unsuspecting species. The cuckoo catfish does this by creating chaos at spawning time and confusing unsuspecting female cichlids into scooping up its spawn, which the cichlids subsequently brood in their mouths.

And Africa fish fauna includes two lineages of truly ancient animals:

- The bichirs – Having first evolved around 400 million years ago, these archaic ray-finned fishes only occur in freshwater habitats in tropical Africa and the Nile river system; and
- The lungfishes – Able to travel across land between water bodies like the bichir, these fishes evolved 'just' 380 million years ago.

But despite their dazzling diversity and critical importance to people and nature, Africa's freshwater fishes have remained largely invisible to decision makers with the benefits they contribute hidden and ignored – and are now facing increasing threats to their survival.

Globally, freshwater species populations are in freefall – crashing 85 per cent since 1970 (WWF, 2024). Nearly a quarter of the world's freshwater fish species are threatened with extinction (Sayer et al., 2025). And Africa's freshwater fishes are no exception. Today, many African species are at growing risk due to a devastating combination of threats from damming rivers to draining wetlands, from habitat loss due to agriculture and mining to abstracting too much water for irrigation, from unsustainable fishing practises to uncontrolled introductions of invasive non-native species – and, of course, the escalating impacts of climate change.

Overall, an estimated 26 per cent of Africa's freshwater fishes are threatened (includes species assessed as Critically Endangered, Endangered and Vulnerable) but data are lacking. Some fish species have not yet been assessed and many that have are under-researched with 558 placed in the category of 'Data Deficient' on the IUCN Red List of Threatened Species. There's evidence to indicate that as many as 50 per cent of Data Deficient species globally are threatened, so the actual number of threatened species of freshwater fish in Africa could well be substantially higher. And the majority of the species are endemic, and not found outside the continent.

The IUCN Red List of Threatened Species classifies nine freshwater fishes in Africa as Extinct, including three from Morocco, two from Madagascar and one each from Kenya and Tanzania, Rwanda, Tunisia and Lake Malawi. However, the true number is likely to be significantly greater. For example, many species have almost certainly been lost in Lake Victoria alone.

Freshwater fishes are an aquatic version of the canary in the coalmine for Africa's rivers, lakes and wetlands. If the continent's freshwater ecosystems deteriorate to the point where they can't support thriving fish populations, they won't be healthy enough to continue to underpin Africa's societies and economies. The continent can't afford to lose any more of its forgotten freshwater fishes or the freshwater ecosystems they inhabit. Healthy inland ecosystems and the extraordinary diversity of fishes within them are essential to their health and ours. To secure our own future, we must act now.

Needless to say, Africa's freshwater fishes are not forgotten by the people who depend on them, whose lives and livelihoods are interwoven with the continent's rivers, lakes and wetlands and the fish beneath their surface. But they have invariably been out of sight and out of mind for policy makers, especially when it comes to big decisions that impact freshwater ecosystems. Very rarely, for example, are the full economic and social values of freshwater fishes and fisheries factored into decisions about hydropower dams, draining of wetlands, dredging for navigation or sand mining.

However, there are indications that some decision-makers are finally starting to take the fate of freshwater ecosystems and fishes into account – and that the momentum for action is building. African countries signed up to the Kunming-Montreal Global Biodiversity Framework in December 2022, which explicitly includes the commitment to protect 30 per cent of 'inland waters' and restore 30 per cent of degraded inland waters. This ambitious agreement paves the way for a new approach to safeguard freshwater biodiversity – a new approach highlighted in the country-led Freshwater Challenge. Championed by the Democratic Republic of Congo, Gabon and Zambia, 20 countries on the continent have already joined the Challenge, which is the largest freshwater protection and restoration initiative in history. Other African countries also have the opportunity to join the Freshwater Challenge as Members. Meanwhile, 51 countries are members of the Ramsar Convention on Wetlands, which is committed to the 'conservation and wise use of wetlands'.

In addition to protecting, restoring and sustainably managing freshwater ecosystems, African countries could adopt the Emergency Recovery Plan for Freshwater Biodiversity as a framework for action (Tickner et al., 2020). Developed by scientists and freshwater experts, this practical, science-based plan incorporates six pillars – each of which has been implemented elsewhere in the world and could be adapted by African countries, supporting and further facilitating the work of communities, fishers and conservation organisations:

1. Let rivers flow more naturally;
2. Improve water quality in freshwater ecosystems;
3. Protect and restore critical habitats and species;
4. End unsustainable management of resources;
5. Prevent and control invasions by non-native species; and,
6. Protect free-flowing rivers.

All stakeholders have an opportunity to chart a new course to restore and protect Africa's freshwater ecosystems, and use them sustainably for the benefit of societies and economies. This course must value Africa's remarkable diversity of freshwater fishes and factor them into development decisions. But it is not just governments: the private sector, civil society organisations and communities also have a role to play in protecting and restoring ecosystems and species.

African countries can lead the way by taking decisions that will drive sustainable development without sacrificing freshwater fishes and ecosystems. This will involve hard choices and difficult trade-offs, but it is possible. And it will pave the way to a brighter future for Africa's freshwater fishes and ecosystems – and a brighter future for people and nature across the region.

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Line 1: *Astatotilapia cf. calliptera, Astatotilapia desfontainesi, Coptodon zillii, Oreochromis urolepis.* Line 2: *Aulonocara stuartgranti, Aulonocara jacobfriebergi, Aphyosemion (Chromaphyosemion) poliak, Barboides gracilis* Line 3: *Cynotilapia afra, Fundulopanchax gardneri, Haplochromis hiatus, Haplochromis lividus.* Line 4: *Julidochromis dickfeldi, Labrochromis ishmaeli, Lithochromis rubripinnis, Haplochromis bicolor.* Line 5: *Haplochromis bicolor, Mbipia mbipi, Maylandia estherae, Haplochromis chromogynos.* Line 6: *Neochromis rufocaudalis, Haplochromis chromogynos, Haplochromis degeni, Poropanchax stigmatopygus.* Line 7: *Procatopus nototaenia, Pundamilia azurea, Haplochromis xenognathus, Pundamilia nyererei.* Line 8: *Tropheus moorii 'Chilanga', Haplochromis phytophagus, Haplochromis perrieri, Haplochromis argens.*

DAZZLING DIVERSITY

Africa's freshwater fishes

There are thousands of rivers, lakes and other wetlands across Africa, each boasting its own distinct and dynamic conditions. Many are also completely isolated from each other. The continent is home to 93 of the world's 426 unique and distinct Freshwater Ecosystems of the World (Fig 1). This creates an immensely complex web of ecological niches, which has led to the evolution of an astonishing diversity of fish species.

Clanwilliam redfin,
Sedercypris calidus

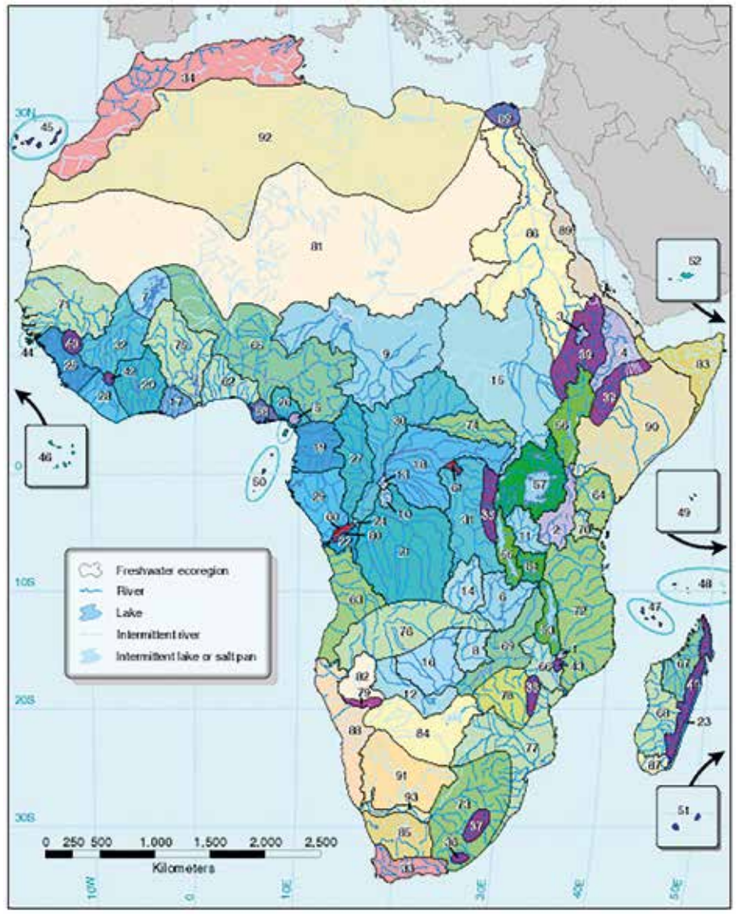


Figure 1: Freshwater Ecoregions of Africa and Madagascar: A conservation assessment

Africa is home to some of the world's most iconic freshwater systems: from the River Nile, the longest river on Earth, to Lake Victoria, the world's largest tropical lake. There is the vast Congo River basin, which is the second largest river basin in the world and sustains the second largest tropical forest. The rivers and wetlands of the Kavango-Zambezi Transfrontier Conservation Area that sustain not only fishes but also one of the highest concentrations of wildlife on the continent, including those of the exceptionally diverse Okavango Delta. And so many more. The total area covered by freshwater bodies on the continent – encompassing lakes, rivers, reservoirs, floodplains and swamps – is about 1.3 million km² (Lehner and Doll, 2004; de Graaf et al., 2012), which is home to the continent's extraordinary, and extraordinarily important, freshwater fishes.

Collectively, these systems are home to more than 3,281 freshwater fish species from close to 100 families (Leveque et al., 2008). This figure is almost certainly an underestimate since hundreds of species have not yet been described by science, especially in the Great Lakes region, and Congolese and Angolan river systems (Darwall et al., 2011).

Equally startling is that almost all of the freshwater fishes found in Africa are endemic. This endemism is not restricted to the species level; the majority of genera are endemic, as are about half of the families (Darwall et al., 2011). Figure 2 shows (a) fish richness, (b) the number of endemic fishes and (c) the percentage of endemic fishes in Africa. Many of these regions are considered Globally Outstanding according to the Biological Distinctiveness Index (Thieme et al. 2005).

There is no way that a report like this can do justice to the wealth of freshwater fishes in Africa but here is a snapshot of some of the most significant river basins and lakes – and the fishes that swim within them.

Congo River Basin

Stretching across Central Africa, the Congo River Basin covers an area of more than 4 million km2, making it the second largest basin after the Amazon. It is also the second most biodiverse in terms of freshwater fishes behind the Amazon, hosting at least 1,200 species of fish (Harrison et al., 2018), an estimated 75 per cent of which are endemic (Darwall et al., 2011). This incredible array of fishes is the result of a wide range of aquatic habitats, from mountain streams and wide rivers to thundering rapids and the deepest river sections in the world, measured at around 160m (Jackson et al., 2009). But compared to what's known about biodiversity in the Amazon, current knowledge of fishes in the Congo Basin is fragmentary at best (Chapman, 2001), and scientists agree there are many more species yet to be discovered.

The river's unique and diverse aquatic habitats have set the stage for the evolution of some particularly unusual fishes. The blind cichlid, *Lamprologus lethops*, is a striking example, with skin-covered eyes, an elongated body and a lack of pigment having evolved in response to the very turbid waters of the rapids and lack of light on the river's bottom (Roberts et al., 1976). Similar evolutionary traits are found in several other unrelated species, including an elephantfish, *Stomatorhinus microps*, the blind spiny eel, *Mastacembelus brichardi*, a blind catfish, *Gymnallabes nops*, and a blind barb, *Caecobarbus geertsii*. Other species include the squeakers (Mochokidae), which make 'stridulatory' sounds by rubbing body parts together, the African tigerfish, *Hydrocynus vittatus*, and its fearsome relative, the Goliath tigerfish, *Hydrocynus goliath*.

Nile River Basin

Flowing for over 6,600 km, the Nile is the longest river in the world. Synonymous with Egypt, where its annual floods fertilised the ancient Egyptian civilisation and where it finally discharges into the Mediterranean Sea, the great river is formed of two major tributaries: the White Nile flowing out of Lake Victoria and the Blue Nile, which rises in Ethiopia's Lake Tana. With 11 riparian

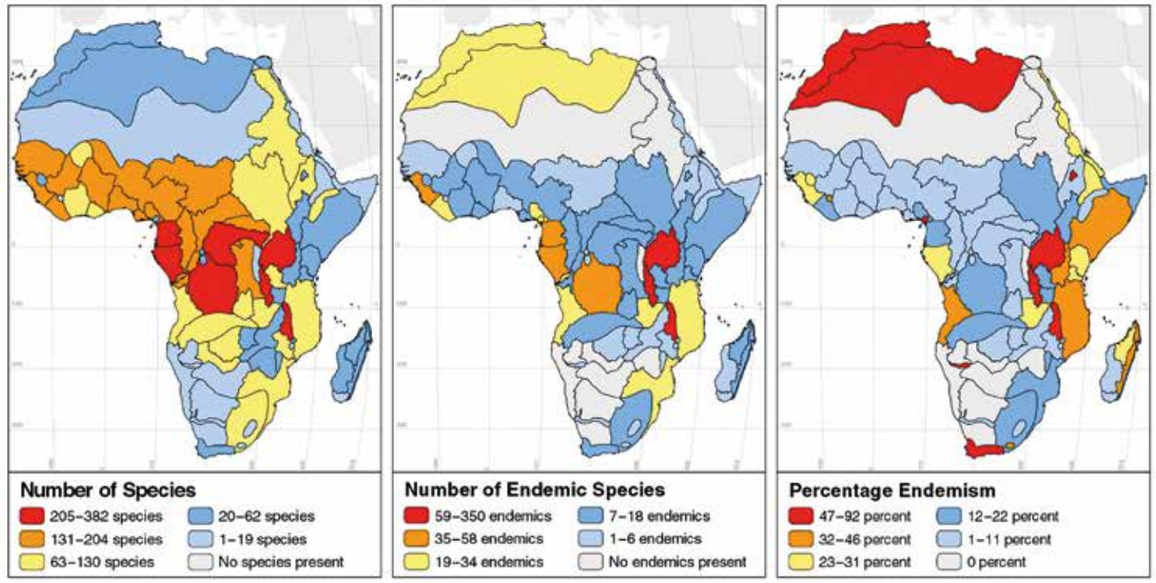


Figure 2: Fish diversity and endemism in Africa

countries, the Nile River system drains a catchment of about 2.59 million km² (Roskar, 2000), which includes highlands, the second largest lake on Earth (see section below on Lake Victoria), vast swamps, the merging of the Blue and the White Niles at Khartoum, the iconic river snaking through the Sahara Desert, and the hugely productive delta. Hundreds of fishes have evolved to occupy niches in the Nile's diverse habitats: the most common families include cichlids (Cichlidae), carps (Cyprinidae), and catfishes (Siluriformes). Its most infamous inhabitant is perhaps the Nile perch, *Lates niloticus*, a popular food fish, which can grow to 2m.

While we're talking about the Nile, let's focus briefly on Lake Tana (Ethiopia), which is the source of the Blue Nile and home to the world's only remaining cyprinid (*Labeobarbus*) lake species flock (Nagelkerke, 1997) after the one in Lake Lanao, Philippines was decimated by overexploitation. Of the 18 species in Lake Tana, one is Endangered (*Labeobarbus macropthalmus*), four are Vulnerable (*L. acutirostris, L. gorguari, L. ossensis* and *L. platydorsus*), and five are Data Deficient (Getahun, 2010). Besides their great ecological importance, these species are economically important, supporting more than 30 per cent of Lake Tana's commercial fishery. Nine of these species were found to migrate every year during the rainy season to the six major feeder rivers of the lake and their smaller tributaries (Anteneh et al., 2012).

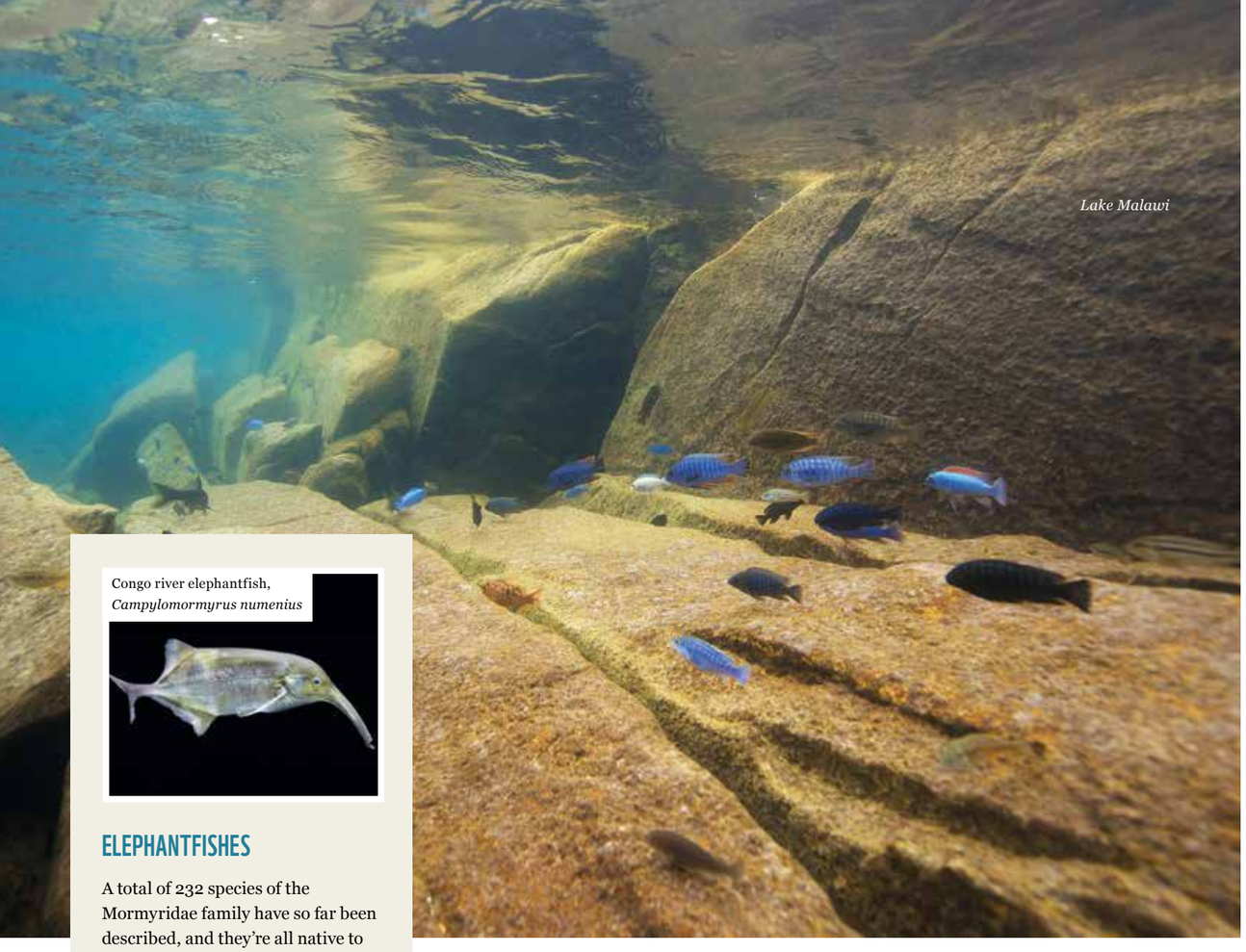
THE AMAZING RADIATIONS OF CICHLIDS

Haplochromis lividus

Native to Africa, the Middle East, Southern Asia and the Americas, cichlids (Cichlidae) are one of the most diverse groups of freshwater fish on Earth, with almost 2000 known species and counting. At least 1600 of these species have evolved in Africa's Great Lakes, including Victoria, Tanganyika and Malawi, with hundreds of species yet to be described (Nelson, 2006). Within these lakes, cichlids have adapted to occupy almost every niche in the food chain, including carnivore, herbivore and detritivore. Some are generalists, others specialists, and they have developed an array of morphological and behavioural adaptations to their niche. The reproductive and parental strategies of cichlids are as diverse as they are, and include monogamous, harem-forming and polygamous species; substrate, cave and mouthbrooders. Some Daffodil cichlids, *Neolamprologus pulcher*, forgo the opportunity to breed at all and choose instead to help parent the offspring of relatives (Wong and Balshine, 2020). The diversity of Africa's Great Lake cichlids is one of the most spectacular examples of speciation in the world, rivalling the Galapagos in terms of significance, and provides scientists with a unique opportunity to better understand the drivers of species evolution, and more recently, extinction.

Niger River Basin

The third longest river in Africa, the Niger flows from its source in the Guinea Highlands in a huge boomerang through the Sahel in West Africa, where it forms the Inner Niger Delta (the second largest wetland in Africa), before eventually transforming into a vast delta in southern Nigeria. At least 229 fish species from 33 families have been recorded in the Niger Basin, along with other diverse aquatic fauna and flora. The Niger's freshwater fishes include cichlids, carps, elephantfish, knifefish (Gymnarchidae), catfish, tetras and two of the oldest freshwater fish



Lake Malawi

Congo river elephantfish, *Campylomormyrus numenius*

ELEPHANTFISHES

A total of 232 species of the Mormyridae family have so far been described, and they're all native to Africa. They're carnivorous fishes that probe for small crustaceans and aquatic insects on the riverbed – and members of the *Gnathonemus* genus do it with the help of remarkable elephant-style snouts, giving the family its colloquial name. With their unusual coloration and shapes these fishes are popular as aquarium fish, as well as being unusually intelligent and with notably large brains. Near their tails they possess special organs with which they can generate a weak, electric field, allowing them to locate prey and obstacles in the dark, as well as communicate with one another to find mates and food, and avoid predators. The strange appearance of the mormyrids in fact contributes to their conservation, particularly in the DR Congo: among the myths relating to them, one is that parents who eat them will have children with unusually elongated mouths – hence it's seen as taboo to do so.

lineages on Earth – bichirs (Polypteridae) and lungfish (Protopteridae). It boasts vital fisheries. However, despite the historical productivity of the ecosystem, scientists are now reporting drastic declines in the quality, quantity, size and diversity of fish, particularly among large species like the Nile perch, *Lates niloticus*.

Zambezi River Basin

With a length of more than 2,500km and a catchment of around 1,390,000km², the Zambezi River forms the fourth-largest basin in Africa, traversing six countries in southern Africa before flowing into the Indian Ocean in Mozambique. It is home to at least 122 fish species – 24 of which are endemic. Unsurprisingly, given its immense size, there are different fish populations above and below the Victoria Falls, which acts as a natural migration barrier for many species. A diversity of habitats creates the conditions for very different fishes to thrive, including the African tigerfish, which hunts in well-oxygenated flowing waters, the Southern African pike, *Hepsetus cuvieri*, which prefers to ambush its prey in quiet, low-oxygen backwaters, and the Vundu, *Heterobranchus longifilis*, the largest catfish on the African continent, which can be up to 1.5m long.

Desert dwellers? The fishes of North Africa

Although North Africa is generally perceived as being very arid – the Sahara Desert is synonymous with the region – it does still contain freshwater habitats in highlands such as the Atlas, Ahagar and Tibesti Mountains. Rivers, streams, springs, artesian wells and lagoons make up around 35 hydrographic systems in North Africa and are home to an unexpected and unique array of freshwater fish species, mostly from eight families with cyprinids being the most abundant (Doadrio, 1994). There are also unexpected individual species, such as the freshwater blenny, *Salariopsis fluviatilis*. Morocco has the richest freshwater fish fauna in the Maghreb region, comprising 69 species across 22 families – 26 of which are endemic (Cherkaoui, 2021). Many of these species are found in isolated habitats, and are unique to that particular habitat or spring. Some have not been observed for many years, such as Tunisia's Critically Endangered blue-lipped cichlid, *Haplochromis desfontainii*.

Of course, we have barely scratched the surface of the fishes that are swimming below the surface of Africa's multitude of rivers. For example, at the opposite end of the continent from Morocco, the Orange River basin in southern Africa is known for its Vaal-Orange smallmouth yellowfish, *Labeobarbus aeneus*, and the largemouth yellowfish, *Labeobarbus kimberleyensis*, the largest cyprinid fish in Africa; while smaller endemic species in South Africa include the Barnard's rock-catfish, *Austroglanis barnardi*; Clanwilliam redfin, *Sedercypris calidus*; golden sleeper, *Hypseleotris cyprinoides*; and the barebreast goby, *Silhouettea sibayi*. Indeed, at the southern tip of the continent, the Cape Fold freshwater ecoregion boasts the largest concentration of endemic fishes south of the Zambezi River. The fishes belong to nine genera (Skelton, 2024) and include the largest anabantid fish, *Sandelia bainsii*, which can reach the (relatively dizzy length) of 26 cm. And how did we get this far without mentioning the Okavango Delta and it's globally rare inland delta, teaming with fishes, including the tigerfish, Southern African pike, *Hepsetus cuvieri*, and an incredible array of freshwater biodiversity?

But now it's time to turn our attention to Africa's Great Lakes – which really are the world's greatest in terms of volume of water and freshwater fish diversity. All 12 of Africa's major Rift Valley lakes are renowned for the diversity and endemism of their fish species. But it's the big three that are the record breakers. Indeed, each of the Lakes Tanganyika, Malawi and Victoria harbour more species than any other lake on Earth (Snoeks et al., 2017), although the diversity is primarily among the cichlids. Read on as we plunge into the waters of these Great Lakes and you'll be amazed by the myriad species swimming before your eyes. So, let's start:

Lake Tanganyika

Lake Tanganyika is the third largest lake in the world by volume and the second by length and depth as well as the oldest of the East African Rift Valley lakes (Cohen et al., 1993). Boasting Africa's most ancient flock of endemic cichlids, with over 200 species identified (Konings, 2015) and more yet to be described, it is viewed as an evolutionary reservoir for the dazzling array of species which have spread throughout the other lakes in the region (Snoeks et al., 2017). Arising from its ancient origins, the lake's high level of endemic fish also include non-cichlids, including catfishes (Claroteidae and Mochokidae), snooks (Latidae) and spiny eels (Mastacembelidae). Indeed, there are more than 150 non-cichlid species in the wider Lake Tanganyika basin (De Vos and Snoeks, 1994), which hosts an estimated 470 species (Thieme et al., 2005). Among the latter are two eponymous clupeid species; the Lake Tanganyika sprat, *Stolothrissa tanganicae*, and sardine, *Limnothrissa miodon*, which live in large schools and are food for the lake's piscivores, which include four large species of perch (genus *Lates*).

Lake Malawi

There is cichlid diversity and then there is Lake Malawi! Also known as Lake Nyasa and Lago Niassa, the southernmost of Africa's Great Lakes hosts an estimated 800 cichlid species, fewer than half of which have so far been formally described by taxonomists, making it the most species-rich lake on Earth. Over 99 per cent of these cichlids are endemic (Snoeks, 2000). The lake basin also hosts 62 native non-cichlid species belonging to 11 different families. As a result, the lake supports what is probably the most varied, multispecies freshwater fishery in the world (Snoeks et al., 2017), providing employment for more than 150,000 fishers, processors and traders (Ganter et al., 2001). Shoals of the endemic Lake Malawi 'usipa', *Engraulicypris*

Blue lyretail killifish, *Fundulopanchax gardneri*

KILLIFISHES

Africa has three native families of these small and vibrantly coloured fishes, and they're remarkable for two very different reasons. For one thing, the African turquoise killifish, *Nothobranchius furzeri*, is the world's shortest-living vertebrate: it can become sexually mature just three weeks after hatching, and has a lifespan of a mere 3-9 months. As such, it is frequently studied by scientists researching the ageing process. And another really amazing thing about Africa's killifish is how they spread their eggs – or rather, how they get other species to do it for them. Killifish lay their eggs in mud, and these eggs are able to 'pause' their embryological development in times of drought. Then, when large herbivores pass through, the mud that clings to their feet often contains buried eggs – which they take with them into other bodies of water, where the eggs are washed off, and development resumes. Indeed, so important is this means of dispersal that a reduction of killifish populations in and around the Zambezi has been directly linked to falling elephant numbers. Who would have expected one of the world's largest and longest-living mammals to play such a vital role in the life of its shortest-living fish? These short-lived and highly-adapted fishes are also amongst the most beautiful of Earth's animals. It's no wonder these little fishes are popular in aquariums.

Breede River redfin, *Pseudobarbus burchelli*

sardella, dominate the pelagic community, along with a complex of cichlids that feed on zooplankton, collectively known as 'utaka'. Larger predatory fishes like those in the genera *Rhamphochromis* and *Diplotaxodon* thrive further offshore, where they hunt the smaller pelagic species. Between 9 and 12 species of mostly deep-water, large catfishes of the genus *Bathyclarias* are endemic to the lake (Snoeks 2004).

Lake Victoria

Last but not least is Lake Victoria. It is almost certainly a shadow of its former diversity due to the deliberate introduction of non-native food fish and other threats.

The saucer-shaped lake is the second-largest lake in the world by area, with a surface area of almost 70,000km². Lake Victoria is shallow in comparison to the other Great Lakes, with a maximum depth of 84m and an average of only around 30m, so it contains no real deep-water fishes. But it did historically support a wonderful diversity of fishes, including an estimated 600 endemic cichlids (Thieme et al., 2005). That was before the release of two non-native food fish, which successfully contributed to the development of one of the most productive inland fisheries in the world, but also devastated this treasure trove of endemic species (Ogutu-Ohwayo and Balirwa, 2006). Indeed, the impact of these introductions was so profound that as many as 200 species may have been driven to extinction (Witte et al., 1992) – although that figure has been challenged. For example, Harrison and Stiassny (1999) concluded that 132 species might be extinct but there was no way of confirming this due to lack of data, insufficient surveying and complications in their taxonomy. We may never know the full extent of what has been lost – and some presumed extinct species have indeed been rediscovered – but from what we can tell Lake Victoria has probably been the scene of the greatest vertebrate extinction of the modern era.

The main culprit? The voracious Nile perch, *Lates niloticus*, is certainly the prime suspect. Introduced in 1954 to create a new commercial fishery, the Nile perch population had exploded by the 1980s, ravaging the native cichlid species in the process. By the 1990s, the Nile perch accounted for more than 90 percent of fish exports from the three Lake Victoria basin countries – Kenya, Uganda and Tanzania (Odongkara et al., 2005) with yields peaking in 2005 at US$322 million, before falling to around US$250 million (Weston, 2015). But the Nile perch is not the only factor: the introduction of water hyacinth, which reduced light and oxygen levels in the lake's waters; unsustainable fishing practices; and habitat deterioration and eutrophication resulting from increasing lakeside agriculture, urbanisation, and deforestation also played their part (Harrison and Stiassny, 1999). Some cichlid populations have shown signs of rebounding in recent years, while one species, the endemic *Lipochromis microdon*, was rediscovered during field trips by Ole Seehausen's research team in 2023 and 2024 after last being formally recorded in 1985. However, many species have likely been lost for good, some before even being properly described, with many others critically endangered.

Small multi-coloured cichlids, generally known as Haplochromine cichlids (Fulu), were once the most speciose group in Lake Victoria with around 300 species. Many of these species have yet to be described by scientists or their ecological function and role understood. Unfortunately, many are very rarely seen and some are feared extinct, including *Haplochromis lividus*. In addition to the threats facing all of Lake Victoria's native fishes, they are considered particularly at threat from land use changes that have resulted in sedimentation and increased turbidity in the lake. This is because these land use changes impact the reproductive success of these primarily visually-orientated fishes – who can no longer see each other. Some of these fishes have sought refuge in rivers that drain into Lake Victoria, including the Mara River, highlighting the importance of these rivers (WWF, 2020).

We could fill pages and pages with the fishes from just these lakes, let alone the other lakes in the Great Rift Valley. Like Lake Turkana, which boasts wonderfully-named endemics such as the Dwarf Turkana robber, *Brachyalestes minutus*, and the Turkana jewel cichlid, *Rubricatochromis exsul*, along with the Electric catfish, *Malapterurus electricus*. Indeed, Lake Turkana, deserves more of a mention since it is the world's largest desert and alkaline lake and the fourth largest lake in Africa. It has a catchment area of about 130,860 km², stretching across both Kenya and Ethiopia (Obiero *et al.*, 2023). The lake is mainly supplied by water from the Omo River – the lake's "umbilical cord" – which provides about 90 per cent of the inflows (Getahun *et al.*, 2020). Though studies are limited, the lake supports a diverse array of flora and fauna, including Nile crocodiles, hippopotamuses, numerous bird species and at least 79 fish species (Obiero *et al.*, 2023; Wakjira and Getahun, 2017). Despite its importance and uniqueness, not much is known about the lake, its ecology or biological resources, including lacking a comprehensive study or scientific documentation of its ichthyofauna.

Madagascar

We could not possibly bypass Madagascar, the fourth largest island in the world, which has been geographically isolated for over 160 million years – resulting in the evolution of an extraordinary diversity of unique species. This is also the true of Madagascar's mysterious treasure-trove of freshwater fishes – 81 per cent of which

LUNGFISHES

Marbled lungfish

Lungfishes are an ancient group that evolved around 380 million years ago. Africa boasts four *Protopterus* species (there's also one in South America and one in Australia). As their name suggests, these incredible yet primitive fishes have lungs and can breathe air, and do something remarkable when their water supply is diminished: they burrow deep into the mud, where they surround themselves with a cocoon of slime and can stay alive – albeit inactive – for up to three years (or maybe more!). Lungfishes are voracious feeders, with teeth so powerful they can cut off a finger. Uniquely, their upper jaw has two rounded teeth with a bridge that moves from side to side to cut tissue – they suck their prey in, crush it, then chew up the carcass. When it comes to breeding, males do most of the work, making a nest at the onset of the rainy season and then guarding both eggs and larvae – while the females offer no parental care, heading instead for the open waters of rivers. At up to 1 metre long, the Tana lungfish, *Protopterus annectens*, is the largest among the species; while the marbled lungfish, *P. aethiopicus*, has the largest genome of any vertebrate, with 133 million base pairs. The latter species also divides opinion: in some local communities it's seen as a delicacy, in others it's used in traditional medicine, and yet in others eating it is strictly taboo.

Polypterus endlicheri

BICHIRS

These 'living fossils', which are sometimes called 'dinosaur fish' due to their unique appearance, are the oldest freshwater fishes on the African continent, to which all 14 bichir species are restricted. Among their 'primitive' features, bichirs have fleshy pectoral fins that look more like limbs, and rudimentary lungs into which they can breathe air through a pair of slit-like spiracles on top of their snouts. The larger species can grow up to a metre in length. Bichirs are predators that live in rivers, streams and shallow floodplains, relying on their acute sense of smell rather than their poor eyesight when hunting. They're also popular in the global aquarium trade, particularly the aptly-named ornate bichir, *Polypterus ornatipinnis*. In captivity, they can live for up to 30 years.

occur nowhere else on earth (Antonelli et al. 2022). These fishes include cichlids, gobies, and the Madagascar rainbowfishes, which is an entire family of fishes found only in Madagascar. What's equally interesting are the fishes not found in Madagascar; there are no tetras, carps, elephantfishes or birchirs, nor indeed many of the families of fishes found in the rest of Africa or 'nearby' in India. This is a great mystery to scientists as it's not what would be expected given our current understanding of the break-up of Gondwanaland (Thieme et al. 2005).

New species are still being discovered, take for example *Malagodon honahona*, a small fish from the forested swamps on the country's eastern coast. Sadly, this fish is already feared extinct in the wild. Indeed, many of Madagascar's freshwater fishes are at risk of extinction, including the threatened Madagascar pupfishes, a genus of stunning brilliantly coloured fishes, some of which are now restricted to tiny pockets of water. Or the Lake Itasy cichlid, known locally as Trondro mainty, *Ptychochromoides itasy*, which translates as 'black fish' and is known for its distinctively large humped head, which is present in both males and females. Or the Critically Endangered Mangarahara cichlid or joba mena, *Ptychochromis insolitus*, which is endemic to the Sofia River catchment. This species received global attention in 2013 when London Zoo launched a global search for a girlfriend for their three male fishes in a bid to start a conservation breeding programme.

Needless to say, this is just a snapshot of the 3,281 known freshwater fishes of Africa. By the time you read this, this total might well have increased as new species are being discovered every year: there were 28 in 2024 alone (Edmondstone et al, 2025). But it has hopefully given you an idea of the astonishing wealth of fishes in Africa's freshwater ecosystems – fishes that are critical to the health of those ecosystems and to the people and nature that depend on them.

GREAT MIGRATIONS - AFRICAN SWIMWAYS

The Serengeti Migration is one of the world's most famous wildlife spectacles. No less spectacular, but less well known are the migrations of Africa's freshwater fishes, which take place beneath the surface. Thousands of Africa's fishes migrate within and across river basins to complete their life cycles, including many of Lake Victoria's species, such as the African sharptooth catfish, *Clarias gariepinus*, the Ningu, *Labeo victorianus*, and many cichlid species. Indeed the tributaries of Lake Victoria are considered an essential refuge for some of the most threatened species (Pringle et al., 2020). Further south, the Vaal-orange Smallmouth Yellowfish, *Labeobarbus aeneus*, which is sought by anglers in South Africa, which migrates in response to changes in water flow and water temperature to complete its lifecycle.

Migratory fishes have key ecological roles. Yet globally they are in decline, with populations declining by 81 per cent between 1970 and 2020 (WWF, 2024). The Convention on Migratory Species (CMS) reported that 97 per cent of CMS-listed species are at risk of extinction primarily due to the blockage of migration routes by dams and other river barriers (Sayer et al. 2024). Sadly, Africa is the only region in the world where data is too limited to determine the trends of migratory fishes. However, existing data demonstrates they are impacted by habitat degradation, fragmentation, exploitation and other threats. The decline of migratory fishes risks indigenous cultures, food security, livelihoods and biodiversity conservation, making the long-term monitoring of their populations a priority. Around the world only 37 per cent of rivers longer than 1,000 kilometres remain free-flowing over their entire length (Grill et al. 2019). Obstructing these essential Swimways (Fig 3). This will result in the extinction of many important species and loss of the benefits they provide. Governments should act now to designate and protect such Swimways. This will be key to achieving future targets to reduce freshwater biodiversity loss, combat climate change, and improve food and water security.

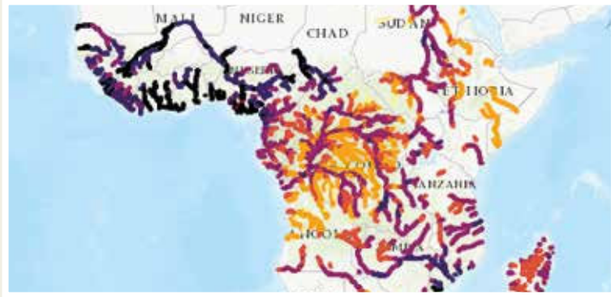


Figure 3: Central African fish Swimways taken from the Global Swimways Explorer: www.explorer.globalswimways.org

HEALTHY FRESHWATER FISHES

= *healthy African ecosystems*

Healthy freshwater ecosystems are essential to sustain thriving populations of freshwater fishes. But, we sometimes forget how the reverse is also true: freshwater fishes are essential to the health of freshwater ecosystems. And healthy rivers, lakes and wetlands are critical for people as they provide us with food, water and other services that underpin our societies and economies, including strengthening climate adaptation.

AFRICA'S RIVERS, LAKES AND WETLANDS SUPPORT DIVERSE SOCIAL, ECONOMIC AND CULTURAL SYSTEMS, PROVIDE HABITATS FOR THOUSANDS OF SPECIES, AND ARE CRITICAL TO THE HEALTH OF TERRESTRIAL AND COASTAL ECOSYSTEMS.

The incredibly diverse fishes of Africa play a regulatory and foundational role within ecosystems and are central to natural balance. They perform many different functions within the river as piscivores, insectivores and other predators, as well as herbivores and detritivores – with fishes eating and thereby controlling populations of plants and other animals, and in turn being eaten. But when we drastically reduce freshwater fish populations and diversity, we upset the delicate equilibrium and threaten the healthy functioning of the systems that so many people and other species rely on.

Africa's rivers, lakes and wetlands support diverse social, economic and cultural systems, provide habitats for thousands of species, and are critical to the health of terrestrial and coastal ecosystems. Healthy freshwater wetlands play a vital role in supporting the livelihoods of local people, supplying not only water but also providing a productive environment for agriculture, aquaculture, wild capture fisheries, non-fish aquatic goods, and tourism. They also provide a host of other important benefits:

- Healthy peatlands, including the massive peatlands of the Congo basin, are huge carbon stores and critical to climate mitigation;
- Protected and restored wetlands and connected floodplains can reduce the impact of extreme floods by spreading and absorbing the floodwaters;
- Healthy wetlands and replenished aquifers can help reduce the impact of droughts;
- Sustaining aquatic plants is critical as many are used for food, medicinal purposes and building materials;
- Mangroves that are thriving due to sufficient water, sediment and nutrient flows from rivers can prevent erosion, buffer communities from storm surges, and trap nutrients that contribute to fisheries productivity; and
- Urban and peri-urban wetlands can filter excessive nutrients and toxins from agricultural, industrial and municipal wastewater before it enters freshwater ecosystems.

Thriving and diverse populations of freshwater fishes play a role in ensuring the health of these ecosystems as well as directly feeding and sustaining a wealth of other wildlife. Take, for example, one of the Africa's top predators and most iconic species ¬– the Nile crocodile (and the other West African, slender-snouted and dwarf crocodiles, of course!) which feeds mostly on fish. Many other species rely on fishes as their primary source of food, including the aquatic genet, the spotted-necked otter, giant otter shrew and many fish-eating birds, including kingfishers, storks, herons, egrets, the shoebill and the African fish eagle.

But it is not just these fish-eaters that are at risk from the increasing threats to freshwater fishes. Entire ecosystems depend on healthy freshwater fish populations, including a vast array of non-fish-eating – and indeed non-freshwater – species. And, of course, hundreds of millions of people.

When we tip the scales by drastically reducing freshwater fish populations, we undermine the functioning of freshwater ecosystems – our very life support systems (Brooks et al., 2016). The decline in freshwater fish populations is the clearest indicator of the damage we have done – and are still doing – to Africa's rivers, lakes and wetlands. And that collapse of aquatic ecosystems across Africa only exacerbates the continent's freshwater fish crisis. Freshwater fishes need healthy freshwater ecosystems. And so do we. But we're losing them both far too fast.

Main © Michael Poliza / WWF, inset: © Martin Harvey / WWF

AFRICA WILD FRESHWATER FISHERIES ARE PRICELESS

Under-reported, undervalued and under pressure

On paper, wild-capture freshwater (aka 'inland') fisheries account for over 12 per cent of the world's annual reported catch, totalling 11.3 million tonnes in 2022, with almost a third harvested in Africa (FAO, 2024). However, these figures are without a doubt a considerable underestimate: global and African statistics only show documented country-level catches, and freshwater fish caught by artisanal, small-scale and subsistence fishers are rarely documented. In fact, research suggests the actual freshwater catch is likely to be around 65 per cent higher than reported (Fluet-Chouinard et al., 2018).

AT LEAST 85% OF TANZANIA'S FISH PRODUCTION COMES FROM FRESHWATER FISHERIES

(BREUIL ET AL., 2014)

Main © James Suter / Black Bean Productions / WWF-US. inset above right © Thomas Nicolon / WWF DRC. inset below © Green Renaissance / WWF-US

FRESHWATER FISHES ARE CENTRAL TO LIFE IN SALONGA NATIONAL PARK

The huge Salonga National Park in the Democratic Republic of Congo is a biodiversity hotspot, rich in both terrestrial and aquatic life. The health of the park's rivers, swamps, and peat bogs are vital for the entire ecosystem and the local communities who rely on artisanal fishing for their food security and livelihoods. Research from 2006-2010 identified 152 fish species in Salonga's rivers.

Local fishermen use traditional methods such as nets, hooks, and harpoons, with a preference for fixed nets due to the submerged tree trunks in the rivers. Fish preservation methods like smoking and salting are common. Smoking is widespread but resource-intensive, while salting is more effective but costlier. But Salonga's freshwater systems are under increasing threat from unsustainable fishing, including harmful practices. For example, some fishermen use toxic substances to increase their catch, damaging the environment and threatening human health.

WWF collaborates with local associations such as the Union of Professional Fishermen of Monkoto to promote responsible fishing. Initiatives include sharing good practices and advocating for seasonal fishing closures to allow fish populations to recover and restricting access to sensitive areas like spawning grounds to ensure sustainable fish populations. WWF also supports legislative efforts and monitoring to enforce sustainable practices.

By fostering collaboration among local communities, stakeholders, and conservation organizations, Salonga can serve as a model for biodiversity and sustainable development, ensuring the protection of Africa's forgotten fishes for future generations.

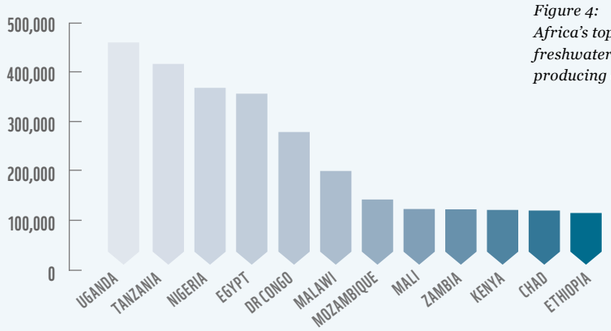


Figure 4: Africa's top 12 wild freshwater fish producing countries

SOURCE: FAO. 2024. The State of World Fisheries and Aquaculture 2024 – Blue Transformation in action. Rome. https://doi.org/10.4060/cd0683en

Many countries require support to overcome the logistical and funding challenges that continue to undermine the quality of their national data collection systems for inland waters, leading to underestimation of inland water catches. Many countries also do not report to the UN Food and Agriculture Organization (FAO), or report only partial inland water catches (FAO, 2024). However, the official figures still show the critical importance of freshwater fisheries to communities and economies across Africa.

Overall, African countries caught 3,324,000 tonnes of wild freshwater fish in 2022, representing 29.4 per cent of the global catch – second only to Asia and far ahead of any other region. Uganda is the 6th largest producer of wild capture inland fish on Earth followed by Tanzania – both of which benefit from the continent's largest freshwater fisheries in Lake Victoria. The rest of Africa's Top Twelve producing countries – spread across the continent from North to South, East to West (see Figure 4) - are all in the top 25 wild freshwater fish producing countries worldwide.

SMALL FISHES PLAY A GIANT ROLE IN THE HEALTH OF COMMUNITIES IN SUB-SAHARAN AFRICA

Small pelagic (open water) freshwater fishes play a major role in food security and nutrition across sub-Saharan Africa (Kolding et al., 2019). Yet, these small silver fishes – dagaa, kapenta, salanga and usipa – receive much less attention than larger and more economically valuable species, such as Nile tilapia and Nile perch. Sometimes called 'vitamin fish', these species are hugely important to the health of many communities as well as supporting livelihoods across the region. And they can also generate significant income. For example, there are two kinds of Tanganyika sardine – *Limnothrissa miodon* and *Stolothrissa tanganicae* – with the pair known locally as kapenta or matemba. They form most of the biomass of the pelagic fish in Lake Tanganyika, although both species have suffered overfishing in the past two decades. These little fish play an outsized economic role, too – Tanzania's freshwater small-scale 'dagaa' fisheries, for example, generate an estimated US$127.5 million in export value, contribute 1.1 per cent to GDP (URT, 2017). There's a further benefit to these smaller fishes; their reproduction. They can spawn several times in a year, facilitating rapid replacement within the ecosystem. This means that they can recover more rapidly from fishing pressure and may be a much more environmentally friendly source of fish (FAO, 2020).

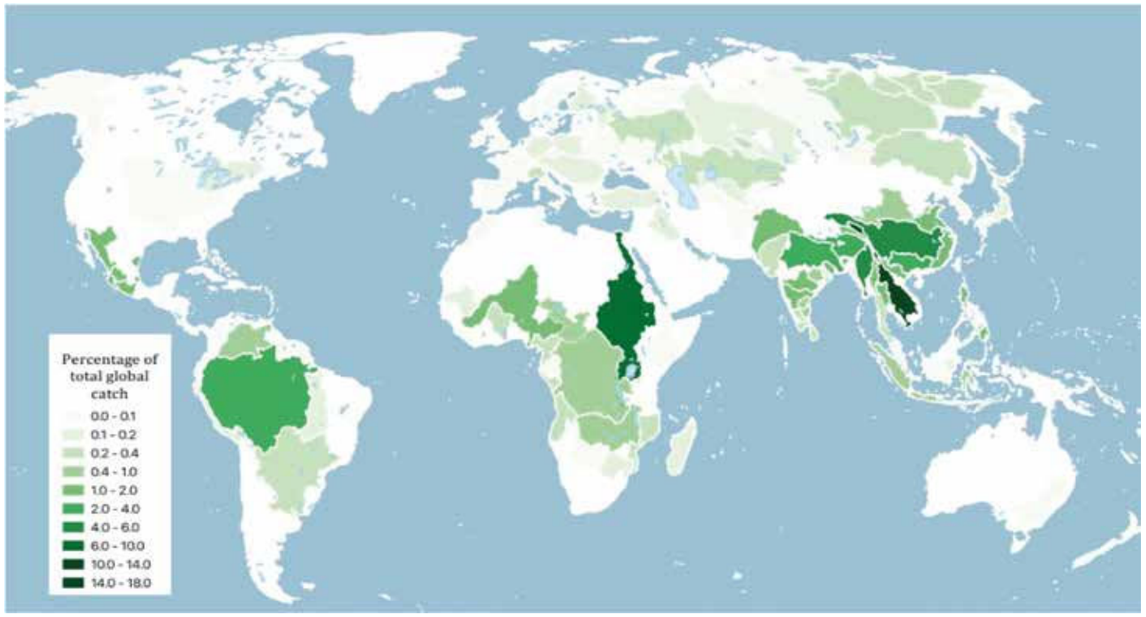


Figure 5. World's largest producer of freshwater fish by river basin (Taken from Ainsworth et al., 2022)

Freshwater fisheries in Africa are spread across the continent, including Madagascar. In addition to major rivers and the Great Lakes, people also harvest fish from streams and ponds, reservoirs, swamps and rice fields – fisheries that are predominantly small-scale in nature. Globally, 99 per cent of total inland capture production comes from small-scale fisheries, and contribute to a third of all global small-scale fisheries catch (FAO, 2024). One particularly important ecosystem for fisheries are tropical floodplains associated with river basins and lakes, where the annual flood pulses are critical for the life cycles of many fish species and the productivity of fisheries.

It's worth noting that at 2.56kg, Africa's annual catch of freshwater fishes per capita is the highest in the world – and 28 per cent higher than Asia's 1.99kg. This underlines the particular importance of wild freshwater fisheries in Africa, especially in land-locked and low-income countries, where small-scale fisheries are a vital source of protein and nutrition, employment and income. The African Great Lakes fisheries (which understandably have more reporting than the thousands of smaller freshwater fisheries in rivers, streams, ponds and rice-paddies) support the largest freshwater lake fisheries in the world (Daley, 2003), with Lake Victoria alone producing over one million tonnes of fish each year, more than the cumulative total of the North American Great Lakes (Lawrence et al., 2018). Importantly, the Great Lakes include commercial and large scale fisheries. The small pelagic inland fisheries of the African Lakes region contribute more than half of the global, commercial freshwater fisheries catch. However, much of the fish caught across the continent comes from artisanal fishing. As well as providing livelihoods, these fisheries provide a vital supply of protein and high quality micronutrients, including iodine, iron, zinc and calcium, all of which all play a critical role in human health and child development (Kolding et al., 2019).

Freshwater fisheries also support the livelihoods of huge numbers of people across the continent, with over 3.1 million estimated to be employed in inland fisheries – accounting for over half the total employed in fisheries and aquaculture in Africa (FAO, 2024).

But these statistics do not tell the whole story because the food resource value of freshwater fisheries are extremely difficult to replace. Or rather, being forced to replace fisheries that have been destroyed or depleted by short-sighted decisions will result in considerable long-term costs – such as increased deforestation to free up more land for crops or livestock. Losing freshwater fisheries will also undermine food and nutrition security, since wild caught freshwater fish are packed with protein and micronutrients, including lysine, which is essential for growth. And it will wreak havoc on communities whose cultures have always been deeply intertwined with them.

Fisheries at risk

The risks facing Africa's fisheries are two-fold:

Environmental factors: The primary drivers of the declining health of freshwater fisheries are environmental: sustainable fisheries need resilient and healthy ecosystems. Dams and other river infrastructure, pollution, the extraction of sand and gravel, habitat loss, and agricultural expansion and conversion are just a few of the pressures undermining Africa's priceless fisheries along with the growing impacts of climate change. Despite their importance to societies and economies across the basin, fisheries are at risk from a combination of loss of hydrological connectivity, land use change and habitat degradation.

Take Zambia's Kafue Flats fishery, which accounts for 15-22 per cent of the country's total fish harvest with an estimated value of US$30 million per year. However, the construction of the Itezhi Tezhi and Kafue Gorge dams has lowered the wet season peak and reduced the flood extent, while year-round releases from Itezhi Tezhi have resulted in permanent inundation of parts of the floodplain. This has restricted the natural movement of fishes between the main river and their spawning areas, contributing to at least five important fishes becoming commercially extinct (WWF, 2020).

Unsustainable fishing pressures: High intensity fishing, destructive fishing practices and the introduction of invasive non-native species by stocking and aquaculture threaten the future of many freshwater fisheries. However, fishers themselves recognize the risks and consequences of unsustainable fishing and, as the custodians of Traditional Ecological Knowledge, can offer and engage in sustainable management solutions, when granted the right and support to do so.

The evidence of risk and decline in fisheries across the continent is alarming – highlighting the urgent need for action. Like the Rufiji River in Tanzania, where fishing pressure has led to significant losses among many species in its fisheries (Hamerlynck et al., 2011) that are critical for small-scale fishers as well as the Rufiji tilapia, *Oreochromis urolepsis*, which sustains the river's only fishery of commercial importance.

Or the floodplain fisheries of the Zambezi and its tributaries, including the Kwando, which are home to a rich and diverse multi-species, multi-gear fishery, adapted to the seasonal flood pulse – and support communities across the region. But its sustainability is severely threatened by harmful fishing practices and catches have declined by about 90 per cent in recent years. Subsistence fishing – using traditional methods including traps, weirs, spears and hooks (Mosepele et al., 2003) – is a source of income for more than 40 per cent of households along the river (Ngwenya and Mosepele, 2008). Almost all of the Zambezi's fisheries have experienced severe declines in catch rates, particularly of the larger and most valuable species, due primarily to intense levels of fishing and the use of environmentally damaging gear, such as mosquito nets. However, rapid population growth and a lack of alternative livelihoods have meant communities have had to continue fishing despite the dwindling returns (Tweddle et al., 2015).

Or in Lake Malawi, where a key species, the Karonga tilapia, *Oreochromis karongae* – widely known as one of the 'chambo' species – has been overfished, with an estimated 94 per cent reduction in the population between 2006-2016 (Kanyere et al., 2018).

But, it is not too late. Local solutions have demonstrated encouraging results, such as co-management of fisheries with local communities in Liuwa Plain National Park in Zambia and some conservancies in Namibia (Tweddle et al., 2015). And in Tanzania, where the dagaa fishery in Lake Tanganyika is critically important to communities living on the lakeshore. Working with The Nature Conservancy, local communities have set up 21 Beach Management Units to protect fish breeding and nursery zones, and prevent the use of illegal fishing gear, such as monofilament nets, beach seine nets or under-sized mesh nets. Similar initiatives are being implemented across Africa, including in Angola where community leaders and fishers are working with ACADIR (Associação de Conservação do Ambiente e Desenvolvimento Integrado Rural), TNC and WWF to establish community fisheries monitoring systems and community fishery management cooperatives. Or, Lake Victoria, where lakeside communities are working with Conservation International to establish 'community conservation areas' to protect native fish and fisheries.

However, the threats facing Africa's critical freshwater fisheries require a broader range of solutions – and they need to be implemented at scale and at speed. The loss of wild fisheries would have severe impacts on communities across the continent, particularly for the poorest and most marginalized in society. It would also undermine efforts across the continent to boost food security, reverse biodiversity loss and drive sustainable development. In the long term, poverty will only be reduced and health improved, if the environment continues to provide services and resources that people need and if resources are managed sustainably so that they can support long-term development. It's essential that more steps are taken to safeguard Africa's often overlooked wild fisheries, the people who rely on them and the freshwater ecosystems that sustain them all.

Freshwater fishes are critical to the food security of many Indigenous People

© Daniel Nelson

Aquaculture in Nigeria

AQUACULTURE

2022 was the first time in history that global aquaculture production of animal species surpassed wild capture production – with an estimated 94.4 million tonnes of farmed aquatic animals, 3 million tonnes more than the estimated wild capture (FAO, 2024). And the majority of the world's aquaculture production comes from inland waters – with an estimated 59.1 million tonnes farmed in 2022, accounting for 62.6 percent of the total global production.

When wild capture fisheries decline, aquaculture is sometimes seen as a solution, but for inland wild capture fisheries the story is more complex. In Africa, millions of people rely on wild populations for subsistence fishing, while for poor families, aquaculture fish can be less affordable or readily available than wild caught fish. Furthermore, there is evidence that replacing the nutritionally diverse catch of a wild inland fishery with the production of a few species of farmed fish is likely to reduce the micronutrient content and increase the risk of malnutrition (Heilpern et al., 2021).

Globally, raising fishes and other species in constructed earthen ponds remains the most widely adopted culture method. In the recent past, many technical innovations in pond-based aquaculture production have been adopted by farmers to improve production efficiency and reduce impact on the environment.

Africa produced over 2.1 million tonnes of farmed freshwater fish species in 2022 – 10 times more than the continent's marine and coastal aquaculture production of 187,271 tonnes. The two largest producers of farmed freshwater fish were Egypt with a whopping 1.4 million tonnes and Nigeria a distant second with 259,000 tonnes (FAO Fishstat, 2024). Overall, there has been a slight net increase of 50,500 tonnes (2.2 per cent) in Africa's total freshwater and marine aquaculture production since 2020. This has been driven primarily by increasing inland aquaculture, mostly in Ghana, Zambia, Tanzania and Rwanda. Over the same period, some small, landlocked freshwater aquaculture producers suffered serious contractions with Malawi (–23.9%), Uganda (–18.2%) and Zimbabwe (–60.7%) registering double-digit declines (FAO, 2024).

Unless very carefully managed, aquaculture production can threaten the health of freshwater ecosystems due to habitat destruction, pollution and the introduction or escape of non-native species, adding to the threats facing fishes and wild capture fisheries. Sustainable fish production from aquaculture also relies on healthy and genetically varied brood stock, which requires healthy ecosystems containing healthy populations of wild species (FAO, 2019).

Cichlids from Lake Malawi

PRIZED PETS AROUND THE WORLD

African fishes in your home – wherever that may be

Keeping a fish tank or visiting an aquarium have been found to reduce stress, anxiety and blood pressure and even help us to sleep (Clements et al., 2019), so it's perhaps unsurprising that freshwater fishes are among the world's most popular pets. Globally, some 5,300 species of aquarium fishes – 90 per cent of which are tropical freshwater species – are traded every year in 125 countries, at a retail value of US$15-30 billion (Evers et al., 2019). Of the traded freshwater fishes, 90 per cent by volume are captive bred on farms, while around 10 per cent are caught and exported from wild stocks (Olivier, 2001).

The majority of wild collected freshwater fishes originate from South America and Asia, but Africa's fishes, despite being a minute percentage of overall trade, are some of the world's most interesting and unique. It is estimated that at least 1,500 African freshwater fish species have been kept in aquaria at some point (Hensen et al., 2010). Over half of these are cichlids.

As this report has highlighted, East Africa's Great Rift Lakes are home to a largely endemic fauna of cichlid fishes, totalling well over a thousand species. The clear, warm waters of Lake Malawi and Lake Tanganyika and the intense competition amongst the cichlids has led to vivid colouration and interesting reproductive behaviours, which have made them favourites with aquarists, particularly the rocky shore dwelling Mbuna. Popular species include the blue-and-black striped dogtooth cichlid *Cynotilapia afra*, the aptly-named electric blue hap, *Sciaenochromis fryeri*, the stunning electric yellow cichlid, *Labidochromis caeruleus*, the multi-coloured blunthead, *Tropheus moorii*, the spotted Livingstone's cichlid, *Nimbochromis livingstonii*, the glorious Freiberg's peacock cichlid, *Aulonocara jacobfreibergi*, and the red zebra, *Maylandia estherae*.

Beautiful riverine cichlids from the tannin-stained creeks of West Africa are also popular, including the beginner-friendly kribensis *Pelvicachromis pulcher*, the African butterfly cichlid *Anomalochromis thomasi*, and the *Hemichromis* jewel cichlids.

Africa is also home to many so-called oddball species, which have unique appearances, adaptations or behaviours, such as the electricity-sensing elephantnose fish *Gnathonemus petersii*, the prehistoric-looking bichirs, the upsidedown catfish *Synodontis nigriventris*, the mouthbrood parasitising cuckoo catfish *Synodontis multipunctatus*, the elegant African butterflyfish *Pantodon buchholzi*, the camouflaged Ctenopoma climbing perches, the Neolamprologus shell-dwelling cichlids, the mastacembelid spiny eels, and the bizarre tube-feeding hingemouth *Phractolaemus ansorgii*. Killifishes of the genus *Nothobranchius* are also popular with a small number of specialist aquarists and over 180 African killifishes have appeared in the trade at one time or another. These are small, short-lived, but beautifully coloured fishes that lay their eggs in ephemeral pools before they dry up, and then subsequently die. The eggs then hatch when the seasonal rains come. This unique trait of diapause means that hobbyists can trade dry eggs with one another in the post.

Most of the early trade on the continent from the 1950s was conducted by European and American missionaries, soldiers, immigrants and scientists, who collected and sent species home. Later, export businesses were established around Lake Malawi and Lake Tanganyika specifically for the cichlids. In the 1980s, Sierra Leone was a popular export location for species such as barbs, mormyrids and catfishes until civil war disrupted economic activity. The Congo basin via the Democratic Republic of Congo became a source of interesting tetras, cichlids, bichirs and catfishes from the 1990s onward, but instability has made exports unreliable and limited. Nigeria, Ghana and Cameroon have been sources of killifishes, tetras and cichlids since the 2000s, and hobbyists often travel to these countries to collect new and interesting species. Tanzania and Malawi remain today the leading exporters of Lake Malawi and Lake Tanganyika cichlids.

Given the astonishing diversity of Africa's freshwater fishes, the global aquarium trade – if well-regulated and sustainably managed – could earn significant income for communities and foreign exchange for the continent. However, if not properly monitored and regulated, wild capture of fishes for the aquarium trade can seriously threaten the survival of these unique fishes.

For example, more than 200 species of valuable, aquarium fishes live in the rivers of the Lower Guinean rainforest but wasteful exploitation and careless shipping of these fishes sometimes results in up to 85 per cent of the them dying before reaching overseas markets – and little benefit to local communities or incentive to safeguard their rivers and forests since almost all the profit ends up in the pockets of foreign middlemen (The WorldFish Center, 2007). But a project by the WorldFish Center in Cameroon in partnership with a local NGO, Organisation pour l'Environnement et le Développement Durable (OPED), showed that a more sustainable approach was possible – one which worked with fishers to improve capture and handling, build cooperatives, negotiate better prices, develop ornamental aquaculture, and raise awareness among local authorities about the potential value of the trade and the importance of protecting the forest and its rivers.

A Congo tetra, *Phenacogrammus interruptus*

It is clear that Africa's freshwater fishes have a potentially huge value in the aquarium trade in terms of the number and variety of species. But they are poorly known, and their trade is largely unreported and unregulated. It's not known exactly what volume of aquarium fish from Africa is harvested from the wild, as accurate statistics are difficult to find, and most of the popular species such as Congo tetras *Phenacogrammus interruptus*, cuckoo catfish *Synodontis multipunctatus* and kribensis *Pelvicachromis pulcher* are also captive bred in Southeast Asia or Eastern Europe.

There's an urgent need to better understand the status and trends of aquarium species, to monitor and manage harvesting to make it sustainable, and to regulate the international aquarium trade. There's also an urgent need to capture data on this trade and to assess the impact that it's having: advances in DNA methods may be able to support this (Collins et al., 2012), but requires investment in museum collections and tissue banks.

Aquarium fishes of Africa can provide significant economic value: if sustainable approaches are implemented, they could contribute to future prosperity for many people across the region.

RECREATIONAL ANGLING IN AFRICA

Hundreds of millions of people around the world enjoy recreational angling, generating over US$100 billion each year and providing hundreds of millions of jobs (FAO, 2020) and pumping much-needed cash into local and national economies.

Smallmouth yellowfish is a prized catch in South Africa

THERE ARE CLEAR BENEFITS TO RECREATIONAL ANGLING IN TERMS OF LIVELIHOODS, THE ECONOMY AND WELL-BEING; AND, WHEN CAREFULLY MANAGED, ECO-TOURISM ANGLING CAN ALSO SUPPORT FISH CONSERVATION.

In Africa, recreational angling is an important economic activity in some areas (Hortle, 2009). The continent is home to a huge diversity of freshwater fishes living in beautiful and varied habitats, and has the potential to attract anglers from across the globe.

There are clear benefits to recreational angling in terms of livelihoods, the economy and well-being; and, when carefully managed, eco-tourism angling can also support fish conservation. Around the world there are many examples of where angling eco-tourism has funded livelihoods, supported the economy, and conserved freshwater fishes and their ecosystems. With many of Africa's capture fisheries and species populations under threat, the development of sustainable sport fishing could offer a valuable source of alternative livelihoods and contribute to the conservation of depleted stocks in certain areas. And initiatives already exist, including on Lake Victoria and in South Africa.

Along with its even larger cousin the Goliath tigerfish, *Hydrocynus goliath*, which is targeted by anglers in the Congo, the African tigerfish, *H. vittatus*, is already a globally famous recreational angling species: it's the fastest freshwater fish on the continent, and has been reported to attack small crocodiles and even mammals with its razor-sharp teeth. Known by anglers as a very powerful fighter, its strong and bony jaw, excellent eyesight and ability to jump make it a popular challenge to catch. The Zambezi and Congo Basins (where a 44kg specimen was landed) are the most popular areas to seek this prized fish. In northeast Namibia, it is estimated that up to 70 per cent of tourist lodge revenue comes from anglers hoping to hook a 'tiger' – revenue that is a major source of income for local communities (Tweddle et al., 2015). Maintaining healthy freshwater systems and healthy tigerfish populations directly benefits communities, who rely on this fearsome fish not only for funds but also for food security.

When size really matters, on the other hand, there's no better sport species in Africa than the Nile perch, which supports a number of recreational fisheries, especially in Lake Victoria. The largest individual reported was around 1.8m long and weighed 164kg. However, introductions of this species – for recreational or food fishing – can severely disrupt the ecosystem and threaten native species.

Like freshwater fisheries, the angling industry relies on healthy freshwater ecosystems to support thriving populations of trophy fish, such as the six species of African pike. However, there is a major shift in recreational angling in South Africa away from non-native species like largemouth bass, *Micropterus salmoides*, toward native species like the largemouth yellowfish, *Labeobarbus kimberleyensis*, with angling groups now advocating for measures to improve the health of the Orange-Vaal River system where this species occurs. However, it is essential that angling does not threaten native species and so a range of stakeholders, including regulatory authorities, anglers and scientific institutions, established the national Yellowfish Working Group in South Africa to increase knowledge, awareness and conservation actions for the yellowfish group (Impson et al,. 2007). Critical measures include catch and release, and preventing the translocation of yellowfish species into catchments where they are not native (Swartz, 2007).

However, issues can arise when a recreational fishery is managed unsustainably or not managed at all. Poor management of recreation angling can also causes other issues, including the introduction of invasive non-native fishes and hatchery fish; poor fish handling and damaging hooks that injure fish; and litter, particularly discarded fishing nets, hooks and lines, which are a threat to all wildlife. But with prior research to understand and manage any potential negative impacts, close collaboration with communities, and governance to ensure sustainability, promoting the development of recreational angling in Africa within the framework of eco-tourism principles could aid the conservation of species and benefit local communities.

AFRICA'S FISHES IN FREEFALL

Africa is a biodiversity hotspot for freshwater fishes, but it's also a hotspot of increasing threats and risks. Globally, a quarter of freshwater fishes are at risk of extinction (Sayer et al., 2025) – a figure that is echoed in Africa, where an estimated 26 per cent of species are threatened.

THREATENED AFRICAN FISHES

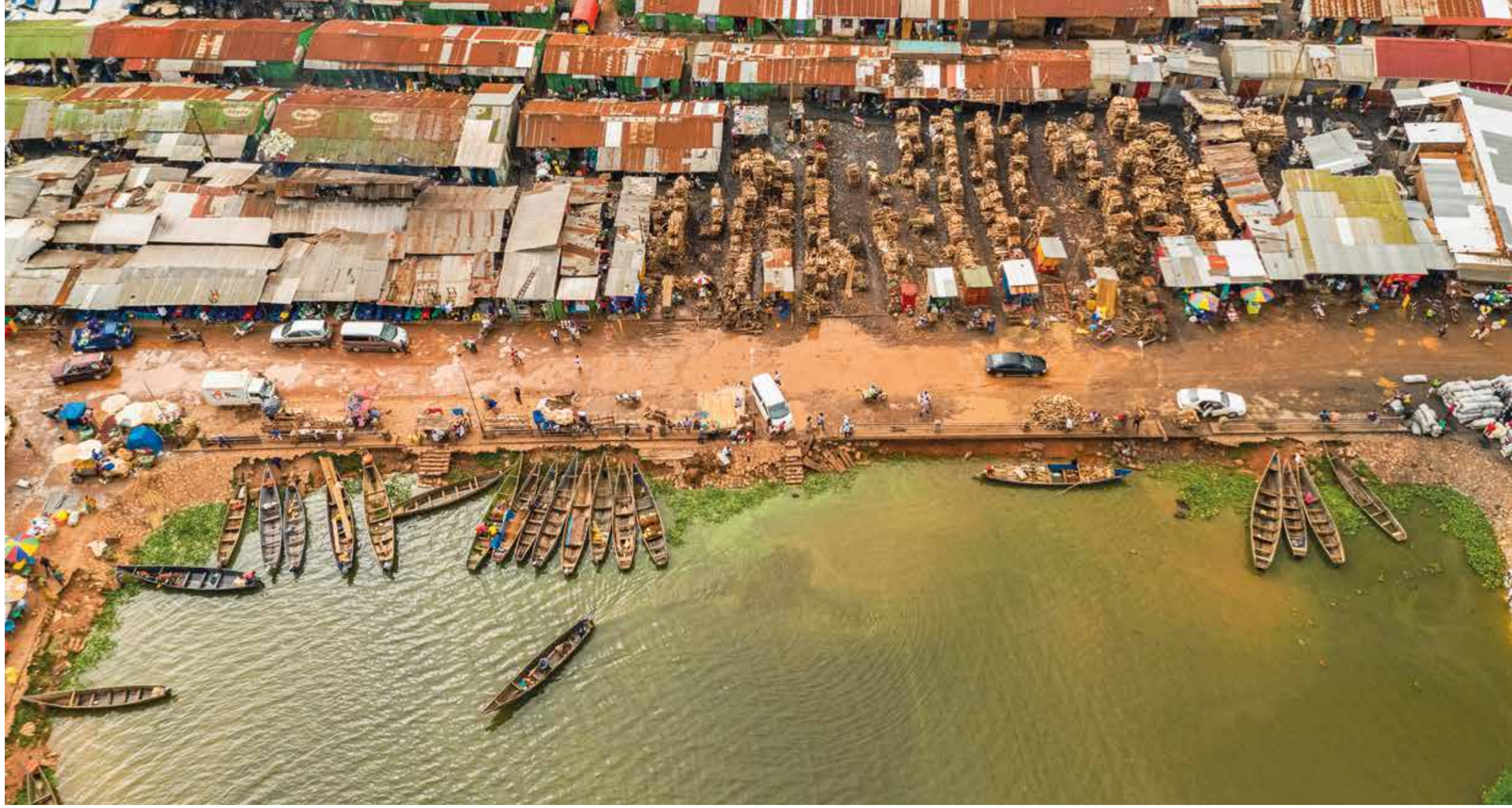
STATUS OF FRESHWATER FISHES IN AFRICA

Extinct	**9**
Critically Endangered	**170**
Endangered	**243**
Vulnerable	**299**
Near Threatened	**98**
Least Concern	**1926**
Data Deficient	**536**
Total	**3281**

EXTINCT FRESHWATER FISHES IN AFRICA

Labeobarbus microbarbis	Rwanda
Labeo worthingtoni	Malawi Mozambique
Giant Atlas Barbel *Atlantor reinii*	Morocco
Luciobarbus nasus	Morocco
Lake Sidi Ali trout *Salmo pallaryi*	Morocco
Western Madagascar cichlid *Ptychochromis onilahy*	Madagascar
Malagodon madagascariensis	Madagascar
Pangani haplo *Ctenochromis pectoralis**	Kenya Tanzania
Chott el Djerid Barbel *Luciobarbus antinorii*	Tunisia

* Good news: *Ctenochromis pectoralis* was recently rediscovered. See https://europeanjournaloftaxonomy.eu/index.php/ejt/article/view/1775/6747



TODAY, THE FUTURE OF THE AFRICA'S FISHES IS UNDER CONSIDERABLE PRESSURE FROM A VARIETY OF FACTORS, WHICH WILL ALL NEED TO BE ADDRESSED IF WE ARE TO SAFEGUARD THESE SPECIES.

1. Best estimates based upon IUCN best estimate methodology https://www.iucnredlist.org/resources/summary-statistics#:~:text=*%20Lower%20estimate%20=%20%25%20threatened%20and,/%20(total%20assessed%20%2D%20EX%20%2D%20DD)

Of the 3,281 freshwater fish species native to Africa, 712 are classified as threatened – with 170 listed as Critically Endangered, 243 listed as Endangered, and 299 listed as Vulnerable (IUCN Red List, 2025-1).

However, the true number is higher since 536 of the continent's assessed freshwater fishes are classified as Data Deficient, which means they are so poorly known that their threat status can't be assessed. This amounts to over 16 per cent of the total – a figure that is higher than the 14 per cent global average for species considered Data Deficient (Cazalis et al., 2023). It is also cause for serious concern since global research suggests that 50 per cent of all Data Deficient species are threatened (Borgelt et al., 2022). Taking a conservative approach and assuming that Data Deficient freshwater fish species in Africa are equally as threatened as data sufficient species – raises the number of freshwater fish species at risk of extinction on the continent to 863 or 26 per cent[1].

These alarming statistics demonstrate how close many species are to the brink. Sadly, at least eight species have already been lost for good from Morocco to Madagascar. But the true number of extinct species is certainly much higher than nine. Take for example Tunisia's blue lip cichlid, *Haplochromis desfontainii*, or Madagascar pupfishes. As discussed earlier, many cichlid species are also likely lost from Lake Victoria alone, including species such as *Yssichromis perrieri* and *Macropleurodus bicolor*. The lack of sufficient data and assessments in many of the continent's freshwater bodies likely means that other extinctions have been missed. Indeed, it is likely that some species have been lost without ever being described by science.

In addition to the 536 Data Deficient species, some have not yet had their conservation status assessed, and some have not been described by science. Furthermore, a lot of the assessed species were analysed years ago, and there's a pressing need to reassess them: one immediate conservation action in Africa should be to increase the monitoring of its fish species.

Threats to Freshwater Fishes in Africa

Today, the future of Africa's unique and diverse fishes is under considerable pressure. While the plight of Africa's terrestrial species is clearly visible, the threats facing fishes is bubbling under the surface, out of sight and out of mind, and therefore neglected. The challenges include:

Treating freshwater ecosystems as wasted space

Significant habitat loss and alteration have occurred – and are continuing to occur – due to the construction of dams and other river infrastructure (i.e., irrigation canals) as well as the conversion of land and wetlands to agriculture, urbanization, flood management structures, navigation improvements and mining. Deforestation is also a significant cause of habitat modification and threats to freshwater fishes as the loss of forests impacts flow regimes and temperatures, and increases sedimentation due to soil erosion (Darwall et al., 2011). The threat posed by deforestation is particularly acute in the Guinean ecoregion, Madagascar and parts of the Congo Basin, where species have evolved to depend on healthy, forested watersheds (Fulanda et al., 2023). Sand and gravel extraction is another, understudied threat. The impacts can be direct or indirect. A review of global evidence found that fishes are negatively impacted by both, including the direct destruction of fish spawning, feeding or refuge sites, and from the indirect alteration to hydrology, habitats and water quality at scale (Koehnken et al., 2020).

Fragmenting free-flowing rivers

The flow of water, sediment and nutrients is critical to the health of rivers – and the fishes that inhabit them, particularly migratory fish. Dams disrupt these flows (as do smaller structures like weirs and culverts). Firstly,

Clanwilliam sandfish, *Labeo seeberi*

SAVING SANDFISH: AFRICA'S LARGEST FRESHWATER FISH RESCUE

Jeremy Shelton and Cecilia Cerrilla

The Clanwilliam sandfish is South Africa's most threatened migratory freshwater fish. Each spring sandfish embark on long journeys upstream to spawn, leaving them vulnerable to human impacts along the way. But these epic migrations also make them awesome ambassadors for healthy, free-flowing river ecosystems. Once widespread throughout the Olifants-Doring River system, sandfish now face extinction due to persistent recruitment failure. Dam walls which block spawning routes and predation by non-native centrarchids have caused a massive range contraction and population decline.

There are now only two confirmed tributaries where sandfish still spawn: the Oorlogskloof and Biedouw rivers. The Oorlogskloof River supports an isolated population of reproducing sandfish sheltered from fish invasions by a waterfall, but they are vulnerable to droughts and extreme flooding events, which have been implicated in a recent concerning decline (Cerrilla et al., 2022). The Biedouw River sees adult sandfish migrating upstream from the Doring to spawn in spring, leaving behind thousands of young hatchlings. Sadly, these young fish perish *en masse*, with many succumbing to predation by non-native bass and bluegill, and the rest to mass stranding as the river dries up due to over-abstraction. Consequently, each year the adult fish in the Doring mainstem grow older, and with little or no recruitment filtering through to build the next generation, the future for sandfish looks bleak.

To prevent sandfish extinction, the Freshwater Research Centre and partners launched the Saving Sandfish project in 2020, which has undertaken Africa's largest freshwater fish rescue on record, with promising results in the early stages (Cerrilla et al., 2024). Teams of scientists, farmers and local community members have collectively rescued and relocated fish to off-stream reservoirs, which were cleared of non-native fish to create sandfish sanctuaries. Once these fish reach a 'bass-proof' size of 15cm, they are released back into the wild with tiny PIT tags which allow scientists to track their movements and survival. Nearly 3,000 bass-proof sandfish have been released, and results to date show a 16.4% return rate, and a more than doubling of the size of the Biedouw spawning population.

To secure the long-term survival of the sandfish, a project is now underway to permanently eradicate non-native predatory fish from the upper Biedouw River, reclaiming 9km of critical habitat for the sandfish and four other endemic fish species. The non-native fish will be removed using the piscicide rotenone, and a barrier weir installed downstream to prevent reinvasion in the future. If successful, this will create a long-term sandfish refuge, and an important source population for the species.

Rigorous science is being used to measure the impact of these conservation actions, and creative visual storytelling is raising freshwater awareness and deepening connections between people and life beneath the surface of our rivers. The Saving Sandfish Web Series takes the viewer on a journey into the hidden world of the endangered Clanwilliam sandfish and the ambitious conservation efforts – involving partners from South Africa and abroad – that are underway to save it.

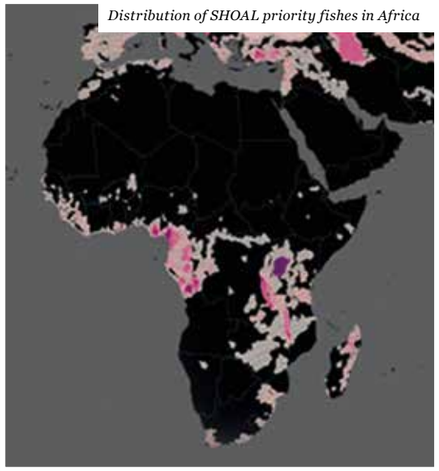
The Saving Sandfish project is funded by the National Geographic Society, The Mohamed Bin Zayed Species Conservation Fund, IUCN Save Our Species, the Rufford Foundation, the Federation of South African Flyfishers, Mount Ceder, Investec, Bushmans Kloof, Alu-Cab and the Ford Wildlife Foundation.

dams create barriers across rivers, breaking their connectivity and preventing passage of fishes upstream and downstream. This can restrict access to essential spawning or feeding grounds needed for a fish to complete its lifecycle and has contributed to the 81 per cent decline globally in native freshwater migratory fishes since 1970 (Deinet et al., 2024). Secondly, dams transform rivers from flowing to still-water systems when reservoirs are created behind the dam wall (Pelicice et al., 2015). For fishes that evolved to survive in a flowing environment this is a considerable change, and many simply can't adapt. Dams can also increase the risk of invasive species being introduced and establishing themselves (Johnson et al., 2008). Dams change the thermal regimes of waters and also hold back sediment and nutrients, preventing them from travelling downstream, which alters natural dynamics and other biogeochemical processes, and impacts fishes, fisheries and other ecosystem services. García et al (2010) highlighted the impact of the construction of the Aswan Dam, which was a major cause of the extirpation of many freshwater fishes in the Nile Basin in Egypt. And there are many more dams, including planned hydropower dams on free-flowing rivers, on the drawing board across Africa – posing a concrete threat to healthy rivers and sustainable fisheries.

Sucking rivers dry

Across Africa, poor management has resulted in far too much water being abstracted from river systems, primarily for agricultural and horticultural irrigation. Agriculture uses around 70 per cent of all water abstracted globally – and this is likely to increase since the world's demand for food is projected to grow by 50 per cent by 2050 (FAO, 2017). With the demand for water and pressure on freshwater ecosystems set to grow dramatically as African populations, cities and economies expand, it is essential that the continent's decision makers, including those who do not necessarily work directly with water, choose the right path (WWF, 2017). This includes river basin planning, water allocation agreements and the setting of environmental flows. Environmental flows have been incorporated into water legislation in South Africa and

A BLUEPRINT FOR CONSERVING PRIORITY FISH SPECIES



Distribution of SHOAL priority fishes in Africa

In April 2024, SHOAL released the landmark *Blueprint for Accelerated Conservation Action for 1,000 Freshwater Fishes by 2035*. This 'SHOAL 1,000 Fishes Blueprint' sets out a plan for how hundreds, potentially thousands of partners will collaborate on a global conservation effort focusing on large-scale action for freshwater fishes.

The 1,000 fish species are any chosen from a longlist of 2,338 SHOAL Priority Fishes, which were selected in consultation with the IUCN SSC Freshwater Fish Specialist Group using the latest IUCN Red List data as being in most urgent need of conservation action. From this list of Priority Fishes, 527 species are found in Africa. Furthermore, 10 of the 36 Priority Countries, i.e. countries highlighted as having the highest need for conservation action, are African, including Cameroon, DR Congo, Gabon, Kenya, Madagascar, Malawi, Nigeria, South Africa, Tanzania, and Uganda. There are also 11 Priority Lakes from East Africa's Rift Valley highlighted in the Blueprint, including three – lakes Malawi, Victoria, and Tanganyika – that are separately included as standalone Priority Areas due to the high number of Priority Fishes they host.

The high number of Priority Fishes, Priority Lakes, and Priority Countries from Africa is a reflection of the intense threatened diversity found within the continent, and highlights the urgency that is needed to bring these species back from the brink of extinction.

The Blueprint for Accelerated Conservation Action for 1,000 Freshwater Fishes by 2035 outlines a framework for a global collaborative which, given the right investment and intensity of support, will lift freshwater fishes and potentially thousands of other neglected freshwater species to a new elevated platform of conservation attention and greatly enhance freshwater conservation efforts globally.

The plan is not just for 1,000 fishes, but for hundreds of critical freshwater habitats, vital to thousands of other species and thousands of communities, very often the poorest on the planet, that rely on these fish and the freshwater provided by their habitats for their everyday lives.

Read the *Blueprint for Accelerated Conservation Action for 1,000 Freshwater Fishes by 2035* at shoalconservation.org/1000-species-blueprint.

implemented through legally mandated catchment management agencies—for example, on the Crocodile River (Ticker et al., 2021).

Africa's irrigation systems and water infrastructure projects play a crucial role in tackling food insecurity, meeting growing energy demands, and enhancing climate resilience. The continent holds significant untapped potential for both irrigation expansion and hydropower development, and many governments are scaling up investments in these sectors to drive agricultural productivity, boost rural incomes, and support broader socio-economic development. The African Union's Malabo Declaration (2014) underscores the importance of agriculture, including irrigation, as a cornerstone of economic transformation. However, unlocking this potential requires a balanced approach that safeguards environmental sustainability, ensures equitable water allocation, and mitigates the social and ecological impacts of large-scale infrastructure —particularly on aquatic ecosystems, fisheries, and downstream communities.

Flood of pollutants

Water pollution is a significant challenge in many ecosystems and one of the main threats to freshwater fishes in Africa. Pollutants come from many sources, such as agriculture, urban areas and industry. Agricultural pollutants include run-off and blow-off of sediments containing pesticides and fertilisers (Darwall et al., 2011). Excessive nutrients caused by agricultural fertilisers lead to eutrophication of rivers and lakes, such as has been seen in Lake Victoria, where it has contributed to the decline of the lake's endemic cichlids (Seehausen et al., 1997). But freshwater bodies are also polluted by mining and industrial waste, such as the Kafue River in Zambia which flows through the Copperbelt, and by oil production, particularly in the lower Niger delta, as well as by untreated sewage, pharmaceuticals and plastics, including micro-plastics. Some of these pollutants, such as heavy metals, can accumulate in the bodies of freshwater fishes, and spread through the food web, including threatening the health of communities that rely on freshwater fisheries.

Dredging up too many fish and too much sand

Unsustainable fishing is a key challenge in many areas from the Great Lakes, particularly Lake Malawi, to waterbodies across West Africa (Smith et al., 2009), which has been exacerbated by the increasing availability of modern fishing gear and the use of mosquito nets in some areas. The use of destructive fishing methods, including explosives and poisons, also poses a risk to freshwater fishes and other species. However, many fishers recognize the risks and consequences of unsustainable fishing and many are keen to engage in better practices and learn from others. Fishers have the knowledge needed to improve fishery management for the better and are also a source of invaluable Indigenous and Local Knowledge, which should be fully integrated into decision making.

POLLUTION IS A SIGNIFICANT CHALLENGE IN MANY ECOSYSTEMS AND ONE OF THE MAIN THREATS TO FRESHWATER FISHES IN AFRICA.

Up to 50 billion tonnes of sand and gravel are mined each year globally – much of it from rivers and lakes – to meet soaring demand from construction and land reclamation, making it the largest extractive industry in the world (Koehnken & Rintoul, 2018). Demand for sand and gravel in Africa is increasing, and in some places it is occurring illegally. Most people are yet to give this a second thought, but it risks ecological processes, fish movements and spawning, and consequently entire ecosystems. It is essential that sustainable sand budgets are set, and that extraction is monitored and regulated.

KEY BIODIVERSITY AREAS ARE CRITICAL TO THE FUTURE OF AFRICA'S FISHES

Key Biodiversity Areas (KBAs) are sites contributing significantly to the global persistence of biodiversity. By mapping these most important sites on Earth, and providing information about the wildlife living there, communities, private industry, governments and other stakeholders can make the best decisions about how to manage these sites, where to avoid development, and how best to conserve and protect the animals and plants for which the sites are so important. KBAs are identified according to a global standard (IUCN, 2016).

Of Africa's 2,155 KBAs identified so far, some 797 KBAs (37%) are in freshwater ecosystems and 204 (9%) are recognised as sites of global significance for species of freshwater fishes, molluscs, crabs, dragonflies and damselflies. Africa contains over half of the KBAs identified for freshwater fishes and invertebrates globally. The majority of these sites reflect concerted efforts to identify freshwater KBAs in the Lake Victoria (Sayer et al., 2018) and Lake Malawi (Sayer et al, 2019) basins, and in Madagascar (Máiz-Tomé et al., 2018), as well as systematic national KBA identification in the Republic of Congo, DR Congo, Gabon, Mozambique and South Africa. There is still a lot of work to be done to identify these critically important freshwater sites and to ensure that they are safeguarded to prevent species extinctions.

An example of a KBA in Malawi, the Upper Shire is a 17 km stretch of the Shire River that connects Lake Malawi in the north with Lake Malombe in the south. The Upper Shire is a reed-lined flowing river, which once had abundant aquatic vegetation. This native vegetation was mostly destroyed by seine netting in the early 1980s and fishing, with seine nets still representing a leading threat to the habitats and freshwater fishes within the river. Nevertheless, the site still supports globally significant populations of two Critically Endangered species of tilapiine cichlids (*Oreochromis squamipinnis* and *Oreochromis karongae*), and is also an important migratory route between the two lakes. This river stretch also contains a globally significant population of the catfish *Bagrus meridionalis*. For its importance for these three fish species, the site was recognised as a KBA in 2018.

By providing the precise location of places that contribute significantly to the global persistence of biodiversity, KBAs can accelerate efforts to reverse the loss of nature, by ensuring conservation efforts are focussed in the places that matter most, and by enabling entities that may have negative impacts on nature to avoid or reduce those impacts in the places they would be most damaging.

Main © Jeremy Shelton, inset © Benjamin Barca

HOW eDNA IS SHINING A LIGHT BELOW THE SURFACE

One of the key challenges to effective freshwater conservation is the dearth of data, particularly on the status of Africa's freshwater fishes. Indeed, 536 fishes are assessed as Data Deficient by the IUCN Red List. Clearly, there is an urgent need to invest more resources in assessing the continent's freshwater fishes as well as its freshwater biodiversity in general.

While typical biodiversity monitoring requires experts on the ground and can be time consuming, environmental DNA (eDNA) technology offers an innovative solution that is relatively easy to do; just one water sample can tell us what is living, usually unseen, in our waters. Monitoring can be undertaken by local communities and citizen scientists, who can work alongside expert ecologists to plan surveys and interpret data, which can provide significant volumes of data that would otherwise be very hard – if not impossible – to gather.

Piloting eDNA for freshwater fishes in Africa

Funded by the Pictet Group Foundation, WWF is conducting eDNA research to improve our understanding of freshwater fishes and other biodiversity across African ecosystems in Lake Kyoga and the Congo, Mara and Limpopo rivers. Involving local communities, eDNA experts NatureMetrics and WWF ecologists, the project will provide insight into the fishes and wider biodiversity present in these ecosystems. Along with enhancing communities' understanding of the status of their resources, the new data will help guide government commitments and policies on freshwater biodiversity and fisheries conservation. It also aims to provide companies and financial institutions, which are investing – or thinking about investing – in these areas, with additional data to help them make more informed decisions and implement sustainable practices.

The project has sampled 75 sites across these locations. Initial analysis identified over 350 species from fishes to amphibians, birds, reptiles and mammals, including the Critically Endangered Victoria Tilapia, *Oreochromis variabilis* (a medium-sized mouthbrooder species that feeds on algae) in Lake Kyoga. Sadly, monitoring has also found a variety of invasive non-native species in the Mara River. Overall, the low average number of species per site indicates that none of the monitored ecosystems are healthy and all require urgent action.

The eDNA data collected during this project will be incorporated in the Freshwater Biodiversity Information Service (FBIS) platform, based in South Africa. This platform provides open access to the most current, reliable and comprehensive freshwater datasets from multiple sources, to support better-informed, data-driven freshwater science, management and decision-making throughout Africa and globally. It is essential that everyone starts to invest in biodiversity monitoring, including established approaches, and new innovative approaches like eDNA, if we are to understand the status of freshwater ecosystems and their fishes.

We wish to thank to the Pictet Group Foundation for their generous support, which has been instrumental in enabling WWF to carry out this important eDNA work.

Species invasions

The spread of non-native invasive species, including fishes and plants, is a major threat to the dazzling diversity of freshwater fishes in Africa. According to the IUCN SSC Invasive Species Specialist Group's Global Invasive Species Database, there are 286 invasive freshwater species in Africa. Many invasive non-native fishes (also referred to as 'aliens' or 'exotics') have been deliberately introduced for food but also for sport fishing. Invasive non-native species can pose a significant threat to native fishes due to increased competition for resources, direct predation, genetic interference and the introduction of diseases. Along with the devastating release of Nile perch into Lake Victoria, introduced North American and European species (e.g., *Micropterus dolomieu, Oncorhynchus mykiss* and *Salmo trutta*) are threatening native species in southern Africa, while introduced mosquitofish (genus *Gambusia*) have wreaked havoc on native species in northern Africa. Invasive non-native species are also a major concern in Madagascar. And once they're established, it's extremely difficult, if not impossible, to remove invasive, non-native fishes. Other invasive non-native species include water plants. These can severely impact habitat and water quality. Like the extraordinarily successful water hyacinth, *Pontederia crassipes*, which is native to South America and has found many waterbodies in Africa to its liking – covering waterbodies, reducing oxygen levels and making the environment unsuitable for fish survival, subsequently impacting species populations and diversity. It has been reported as invasive in the Nile Delta, Niger Delta, Lake Victoria, and the Middle and Lower Zambezi River (Thieme et al., 2005). And the situation is becoming more complex under climate change as some native species are becoming invasive, as altered conditions are making them highly competitive or allowing them to expand their range into new areas.

Climate change

The impact of climate change exacerbates all other threats, through warming of surface water, changes in the hydrological cycle, thermal stratification, eutrophication, and extreme weather events (Bouraï, et al., 2020; Islam et al., 2020; Littlefair et al., 2021). Droughts are a major threat to freshwater fishes in northern and southern Africa, where many once permanent streams have become seasonal or dried up completely. Or take Lake Chad, in West Africa: it was reduced to a fraction of its former surface area between the 1960s and 2001, and it is estimated that 50 per cent of this reduction was caused by changes in climate patterns (Pietersen and Beekman 2006). It is expected that, by the 2050s, more than 80 per cent of Africa's freshwater fish species may experience hydrologic conditions that are substantially different from the existing conditions (Darwall et al., 2011), challenging their capacity to adapt and thrive – or even survive.

PROTECTING AND RESTORING HEALTHY AND HYDROLOGICALLY FUNCTIONING RIVERS AND THEIR ASSOCIATED HABITATS CAN PROVIDE A BUFFER AGAINST MANY CLIMATE CHANGE IMPACTS ON PEOPLE AND FISHES

But there is hope: protecting and restoring healthy and hydrologically functioning rivers and their associated habitats can provide a buffer against many climate change impacts on people and fishes. And there are solutions to help tackle the other challenges too. The question is, will decision makers take the necessary steps?

A BRIGHTER FUTURE FOR AFRICA'S FISHES

Rising to the Freshwater Challenge in the region

Despite their importance, the freshwater fishes of Africa – their rich biodiversity, critical role in food security and the overall health of the freshwater ecosystems – have invariably received much less attention than other pressing aspects of river and wetland management as part of the development agendas of African countries. This cannot continue, especially given the magnitude of the threats they face – and the far-reaching consequence for people and nature across the region if the alarming decline in the Africa's freshwater fishes carries on.

Healthy freshwater ecosystems and thriving fish populations are critical to sustainable development across Africa. Millions of people depend on their inland fisheries for food security and livelihoods – fisheries that are irreplaceable and are declining in many ecosystems. Economic and development decisions must factor in their impact on rivers, lakes and wetlands as well as the fishes, other species and ecosystems they sustain. In the long term, equitable economic growth, which reduces poverty and improves human well-being, depends on protecting and restoring the overall health of the environment. The simple fact is that people across Africa cannot afford to lose their fishes or the freshwater ecosystems they inhabit.

REVERSING DECADES OF DECLINE WILL BE DIFFICULT, BUT IT'S POSSIBLE – IF WE ACT COLLECTIVELY AND URGENTLY

The good news is that policymakers are finally starting to take notice of freshwater fishes, and major global milestones towards their conservation have recently been achieved. In 2022, countries signed up to the new Kunming-Montreal Global Biodiversity Framework, which explicitly includes the commitment to protect 30 per cent of 'inland waters' (rivers, lakes and freshwater wetlands) and restore 30 per cent of degraded inland waters as well as a target to ensure sustainably managed fisheries. This ambitious agreement paves the way for a new approach to transform freshwater biodiversity. The critical issue now is implementation, with countries ensuring restoration and protection targets are incorporated into their National Biodiversity Strategies and Action Plans.

One opportunity that countries across Africa can seize is to join the Freshwater Challenge. Launched in March 2023 at the UN Water Conference in New York by six countries, including DR Congo, Gabon and Zambia, this country-led initiative aims to ensure that 300,000km of degraded rivers and 350 million hectares of degraded wetlands globally are under restoration by 2030, and to protect key freshwater ecosystems. Already 49 countries and the European Union have joined the Challenge, including 20 from Africa[2]. Other African countries have the opportunity to become Members as well and then set targets to restore and protect their priority rivers, lakes and wetlands. Funders and private sector investors should then follow through with concrete commitments of resources and actions – benefiting societies, economies and ecosystems across the continent as well as freshwater fishes.

But protecting and restoring freshwater ecosystems alone is not enough. What's needed in Africa is an Emergency Recovery Plan for Freshwater Biodiversity and – more good news – one already exists (Tickner et al., 2020). Developed by scientists and freshwater experts from across the world, this practical, science-based plan incorporates six pillars, each of which has been implemented in different parts of the world and could be adapted and built upon by African countries, supporting and further facilitating the work already carried out by communities, fishers and conservation organisations:

1) Let Rivers Flow More Naturally

Water volume and flow conditions are central to the health and functioning of rivers and wetlands – and are disrupted by the operation of dams, reservoirs, dykes and other impoundments, which alter not only the quantity of flow, but also the timing and variability of water flows. Ensuring Africa's rivers have sufficient flow is foundational to safeguarding freshwater fishes and fisheries. Water volumes and flows must be incorporated into decision making through river basin management, water allocation agreements and the establishment of environmental flows. Many environmental flow assessment tools are available, and many consider socioeconomic and cultural objectives alongside environmental and biodiversity goals. These provide a foundation upon which water allocation can be divided amongst users sustainably and equitably, and upon which decisions about the sustainable design and operation of water infrastructure can be based. In addition, this approach can be enhanced to implement responses based on the River Connectivity Index Assessment Tools (Grill, 2021), which were designed to monitor volumes of water, sediment and nutrients, and guide the creation of regulatory baselines and objectives. Taking such an approach will safeguard water flow for people and fishes in a climate variable environment.

2) Improve Water Quality in Freshwater Ecosystems

There's an urgent need to reduce pollutants, including sediment runoff from agriculture and deforested land that are entering Africa's freshwater ecosystems. Tackling water pollution requires improvements in agricultural practices to enhance soil quality and reduce the use of chemical pesticides and fertilizers, as well as measures to reduce pollution from industry, mining, urbanization, domestic sewage and sanitation.

3) Protect and Restore Critical Habitats and Species

The Kunming-Montreal Global Biodiversity Framework requires the commitment to protect 30 per cent of inland waters and restore 30 per cent of degraded inland waters by 2030. This target can be achieved by building and expanding upon existing systems of protected areas and designating new areas. This includes sites designated by the Ramsar Convention on wetlands, and other effective area-based conservation measures (OECMs), such as Fish Conservation Zones, beach-management units, and other area-based protections. These should focus on critical areas, including those important for fish spawning, such as floodplain habitats, as well as protecting restricted range species, and prioritizing the most threatened. Critically, area-based conservation targets should be strategically planned to provide the most effective outcome, including by focusing on Key Biodiversity Areas, equitably delivered with communities at the heart of decison making and rigorously monitored to ensure that they have the biggest impact for people, fishes, nature and ecosystem services.

In addition, maintaining *ex-situ* populations of some fishes, in particular those with narrow ranges or most at risk of extinction, for captive breeding will allow for reintroduction when threats have been managed. Furthermore, it's vital to improve the monitoring of all fish species within Africa, particularly those that are at risk due to their narrow range, those that have not been assessed, have been assessed as Data Deficient or assessed as Threatened by the IUCN Red List. Critically, this – along with many of the other solutions –requires a rapid increase in capacity in ecology and science since there are insufficient taxonomists in the whole of Africa to support these vital tasks (Darwall et al., 2011).

4) End Unsustainable Management of Resources

The unsustainable exploitation of sand and gravel in many rivers has the potential to significantly impact fish populations in the immediate vicinity and at a wider basin scale as well as undermine the overall health of rivers and contribute to the sinking and shrinking of deltas. There is an urgent need for more research to create evidence-based policies to minimize this impact. In addition, African countries need to manage sand as a strategic resource that is key to climate resilience and economic growth, and use regulation to shift away from the unsustainable exploitation of river sand to alternative sources and materials. Best practice approaches exist and can be adapted and implemented in Africa.

Unsustainable fishing practises are also a challenge. Decision-makers in all countries must work with and support fishers and communities by developing and implementing comprehensive fisheries policies, including policies on fish stocking, professionalizing fisheries management and supporting co-management initiatives. All fisheries should have management plans, management targets, monitoring and reporting systems, and the necessary governance to implement them. Critically, fisheries policies must consider fisheries within the scope of the whole ecosystem and, for example, tackle environmental threats to fisheries such as poor water quality, or barriers to fish migration. Fishers are part of the solution, and decision makers should harness their Indigenous and Local Knowledge.

Africa is home to many species found in the aquarium pet trade. The extent and scope of the trade is not well documented and so is almost completely unregulated. Harvested populations should be monitored, along with traded and exported species. Governments should also enforce best practice management and harvest methods, including setting harvest targets.

5) Prevent and Control Invasions by Non-Native Species

Target 6 of the Global Biodiversity Framework (GBF) recommends that the rate of introduction and establishment of invasive non-native species should be reduced by 50 per cent, and control and eradication measures are implemented to achieve this. It is essential to start to monitor the presence and extent of invasive non-native fishes in Africa to understand their distribution and impacts upon native fishes and the wider ecosystem. Equally, it is vital to develop regional and country-scale legislation to prevent the introduction of new non-native invasive species, and to manage and control those already introduced. To protect fishes particularly at risk from invasive non-native fishes, *in-situ* and *ex-situ* conservation programmes should be implemented.

6) Protect Free-Flowing Rivers

Maintaining connectivity is critical to the functioning of rivers and the health of the species and ecosystems they sustain. Africa's remaining free-flowing rivers – the essential Swimways of fishes and fisheries – are central to adapting to climate change, halting nature loss and driving sustainable development. Decision makers should always factor in the impacts on fish and fisheries, and the healthy functioning of floodplains – which reduce flood risk, regulate water supplies, boost fisheries productivity and support flood recession agriculture - into river infrastructure decisions. In many cases, these long-term benefits will outweigh short-term ones. Where new river management infrastructure is needed, decisions on siting, construction and operation should be taken to avoid or minimize impacts on rivers, floodplains and fisheries.

2. Botswana, Burkina Faso, Chad, DR Congo, Gabon, Gambia, Guinea, Kenya, Liberia, Malawi, Mali, Mauritania, Mozambique, Niger, Republic of Congo, Senegal, Tanzania, Uganda, Zambia and Zimbabwe

ALL STAKEHOLDERS AND DECISION MAKERS HAVE THE OPPORTUNITY TO CHART A NEW COURSE THAT INVESTS IN RESTORING AND PROTECTING AFRICA'S FRESHWATER ECOSYSTEMS, AND USE THEM SUSTAINABLY FOR THE BENEFIT OF SOCIETIES AND ECONOMIES TODAY AND IN THE FUTURE – A FUTURE IN WHICH THE CONTINENT'S EXTRAORDINARY FRESHWATER FISHES SURVIVE AND THRIVE. BUT WE NEED TO ACT NOW.

Commit to action: Governments should set national biodiversity targets for 2030 that will safeguard their freshwater ecosystems and the future of freshwater fishes and other species as set out in the GBF. And then they should develop and implement practical plans to achieve those targets.

Partner and innovate: While the solutions exist, real progress towards halting the loss of freshwater fishes and ensuring healthier freshwater ecosystems will only be achieved through collective action involving governments, businesses, investors, NGOs and communities. Corporate water stewardship creates a space for the private sector to invest in collectively improving the health of freshwater ecosystems and mitigating risks, while financial institutions should invest in innovative financial solutions that can strengthen resilience and generate returns.

Value freshwater fishes: Last but not least, it's time for decision makers to value the dazzling diversity of fishes in Africa: an astonishing 3,281 species that are essential to the health and resilience of the continent's freshwater ecosystems – and the people and nature that rely on them. Freshwater fishes have swum through the continent's cultures and communities for millennia and are still vitally important to the daily lives of millions of people, yet they are invisible to many decision makers. It is time they recognised the role freshwater fishes play in societies, economies and ecosystems – and began to factor them into decisions.

People across Africa cannot afford to lose their freshwater fishes or the freshwater ecosystems they inhabit. Rivers, lakes and wetlands are their life support systems and the extraordinary diversity of fishes within them are essential to their health. Reversing decades of decline will be difficult, but it is possible – if we act collectively and urgently.

All the organizations involved in this report are fully committed to ensuring a brighter future for Africa's freshwater fishes, because that will mean a brighter, sustainable future for people and nature across the continent. We hope you'll join us.

Clanwilliam sawfin,
Pseudobarbus serra

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