Oreochromis squamipinnis (Günther, 1864)

Lake Malombe, Malawi; 22 cm TL male of white-headed morph. © G.F. Turner.

Synonyms
Chromis squamipinnis Günther, 1864

FAO names
None

Local names
Nyanja (Chichewa): Chambo (Malawi), Ching'ang'a (Malawi), Ching'anga (Malawi), Kasawala (Malawi), Li/Ma ng'ara (Malawi), Li/Ma sanga (Malawi), Ling'ara (Malawi), Mang'ara (Malawi), Mkambo (Malawi), Mphende (Malawi), Nchesichesi (Malawi), Ngwalu (Malawi), Zeya (Malawi)
Swahili: Kasawala (Tanzania), Ling'ara (Tanzania), Chambo (Tanzania)
Tonga: Chambo (Malawi), Chambu (Malawi),
Yao: Chambo (Malawi), Ling'ara (Malawi), Mang'ara (Malawi), Mkambo (Malawi), Nchesichesi (Malawi)

Geographical distribution
Lake Malawi and its catchment (Schechonge et al 2018), including crater lakes Kingiri, Ilamba and Massoko (Genner et al 2018) and the Upper Shire River (Tweddle et al 1979).

Habitat and Biology
Semi-pelagic (Eccles 1992), found in all kinds of habitats but seen mostly in shallow water; abundant in the South East Arm of Lake Malawi, where it occurs in shallow, vegetated bays (Konings 1990). Feeds on phytoplankton and sometimes from the sediment on the sand; diatoms constitute the major part of its diet (Konings 1990). Major component of the fisheries catch in Lake Malawi; IUCN red list status critically endangered (Phiri & Kanyerere 2018).

Key features
Heavily-built large tilapia species with a wide rounded head; dwarf populations exist in some crater lakes, showing bony 'hunger-form' body shape (Genner et al 2018). Dorsal fin with 16-17 spines and 10-11 soft rays; anal fin with 3 spines and 8-10 soft rays (Trewavas 1983). Females and juveniles with grey bodies and 6 or more vertical bars; males with bright blue, occasionally white or green, 'mask' across the head; when fully ripe, underside of most of the body can be black, with upper surface a

conspicuous white to pale blue; genital tassel can be long and branched, pinkish to bright yellow; females and non-territorial males indistinguishable from *Oreochromis karongae* (Genner et al 2018).

Interest to fisheries

Due to their difficult identification, published catch data usually do not distinguish between the three different species of *Oreochromis* collectively called chambo (*O. karongae, O. lidole* and *O. squammipinnis*). FAO (2024) does not hold catch statistics for *O. squamipinnis* or chambo.

The main fishing grounds for chambo in Malawi are the southern parts of Lake Malawi, especially the Southeast Arm (SEA) where the fishery is well established in the productive shallow waters, and the smaller Lake Malombe; fishing in the northern part of Lake Malawi is not as intensive (FAO 1993; Banda et al 2005; Kapute et al 2008; Tweddle et al 2015). Chambo in the SEA of Lake Malawi is intensively exploited by both artisanal (traditional) and commercial fishers (FAO 1993; Weyl 2001; Weyl et al 2004a; Banda et al 2005).

Traditionally exploited by artisanal gillnet and beach seine fishers (Turner et al 1995), chambo were considered fully exploited soon after the initiation of industrial purse seining in 1942 (Lowe 1952). Effort has exceeded the level that allows Maximum Sustainable Yield (MSY) for chambo since 1976 (Bell et al 2012). Of the formerly important fishing grounds only the SEA still retained a viable fishery in 1986 which appeared to be fully exploited (Lowe McConnell 2003). In 1992, Seisay et al estimated MSY of *O. squamipinnis* in the SEA at 60% of the then applied effort level, with *O. squamipinnis* being harder hit than *O. karongae* and *O. lidole*. Combined MSY and maximum sustainable economic yield estimates for all *Oreochromis* sp. in the SEA of Lake Malawi were at 70% of the then applied effort, and no increase in effort could be accommodated.

Fisheries assessments in the 1960s demonstrated that haplochromine cichlids were underexploited, and a trawl fishery was subsequently developed (Tarbit 1972). This fishery rapidly depleted larger, slower growing, late maturing species (Turner 1977; Banda et al 1996) and began to fish in shallower waters where chambo were a common bycatch (Weyl et al 2005b). As the fishing effort increased, and catches of larger species decreased, the artisanal fishery changed from targeting primarily large cyprinids and tilapia to fishing for small haplochromine cichlids (Weyl et al 2005b). The resultant gear modifications, such as the use of small-meshed gillnets and light attraction, increased the harvest pressure on immature chambo, particularly in southern Lake Malawi where the 1+ year-class chambo, previously relatively unexploited, contributed heavily to the catch in the light attraction kauni fishery (Weyl et al 2004a, 2005a,b). Weyl (2001) already reported that, in some parts of the SEA of Lake Malawi, the spawner biomass-per-recruit for chambo had decreased to 37% of pristine levels, considered to be too low to sustain the chambo stock. Excessive fishing pressure in the SEA likely also caused the decrease in length at which 50% of the fish are mature, from 275mm TL in 1985 (Lewis 1990) to around 222 mm TL for various populations studied in 2008 (Kapute et al 2008). It was most likely this additional pressure on the juvenile stock which caused the crash of the chambo fishery and the dramatic decline of the catches (Banda et al 2005; Weyl et al 2010; Tweddle et al 2015), despite the large increases in fishing effort (Hara & Njaya 2016), although environmental variability such as fluctuating lake levels may also have played a role (e.g. Tweddle & Magasa 1989). According to Breuil & Grima (2014), the estimated fish production in Malawi increased in the early 2000s mainly due to the promotion of offshore deep-water fishing in Lake Malawi and the intensification of recording. These authors did not observe any loss of fish biodiversity since the late 1990s, which neglects the likely disappearance of *Oreochromis lidole*, which has not been recorded since 2007 (Genner et al 2018), and attribute the changed fish composition to overfishing and environmental degradation. During the late 1970s, production of chambo was about 9000 tonnes annually but landings have since severely declined, with current estimates of about 4000 tonnes (Chavula et al 2023). In southern Lake Malawi catches decreased from 5000 tonnes per year in 1992 to less than 2000 tonnes per year by 1999 (Weyl et al 2010; Hara & Njaya 2016) (Figure 1). Prior to 1986 chambo dominated the Lake Malawi fisheries (Lowe-McConnell 2003), but catch contributions decreased to 17% by 1994 (Turner 1994), further dropping to 11.7% by 2002 (Irvine 2002).

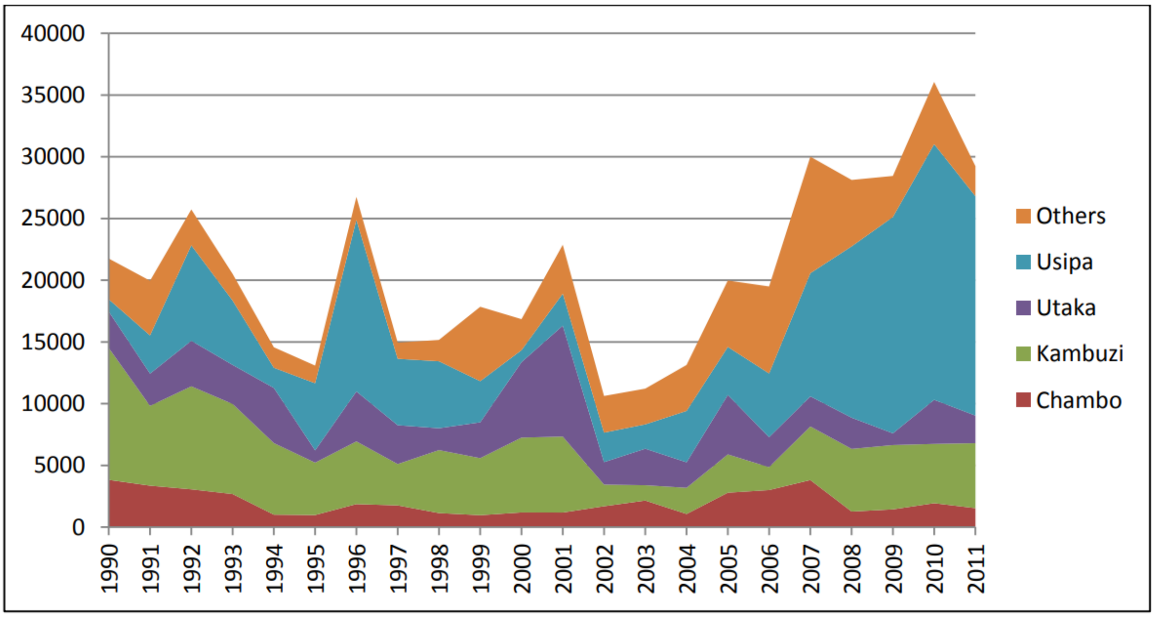

Figure 1: Estimated total production from the South East Arm and South West Arm of Lake Malawi for the years 1990 to 2011. Image from Hara & Njaya 2016.

Lake Malombe is a prime example of the loss of economic value resulting from the depletion of a high-value species in an African fishery. This highly productive lake consistently yielded about 4000 tonnes per year of chambo until the 1970s (Figure 2) (Tweddle et al 2015). Chambo were harvested using mostly large-meshed gillnets. The introduction of a small-meshed purse seine (nkacha net) in the mid-1980s in combination with continued fishing on adults initially increased chambo catches, to about 8000 tonnes per year by 1982, as the small immature fish were now also being caught. By the early 1990s however, recruitment in Lake Malombe was very low due to a severely depleted parent stock and continuous exploitation of juveniles and spawners, which resulted in severe recruitment and growth overfishing and a crash of the chambo catch to less than 200 tonnes per year in 1992 (Figure 2) (Van Zalinge et al 1991; Seisay et al 1992; Turner 1995; Tweddle et al 1995, 2015; Banda et al 2005; Weyl et al 2010).

The 2001 mean beach price for chambo was US$ 1.04 per kg while the mean for other fishes was US$ 0.36 per kg (Department of Fisheries, unpublished data). Consequently the value of the overall catch decreased from more than US$ 9.4 million per year to less than US$ 2 million per year. For the about 2200 fishers the decreases in catch rate and value have resulted in a reduction of the overall value of the catch from US$ 4000 per fisher per year to only US$ 720 per fisher per year after the collapse (Tweddle et al 2015). The lack of alternative livelihoods for small scale fishers means that they have had no choice but to stay in the fishery (Allison & Ellis 2001), resulting in a relatively stable number of fishermen despite dwindling economic returns (Tweddle et al 2015).

The low fecundity of chambo, typically <1000 eggs per female annually (Trewavas 1983), poses a potential problem for producing a sufficient number of juveniles for large-scale cage culture (Banda et al 2005).

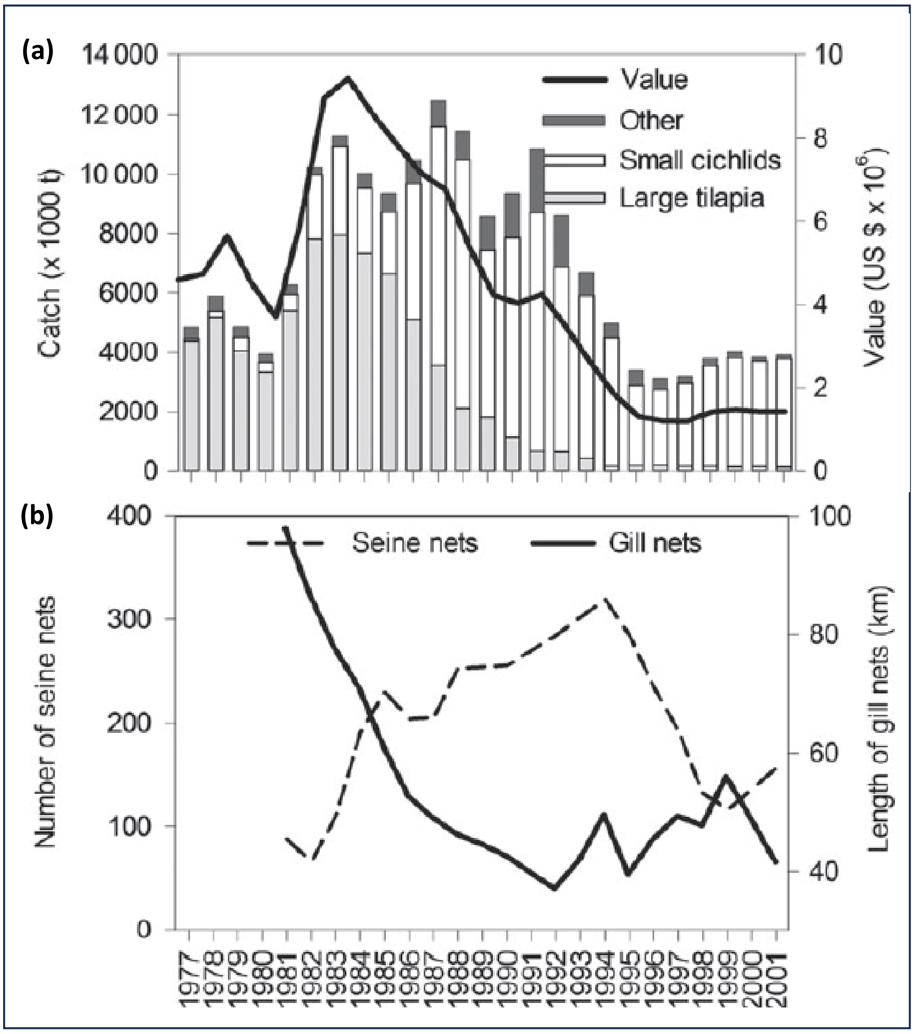

Figure 2: Demise of the fishery for large tilapias in Lake Malombe, Malawi. (a) Catch of large tilapias vs small haplochromine cichlids and corresponding catch value calculated using the fish price from 2000; (b) replacement of the gillnet fishery by a small-meshed seine net fishery (Source data Malawi Department of Fisheries; image from Tweddle et al 2015).

Bibliography

Allison, E.H. and F. Ellis (2001). The livelihoods approach and management of small-scale fisheries. Marine Policy 25: 377-388.

Banda, M., D. Jamu, F. Njaya, M. Makuwila and A. Maluwa (2005). The Chambo Restoration Strategic Plan. WorldFish Center Conference Proceedings 71, Penang, Malaysia. 112p.

Banda, M., T. Tomasson and D. Tweddle (1996). Assessment of the trawl fisheries of the South East Arm of Lake Malawi using exploratory surveys and commercial catch data. pp 53-75. In: I.G. Cowx (ed). Stock Assessment in Inland Fisheries. Oxford: Fishing News Books, 528p.

Bell R.J., J.S. Collie, D. Jamu and M. Banda (2012). Changes in the biomass of chambo in the southeast arm of Lake Malawi: a stock assessment of *Oreochromis* spp. Journal of Great Lakes Research 38: 720-729.

Chavula, G.M.S., M.S. M'balaka, E. Gondwe, M. Ngochera, J.S. Halafo, A.H. Shechonge, N.P. Gabagambi, A.S. Mbonde, D. Banda, N. Muyumbana, T.J. Lawrence, M.Z. Ajode, S. Smith, C. Jonasse, G.Z. Kanyerere and B.P. Ngatunga (2023). Lake Malawi/Niassa/Nyasa basin: Status, challenges, and research needs. Journal of Great Lakes Research 49(6): 102241.

Eccles, D.H. (1992). FAO species identification sheets for fishery purposes. Field guide to the freshwater fishes of Tanzania. Prepared and published with the support of the United Nations Development Programme (project URT/87/016). FAO, Rome. 145 p.

FAO (1993). Fisheries management in the southeast arm of Lake Malawi, the upper Shire River and Lake Malombe, with particular reference to the fisheries on chambo (*Oreochromis* spp.). CIFA Technical Paper 21: 1-113.

FAO (2024). FishStat: Global capture production 1950-2022. [Accessed on 29 March 2024]. In: FishStatJ. Available at www.fao.org/fishery/en/statistics/software/fishstatj. Licence: CC-BY-4.0.

Genner, M.J., G.F. Turner and B.P. Ngatunga (2018). A guide to the tilapia fishes of Tanzania. Martin J. Genner, George F. Turner and Benjamin P. Ngatunga, August 2018. 29 p.

Hara, M. and F. Njaya (2016). Between a rock and a hard place: the need for and challenges to implementation of rights based fisheries management in small-scale fisheries of southern Lake Malawi. Fisheries Research 174: 10-18.

Irvine, K. (2002). The trophic ecology of the demersal fish community of Lake Malawi/Niassa, Central Africa. INCO-DC Final Report covering period from 1st March 1998 to 28th February 2002. Contract number ERBIC18CT970195. 159 p.

Kapute, F., E. Kaunda, M. Banda and S. Morioka (2008). Maturity, age and growth of Oreochromis karongae (Teleostei: Cichlidae) in Lakes Malawi and Malombe, Malawi. African Journal of Aquatic Science 33(1): 69-76.

Konings, A. (1990). Ad Konings's book of cichlids and all the other fishes of Lake Malawi. T.F.H. Publications, Inc. 495 p.

Lewis, D.S.C. (1990). A review of the research conducted on chambo (*Oreochromis* spp.) and the chambo fisheries of Lakes Malawi and Malombe, 1859-1985. Collected reports on fisheries research in Malawi, Occasional Papers 1: 5-22.

Lowe, R.H. (1952). Report of the *Tilapia* and other fish and fisheries of Lake Nyasa 1945-47. Part 2. Colonial Office Fishery Publications 1: 1-126.

Lowe-McConnell R. (2003). Recent research in the African Great Lakes: fisheries, biodiversity and cichlid evolution. Freshwater Forum 20: 1-64.

Phiri, T.B. and G.Z. Kanyerere (2018). *Oreochromis squamipinnis* (errata version published in 2019). The IUCN Red List of Threatened Species 2018: e.T60760A148648312. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T60760A148648312.en. Accessed on 13 August 2024.

Seisay, M.B.D., N.P. van Zalinge and G.F. Turner (1992). Population dynamics and stock estimates of chambo (*Oreochromis* spp.) in the South East Arm of Lake Malawi and Lake Malombe - length based approach. GOM/UNDP/FAO Chambo Fisheries Research Project, Malawi. FAO FI:DP/MLW/86/013, Field Document 19, 30p.

Shechonge, A., B.P. Ngatunga, S.J. Bradbeer, J.J. Day, J.J. Freer, A.G.P. Ford, J. Kihedu, T. Richmond, S. Mzighani, A.M. Smith, E.A. Sweke, R. Tamatamah, A.M. Tyers, G.F. Turner and M.J. Genner (2018). Widespread colonisation of Tanzanian catchments by introduced *Oreochromis* tilapia fishes: the legacy from decades of deliberate introduction. Hydrobiologia 832: 235-253.

Tarbit, J. (1972). Lake Malawi trawling survey: interim report 1969-1971. Malawi Fisheries Bulletin 2: 1-16.

Trewavas, E. (1983). Tilapiine fishes of the genera *Sarotherodon*, *Oreochromis* and *Danakilia*. British Museum of Natural History, London, UK. 583 p.

Turner, G. (1994). Fishing and the conservation of endemic fishes of Lake Malawi. Archiv fur Hydrobiologie 44: 481-494.

Turner, G. (1995). Management, conservation and species changes of exploited fish stocks in Lake Malawi. pp. 365-396. In: T.J. Pitcher & P.J.B. Hart (eds.). The impact of species changes in African lakes. Chapman & Hall, London, UK. 601p.

Turner, G.F., D. Tweddle D. and R.D. Makwinja (1995). Changes in demersal cichlid communities as a result of trawling in southern Lake Malawi. pp 397-412. In: T.J. Pitcher & P.J.B. Hart (eds.). The impact of species changes in African lakes. Chapman & Hall, London, UK. 601p.

Turner, J.L. (1977). Changes in the size structure of cichlid populations of Lake Malawi resulting from bottom trawling. Journal of the Fisheries Research Board of Canada 34: 232-238.

Tweddle, D., I.G. Cowx, R.A. Peel and O.L.F. Weyl (2015). Challenges in fisheries management in the Zambezi, one of the great rivers of Africa. Fisheries Management and Ecology 22: 99-111.

Tweddle, D., D.S.C. Lewis and N.G. Willoughby (1979). The nature of the barrier separating the Lake Malawi and Zambezi fish faunas. Ichthyological Bulletin of the Rhodes University 39: 1-9.

Tweddle, D. and J.H. Magasa (1989). Assessment of yield in multispecies cichlid fisheries of the South East Arm of Lake Malawi, Africa. Journal du Conseil international pour l'Exploration de la Mer 45: 209-222.

Tweddle, D., G.F. Turner and M.B.D. Seisay (1995). Changes in species composition and abundance as a consequence of fishing in Lake Malombe, Malawi. pp. 413-424.In: T.J. Pitcher & P.J.B. Hart (eds.). The impact of species changes in African lakes. Chapman & Hall, London, UK. 601p.

van Zalinge, N.P., S.B. Alimoso, S.J. Donda, M. Mdaihli, M.B.D. Seisay and G.F. Turner (1991). Preliminary note on the decline of Chambo catches in Lake Malombe. GOM/FAO/UNDP Chambo Fisheries Research Project. FI:DP/MLW/86/013, Field Document 9.

Weyl, O.L.F. (2001). Hard choices for chambo management in Area A of the southeast arm of Lake Malawi. pp 146-155. In: Weyl, O.L.F. and M.V. Weyl (eds). Proceedings of the Lake Malawi fisheries management symposium, June 4-9th 2001, Capital Hotel Lilongwe, Malawi. Deutsche Gesellschaft für Technische Zusammenarbeit and Government of Malawi - National Aquatic Resource Management Programme (NARMAP). 272p.

Weyl, O.L.F., J. Kazembe, A.J. Booth and D.S. Mandere (2004a). An assessment of the light attraction fishery in southern Lake Malawi. African Journal of Aquatic Science 29: 1-11.

Weyl, O.L.F., A.J. Booth A.J., K. Mwakiyongo and M.M. Banda (2005a). Per-recruit simulation as a rapid assessment tool for a multi-species small-scale fishery in Lake Malombe, Malawi, Africa. pp. 235-254. In: G.H. Kruse, V.F. Gallucci, D.E. Hay, R.I. Perry, R.M. Peterman, T.C. Shirley, P.D. Spencer, B. Wilson & D. Woodby (eds). Fisheries assessment and management in data-limited situations. University of Alaska Sea Grant Program AK-SG-05-02, Fairbanks, Alaska. 948p.

Weyl, O.L.F., T. Nyasulu T. and B. Rusuwa (2005b) Assessment of catch, effort and species changes in the pair trawl fishery of southern Lake Malawi, Malawi, Africa. Fisheries Management and Ecology 12: 395-402.

Weyl, O.L.F., A.J. Ribbink and D. Tweddle (2010). Lake Malawi: fishes, fisheries, biodiversity, health and habitat. Aquatic Ecosystem Health and Management 13(3): 241-254.