PRACTICAL APPROACHES TO HEALTH MANAGEMENT FOR CAGE CULTURED MARINE FISHES

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The need for health management

Large numbers of diseased fish dying is seldom observed in the natural environment unless environmental conditions have recently deteriorated. In the natural environment, fish lead a less stressful life and are free to move, and mortality is not easily observed. However, in the confined area of the net cages, fish are subjected to a large variety of stresses, such as handling in grading and net changing and it is easier to observe when there are mortalities due to one cause or another. The fish farmers usually observe the occurrence of disease soon after the fish are placed in the net cages. The newly placed fish often have hemorrhages and lesions on the body, indicating some bacterial infections, and die within a few days.

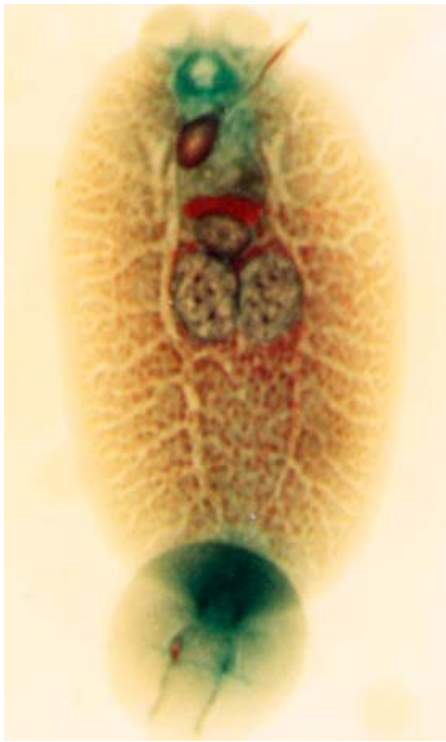
Initially only wild juvenile fish caught from the surrounding coastal region were farmed in floating cages, but now many species of fish can be produced in the hatcheries, particularly in Taiwan R.O.C. The majority of the tropical marine fish species found in the region belong to three families, namely Centropomidae (Asian seabass), Lutjanidae (snappers) and Serranidae (grouper). Of the three families, both snappers and groupers have the most number of species farmed in captivity. Most net cage fish farms in Southeast Asia are into multi-species fish farming, which complicates the process of fish health management, particularly in the control of disease.

The severity and greater frequencies of diseases in farmed fish have increased in recently years with the rapid expansion and greater concentration of fish farms as well as the larger number of fish species in farms. The large-scale international movement and importation of hatchery-produced fingerlings/juveniles is a major factor contributing to the emergence of new and serious diseases observed in cultured marine fish. Some of these new fish species are more susceptible than others resulting in greater frequency and severity of disease.

Diseases do not occur with consistent incidence throughout the culture period. Most outbreaks occur during the first 2 - 12 weeks after initial placement in the net cages. The severity depends on the condition of the fish on arrival, their size and fish species involved. For example, 5-8cm Asian seabass fingerlings are very susceptible to tail-rot disease soon after placement in the net cages, but other fish species are not usually affected. Recently (2001/2002), it was observed that large number of newly introduced 5cm red snapper were also readily affected by tail-rot disease that has not been observed in previous years. This caused about 5-10% mortality. Early recognition of the disease and immediate treatment are important to reduce mortality.

Most diseases occurring in the grow-out phase of the culture cycle are caused by multiple pathogens, namely bacteria (*Vibrio* spp. and *Flexibacter maritimus*), protozoans (*Cryptocaryon irritans* and *Trichodina* spp.) and monogeneans (*Benedenia* spp., *Neobenedenia* spp., *Diplectanum* spp., *Pseudorhabdosynochus* spp., and *Haliotrema* spp.). Recently, large number of imported hatchery-produced juvenile grouper suddenly died off in net cages in China with a virus identified as the pathogen causing the disease. Such symptoms have also been observed in imported juvenile grouper in Malaysia where a virus is suspected to have caused mass mortalities.

Very often, the densities of the monogenean parasites in diseased cultured fish are found to be higher than in the healthy cultured ones, which in turn are higher than in the wild ones. The bacterial flora is present naturally in the aquatic environment, as well as in the digestive system of the fish, but protozoans and monogeneans are introduced along with the fish host. Once they are introduced into the farm, it is impossible to eliminate them from the system.



Benedenia spp., a common parasite

The routine maintenance activities in a floating net cage farm (net changing, net washing, handling and grading of fish) along with poor quality of trash fish are major contributing stress factors and contradict good animal husbandry management. Furthermore, multi-species farming and overlapping batches of farmed fish in closed proximity results in the floating net cage farm acting as a reservoir of pathogens. There is not usually a break in the culture cycle in the floating net cage system that would allow a reduction in the population of pathogens. Juvenile fish are continuously introduced in the net

cages and are exposed to a pool of pathogens in the culture environment.

Given a general understanding of multi-species fish farming, the diseases and their occurrence in the floating net cage culture system, a practical approach to prevention and control of diseases could be developed and integrated into the routine fish farm activities. The chemicals and drugs used, where possible should not be hazardous to human or animal health, acceptable to end markets, easily available and importantly, their correct use must be understood. Chemicals and drugs reported to be effective in treating diseases in the laboratory may not be effective in the farm environment.

A simple study should be undertaken to determine the type of pathogens on the farm

Before one can implement a strategy to control and treat diseases, a number of steps must be taken. The most important ones are the human resource development of the farm workers, particularly the foreman/manager by providing some technical training on various aspects of fish farm management, in the general recognition of various disease symptoms and in the appropriate use of treatments including chemical. It is very important that practical hand on experience be undertaken at the farm with the participation of the farm workers. Experienced farm workers generally know when the fish are not well in a particular cage. It must be emphasized in the training course that in such a situation, **immediate** action must be taken to treat the affected fish in that cage **without delay**. A delay in treatment results in higher losses and possibly the total loss of all the fish in the cage. This is to ensure that the farm workers know how to carry out the required task properly and quickly, especially in immediate response to an emergency situation, like disease outbreak.

The second step is to undertake a simple epidemiological study of pathogens among the various species of cultured fish in the farm, noting particularly the types and density of monogeneans. Data obtained provide an insight into the extensiveness of infestation among the cultured fish in that farm. This technical support should be provided by the government to assist fish farmers. The technical support team from the government should regularly visit fish farms and to discuss any problems that have been encountered in the farm. Also they should make sure that the fish farmers implement a code of aquaculture practice. This is very important to the fish farm community, especially if the fish are farmed for export overseas.

Farm hands need to be given some technical training on health management

In most, if not all cases, fish farmers will encounter disease within the first 8 weeks when fingerlings and juveniles are placed in the net cages. Some species of fish are more susceptible to disease than others. It is impossible for fish farmers to determine if the newly imported fish harbor any particular pathogens or not, as they do not have the facilities to do so. Besides, the fish can arrive at the farm at odd hours and in large number. Even if the imported fish were certified as pathogens free, the 'healthy' fish would immediately be exposed to a reservoir of pathogens in the net cage system.

A routine prophylactic treatment should be incorporated into the farm management activities. One would ask what should we used to treat the newly arrive fish with, given that there are so many pathogens in the cage culture system? Many studies on diseases involving marine fish cultured in the tropical region indicated these diseases

are caused by infection with multiple pathogens. Fortunately, most of the pathogens found associated with these diseases in these newly placed fish were vibrio bacteria, protozoans and monogeneans. Therefore at this stage of the culture circle, the treatment chosen should be those with a wide spectrum application. Protozoans and monogeneans are ectoparasites, ie they are found on the body surface, either on the gills or on and under the scales. These pathogens on the body surface can easily be treated with freshwater, although this is not very effective for treating the gills. Formalin is an effective chemical that could be used to treat protozoans and monogeneans on the gills. One has to be very careful when one uses formalin because too strong a concentration could kill the fish and low concentration would not be effective in removing the pathogens [NB: Formalin is hazardous to humans, so avoid skin contact, avoid breathing the vapor and use appropriate safety equipment – ed.]. Fortunately, the monogeneans on the gills are not as pathogenic as those under the scales. Very often, fish are injured in the process of grading, packaging and transportation and do not show any external signs of injury. These can result in secondary bacterial infection when the packed fish reach their destination.

During this initial period of the fish adaptation to the new farm environment, they should be treated regularly with freshwater with or without the addition of formalin, methylene blue and possibly appropriate antibiotics. The duration and frequency of treatment would depend on the condition, size and species of fish. Generally treatment should not be more than 15 - 30 minutes. The newly placed fish should be treated with freshwater and 100ppm formalin on the second day for 30 minutes with aeration. This treatment is repeated on the fourth day, each time watching the fish closely to see signs of any stress on the fish. During the second week, it is best not to treat the fish, but this would depend on the condition of the fish. If the fish are healthy and actively feeding, then discontinue any prophylactic treatment. If treatment should continue, this is usually treated on a weekly or longer time interval. The newly placed fish would have adapted to the new farm environment by the 4th week. This treatment is used not only to remove any pathogens in the fish, but more important also to condition the fish for adaptation to the rough handling in the cultured environment. **NOT** all fish species required prophylactic treatment on arrival. The prophylactic treatment as described above has been found to be effective for grouper and red snapper, particularly in farms that have large population of capsulid monogeneans.

A routine prophylactic treatment should be incorporated into farm management activities

The named chemicals could be used singly or in combination with one or more. At times, even after these treatments, the fish may also prove to be infected with bacteria, particularly with ulcers/lesions on the body, especially in grouper and begin to die after a few days. In such situations, it is best to inject a sulfur drug to all the fish in that cage. This is a very simple prophylactic treatment of newly placed fish and it should be carried by all fish farmers if they want to reduce mortality of fish in their farm.

An experienced farm worker should be able to detect the onset of disease in a cage throughout the grow-out stage of the culture cycle. The first sign of disease occurring in a net cage is when the fish are not actively feeding and some fish are swimming sluggishly at the surface. Appropriate action(s) must be immediately taken. All the affected fish in that cage must be immediately treated with freshwater with or without formalin or methylene blue. If affected fish have red boils or lesions on the body, they should be injected with a sulphur drug. The freshwater treatment is to eliminate and or reduce the density

Injecting a sulfur drug

of protozoans and monogeneans, while the injection of drug is to treat the systemic bacteria vibrio infection. This freshwater treatment and injection of drugs have been successfully used in many farms in Malaysia and have been incorporated into routine activities in some fish farms with very satisfactory reduction of mortality.

These treatments as described in the previous paragraph are effective against most diseases except for scale drop disease in seabass and ulcerative disease in mangrove snapper. They do not assist in treating viral infections. Seabass juveniles are very susceptible to tail-rot disease in Southeast Asia. The symptom of this disease is the rotting of the tail and the breaking down of the muscle at the base of the tail. All seabass in that net cage should be immediately treated with freshwater.

Should fish be vaccinated against disease? Unfortunately, we know very little about the types of disease in cultured marine fish in Southeast Asia. Most of the cultured fish are affected by vibriosis, particularly grouper. Vaccine for vibriosis is commercially available in Europe and USA. The results of vaccination against vibriosis in greasy grouper are fairly encouraging and vaccinated grouper were less susceptible to vibriosis during the grow-out cycle period. For the vaccination to be effective the grouper should be at least 10cm in length and after vaccination, fish should be given prophylactic treatment as described in the previous section. It takes between 10-14 days post vaccination for the fish to develop some immunity to vibrio bacterial infection. During this period the fish may be affected by other pathogens, as most diseases are caused by multi-species pathogens infection, reducing the effectiveness of the vaccination. It is important that the vaccination programme be carried out in the farm with participation of the fish farmers. Other fish farmers will adapt the vaccination programme once they find out that less fish are dying from disease. The vibrio vaccine has not been used to determine its effectiveness against vibriosis in other fish species. With the availability of vibrio vaccine, an active field research vaccination programme should be undertaken to determine its effectiveness against vibriosis in various fish species.

Aquaculture Fundamentals

Simon Wilkinson, NACA

A general approach to disease treatment and control

In the context of aquaculture, disease may be broadly defined as any condition that leads to sub-optimal production[1]. The aetiology of disease involves an often complex interaction between three main factors: The status of the host organism, the environment and pathogens[2]. When one or more of these factors is unfavourable the host must adapt its physiology and/or behaviour to compensate. These adaptive responses, stress, impair normal physiological functioning and reduce the hosts chance of survival[3]. In particular, chronic stress lowers the resistance of fishes to infectious agents. This is caused by depression of the immune response and progressive leukopenia resulting from the release of corticosteroid hormones[2,3]. The relationship between disease and stress highlights the link between disease and poor management practices in aquaculture[4].

The essential principles of disease treatment and control[1] are to:

- Establish an accurate diagnosis;
- select an appropriate and environmentally responsible treatment;
- evaluate management practices within the farm and determine if future outbreaks could be prevented by changes in procedure or design.

1. Establish an accurate diagnosis

An accurate diagnosis is an essential first step in disease control since it is fundamental to the selection of an appropriate treatment[1,2]. Investigations should commence as soon as a disease problem is detected[5]. This can reduce losses by facilitating early treatment and allowing infected populations to be isolated. It can also assist diagnosis through by allowing the selection of fresh specimens.

Diagnosis requires a systematic approach considering all possible factors to determine the cause or causes of the disease. Ideally, investigations should include the following the following studies[2]:

- Investigation of environmental factors, water quality and stress related factors;
- investigation for pathogens; and
- histopathology (investigation of the host).

Unfortunately, few farms have the facilities or expertise to carry out detailed investigation of pathogens or histopathology[4]. If the farm has the resources (and if one is available) then an appropriate fish health specialist should be consulted to provide a professional diagnosis in addition to on-farm investigations.

Laboratory investigations

A range of clinically affected individuals at various stages of disease should be collected along with some apparently healthy specimens for comparison[5,6]. Sampled fishes should be sent to the laboratory live if at all possible since autolytic changes occur rapidly in fish and freezing destroys or inactivates some pathogens[7]. Anaesthetics should not be used on specimen fish since they kill ecto-parasites and make them more difficult to observe[6]. A comprehensive account of the clinical signs and losses, recent records of environmental parameters, stocking densities, feed and management practices should accompany the sample, along with a sample of the water supply[2].

Strategies for on-farm investigations

On-farm investigations and treatment of disease should focus on identifying and reducing sources of stress[2]. Two approaches to on-farm disease investigations are[1]:

1. Examine the major components of the culture system (fish, water, containment facilities and diet) with reference to the