

The ornamental freshwater fish trade in Malaysia

The collection, breeding and marketing of ornamental fishes is a sizable industry.

By Casey Ng



Koi fish being graded for export

Ornamental fish keeping is a popular hobby. Many enthusiasts are attracted to the colours, shapes and swimming behaviours that different kinds of fish display in an aquarium. It is easy to get mesmerised by the graceful gliding movements and majestic 180° turns that the Arowana can perform, and by the synchronized ballet-dancing of some forms of goldfish.

Currently there are 259 ornamental fish exporters in Malaysia (Department of Fisheries, 2016). The collection, breeding and marketing

of ornamental fishes is a sizable industry that generates jobs and foreign exchange. But there are concerns over the economic viability and ecological sustainability of the industry.

Ornamental fish keeping was first enjoyed in ancient times by the Chinese, Japanese, Egyptians and Romans (Swann, 1992). Besides collecting from the wild, early aquarists also learned to breed the fish and produce varieties that bore very little similarity to their wild counterparts.



The goldfish is believed to have been bred in China during the Song Dynasty (960-1279) and the Koi was domesticated by the Japanese in 1820s.

An ideal species for the ornamental fish trade should possess favourable features such as acceptance of artificial diet, hardiness, attractive colouration and pattern, and non-aggressive nature that allows them to get along with other species.

Some fish have interesting names that may contribute to their popularity. These include the Chocolate Gourami (*Sphaerichthys osphromenoides*), Bumble-bee Catfish (*Leiocassis poecilopterus*), Ikan H Angus (*Labeo chrysophekadion*), Croaking Gourami (*Trichopsis vittata*) and Kissing Gourami (*Helostoma temminckii*).

Some species are valued for their transparency, like the Glass Catfish (*Kryptopterus* spp.) and Glassfish (*Parambassis siamensis*).



Parambassis siamensis, the Glassfish, is almost transparent in the water and this attracts the interest of many hobbyists.

In nature, fishes are dependent on body colouration and pattern to attract mates or to hide from predators. However, fishes do not produce the colour pigments themselves. They need to ingest natural pigments from their food web (Grether, 2000). Their food web may include algae, insects, flowers and fruits that are found in their habitats. In commercial farms, fishes are fed with special dietary compounds with colouring agents to influence their colouration. These are among the many interesting tricks and trade secrets of the industry.

The United States appears to be the single largest importer and the European Union is the largest market for ornamental fish. The worldwide economic value of the ornamental fish trade is valued at approximately USD 278 million (FAO, 2005) and the aquarium industry is worth over USD 1,000 million (Cato & Brown, 2003). In Australia, Patrick (1998) estimated that 12-14% of the population own aquariums as a hobby.

Ornamental fishes became popular in Malaysia in the 1950s after the country picked itself up from the ruins of World War II. Resourceful entrepreneurs in Johor started collecting species from the wetlands and peat swamps to breed, and soon the trade expanded to other states. Johor’s early start has enabled the Johor fish dealers to become clear market leaders in an industry valued at RM353 million (Table 1).

Table 1. The economic value of ornamental fish produced by states in 2013.

Value of fishes produced	(RM'000)
State	
Johor	252,961
Perak	70,179
Pulau Pinang	24,836
Melaka	1,357
Kedah	1,197
Pahang	628
Kelantan	588
Terengganu	536
Selangor	477
Sarawak	189
Sabah	92
W.P. Labuan	5
Negeri Sembilan	0
Perlis	0
Total =	353,045

Source: Department of Statistics Malaysia (2014, table 11, p.20).

Table 2. The economic value of each family in 2015.

Value produced	(RM)
Fish Family	
Cyprinids	102,687,250
Poecilids	101,447,395
Osteoglossids	56,719,396
Cichlids	42,613,136
Anabantids	14,338,135
Characins	9,989,884
Others	7,769,056
Callichthyids	5,321,951
Cobitids	252,254
Total =	341,138,460

Source: Department of Fisheries (2015, table 31.3)

Fish fans and fengshui

The industry is supported by four categories of fish keepers, namely 1) beginners 2) collectors 3) biotope enthusiasts and 4) “fengshui” practitioners.

The beginners market is the largest and its popular species include angelfish, guppies, gourami and some varieties of barbs. These species are hardy and do not need special care, and they are also easy to breed. Their low production cost makes them affordable for beginners.

The collectors are specialists interested in bringing together different species and strains of the same genus. In Malaysia, *Betta* and

Rasbora seem to command the most fans. Beside wild species, many colourful strains have been developed and are exchanged among the hobbyists themselves. Those species that require special care and only have a small niche market are usually shunned by farm breeders. For native species, hobbyists tend to collect them from the wild and this can be a cause for concern as wild habitats decline.

Biotope enthusiasts are those who like to challenge themselves in creating a self-sustaining ecosystem in the aquarium. Although automatic systems for water-recirculation and oxygen aeration may be installed, the enthusiast takes pride in harmonizing a variety of aquatic flora and fauna. Hiding nooks and corners are created by the arrangement of petrified wood pieces and aquatic plants are stratified to host fish species of different breeding and foraging behaviours, thus creating a demand for aquatic plants, petrified wood and other paraphernalia.

Table 3. The economic value of aquatic plants produced by states in 2015.

Value of aquatic plants produced (RM)	
State	
Johor	148,459,877
Negeri Sembilan	652,000
Pulau Pinang	52,350
Kedah	3,803
Kelantan	838
Total =	149,168,869

Source: Department of Fisheries (2015)

The production value of aquatic plants alone is valued at roughly RM149 million, with Johor taking the lead as the largest producer (Table 3).

The most lucrative sector is the “feng shui” sector, in which enthusiasts buy and keep ornamental fishes for their perceived value in bringing good luck. The Chinese term “feng shui” literally translates as “wind-water” and harmonious “feng shui” is necessary for prosperity. The aquarium is typically placed in the most prominent part of the house, office or business facility, usually in the lobby and entrance section. “Feng shui” aquariums are never placed in kitchens and bedrooms.

Species usually kept for “feng shui” purposes are Arowana (*Scleropages formosus*), Koi (*Cyprinus carpio*), Blood-parrot Cichlid and Flowerhorn. Blood-parrot Cichlid is a hybrid reputedly developed in Taiwan by crossing *Amphilophus labiatus*, *Heros severus*, *Amphilophus citrinellus* and *Vieja synspilum* (Tomasello, 2013). The Flowerhorn is a hybrid believed to be first developed in Malaysia in 1990s by cross-breeding Latin American cichlids namely *Cichlasoma citrinellum*, *C. festae*, *C. trimaculatum* and *Vieja synspila* (Nico *et al.*, 2007).

The bane of intensive farming

Fish may die of starvation, injury, stress, oxygen-deficiency (hypoxia), pollution, diseases, parasites, toxic algae and many other reasons. Most of these problems can be traced back to one root cause—overcrowding.

As in all agriculture and aquaculture endeavours, farmers are constantly struggling to maximise production with minimal space. However, overcrowding and poor sanitation results in higher disease occurrence and high mortality rates. In response, breeders turn to quick fixes in the form of chemotherapeutants, namely tropical disinfectants, antimicrobials and probiotics. Disinfectants like lime, formalin and tea seed cake are commonly applied in ponds, while acriflavine and benzalkonium chloride are applied in hatcheries. Antimicrobials like chloramphenicol, nitrofurans, sulfonamides and virginiamycin are also used to quell disease outbreaks (Mohamed *et al.*, 2000). Consequently, these drugs find their way into the local drainage system and eventually contaminate the rivers.

Poor sanitation caused by overcrowding also increases algal bloom in the water, especially in undrained outdoor ponds exposed to sunlight. At night or when sunlight is too low for photosynthesis, algae extract oxygen from the water. The fish then have to gulp air on the water surface, hence air gulping is an important indicator of low dissolved oxygen in water. However, long hours of air gulping causes stress and fatigue. After a whole night of oxygen depletion, *en masse* fish die-off typically occurs before sunrise. This condition is known as "early morning mortality". Massive algal die-off due to changing weather can also suffocate fishes because the algal decaying process takes up oxygen from the water.

Poor sanitation increases the amount of nitro-penous waste and causes excessive increase in plankton population, which in turn creates more oxygen demand in competition with the fish stock.



In Malaysia, ornamental fishes are usually bred in earth ponds, concrete ponds and fibre glass tanks. The outdoor ponds are protected by nets to prevent monitor lizards, eagles and other fish-eating wildlife from preying on the fishes. The ponds are filled to no more than 50 cm depth of water to be shallow enough to work in. Breeders claim that shallow ponds enable fishes to be exposed to more sunlight thus producing more intense colours on the body. For example, juvenile goldfishes are dark green in colour and breeders believe that exposure to sun will bring out the intense orange colour on the scales. This approach is widely practiced by breeders of goldfish, Koi and many other colourful species.

In the author's observation (with the exception of Arowana farming), most ornamental fish farms are not equipped with scientific instruments to measure dissolved oxygen, pH and other critical water quality parameters. Thus farmers find it difficult to forecast, control and manage water

quality fluctuations in the ponds and hatcheries. There is a dire need for improved technology to deal with water pollution and other limiting factors.

It is in the genes

Then there is the issue of proper broodstock management. Because physical appearance, coloration and pattern characteristics are the most captivating features of fishes, the industry is obsessed with breeding strains that are more vibrant and colourful. A fish's coloration is determined by its genes with health, water quality, habitat properties and dietary factors having additional effects.

The industry typically classifies fish stock as WC (wild caught), P, F1, F2 and so on. P is the designation for the "parental" individuals used to start a breeding project. The "F" stands for "filial generation" and the number denotes the breeding sequence. An F1 fish is one that was bred from two P individuals which are usually non-sibling WC types.



The dermal chromatophore is the basic colour unit in fishes. It includes melanophores (black, gray and brown), xanthophores (red, orange and yellow) and iridophores which give fishes their iridescence (Khoo *et al.*, 2014).

When two sibling F1 fishes are interbred, the resulting fries are classified as F2. The F2 generation is usually much more variable than the F1 and is a better source for selection of desirable properties than the F1. Interesting results may also be obtained if F1 or F2 fishes are backcrossed to the parents P.

If F2 fishes are allowed to interbreed among themselves with no further external inputs, there may be a decline in health, fecundity etc and such decline is called 'inbreeding depression' for which the cure is to outbreed with other lineages.

It is no secret that the local industry is populated by smallholders who have very little knowledge of genetics. In most cases, the most beautiful and healthiest fishes, which command the highest value are sold off and leftovers are used for breeding. In the worst cases, genetically poor stock is discarded into the rivers where interbreeding with wild stocks may take place, with possible negative genetic impact on wild stocks.

The conservation of wild stocks

There is no control over the release of non-native ornamental fishes into the wild and also no control over the collection of wild specimens.

Native wild species are self-renewable and natural assets for the industry but their survival is affected by over-exploitation and habitat alteration. Some species are exclusively collected from the wild because captive breeding is not always successful for various reasons.



Peat forests and swamps are considered as valueless hinterland in most states. They are often cleared on large scale for agriculture activities and such approach undermines the efforts to conserve endangered fish species.

In some cases such as Arowana (*Scleropages formosus*), Pearl Gourami (*Trichopodus leerii*) and Bala Shark (*Balantiocheilos melanopterus*) where the wild types are almost extinct, captive breeding has become very important for the continued existence of the species.

It is no secret that there is an active but difficult-to-trace wild fish trade among enthusiasts. Pet shops offering exotic and wild types do not appear to be regulated or subjected to surveillance. There are reports of unscrupulous collection techniques such as electrofishing, and the use of sodium cyanide and rotenone to immobilize fishes for collection in the wetlands and rivers.

So far, there is no impact study conducted and the detailed ecological implications of wild type collection are not yet determined. However, as a precautionary principle, specialized laws should be formulated and enforced to conserve wild populations. Also, their niche aquatic habitats should be conserved sensibly. Indeed, Malaysia urgently needs to improve on these matters to ensure that the industry enjoys long term sustainability.

Packed to the gills

Packaging the fishes into bags for air shipping is an interesting science by itself. After fingerlings are painstakingly nurtured to adult size, they are ready for the market. During import/export



All hands on deck—bagging a consignment must be done quickly to reduce turnaround time and mortality rate.

transfers and transits, the fishes are expected to be subjected to injury, extreme fluctuations in water quality, temperature and toxic chemical treatment for disease control. Time is of the essence. A consignment is often hindered by delays in clearing by custom and quarantine procedures and this can result in massive mortalities.

Next, fishes are subjected to starvation for two to three days to minimize or eliminate defecation and regurgitation when they are bagged. This ensures that the water in the bags remains clean from excreta and that dissolved



Bags containing fries contain mostly oxygen and little water to ensure ample oxygen is dissolved into water.

oxygen is not used up by the decomposition process. The fishes are graded, counted and packed in polyethylene bags. Lastly, the bags are placed in an air-conditioned room at 21-23°C for acclimatization to air freight conditions. A lower water temperature also enables more oxygen to be dissolved in the water and reduces the metabolic rate of fishes, thus decreasing ammonia and carbon dioxide which are major metabolic wastes. As a precaution, clinoptilolite and methylene blue are usually added into the water to remove biowaste ammonia and inhibit bacterial growth respectively in the water. Under stress, fish tend to experience osmoregulatory dysfunction and sodium chloride (salt) is added in small amount in the water to reduce the problem.

In Malaysia, the Malaysian Quarantine and Inspection Services (MAQIS) formed under the Ministry of Agriculture and Agro-Based Industry Malaysia is responsible to ensure all imports or exports of ornamental fish in exit and entry points around the country are certified free from epizootic diseases and chemical and biology contaminants. The department is backed by the Fisheries Act 1983 and



This non-native undertified cichlid was found in Malim Nawar wetland, Perak, by the author. This may be an escapee or a discarded specimen.

Enforcement of the Malaysian Quarantine and Inspection Services Act 2011. To qualify as a live fish exporter, a farm has to be licensed by the state Department of Fisheries and Fisheries Development Authority of Malaysia. Currently, the department is particular about screening out Epizootic ulcerative syndrome (EUS), Koi Herpes Virus (KHV), Epizootic haematopoietic necrosis (EHN) and Spring Viraemia of Carp (SVC)(MAQIS, 2012).

Responsible fish-keeping

Suppliers and buyers in the ornamental fish industry must recognize that the wild stock will be critically endangered if ethical collection is

not practiced and the habitats are not conserved. If the states and authorities want to see the multi-million dollar industry flourish, they must begin to protect the habitats and control commercial collection of rare, endemic and endangered species. Genetic diversity of wild types is needed to provide a healthy gene pool for renewal of breeding stocks, without which the industry faces risks of being genetically too narrow and vulnerable to disease and other challenges. Wild resources are critical to the industry. The sustainability of the ornamental fish industry requires responsible keeping of fishes at home, farms and responsible management of the natural ecosystems.



The small puddle where *B. persephone* was found

Princess—but not for long

In April 2016, the author conducted a field study in the peat swamp of Pagoh area, Johor, to assess the effects of El Nino peak dry season on wild fish populations. Many areas were reduced to dry land, and yet, nature was surprisingly resilient.

When the layer of dry leaf litter was dug to about 20 cm deep, water started filling the hole. To the author's amazement, some *Betta persephone* were found in the puddle!

Water pH was 3.78 when measured. However, the tiny *Betta* was unperturbed. It was living in the underground water table beneath the leaf-litter, and patiently waiting for the wet season to arrive.

B. persephone is native to Malaysia and it belongs the *Betta* genus which hosts a number of captivating fighting fish species. *B. persephone* is classified as Critically Endangered (CR) under the IUCN Red List and can only be found in the peat forest of West Johor. The species is named after Persephone, the daughter of Zeus in Greek mythology She rules the underworld and often depicted as the Princess of Darkness. Naturally, Persephone is an apt name for a fish that lives underground, mostly in total darkness. However, its days may be numbered as its habitat is being taken over by oil palm estates.



Betta persephone is small and the adult size is only about 3cm, but it is just as fiery as any other fighting fish. Its last known habitat, in peatswamp forest in Pagoh, Johor is under severe threat from expansion of oil palm plantation.
 Photo credit: Zahar A. Zakaria

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