

A GUIDE TO THE TILAPIA FISHES OF TANZANIA



Martin J. Genner, George F. Turner and Benjamin P. Ngatunga

ACKNOWLEDGEMENTS

This guide is based on observations collected between 2011 and 2018 by the main authors and our fieldwork collaborators. We have been assisted during fieldwork by many friends and colleagues to whom we wish to express our gratitude.

We received direct assistance in the field from Stephanie Bradbeer, Julia Day, Laurent Felix, Antonia Ford, Carlos Gracida, Jonathan Kihedu, Semvua Mzighani, Tabitha Richmond, Lorena Romero, Asilatu Shechonge, Cosmas Shonga, Alan Smith, Emmanuel Sweke and Alex Tyers. Many of the photos in the guide were taken by Alan Smith, or other team members. We received assistance in the laboratory from Jack Harrington, Kirthana Pillay, Lorena Romero, Henry Watson and Abrahim Warraich.

We are grateful to the funders who have supported our work on fishes of Tanzania. Much of the work has been supported by the Royal Society – Leverhulme Trust Africa Award scheme. This scheme provided funds for fieldwork, laboratory analyses and scientific exchanges that underpin the results presented here. Our work on tilapiine fishes of Tanzania has also been supported by the UK Biotechnology and Biological Sciences Research Council, who supported genome sequencing that has helped to clarify the evolutionary relationships of populations. Finally, our ongoing TilapiaMap work is supported by the JRS Biodiversity Foundation.

Martin J. Genner, George F. Turner and Benjamin P. Ngatunga, August 2018



LEVERHULME
TRUST



TABLE OF CONTENTS

Part 1: Tilapia in Tanzania: An overview	1
---	----------

Part 2: Species information

1: <i>Alcolapia alcalica</i> (endemic)	4
2: <i>Alcolapia latilabris</i> (endemic)	5
3: <i>Alcolapia ndalalani</i> (endemic)	6
4: <i>Coptodon rendalli</i> (native)	7
5: <i>Coptodon zillii</i> (exotic)	8
6: <i>Oreochromis (Neotilapia) tanganicae</i> (native).....	9
7: <i>Oreochromis (Nyasalapia) chungruruensis</i> (endemic).....	10
8: <i>Oreochromis (Nyasalapia) karomo</i> (endemic)	11
9: <i>Oreochromis (Nyasalapia) karongae</i> (native)	12
10: <i>Oreochromis (Nyasalapia) malagarasi</i> (endemic)	13
11: <i>Oreochromis (Nyasalapia) rukwaensis</i> (endemic)	14
12: <i>Oreochromis (Nyasalapia) squamipinnis</i> (native)	15
13: <i>Oreochromis (Nyasalapia) variabilis</i> (native)	16
14: <i>Oreochromis (Oreochromis) esculentus</i> (native)	17
15: <i>Oreochromis (Oreochromis) hunteri</i> (native)	18
16: <i>Oreochromis (Oreochromis) jipe</i> (native)	19
17: <i>Oreochromis (Oreochromis) korogwe</i> (endemic)	20
18: <i>Oreochromis (Oreochromis) leucostictus</i> (exotic)	21
19: <i>Oreochromis (Oreochromis) niloticus</i> (native)	22
20: <i>Oreochromis (Oreochromis) shiranus</i> (native)	23
21: <i>Oreochromis (Oreochromis) urolepis</i> (endemic)	24
22: <i>Oreochromis (Vallicola) amphimelas</i> (endemic)	25
23: <i>Tilapia sparrmanii</i> (native)	26

Part 3: Dubious records and synonyms.....	27
--	-----------

Alcolapia grahami, *Oreochromis (N.) lidole*, *O. (N.) macrochir*, *O. (N.) saka*,
O. (O.) girigan, *O. (O.) mossambicus*, *O. (O.) pangani*, *O. (O.) placidus ruvumae*,
O. (O.) spilurus, *O. (O.) urolepis hornorum*, *Tilapia melanopleura*.

Part 4: Cited Literature.....	29
--------------------------------------	-----------

Note: The distribution maps within this guide use records from our own studies conducted between 2011 and 2018 (**Black**) augmented with records from the Global Biodiversity Information Facility (**Red**).

Cover photo, Lake Tanganyika near Kigoma, by Alan Smith.

TILAPIA IN TANZANIA – AN OVERVIEW

What are Tilapia?

The word “Tilapia” is commonly used to refer to a group of relatively deep bodied African fish species, that occupy lakes or slow-moving rivers, and have a generalist diet including plankton, aquatic plants, vegetative detritus and benthic invertebrates. Taxonomically-speaking, all fish commonly referred to as “Tilapia” are within the Family Cichlidae, an extremely diverse clade of freshwater fishes that are naturally distributed across Africa, the Middle East, the Neotropics and the Indian subcontinent. The “Tilapia” form part of the African-Middle Eastern subfamily, known as the Pseudocrenilabrinae, and are part of an evolutionary line within this subfamily called the Haplotilapiines.

Historically, species we commonly refer to as “Tilapia” were placed within the Tilapiini tribe, with many being placed into the genus *Tilapia* (the italics indicate a formal taxonomic genus). However, reconstructions of their evolutionary relationships using DNA sequences shows that “Tilapia” should be split into multiple separate genera and tribes. Now, the Tilapiini tribe is restricted to a small number of genera, and other “Tilapia” species are now transferred to tribes such as the Coptodini, Oreochromini, Coelotilapini and Heterotilapini. Some of these tribes are actually more closely related to non-tilapiine cichlid fishes, making the “Tilapia” group paraphyletic (Dunz & Schliewen 2013).

In Tanzania, there are representatives of three “Tilapia” tribes. The most species rich tribe in Tanzania is the Oreochromini, of which there are at least 20 species. The tribe Coptodini is represented by two species (*Coptodon rendalli* and *Coptodon zillii*), and the tribe Tilapiini is represented by one species (*Tilapia sparrmanii*). Hereafter we use the common term Tilapia, with no italics, to refer to the representatives of the Oreochromini, Coptodini and Tilapiini.

Tilapia production in Tanzania

Tilapia species form the mainstay of most small-scale inland fisheries and aquaculture initiatives in the country. Tanzania’s tilapia capture fisheries yield was 64,740 tonnes in 2016 while aquaculture was 3,800 tonnes, forming approximately 20% of fish production in the country (FAO 2018). The aquaculture production of tilapia will expand as demand for fish increases.

The most important tilapia fisheries are based on large productive water bodies, including Lake Victoria, Lake Rukwa, the Nyumba ya Mungu reservoir on the Pangani system, and the Mtera reservoir on the upper Ruaha system. Many smaller rivers and impoundments are however locally important for fish production. Tilapia aquaculture is almost exclusively small scale and rural, but collectively there are over 14,000 ponds

in the country. In general, both fisheries and aquaculture tend to be based on a mix of species that are native to the catchment, and those that have been introduced. Rural ponds often have poor biosecurity, often allowing introduced farmed species to escape into non-native freshwaters, while allowing native species to contaminate pond stocks.

Mouthbrooding Tilapia: the Oreochromini

The Oreochromini of Tanzania includes species in the genera *Oreochromis* and *Alcolapia*. These are mouthbrooding cichlids, and there are considerable differences in coloration between the sexes, with the reproductively active males typically exhibiting brighter, bolder and/or more contrasting colours than the females and subadult males. Sexually mature males may also have different head and body shapes, and different fin lengths, to the females and subadult males. During the breeding season in the natural environment the males will aggregate into “leks”. Typically, males dig spawning craters, known as bowers, which are guarded from other males. Females who are ready to spawn will visit the bowers, and enter into a courtship ritual with the male, and then lay some eggs which are fertilised by the male and then collected in the mouth of the female. It is possible that females will mate with multiple males on the lek. Females will then mouthbrood the eggs for several weeks, before releasing a brood of free swimming fry, which shoal together in nursery areas such as patches of aquatic plants, until they are large enough to leave.

Across the Oreochromini group there are diversity of different body sizes, morphologies, environmental tolerances, dietary preferences and colour patterns. All species, however, are found within lakes and/or slow flowing stretches of streams and rivers. We still have very little knowledge of the ecology of many of the tilapia species, or factors that promoted the diversification. Most of the species do not naturally coexist, and sometimes there can be sharp boundaries between the distributions of species. Although there are likely to be dietary differences among the species, most appear to be generalist in nature, feeding upon a range of food items from phytoplankton, macrophytes and benthic invertebrates.

Substrate spawning Tilapia: the Coptodini and Tilapiini

Substrate spawning Tilapia excavate nests in the substrate in which to lay their eggs, and both the male and the female will guard the eggs and free-swimming fry until they are large enough to leave the nest. In contrast to the mouthbrooders, the sexes of substrate-spawning species tend to look very similar even in the breeding season, although males may be larger than females. In Tanzania, species in the Coptodini are relatively common, but the two species can be hard to tell apart, and indeed there may be hybrid populations. *Coptodon* species are typically hardy and occupy a range of habitats from small streams to open lakes, where they feed largely on aquatic plants and vegetative detritus. They tend to stick to the bottom in shallow water. The only species in the Tilapiini in Tanzania is *Tilapia sparrmanii*. This small-bodied species has a limited distribution in the country, being present only in catchments in the southern

part of the country. It appears to have remarkable cold tolerance and will usually be only tilapia species present at higher altitudes. While it is relatively abundant in streams, rivers, lakes and fish ponds, it does not tend to be widely fished or deliberately farmed.

Cautionary notes when identifying Tilapia

Tilapia species can be distinguished from one another by examining key aspects of their body and head shape, jaw morphology, and the colours of the head, flank and fins. Characteristic features are highlighted in the following descriptions. However, it is important to note that although colour patterns and morphology can differ between species, the differences between the sexes of the same species can be greater. It is also possible for the same species of Tilapia to vary considerable among sites. For example, fish reared in dark turbid conditions are often different in colour and body shape to those reared in light open environments. Finally, when using colour information, bear in mind that fish colours can change dramatically between life and death, and during preservation (freezing, alcohol or formalin). Small juveniles of all Tilapia can be distinguished from co-occurring cichlid species by looking for the “tilapia spot” on towards the back end of the dorsal fish. However, juveniles of all Tilapia species tend to be very similar, and often these cannot be reliably assigned to species without genetic information.



Commercial catch of mixed Tilapia species from Nyumba ya Mungu reservoir. Photo: Steph Bradbeer

SPECIES 1: COMMON NATRON TILAPIA

Alcolapia alcalica (Hilgendorf, 1905)



Male (yellow morph), underwater

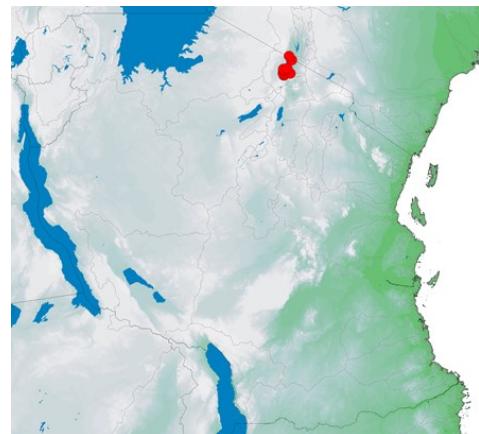


Male (blue morph), Lake Natron

Maximum total length: 11.6cm

Description: A small elongated species with a terminal mouth. Mature males have dark-edged dorsal and anal fins, iridescent blue-white spots on flanks, white lower lips, and a spotted caudal fin with a pink edge. They appear to be colour polymorphic, with some males having yellow bellies and throats, while others are blue white: both morphs can be found in the same location and the colours are stable in aquarium-held specimens, suggesting it is a true polymorphism and not related to reproductive state. Females and non-territorial males are sandy-coloured, pale ventrally, sometimes with faint vertical bars.

Distribution: Endemic to Tanzania and known only from the catchment of Lake Natron, where it lives in hot (30-40°C) alkaline springs.



Fisheries and aquaculture potential: The species is occasionally caught as a food fish in its natural range. Although it attains a small size, its tolerance of hostile environments may make it suitable for culture in high salinity environments. Potential as an aquarium fish.

IUCN Conservation Status: Classed as Endangered, due to its restricted distribution.

Notes: A maternal mouthbrooder: males excavate pits in the substrate in shallow water. There is substantial genetic and morphological variation among populations around Lake Natron, which are probably largely isolated due to the hostile conditions in the main lake.

SPECIES 2: WIDE-LIPPED NATRON TILAPIA

Alcolapia latilabris (Seegers & Tichy, 1999)



Male (white-bellied morph), underwater



Females feeding, underwater

Maximum total length: 6cm

A very small slender species with a wide mouth with broad lips bearing numerous teeth. Mature males have dark-edged dorsal and anal fins, iridescent blue-white spots on flanks, white lips, and a spotted caudal fin edged in pink. Male breeding dress shows geographic variation, with some populations having yellow bellies and throats, while others are white. Females and non-territorial males are sandy-coloured, paler ventrally, sometimes with numerous vertical bars.

Distribution: Endemic to Tanzania and known only from the catchment of Lake Natron, where it lives in hot (30-40°C) alkaline springs, particularly over rocky areas.



Fisheries and aquaculture potential: Potential as an aquarium fish.

IUCN Conservation Status: Not assessed.

Notes: A maternal mouthbrooder: males defend spawning territories among rocks in shallow water. There is substantial genetic and morphological variation among populations around Lake Natron, which are probably largely isolated due to the hostile conditions in the main lake.

SPECIES 3: NARROW-MOUTHED NATRON TILAPIA

Alcolapia ndalalani (Seegers & Tichy, 1999)



Male (yellow-throated variety), Underwater



Male (orange-bellied variety), Underwater

Maximum total length: 5cm

A very small slender species with a narrow ventrally-placed mouth. Mature males have dark-edged dorsal and anal fins, iridescent blue-white spots on flanks, white lower lips, and a spotted caudal fin. Male breeding dress shows geographic variation, with males of some populations having yellow throats and white bellies, while others are a fiery orange underneath. Females and non-territorial males are sandy-coloured, paler ventrally, sometimes with faint vertical bars.

Distribution: Endemic to Tanzania and known only from the catchment of Lake Natron, where it lives in hot (30-40°C) alkaline springs, particularly over rocky areas.



Fisheries and aquaculture potential: Potential as an aquarium fish.

IUCN Conservation Status: Not assessed.

Notes: A maternal mouthbrooder: males defend spawning territories among rocks in shallow water. There is substantial genetic and morphological variation among populations around Lake Natron, which are probably largely isolated due to the hostile conditions in the main lake.

SPECIES 4: RENDALL'S REDBREAST TILAPIA

Coptodon rendalli (Boulenger, 1897)



Adult, Lake Rutamba

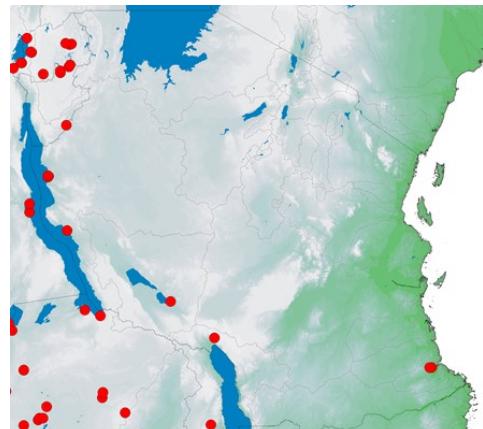


Juvenile, Lake Rukwa catchment

Maximum total length: 45cm

Description: A large, deep-bodied species with a steep head profile, narrow head and small mouth. Often appearing brownish with a white belly, some individuals (both adults and juveniles) have bright red bellies. The sexes look very similar, although males are usually larger. Very difficult to distinguish from *Coptodon zillii*, but *C. rendalli* usually have a steeper head profile and less prominent vertical bars. In East Africa, the tailfin of *C. rendalli* is often divided into a brownish upper part and yellowish lower part, whereas that of *C. zillii* is uniform and spotted.

Distribution: Widespread in southern and central Africa, with reports of occurrence in north Africa likely due to confusion with similar species and to introductions. Its native range in Tanzania is probably confined to Lakes Tanganyika and Nyasa and their catchments. Now found in more catchments as a result of stocking. Shown are Global Biodiversity Information Facility locations.



Fisheries and aquaculture potential: Widely exploited in fisheries and aquaculture. In Tanzania, tends to be cultivated in mixed tilapia stocks along with Nile Tilapia, Ugandan Spotted Tilapia and various hybrids. In larger lakes and dams, it tends to be confined to very shallow muddy areas with lots of vegetation, so it rarely makes a major contribution to fisheries catches, in comparison to *Oreochromis* species.

IUCN Conservation Status: Least Concern.

Notes: A substrate spawner. Male and female form pairs to rear the young. Eggs and larvae are usually guarded in a steep-side circular pit dug in the mud. In Lake Nyasa, they are reported to dig a network of tunnels at some sites. They are tolerant of a wide range of temperatures and salinities. Adults feed on leaves and stems of underwater plants as well as algae, and vegetative detritus.

SPECIES 5: ZILLE'S REDBREAST TILAPIA

Coptodon zillii (Gervase, 1848)



Adult, Lake Victoria

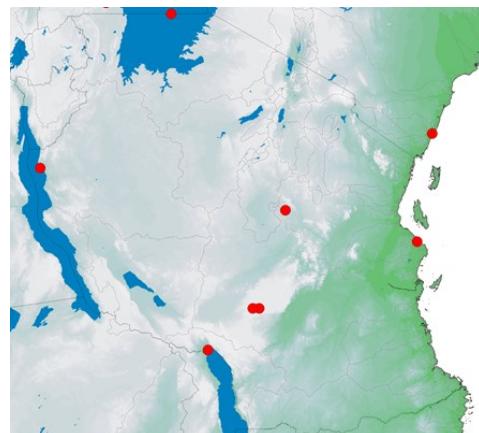


Adult, Lake Naivasha (Kenya) (Photo L. de Vos)

Maximum total length: 40cm

Description: A large, deep-bodied species with a narrow head and small strong jaws. Generally has a bright red belly and prominent vertical barring. The sexes look very similar, although in a mated pair the male is usually larger. Difficult to distinguish reliably from *Coptodon rendalli*, but *C. zillii* can have a less-steep head profile and more prominent vertical bars. In East Africa, the tailfin of *C. rendalli* is often divided into a brown/grey upper part and red/yellowish lower part, whereas the tail of *C. zillii* is more uniform throughout.

Distribution: Introduced to Tanzania. Widespread in northern and western Africa, in East Africa, its native range extends as far south as the Nilotic lakes, including Lake Albert. Deliberately introduced into Lake Victoria in the 1950s, to feed on aquatic vegetation. Likely to be widely distributed in Tanzania as a 'contaminant' of aquaculture stocks sourced from Lake Victoria. Difficult to assess its range due to confusion with *C. rendalli*. Shown are Global Biodiversity Information Facility locations.



Fisheries and aquaculture potential: As a large-growing species that thrives in the eutrophic muddy conditions of farm ponds, it is likely to be exploited in fisheries and aquaculture. In larger lakes and dams, it tends to be confined to very shallow muddy areas with lots of vegetation, so it rarely makes a major contribution to fisheries catches, in comparison to *Oreochromis* species.

IUCN Conservation Status: Not assessed, wide distribution suggests 'Least Concern'.

Notes: A substrate spawner. Male and female form pairs to rear the young. Eggs and larvae are usually guarded in a pit dug in the mud. They are tolerant of a wide range of temperatures and salinities. Adults feed on leaves and stems of underwater plants as well as algae and vegetative detritus. This species does not naturally co-occur with *Coptodon rendalli*, and it is not yet known whether or not they will hybridise when they are stocked in the same water body. Since both have been introduced to Lake Victoria, there should be plenty of scope to test this.

SPECIES 6 TANGANYIKA TILAPIA

Oreochromis (Neotilapia) tanganicae (Günther, 1894)



Male, Kigoma

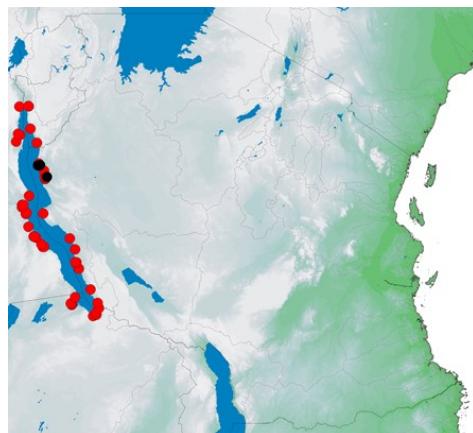


Female, Kigoma

Maximum total length: 42cm

Description: A large, deep-bodied species, with wide bands of teeth in the jaws. Adult males are covered with complex bright pale blue markings, over the head, flanks and unpaired fins. The background colour can vary from greyish, through yellow to bright red. The lower part of the head is grey-white. The tailfin often has a red background and the dorsal fin has a broad red margin. Females and non-territorial males are generally a plain silvery colour, with pearly spots on the flanks. They occasionally exhibit vertical bars and/or horizontal dark bars.

Distribution: Native to Tanzania, this species is endemic to Lake Tanganyika, where it is the dominant tilapiine species in the main lake, despite the presence of the normally invasive Nile Tilapia. It is not normally found far up into inflowing rivers.



Fisheries and aquaculture potential: A large fast-growing species well represented in fishery catches in and around Lake Tanganyika. Currently being promoted as an aquaculture species in the Tanganyika catchment. Occasionally exported for the aquarium trade.

IUCN Conservation Status: Least Concern.

Notes: A maternal mouthbrooder. Males defend territories in shallow water in sheltered sandy or muddy areas, and dig simple pits in the substrate

SPECIES 7 KIUNGULULU TILAPIA

Oreochromis (Nyasalapia) chungruruensis (Ahl, 1924)



Male, Lake Kyungululu

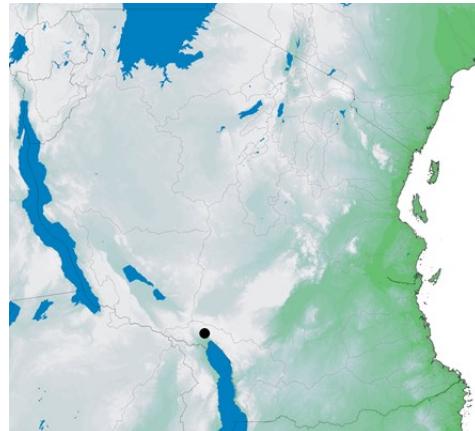


Female, Lake Kyungululu (spent)

Maximum total length: 19cm (this is TL, not SL as stated in FishBase).

Description: A relatively small bodied tilapia species. During sampling in June and November 2011 larger individuals in the lake were found to have large heads, thin bodies and an overall emaciated appearance - referred to as "hunger form tilapia". Females and non-territorial males have grey bodies and 4-5 vertical bars. Ventral region lighter. Some juveniles very dark overall. Breeding males black with a thin white/orange dorsal margin.

Distribution: Endemic to Tanzania: found only in Lake Kyungululu (Kiungululu), a small oligotrophic crater lake in the Rungwe volcanic range. In older literature, the lake was referred to as Chungruru and Tschunguru.



Fisheries and aquaculture potential: The single natural population of this species is probably very small and vulnerable and is unlikely to support a sustainable fishery. The small adult size of the species would suggest minimal potential for aquaculture.

IUCN Conservation Status: Critically Endangered, based on risk of siltation and water level fluctuations due to drought. In addition, populations are likely to have been impacted by the stocking of the lake with *Coptodon rendalli* and *Tilapia sparrmanii*, which are both presently abundant. When we visited in 2011, the lake was being fished with a very long gillnet.

Notes: A maternal mouthbrooder. Males defend territories in shallow water, digging a pit among branches and roots of reeds. Classed as one of the "chambo" group *Oreochromis* from the Lake Malawi catchment, but males do not develop a genital tassel. Trewavas (1983) suggested *O. lidole* was also present in Lake Kyungululu, but these appear to be the 'hunger-form' of *O. chungruruensis*.

SPECIES 8 KAROMO TILAPIA

Oreochromis (Nyasalapia) karomo (Poll, 1948)

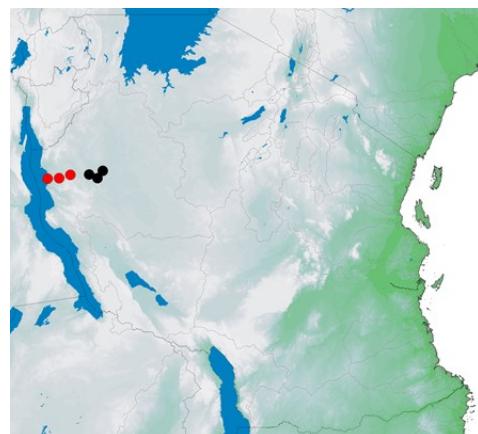


Male, Lake Nyamagoma (not full breeding Female, Malagarasi river
dress)

Maximum total length: 36 cm (estimated from Fishbase record of 28cm SL)

Description: A large bodied *Oreochromis*, characterised by elongated jaws and broad bands of tricuspid teeth. Dorsal region and flanks dark green/olive, ventral region lighter. Fins of ripening males dark with orange lappets on the dorsal, female fins plain grey/olive. Females and non-breeding males have 3 large blotches on the flanks. Fully ripe males are purplish blue with dark spots on the flank scales, a blue-green head, bright blue lips and have blue-white stripes and spots on the dorsal, anal and tail fins. The dorsal and tailfins have broad orange margins, and there is a long, branched orange/red genital tassel.

Distribution: Endemic to Tanzania and confined to the Malagarasi system, where it is found in slow flowing wide stretches of the upper regions of the river, and is abundant in Lakes Sagera and Nyamagoma. Sampling in 2016 suggested this species is only present in the upper Malagarasi region, although Trewavas (1983) reports it from the delta near Lake Tanganyika.



Fisheries and aquaculture potential: An important component of the fisheries catch in Lakes Sagera and Nyamagoma. Potential as an aquaculture species.

IUCN Conservation Status: Critically Endangered, based on small range, fishing pressure and habitat degradation.

Notes: A maternal mouthbrooder. Males defend territories in shallow water, building a small platform of fine sand in the centre of a small pit.

SPECIES 9 KARONGA TILAPIA (= CHAMBO, SAKA)

Oreochromis (Nyasalapia) karongae (Trewavas, 1941)



Male, Lake Nyasa

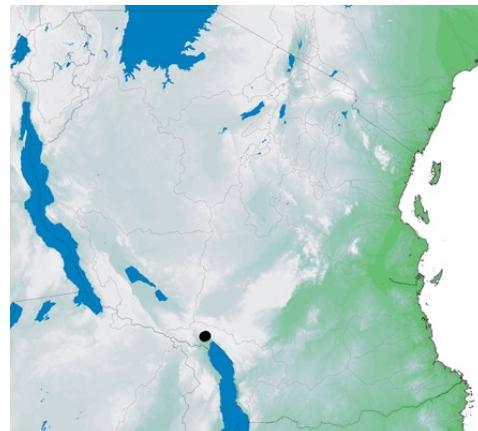


Female, Lake Nyasa

Maximum total length: 42cm

Description: A heavily-built large tilapia species with a wide rounded head and short jaws: individuals vary a lot in dentition, with some having very wide bands of jaw teeth. Females and juveniles with greyish-brown bodies and 4-5 vertical bars. Males are black with a white margin to the dorsal and tailfins. The genital tassel can be long and branched and pinkish to bright yellow. One of the “chambo” group *Oreochromis* from the Lake Malawi catchment. Females and non-territorial males cannot be reliably distinguished from those of *O. squamipinnis*. Females and non-territorial males from Lake Ikapu are a bright golden colour

Distribution: Native to Tanzania: endemic to Lake Nyasa and its catchment, including crater Lakes Itamba and Ikapu. In Lake Nyasa, this species is present from the surface waters to depths of 40-50m. It tends to be restricted to the main lake and does not penetrate far upstream into rivers.



Fisheries and aquaculture potential: An important component of the fisheries catch in Lake Nyasa.

IUCN Conservation Status: Rated as Endangered, based on declining fishery catches due to overfishing.

Notes: A maternal mouthbrooder. Males defend territories from shallow water down to at least 28m. Males dig pits, which are sometimes huge craters with a small raised platform of fine sand.

SPECIES 10 MALAGARASI TILAPIA

Oreochromis (Nyasalapia) malagarasi Trewavas, 1983



Male, Malagarasi catchment

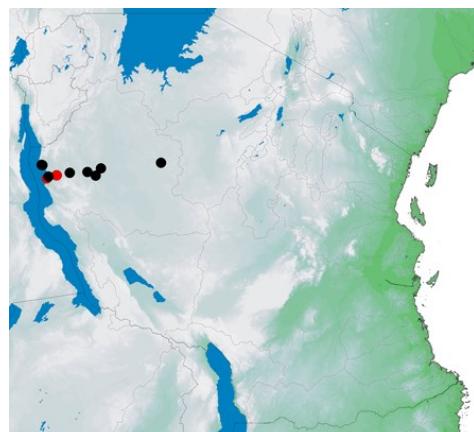


Female, Malagarasi catchment

Maximum total length: 27cm

Description: A large bodied *Oreochromis*, characterised by a deep body, short snout and 3-4 blotches on the flank coupled with around 6 faint wide vertical bars. Grey/green fins and flanks. Male dorsal and caudal fins have red/orange margins. Trewavas reports this to be a tassled species. Ripening males reported to be dark green-grey, possibly almost black. Some authorities regard this as a subspecies of *O. upembae* (type specimen from DR Congo), but specimens of the latter species seem to lack the dark flank spots and have strongly striped caudal fins.

Distribution: Native to Tanzania and possibly endemic: distributed within the Malagarasi river and marginal waters of Lake Tanganyika near Kigoma.



Fisheries and aquaculture potential: A locally important species in artisanal fisheries. Recorded from aquaculture ponds near Kigoma.

IUCN Conservation Status: Rated as Least Concern.

Notes: A maternal mouthbrooder. Eschmeyer's catalogue lists *O. malagarasi* as a valid species, but Fishbase and IUCN list it as a subspecies of *O. upembae*

SPECIES 11: RUKWA TILAPIA

Oreochromis (Nyasalapia) rukwaensis (Hilgendorf & Pappenheim, 1903)



Male, Lake Rukwa (not full breeding dress)

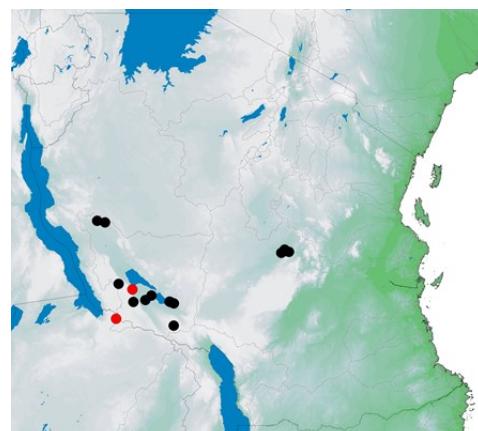


Female, Lake Rukwa

Maximum total length: 33cm

Description: Typical tilapiine cichlid, relatively deep bodied, with rather a small head. Ripe males have a dark body and fins (almost black), with bright red/orange margins on the dorsal and caudal fins. Vertical barring can be noticeable in freshly caught specimens. Head region in ripe males has a blueish sheen. Ripe males have yellow-orange tassels. Females and subadult males plain silver/grey with 6-7 post-opercular vertical stripes and blueish snout present in freshly caught specimens.

Distribution: Endemic to Tanzania, known only from the Lake Rukwa and Upper Ruaha river systems, but has not been recorded downstream from Mtera dam. The species is found both in large lakes and small rivers.



Fisheries and aquaculture potential: The species is a major component of the fisheries catch in Lake Rukwa and the Mtera Dam. Strong aquaculture potential given broad habitat requirements.

IUCN Conservation Status: Vulnerable D2, declining population trend.

Notes: A maternal mouthbrooder. IUCN red list status was determined prior to recognition of this species within the Upper Ruaha system. Specimens resembling this species are currently in small scale aquaculture within the Lake Rukwa catchment.

SPECIES 12: CHAMBO

Oreochromis (Nyasalapia) squamipinnis (Günther, 1864)



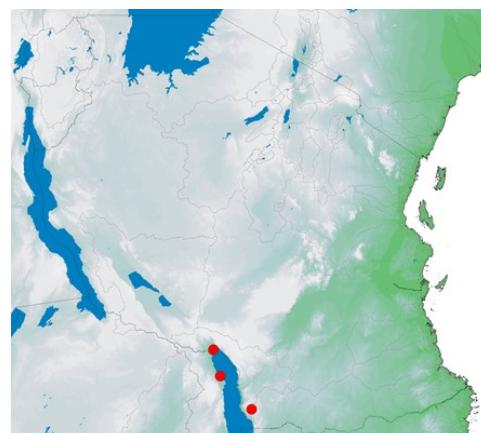
Male (above) and female (below), Lake Nyasa.

Male (above) and female (below), Crater Lake Ilamba

Maximum total length: 35cm

Description: A heavily-built large tilapia species with a wide rounded head. Dwarf populations exist in some crater lakes, showing bony 'hunger-form' body shape. Females and juveniles with grey bodies and 6 or more vertical bars. Males have a bright blue (occasionally white or green) 'mask' across the head. When fully ripe, the underside of most of the body can be black, with the upper surface a conspicuous white to pale blue. Genital tassel can be long and branched; pinkish to bright yellow. Females and non-territorial males are indistinguishable from *O. karongae*.

Distribution: Native to Tanzania: endemic to Lake Nyasa and its catchment. This species is present in crater Lakes Kingiri, Ilamba and Massoko (Kisiba).



Fisheries and aquaculture potential: Major component of the fisheries catch in Lake Nyasa.

IUCN Conservation Status: Endangered, due to declining population trend.

SPECIES 13: VICTORIA TILAPIA

Oreochromis (Nyasalapia) variabilis (Boulenger, 1906)



Male, Lake Victoria

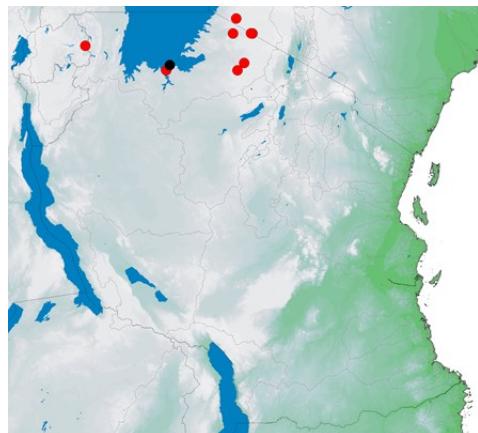


Female, Lake Victoria

Maximum total length: 30cm

Description: Large bodied tilapiine cichlid. Females and unripe males have a grey/green body and fins with 6-7 dark vertical bars on the flank. Ripening males with yellowish chin, and notable bright red/orange margins to the dorsal and caudal fins. Fully ripe males are black with a blue sheen on the head, bright red/orange margins to the dorsal and caudal fins and a long, branched whitish or yellow genital tassel.

Distribution: Native to Tanzania: endemic to Lake Victoria catchment. In Tanzanian territory, it has only been recorded in recent years from the rocky habitat of Makobe island near Mwanza. Introduced into several dams in the Lake Victoria region.



Fisheries and aquaculture potential: Was a major component of the fisheries catch in Lake Victoria. Some pond culture attempted.

IUCN Conservation Status: Critically Endangered.

Notes: A maternal mouthbrooder, males make complex courtship structures in the substrate. The name 'variabilis' refers to the colour polymorphism seen in this species, with a 'piebald' morph which had an orange-yellow background colour and dark blotches similar to the 'OB' morph haplochromine cichlids found on rocky shores in Lake Victoria and Nyasa. None of these have been seen in recent decades. Individuals phenotypically resembling this species have been recorded in 2016 from a dam near Njombe in southern Tanzania (Rufiji catchment) and in 2017 in ponds in Mbeya district, although the identity of these specimens requires confirmation.

SPECIES 14: SINGIDA TILAPIA

Oreochromis (Oreochromis) esculentus (Graham, 1928)



Adult male, Pangani catchment

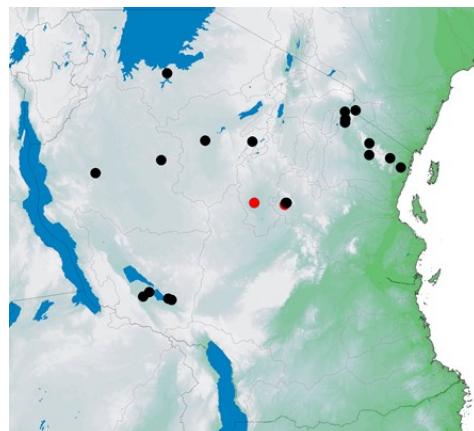


Adult female

Maximum total length: 50cm, but rarely exceeding 20-30cm in recent collections

Description: A large bodied tilapia with a small rounded head, short snout, forward-facing mouth, deep body, relatively small eye for the body size, and generally lacking any dark stripes or blotches. Females and non-territorial males typically pale grey, white ventrally. Males are typically darker, especially in the head/dorsal region. Breeding males have a reddish-pink head and flank, dark fins with red/pink dorsal margins, and red/pink caudal region.

Distribution: Native to Tanzania: endemic to Lake Victoria catchment, but now extirpated from the main lake body and the only natural remaining populations are those of satellite lakes. The species has been introduced into dams in the Lake Victoria catchment, as well as the Pangani catchment, the Zigi river, Lake Rukwa, and the central Tanzania lakes surrounding Dodoma and Tabora. Although known as the 'Singida Tilapia', the species is not native Lake Singida, but was introduced there in the 1950s.



Fisheries and aquaculture potential: Was a major component of the fisheries catch in Lake Victoria. Supports artisanal fisheries in satellite lakes of Lake Victoria (e.g. Lake Malimbe) and forms a large part of the catch in Lake Rukwa, Nyumba-ya-Mungu and the central Tanzania lakes.

IUCN Conservation Status: Critically Endangered.

Notes: Maternal mouthbrooder, males make simple nests in shallow water. Ecologically, an offshore-living plankton feeder, which complemented the more inshore-living *Oreochromis variabilis* in the original ecosystem of Lake Victoria. These niches are now filled by *Oreochromis niloticus* and *O. leucostictus*, respectively.

SPECIES 15: CHALA TILAPIA

Oreochromis (Oreochromis) hunteri Günther 1889



Male, Lake Chala (Photo J. Dieleman)

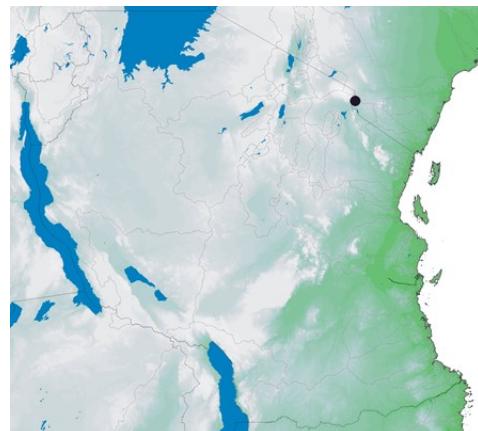


Female, Lake Chala (Photo J. Dieleman)

Maximum total length: 30cm

Description: A large bodied tilapia, with a relatively large and forward-facing snout. Males characterised by an intricate melanin pattern on the head, flank scales that are darker towards posterior side, and a background light grey-blue colour. The dorsal region is darker than the ventral, and ripe males with dark pectoral, anal, caudal fins, while the dorsal fin is dark with orange margins. Females with less contrasting colours, with flanks uniformly grey or olive, with a lighter ventral region.

Distribution: Native to Tanzania: endemic to the closed basin of Lake Chala, a crater lake close to the headwaters of the Pangani system. Several non-native tilapias are now established in this small lake as a result of stocking, and *O. hunteri* is apparently much less common than previously.



Fisheries and aquaculture potential: Fished in Lake Chala.

IUCN Conservation Status: Critically Endangered.

Notes: A maternal mouthbrooder. Colour pattern and location suggest affinity with *O. jipe*. Is the type species of the genus *Oreochromis*.

SPECIES 15: JIPE TILAPIA

Oreochromis (Oreochromis) jipe (Lowe 1955)



Male, Nyumba ya Mungu

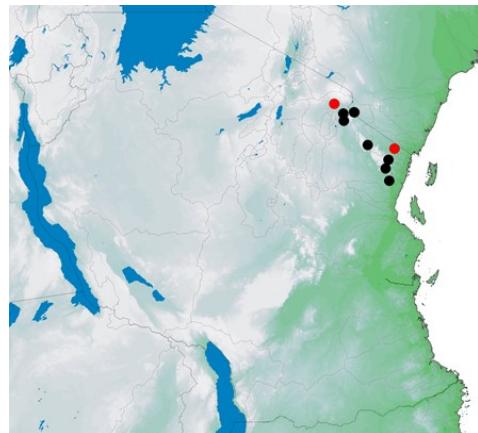


Female, Pangani catchment

Maximum total length: 50cm

Description: A large bodied tilapia, with a slender body and small head and mouth. Males and females characterised rows of blotched scales across the flanks. Males have a pale blue head with dark spots, dark fins with pale spots, and orange margins to the dorsal and caudal. Females and non-territorial males plainer and typically paler, and in some populations there is a more olive/yellow gular and ventral region.

Distribution: Native to Tanzania: endemic to the Pangani catchment and found from Lake Jipe down to the Pangani falls dam.



Fisheries and aquaculture potential: Supports artisanal fisheries in lakes and dams across the Pangani catchment, with the largest fisheries in Lake Jipe and Nyumba-ya-Mungu.

IUCN Conservation Status: Critically Endangered due to its restricted range in the assessed literature (Lake Jipe and Numba-ya-Mungu) and evidence of declining stocks between the 1970s and 2000.

Notes: A maternal mouthbrooder. Considered conspecific with *O. pangani* and *O. girigan*.

SPECIES 16: KOROGWE TILAPIA

Oreochromis (Oreochromis) korogwe (Lowe 1955)



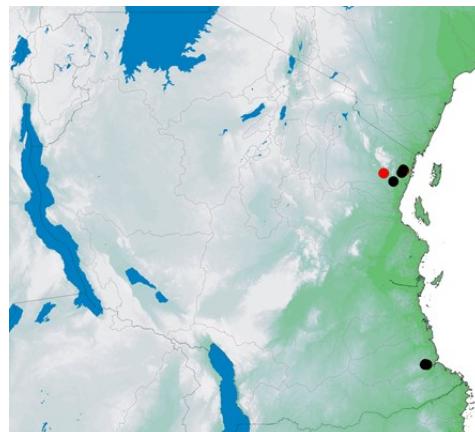
Male (above) and female (below) from Mlingano dam (Northern group)

Male (above) and female (below) from Lake Nambawala (Southern group)

Maximum total length: 20.8cm (this is TL, not SL as erroneously listed on Fishbase)

Description: A small bodied tilapia. Females, subadult males and juveniles with a silver/grey flank colour, light ventral colour, and characteristic melanin pattern of 7-9 broken vertical stripes on the dorsal side giving a spotted appearance. Males darker, with a series of white spots/bars on the flanks. Ripe males have red margins on dorsal and caudal, with a reddish tinge to the pectoral fins. Males from southern populations showed a bluish sheen and less contrasting male coloration.

Distribution: Native to Tanzania: during surveys of northeast Tanzania in 2015 the species was recorded in the lower Pangani river (Pangani falls dam), Zigi river, and the Mlingano Dam. The species was originally recorded in the Pangani system at Korogwe, but was not seen in the area of Korogwe in 2015. Surveys of southeast Tanzania between 2013 and 2016 revealed populations we have assigned to this species in Lakes Rutamba, Nambawala and Mitupa near Lindi.



Fisheries and aquaculture potential: Of only minor importance to artisanal fisheries.

IUCN Conservation Status: Least Concern.

Notes: A maternal mouthbrooder. Evidence of hybridization with native *O. jipe* in northern Tanzania (Bradbeer *et al.* 2018), and non-native *O. niloticus* in southern Tanzania. Specimens from crater Lake Chala have been assigned to this species, but recent work suggests these Chala specimens are introduced *O. urolepis* (Dieleman *et al.* 2018).

SPECIES 17 BLUE / UGANDAN SPOTTED TILAPIA

Oreochromis (Oreochromis) leucostictus (Trewavas 1933)



Male

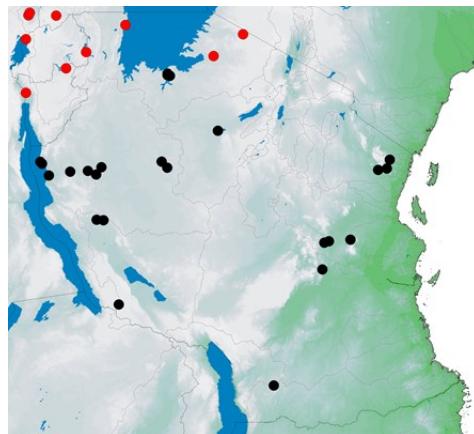


Female

Maximum total length: In our collections, maximum size 20-25cmTL; based on specimens collected in Lake Victoria in the 1960s, Trewavas (1983) gives 36cm TL (FishBase reports 36.3cm SL, but it probably should be TL).

Description: A small-medium-sized tilapia, with a relatively deep, flattened body and small head and jaws. Males are black with white spots on the flanks and fins. Females are more olive coloured, with pale ventral regions, faint vertical barring and dark anal and tail fins.

Distribution: Native to Uganda, the species was introduced to Lake Victoria in the 1950s. It has since been spread throughout much of Tanzania as an accidental contaminant of farm strains of *O. niloticus* founded from Lake Victoria. Tolerant of warm water and low oxygen conditions, it thrives in shallow, swampy habitats, such as the margins of lakes and in aquaculture ponds and appears to outcompete other larger species.



Fisheries and aquaculture potential: Strongly prone to precocious maturity: Trewavas (1983) reports maturity of females at 10cmTL. This makes it an undesirable aquaculture species. Caught in large numbers by small-meshed nets in shallow swampy areas, where it has become established.

IUCN Conservation Status: Least Concern.

Notes: A maternal mouthbrooder. Males dig simple pits in shallow water. Known to hybridise with many other *Oreochromis* species in Tanzania and more widely. Highly invasive also in Kenya. When stocked along with Nile Tilapia, probably will assist in filling all suitable niches and competitively excluding native species.

SPECIES 19 NILE TILAPIA

Oreochromis (Oreochromis) niloticus (Linneaus 1758)



Male

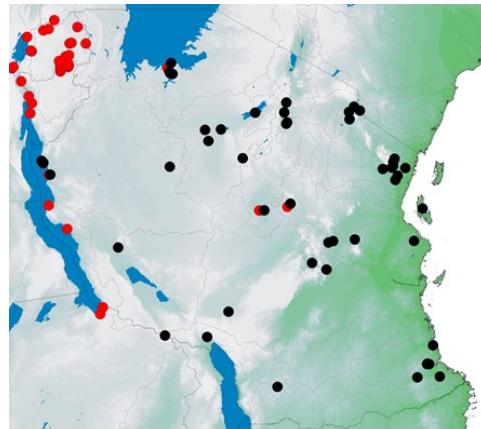


Female

Maximum total length: Fishbase gives max SL of 60cm (~75cmTL), but the largest we have seen in Tanzania is around 45cm TL.

Description: A large deep-bodied tilapia, with a relatively small head. At all life stages, the tailfin is marked with numerous thin vertical stripes. In smaller fishes, these are relatively wide and form an arc, and start at the base of the tailfin. Males are bluish pink, sometimes with a dark throat, belly, anal and pelvic fins. Females are usually brownish, silvery/white beneath with around 10 thin vertical bars.

Distribution: Within Tanzania, native only to Lake Tanganyika, where it was relatively rare and confined to weedy river mouths. This strain does not seem to have been stocked more widely. Farmed stocks and resulting feral populations are mostly descended from populations from Lake Victoria, which in turn, was stocked in the 1950s, probably from Lake Albert, as a contaminant of *Coptodon zillii* stocks, but this was later augmented by other translocations. Now found in most catchments in Tanzania. Has been introduced into most tropical or subtropical countries through fish farming. It is generally highly invasive.



Fisheries and aquaculture potential: Globally, the most important tilapia species in fish farming and supports major capture fisheries where established.

IUCN Conservation Status: Least Concern.

Notes: A maternal mouthbrooder. Males dig simple pits in shallow water. Known to hybridise with many other *Oreochromis* species in Tanzania and more widely and for this reason further stocking has been banned in a number of countries (e.g. South Africa, Malawi, Zambia).

SPECIES 20 SHIRE TILAPIA

Oreochromis (Oreochromis) shiranus (Boulenger, 1897)



Male, Songea

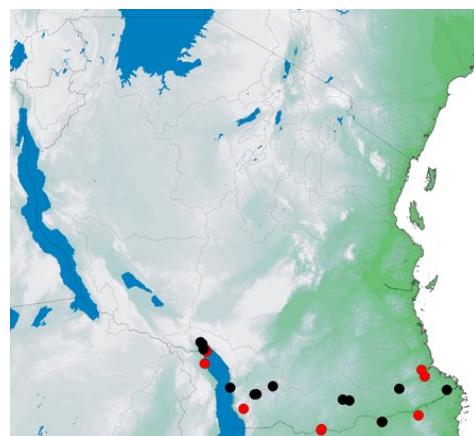


Female, Lake Nyasa

Maximum total length: 39cm

Description: A large, deep-bodied species with 4 anal fin spines. Females and immatures from the Lake Nyasa catchment have a dark olive-coloured body, yellow-gold below. Other populations, such as those from Lakes Chilwa and Chiuta and the Ruvuma system show a more silvery colour. Unusually for *Oreochromis*, the horizontal stripes are often more prominent than the vertical bars. Adult males develop very large jaws and a concave head profile. They are black, with red margins to the dorsal and caudal fins. Underwater or in aquaria, males show numerous white spots on the upper half of the flanks, but these fade quickly under stress, so that they appear uniformly black when removed from the water.

Distribution: Native to Tanzania, Malawi and Mozambique, its natural distribution includes the catchment of Lake Nyasa and the Ruvuma river system.



Fisheries and aquaculture potential: A large species heavily exploited in Lake Nyasa and its catchment. Males in particular are fast-growing and the species is cultured commercially in Malawi in cages and ponds.

IUCN Conservation Status: Not evaluated.

Notes: A maternal mouthbrooder. The population from the Ruvuma system has historically been regarded as *Oreochromis placidus ruvumae*, but our studies indicate that its affinities lie with *O. shiranus*.

SPECIES 21 WAMI TILAPIA

Oreochromis (Oreochromis) urolepis (Norman, 1922)



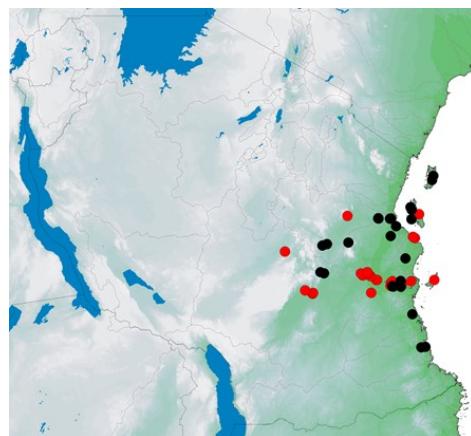
Males, Ifakara (above) and Zanzibar (below)

Male, near Lindi (above), female near Rufiji (below)

Maximum total length: 44cm SL (~56cm TL).

Description: A large, deep-bodied species. Freshly collected males vary in colour: sometimes with grey head, brownish-golden upper parts, or sometimes with pinkish unpaired fins and upperparts. Under stress, or after death, males tend towards uniform black body and fins, with reddish-pink dorsal and tail fin margins. Mature males develop enlarged jaws and a concave head profile. Females and immatures vary from light grey to dark brownish background, with dark flank patches and an anal fin with faint vertical bars.

Distribution: Endemic to Tanzania, its native range includes most of the Rufiji system, including the Kilombero and the Great Ruaha below the Mtera Dam. It is also found in the southern Ruvu River (i.e. Bagamoyo westwards), and the Wami system. Populations in Zanzibar and Pemba may be native, although there may also have been some stocking from the mainland.



Fisheries and aquaculture potential: A large, fast-growing species heavily exploited in its native range. Was globally cultured in the past, making use of its salt tolerance and ability to produce all-male strains through hybridisation with *O. niloticus* or *O. mossambicus*.

IUCN Conservation Status: Not evaluated.

Notes: A maternal mouthbrooder. The Wami system population has historically been regarded as *Oreochromis urolepis hornorum* or even *O. hornorum*. We have been unable to find any characters distinguishing specimens from the Wami from the populations from further south.

SPECIES 22 MANYARA TILAPIA

Oreochromis (Vallicola) amphimelas (Hilgendorf, 1905)



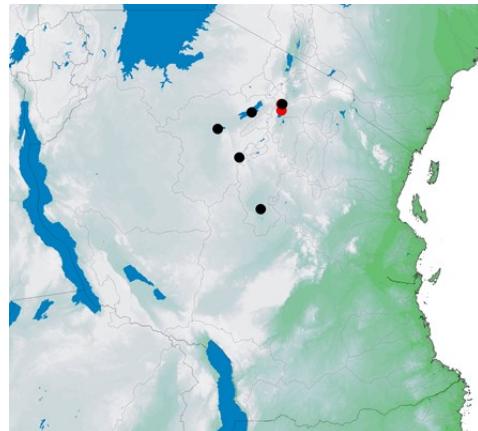
Male, Lake Manyara



Female, Lake Manyara

Maximum total length: Fishbase reports 33cm SL; Trewavas 33cm TL (latter probably correct).

Description: Slender bodied tilapia, characterised by its small eye and slender head profile with terminal mouth. Live territorial males have jet black dorsal fins and are black underneath (pelvics, anal and belly) but are pinkish-red on flank and caudal fin. Under stress, such as following capture, the flanks darken and the whole fish appear dark grey, apart from the reddish tailfin. Females and non-territorial males grey/silver with a pale ventral region. Unusually for tilapia, females seem to grow larger than males.



Distribution: Endemic to Tanzania, it is confined to several shallow saline lakes in central Tanzania. Small bodied forms are present in Lake Eyasi and Lake Manyara, while large bodied forms can be found in lake Kitangiri and Lake Singida. Small-bodied individuals were recorded from Lake Sulungali near Dodoma in 2017.

Fisheries and aquaculture potential: Limited potential as an aquaculture species, it comprises a high proportion of the catch in lakes where it is found: for example, dominating catches in Lake Manyara when visited in 2017, although the larger *O. niloticus* was much more important in catches on Lake Sulungali.

IUCN Conservation Status: Endangered, due to restricted distribution, drought and overfishing.

Notes: A maternal mouthbrooder. Some indication of hybridization with *O. niloticus* and *O. esculentus*.

SPECIES 23 BANDED TILAPIA

Tilapia sparrmanii Smith, 1840



Adult, Njombe

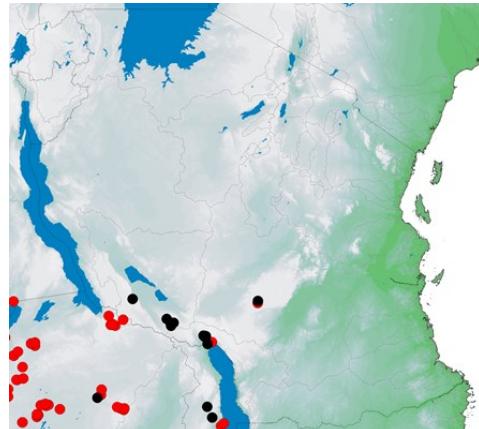


Juvenile, Lake Rukwa catchment

Maximum total length: 23.5cm

Description: A small, deep-bodied species with a narrow head and small strong jaws. Often appearing a rich deep yellow with wide dark brown bands, and red/orange fin margins. Mature adults are very dark with prominent black stripes and a patch of scarlet scales behind the head.

Distribution: Widespread in southern and central Africa. Its native range in Tanzania is probably confined to the catchments of Lakes Nyasa and Rukwa and upper tributaries of the Ruaha system. In the Mbeya District, it occurs in Lake Ikapu and has been stocked in Lake Kiungululu (apparently misidentified as 'black bass') where it is now the most numerous species and may represent a threat to the endemic *Oreochromis chungruruensis*. Tends to be confined to shallow weedy areas, so does not build up large populations in deep lakes.



Fisheries and aquaculture potential: A relatively small species, so unlikely to play much of a role in capture fisheries, but cultured in ponds in Njombe and apparently deliberately stocked into Lake Kiungululu where it is not presently exploited.

IUCN Conservation Status: Least Concern.

Notes: A substrate spawner. Male and female form pairs to rear the young. They are reported to be cold-tolerant. Adults are omnivorous, feeding on animal and plant matter.

PART 3: DUBIOUS RECORDS AND SYNONYMS

Below we list names that have been reported for Tanzanian tilapiine populations in major international databases or which have been in use among researchers based in the country in recent years. We have not included old synonyms that have been out of use for decades. For example, almost all of these species were once classed in the genus *Tilapia*, most *Oreochromis* spent a few years in *Sarotherodon*, and *Alcolapia* species were formerly included in *Oreochromis*. Long defunct species names include things like *Tilapia manyarae* Hilgendorf 1905, which was originally applied to females and juveniles of *Oreochromis amphimelas*. Such synonyms can be found in resources such as Eschmeyer's online catalogue (<https://www.calacademy.org/scientists/projects/catalog-of-fishes>).

Alcolapia grahami (Boulenger, 1912). This is a soda-lake cichlid closely related to the native *Alcolapia* of Lake Natron. It is reported on Fishbase as having been introduced to Lake Natron from Lake Magadi in Kenya. This is based on a secondary source that we have not seen (a 20 year old 400-page book on naturalised fishes: Lever 1996). Recent surveys of Natron have not recorded this species and there is currently no evidence that any introduction led to establishment of breeding populations.

Oreochromis (N.) lidole (Trewavas 1941). This is a large offshore plankton-feeding species endemic to Lake Nyasa. It was reported to be confined to the southern part of the lake, all of which lies within Malawian territory: it has never been positively recorded north of Nkhotakota. Reports of this species from the Tanzanian crater lakes Kyungulu and Kingiri (Trewavas 1983, repeated in Fishbase) are now believed to have been the result of misidentification of emaciated spent individuals of *Oreochromis chungruruensis* and juvenile *Oreochromis squamipinnis* respectively. There is no evidence that this species was ever native to Tanzania and it is suspected that *O. lidole* is now globally extinct, as it has not been positively recorded since 2007.

Oreochromis (N.) macrochir (Boulenger, 1912). A large species from central and SW Africa, there are reports that it was stocked near Korogwe (NE Tanzania) from the DRC (Eccles 1992), although it is possible that it was actually the related *O. (N.) mweruensis*, which was not at time distinguished. Neither species has been reported in recent surveys and there is no evidence that breeding populations were ever established.

Oreochromis (N.) saka (Lowe 1953). This name was proposed for populations of endemic *Oreochromis* found in the southern part of Lake Malawi, which had similar body proportions and dentition to the sympatric *O. squamipinnis*, but which had black rather than blue/white males. Following comparison of extensive collections of specimens, Turner & Robinson (1991) concluded that *O. saka* represented a geographic variant and junior synonym of *Oreochromis karongae*, and this has been followed in all subsequent studies of the Lake Malawi/Nyasa *Oreochromis*. However, *O. saka* is still listed as valid by Fishbase and Eschmeyer's catalogue.

Oreochromis (O.) girigan (Lowe 1955) & ***O. (O.) pangani*** (Lowe 1955). Lowe described four species from the Pangani system: the very distinctive *O. korogwe* and three very similar species: *O. pangani* from the river and *O. jipe* and *O. girigan* from Lake Jipe. The latter two forms were found to differ partially in the shape of the lower pharyngeal bone: *O. girigan* having wider bones and coarser teeth. *Oreochromis pangani* and *O. girigan* were reported to have 3 anal fin spines, while *O. jipe* normally had 4, but sometimes 3. Trewavas (1983) regarded *O. girigan* as a subspecies of *O. pangani*, but subsequent workers have failed to distinguish any of the three and so regard *O. girigan* and *O. pangani* as junior synonyms of *O.*

jipe (Seegers *et al.* 2003). Were these ever really different species? It is possible that formerly existing differences may have been eliminated as a result of people moving fish around between Lake Jipe and the river, and/or by loss of niche differentiation among the natives as a result of competitive exclusion from part of their niche by successive introductions of non-native species, including *O. esculentus*, *O. niloticus*, *O. leucostictus* and *Coptodon* spp. Perhaps, the Jipe taxa represented the early stages of an adaptive radiation descended from the riverine Pangani ancestor. If so, perhaps the differentiation into distinct ecomorphs has since been destroyed by human intervention? For now, it seems that only one species of this group can be distinguished, and based on page priority, this would have to be called *O. jipe*.

Oreochromis (O.) mossambicus (Peters, 1852). This species is listed by Fishbase as having been introduced to Tanzania (citing the same reference as for *A. grahami*: Lever 1996). We have seen numerous reports of *O. mossambicus* from recent collections in Tanzania. All have proved false: they have all been mature male *O. urolepis* or *O. shiranus* which showed extreme jaw development which is common to all three species. Mature male *O. mossambicus* always show distinctive white opercula. We have never seen any such specimens in recent collections, so provisionally we suggest that this species has not become established in Tanzania.

Oreochromis (O.) placidus ruvumae (Trewavas, 1966). It has long been assumed that the *Oreochromis* from the Ruvuma system belonged to this taxon rather than *O. shiranus*. It is not clear why. No direct comparison appears to have been made between them. Based on examination of the types, a great deal of freshly collected material and DNA sequence data, we see no reason to distinguish Ruvuma *Oreochromis* and *O. shiranus*. The populations from Lakes Chilwa and Chiuta have long been assigned to *O. shiranus chilwae*, yet Lake Chiuta is currently connected to the Ruvuma system, and Lake Chilwa was only separated less than 10,000 years ago. Moreover, the Ruvuma, Chilwa and Chiuta share many other species, including the cichlids *Astatotilapia gigliolii* (junior synonym: *A. tweediei*) and *A. calliptera*.

Oreochromis (O.) spilurus (Günther, 1894). This species is (or was) widespread in Kenya, but has been reported from Lake Momello/Momela/Momella in Tanzania (FishBase, using a secondary source: Trewavas & Teugels 1991). The source of the information seems to be a photograph in an aquarium book by H. Mayland. This small lake lies within the Arusha National Park, near to Kilimanjaro. One of us (BPN) has seen specimens from this lake in the past, and considers the ID as *O. spilurus* as plausible. However, the lake has not been visited by us recently. It is not clear whether this population is native or introduced, nor whether it has been correctly identified, nor even if it is still extant.

Oreochromis (O.) hornorum (Trewavas, 1966). This name, then as *Tilapia hornorum*, was originally applied to specimens from the Wami system by Trewavas in 1966. This was proposed as a replacement name for the previous *Tilapia adolfoi* Steindachner 1916 based on specimens collected from the Mkondowa River near Kilosa on the Wami system. Trewavas noticed that Steindachner had already used the name *Tilapia adolfoi* Steindachner 1909 for a Lake Tanganyika cichlid. He seems to have forgotten that one! As a result, *Tilapia hornorum* became the name for the *Oreochromis* from the Wami. Trewavas later compared these to *Oreochromis urolepis* and felt they were at most, two subspecies (*O. urolepis urolepis* and *O. urolepis hornorum*) but noted that perhaps the degree of scaling on the tailfin and possibly male breeding colours might distinguish them. We have examined the scale coverage of the tailfin and obtained more information on male breeding colours and we cannot see any grounds for maintaining *O. urolepis urolepis* and *O. urolepis hornorum* as subspecies, so recommend the use of *O. urolepis* for Wami as well as other populations.

Tilapia melanopleura Duméril 1861. We found that this name was still in use among fishery workers in Tanzania in the 2010s. It has been regarded as a junior synonym of *Tilapia* (now *Coptodon*) *zillii* for many decades. Confusingly, it was also used for the similar-looking *Coptodon rendalli*. The name should not be used for any population any longer.

PART 4: CITED LITERATURE AND FURTHER READING.

- Bradbeer, S.J., Harrington, J., Watson, H., Warraich, A., Shechonge, A., Smith, A., Tamatamah, R., Ngatunga, B.P., Turner, G.F. and Genner, M.J. (2018) Limited hybridization between introduced and Critically Endangered indigenous tilapia fishes in northern Tanzania. *Hydrobiologia* DOI: 10.1007/s10750-018-3572-5.
- Dieleman, J., Muschick, M., Nyingi, W.D. and Verschuren, D (2018) Species integrity and origin of *Oreochromis hunteri* (Pisces: Cichlidae), endemic to crater Lake Chala (Kenya–Tanzania). *Hydrobiologia*, DOI: 10.1007/s10750-018-3570-7.
- Dunz, A.R. and Schliewen, U.K. (2013) Molecular phylogeny and revised classification of the haplotilapiine cichlid fishes formerly referred to as "Tilapia". *Molecular Phylogenetics and Evolution* **68**, 64-80.
- Eccles, D.H. (1992) *Field guide to the freshwater fishes of Tanzania*. FAO Species Identification Sheets for Fishery Purposes. FAO, Rome.
- FAO (2018) *The State of World Fisheries and Aquaculture 2018 - Meeting the sustainable development goals*. FAO, Rome.
- Lever, C. (1996) Naturalized fishes of the world. Academic Press, California, USA. 408 p.
- Lowe, R.H. (1955) New species of *Tilapia* (Pisces, Cichlidae) from Lake Jipe and the Pangani River, East Africa. *Bulletin of the British Museum (Natural History) Zoology* **2** **12**, 349-368.
- Seegers, L., De Vos L.D.G. and Okeyo D.O. (2003) Annotated checklist of the freshwater fishes of Kenya (excluding the lacustrine haplochromines from Lake Victoria). *Journal of East African Natural History* **92**, 11-47.
- Shechonge A., Ngatunga B.P., Bradbeer S.J., Day J.J., Freer J.J., Ford A.G.P., Kihedu J., Richmond, T., Mzighani, S., Smith, A.M., Sweke, E.A., Tamatamah, R., Tyers, A.M., Turner G.F. and Genner, M.J. (2018a). Widespread colonization of Tanzanian catchments by introduced *Oreochromis* tilapia fishes: the legacy from decades of deliberate introduction. *Hydrobiologia* DOI: 10.1007/s10750-018-3597-9.
- Shechonge, A., Ngatunga, B.P., Tamatamah, R., Bradbeer, S.J., Harrington, J., Ford, A.G., Turner, G.F. and Genner, M.J., (2018b). Losing cichlid fish biodiversity: genetic and morphological homogenization of tilapia following colonization by introduced species. *Conservation Genetics* DOI: 10.1007/s10592-018-1088-1
- Trewavas, E. (1983) Tilapiine fishes of the genera *Sarotherodon*, *Oreochromis* and *Danakilia*. British Museum (Natural History), London. UK
- Trewavas, E. and Teugels, G.G. (1991) *Oreochromis*. p. 307-346. In J. Daget, J.-P. Gosse, G.G. Teugels and D.F.E. Thys van den Audenaerde (eds.) Checklist of the freshwater fishes of Africa (CLOFFA). ISBN, Brussels; MRAC, Tervuren; and ORSTOM, Paris. Vol. 4.
- Turner, G.F. and Robinson, R.L. (1991) Ecology, morphology and taxonomy of the Lake Malawi *Oreochromis* (*Nyasalapia*) species flock. *Annales de la Musée Royal de l'Afrique Centrale (Tervuren)* **262**, 23-28.

