

Limnothrissa miodon (Boulenger, 1906)



Near Mpulungu, Lake Tanganyika, Zambia. © A.D. Mohamed.

Synonyms

Pellonula miodon Boulenger, 1906

Microthrissa stappersii Poll, 1948

FAO names

Lake Tanganyika sardine

Local names

Afrikaans: Tanganikameer-sardyn (South Africa), Tanjanikameer sardyn (South Africa), Kapenta (South Africa)

Bemba: Chisamba (Zambia), Kapenta (Zambia)

Chilungu: Chisamba (Zambia), Kapenta (Zambia), Lumbo (Zambia), Nsembe (Zambia)

English: Lake Tanganyika sardine (official FAO name), Stapper's sprat (old FAO name), Kapenta (South Africa), Lake Tanganyika sardine (Rwanda, South Africa, Zimbabwe), Tanganyikan anchoveta (Zambia)

Kirundi: Lumpu (Burundi), Ndagala (Burundi)

Rwanda: Yorogo (Rwanda), Isambaza (Rwanda)

Kinyarwanda: Agahuza (Rwanda), Indagara (Rwanda), Karumba (Rwanda)

Swahili: Dagaa (Congo Dem Rp, Tanzania), Lumpu (Congo Dem Rp), Ndakala (Congo Dem Rp), Lumbu (Congo Dem Rp, Tanzania), Ndagaa (Tanzania)

Geographical distribution

Endemic to Lake Tanganyika (Whitehead 1985; Gourène & Teugels 1994; Snoeks et al 2012), but introduced in Lake Kivu and the Zambezi basin dam lakes Itezhi-Tehzi and Kariba, from which it invaded Cahora Bassa (Whitehead 1985; Skelton 1993, 2001; Gourène & Teugels 1994; Tweddle 2010; Marshal 2011; Snoeks et al 2012). Also reported as *Microthrissa stappersii* from Lake Mweru (Jackson 1961; Bell-Cross 1968), but this is based on an erroneous type locality of the species (Gourène & Teugels 1993).

Key features

Body fairly slender, depth about 22-24% SL; pre-pelvic scutes not strongly keeled, beginning behind base of last pectoral fin ray; maxilla blade over 4 times as long as its shaft, its lower toothed edge continued forward to meet posterior tip of premaxilla; second supramaxilla asymmetrical, lower half larger; 35-40 lower gillrakers, long and slender; dorsal fin with 13-18 soft rays, anal 15-19; 41-44 vertebrae; a distinct silver stripe along flank (Boulenger 1909; Whitehead 1985). Synonym *Limnothrissa stappersii* characterised by fewer lower gill rakers (22-25), fewer anal fin rays (15-17), and the absence of scutes, and possibly representing a juvenile form of *L. miodon* (Whitehead 1985; Gourène & Teugels 1993). Resembles *Stolothrissa tanganicae* from Lake Tanganyika, which is more

slender, has a small eye and a shorter maxilla blade not reaching forward to posterior tip of premaxilla (Whitehead 1985).

Habitat and Biology

Lacustrine, forming large schools (Whitehead 1985; Skelton 1993), preferring offshore, open water (Matthes 1966; Bell-Cross & Minshull 1988). Also occurs at river mouths, where the water is not too muddy and physico-chemically not very different from the lake (Matthes 1966). Found throughout Lake Kariba in both inshore habitats and open water to a depth of 20-35 m depending on the thermocline (Skelton 1993, 2001). Feeds on plankton and invertebrates, especially atyid shrimps, also copepods and prawns, but larger individuals apparently take larval stages of *Stolothrissa tanganicae* (Whitehead 1985). Cannibalism does occur (Bell-Cross & Minshull 1988). Breeds close to the shore throughout the rainy seasons, but with peaks in May/June and December/January (Whitehead 1985). IUCN red list status least concern (Ntakimazi 2006).

Interest to fisheries

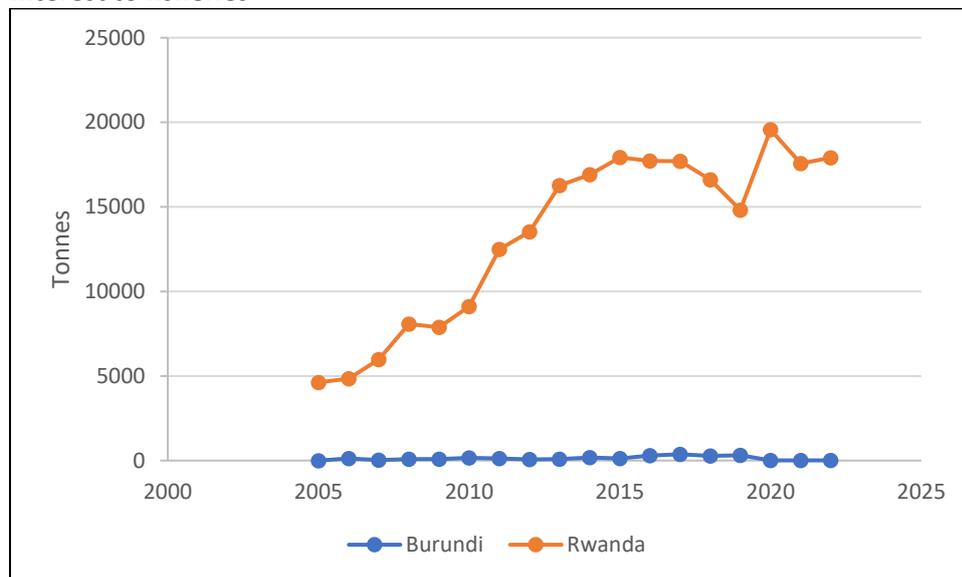


Figure 1: Catches (in tonnes) of *Limnothrissa miodon* as available from FAO (April 2024).

This species is reported from Rwanda following its introduction in Lake Kivu.

Very oddly, FAO (2024) statistics contain data from Cote d'Ivoire of *Stolothrissa* or *Limnothrissa*. Both genera are currently monospecific and do not occur in West Africa. Only *Limnothrissa* occurs (introduced) in Mozambique and Zimbabwe, so the combined data of the two species from these countries (Figure 2) refer to the catches of *L. miodon*. In Tanzania, Zambia and the DRC both *L. miodon* and *S. tanganicae* occur, but species level data are not available from FAO (2024).

Burundi reports species level data for both *L. miodon* and *S. tanganicae*, although reported catches for the former are surprisingly low. In addition, the added data for the two species do not correspond at all to the data reported at the combined generic level (Figure 2). At present, it is unclear what the Burundian data, at both the species and generic level, represent.

In general, even though the major commercial pelagic stocks are distributed throughout all sectors of Lake Tanganyika, its northern half is dominated by a clupeid-based fishery, whilst the southern areas feature a *Lates stappersii*-based fishery (Mannini 1998). *Limnothrissa miodon* is more evenly distributed in the lake than *S. tanganicae* (Mannini et al 1999).

In Lake Tanganyika, most of the catch derives from the artisanal fishery in which the clupeids, *Stolothrissa* and *Limnothrissa*, compose about 65 %, *Limnothrissa* contributing 10-15 % of the pelagic catch (Langenberg 2008). The clupeids are caught in the pelagic area by artisanal fishers using lift-nets of 6–8 mm mesh sizes and artificial light during dark nights (Mulimbwa et al 2022).

The fishing pressure has steeply increased during the last decades (Mölsä et al 1999; Sarvala et al 2006; Van der Knaap et al 2014). Presently, overfishing is threatening the recruitment, and therefore also the fishery of the clupeid fish in Lake Tanganyika (Mulimbwa 2006; Mulimbwa et al 2014a, 2014b, 2019, 2022; Van der Knaap et al 2014; De Keyzer et al 2020). Although the contribution of *L. miodon* to the lift-net and purse seine pelagic catches is smaller than that of *S. tanganyicae* and *L. stappersii* (Mannini et al 1999), it dominates the highly unselective beach seine (=kapenta seine) fishery, operated close inshore over shallow, sandy bottoms, particularly along the southernmost coastlines (Mannini 1998; Mannini et al 1996, 1999).

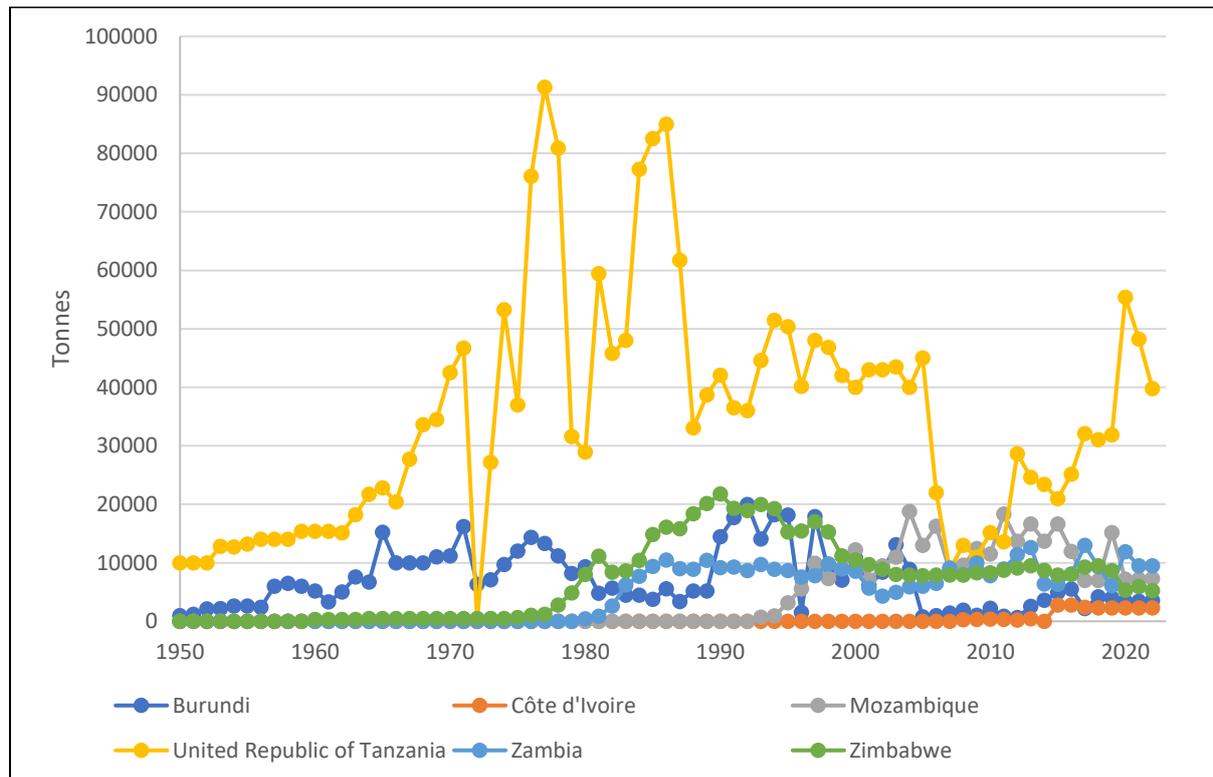


Figure 2: Catches (in tonnes) of “*Stolothrissa, Limnothrissa spp.*” as available from FAO (April 2024).

While in northwestern Lake Tanganyika/Uvira area, *S. tanganyicae* is most dominant in the catches (62%), followed by *L. miodon* (17%) and *Lates stappersii* (11.6%) (Mushagalusa et al 2015), the kapenta seine fishery in Zambia mainly catches *L. miodon* (65%) and *S. tanganyicae* (25%) (Plisnier 1995). The lift nets and chiromilla nets surveyed, caught exclusively clupeids, with 69% *L. miodon* and 31% *S. tanganyicae* for the lift nets and respectively 50% and 49% for the chiromilla nets (Plisnier 1995). The artisanal fishery represented 73% of all catches in Zambia, dominated by *L. miodon* (42% of the total artisanal catches) followed by *S. tanganyicae* (22%). The clupeid catch represented 63% of the total artisanal catches (Plisnier 1995). This is lower than previously reported, 78% in 1992 and 73% in 1980 (Lupikisha 1993). Only 67 tonnes of clupeids were caught by industrial fishery in 1994 (2% of the industrial catch), with *L. miodon* the main clupeid caught. The fishing companies of Mpulungu (Zambia) do not target clupeids since their abundance is generally low in Zambian pelagic waters (Plisnier 1995). The much higher exploitation rate in the south of the lake is caused by a higher total effort and differences in the distribution pattern of the *Limnothrissa* population components (Aro & Mannini 1995). The exploitation of large quantities of immature fish will eventually affect the commercial pelagic fishery (Van der Knaap et al 2014). Large *L. miodon* (>125 mm) occur almost exclusively offshore outside the range of artisanal fishery (Mannini et al 1999).

Decreasing annual catches and declining fish stocks have been reported (Mulimbwa 2006; Sarvala et al 2006) for Tanzania (since a peak in 2001, which followed a steady decrease between 1985 and

1994) (Kimirei et al 2008), the northern part of the lake (Van der Knaap et al 2014; Mushagalusha et al 2015) and Zambia (FAO 2006). The decreasing catches are characterized by daily, seasonal and long-term fluctuations that are partly due to natural causes such as predator-prey relationships between clupeids and *Lates stappersii*, food availability or an environment favourable to reproduction, and local over-exploitation (Roest 1988; Bayona et al 1992; Plisnier 1995; Mölsä et al 2002; O'Reilly et al 2003; Chitamwebwa & Kimirei 2005; Mulimbwa 2006; Sarvala et al 2006; Kolding & van Zwieten 2012). Also climate change may be playing an important role (Plisnier 1997). Nonetheless, the effect of fishing pressure resulting into local overfishing cannot be neglected since the fishing pressure has steeply increased during the last decades and remains high (Mölsä et al 1999; Chitamwebwa & Kimirei 2005; Sarvala et al 2006; Van der Knaap et al 2014). However, efforts to document the total catch and Catch Per Unit Effort (CPUE) have been sporadic and inconsistent (Plisnier et al 2018), making assessment of catches and fisheries potential speculative (Kolding et al 2019; De Keyzer et al 2020). A recovery in the highly fished areas of Zambia, Burundi and Congo has not been realized (Kimirei et al 2008).

The development of fisheries on introduced *L. miodon* in artificial impoundments, Lakes Kariba, Cahora Bassa and Itezhi-Tezhi, to fill the new open water niche, is described as a major success (Tweddle 2010).

Limnothrissa miodon was introduced to Lake Itezhi-Tezhi in March 1992 and grows bigger than in other man-made lakes (Tweddle 2010). Hydroacoustics studies showed that it became established with a biomass sufficient to support a fishery (Mbewe, 2000) but there are no accurate data on catches from the light attraction fishery now in operation.

The total annual catches of *L. miodon* in Lake Kariba rose from the time the fishery started in 1974 to a peak in 1990, and thereafter declined steadily till 2011 (Chifamba 2019). Published datasets generally agree with these trends, but differ in total yields. According to Magadza (2006) total kapenta catches from Lake Kariba peaked at around 35000 t per year in 1990 and declined to about 20000 t per year in 2005 (Magadza 2006). Data from the World Commission on Dams (2000; Figure 3) and Tweddle (2010) report a peak yield of nearly 29000 t per year in 1990 and a decline to 23000 t per year by 1998. Marshall (2011) reports that kapenta is by far the most important commercial fish species in Zimbabwe, supporting a fishery that yields around 20000 to 30000 tonnes per year in Lake Kariba, but that productivity likely has reached its limit since catches have declined in recent years. Kapenta statistics from the Lake Kariba Fisheries Research Institute (Zimbabwe) report a peak catch of 20-25000 tonnes in 1990 in the Zimbabwean part of the lake, decreasing to 5-10000 tonnes by 2020. FAO (2006) reported a decline in catches to approximately 7820 tonnes per year by 2005, or a 50% reduction from 1994. However, according to the three sets of available data the decline is more pronounced. All these non-matching results raise questions about the accuracy of data, a situation that is certainly not beneficial for the development of well-founded management plans.

Tendaupenyu & Pyo (2017) concluded that, for the period 1988-2009, there was overcapacity in Lake Kariba and that the kapenta stock was in decline. Marshall (2011) reported a decline in catch and CPUE in recent years, which was confirmed by Chali et al (2014) for the period between 2009 and 2012. Fishing effort increased throughout 1974-2011 except from 1992 to 2000, when it was more or less constant. Catch per boat per night decreased throughout 1974-2011 except for a more constant period between 1980 and 1990, suggesting a deterioration of conditions for the fish (Chifamba 2019). As the catches were at and above estimated Maximum Sustainable Yield, the declining harvest and collapse of the clupeid fishery may be explained by high fishing pressure and overfishing, in combination with less suitable ecological conditions due to warmer water (Marshall 2012; Magadza 2011; Chifamba 2019). The size at maturity of *L. miodon* in Lake Kariba decreased from 5.2-5.6 cm and 7.1-7.3 cm in 1970, to 3.43 and 3.63 cm in 2013 for females and males, respectively. The decrease in the size at maturity of *L. miodon* in Lake Kariba is consistent with fishery-induced evolutionary change (Chifamba 2019).

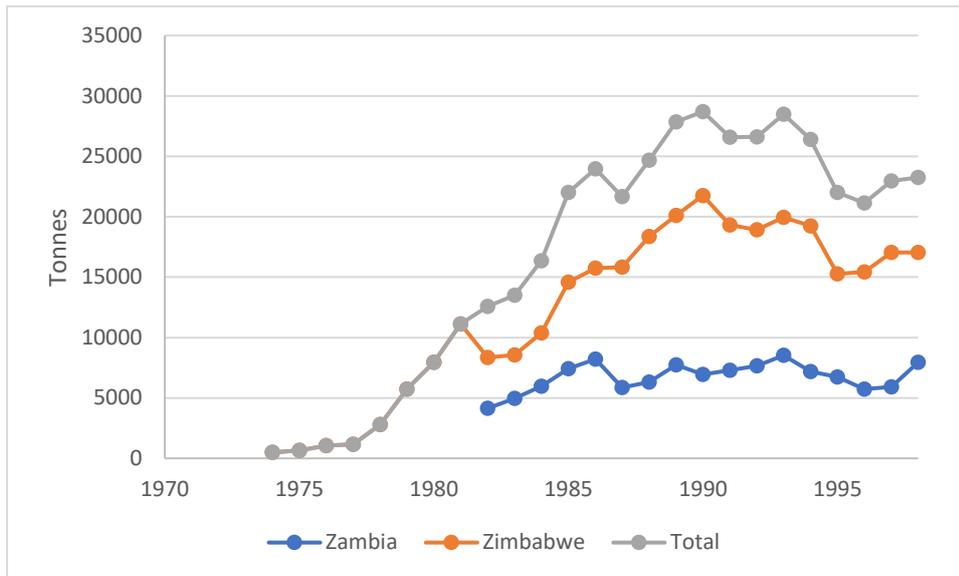


Figure 3: Annual catch of kapenta in Lake Kariba. Data from the Department of National Parks and Wildlife Management, Zimbabwe, and the Department of Fisheries, Zambia, as published in the report of the World Commission on Dams (2000).

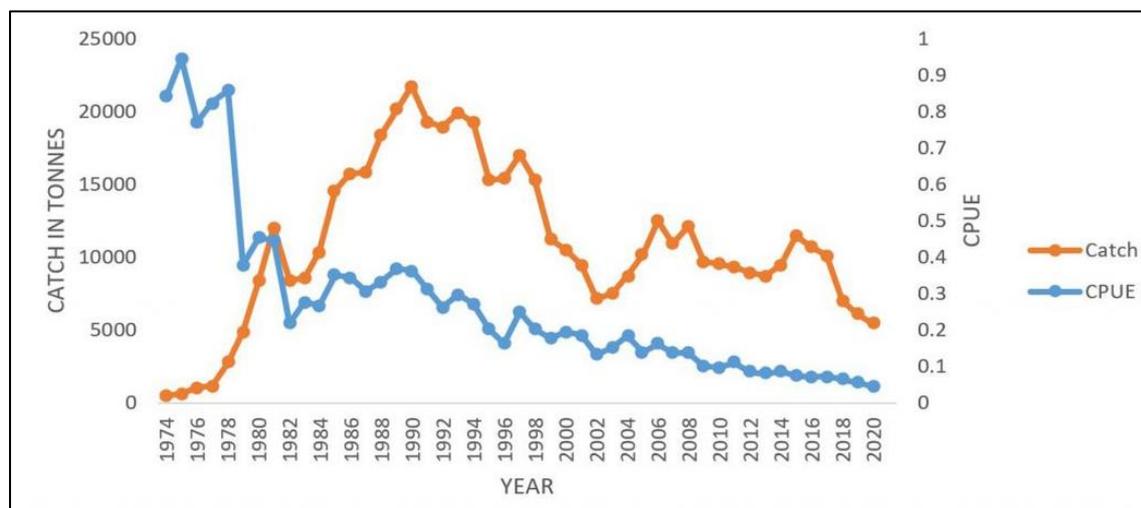


Figure 4: Kapenta (*Limnothrissa miodon*) catch statistics from 1974 to 2020 for the Zimbabwean part of Lake Kariba (data from the Lake Kariba Fisheries Research Institute, Zimbabwe).

The commercial kapenta fishery in Lake Cahora Bassa in Mozambique started in 1994. After rapid expansion, catches peaked in 2004, with a subsequent decline to 2007 (Tweddle 2010). Barnes et al (2002) estimated catches at about 15000 tonnes in 2001 from the offshore semi-industrial kapenta fishery on the lake, equal to the offshore estimated sustainable yield (Kolding et al 1993). Data from 2010 to 2019 from the Mozambican Ministry of the Sea, Inland Waters and Fisheries (Capaina 2021) show a peak of 18330 tonnes in 2011, followed by a steady decrease to almost 7000 tonnes in 2017 (Figure 6). The exceptionally low values of only a few 100 tonnes in 2018-2019 are erroneous; the values for “Fauna Acompanhante” include the kapenta catches. Despite a strong increase in vessels, catches in 2018-2019 remained at the levels of 2010-2016, and a decrease in CPUE is likely. The percentage contribution of kapenta in semi-industrial fishing dramatically dropped from an average of 88.2% in 2010-2016 to about 3.4% of the 2010 production in 2018 and 2019. Illegal fishing for kapenta by unlicensed vessels is reportedly carried out mainly by Congolese, Tanzanians, Zambians and Zimbabweans. Licensed operators already in 2018 warned of the possibility of the catch collapsing in the not-too-distant future if illegal fishing continued. The use of mosquito netting,

mainly catching juvenile fish, is another concern. Artisanal and subsistence fisheries were reported to catch 4000 t per year from the lake each year (Bernacsek & Lopes 1984; Marshall 1994), equal to the inshore estimated sustainable yield (Kolding et al 1993).

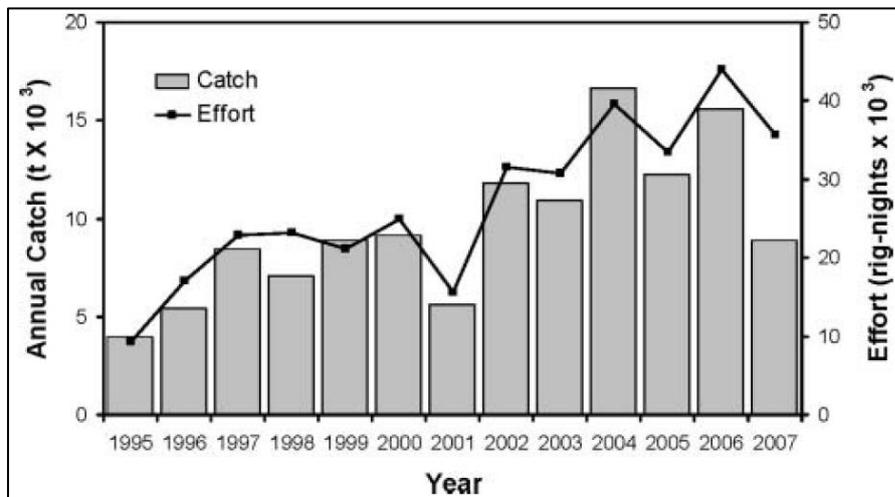


Figure 5: Annual catches of kapenta from Lake Cahora Bassa (graph from Tweddle 2010 based on data from Mafuca 2008).

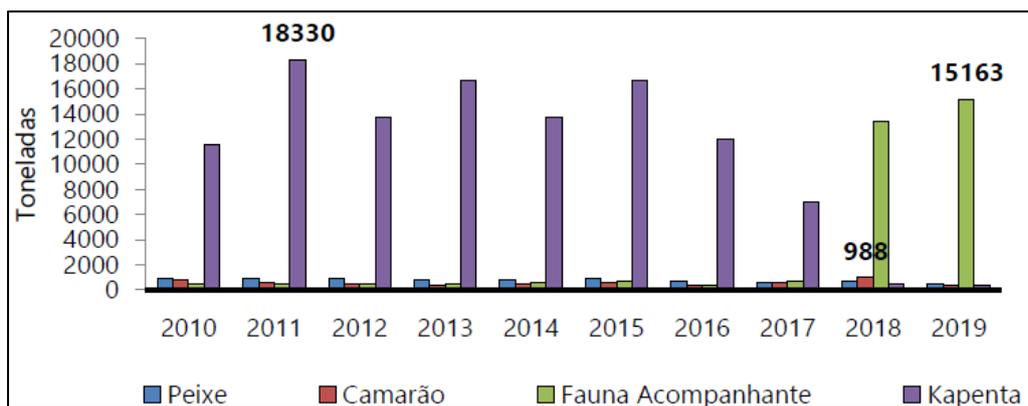


Figure 6: Main catches of the semi-industrial fisheries in marine waters and Lake Cahora Bassa in Mozambique (from Capaina 2021).

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