

## Keeping ornamental fish without antibiotics

By Shane Willis MSc  
Email: [shanew@natiaquaculture.com](mailto:shanew@natiaquaculture.com)



NATIONAL AQUACULTURE  
TRAINING INSTITUTE



OFI Executive Board Member

**T**he use of antibiotics as treatments in our industry is common place, and is an essential tool for fish health management. However, there is a growing concern by governments around the world of the incorrect use of antibiotics. The main concerns are the indiscriminate use of antibiotics leading to the development of resistant strains of bacteria, and the ‘masking’ effect of antibiotics, where the use of an antibiotic covers an underlying problem such as a carrier state for a virus. These issues will see more regulation in the use of antibiotics in our industry, and already some governments are making these changes. The Australian government has already made changes to the use of antibiotics in ornamental fish quarantine operations that have forced the Australian industry to look at alternatives to antibiotic use. This article looks at some of the issues of antibiotic ‘abuse’ and approaches we used to adapt to quarantine of fish without antibiotics.

### Bacterial resistance:

The problem of bacteria developing resistance to antibiotics is not new, and there have been many documented cases of this in human medicine. In the case of human medicine it is thought that the over-prescribing of antibiotics for ailments not necessarily needing antibiotics (ie viral infections such as colds). We have a similar problem in our industry where antibiotics are often used without any supervision by vets on an *ad hoc* basis with no proper diagnosis of what bacteria, if any, is causing the problem – without this diagnosis it can be difficult to ensure the correct antibiotic is being used. Therefore many operators use a ‘shotgun’ approach to treatment of ‘bacterial’ infections, using minimal diagnostic effort and simply applying different treatments until either the fish stop dying, or the fish are all dead.

This treatment regime is an ideal breeding ground for resistant strains to develop and we are seeing an increasing level in our industry. Several papers have reported the high prevalence of antibiotic resistant bacteria isolated from ornamental fish and their transport water. Resistant strains of *Columnaris*, *Vibrio* and *Aeromonas* are becoming more common and can be extremely difficult to deal with. While this makes bacterial infections more difficult to treat in fish, the other major concern is worker safety with zoonotic infections (disease transferred from animals/fish to humans).



**Figure 1: Bacterial Gill Disease is caused through exposure to poor water quality.**

There are many reports of zoonotic infections leading to significant disease in workers, which have resulted in amputations and there is a documented case of the death of a fish worker from a resistant strain of *Vibrio* contracted from ornamental fish. There are also reports of workers on farms developing sores or ulcers on the arms and legs that take long time to heal. Tests have revealed in some cases that these 'fish farmers sores' have resistant strains of bacteria present, and there are even reports about significant changes to the gastrointestinal bacteria population structure in workers exposed to antibiotics. While the number of these reports is still relatively low, it does point to a need to more careful in the use of antibiotics in our industry.

### **Regulatory changes in Australia:**

The other major issue of the use of antibiotics is the 'masking' has lead to changes in regulations regarding the use of antibiotics in Australian quarantine stations, with the Australian Quarantine and Inspection Service (AQIS) effectively banning the use of antibiotics while fish are in quarantine. The regulations, formalised in May 2008, require importers to submit an application to AQIS for approval of the use of an antibiotic prior to using it. The application will only be approved where:

- The use is for the treatment of fish with clinical signs of disease ie no prophylactic use permitted
- A professional diagnosis by an AQIS approved laboratory where the disease organism is identified is given
- The disease is endemic to Australia – any batch of fish found to have an 'exotic' disease are destroyed
- The antibacterial is registered for use in ornamental fish or is prescribed by a veterinarian

As well as these conditions, at the completion of the treatment, the fish must undergo an extension to the quarantine period of:

- Goldfish – 36 days
- Gouramis and Cichlids – 28 days
- Other freshwater species – 21 days
- Marine fish – 7 days

So, as you can see from these onerous regulations, we are effectively unable to use antibiotics in our quarantine area and must rely on other methods to address bacterial issues. At the time these regulations were put in place, the Australian industry was very worried about the negative impact that these new regulations would make and expected the worst with high mortalities and poor quality fish coming through quarantine. However, the industry had no choice but to adapt to the new regulations which has been done, and as it turns out with relatively minimal impact with minimal increases to fish losses in quarantine.

### **So what are the alternatives to antibiotics?**

Antibiotics are obviously the best course of treatment when dealing with bacterial infections, and unfortunately there is no magic bullet to replace them. Before discussing the

alternatives, the main causes of bacterial infections are worth noting. The following list, while not exhaustive covers some of the major causes of bacterial infections:

- Chronic low level irritation due to poor water quality including:
  - High levels of suspended solids (5 to 10 micron size)
  - Extreme pH
  - High ammonia and nitrites
  - Other water quality parameters outside normal tolerances of the species
- Overstocking of fish, poor handling
- Transport stress – this stress increases exponentially with time in transit
- Poor hygiene and cross-contamination with diseased fish
- Presence of parasites and other disease organisms
- Poor nutrition



**Figure 2: Poor water quality at the farm is a major contributor to fish disease**

These causes have all been identified as issues contributing to ‘Biosecurity’ (refer to the recent OFI book ‘Biosecurity in the ornamental Aquatic Industry’) and factors vital to the success of holding fish in a healthy state. Knowing that these are the main causes of bacterial problems, our approach is a combination of alternative measures based around:

1. Quality of supply – you can’t afford to buy second grade fish.

2. Improved husbandry – good old fashioned fish keeping, making sure water quality, nutrition etc are correct
3. Use of disinfectant type chemicals for topical bacterial infections and to prevent spread of disease
4. Use of plant based extracts for ‘treating’ fish or enhancing the immune system

### Quality of Supply

There is an expression that “you can’t make a silk purse from a sow’s ear” and this is very true when dealing with ornamental fish. If the quality of fish sent to the importer is poor then it is very difficult to have successful quarantine with minimal losses. This means that selecting the suppliers you deal with becomes very important, as well as the price paid. The cheapest fish are not always the most economic fish – there is no point buying a cheaper priced fish if it is going to be of poor health and losing fish because you cannot use an antibiotic – it ends up costing more in the long run.



**Figure 3: Fish should be sourced from well run, biosecure farms.**

Therefore, it is important for farmers and collectors to ensure the fish they supply are in good health and have good ‘biosecurity measures’ in place to ensure the fish are held at their facility in a healthy state. Increasing

concerns about the spread of disease with ornamental fish and changes to import legislation by importer countries such as Australia, will lead to increasing pressures on producers throughout the world to be 'Biosecure' and I believe this is the biggest challenge to the future of our industry.

The other important thing to note about supply is having good communication between exporters and importers. Communication needs to be a two way street with discussion about problems and possible solutions going both ways. I spend a lot of time talking to suppliers about issues in each shipment, as well as visiting our suppliers and offering advice on a range of factors including water quality and disease control. I am also always asking questions about how the fish are farmed and held – information on water quality and nutrition is always important so that we can better match our holding conditions to what the fish have been grown in by the farmer. Sometimes the simple ability to exchange information can go a long way to solving quality issues.

### **Improved husbandry**

My personal view is that antibiotics are often used as a 'crutch' to make up for lax or bad husbandry practices such as poor water quality, increased stocking densities and other factors that produce stress on the fish. This means that they need to manage their fish in ways that minimise stress (good water quality, minimal handling, good nutrition, adequate stocking density, fish health management program). Nutrition is likely to be an area that can be easily improved - Vitamin C and B complex are vital to the immune system and

are easily incorporated into the diet. Research in Singapore also suggested that even adding vitamin C to water can improve survival of ornamentals after transport and can also be used to help reduce stress when receiving new shipments as well. Good hygiene practices are also important to help prevent the spread of disease in a facility, even sorting / culling of poor quality sick fish can help prevent disease spreading. Our experiences here certainly support this and paying more attention to correct husbandry practices can go a long way towards preventing problems with bacterial infections.

### **Use of disinfectants**

There are a range of disinfectants that can be used for 'treating' external bacterial infections and include chemicals such as:

- Potassium permanganate
- Chloramine-T
- Benzalkonium chloride
- Malachite green
- Acriflavine
- Hydrogen peroxide

Salt can also be used and has significant health benefits for the fish as well as acting as a disinfectant. However, while these chemicals can be used for treating topical infections and to control the spread of bacteria between fish/batches etc, their use for treating systemic infections is very limited. For this reason disinfectants are should be used more as a preventative measure more than a treatment for bacterial infections.

### **Plant Extracts and Immunostimulants**

The use of plant extract based medications is an area that potentially holds great promise for

new treatments that can be applied to our industry. The use of plant based extracts for treating fish dates to ancient China and is not new to our industry. A great example of a commercial product is Melafix, produced by Aquarium Pharmaceuticals in USA, is based on Tea Tree oil and can be used to treat topical bacterial infections in fish, this product also



**Figure 4: Melafix is formulated using plant extracts**

has the added benefit that it can reduce inflammation in affected areas and aid the recovery of the fish. Another plant well known for its curative powers is Ketappa or Indian Almond tree. The leaves of this tree are used throughout Asia to condition fish water and prevent bacterial infections with good success. Even peat extract or blackwater is thought to have some curative and/or preventative powers.



**Figure 5: Red coloured Indian Almond leaves are used widely in Asia for conditioning water and reducing bacterial infection.**

Research is going on throughout the world into the use of plant based extracts for use in fish. I

recently attended the World Aquaculture Society Asia-Pacific Conference in Malaysia where there were many presentations given on various plant extracts for use in food fish species such as shrimps, tilapia and marine fish to improve growth and survival. The plant extracts play two main roles in promoting growth and survival. The first is to stimulate or enhance the immune system of the fish so it is better armed to fight off any infection and two, the extracts are 'toxic' in some way to the diseases they act upon. As these 'extracts' are often based on a complex of different chemical compounds they can often be more effective than traditional treatments and can produce both. While research into this area is relatively new, it does hold great promise as possible replacement of traditional antibiotic treatments. Most research in this area tends to be from the Asia region and often is based on Traditional Chinese Medicine principles. One such product that is currently being commercialised is a Singapore based product 'AquaHerb' has shown promise in improving health and survival among a number of species.

The other benefit of plant extracts is potential reduction in development of bacterial resistance. Research from Israel suggests that bacteria may not develop resistance to these extracts in the same way they do to antibiotics – again this is most likely due to the 'complex' of chemicals found in these plant based extracts compared with specific chemicals as is generally the case in antibiotics. Replacing antibiotic use with these extracts therefore has the potential to reduce the problems of worker safety previously highlighted.

## Conclusion

There are very real issues surrounding the indiscriminate use of antibiotics leading to resistant strains of bacteria. These have the potential to cause significant economic losses to operators and lead to potential health risks for workers. Governments are also becoming more aware of the spread of disease via ornamental fish and the potential for antibiotics to mask carrier states in fish which

can aid the spread of disease. While antibiotics have an important role in fish health management, the importance of good fish keeping practices and biosecure measures should not be overlooked. Experience from Australia shows that fish can be kept successfully without antibiotics to some degree by 'going back to basics' and further improvements will likely come from increasing research into the use of plant extracts as treatments in all forms of aquaculture.

---

## Useful references

Abutbul, S., et al., 2005. Screening of desert plants for use against bacterial pathogens in fish. *Israeli Journal of Aquaculture*. 57(2), p 71-80.

Dügenci, s., et al., 2003. Some medicinal plants as immunostimulant for fish. *Journal of Ethnopharmacology*. 88, p 99–106.

Verner-Jefferys. D., 2009. High prevalence of Multidrug-tolerant bacteria and associated antimicrobial resistance genes isolated from ornamental fish and their carriage water. *Plus One* . December 2009 Volume 4(12)

Zilberg, D., 2010. Dried leaves of *Rosmarinus officinalis* as a treatment for streptococcosis in tilapia. *Journal of Fish Diseases*