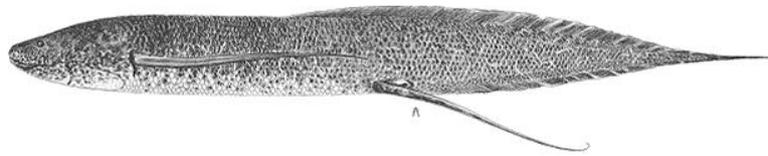


Protopterus aethiopicus Heckel, 1851



Left: albino specimen. Right: drawing from Poll (1961) of a specimen from Mateba (Lower Congo, DRC). Both images © Royal Museum for Central Africa.

Synonyms

Protopterus aethiopicus aethiopicus Heckel, 1851

Lepidosiren arnaudii Castelnau, 1855

Protopterus aethiopicus congicus Poll, 1961

Protopterus aethiopicus mesmaekersi Poll, 1961

FAO Names

Marbled lungfish

Local names

Alur: Lût (DRC), Lut (Uganda)

Arabic: Samak el teen (Sudan), Samak el tin (Sudan), Umkoru (Sudan), Umm quru (Sudan)

Chiga (Kiga): Emamba (Uganda)

Dinka (northeastern): Luth (Sudan)

English: Marbled lungfish (official FAO and AFS name; Kenya, Rwanda), Lung-fish (Uganda)

Kele (Ya Okandja): Botonga (Congo Dem Rp), Itotonga (Congo Dem Rp)

Kele (Ya Wembe): Ilolondi (Congo Dem Rp)

Kirundi: Injombo

Konzo: Ehondwe (Uganda)

Lango: Lut (Uganda)

Lombo (Olombo): Botonga (Congo Dem Rp), Itotonga (Congo Dem Rp)

Luo: Kamongo (Kenya), Monye (Kenya)

Language not specified: Sombe (Congo Dem Rp), Sombo (Congo Dem Rp), Sompa (Tanzania),

Mbamba (Congo Dem Rp)

Nuer: Lot (Sudan)

Nyoro (Lunyoro): Mamba (Uganda)

Kinyarwanda: Mamba (Rwanda)

Shiluk: Luth (Sudan)

So (Eso): Botonga (Congo Dem Rp), Igolugolu (Congo Dem Rp)

Swahili: Kamongo (Kenya, Tanzania), Mamba (Kenya, Uganda), Kambale mamba (Tanzania, Uganda)

Zande: Namomu (Sudan)

Geographical distribution

The subspecies *Protopterus aethiopicus aethiopicus* is known from the Nile basin and lakes Albert, Edward, Victoria, Nabugabo, Tanganyika, Kyoga (Gosse 1984) and Turkana (Seegers et al 2003). The

subspecies *P. a. congicus* is present in the Upper and Middle Congo basin, from the Upper Lualaba to Pool Malebo (Gosse 1984). The subspecies *P. a. mesmaekersi* is limited to the Lower Congo basin (Gosse 1984).

Key features

Smooth, slimy, cylindrical body with deeply embedded scales (Bailey 1994). Tail pointed and confluent with long dorsal and anal fins; dorsal fin originating at an equal distance from eye and vent, or nearer to latter; pectoral and pelvic fins slender and filamentous (Van Oijen 1995). 55-70 scales in a longitudinal series from immediately behind head to above vent; 40-50 scales around body (Poll 1946; Greenwood 1966). 37-40 pairs of ribs (Greenwood 1966). Dentition consisting of upper and lower tooth-plates in the form of sharp cutting ridges (Van Oijen 1995). Young fishes with true external gills, but usually absent in specimens greater than 15 cm TL (Van Oijen 1995). Dark slate-grey above, yellowish-grey or pinkish below; often with numerous dark spots or flecks on fins and body (some specimens bright yellow ventrally); sensory canals on head and body are outlined in black (Van Oijen 1995).

Habitat and Biology

Adults inhabit river and lake fringes, swamps and floodplains (Bailey 1994). In Lake Victoria found in the open lake and marginal swamps, in the Lake Tanganyika basin only found near rivers and deltas (Eccles 1992). Juveniles found in matted roots of papyrus (Witte & de Winter 1995). Adults able to live in streams and swamps that are completely dry for long periods of the year (Lockley 1949). Withstands desiccation on floodplains by aestivating in cocoons until the next rains, breathing air by a small passage leading to the outside (Lockley 1949). Mature individuals breed during the flood season (Bailey 1994). One or several females spawn in burrows which are dug and cleaned by the male, who later guards the eggs and young. Principal diet of adults and sub-adults consists of mollusks, but small fishes and insects are also eaten in small quantities; young individuals less than 35 cm TL feed almost exclusively on insects (Witte & de Winter 1995). Obligatory air breather under laboratory conditions (Witte & de Winter 1995), but may not be obligate air breather under certain conditions in the wild and the use of aerial respiration may be a function of ecological as well as physiological factors (Mlewa et al 2007). IUCN red list status least concern (Snoeks 2018).

Interest to fisheries

A large part of African lungfish is caught from Uganda's lakes, rivers and floodplain wetlands (Hecky & Bugenyi 1992; Walakira et al 2012). Capture fisheries production of African lungfish in Uganda peaked between 1976 and 1985 but decreased thereafter. Populations in Uganda are rapidly declining (Walakira et al 2012). In several Ugandan districts north of Lake Victoria and east of Lake Kyoga, the average size and numbers of lungfish has fallen markedly from increased demand and catching undersized (but sexually mature, thus suggesting a plasticity of response to increased fishing pressure) lungfish of less than 300 g (Okaronon 1995; Walakira et al 2012).

Protopterus aethiopicus is the most important species in the catches in Lake George (35.2%), and the second most important one in the Ugandan part of Lake Edward and the Kazinga Channel (Musinguzi et al 2021). Catches in Lake George have strongly increased since 2017, more or less doubled in Lake Edward and are relatively stable but low (below 250 tons) in the Kazinga Channel (Nakiyende et al. 2020). Although Nakiyende et al. (2020) attributed rising catches in these lakes to a progressive recruitment and fish stock recovery, the stock is assessed as recruitment impaired in Lake George (Musinguzi et al. 2021). The species is not in the top three for the DRC part of Lake Edward, where tilapias, *Bagrus* and haplochromines comprise over 80% of the catches (NELSAP 2020).

The fishery in Lake Victoria before the 1960s was dominated by demersal and benthopelagic species, including the marbled lungfish (Ogotu-Ohwayo 1990), while the present-day commercial fishery is dominated by the introduced Nile perch (*Lates niloticus*) and Nile tilapia (*Oreochromis niloticus*), and the native silver cyprinid (*Rastrineobola argentea*) (Lake Victoria Fisheries Organisation 2016).

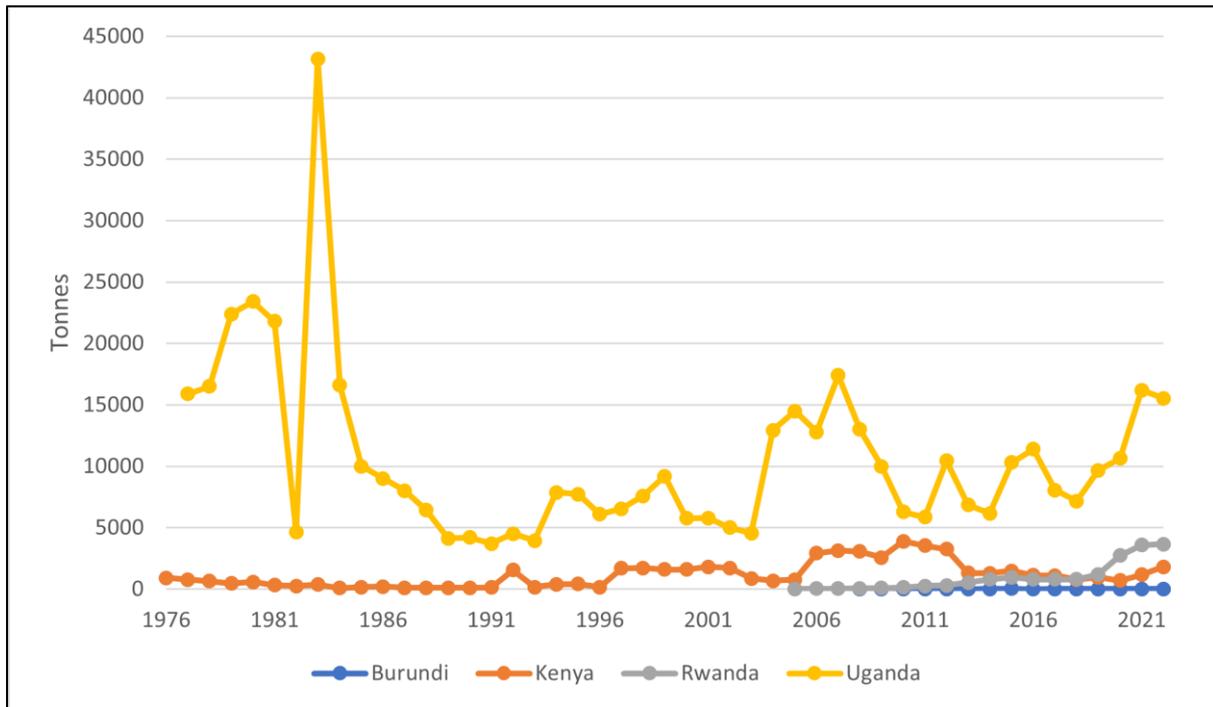


Figure 1: Catches (in tonnes) of *Protopterus aethiopicus* as available from FAO (April 2024). Listed by FAO as *P. aethiopicus* for Burundi and Rwanda. Listed as *Protopterus spp.* for Uganda (= *P. aethiopicus*) and Kenya (probably mostly *P. aethiopicus*; the capture of the two other species with an uncertain taxonomic status, *P. aff. amphibius* and *P. aff. annectens* (Seegers et al 2003), is considered less important).

Current catches and yield of African lungfish stand at only 10-30% of the initial or peak values (see e.g. FAO 1985, 1988; Ogutu-Ohwayo 1990; Omwoma et al. 2014; Natugonza et al. 2020, 2022), or even less (Muller & Benda 1981; Asila and Ogari 1987; Goudswaard et al. 2002). Initially a major component of the fisheries catches, the species in some areas completely disappeared from the catches in 15 to 20 years (FAO 1985, 1992; Ogutu-Ohwayo 1993; Ochumba 1995).

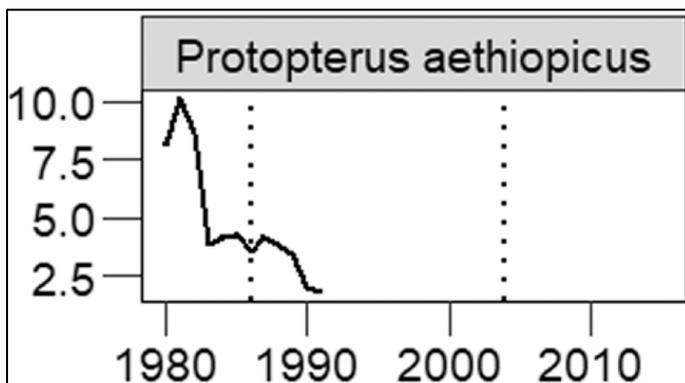


Figure 2: Total annual catches (thousand tonnes) of *Protopterus aethiopicus* in Lake Victoria over time. Image from Natugonza et al 2022.

Similarly, once abundant and a major component of the fisheries of lakes Nabugabo (by weight the most important species in commercial catches in 1962), Kyoga (third most important commercial fish species until the early 1950s) and Manywa, the marbled lungfish became extremely rare in these Ugandan lakes by the early 1990s (FAO 1985; Ogutu-Ohwayo 1993; Chapman et al. 1996; Goudswaard et al. 2002) and was even completely absent from a survey of Lake Nabugabo (Ogutu-Ohwayo 1993). It was however still abundant in nearby lakes Kayanja and Kayugi (Ogutu-Ohwayo

1993). Chapman et al (1996) found the species uses the wetlands surrounding Lake Nabugabo as refugia, benefitting from its air breathing capacities to tolerate the low oxygen conditions. In Lake Baringo (Kenya), the species constitutes a significant component of commercial landings, sometimes exceeding catches of Baringo tilapia *Oreochromis niloticus baringoensis* by weight (Mlewa & Green 2006). Lungfish appeared in 1984, after the introduction of 3 juveniles in 1975. The species represented 51% of the catches by 2003 and is currently the major fishery, with 90% of landings at the beaches being this species, but it can probably not withstand this high exploitation rate due to its low fecundity (Nyakeya et al. 2020). *Protopterus aethiopicus* was successfully introduced in Lake Muhazi (Rwanda) and spread to Lake Mugusera, but is not so well appreciated locally and sold cheaper than tilapia (Micha & Gashagaza 2002). Overall, populations of *P. aethiopicus* are rapidly declining and the species is now endangered, mainly caused by overexploitation, environmental degradation, large-scale conversion of wetlands to agricultural land, some (low) Nile perch predation and harvesting of nest-guarding male lungfish (Goudswaard et al. 2002, Balirwa et al. 2003). No reliable data are available on the fisheries status of this species in the Congo basin.

Bibliography

- Asila, A. and J. Ogari (1987). Growth parameters and mortality rates of Nile perch *Lates niloticus* estimated from length frequency data in the Nyanza Gulf (Kenya), Lake Victoria. FAO Fisheries report 389: 271-287.
- Bailey, R.G. (1994). Guide to the fishes of the River Nile in the Republic of the Sudan. Journal of Natural History 28: 937-970.
- Balirwa, J.S., C.A. Chapman, L.J. Chapman, I.G. Cowx, K. Geheb, L. Kaufman, R.H. Lowe-McConnell, O. Seehausen, J.H. Wanink, R.L. Welcomme and F. Witte (2003). Biodiversity and fishery sustainability in the Lake Victoria Basin: an unexpected marriage? Bioscience 53: 703-716.
- Chapman, L.J., C.A. Chapman, R. Ogutu-Ohwayo, M. Chandler, L. Kaufman and A.E. Keiter (1996). Refugia for endangered fishes from an introduced predator in Lake Nabugabo, Uganda. Conservation biology 10(2): 554-561.
- 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 (1985). Committee for Inland Fisheries of Africa. Report of the third session of the Sub-Committee for the development and management of the fisheries of Lake Victoria. Jinja, Uganda, 4-5 October 1984. FAO Fisheries Report 335. 145 p.
- FAO (1988). Committee for Inland Fisheries of Africa. Report of the fourth session of the Sub-Committee for the development and management of the fisheries of Lake Victoria. Kisumu, Kenya, 6-10 April 1987. FAO Fisheries Report 388. 112 p.
- FAO (1992). Committee for Inland Fisheries of Africa. Report of the sixth session of the Sub-Committee for the development and management of the Fisheries of Lake Victoria. Jinja, Uganda, 10-13 February 1992. FAO Fisheries Report 475. 48p.
- 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.
- Gosse, J.-P. (1984). Protopteridae. p. 8-17. In: J. Daget, J.-P. Gosse and D.F.E. Thys van den Audenaerde (eds.) Check-list of the freshwater fishes of Africa (CLOFFA). Volume I. ORSTOM, Paris and MRAC, Tervuren. 410 p.
- Goudswaard, K.P.C., F. Witte and L.J. Chapman (2002). Decline of the African lungfish (*Protopterus aethiopicus*) in Lake Victoria (East Africa). African Journal of Ecology 40(1): 42-52.
- Greenwood, P.H. (1966). The Fishes of Uganda. The Uganda Society, Kampala. 131p.

- Hecky, R. E. and F.W.B. Bugenyi (1992). Hydrology and chemistry of the African great lakes and water-quality issues: Problems and solutions. *Mitteilungen Internationale Vereinigung für Theoretische und Angewandte Limnologie* 23: 45-54.
- Lake Victoria Fisheries Organisation (2016). Regional catch assessment survey synthesis report. June 2005 to November/December 2015. 19p.
- Lockley, G.J. (1949). The families of freshwater fishes of Tanganyika Territory, with a key to their identification. *East African Agricultural Journal* 14(4): 212-218.
- Micha, J.-C. and J.-B. Gashagaza (2002). Réussite de l'introduction du protoptère, *Protopterus aethiopicus* Heckel, dans le lac Muhazi (Rwanda). *Bulletin des séances de l'Académie royale des sciences d'outre-mer* 48: 315-318.
- Mlewa, C.M. and J.M. Green (2006). Translocation of marbled African lungfish, *Protopterus aethiopicus* (Telostei: Protopteridae), and its fishery in Lake Baringo, Kenya. *African Journal of Aquatic Science* 31(1): 131-136.
- Mlewa, C.M., J.M. Green and R. Dunbrack (2007). Are wild African lungfish obligate air breathers? Some evidence from radio telemetry. *African Zoology* 42(1): 131-134.
- Muller, R.G. and R.S. Benda (1981). Comparison of bottom trawl stock densities in the inner Kavirondo Gulf of Lake Victoria. *Journal of Fish Biology* 19: 399-401.
- Musinguzi L., S. Bassa, V. Natugonza, M. Van Steenberge, W. Okello, J. Snoeks and R. Froese (2021) Assessment of exploited fish species in the Lake Edward System, East Africa. *Journal of Applied Ichthyology* 37(2): 216-226.
- Nakiyende, H., W. Nkalubo, S. Bassa, M. Olokotum, E. Nduwayesu, F. Nansereko, A. Basooma, P. Mudondo, A. Endra, E. Arayo, B. Mugeni, A. Mulowoza, A. Bakunda, P. Byamukama, R. Mangeni, E. Kagoya, H. Tumushabe, E. Muhumuza, R. Mangeni-Sande and A. Taabu-Munyaho (2020). Status of commercial fisheries on lakes Edward, George and the Kazinga Channel (Uganda). Poster.
- Natugonza, V., C. Ainsworth, E. Sturludóttir, L. Musinguzi, R. Ogutu-Ohwayo, T. Tomasson, C. Nyamweya and G. Stefansson (2020). Ecosystem modelling of data-limited fisheries: How reliable are Ecopath with Ecosim models without historical time series fitting? *Journal of Great Lakes Research* 46(2): 414-428.
- Natugonza, V., C. Nyamweya, E. Sturludóttir, L. Musinguzi, R. Ogutu-Ohwayo, S. Bassae, E. Mlaponi, T. Tomasson & G. Stefansson (2022). Spatiotemporal variation in fishing patterns and fishing pressure in Lake Victoria (East Africa) in relation to balanced harvest. *Fisheries Research* 252: 106355.
- NELSAP (2020). Regional catch assessment survey of 2019 for lakes Edward and Albert (D.R. Congo and Uganda). NELSAP Technical Reports: Basin Development Series 2020-04, June 2020. 37p.
- Nyakeya, K., E. Chemoiwa, J. Moraa Nyamora, C. Odoli Ogombe, Z. Moraa Gichana, E. Kakunde Mbaru, F. Onderi Masese, C. Mulanda Aura, C. Nyamweya, J. Njiru, R. Ondiba and E. Basweti (2020). Endemic Lake Baringo *Oreochromis niloticus* fishery on verge of collapse: Review of causes and strategies directed to its recovery, conservation and management for sustainable exploitation. *Lakes and Reservoirs* 25(4): 423-438.
- Ochumba, P.B.O. (1995). Limnological changes in Lake Victoria since the Nile perch introduction. Pp. 33-43. In: T.J. Pitcher & P.J.B. Hart (eds.). *The impact of species changes in African lakes*. Chapman & Hall, London, UK. 601p.
- Ogutu-Ohwayo, R. (1990). The decline of the native fishes of lakes Victoria and Kyoga (East Africa) and the impact of introduced species, especially the Nile perch, *Lates niloticus*, and the Nile tilapia, *Oreochromis niloticus*. *Environmental biology of fishes* 27: 81-96.
- Ogutu-Ohwayo, R. (1993). The effects of predation by Nile perch, *Lates niloticus* L., on the fish of Lake Nabugabo, with suggestions for conservation of endangered endemic cichlids. *Conservation biology* 7(3): 701-711.

- Okaronon, J.O. (1995). A decline in Fish catches and the size of *Oreochromis niloticus* in Lake Wamala (Uganda) following human exploitation. *African Journal of Tropical Hydrobiology and Fisheries* 6: 43-50.
- Omwoma, S., P.O. Owuor, D. M.-K. Onger, M. Umani, J.O. Lalah and K.-W. Schramm (2014). Declining commercial fish catches in Lake Victoria's Winam Gulf: The importance of restructuring Kenya's aquaculture programme. *Lakes and Reservoirs: Research and Management* 19: 206-210.
- Poll, M. (1946). Révision de la faune ichthyologique du lac Tanganika. *Annales du Musée du Congo Belge, Zoologie, Série I, 4(3): 141-364.*
- Poll, M. (1961). Révision systématique et raciation géographique des Protopteridae de l'Afrique centrale. *Annales du Musée royale de l'Afrique centrale, Série in-8°, 103: 3-50.*
- Seegers, L., L. De Vos and D.O. Okeyo (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.
- Snoeks, J. (2018). *Protopterus aethiopicus*. The IUCN Red List of Threatened Species 2018: e.T182574A58331340. <https://dx.doi.org/10.2305/IUCN.UK.2018-1.RLTS.T182574A58331340.en>. Accessed on 13 August 2024.
- van Oijen, M.J.P. (1995). Appendix I. Key to Lake Victoria fishes other than haplochromine cichlids. p. 209-300. In: F. Witte and W.L.T. van Densen (eds.) *Fish stocks and fisheries of Lake Victoria. A handbook for field observations*. Samara Publishing Limited, Dyfed, Great Britain. 404p.
- Walakira, J., G. Atukunda, J. Molnar and K. Veverica (2012). Prospects and potential for aquaculture of African lungfish in Uganda. *World Aquaculture* 43(3): 38-42.
- Witte, F. and W. de Winter (1995). Appendix II. Biology of the major fish species of Lake Victoria. p. 301-320. In: F. Witte and W.L.T. Van Densen (eds.) *Fish stocks and fisheries of Lake Victoria. A handbook for field observations*. Samara Publishing Limited, Dyfed, Great Britain. 404p.