The fish labelling regulations (1) designate that all species of the family Pangasiidae can be called panga, pangasius, basa, or river cobbler; and any of these names can be used with the addition of the word ‘catfish’. Other names included striped catfish, swai or tra, but may also be sold as cream dory, iridescent shark, silver striped catfish, sutchi catfish, Vietnamese catfish. Fishbase (2) lists 28 species of this family. The main species farmed and imported into Europe and the UK is Pangasianodon hypophthalmus (3, 4).

The purpose of this guide is to give buyers background information on the responsible sourcing of farmed pangasius.

The farming of P. hypophthalmus has seen it emerge as a commercial freshwater species that is now a significant component of global whitefish supplies. This species is now a highly competitive white fish product on many markets, and the EU and the US are the most important market for pangasius (5). Whilst import value of frozen pangasius fillets into the EU decreased 30% from 2010 to 2013, import values into the UK increased by 15%; from €21 million in 2010 to €27 million in 2013 (4).

Pangasius was by far the fastest growing retail seafood segment in the UK increasing by over 50% between October 2009 and October 2010. In the period between July 2011 and July 2012, pangasius was ranked 20th of fish products sold in the UK. The UK imported 9,400 metric tonnes (mt) of frozen pangasius fillets in 2010 (4% of total EU imports in that year). In 2013, it imported 11,800 mt of pangasius, an increase of 36% compared to 2010. Besides frozen fillets, the UK also imported small volumes of frozen whole pangasius (700 mt) and fresh pangasius fillets (600 mt) in 2013 (4, 6). By 2014 UK imports had risen to 3,500 mt, and pangasius ranked 15th in the top 35 UK retail species by value in the 52 weeks running up to August 2014 (7).

**BUYERS’ TOP TIPS**

- It is vital the buyer is aware of flesh colour requirements (white, pink and yellow, also light pink and light yellow) before purchasing. Colour differences are dependent on the practice in the growing and processing operations.
- Know your source of supply and only purchase pangasius which is traceable throughout its entire production chain.
- Ensure product complies with the appropriate farming, processing and production standards.
- Understand the legal system for importing pangasius, and the testing requirements to ensure all product is free from drug and chemical residues.
- Be aware of the social and environmental impacts.

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To support a profitable, sustainable and socially responsible future for the seafood industry.
Sources and quantities

*P. hypophthalmus* is native to the Mekong (Vietnam, Lao PDR and Cambodia), Chao Phraya and Mae Klong (Thailand) rivers and also the Ayeyawady basin in Myanmar (Burma). In the Mekong River (Figure 1) there are thought to be two populations of *P. hypophthalmus*, above and below the Khone Falls on the Cambodian/Lao PDR border (8).

Global aquaculture of *P. hypophthalmus* produces over 2 million mt (9). Vietnam dominates production, with an estimated 1.1 million mt being cultured in 2015 (Figure 2), and pangasius products generating US$ 1.77 billion for Vietnam in 2014 (5).

The species has been introduced for aquaculture in several other Asian countries. *P. hypophthalmus* is now farmed in significant numbers in Bangladesh, India, Indonesia and Thailand (Figure 3) (9), and to a lesser extent in countries such as China, Myanmar and the Philippines (10). Although Vietnam continues to develop production techniques and remains the world leader in pangasius aquaculture, production is rising in what are relatively new producing nations - raising the species mainly to supply demand in their own domestic markets.

Figure 1: The Mekong

Figure 2: Vietnamese pangasius production and export price 1997 – 2015 (9)

Figure 3: Total production of farmed pangasius by country 2010 – 2015 (9)
Biology, cultivation methods and systems

Wild *P. hypophthalmus* is a migratory species with migrations tied to annual monsoon flood cycles. The lower Mekong population for instance migrates hundreds of km annually between several upstream sites in northern Cambodia below the Khone Falls and feeding grounds on the Mekong floodplain and the Tonle Sap Lake in Cambodia (8).

Spawning starts with the monsoon season in May - June in habitats consisting of rapids, sand banks and deep rocky channels and pools. The eggs are sticky and are deposited onto exposed tree roots in fast flowing streams. The fish make extensive feeding migrations into the Mekong delta during the flood season, which also act as nursery areas. In the dry season they congregate in deeper areas upstream. Wild fish can reach 130 cm in length and up to 44 kg in weight. They are omnivorous, and will eat algae, plants, zooplankton and insects, with larger specimens taking fruit, crustaceas and fish. Typically they live in water with a pH of 6.5 - 7.5 and temperatures 22 - 26°C (8, 11).

Wild populations of *P. hypophthalmus* were once an important fishery and food source in Cambodia, Lao PDR, Thailand and Vietnam but are now declining. Over-exploitation, habitat degradation and changes in water quality and flow are the major threats to this species. Future plans to dam the Mekong could significantly disrupt the species life cycle (12).

Cultivation methods and systems

In the early 2000’s Vietnam saw the rapid expansion of catfish aquaculture, namely *P. hypophthalmus* in ponds and *P. bocourti* in net cages and net pens. Subsequent collapse of cage and pen culture witnessed significant expansion and productivity improvements in *P. hypophthalmus* pond culture since 2005 (Figure 3) (13). Intensive pond aquaculture of *P. hypophthalmus* now represents over 95% of current production in Vietnam (14). On-growing is high density monoculture in earthen ponds with production figures of over 200 - 300 mt per ha per crop; and with 1.45 crops per year, this equates to as much as 400 - 600 mt per ha per year. Currently around 6000 ha of the Mekong Delta are under pangasius production (15).

Ponds are sited near rivers and canals for the convenience of water exchange (pumped or tidal exchange), effluent discharge, transportation of inputs such as juvenile fish (seed) and feed, and the output of harvested fish (16).

Intensive pond aquaculture of *P. hypophthalmus* has a complex value chain but is divisible into four independent but highly integrated sub-sectors; hatchery production, fry to fingerling rearing (nursery) and grow-out, which leads ultimately to processing (13).

In 1995 artificial spawning techniques closed the life cycle of *P. hypophthalmus*, and the development of a commercial hatchery sector
began in 1998. This was the vital ingredient to enable the rapid growth of Vietnamese *P. hypophthalmus* aquaculture. There were 93 hatcheries in the Mekong Delta in 2008 (17), this has subsequently risen to over 148 (16).

Domestically held broodstock are usually replaced every 3 years and largely sourced from the large broodstock populations kept by hatcheries or from other delta farms. However, most hatcheries still need to recruit new stock and these are sourced from the wild. Most wild caught broodstock originate in Cambodia. Cambodian *P. hypophthalmus* stocks were considered abundant in the 1990s but now considered in decline (8, 18).

The FAO currently states that in Cambodia, Lao PDR and in some parts of Thailand farmers may rely on supplies of wild captured juveniles for on-growing (10) (this is not acceptable to all processors). However, the extent to which this still occurs is questionable, for instance the Cambodian government banned the collection of wild seed in 1994, as did the Vietnamese government in 2000 (8).

Rearing from eggs to fully grown fish of 1-1.5 kg takes between 8.5 and 10 months. Adult brood stock are induced to spawn by hormonal injections, the eggs and sperm are mixed in water and tannin is added to remove the stickiness of the eggs which are incubated for 22 - 24 hours. The larvae are placed in nursery stage one ponds after 24 hours when they commence feeding. These earthen ponds are prepared by drying, liming and stocking with small crustaceans (*Moina*) and filtered to exclude predators. The fish are fed on boiled egg yolk and soya bean meal for the first two weeks followed by commercial feed pellets. At the end of this stage the 0.3 - 1.0g fry are harvested and transferred to second stage nursery ponds. Here the fish are kept for a further two months before being transferred as 14 - 20g fingerlings to grow-out farms (10).

*P. hypophthalmus* is able to breathe air, so low levels of oxygen are tolerated, as are variable water qualities. However, the growing conditions can affect the flesh quality, with a yellow colour developing when the fish is kept in conditions where there is a shortage of oxygen. There are two main harvesting times; March and at the end of October, although harvesting can occur all year. The fish are harvested by net following partial drainage of the pond and transferred to the processing factories by well boat (16).

**Feed**

In the initial development phase of the (Vietnamese) pangasius industry, grow-out farmers prepared their own feed using a range of locally available ingredients, but feed conversion ratios (FCRs) were high. Although farmers still utilize farm-made diets to some extent industrial compound feeds have long been recognized by producers as more effective. The use of commercial aquafeed has risen sharply since 2008 in Vietnam (12, 19) and is now the norm. Today over thirty companies produce *P. hypophthalmus* feed in the Mekong Delta, with 2012 production around 1.95 million mt. Commercial feeds have low fishmeal
inclusion (5% - 10%) and a high vegetable ingredient content (90%+) (16). Although the pellets are more expensive, they result in better FCRs and water quality. They are also extruded pellets (designed to float) thus avoiding the build-up of feed in pond sediments. The majority of farms feed commercial pellets throughout the on-growing process.

Environmental considerations

Both environmental and economic pressures support the certification of aquaculture production. It is a process that allows a supplier to demonstrate ‘responsibility’ by: minimising impact on the environment; making the best use of locally available resources; making informed choices as far as labour rights in the developing world; complying with national legislation and ensuring the best use of feed and therapeutic products.

The rapid growth of the *P. hypophthalmus* aquaculture industry has raised a number of environmental and social concerns including (12, 13, 15, 16):

- Regulatory and enforcement issues surrounding farm siting, construction and operation
- Water pollution and waste management e.g. pond sludge disposal
- Escapees may compete with wild fish and affect ecosystems
- Potential risks of parasite and disease transfer to wild fish from culture water
- The use of fishmeal, especially trash-fish in commercial pangasius feeds, and import of many plant ingredients currently used in commercial feeds

- Issues surrounding health management, veterinary medicines and chemicals
- Social responsibility regarding labour practices and conflicts among users of the shared resources.

There is a need (and an on-going drive) to minimise the potential negative impacts pangasius farming can have on the environment and society. FAO reports that despite the large tonnages produced, some at extremely high density production systems, large scale disease outbreaks have seldom been reported. Two of the major bacterial diseases faced by the industry are Bacillary Necrosis of Pangasius (BNP; caused by *Edwardsiella ictaluri*) and Motile Aeromonid Septicaemia (MAS; *Aeromonas* spp). The former can be controlled by antibiotics, the latter by improved water quality and antibiotics (10).

Of the two *E. ictaluri* is the most commercially serious disease. An important step forward in 2013 was the licensing of the ALPHAJECT® Panga 1 vaccine in Vietnam, the first vaccine against *E. ictaluri* (20). With its usage a reduction in the number of outbreaks of BNP should be seen and antibiotic use reduced.

In January 2011 the first global guidelines for aquaculture certification were approved by the UNFAO Committee on Fisheries. The guidelines, which are non-binding, cover animal health, food safety, the environment and labour issues (21).
Management standards and certification

The use of independent 3rd party international certification schemes within pangasius aquaculture has been growing since 2010. The three main certification bodies and the volumes of live weight pangasius production they have certified in Vietnam are (16):

- **Aquaculture Stewardship Council (ASC)** (22): 110,000 - 120,000 mt in QII 2013 = approx. 10% of 2012 production. This figure rose 69% to 196,000 mt by QIV 2014 = approx. 20% of 2013 production.
- **Global Aquaculture Alliance (GAA)** (23): 29,174 mt = approx. 2.5% of 2012/2013 production.

All these schemes seek to promote and instil responsible pangasius aquaculture practice in the industry, via individual farm certification. ASC certification has become the main sustainability certification scheme for pangasius, especially in Europe.

Certification so far has been generally attained by the largest producers/farms, and many of these hold certificates from more than one scheme. GLOBALG.A.P. announced in 2014 the first aquaculture group certification for small-scale pangasius farmers in Vietnam (25).

- **The Global Sustainable Seafood Initiative (GSSI)** (26). As seafood certification and labelling programs have become the primary tool to address sustainability issues for many companies, buyers, and consumers, the number of such programs has led to confusion and inefficiencies. In 2013 the GSSI was created to develop a common, consistent and global benchmarking tool for these programs, to measure and compare their performance. The final version of the GSSI Global Benchmark Tool should be available in QIII 2015.

In Vietnam the government targets 1.5 - 2 million mt of pangasius produced by 2020. The Vietnamese government, Vietnam Fisheries Society (VINAFIS) and the Vietnam Association of Exporters and Processors (VASEP), with assistance from independent bodies such as WWF, IDH (27) and SNV (28), have committed the industry to achieve 100% of farmed pangasius under one of the available certification schemes by 2015, with at least 50% under ASC (29).

The Vietnamese Ministry of Agriculture and Rural Developments (MARD) has also developed ‘VietG.A.P’ which is intended to raise the standards of Vietnamese aquaculture and be a possible stepping-stone to attain international certification. MARD states that from 2015 it will be obligatory to apply the VietG.A.P standard in pangasius farming. It intends to have 80% of all intensive / semi-intensive aquaculture in certified VietG.A.P by 2020 (16).

The Sustainable Fisheries Partnership operates Aquaculture Improvement Partnerships (AIPs) – the Vietnamese Pangasius AIP is to reduce or mitigate the
potential cumulative and combined impacts of pangasius farming practices on a zonal level with producers, suppliers and buyers working together to address sustainability issues within the fish farming sector (15).

**Product characteristics**

Flesh colour depends on the production and processing methods used. Pangasius has firm flesh and a mild flavour with slight shellfish overtones. Mouth feel is less fibrous than cod or haddock. If cultured correctly it should not have a muddy earthy flavour.

Vietnam is an approved non-EU country authorised to export fishery products to the UK (30). Basic information about product specs and import requirements in the UK (4):

**Labelling:** The contents of labelling must be provided in English. When importing fishery and aquaculture products into the EU, information must be provided on the labelling or packaging of the fishery product, or by means of a commercial document accompanying the goods.

**Packaging:** Some general characteristics –

- Frozen pangasius imported by wholesalers are mostly delivered in 10 x 1kg bags packed in master cartons.
- Frozen fillet is mostly imported in polybags of 250/500g or 1kg, which are directly distributed to retail. Breading or battering of frozen pangasius fillets is usually done by UK processors.
- In retail, defrosted pangasius is sometimes sold over the counter, but mostly packed for self-service in a tray and plastic filter as breaded, battered, and sometimes also smoked product.

**Processing and colour:**

- Colour: UK consumers have a strong preference for white and sometimes light pink. Pink is not the preference.
- Preferred processing: Mostly natural fillets (skinless, boneless, belly fat off, red meat off), that also can be breaded or battered. Defrosted fillets can also be smoked.
- Glazing: The Vietnamese Ministry of Agriculture and Rural Developments (MARD) recently has issued a decree to limit glazing to 10%, and glazing rates have to be declared.
  - Tumbling to increase water content is allowed but limited if it is declared. However, it is often unwanted by buyers and consumers in Europe. In the decree mentioned above, the water content of frozen pangasius is set at 83% maximum.

There are supply chain standards. The British Retail Consortium (BRC) Global Standard & Safe & Local Supplier Approval (SALSA) certification are designed to raise standards in the seafood processing and wholesaling sectors. At the end of 2014 new EU ‘Labelling of Fishery and Aquaculture products’ (FAPs) came into force. Now all wild fishery and farmed aquaculture products marketed within EU (both the EU and non-EU products) will display mandatory and voluntary information about the product for final consumers and mass caterers (31, 32).
For other aquaculture guides see:  
http://www.seafish.org/industry-support/aquaculture

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