

Biodiversity and aquaculture of African catfishes (Teleostei, Siluroidei): an overview

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Introduction

Catfishes are a large group of predominantly freshwater fishes. TEUGELS (1996) listed 33 families, with 416 genera and 2584 species. The systematics of catfishes however, are far from being completely known. Especially in South America and in South-East Asia, several new species and even new genera are regularly being discovered. Therefore total taxa numbers continuously change. The most recent estimates include 32 families, 418 genera and 2612 species.

Catfishes belong to the Siluriformes, one of the four orders of the Ostariophysi (FINK and FINK, 1981) including also Gonorynchiformes (milkfishes, etc.), Cypriniformes (carps, suckers, etc.) and Characiformes (piranhas, etc). Ostariophysi are recognized in particular by a notable modification of the anterior four or five vertebrae (three in Gonorynchiformes) into the so-called Weberian apparatus, a connection of alternating ligaments and small bones between the gas bladder and the otic capsule

(CHARDON, 1968). It has an important role in sound perception and its development in Ostariophysi is undoubtedly related to their almost exclusive occurrence in freshwater, where often limited visibility reduces visual perception.

Within the Siluriformes, catfishes belong to the suborder Siluroidei. FINK and FINK (1981) and ARRATIA (1992) listed several synapomorphies to demonstrate the monophyly of this group most of them based on osteological features. An important variation exists in the external morphology of catfishes and it is therefore difficult to give a standard definition. General characters include the absence of scales (although in some South American families the body is covered with bony scutes), and the presence of up to four pairs of circumoral barbels, used for the detection of food. Dorsal and pectoral fins are often provided with a leading spine. An adipose fin is often present.

Catfishes occur in North, Central and South America, Africa, Eurasia, South-East Asia, Japan and Australia. TEUGELS (1996) reported on the proportional distribution of freshwater catfishes in the world: some 64% of all species known are confined to Central and South America about 19% occur in Africa and about 15% are found in Eurasia and South-East Asia. Some 2% of the species are present in North America.

|| African catfish families

Nearly one fifth of all known catfish species occur in Africa. Ten families are recognized. Two of them, Ariidae and Plotosidae, generally contain marine species and have a large distribution. Three others, Clariidae, Bagridae and Schilbeidae, are also present in southern Asia. All the others are endemic to Africa. At present 58 genera including 465 species are known.

Family Clariidae

This family occurs in Minor, South and South-East Asia and in Africa. Its highest diversity however is found in the latter continent. TEUGELS (1986a) reported 12 genera with 74 species in Africa, while only 2 genera with some 17 species are presently known from Asia (TEUGELS, 1996).

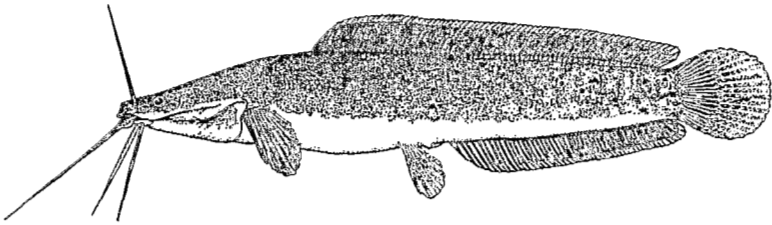
Clariidae are elongated catfishes with long dorsal and anal fins. A dorsal spine is missing but the pectorals are provided with a strong leading spine. An adipose fin is present in a few genera (*e.g.* *Heterobranchus*). They have four pairs of barbels. A remarkable character for this family is the presence of a suprabranchial organ, formed by folds of the second and the fourth branchial arches. With this organ, the fishes are able to practice aerial respiration, implicating that they can survive out of the water for a long time. They are also known for walking on land over distances of several hundred meters, breathing atmospheric air and using their pectoral spines as a support.

Within the Clariidae, the genus *Clarias* is the most speciose group, containing 32 species (TEUGELS, 1986b) in Africa and some 12 species in Asia (TEUGELS, 1996). This genus contains the most cultured African catfish (Figure 1), *Clarias gariepinus* (Burchell, 1822). Its culture started almost fifty years ago. Its large size (up to 1,5 m), its omnivorous feeding habits, its almost Panafrican distribution and its capacity to survive in poorly oxygenated water, favoured its selection for aquaculture purposes. For 1994, GARIBALDI (1996) reported a production of 3,978 metric tons in Africa and 1,057 mt in Europe. The species has also been introduced in South-East Asia, where it is a severe threat for the local fish fauna.

Clarias anguillaris (Linnaeus, 1758) is of minor importance in African fishculture. GARIBALDI (1996) reported a production of 1,185 mt in Africa for 1994. The species only occurs in West Africa and the Nile. Although other *Clarias* species have been studied for aquaculture purposes, their importance is at present limited.

Recently however the genus *Heterobranchus*, recognized by the presence of a large adipose fin and including four species (TEUGELS

et al., 1990), was introduced in aquaculture and shows most promising results. LEGENDRE *et al.* (1992) demonstrated that under identical conditions, *Heterobranchus longifilis* Valenciennes, 1840 has a growth rate which doubles that of *Clarias gariepinus*. At present, *H. longifilis* is cultured in Côte d'Ivoire (AGNESE *et al.*, 1995), Nigeria (NWADUKWE, 1993), Cameroon (NGUENGA *et al.*, 1996) and Zambia (HECHT *et al.*, 1991). *Heterobranchus isopterus* Bleeker, 1863 is another species presently cultured in Côte d'Ivoire (DA COSTA *et al.*, 1996). Experiments with *H. bidorsalis* (Geoffroy Saint-Hilaire, 1809) have recently been conducted in Côte d'Ivoire (Gilles, pers. comm.) and in Nigeria (FAGBENRO *et al.*, 1993). Data on production of *Heterobranchus* species are not yet available.



■ Figure 1
Clarias gariepinus; representative of the Clariidae.

Bathyclarias (sometimes referred to as *Dinotopterus*) is another clariid genus which is actually being studied for aquaculture purposes in Malawi (Kaunda and Hecht, pers. comm.). Preliminary research by MSISKA *et al.* (1991) showed promising results. The genus merely differs from the large *Clarias* and *Heterobranchus* by the presence of a small adipose fin and by the lower jaw reaching beyond the upper jaw. The genus has a limited distribution: a species-flock (12 species) has been described from Lake Malawi, one species is known from Lake Tanganyika and another, originally described in *Heterobranchus*, is known from Lake Mweru and its

neighbouring rivers (TEUGELS, in prep.), in between Lakes Malawi and Tanganyika. Their taxonomy, growth, reproduction and feed requirements are presently being studied.

Finally some anguilliform clariid genera are presently being tested on their aquaculture potential. Although belonging to the same family, they substantially differ from other clariid genera. The body is extremely elongated and the head is strongly reduced. Several genera have been described but their taxonomy is problematic. In Belgium and the Netherlands experimental research is presently being done on *Gymnallabes typus* Günther, 1867 as a possible replacement for common eel-culture.

Family Bagridae

A detailed osteological and phylogenetical study led MO (1991) to split the Bagridae into three families: Bagridae, Claroteidae and Austroglanididae.

As a result of MO's revision the Bagridae are represented in Africa by only one genus, *Bagrus* containing 10 species. The genus is recognized by a moderately elongated body, compressed posteriorly, four pairs of barbels, strong dorsal and pectoral spines and a large adipose fin.

The genus has a large distribution including the Senegal, Niger, Volta, Chad and Nile basins, the East African Rift Lakes and the Zaire basin. Some species like *Bagrus docmak* (Forsskall, 1775) can attain a total length of over one meter. Although they are important food fishes, in those areas where they form an important part of the fish catches, they are presently not used in aquaculture.

Family Claroteidae

Following MO (1991) this family contains 13 genera, all endemic to Africa. TEUGELS (1996) mentioned 88 species. Two subfamilies are recognized, Claroteinae and Auchenoglanidinae. The former includes seven genera, the latter has five. The most important

difference between both sub-families is the presence of an accessory toothplate on the palate in the Claroteinae.

The external morphology varies considerably within the family. Generally, the body is moderately elongated. There are usually four pairs of barbels (three in *Auchenoglanis*). The dorsal and the pectoral fins have strong leading spines and an adipose fin is present.

Claroteidae have a large sub-saharian distribution. Within the Claroteinae *Clarotes* and in particular *Chrysichthys* are economically important. The latter has been introduced in aquaculture in the early 1980's (HEM, 1986; DIA and OTEME, 1986). *Chrysichthys nigrodigitatus* (Lacepède, 1803) (Figure 2) is presently cultured in Côte d'Ivoire (OUATTARA *et al.*, 1993) and in Nigeria (EKANEM, 1993). For 1994, GARIBALDI (1996) mentioned a production of 1,503 mt in Africa.

Within the Auchenoglanidinae, especially *Auchenoglanis* is economically important in local catches. BARDACH *et al.* (1972), MICHA (1973) and PLANQUETTE (1976) published on the aquaculture potential of *Auchenoglanis occidentalis* (Valenciennes, 1840). The species, however, is at present not used in aquaculture.

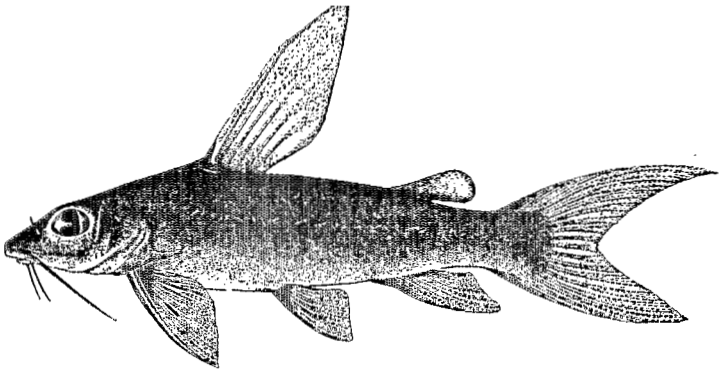


Figure 2
Chrysichthys nigrodigitatus, representative of the Claroteidae.

Family Austroglanididae

Originally included in the Bagridae, this family, containing one genus *Austroglanis* with three species is only known from the Orange and Olifantsriver in southern Africa.

Morphologically, the family is recognized by the presence of three pairs of barbels, strong dorsal and pectoral spines and a small, posteriorly placed adipose fin. The maximal size reported is 250 mm. They have no importance in aquaculture.

Family Malapteruridae

The electric catfish family Malapteruridae contains one genus *Malapterurus*. Three species are currently recognized as valid but the systematics of this group are poorly known and are presently being revised (Norris, in prep.).

Morphologically they are recognized by a somewhat cylindrical body, three pairs of barbels, the absence of a dorsal fin and the absence of spines in the pectoral fin. An adipose fin is present. They possess an electric organ of muscular origin which produces violent electric discharges up to 450 Volts.

Electric catfishes have a wide distribution in tropical Africa. Their maximal total length is 1,5 m. They have no aquaculture potential.

Family Mochokidae

Eleven genera, including 177 species are presently known for this family, which is endemic to Africa.

Their external morphology consists in a robust body, slightly compressed posteriorly. They have three pairs of barbels, of which the mandibular pair is branched in some genera (*e.g. Synodontis*). The dorsal and pectoral fins have strong spines. An adipose fin is present. Although the maximal length reported is 800 mm in a species of *Synodontis*, the mochokids are in general much smaller.

They have not been introduced in aquaculture but some species are popular aquarium fishes.

Family Amphiliidae

Amphiliids are small freshwater catfishes (maximal total length 195 mm but usually much smaller) endemic to tropical Africa. Nine genera including 60 species are known.

They have three pairs of barbels; in most genera dorsal and anal spines are lacking; an adipose fin is present. Many genera are rheophilic and display greatly enlarged pectoral and pelvic fins.

Amphiliidae are of no interest to aquaculture.

Family Schilbeidae

Schilbeidae are pelagic catfishes found in freshwaters of Africa and southern Asia. In Africa DE VOS (1995) recognized five genera with 34 species.

Morphologically schilbeid catfishes are recognized by a laterally compressed body and two to four pairs of barbels. A short dorsal fin may be present or absent. When present, it has a strong spine. An adipose fin is present or absent. The anal fin is very long and the pectoral fin has a strong spine.

Maximal total length reported is 590 mm in *Schilbe*. Some schilbeids are excellent and important food fish. No records on their introduction in aquaculture could be found.

Family Ariidae

Most ariids are marine catfishes with a worldwide distribution in tropical and subtropical regions. Four genera, *Anchorius* with two species, *Arius* with eight species, *Galeichthys* with two species and *Netuma* with one species, have been reported from Africa mostly

from coastal bays and estuaries. Some, however, are confined to freshwaters.

Morphologically they are recognized by a robust body, compressed posteriorly, three pairs of barbels, dorsal and pectoral fins with strong spines and the presence of an adipose fin.

Arius gigas Boulenger, 1911 is exclusively found in freshwater in the Niger and Volta basins. Its maximal length reported is 1.5 m. It has become however, extremely rare. They have not been used in aquaculture in Africa.

Family Plotosidae

Like the Ariidae, the Plotosidae are mostly marine catfishes found in the western Pacific and the Indian Ocean from the east coast of Africa to Australia. One genus, *Plotosus*, and three species have been reported from the east coast of Africa. They occasionally enter freshwater.

Plotosidae are recognized by an elongated body with a pointed tail. Four pairs of barbels are present. Two dorsal fins are present, the first with a strong leading spine, the latter very long and confluent with the caudal. Caudal and anal fins are also confluent. The pectorals have a strong spine. The maximal size reported is about 600 mm. They are not used in aquaculture.

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