



## DEVELOPMENT OF ORNAMENTAL FISHERIES IN INDIA AND THE CHALLENGES OF DISEASE

Madhumita Mukherjee<sup>1\*</sup>, Pradeep, H.D.,<sup>1</sup> Amit Dutta<sup>2</sup> and  
Abul Kashem, S.K.<sup>2</sup>

<sup>1</sup> National Fisheries Development Board, "Fish Building", Hyderabad

<sup>2</sup> ARHMC, Department of Fisheries, Govt. of West Bengal, Pailan

\*Corresponding author: khookee6@gmail.com

**Abstract:** Ornamental fishery has grown into a multibillion dollar industry as an important sub-sector within the fisheries segment. Currently, the aquarium industry is estimated to be worth around US\$ 15 billion world over. In ornamental aqua culture and aquarium keeping, incidence of diseases is the main problem which crop up during culture and badly affects the profitability of the ventures. Under intensive culture conditions the risk of stress increase and a significant proportion of the stock may become infected. Diseases are caused by virus, bacteria, fungi, protozoa and parasites. Among these, viral and bacterial diseases are the most responsible factors for sudden mortality of the fishes. Now - a - days, in most of the states of India, veterinary grade antibiotics are being used for treating the infected fishes. But, due to the resistance of bacteria and negative impacts to the organisms, expected results could not be seen. Prevention of disease is always cheaper than dealing with disease outbreak once it has occurred. Approaching the development and implementation of a health management plan will not guarantee a disease free facility, but will go a long way towards significantly reduced risks of disease introduction and spread. With this back drop, an attempt was made in the present study to document the major diseases occurring in the farm sectors and the information collected and case studies are discussed in detail. Along with hygiene and disease control, successful production of ornamental fish is dependent on a range of factors, the most important being: climate, quality and quantity of water available, soil type and infrastructure including access to markets, airports, roads and electricity.

**Key words:** Aquarium, ornamental fish, disease, hygiene, management

### INTRODUCTION

Aquarium keeping is the second largest hobby in the world next to photography and the ornamental industry is fast gaining importance due to its tremendous economic opportunities and prospects. The global ornamental fish industry is worth US\$ 15 billion. In 2008 the trade on export earnings was to a tune of US \$ 344 million while the import was at the tune of US \$ 349 million. During 2010-11, Indian export about ornamental fish is 1.26 Million USD, which is only about 0.3% of the global trade. A rich species diversity and favorable climate, cheap labor and easy distribution make India suitable for ornamental aquaculture. About 90% of Indian exports go from Kolkata followed by 8% from

Mumbai and 2% from Chennai. The exportable size range of the commonly bred ornamental fishes in India is given in Table 1. Keeping the above points in view, the National Fisheries Development Board has introduced various subsidy schemes to support small to integrated farming of ornamental fishes, thus generating employment opportunities for the urban and rural youth. The disease outbreak is the bottleneck during raising and developing the brood stock and also during breeding and rearing. The number of potential hazards especially disease infestation and attack by parasite and predator is frequently encountered causing heavy mortality. These diseases would often inevitably

lead to diminishing profit margins and would slow down the growth of the industry. There is a need to identify these elements for proper intervention and taking precautionary measure for the successful commercial production. The

hobbyists are also concerned regarding the health and survival rate of the fishes. The commonly occurring fish diseases encountered in the India and possible remedies are discussed in the present paper.

**Table 1.** Common signs of stress and disease in Ornamental fish

· Improper buoyancy	· Off feed
· Scale loss	· Lethargy
· Changes in color	· Isolation
· Reddened/ulcerated areas on fins/body	· Increased respiratory rate
· Lumps and bumps on the skin and fins	· Flaring of the gill covers
· Clamped fins	· Pale gills
· Loss of mucous on the skin	· Excess mucus production – skin & gills
· Sunken eyes	· Brown or black patches on the gills
· Gasping at surface	· Bleeding from the gills, loss of gill tissue

## MATERIALS AND METHODS

The material of the present paper is collected based on the case study conducted, while running the departmental ornamental fish project on brooder development, breeding and diseases at ARHMC, Pailan and its substation hatchery at Captain Bherry, West Bengal and also the diseases reported from Tamil Nadu, Kerala, Maharashtra and Karnataka.

The AHRC, Pailan have facilities like Olympus CK-2 inverted light microscopes and other needy items. Different magnification photographs of the microbes were captured in Motic cam (microscope camera) and still camera was used in this study. For treatment purpose conventional medicine and commercial chemicals available in the market as well as ARHMC formulated medicine 'Swasti' was used.

### Case I

#### a. White spot disease (*Ichthyophthirius multifiliis*)

At AHRC, Pailan white spot was noticed on the body of redline torpedo barb, *Puntius denisonii* during July 2009. During this period, the fish looked unhealthy and their body coloration became dull and there was fin erosion at the edge. Microscopic examination from the body

scrapping revealed the presence of *Ichthyophthirius multifiliis* (Figs. 1-3). Erosion of the fins was also seen especially at the edge of the caudal fin. Once, this was noticed, the fish was isolated to a clean tank and Entero quinol (Quiniodochlor) powder soaked tubifex was fed during morning hours and this was helpful in control protozoans. Oxytetracycline hydrochloride and vitamin-B powder soaked tubifex feed fed during evening hours for the probable control of bacterial infection for five consecutive days with 40% water exchange daily. The movement became normal in three days from the beginning of the treatment and they regained their normal coloration in one month of time when no sign of illness was seen.



**Fig. 1.** Infected redline torpedo barb



Fig. 2. Isolation of body swab



Fig. 3. Microscope view of *Ichthyophthirius multifiliis* from redline torpedo

During August 2009, few white spot was noticed on the body of Oscar (*Astronatus ocellatus*). The eyes of the infected specimens seem to be bulging out the eyes coverings seems to losing its transparency and has become whitish opaque. The fish were not showing normal movement and seems to be sitting at bottom. By the end of the day, 2 fishes already died few others seems to be struggling. On the following day five more fish died. Body scrapings as observed under the microscope revealed the presence of *Ichthyophthirius multifiliis*. However, these protozoa seem to be losing their motility and becoming transfixed within few minutes of time (3 minutes). Some smaller protozoan with large dark nucleus were also present seems to be exhibiting amoeboid movement through formation of pseudopodia and constantly changing their shape.

**Treatment:** The infected fish were treated with salt and Swasti bath. The infected fish were shifted to another clean tank. A 100-watt lamp was set in proximity and a thermostat was set at 28°C. The fish separated fish were given Enteroquinol (Quiniodochlor) powder soaked tubifex feed in the morning for controlling the protozoan's and Oxytetracycline hydrochloride & vitamin-B powder soaked tubifex feed given in

the evening for probable bacterial infection for five consecutive days with 40% water exchange daily. Four days later, the fish seems to be in much better condition, the eyes had regained its normal shape and structure to a great extent. The Fish became completely normal after one week



Fig. 4. Oscar infected with white spot disease

In a similar case, during January 2010. Formalin bath treatment was given (0.2ppt dose) for five-minute every day.

Metronidazole soaked tubifex feed given for five days along with daily water exchange. In two days the spot disappeared completely only to reappear again in one month in February 2010. Formalin bath treatment was replaced by bath treatment with Malachite green (2ppm) for five days. The spot disappeared completely and the fish was cured completely from 6<sup>th</sup> day onwards.

This infection is quite common to aquarium fishes and caused mainly during cold season. In most of the cases acute infection of *Ichthyophthirius multifiliis* is seen to cause the maximum damage in brooders, their eggs and larvae.

## Case-II

### b. Trichodiniasis (*Trichodina* spp.)

Discus stock maintained at ARHMC, Pailan, west Bengal revealed that the disease *Trichodina* sp. and *Ichthyophthirius multifiliis* was found in Discus adult brooders, wherein white patch developed on one of the lateral side of the body. The fish was treated with  $KMnO_4$  and also

treated with 'Swasti' (Product developed by AHRC). However, the fish was dead later on. The immediate microscopic examination revealed the presence of *Trichodina* sp. and *Ichthyophthirius multifiliis*. The rest of the fish though seems to be unaffected were immediately removed to separate tank with 100% water exchange and treated with mild dose of methylene blue and formalin. Followed, 40% water exchange was done for one week regularly and no mortality was observed after the treatment.

### Case- III

#### c. Whirling disease (*Myxosoma cerebralis*)

This disease has been reported from Kerala, Mumbai, Chennai and Kolkata. The main symptoms are whirling movement of the fish; malformation of vertebral column, cranium etc, and it is quite common in angel fishes.

Treatment: The best remedy is to discard the infected fish, so as to stop the spreading of the disease to other tank mates.

Treatment: Dip treatment in saltwater, increase in temperature about 28-30°C, treatment of infected fish by low dosage of kanamycin in the initial stage might

### Case- IV

#### d. Hole in the head disease

In November 2009 a white spot appeared in central head region of a Discus brood fish in one of the segregated brood pair. The location and the external appearance of the spot indicated towards the common well-known 'hole in the head' disease infection of Discus caused by Hexamita protozoan. However to avoid handling stress to the brooder, no confirmatory microscopic test was done to confirm the disease.

Treatment: As precautionary measure the fish was immediately given tubifex soaked in metranidazole solution one time daily for five days with 40% daily water exchange after which the movement of the fish became normal again. The spot started fading out from third day of treatment the spot completely disappeared by 10days. The cured fish also started to participate

in breeding in one month of time in late November for the first time.

### Case- V

#### e. Neon Tetra disease (NTD):

This disease is mainly reported from Mumbai, this may be due to reason that many breeders are using live feed which and collected from the local sewage system. This disease is also called as pleistophora disease, caused by a sporozoan caused by *Pleistophora hypheosobryconis*. Despite being a well-known condition, it is currently incurable and often fatal to the fish. The disease cycle begins

when microsporidian parasite spores enter the fish after it consumes infected material, such as tissues of a dead fish, or live tubifex, which may serve as intermediate hosts. This disease is most likely passed from newly acquired fish, which have not been quarantined.

Symptoms include restlessness, loss of coloration, lumps on the body as cysts develop, difficulty swimming, curved spines as the disease progresses and secondary infections, such as fin rot and bloating.

**Treatment:** mainly in a long bath in Methelene blue (1g/100lt) for 1-2 hours may cure in the initial stage.

### Case-VI

**f. Argulosis** (*Argulus* sp.; Fig. 5): Commonly called fish louse, these ectoparasites are mainly found in the fishes fed with live feed like bloodworms, tubif ix etc. This disease was mainly reported from West Bengal, Tamil Nadu, Kerala, Maharashtra and Andhra Pradesh.

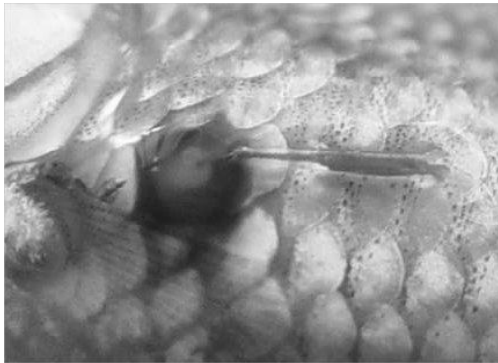


Fig. 5. *Argulus* sp.

The symptoms are mainly restless with erratic swimming behavior and loose appetite; ulceration at attach muscle visible with naked eye like "louse".

**Treatment:** It is recommended that to disinfect the entire tank, a dip treatment of the infected fish may help in the initial state of infection. Dimilin is used by the ornamental fish breeders of Tamil Nadu, Kerala, Karnataka, Maharashtra and Andhra Pradesh.

**g. Anchor Worm (*Lernia* sp.; Fig. 6):** This disease has also been indentified at Howrah during monsoon period. Anchor worms are tiny thread like crustaceans that bury themselves under the scales of Koi carp, which then become parasitic. Anchor worms can greatly reduce the fish strength and increase the chances of secondary infection. They can be seen through naked eyes, however may be overlooked as an Anchor worm, the use of magnifying glass will help to confirm the Anchor worm presence.



**Fig. 7.** Koicarp infected with Anchor worm

The affected fish will remain unscathed, but they will not able to produce offspring for a longer period. Once the life cycle of the anchor worm is broken, the female will eventually die and the fish should recover as it is not wise to attempt to remove the parasite from the fish (mainly Anchor worm) as it will potentially lead to secondary infection. Hand picking for high value species may one the option and disinfecting the entire tank.

Treatment: Potassium permanganate dip treatment in initial stage or Dimilin at different concentration depending upon the intensity of infection and size of the fish is used for treatment for both Argulus and Anchor worm infection. Dimiln is used by the ornamental fish breeders of Tamil Nadu, Kerala, Karnataka, Maharashtra & Andhra Pradesh.

#### **Case-VII**

##### **h. Nematode infection**

In August 2009 at Kolkata, in Danisoni barb(Kerala Queen), stomach was flat and inwardly drawn then others and little slimmer. They were not feeding well. Microscopic examination from the body scrapping did not showed any parasite. Gradually it became thinner than the rest of the others. It was isolated from the rest. 20 days later in September it died. Presence of a Nematode Helminthes near the upper esophagus close to the gills was found during autopsy. It probably grew at that place to enormous size gradually choking its feeding pathway leading it to death.

#### **Case-VIII**

##### **i. Gill Fluke (*Dactylogyrus* spp.)**

They are oviparous monogeneans that have two pairs of anchors, which can be used to latch onto the gills of a host, particularly freshwater fish such as carp. In heavily infected fish, *Dactylogyrus* can also be found on the buccal cavity. Other characteristics like, *Dactylogyrus* include the appearance of four eye-spots, 14 marginal hooks, one to two connective bars and two needle-like structures and spindle-shaped dactylogyrid-type seminal vesicles.

During November 2009 few among the new Milk carp stock procured was found to be overactive and jumping at AHRC, Pailan, creating sound in the body of the plastic tank of the hatchery. Thus they were shifted to the cemented circular tank from plastic tank to provide them darker place where they would be more comfortable on December 2009, one week later. Even after shifting, it was found that sometimes they were

jumping and swimming near the wall of the tank. There were absolutely no signs of any abnormality in the external body or fins. All the fishes were fed as per their demand. After 10 days two milk carp died. Other fishes found to be more sluggish and feeble. In five days three fish died. The said fish was dissected and white patches found in the gills and were covered with more slime. The slime and gills segment were observed under the microscope. Severe infection of *Ichthyophtherius multifilii* and *Dactylogyrus* were observed. These infections caused severe respiratory problem leads death to fish. The reason for their over activeness may be due to itching problem for the presence of these microbes at the time of procurement.

**Treatment:** The fish were separated in a clean tank, they were given Enteroquinol (Quiniodochlor) powder soaked Tokyo dry feed in the morning for protozoans and Oxytetracycline hydrochloride & vitamin-B powder soaked tubifex feed in evening for probable bacterial infection for seven consecutive days with 40% water exchange daily. All the tanks in hatchery were washed with hot salt water, huge water exchange and formalin treatment were done in all tanks and aquaria in the said office as a precautionary measures. The remaining live fishes got cured in two week.

### **Infection of nematode and protozoan in Milk Carp**

During Feb'2010 the gold fish spawn and fry (especially between 1 to 3 cm) Microscopic examination of gill and body scraping revealed infestation helminthes (*Dactylogyrus*).

**Treatment:** The spawn were treated with salt bath and mild dose of albandazole gave considerably good recovery results.

### **Case IX**

**j.** Cotton wool disease (*Saprolegnia* sp.): This is a very common disease during monsoon season. The common fishes affected are gold fish, kissing gourami, angles etc. This disease was reported by a hobbyist from Bengaluru, Karnataka. The fishes mainly affected are typically feeds on waste from fish or other dead cells and they will also

take advantage of creatures that have been injured or compromised eggs. When they inhabit a live animal, they exhibit as a fungal infection known as mycoses.

*Saprolegnia* is generally a secondary pathogen, though in the right circumstances, it can act as primary. It is mostly targeting fishes frequently, both in wild and captivity. Through cellular necrosis and other epidermal damage, *Saprolegnia* will spread across the surface of its host as a cotton-like film. Though it is often stays in the epidermal layers, the mould does not appear to be tissue specific. *Saprolegnia* infection is usually fatal, eventually causing haemodilution, though the time to death varies depending on the initial site of the infection, rate of growth and the ability of the organism to withstand the stress of the infection.

Fin rot and mouth fungus are all opportunistic infections that can occur when fish are stressed or injured. In some situations, fish may contract more than one of these diseases and distinguishing between them is often difficult. Fortunately for the aquarist, there are numerous medications available that will treat all three maladies equally well.

**Treatment:** Combinations of formalin and malachite green are particularly popular and will treat a range of fungal and bacterial pathogens, but as stated earlier, such medications can be harmful to certain types of livestock, so they should always be used with care.

### **Case X**

**k. Dropsy:** This disease problem was faced by a hobbyist from Bengaluru, Karnataka. This will be caused by *Aeromonas hydrophila*. Accumulation of water in the body cavity or in scale pockets, followed the scale becomes loose and abdomen swollen.

**Symptoms:** This disease is characterized by a swollen or hollow abdomen (Ascites). Concentration of fluid in the body tissues and cavities causes the fish's abdomen to become swollen and appear bloated. Swollen areas may exhibit a 'pine-cone' appearance caused by the fish's scales sticking out. It can be observed this

by viewing the fish from the top and the fish may also stop feeding, appear off-colour, become listless and/or lethargic, have sunken eyes, and hang at the top or stay at the bottom of the aquarium. The condition affects the fish's internal organs, ceasing proper function.

**Causes:** Dropsy is fairly easy to diagnose non-specifically, however, it is much harder to diagnose the cause. The main cause is bacterial infection. The causative agent may be introduced through food or dirty water. Edema second to kidney failure or ascites due to liver or heart failure are other possible causes.

**Treatment:** Dropsy is not very contagious; however, if a fish is diagnosed with dropsy, it is important to remove it from the aquarium/ pond because the infected fish will contaminate the water and end up dying. Dropsy can spread from the ill fish, possibly causing stress among the other fishes of the tank community. This extra stress may make the others vulnerable to dropsy or other forms of disease. Treatment may consist of herbal and non antibiotics targeting the causative agent, as many of the regular antibiotics is not effective on aeromonas. The herbal extracts are mainly from the mangrove plants developed at AHRC, Pailan which are effectively used for the treatment. They work best in the very early stages of dropsy. A more hands-on approach is to raise the aquarium's temperature for a few degrees - slightly higher than usual. Adding Epsom salts (Magnesium sulfate) to the water (at a rate of 20 mg/L) helps to encourage the fish to expel unnecessary damaging fluids.

#### **Case XI**

##### **I. Fin and tail rot (*Pseudomonas* sp.) and Skin ulcer disease (*Pseudomonas aeruginosa*)**

It was reported in AHRMC research centre, Pailan, West Bengal. Fin & tail rots and skin ulcer disease along with infected eye was observed in Pearl spot. Ulceration seen on the body surface, fin rot appeared in pectoral and caudal fin, mouth fungus observed and the eyes turned whitish opaque. The fish seems to have lost its balance and were floating in surface water. Some

salt was given to the aquarium to adjust the salinity to 4 ppt as this fish are brackish water in origin, followed, two fish that lost its balance and died on the subsequent days. Next day, body scrapping and swab was examined under microscope and no external parasite seen. The scrapping and swab was subjected to microbiological test bacterial culture.

**Treatment:** The fish were given bath treatment for five consecutive days in 5% methylene blue solution (15 drop), SWASTI, ten drops and 10 gm common salt in 2.5 liters of water for five minutes. Applicap gel (Chloromycetine) directly applied to eyes for three days and 2 drops formalin also given to aquarium water. The fish started to recover on 3<sup>rd</sup> day onward and were cured completely as seen on 7<sup>th</sup> day and were readjusted in fresh water.

#### **Case XII**

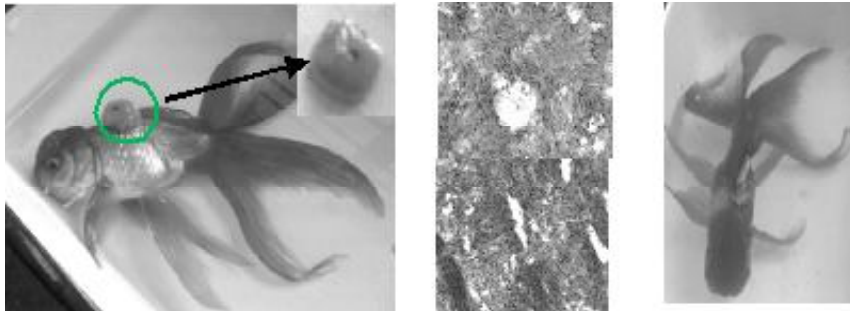
##### **m. Tumors in fishes**

In March 2010 a gold fish was sent to the lab of ARHMC by an ornamental farmer from Falta, South 24 Parganas, West Bengal. The fish had a tumor on the left side near the dorsal fin. The reason for growth of tumor has many causes like unhealthy environment mainly rich in arsenic. Many of the times it was reported mainly in Gold fish and Koi and it has been removed surgically and after surgery it has to be protected from secondary infections.

In one of the case in gold fish, although the fish showed no sign of distress except losing its swimming balance a bit, the tumor was surgically removed through a minor operation. Mercurochrome (2%) was applied immediately at the operated zone for a few minutes and then the fish was liberated in 10 liter water with high dose of antibiotic (500 mg Tetracycline Hydrochloride) and 1 drop of formalin (40% solution) and 1 drop of methylene blue (5% solution). It was feed a little 4 hours later. The fish was kept there with high aeration for three days. Then it was transferred to another fresh water tank with mild dose of same antibiotic and 2 drops of methylene blue. The fish was completely normal from next day and fed normally. Histopathological section of the tumor

operated was observed after H E (haematoxyline-eosin) staining under 200 X magnification (Olympus CK-2 inverted). Spindle shaped nucleus with tissue degeneration and necrosis

seen. The fish continued to live normally without any sign illness. The fish slowly recovered from the injury.



**Fig. 8.** Tumor in gold fish (operated tumor in inset) Histopathological section, after operation

### Case XIII

**n. Death due to choking:** This was reported by a farmer in Howrah, when the fish was dissected it showed the crab inside the esophagus region.

### Case XIV

During December 2009, at AHRC, Pailan, there was an attack of the dragon fly nymph mainly dangerous to the newly spawn angel fish.

Treatment: Manual removal was found to be the only solution.

### Case XV

#### Disease of other species of ornamental importance

##### *Trematode growth on ornamental yellow snail*

In April 2010, an Ornamental fish breeder and keeper Shri. Joyanta mondal of Howrah Dist. wst Bengal came to the research station came with a problem of growth of a rapid gelatinous growth on the shell surface of ornamental snail. Om microscopic examination it was seen to be sedentary colony has developed on the surface which are attached to the substratum yet has highly motile structure some of which are freely moving among the tentacular structure. Though

they were yet to be identified upto species level, they were found highly sensitive to common salt.

Treatment: With application of salt solution in a very low dose of 5 ppt, the colony almost disappeared in 24 hours. The shell became completely fresh in three days of time.

### CONCLUSIONS

Addressing the disease is very important in ornamental fish culture as there is a growing demand for them in both domestic and international markets. A necessary preventive measure has to be taken like quarantining the new fishes before introducing them with the existing stock. Prevention by means of good husbandry and maintaining water quality are keys to prevent the diseases.

The OIE (world Organization for Animal Health) notifiable listed diseases include:

- Epizootic haemopoietic necrosis (EHN)
- Infectious haemopoietic necrosis (IHN)
- Spring viraemia of carp (SVC)
- Viral haemorrhagic septicaemia (VHS)
- Infectious Salmon anaemia (ISA)
- Epizootic ulcerative syndrome (EUS)
- Gyrodactylus salaries
- Redsea bream Iridovirus (RSIV)
- Koi Herpes Virus (KHV)



**“Few steps to quality fish health management”**

**1. Learn about your animals:** understand the basic natural history, biology and husbandry requirements of the fish. Such information should include – country and environment of origin, life cycle, maximum size, behavior in the wild and captivity, temperature and required water quality parameters, key breeding requirements, captive husbandry requirements, common diet and feeding frequency, common sign of disease etc...

**2. Exclusion of pathogen** – the procedures typically focus on reducing the risks associated with various potential routes of disease entry and establishing an effective quarantine protocol for all new introductions. The most important pathways for pathogen entry are associated with fish/water/food/people/equipment.

**3. Workout with the problem** : when a disease outbreak occurs - this is the actual time to be panic. Examine the overall situation with cool head. Address any immediate life threatening problems first suggest lack of power and water flow and then make a proper disease diagnosis. Finally identify all the potential contributing factors that may be associated with the disease output.

**4. Identify reliable scientific institutions** – ensure that adequate disease diagnostic laboratories are available that can provide a timely and proper disease diagnosis and prescription for treatment.

**5. Quarantine** – quarantine is the critical component of pathogen exclusion. The major role of quarantine is to prevent the introduction of pathogens directly. Quarantine also provides for the important process of acclimation of fish to new water conditions, new husbandry protocols and new feeds. Quarantine period also allows time for the fish immune system to recuperate from the stresses of transport and handling.

An understanding of these key areas is essential to develop a sustainable ornamental industry.

Major medicines used in ornamental fisheries are veterinary medicines of which many are banned for aqua systems, there is a need for research on identification, measures and development of specific medicines for fishes.

One point worth mentioning is that most of the losses that farmers observe in our export business is when they do not adhere to the requirements of the quality considerations with regards to the size of the fish and because of improper handling and transportation of fish. Secondly, the high mortality of the fish and invertebrates from the collection point to the time of reaching the aquarium is also a major hindrance.

In India there is a lot of research in fisheries being done in the country, which is acclaimed globally but it is confined to research journals and not transferred to the field. We still lack needed research input on fish medicine, ahead of their introduction by the farming community. Local surveys speak that majority of the farmers are not knowing much about the research institutes and as in other neighboring countries fishery related institutes have a commercial cell which is accessible to farmers in respect of their needs. The research institutes, state fisheries department and the industry people should sit together under one roof to address the state specific problems and only demand driven collaborative research may be undertaken by the Research Institutes. To fully take the advantage of the booming ornamental fish trade, technical knowhow should be imparted to those interested with on-hands training.

NFDB has organized a one day workshop on “Integrated Development of Ornamental Fish Production and Marketing” on 18-10-2011 at NFDB, Hyderabad and have also conducted stake holders meetings in Chennai, Tamil Nadu on 23.12.2011, Mumbai, Maharashtra on 28.12.2011 and Kolkata, West Bengal on 30.12.2011 to identify the felt needs of the ornamental fish industry in the country.

In the above meeting majority of participants requested for the following:

- a. Literature on the hatchery management, culture practices, disease management of ornamental fishes has to be published and circulated to the states engaged in this activity.
- b. Therefore, laboratories for disease diagnosis and soil and water testing have to be established, in those states where the trade of ornamental fishes is significant.
- c. The sector lacks reliable data base on the production, export, species cultured and traded, list of producers, hatcheries, exporters etc. Similarly, the documentation of the breeding techniques, success stories is not happening in an organized way. Hence efforts in this direction have to be initiated.
- d. As far as possible, the producers may be organized into clusters and these clusters should be organized into societies.
- e. Further, infrastructure such as acclimatization facilities and quarantine has to be developed at international airports to promote export trade.
- f. States where ornamental fisheries has already developed such as Tamil Nadu, West Bengal may develop a good marketing network for the efficient / effective trade of ornamental fishes in the domestic as well as the international markets.

## REFERENCES

- Erwin, A. 1997. Translated by - D. A. convoy and R.L. Herman. *Textbook of Fish Disease - Protozoan Disease*. 179-206.
- Gupta , S. and Banerjee, S. 2008. Ornamental Fish Trade in West Bengal, *Fishing Chimes*, 28 (8): 25-27.
- Joseph, I. 2011. Global Trade structure of ornamental fishes- an overview. *Fishing Chimes*, 30: 76-77.
- Leena Nair 2012. Export of Ornamental Fishes and Development al Intervention by MPEDA, The Ornamentals Kerala 2012-Souviner, pp 57-60.
- Mukherjee, M. 2005. Diseases Problem and related issues of Ornamental fish. Colored fish in water garden-A status report of West Bengal. MPEDA & Dept. of Fisheries, Govt. of West Bengal publication, pp. 34-156.
- Mukherjee, M. and Dutta, S. 2005. Microenterprise Development Through Micro-credit: A Unique Step for Development of Ornamental Fish Industry and Women Fishers of Ornamental Fish Industry and Women Fishers in Kolkata, Coloured Fish In Water Garden- A Status Report of West Bengal, Published by MPEDA & Department of Fisheries, Aquaculture, Aquatic Resources And Fishing Harbour, Govt of West Bengal, P: 101-122.
- Mukherjee. M. et al. 2000. Problems and prospects of aquarium fish trade in West Bengal, *Fishing Chimes*, 90-93.
- Rodgers, L.J.Burke J.B. Ulcer disease in fish. Research Report, 1976-1977, Queensland, Fisheries Service, 1977, 12-14.
- Shuzo Egusa. 1991. Oxonion press Pvt Ltd.1991 Translation of "Sakana no kansensho", koseisha koseikaku Co. Ltd., Tokyo, 1978. *White spot disease of fresh water fish*. 454-465.
- Suzuki J. 1935. On the reproduction of *Ichthyophthirius multifiliis* fouquet in relation to water temperature. *Bull. Japan Soc. Sci. Fish.* 3: 265-272.
- Wagner G. 1960. Der Entwicklungszyklus on *Ichthyophthirius multifiliis* Fouquet under einfluss physikalischer and chemischer Aussenfaktoren. *Z. Fisch. N.F.* 9: 253-255.

