

# FRESH WATER ORNAMENTAL FISH CULTURE AND MANAGEMENT

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Scheduled Caste Sub Plan, Govt. of India



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# Preface

**A**quarium fish/ornamental fish keeping is a popular hobby, growing interest in which has resulted in steady expansion in its trade in more than 125 countries. Majority of the ornamental fish is collected from developing countries in the tropics and sub tropics. About 2500 species are involved in the global ornamental fish industry, of which over 60% are of freshwater origin and about 30 freshwater fish species dominate the global market, such as live bearers, neon tetra, angel fish, gold fish, zebra danio and discus. The guppy and neon tetra species alone contribute more than 25% of the market by volume and greater than 14% of total value.

Since, this century, the exports of ornamental fish increase steadily from US\$177.7 million to a peak of US\$364.9 million in 2011, then declining slightly to US\$347.5 million in 2014. The aquarium fish trade has always been linked to the state of the national economy. About 90% of the freshwater ornamental fish exported from India are wild caught indigenous species. The Western Ghats of India is one of the 34 – biodiversity ‘hotspot’ areas of the world.

The countries namely Singapore, USA, China, Hong Kong, Malaysia and Japan were accounted for about 70% of the total export of ornamental fish from India. India is one of the top ten mega-diverse countries of the world in terms of fish diversity. Indian ornamental fish export accounted for about US\$ 1.06 million in 2016 and India occupied the 31<sup>st</sup> position globally. The Middle East and Asia are coming up as interesting markets for the aquarium industry. India occupies a significant position in world fisheries. Ornamental fish production is especially high owing to the trainings, subsidies and assistance provided by public institutions in India, and also in response to the strong demand and attractive prices in the country for these fish.

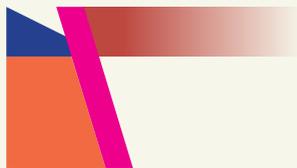
Home aquaria have shifted from traditional glass tanks to imported moulded aquaria, sleek wall-mounted plasma aquaria, nano aquaria etc. There is increasing demand for aquaria in hotels, hospitals, airports, banks etc., there are more and more ornamental fish exhibitions being held, and big and small public aquaria are being opened in many parts of the country. Outlets of product lines like ornamental fishes, aquatic plants, aquaria, equipment, accessories, feeds, medicines etc., are increasing. The bigger and more colourful species have greater demand in India. Initially, ornamental fish production and trade was highly concentrated in four states i.e. West Bengal, Tamilnadu, Maharashtra and Kerala, which supplied other States and Karnataka state also adjoined.

This technical bulletin will be able to share valid information on the scope, challenges and basic requirements of ornamental fish keeping, which will enable the hobbyists to make the fish keeping more scientific and interesting.

*Authors*

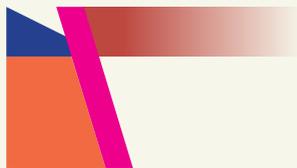
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## INTRODUCTION

Ornamental fish keeping is the second most popular hobby in the world next to photography (Das et al. 2005; Singh & Ahmed, 2005). Ornamental fishes can be kept in confined spaces like an aquarium or garden pond with the purpose of enjoying their beauty (Mukherjee et al. 2000). About 90% of the freshwater ornamental fish exported from India are wild caught indigenous species (Silas et al. 2011). The Western Ghats of India is one of the 34 – biodiversity ‘hotspot’ regions of the world. In the Western Ghats, of the 300 freshwater fish species, 155 are considered ornamental fishes, of which 117 are endemic to the Western Ghats (Gopalakrishnan and Ponniah 2000). Indian ornamental fish export accounted for about US\$ 0.24 million in 1991 and US\$ 2.10 million in 2008. The share of ornamental fish exports to the total value of Indian fisheries export has increased from 0.04% in 1991 to 0.15% in 2008. The growth rate of world ornamental fish exports during 1991 – 2009 was 6.1% in value, 15.5% in terms of quantity and diminished by 8.1% in unit value. Indian ornamental fish export registered a higher positive growth rate of 14.4% in terms of export value, a lower growth rate of 12.1% in terms of quantity exported and a higher growth rate of about 2.1% in terms of unit value (Rani et al. 2013). The countries namely Singapore, USA, China, Hong Kong, Malaysia and Japan were accounted for about 70% of the total export of ornamental fish from India (Rani et al. 2014). India is one of the top ten mega-diverse countries of the world in terms of fish diversity (Mittermeier et al., 1997). Asia is the home of 3500 fishes (Kottelat and Whitten, 1996). The Asian region provides about 60% of the marine and freshwater ornamental fishes in global trade (INFOFISH, 2016). The massive chunk of the trade, say 90%, is supported mainly by freshwater ornamental fishes and the rest from marine fishes (Tissera, 2010). Indian ornamental fish export accounted for about US\$ 1.06 million in 2016 and India occupied the 31<sup>st</sup> position globally. Developing technology for breeding, seed production and culture of ornamental fishes in suitable localities is an essential requirement for the development of the sectors (Murty, 1995).



## AQUARIUM FABRICATION AND MANAGEMENT FOR FRESHWATER FISHES

**A**quarium, the receptacle for maintaining aquatic organisms, either freshwater or marine, or a facility in which a collection of aquatic organisms is displayed or studied. The earliest known aquarists were the Sumerians, who kept fishes in artificial ponds at least 4,500 years ago. The first display aquarium was opened to the public in 1853 at Regent's Park in London. It was followed by aquariums in Berlin, Naples, and Paris. P.T. Barnum, the circus entrepreneur, recognized the commercial possibilities of living aquatic animals. In 1856, the first display aquarium was opened at the American Museum in New York City as a private enterprise. A freshwater glass aquarium contained *Vallisneria spiralis* (eelgrass) and goldfish, from *The Book of the Aquarium and Water Cabinet* (Shirley Hibberd, 1856).

By 1928, there were 45 public or commercial aquariums throughout the world. After II World War the growth declined and few public aquariums were established. In India, the concept of aquarium and aquarium fish keeping has been a practice since long ago, popularised mainly by the Britishers through the inclusion of exotic varieties. Today, many homes and public arenas have aquaria made not only of glass but also of Perspex or Plexiglas (Kutz, 2002).

### **Fabrication of aquarium tank:**

Essential factors for tank construction are the size and shape of the tank, thickness of the glass, the volume of water, and the density of fish that it holds.

### **Size of the aquarium:**

The minimum considerable size of an aquarium is 60 x 30 x 30 (LxBxH). When size of an aquarium considered, the fish requirements should be kept in mind as there are some fishes, which live in small pools and are much more at home in aquariums of about 30 cm wide. Standard aquarium sizes usually range from 45 x 25 x 25 cm, 60 x 30 x 30 cm (Pandey and Shukla 2005; Esther 1998).



### Standard rectangular shaped aquarium dimensions:

Length (cm)	Breadth (cm)	Height (cm)	Capacity (L)	Glass thickness (mm)
60	30	30	54	4
90	30	38	103	5
120	30	45	162	6
150	45	60	405	10
180	45	60	486	12

Fish stocking density in aquarium: Should keep the fish as low density, it should not over crowd, for number of fish keeping to aquarium purpose use the formula:

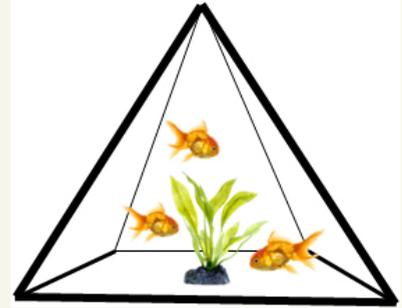
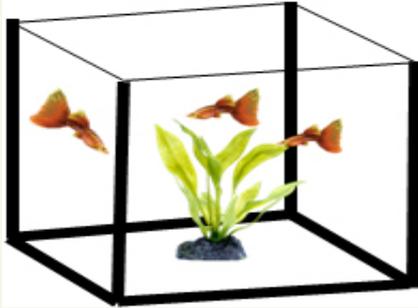
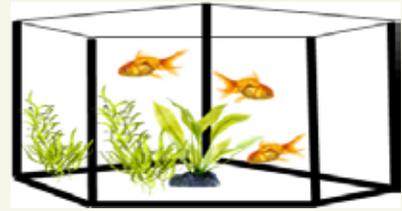
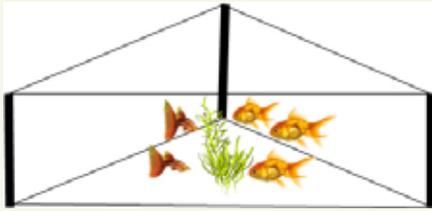
Stocking density (numbers) = (Length of Aquarium (cm) x Breadth of Aquarium (cm))/20



Rectangular Aquarium

### Shape of the aquariums:

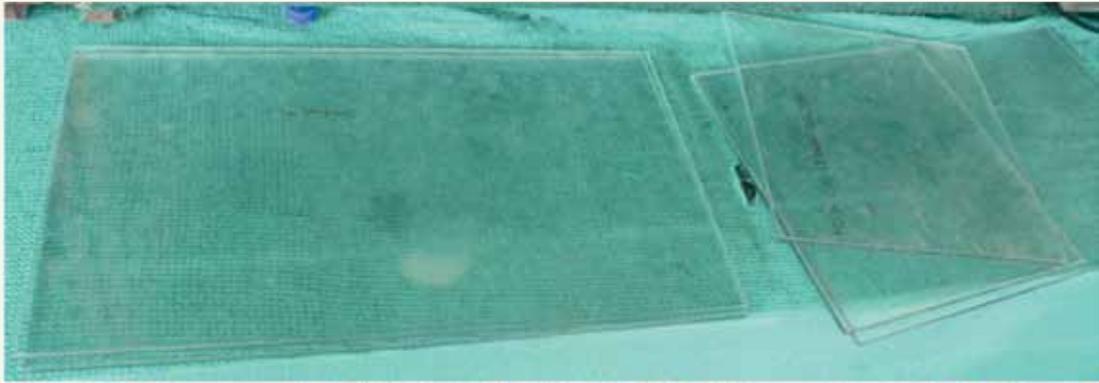
In addition to the traditional rectangular aquarium, aquariums are made in different shapes such as square, triangle, rectangle, hexagonal, trapezoid, global, pyramid shaped, etc. However, every fish species cannot be kept in all types of aquariums.



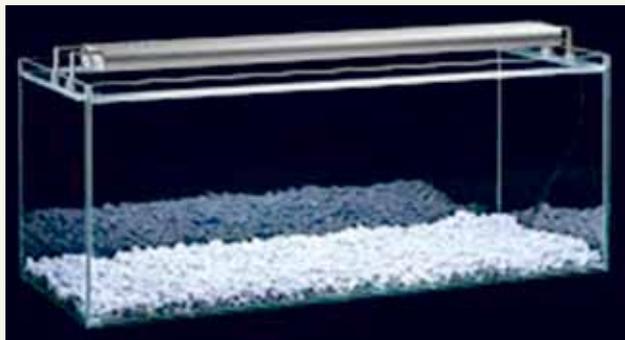
### Important Aquarium Accessories:

1. Glass: Glass panels of required size are cut and cleaned- 4 side panels and 1 base panel. Photos of panels.
2. Composts: An aquarium composts is the gravel (small stones, pebbles (3-5 mm) and some sand) placed at the bottom of the tank there plants can be grown. Composts must be washed well before use.





3. Lighting arrangement: Aquarium lamps about 25w (240v) fluorescent white tube is suitable for 48"x18"x12" aquarium which would be fixed above the water surface leaving a gap 4-6 inches. Light is a stimuli for plant growth (photosynthesis). At least 10-12hr of light period is needed. The most popular- fluorescent lamp and compact fluorescent lamp- gives a cool and effective illumination. Imported aquarium lamps (Gro-lux) - enhance the colour of fishes. Lamp always fitted in the hood - so no shade falls on the viewing side. Necessary to give a ventilation to minimize the build-up of heat in the aquarium.



4. **Thermometers:** The Thermometer is very important accessory especially for tropical fishes. Aquarium fishes need optimum temperature to prevent biological oxygen demand and susceptibility to diseases. The thermometer is magnate to the glass surface inside the aquarium and can be read through the transparent glass or Perspex.
5. **Heater-stats (Heaters with thermostats):** Tropical Freshwater fishes are warm water fish. These fish cannot survive in cold waters. For that temperature range should be 18 °C - 29 °C depending upon the species. A heater aids in controlling the temperature of the aquarium by raising it to the desired temperature range, regulated by its thermostat. This instrument is partly submerged or fully immersed in the aquarium.



6. **Aerators:** The aquarium aerator is made up of air tubes and joints, controller and a power source. Aerators are used in aquarium to increase the oxygen content and remove excess carbon dioxide. Aerator must be kept above the water level in order to prevent back sucking of water if the power supply fails.
7. **Filters:** For water quality maintenance, mainly using mechanical, chemical, biological filters.

**Mechanical:** Water passes through a filtration material like filter wool. Generally this is the first stage of filtration process; here filter medium is filter wool, to sieve particulate waste from the aquarium water. In the mechanical filtration system the waste (excess feed, fish excretion, decayed plant material and other debris) from the aquarium water is physically trapped by the fibrous structure of filter wool, then which can be removed. Mechanical filter media must be washed or replaced on a regular basis.

**Biological:** Water passed through a filter bed and bacteria convert toxic ammonia to less toxic nitrates. The breakdown of the waste from the aquarium water by beneficial bacteria (in nitrogen cycle, in nitrification process, ammonia molecules are oxidized, in this reaction first production is Nitrite (NO<sub>2</sub>) and the second one is Nitrate (NO<sub>3</sub>); The ammonia is converted to nitrite caused by the genera, *Nitrosomonas*, *Nitrosococcus*, *Nitrospira* and *Nitrosolobus* bacteria, then nitrite is converted to nitrate caused by the genera, *Nitrobacter*, *Nitrococcus*, *Nitrospina* and *Nitrospira* bacteria). These beneficial bacteria multiply in the media such as foam sponge and in the substrate.



Handy aquarium filter

External Hang on Canister Filter

Hang on back filter

**Chemical:** water filters through activated carbon (charcoal). This activated carbon is eliminating the dissolved wastes from the aquarium water. Unfortunately this process also neutralizes some medical treatments.

Other types of filters commonly used by aquarist are: under gravel filters and reverse flow filters. Filters the water with magic jet power filter is used to maintain good quality water in an aquarium. This device, filters the water by mechanically, chemical and biologically.

- Hood (cover) and Stand:** Aquarium hood prevents the dust, fishes from jumping out, reduce heat loss and evaporation, it may take the form of a plain



glass sheet, plywood or metal-hood and also improves the aesthetic beauty of the unit. The stand should be firm and capable of the weight of full tank-gravel, water and accessories. Stand made of wood or metal (Iron, steel).

9. **Aquarium Plants:** Aquarium plants are making a natural appearance and provide oxygen in the aquarium. These aquarium plants are useful as shelter, food to aquarium fishes and also the best environment for fish spawning. The plant can be Surface /free floating plants (*Lemna sp.*, *Pistia sp.*, *Salvinia sp.*, *Riccia sp.*, *Azollapinnata* (mosquito fern), *Eichhornia* or Rootless submerged plants: *Ceratophyllum sp.*, *Myriophyllum sp.*, *Nitella sp.*, *Cabomba sp.*, *Limnophila sp.*, *Hygrophila sp.* or Rooted submerged plants: *Vallisneria sp.*, *Hydrilla sp.*, *Najas sp.*, *Potamogeton sp.*, *Cryptocoryne sp.*, *Sagittaria sp.*



*Cryptocorine spiralis*



*Hygrophilla difformis*



*Ludwigia sedioides*



*Hydrilla verticillata*

## FRESHWATER ORNAMENTAL FISHES



*Pethia setani* (Narayan Barb)



*Haludaria pradhani* (Melon barb)



*Pethia ticto* (Ticto barb)



*Carinotetraodon travancoricus*  
(Malabar pufferfish)



*Danio rerio* (Zebra Danio)



*Danio malabaricus* (Malabar danio)



*Devario aequipinnatus* (Giant Danio)



*Rasbora dandia* (Black line Rasbora)



***Garra mullya*** (Sucker fish)



***Dawkinsia filamentosa*** (Blackspot barb)



***Aplocheilus lineatus*** (Striped panchax)



***Lepidocephalichthys guntea*** (Guntea loach)



***Mystus malabaricus*** (Jerdon's Mystus)



***Puntius vittatus*** (Green stripe barb)



***Lepidocephalichthys thermalis***  
(Common soiny loach)



***Puntius mahecola*** (Mahecola barb)





*Osteochilus nashii* (Nash's barb)



*Channa gachua* (Dwarf snakehead)



*Channa marulius* (Great snakehead)



*Xenentodon cancila* (Freshwater garfish)



*Etroplus maculatus* (Orange chromide)



*Ompok goae* (Butter catfish/Goan catfish)



*Glyptothorax lonah* (Mountain catfish)

## COMMON ORNAMENTAL FISHES



*Atractosteus spatula* (Alligator gar)



*Osteoglossum bicirrhosum* (Arowana)



*Serrasalmus rhombeus* (Pirahna)



*Piaractus brachypomus* (White pacu)



*Astronotus ocellatus* (Oscar)



*Betta splendens* (Fighting fish)



*Pterophyllum scalare* (Angelfish)



*Horabagrus brachysoma* (Gunther's catfish)



***Potamotrygon leopoldi* (white-blotched stingray)**



***Cyprinus rubrofuscus* (koi carp)**



***Phractocephalus hemiliopterus* (red-tail catfish)**



***Heros severus* (Golden severum)**



***Monodactylus argenteus* (Silver moony)**



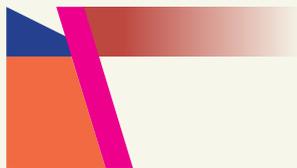
***Carassius auratus* (Gold fish)**



***Poecilia sphenops* (Molly)**



***Poecilia reticulata* (Guppy)**



## NUTRITION AND FEEDING

Nutrients essential to fish, include water, proteins (amino acids), lipids (fats, oils, fatty acids, carbohydrates (sugars, starch), vitamins, minerals and other supplementary additives such as probiotics and prebiotics. In their natural environment, fish have developed a wide range of feeding colaptation (behavioural, morphological and physiological) to acquire essential nutrients and utilize varied food sources. Feeding habit of the fish vary such as carnivorous, herbivorous, omnivorous and also there is enormous diversity in their feeding patterns. Some species are surface feeders, and others are column and bottom feeders. Diets for aquatic animals can only be effective if they are formulated to contain the full array of necessary nutrients at appropriate concentrations relative to each other along with appropriate factors inducing rapid consumption on a consistent base. (Conklin and Piedrahita, 2003).

Generally, the first portion of the digestive system in fish is the mouth. The positioning of the mouth is critical. Most carnivorous fishes (*Astronotus sp.* or Oscar cichlid) have a terminal mouth. Suckers and some other bottom feeders (catfishes) have subterminal mouths. Some species of fish have teeth. The teeth of fish are generally adapted for performing specialized functions. Predatory catfish will, for instance, have small sharp pointed teeth (Berg, 2005). The digestive process differs in different fish species, but there are elements common to many fishes, and these could serve as a basis for estimating general parameters of digestion. A well-known and widespread relationship is the dependence of oxygen consumption rate on weight and temperature (Tseitlin, 1980). Some fishes depend on natural feed (sturgeon fish) (Yousefian et al., 2010) and some thrive on formulated artificial feed. Fish feeds contain macronutrients, trace elements and vitamins necessary to keep captive fish in good health. Feeding ornamental fish is more critical compared to pond fish due to the limitation of space and lack of natural food. To make the aquarium similar to their habit: adjusting the temperature, light, salinity, oxygen, pH and hardness and filling with plants, the fish might feed the natural system and take the food. In ornamental fish, a correct formulation of the diet improves the nutrient digestibility, supply the metabolic needs and reducing the maintenance cost and at the same time the water pollution (Yohana and Wilson 2011).

## Characteristics of fish feed:

Flavour and taste, sound, smell, colour and buoyancy of food are the primary factors influencing the feeding of ornamental fishes.

**Flavour and taste:** Smell can be detected by the specific anatomical receptors in fish, but the flavour has to be dissolved in water for the fish to locate it. Some fish have receptors in their mouths, or on the head or lips. Some even have taste receptors on their skin. These receptors carry messages to the brain and tell the fish to swim towards the food (Berg, 2005). Fish are governed by olfactory senses and taste buds. The food should be available with a pleasant flavour and good taste for fish (Yousefian et al., 2012).

**Sound:** Fishes are routine in their feeding activity that they start grouping when they hear sounds that usually precede feeding (Berg, 2005).

**Smell:** In nature, fish needs to be able to identify their food and also their mates through the sense of smell. So, many fish species have nostrils that help them to identify the various things they come across. These sensors thus help the fishes to find their food (Berg, 2005).

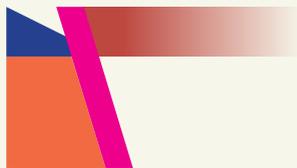
**Colour and buoyancy of food:** Fishmeal has a yellow-brown, russet, off-white or dusty colour and few are white. Fishmeal has slight differences in appearances and smells according to its type. The moisture should be within 10% to ensure its storage and use it safely. The buoyancy of fish meal depends on the fish in the aquarium. Bottom feeder and most tropical fish prefer to take the food when it sinks to the bottom (Yousefian et al. 2012).



Floating pellet



Sinking feed



## NUTRITIONAL REQUIREMENTS OF ORNAMENTAL FISH

Ornamental fish have the same nutritional requirements as foodfish except for the fact that the growth of ornamental fishes is not much focussed. Prepared of complete artificial diets supply all the ingredients of protein, fats, carbohydrates, vitamins, minerals and trace element, necessary for the optimal growth, reproduction and health of the fish. Most fish use complete diets, those containing all the required protein (15-50%), lipid (10-25%), carbohydrate (10-25%), ash (5-10%) and in addition about 5 percent other material such as trace element, vitamins, minerals, supplementary and complement (probiotic, prebiotic and enzymes). The nutritional value of a dietary ingredient is in part dependant on its ability to supply energy. Physiological fuel values are used to calculate and balance available energy values in prepared diets. They typically average 4, 4, and 9 kcal/g for protein, carbohydrate and lipid, respectively (Craig and Helfrich, 2009). The efficiency of nutrient use by ornamental fish can contribute to the formulation of appropriate diets, as well as helping to decrease the elimination of nitrogen and phosphorus in excreta, thereby favouring the maintenance of the water quality and reducing environmental pollution caused by effluence (Zuanon and Salaro 2011). Protein requirements for ornamental fish species vary with feeding behaviour, and they can be supplied through varied sources as described below:

- a. Herbivorous and omnivorous juveniles, grower and brood stock: 30-40 % (soybean meal, mustard meal, groundnut meal, wheat gluten)
- b. Carnivorous (e.g. cichlids): Above 45 % (Fish meal, squid meal, shrimp meal, clam me)
- c. Larval stages (most of the species): Above 50 % (natural/live feed)

### **Suitable feed for ornamental fishes regarding their feeding habitat:**

- a. Surface feeders: Dry mash/meal
- b. Column feeders: Mixture of dry/moist feed
- c. Bottom feeders: Moist / wet / paste feed

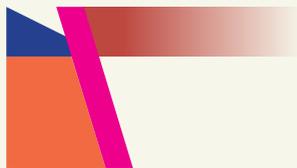
### Percentage nutrient requirement of a fish at young and brood stock stages:

Nutrients	Proteins	Lipids	Carbohydrates	Vitamin-mineral
Young	40-45	4-6	40-45	1-2
Brood stock	30-40	6-8	40-45	1-2
Sources	Fish meal, squid meal, shrimp meal, clam meat, soybean meal, mustard meal, groundnut meal, wheat/maize gluten or live feed	Fish oil, vegetable oil (sunflower, linseed, etc.)	Corn flour, rice bran, wheat bran	Synthetic forms

### Use of natural carotenoids for pigmentation in fishes:

Pigmentation is one of the critical quality attributes of the fish for consumer acceptability. One of the most significant challenges in the ornamental fish industry is to replicate the accurate natural colour of the fish in the captive environment. Carotenoids are responsible for pigmentation of muscle in food fish and skin colour in ornamental fish. Dietary supply of carotenoids can improve the skin colour as well as the market value of ornamental fishes. Carotenoids commonly occurring in fishes with their colours are tunaxanthin (yellow), lutein (greenish-yellow), beta-carotene (orange), alpha, betadoradexanthins (yellow), zeaxanthin (yellow-orange), canthaxanthin (orangered), astaxanthin (red), echinenone (red) and taraxanthin (yellow). Sources of natural carotenoids: can be Algae, zooplankton, tubifex, chironomid larvae, artemia, crayfish meal, shrimp meal, crab meal, yeast, or plant origin sources such as flowers and vegetables. Synthetic carotenoids: Astaxanthin,  $\beta$ -carotene, lutein, zeaxanthin, etc. are few of the commercially available carotenoids (Gupta et al. 2006).





## ORNAMENTAL FISH DISEASES AND MANAGEMENT

**D**isease is one of the critical limiting factors that hinder the development of ornamental fish culture. Due to diseases, 50% – 100 % of ornamental fishes have been lost in culture systems annually. The control of disease is very complex and often it is very difficult. Diagnosis of the infection and identification of factors affecting the infection are critical. The identification of life stages and life cycle strategies are also very important. Generally, the diseases of aquatic animals are extremely difficult to control and prevention is better than cure. Prevention is often related to control of the environment and management of the culture system involving the following important aspects. Stress is the major disease-causing factor for ornamental fish, which is due to inadequate or incorrect feeding practice, inadequate habitat conditions, and overcrowding. Long-term exposure to stress has a profound effect on the fish's wellbeing. Stress reduces the growth, reproductive ability, immune response, and alter the blood chemistry in fish. The major symptoms showed by the diseased fish are abnormal swimming, wandering movement, drooping dorsal and anal fins, staying isolated, scratching of body in hard substratum, cloudy or exophthalmic eyes, discoloration and cloudy patches on the skin, loss of appetite, and excessive mucus, etc.

The fish diseases are broadly classified into communicable diseases (caused by microbes and parasites), non-communicable diseases (caused by environmental, nutritional and genetic factors and certain conditions of unknown causes) and neoplastic diseases (tumors and cancers). Generally, microbial diseases are symptomatic and if identified properly, it can be controlled using antibiotics. In parasitic diseases, specific symptoms may not be there and are very difficult to control.



## Freshwater ornamental fish diseases

Protozoan Diseases					
Disease Name	Commonly Affected fish	Causative agent	Symptoms	Treatment	References
<i>Chilodonella</i> sp. infestation ( <i>Chilodonella punctatus</i> , disease)	Freshwater tropical ornamental fishes. Channel catfish ( <i>Ictalurus punctatus</i> ), goldfish ( <i>Carassius auratus</i> ).	<i>Chilodonellapiscicola</i> , <i>C. hexasticha</i>	Attacks skin and gills of the fish, easy to identify by microscopically its heart-shaped structure and slow circular motion.	Formaldehyde, malachite green or salt treatment.	Lewbart 2001; Padua et al. 2013 <a href="http://www.pondstarsuk.com/wp-content/uploads/2016/09/chilodonella-piscicola.jpg">http://www.pondstarsuk.com/wp-content/uploads/2016/09/chilodonella-piscicola.jpg</a> ; <a href="https://fishpathogens.net/pathogen/chilodonella">https://fishpathogens.net/pathogen/chilodonella</a>
<i>Epistylis</i> sp. (Heteropolaria) (Red sore disease)	Oscars, cichlids and gold fishes. Commonly in catfishes. Skin lesion gold fish	Branched stalked ciliated protozoan, <i>Heteropolaria</i> .	Ulcers or Cotton-like growth on the skin, red coloured lesion on scales and spine.	Formaldehyde treatment, Clean well-filtered tank is the best solution.	Lewbart 2001; Sharma et al. 2012. <a href="https://www.google.com/search?q=Epistylis+(heteropolaria)+pdf&amp;aq=chrome..69j57.42513j0j7&amp;client=ms-android-xiaomi&amp;sourceid=chrome-mobile&amp;ie=UTF-8#sfbu=1">https://www.google.com/search?q=Epistylis+(heteropolaria)+pdf&amp;aq=chrome..69j57.42513j0j7&amp;client=ms-android-xiaomi&amp;sourceid=chrome-mobile&amp;ie=UTF-8#sfbu=1</a> Moyses et al. 2015 ( <a href="http://www.scielo.br/pdf/rbpv/v24n3/1984-2961-rbpv-24-3-283.pdf">http://www.scielo.br/pdf/rbpv/v24n3/1984-2961-rbpv-24-3-283.pdf</a> )
Hexamita (Spiroucleus)	Freshwater tropical ornamental fishes.	Flagellated protozoa.	Severe gastrointestinal disease. It is an ectoparasite causing head and lateral line erosion.	Effective treatment with metronidazole.	Lewbart 2001. <a href="https://www.jbl.de/en/blog/detail/247">https://www.jbl.de/en/blog/detail/247</a> ; <a href="https://agrificedn.tamu.edu/fisheries/files/2013/09/Introduction-to-Freshwater-Fish-Parasites.pdf">https://agrificedn.tamu.edu/fisheries/files/2013/09/Introduction-to-Freshwater-Fish-Parasites.pdf</a>

Costiasis	Most common in major carps and freshwater aquarium fishes.	A flagellated protozoal ectoparasite. Mastigophoran parasites <i>Costia necatrix</i> , <i>Bodomonas</i> spp., <i>Trypanopneustes</i> .	A bluish coating on the skin of the fish and presence of a large amount of mucus.	Formaldehyde, malachite green treatment.	Lewbart, 2001. Sharma et al. 2012. <a href="https://link.springer.com/reference/workentry/10.1007/978-3-642-27769-6_714-2">https://link.springer.com/reference/workentry/10.1007/978-3-642-27769-6_714-2</a> ; <a href="http://www.fishbase.org/diseases/diseasessummary2.php?discode=29">http://www.fishbase.org/diseases/diseasessummary2.php?discode=29</a> ; <a href="http://www.fishbase.org/Diseases/DispicSummary.php?pic=CostiaDa.jpg&amp;notcom=">http://www.fishbase.org/Diseases/DispicSummary.php?pic=CostiaDa.jpg&amp;notcom=</a> ; Lewbart 2001. Sharma et al. 2012. <a href="https://en.wikipedia.org/wiki/Ichthyophthirius_multifiliis#/media/File:Ichthyophthiriasis.jpg">https://en.wikipedia.org/wiki/Ichthyophthirius_multifiliis#/media/File:Ichthyophthiriasis.jpg</a> ; <a href="https://en.wikipedia.org/wiki/Ichthyophthirius_multifiliis#/media/File:Ichthyophthirius_multifiliis.jpg">https://en.wikipedia.org/wiki/Ichthyophthirius_multifiliis#/media/File:Ichthyophthirius_multifiliis.jpg</a> ; Sharma et al. 2012. <a href="https://www.adfg.alaska.gov&gt;fishdiseases">https://www.adfg.alaska.gov&gt;fishdiseases</a> ; <a href="http://article.sciencepublishinggroup.com/html/10.11648.j.ajls.2015030601.15.html">http://article.sciencepublishinggroup.com/html/10.11648.j.ajls.2015030601.15.html</a>
Ichthyophthiriasis (Ich):	Most common in fresh water tropical ornamental fishes.	Trophozoites. Protozoan ciliate, <i>Ichthyophthirius multifiliis</i> .	Whitish cysts on the skin, gills and fins.	Prevention is the best method. Although formaldehyde, malachite green treatment.	Lewbart 2001. Sharma et al. 2012. <a href="https://en.wikipedia.org/wiki/Ichthyophthirius_multifiliis#/media/File:Ichthyophthiriasis.jpg">https://en.wikipedia.org/wiki/Ichthyophthirius_multifiliis#/media/File:Ichthyophthiriasis.jpg</a> ; <a href="https://en.wikipedia.org/wiki/Ichthyophthirius_multifiliis#/media/File:Ichthyophthirius_multifiliis.jpg">https://en.wikipedia.org/wiki/Ichthyophthirius_multifiliis#/media/File:Ichthyophthirius_multifiliis.jpg</a> ; Sharma et al. 2012. <a href="https://www.adfg.alaska.gov&gt;fishdiseases">https://www.adfg.alaska.gov&gt;fishdiseases</a> ; <a href="http://article.sciencepublishinggroup.com/html/10.11648.j.ajls.2015030601.15.html">http://article.sciencepublishinggroup.com/html/10.11648.j.ajls.2015030601.15.html</a>
Trichodiniasis	Freshwater and salt water fishes.	A group of peritrichal ciliated protozoans like	White to bluish haze on the skin and increasing the mucous production. On the skin may develop ulcers and the fins may fray.	The chelated copper compounds, like Argant and Aquavet are effective for the protozoan parasite.	Sharma et al. 2012. <a href="https://www.adfg.alaska.gov&gt;fishdiseases">https://www.adfg.alaska.gov&gt;fishdiseases</a> ; <a href="http://article.sciencepublishinggroup.com/html/10.11648.j.ajls.2015030601.15.html">http://article.sciencepublishinggroup.com/html/10.11648.j.ajls.2015030601.15.html</a>
Tetrahy-meniasis (Guppy killer disease)	Mostly guppies, fresh water tropical ornamental fishes.	<i>Tetrahymanacorlissi</i> , possibly <i>Chilodonella</i> sp.	Raised scales, epithelial sloughing, Small white spots (1mm) in the skin and musculature of the fish, and a loss of equilibrium.	Prevention is the best method.	Hoffman et al. 1975; Lewbart, 2001. <a href="http://ufdcimages.uflib.ufl.edu/UF/E0/04/51/16/00001/SRIWANAYOS.Ppdf">http://ufdcimages.uflib.ufl.edu/UF/E0/04/51/16/00001/SRIWANAYOS.Ppdf</a>

Myxosporidiosis	Freshwater Fishes	The common myxosporidia genera are <i>Leptotheca</i> , <i>Chloromyxum</i> , <i>Henneguya</i> , <i>Thelohanellus</i> , <i>Myxidium</i> , <i>Leptospermum</i> , etc.	Fish weakness, emaciation, raising of the scales along their posterior margins, falling of scales, etc.	Disinfect aquarium and equipment on a regular basis. Use formaldehyde for targeting of free swimming spore stages.	Sharma et al. 2012; Read et al. 2007.  <a href="http://www.bvmj.bu.edu.eg/issues/25-2/32.pdf">http://www.bvmj.bu.edu.eg/issues/25-2/32.pdf</a> ; <a href="http://nexusacademicpublishers.com/uploads/files/Nexus_447.pdf">http://nexusacademicpublishers.com/uploads/files/Nexus_447.pdf</a>
<b>Bacterial Diseases</b>					
Furunculosis (Fin Rot)	Siamese fighting fish, Mollies, Goldfish and other cyprinids.	<i>Aeromonas salmonicida</i>	Ulceration of skin, distended abdomen, and inflamed fins and fin bases, fin rot	Use antibiotics and chemicals at different doses. In case of serious infection mainly in brooder fishes, the affected parts of fins are removed surgically, and the wound is disinfected by washing with 1 % solution of Silver nitrate followed by keeping fish into a solution of $K_2Cr_2O_7$ (1:25000) for recovering of a wound for 7days. Vaccination (bacterin).	Idowu et al. 2017; <a href="https://articles.extension.org/sites/default/files/w/b/b7/Furunculosis.pdf">https://articles.extension.org/sites/default/files/w/b/b7/Furunculosis.pdf</a> ;  <a href="https://www.researchgate.net/profile/Gokhlesh_Kumar/publication/301536167-Aeromonas_salmonicida_Update_online_links/5762844c08aefc1f664c1a09/Aeromonas_salmonicida-Updates-on-an-old-acquaintance.pdf?origin=publication_detail">https://www.researchgate.net/profile/Gokhlesh_Kumar/publication/301536167-Aeromonas_salmonicida_Update_online_links/5762844c08aefc1f664c1a09/Aeromonas_salmonicida-Updates-on-an-old-acquaintance.pdf?origin=publication_detail</a>
Dropsy or Pine cone disease	Gold fish, Rosybarb, Molly, Gourami & Cyprinus carpio (koj) Dropsy disease in gold fish	<i>Aeromonas species</i> and <i>Pseudomonas species</i>	Abdominal distension (ascites) and cutaneous oedema of fish is the common symptom. The belly of fish. Distends considerably and its scales protruded outward giving a pine-cone appearance.	The affected fishes could be effectively treated by Terramycin in the feed.	Wildgoose 1998;  <a href="https://en.wikipedia.org/wiki/Dropsy_(fish_disease)#/media/File:Hydropsis.jpg">https://en.wikipedia.org/wiki/Dropsy_(fish_disease)#/media/File:Hydropsis.jpg</a> ; <a href="https://en.wikipedia.org/wiki/Pseudomonas">https://en.wikipedia.org/wiki/Pseudomonas</a>

Columnaris	Goldfish, Barbs, Mollies and Sword Tails	<i>Flexibacter columnaris</i>	Anorexia, whitish plaques eroding the affected area (mouth, body surface, fin, gills), orange Lesions.	Antibiotic medications and disinfect the aquarium	Idowu et al. 2017
Exophthalmia or pop eye disease	Gold fish, Barbs, Angel fish, Mollies and Sword Tails	<i>Diplostomum spathaceum</i> or 'eye fluke' and parasitic copepod <i>Omatokoita elongate</i>	Bulging of one or both eyes	OTC medication may be work effectively.	<a href="http://www.wetwebmedia.com/fwsubwebindex/fwpopyeafaqs.htm">http://www.wetwebmedia.com/fwsubwebindex/fwpopyeafaqs.htm</a> ; <a href="https://onlinelibrary.wiley.com/doi/pdf/10.1046/j.1365-2761.1998.00122.x">https://onlinelibrary.wiley.com/doi/pdf/10.1046/j.1365-2761.1998.00122.x</a>
Necrotizing granuloma-like tuberculosis	Tropical ornamental fishes Abdominal distention, aemorrhages on the skin, scale loss, faded pigmentation and in viscera white coloured, different sized granulomas in gold fish.	<i>Mycobacterium sp.</i> Numerous granulomas with eosinophilic necrotic centers (H&E stain) in Histological section of the kidney of a gold fish.	Uncoordinated swimming, abdominal swelling, loss of weight, skin ulceration, white nodule formation as granuloma in liver, kidney, spleen in both fresh and marine water fish	May need the destruction of all affected stocks and disinfecting the holding tanks and plumbing. Ethanol, lysol and sodium chlorite have been reported efficiently capable of destroying <i>M. marinum</i> in aquaria, while potassium peroxy monosulfate is ineffective.	Hashish et al. 2018. <a href="https://www.google.com/search?q=Necrotizing+granuloma+like+tuberculosis+in+freshwater+r+ornamental+fishes&amp;ei=dFWSXMfdCl_79QOW4Z3IBg&amp;start=10&amp;sa=N&amp;ved=0ahUKEwjH562D_pDhA_hWPFx0KHZZwB2kQ8tMDCH8&amp;biw=1455&amp;bih=717">https://www.google.com/search?q=Necrotizing+granuloma+like+tuberculosis+in+freshwater+r+ornamental+fishes&amp;ei=dFWSXMfdCl_79QOW4Z3IBg&amp;start=10&amp;sa=N&amp;ved=0ahUKEwjH562D_pDhA_hWPFx0KHZZwB2kQ8tMDCH8&amp;biw=1455&amp;bih=717</a>
<b>Fungal Diseases</b>					
Saprolegniasis (Cotton wool disease)	All ornamental fishes mostly in Gold fishes Skin lesion on fish due to Saprolegnia fungus	<i>Aphanomyces slaevis</i> , <i>Aspergillus niger</i> and <i>Saprolegnia parasitica</i>	Epidermal tissues and produce clumps of hyphal strands that project outwards from the infection site resembling cotton wool like growth on fish radiating out	Antibiotic medications, External disinfectant treatments, Copper sulphate treatment.	Chauhan et al. 2014; <a href="https://www.adfg.alaska.gov/static/species/disease/pdfs/fishdiseases/saprolegniasis.pdf">https://www.adfg.alaska.gov/static/species/disease/pdfs/fishdiseases/saprolegniasis.pdf</a> .

Branchio- mycosis (Gill rot)	All freshwater fishes  multifocal necrosis of gill filaments producing a notched appear- ance of the gill margin of fresh- water fish due to branchiomycosis	<i>Branchiomycessanguinis</i> and <i>Branchiomyces- demigrans</i>	Fish may appear lethargic; gills appear striated or marbled with pale areas representing infected and dying tissue.	Maintain good management practices. Formalin and copper sulphate treatment, aquaria must be disinfected and dried.	Klinger and Francis-Floyd, 1996;  http://koioorganisatio ninternational.org/sites/default/ files/FUNGUS%20branchiomycos is%202014.pdf.
<b>Viral Diseases</b>					
Lymphocys- tis Disease	Bony fishes (freshwater and marine water fishes), including cichlids, killifishes, gouramies, sunfishes, gobies, butterflyfishes, damselfish, snook, drums etc.,	<i>Lymphocystivirus</i> or <i>Lymphocystis</i> disease virus (LCDV), (family <i>Iridoviridae</i> )	Small to moderate- sized, irregular, nodular, wart- like or pearl like growths on the fins, skin, or gills, these may be cream to graycolored but can be other colours if they appear under pigmented areas.	Only course is to destroy the fish and effectively disinfect all equipment.	Yanong, 2010;  <a href="https://agrificedn.tamu.edu/fisheries/files/2013/09/Lymphocystis-Disease-in-Fish.pdf">https://agrificedn.tamu.edu/ fisheries/files/2013/09/ Lymphocystis-Disease-in-Fish. pdf.</a>
Spring viremia of carp (SVC)	Common carp, grass carp, bighead carp, silver carp, Crucian carp, gold fish. Koi infected with SVCv. Exophthal- mia and petecchia hemorrhages on body wall.	Rhabdovirus carpio, a bullet-shaped RNA virus	Darkening of the skin, exophthalmia (pop-eye), ascites (dropsy), pale gills, haemorrhages in the gills, skin, and eye, and a pro- truding vent with a thick mucoid (white to yellow- ish) faecal cast.	Antiviral drugs are not avail- able to treat SVC or other viral diseases. Maintain the water temperature above 20°C may prevent a potential outbreak. Complete disinfec- tion of aquaria	Petty et al. 2002;  <a href="http://edis.ifas.ufl.edu/pdf/files/VM/VM10600.pdf">http://edis.ifas.ufl.edu/pdf/files/ VM/VM10600.pdf.</a>

Koi Herpes virus (KHV)	Koi and common carp fishes Gill lesions and herpetic skin lesions on the body and fin erosion in koi infected with koi herpes virus (KHV)	Cyprinid herpes virus-3 (CyHV-3) Electron micrograph image of cyprinid herpesvirus 3 virion. Scale bar = 100 nm.	Lethargic, swim at the surface and may show behavioural signs of respiratory distress.	Disease affected fish can be culling and discarded.	Ganguly 2016; <a href="http://cmsadmin.atp.co.il/Content_siamb/editor/61_3_3_7%20goodwin.pdf">http://cmsadmin.atp.co.il/Content_siamb/editor/61_3_3_7%20goodwin.pdf</a> ; <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3294573/pdf/10-0593_finalS.pdf">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3294573/pdf/10-0593_finalS.pdf</a> ;
Carp Pox (Fish pox)	Mostly Koi carp.	Cyprinid herpesvirus-1 (CyHV1)	Individual lesions are formed on the epidermis which gives a milky appearance. These are benign and non-necrotizing and resemble epidermal hyperplasia. The lesions are papillomatous in nature, and many times secondary bacterial infections are also evident.		<a href="https://ifm.org.uk/wp-content/uploads/2018/08/Carp-pox.pdf">https://ifm.org.uk/wp-content/uploads/2018/08/Carp-pox.pdf</a> ;
Herpesviral Hematopoietic Necrosis	Goldfish Skin.	Cyprinid herpesvirus-2 (CyHV-2)	Anorectic and exhibit pale gills and ascites; At necropsy, the spleen and kidneys (anterior and posterior) are often enlarged.		<a href="https://www.researchgate.net/profile/Nicholas_Crossland/publication/324609455-Investigation_of_a_Cyprinid_Herpesvirus_1_Disease_Episode_in_a_Group_of_Pond-Reared_Koi/links/5b418eca6fdccb90a8d73/Investigation-of-a-Cyprinid-Herpesvirus-1-Disease-Episode-in-a-Group-of-Pond-Reared-Koi.pdf?origin=publication_detail">https://www.researchgate.net/profile/Nicholas_Crossland/publication/324609455-Investigation_of_a_Cyprinid_Herpesvirus_1_Disease_Episode_in_a_Group_of_Pond-Reared_Koi/links/5b418eca6fdccb90a8d73/Investigation-of-a-Cyprinid-Herpesvirus-1-Disease-Episode-in-a-Group-of-Pond-Reared-Koi.pdf?origin=publication_detail</a> ;

<b>Crustacean diseases</b>	
<p>Argulosis</p> <p>Mostly gold fish and koi fish</p>	<p><i>Argulus coregoni</i>, <i>Argulus japonicas</i> and <i>Argulus foliaceus</i>.</p>
<p>Erratic movements, rubbing themselves against the wall of the tank, abnormal swimming, frayed fins, loss of appetite, flashing, scratching, mucous increase, blood spots in the surface of fish body and fins.</p>	<p>Chemotheraputants using will damaging to the environment and human health. Disinfect aquarium and equipment regularly. Prevention is the best method.</p>
<p>Argulosis</p> <p>Freshwater ornamental fishes like gold fishes, one spot live bearers, perches etc., and farmed catla fish.</p>	<p><i>Lernaea cyprinacea</i> is a parasitic copepod.</p>
<p>Lernaeosis</p>	<p>Lernaea infestation is serious effects on fish, disruption and necrosis of gill epithelium, haemorrhages, muscle necrosis, intense inflammatory response.</p>
<p>Saha and Bandyopadhyay, 2015; <a href="https://www.researchgate.net/publication/273892005-DIAGNOSTIC_AND_PATHOLOGICAL_STUDY_OF_ARGULUS_JAPONICAS_IN_GOLDFISH_CARASSIUS_AURATUS">https://www.researchgate.net/publication/273892005-DIAGNOSTIC_AND_PATHOLOGICAL_STUDY_OF_ARGULUS_JAPONICAS_IN_GOLDFISH_CARASSIUS_AURATUS</a>;</p> <p><a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4408894/pdf/cm2015000093.pdf">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4408894/pdf/cm2015000093.pdf</a>.</p> <p>Sharma et al. 2012; Hassan et al. 2008; <a href="https://www.researchgate.net/publication/316689193-LERNAEA_ANCHOR_WORM_INVESTIGATIONS_IN_FISH">https://www.researchgate.net/publication/316689193-LERNAEA_ANCHOR_WORM_INVESTIGATIONS_IN_FISH</a>;</p> <p><a href="https://invasions.si.edu/nemesis/calendar/speciesummary.jsp?TSN=89254">https://invasions.si.edu/nemesis/calendar/speciesummary.jsp?TSN=89254</a>.</p>	

<b>Helminth diseases</b>					
Gyrodactylosis (Skin Flukes)	Freshwater ornamental fishes, mostly guppy fishes, carp.	<i>Gyrodactylus</i> spp. e.g. <i>Gyrodactylus bullatarudis</i> , <i>Gyrodactylus legans</i> , <i>Gyrodactylus turbull</i> , <i>Gyrodactylus salaris</i> , <i>Gyrodactylus arcuatus</i> .	Fish movement very less, fins will start falling, body colour changes to yellow and appear blood spots on their body.	Acetic acid and sodium chloride solutions treatment effective for major carps. Also dip treatment of formaline and dip treatment of salt may be effective.	Sharma et al. 2012. <a href="https://folia.paru.cas.cz/pdfs/fo/2018/01/06.pdf">https://folia.paru.cas.cz/pdfs/fo/2018/01/06.pdf</a> ; <a href="http://dergipark.gov.tr/download/article-file/132871">dergipark.gov.tr/download/article-file/132871</a> ; <a href="https://en.wikipedia.org/wiki/Gyrodactylus_salaris">https://en.wikipedia.org/wiki/Gyrodactylus_salaris</a> ;
Dactylogyrosis (Gill Flukes)	Freshwater ornamental fishes mostly gold fishes. Cyprinid fishes.	<i>Dactylogyrus</i> spp. e.g. <i>Dactylogyrus extensus</i> , <i>Dactylogyrus achmerowi</i> , <i>Dactylogyrus anchoratus</i> .	Gill movements increased appears damaged gill tissues.	One hour bath treatment with Chloramin-T (authorized by council regulation (EEC) no. 2377/90 of the European Council.) 7-15 mg/L.	Abidi et al. 2011; <a href="https://eprints.kingston.ac.uk/39278.pdf">https://eprints.kingston.ac.uk/39278.pdf</a> ; <a href="https://pdfs.semanticscholar.org/18e9/4eb2fe10b3d6f8dc3c5a3b651383aa1b0e23.pdf">https://pdfs.semanticscholar.org/18e9/4eb2fe10b3d6f8dc3c5a3b651383aa1b0e23.pdf</a> ; <a href="http://www.lifesciencesite.com/lisj/life140817/03_326711/sj140817_19_33.pdf">http://www.lifesciencesite.com/lisj/life140817/03_326711/sj140817_19_33.pdf</a>





## **SCHEMES FOR DEVELOPMENT OF ORNAMENTAL FISHERIES**

### **Pradhan Mantri Matsya Sampada Yojana (PMMSY)**

The PMMSY scheme will be implemented as an umbrella scheme having both centrally Sector components and centrally sponsored scheme components. It would focus on all round development of fisheries sector through a bunch of diverse interventions along the fisheries value chain right from production to consumption. The Scheme would maintain a fine balance between production and productivity activities including technology infusion, post-harvest infrastructure including strengthening and modernization of value chain and a robust Management and Regulatory Framework. One of the key objectives of the scheme is to enhance fish production and productivity, now thrust would be given for quality, sustainability, standards and traceability in fisheries sector from 'catch to consumer', post-harvest infrastructure and management, modernization and strengthening of value chain, enhancement of fisheries export competitiveness and a robust fisheries management and regulatory framework.

### **Enhancement of production and productivity**

In ornamental aquaculture, input support and facilities such as brood banks, hatcheries, rearing facilities, and quality seed units will be provided for enhancing production and productivity. Infrastructure and systems for seed and feed certification, input quality testing, aquatic animal health management including quarantine, and disease diagnostics laboratories and referral laboratories, capacity building and establishment of extension support services will be supported.

India's share in the global ornamental fish industry is minimal. In view of growing domestic and export market demand, support under PMMSY will be provided for ornamental fish cultivation through requisite interventions like establishment of production units, introduction of commercially important exotic species, import of breeding technology, extending technological, marketing and logistical support to entrepreneurs.

Under PMMSY, aquaparks are proposed as hubs of multifarious fisheries activities/facilities covering various stages/aspects of fisheries and aquaculture value chain. Inter alia, Aquaparks may be centers of production of quality seed and feed, pre and post-harvest infrastructure, business & commerce, logistics, marketing, export promotion, innovation, technology incubation, knowledge dissemination, recreation etc. Besides, Aqua parks may be developed on a hub and spoke model integrating clusters/areas with end to end solutions based on local needs and specific themes.

## Development of ornamental and recreational fisheries

Sl. No	Sub-component and Activities	Unit	Unit cost (Rs. lakhs)	Governmental Assistance (Rs. lakhs)	
				General (40%)	SC/ST/Women (60%)
1	Backyard Ornamental fish Rearing unit (both Marine and Fresh water)	Nos	3.00	1.20	1.80
2	Medium Scale Ornamental fish Rearing Unit (Marine and Freshwater Fish)	Nos	8.00	3.20	4.80
3	Integrated Ornamental fish unit (breeding and rearing for fresh water fish )	Nos	25.00	10.00	15.00
4	Integrated Ornamental fish unit (breeding and rearing for marine fish)	Nos	30.00	12.00	18.00
5	Establishment of Fresh water Ornamental Fish Brood Bank.	Nos	100.00	40.00	60.00
6	Promotion of Recreational Fisheries.	Nos	50.00	20.00	30.00

## Markets and Marketing infrastructure

Sl. No	Sub-component and Activities	Unit	Unit cost (Rs. lakhs)	Governmental Assistance (Rs. lakhs)	
				General (40%)	SC/ST/Women (60%)
1	Construction of fish retail markets including ornamental fish/aquarium markets.	Nos	100.00	40.00	60.00
2	Construction of fish kiosks including kiosks of aquarium/ornamental fish	Nos	10.00	4.00	6.00
3	E-platform for e-trading and e-marketing of fish and fisheries products	Nos			

## **Funding schemes available from MPEDA**

Recently the Marine Products Exports Development Authority (MPEDA) launched subsidy scheme for setting of ornamental fish breeding units to facilitate foreign exchange. Under this scheme MPEDA provides subsidy for the ornamental fishery to registered self help group and societies. To support livelihood and to promote foreign trade, Financial assistance is provided at the rate of 25% of the total investment, subject to maximum of Rs 10 lakh. The MPEDA has also launched a Green Certification scheme, the first of its kind for the freshwater ornamental fishery, to curb the harmful impact of wild capture of aquarium fishes and help maintain the environmental and economic sustainability.

## **Financial Assistance for setting up of Ornamental Fish Unit in Goa in goa Following schemes are available for ornamental fisheries development.**

- (a) For setting up of a Breeding unit- 50% of the actual cost limited to Rs. 1,50,000/.
- (b) For setting up of a Rearing unit- 50% of the actual cost limited to Rs. 1,50,000/-.
- (c) For setting up of a Rearing unit & Breeding unit- 50% of the actual cost limited to Rs. 2,50,000/-.

## **Eligibility/Criteria**

Fish farmer/ Individual should be resident of Goa for last fifteen years. Applicant site should have adequate water facilities for setting up of the unit. Applicant having own/ leased land, adequate to set up an ornamental unit can avail the benefit under this scheme. Applicant should undergo training programme on Ornamental Fish Farming organized by the Fisheries Department/ MPEDA/ ICAR.

## **Schemes for ornamental Fisheries by the NFDB**

- Ornamental fish production – Backyard hatcheries for women SHGs/ Fisher women cooperatives/ other house holds
- Medium scale unit for ornamental fish production by the entrepreneurs
- Integrated ornamental fishery units with hatcheries for ornamental fishes
- Setting up of Aquarium fabrication units - women SHGs / Fisher women cooperatives/ others
- Training and demonstration to the beneficiaries of the scheme.

## ***Backyard hatcheries for Ornamental fish production***

- Members of women SHGs / fisherwomen cooperatives and any household those who have own house with a minimum area of approximately 200-250 sft vacant land with adequate water facility for setting up of ornamental fish production unit.

- Members of women SHGs/ fisherwomen cooperatives and any household those who have vacant land with a minimum area of approximately 200-250 sft and adequate water facility on lease for a minimum of 7 years period adjacent to their house for setting up of ornamental fish production unit .
- Willing to take up the activity in accordance with the guidelines of NFDB
- Prospective beneficiaries willing to undergo training at the Government sponsored institutions

#### ***Medium scale ornamental breeding and rearing unit***

- Entrepreneurs having owned a minimum area of approximately 300 mts vacant land with adequate water facility for setting up of ornamental fish production unit.
- Entrepreneurs having taken a minimum area of approximately 300mts vacant land with adequate water facility on lease for minimum period of 7 years for setting up of ornamental fish production unit .
- Willing to take up the activity in accordance with the guidelines of NFDB
- Prospective beneficiaries willing to undergo training at the Government sponsored institutions.

#### ***Integrated ornamental fishery units***

- State Fisheries Department / Fisheries corporations / Federations/ICAR institutions having own land and water facilities adequate enough to set up the unit. The land along with water facility may be hired on lease basis with a minimum period of 7 years.
- The private entrepreneurs having owned a minimum land area of 1000 sq fts and water facility for setting up of integrated ornamental unit.
- The private entrepreneurs having taken a minimum land area of 1000 sq fts and water facility on lease for a period of 7 years to set up of integrated ornamental unit.
- Willing to take up the activity in accordance with the guidelines of NFDB
- Prospective beneficiaries willing to undergo training at the Government sponsored institutions.

#### ***Aquarium fabrication units***

- Members of Women SHGs /fisherwomen cooperatives and any individual having owned adequate vacant place for setting up fabrication of aquaria unit as prescribed by the NFDB.
- Members of Women SHGs/ fisherwomen cooperative societies, any individual having taken adequate vacant land on lease for a minimum period of 7 years for

setting up fabrication of aquaria unit as prescribed by NFDB.

- Willing to take up the activity in accordance with the guidelines of NFDB
- Prospective beneficiaries willing to undergo training at the Government sponsored institutions

### ***Training of beneficiaries***

- Members of Women SHGs /Fisherwomen cooperatives and any individual setting up of ornamental units
- Willing to take up the activity in accordance with the guidelines of NFDB.

S. No.	Name of the activity	Unit cost	Pattern of assistance
1	Backyard Hatchery	Rs. 1.50 lakh	40% unit cost as subsidy to members of Women SHGs/ Fisherwomen Cooperative Societies/ Entrepreneurs
2	Medium Scale Unit	Rs 4.00 lakh	40% unit cost as subsidy to all categories of beneficiaries
3	Integrated Ornamental Fishery Units	Rs 15.00 lakh	40% Subsidy to the Government Agencies/ Government Institutions/ Entrepreneur
4	Setting up of Aquarium Fabrication Units	Rs. 1.00 lakh	40% unit cost as subsidy to members of Women SHGs/ Fisherwomen Cooperative Societies. 25% unit cost as subsidy to Entrepreneurs/ individual persons.

### ***Financial Assistance for setting up of Ornamental Fish Unit in Goa Quantum of Assistance***

- For setting up of a Breeding unit- 50% of the actual cost limited to Rs. 1,50,000/-.
- For setting up of a Rearing unit- 50% of the actual cost limited to Rs. 1,50,000/-.
- For setting up of a Rearing unit & Breeding unit- 50% of the actual cost limited to Rs. 2,50,000/-.

### **Eligibility/Criteria**

1. Fish farmer/ Individual should be resident of Goa for last fifteen years.
2. Applicant site should have adequate water facilities for setting up of the unit. 3. Applicant having own/ leased land, adequate to set up an ornamental unit can avail the benefit under this scheme.
3. Applicant should undergo training programme on Ornamental Fish Farming organized by the Fisheries Department/ MPEDA/ ICAR



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