



# African Catfish

What should we know?

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**Species tool**

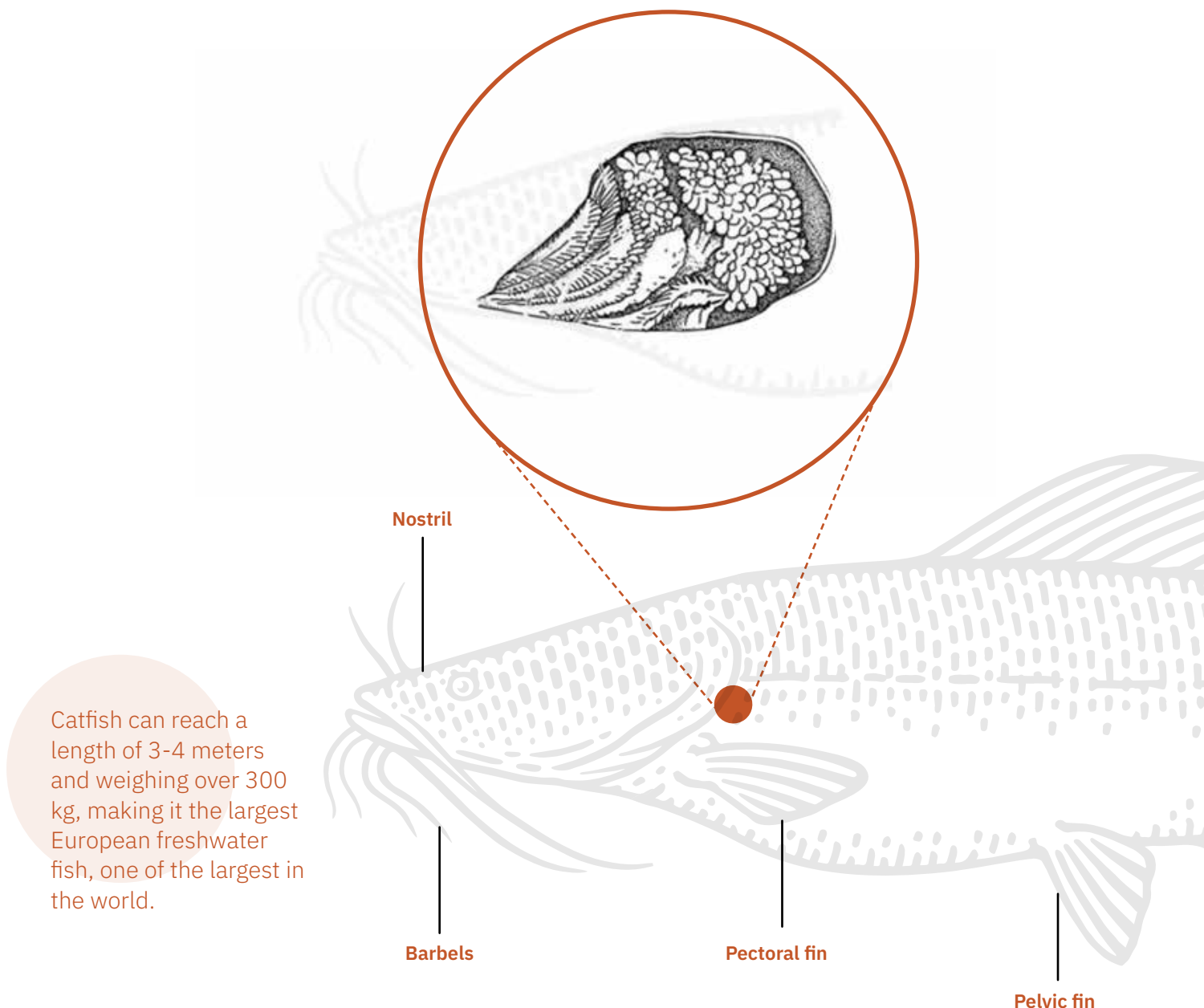
# African Catfish:

## What should we know?

Most catfish have a cylindrical body with a flattened ventral to allow benthic feeding (Bruton, 1996). Catfish are so-named because of their whisker-like barbels, located around the mouth.

Biologically, the **African catfish** (*Clarias gariepinus*) is undoubtedly an ideal aquaculture species. The *Clariidae* family are air-breathing catfish found throughout Africa and the Middle East in freshwater lakes, rivers and swamps, as well as human-made habitats, such as oxidation ponds or even urban sewage systems. This species was introduced worldwide in the early 1980s for aquaculture purposes, and moving forward in this book, we will focus exclusively on the breeding of African catfish.

African catfish have both gills that take in oxygen from water and an organ called the “**labyrinth**” or “**air-breathing organ**.” They are scaleless with leathery skin, distinguishing them from most other teleost fish.



Catfish can reach a length of 3-4 meters and weighing over 300 kg, making it the largest European freshwater fish, one of the largest in the world.

# Other well-known catfish species are:



## European catfish

*Silurus glanis*

A carnivorous species of catfish native to Europe, the Baltic, Black and Caspian Seas, and introduced to Western Europe as a prized sport fish. It is a freshwater fish recognizable by its broad, flat head and wide mouth. European catfish can live for at least fifty years. This species does not have a labyrinth organ and, therefore depends, on the oxygen in the water.

## Channel catfish

*Ictalurus punctatus*

The most important commercially cultured aquatic animal species in the U.S., making up 90% of its farm-raised catfish. This species does not have an air-breathing organ.



## Heteroclarias

A cross of *Clarias gariepinus* with another African catfish, *Heterobranchus longifilis*, that cannot reproduce. This cross grows slightly faster and has a lighter coloured filet than the *Clarias gariepinus*. A major disadvantage of the Heteroclarias is its higher susceptibility to stress, as the *Heterobranchus longifilis* is not well-domesticated.

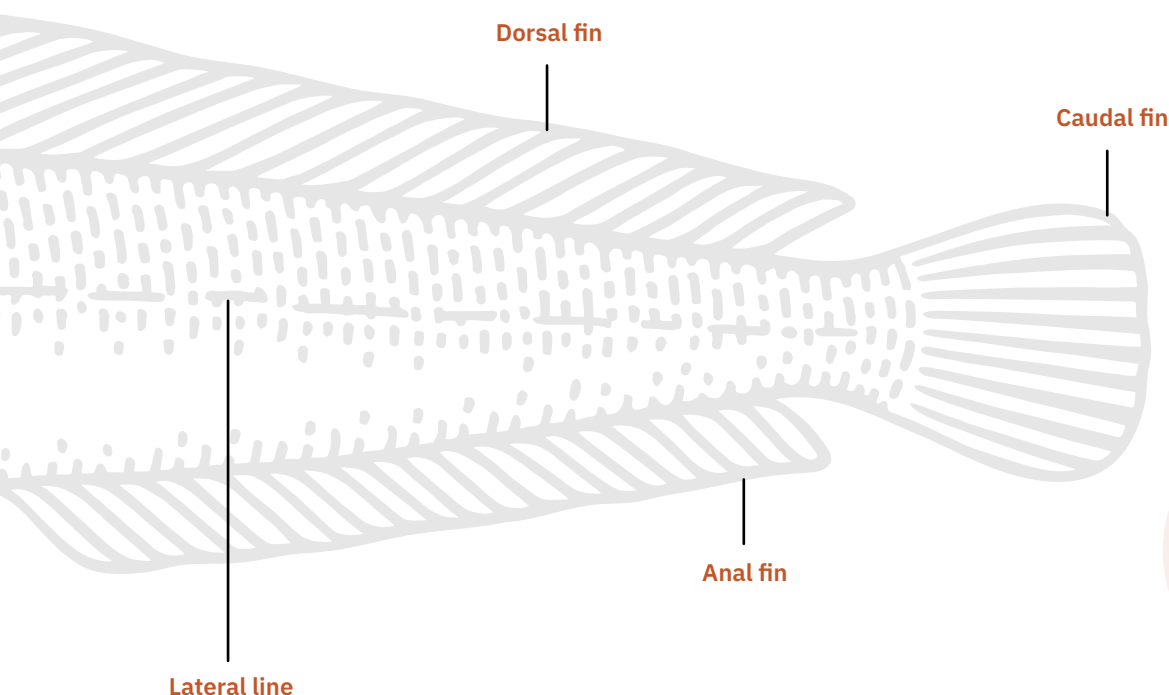


## Pangasius

*Pangasius bocourti*

This species, and some other pangasius, are primarily farmed in Asia, with a significant share in Vietnam. They have a streamlined body, dark grey back, silver belly, wide mouth and long twin beard. Pangasius is a facultative air breather and uses its swim bladder as an air-breathing organ. This means it can tolerate environments with little dissolved oxygen. It grows rapidly and can live in the wild for as long as 20 years.

The name “catfish” refers to the long barbels, or feelers, which are present about the mouth of the fish and resemble cat whiskers.



Catfish can live up to 60 years depending on location and species.

# African catfish farming

## Hatchery

A recirculating aquarium system (RAS) is ideal for incubating eggs and rearing catfish larvae. This could consist of tanks; a sedimentation filter; a biofilter with a high surface open structure filter material, like a trickling tower; preferably a UV installation, well-aerated, clean, fresh water; an aerator; a pump and a heater. The water in this system is recycled at least 1.5 times per hour to maintain good water quality. About 10% of the total water volume is exchanged daily, and the optimum temperature for larval rearing is 28–30 °C.

Within 2–3 days after hatching (48 hours at 28 °C), the yolk-sac is absorbed, and the hatchling is visibly developed into a small catfish, beginning their search for food. The success of the intensive production of fingerlings greatly depends on the use of *Artemia nauplii* (live feed) at first feeding, which stimulates the larvae' feeding response.

Larval rearing occurs at relatively high densities to suppress cannibalistic behaviour.

**Table 1.** Water quality requirements for the African catfish hatchery:

Chemical & physical feature	Desired level
Dissolved oxygen	Min. 90 mg/L
Temperature*	Consistent 27-28 °C
pH	7-7.5
Water hardness	Max. 3 dH
Ammonia (NH <sub>3</sub> )	Max. 0.125 mg/L
Nitrite (NO <sub>2</sub> )	Max. 0.1 mg/L
Nitrate (NO <sub>3</sub> )	Max. 50 mg/L
Carbon dioxide (CO <sub>2</sub> )	Max. 10 mg/L

\*Optimal temperature for keeping broodstock is 25 °C

## Nursery

After about 10 days, when the larvae are completely fed using dry feed, the early juveniles are transferred to the nursery system for about 6–8 weeks. Once they weigh 10 grams, hatcheries will typically sell these fingerlings to farms for the grow-on phase.

The newly produced fingerlings are size-graded several times before they are transferred to production tanks or ponds. Regular grading reduces the rate of cannibalism and facilitates even growth without stress, as does sufficient access to feed following an appropriate feeding regime. In this phase, the young catfish fry develops rapidly. Therefore, a strict feeding protocol is necessary for the successful nursing of these young fish. Feeding too little risks malnourishment, while feeding too much risks pollution. Keen observation and regular cleaning are essential.





## Ongrowing

Once transferred to the ongrowing system, African catfish are fed according to specifically designed feeding curves based on a farm's design and/or strategy. Depending on market demand or a farmer's tactics, maximum growth or a low feed conversion rate can be achieved. The fish are graded up to 150 grams, but after this, it is avoided to deter stress and aggression among the fish.

To assure the optimal conditions for farming African catfish, a stress-free environment for the fish is necessary. Often, music is played in these facilities to mask any unexpected sounds. Catfish are most comfortable in semi-dark to dark environments.

In the tanks, you often find self-feeding systems, which are filled up to twice a day. By hitting a pendulum (or shuttle), the feed falls into the tank so the fish can eat.



## Broodstock

Under good farming conditions, both male and female catfish mature at 12 months. Female African catfish raised in a RAS under optimal conditions have a fully developed ovary containing ripe eggs year-round. The ideal water temperature for broodstock is around 25 °C. Generally, mature females are selected according to their swollen reddish genital papilla and a well-distended, swollen soft abdomen. The eggs of a “ripe” female make up 15–20% of the body weight.

Although larger females produce larger eggs with higher yolk content and, hence, result in a higher survival rate, it is better not to use fish older than 4–5 years. Eventually, the egg quality starts to deteriorate from large females. Another reason to change is to avoid difficulty in handling very big females. Measures should be taken to avoid inbreeding.

The males of the African catfish cannot be stripped, and the sperm can only be obtained by sacrificing a male. Consequently, the male broodstock depletes, and yearly recruitment of new males is necessary. After semen collection, the quality should be checked using a microscope. A healthy mature male can fertilize eggs of up to 10 females. Fish development depends largely on feed quality, mainly on protein supply to facilitate repeat spawning.



## Harvest

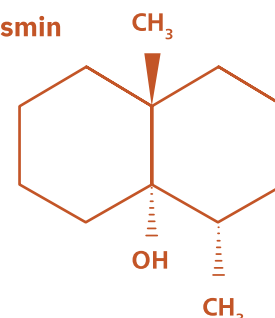
To guarantee the quality of products demanded by consumers, the harvest process is critical. A final size grading is essential in order to deliver according to your customer needs. The so-called ‘off-flavour’ — characterised by a muddy, unpleasant taste — of the fish should be ruled out. Moving the fish to clean, odour-free water for a time before harvest is still the only reliable way to remove these off-flavours.

The most common off-flavour compounds found in farmed fish are 2-Methylisoborneol (MIB) and geosmin (GSM), secondary metabolites released by micro-organisms, such as cyanobacteria or actinomycetes that exist in most aquaculture systems. Due to their high bioaccumulation rates in lipid-rich tissue, even very low concentrations of MIB and GSM in the water can cause an undesirable earthy/musty smell and taste in fish flesh. This leads to a loss of product quality and reduces marketability.

### 2-Methylisoborneol



### Geosmin



# Commercial products

Traditionally, catfish is bred mainly for the yield of high-quality fillets. New products and regional delicacies from catfish have also been introduced. Finally, all residual flows are being re-used in other industries, like cosmetics and pet food.

- Filets
- Smoked fillets
- Sausages
- Local delicacies: fish soups, frikadellen (Germany)
- Kibbeling (Holland), dried whole fish
- Collagen for cosmetics
- Leather
- Live fish for angling ponds (put and take fisheries)
- Dried carcasses for pet food



# Challenges in African catfish production



## Optimal growth performance

A major challenge in commercial catfish farming is achieving optimal growth performance while producing minimal waste. Catfish live in high densities where water quality makes a big difference for optimal growth performance. Three main factors that affect water quality are:



## Uneaten feed/feeding management

The right feeding management is vital to achieving optimal performance on-farm. The frequency of feeding and amount of feed input depend on the size of the catfish. Overfeeding should always be prevented since it leads to adverse environmental conditions, including low oxygen, high ammonia and high suspended solids. Overfeeding wastes feed and results in poorer water quality, limiting the farm's performance and doubling the disadvantage.



## Ammonia excretion

Choosing the correct ratio between digestible protein and digestible energy in RAS diets formulation has shown a lower amount of ammonia is excreted per kilogram of feed. In this way, the biofilter can handle more feed per day.

Also, in flow-through systems, less digestible feed or nutrient uptake can result in polluted water. The last raceways or ponds in line can be especially heavily polluted by this. Polluted water negatively impacts breeding conditions, mainly resulting in a lower feed intake, a higher FCR and overall lower productivity.



## Digestibility & faeces

Catfish faeces is a watery substance that is difficult to filter out of the water. Feed digestibility determines the amount of faeces, while the raw materials used strongly influence firmness. A high amount of loose faeces can lead to poor filter performance and water quality. It also leads to more cleaning time and higher water requirements.



## Disease prevention

In aquaculture, diseases rarely result from contact between the fish and a potential pathogen alone. Aquatic pathogens are often opportunistic; they only cause a disease outbreak when stressors like poor water quality, reduced oxygen level or suboptimal density are present.

African catfish, especially after developing the accessory breathing organ, are relatively resistant to diseases, particularly when feed supply is of good quality and quantity. However, there are infection risks in fingerling production in the hatchery. Although it is a robust fish, African catfish is sensitive to opportunistic bacteria when exposed to poor water quality, thus negatively impacting the health of catfish and, ultimately, limiting farm profitability.



## Reproduction

Specific challenges encountered in hatcheries are genetic selection, optimal fertility and maximising fry survival and quality.

Critical selection of new broodstock and regularly adding new genetic lines are vital to optimal genetic potential, improving farm performance now and in the future. Specific feed for broodstock for the best egg and sperm quality ensures optimal fertilisation, hatching rate and strong fry, with a high survival rate. Optimal farm performance begins with a good start in the early life stage.

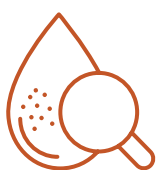
# Solutions:



## Feed & feeding

Catfish do not have a direct requirement for high protein content alone but rather for a well-balanced mixture of essential and non-essential amino acids from which to construct their own tissue proteins. The protein digestibility and the balance of essential amino acids in the diet are, therefore, more important than crude protein levels. Working with the optimal protein and lipid ratio is important for formulating a feed and building up a profitable aquaculture farm. Along with the ideal amino acid profile, Alltech Coppens makes sure its catfish diets are highly palatable for good feed intake.

The African catfish feeding table published by Alltech Coppens is based on the composition of the feed and targeted to reach optimal growth and FCR. This well-proven feed table enables optimal performance and helps to prevent overfeeding and uneaten pellets from polluting the water.



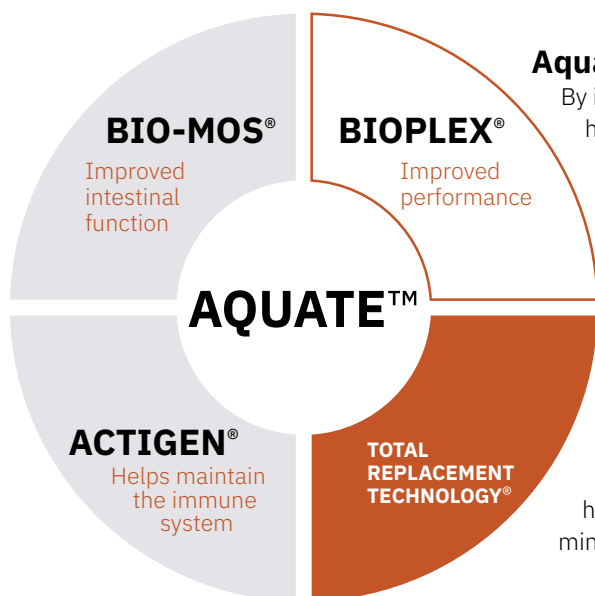
## Pollution control

By focussing on high digestibility, Alltech Coppens feeds minimise the amount of faeces per kilogram of feed. Catfish faeces must be large, firm and water-stable so that the mechanical filters can easily remove. Additionally, Alltech Coppens works with an optimal ratio between digestible protein and digestible energy (DP/DE ratio), which increases dietary protein utilisation and minimises ammonia production per kilogram of feed.



## Feed for broodstock & fry

The early life stage of a catfish is their most delicate stage. Getting it right from the start with a nutritionally balanced feed is essential to achieving good results. Alltech Coppens broodstock and hatchery feeds are tailored to support optimal performance, meet nutritional requirements and rule out deficiencies, minimising deformities and mortality.



## Aquate health pack: healthy growth from hatch to harvest

By incorporating Alltech's Aquate technology in our catfish diets, we enhance a healthy gut microbiome for optimal nutrient digestibility and boost fish health, ultimately contributing to better farm performance. Aquate contains yeast-based products such as Bioplex®, Bio-Mos® and Actigen®. This technology safeguards the healthy growth of this fish species, from hatch to harvest.

The inclusion of Bio-Mos supports digestive function, the mucus barrier protection to opportunistic pathogens, the immune response and optimises growth. Actigen within the feed premix preserves the microbial balance within the gastrointestinal system, ensuring improved digestion, nutrient absorption and utilisation. Bioplex chelated minerals have a much higher bioavailability compared to inorganic minerals, and this helps to make sure that the fish's requirements are more easily met. Minerals play hundreds of roles in the fish's metabolism, and Bioplex provides the fish with minerals in the ideal form without unnecessary pollution.



## Research programme for catfish

The Alltech Coppens Aqua Centre (ACAC) addresses challenges related to farmed catfish. The recent expansion of the ACAC in 2021 reinforces the commitment to high-performing catfish feeds for profitable farming. The new system is a unique and revolutionary trial system and offers the possibility to combine growth and digestibility trials for catfish.

Alltech Coppens' specialism in RAS, where feeds must conform to more stringent criteria than feeds for any other type of fish farming, gives insights that are also applicable to fish farming in raceways, ponds and cages. RAS feeds can also excel in traditional farming settings because they meet a higher standard.

With 30 years of experience researching, developing and producing high-quality catfish feeds, Alltech Coppens offers on-farm assistance through our dedicated sales team and technical support team, ensuring optimal farm performance.



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**The new system offers the possibility to combine growth and digestibility trials for catfish.**







## Research & development

With 30 years of experience researching, developing and producing high-quality catfish feeds, Alltech Coppens offers on-farm assistance through our dedicated sales team and technical support team, ensuring optimal farm performance.

Alltech Coppens formulates feed on the 4 Pillars of Fish Nutrition: **Palatability**, **Performance**, **Pollution Control** and **Planet**. All four pillars are important and taken into the balance of sourcing new/alternative raw materials:



### Palatability

To ensure the best growth and performance of fish, optimal feed intake is vital. Fish must be attracted to the smell and taste of the feed.

### Performance

Our feeds must perform well. This means that they must generate healthy growth and ensure efficient feed utilisation. This is a decisive factor in the profits of fish farmers.




### Pollution Control

To maintain water quality and secure optimal fish health and performance, it is crucial that all our feeds are highly digestible, thereby decreasing the risk of pollution.

### Planet

The environmental sustainability of the feed.



For more information, please contact us:  
Dwarsdijk 4, 5705 DM Helmond, The Netherlands  
Tel.: +31 (0)88 23 42 200 |    Alltech Coppens  
<https://www.alltechcoppens.com>

