Agriculture, Fisheries and Conservation Department
Aquaculture Fisheries Division

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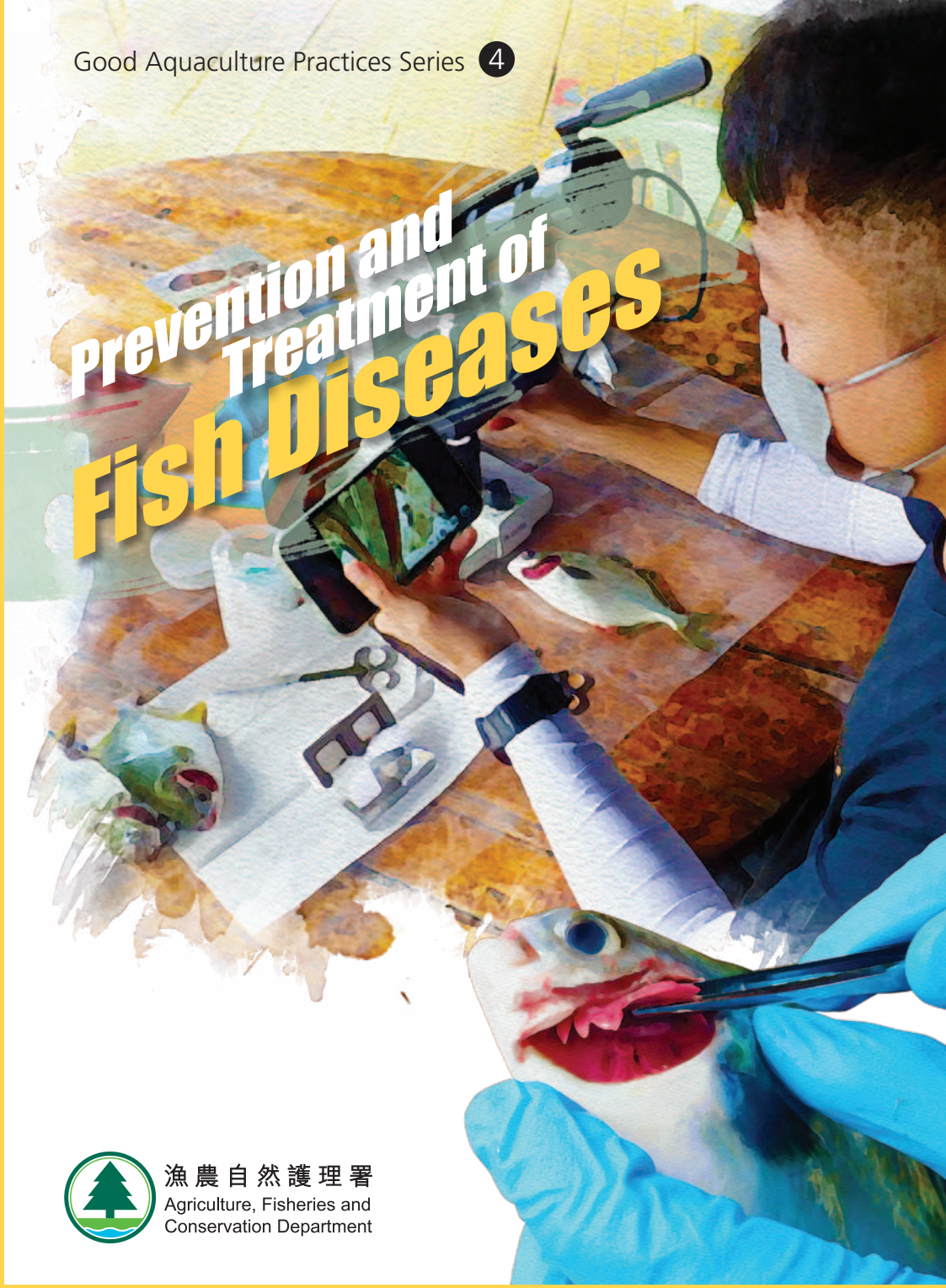
Good Aquaculture Practices Series 4

Prevention and Treatment of Fish Diseases



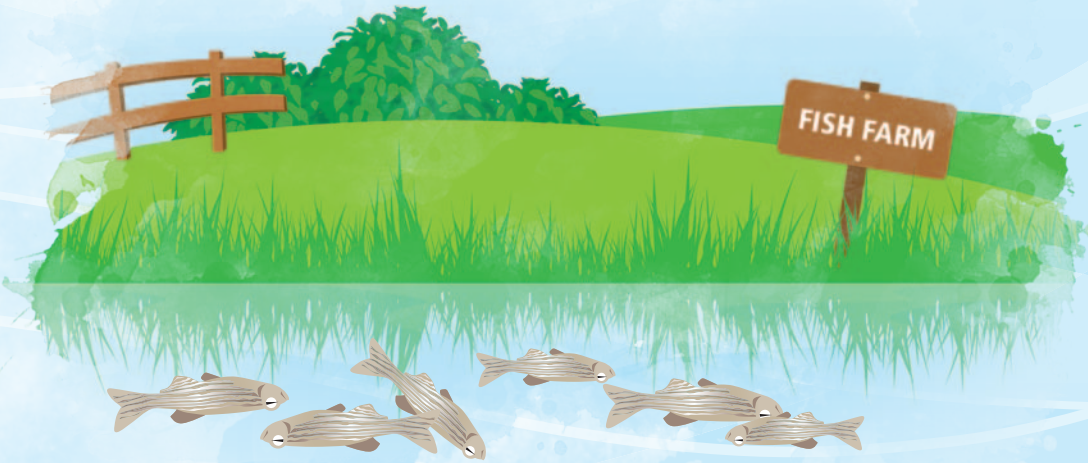
漁農自然護理署
Agriculture, Fisheries and
Conservation Department

Introduction

The survival rate of cultured fish is directly related to the income of fish farmers. The death of cultured fish will bring significant financial losses to fish farmers.

To minimise the losses caused by fish diseases, fish farmers must take proper measures to prevent diseases by reducing pathogens in water bodies, preventing deterioration of the water quality and strengthening the disease resistance of the cultured fish.

Delayed treatment due to neglect of the infectious nature of fish diseases is the main cause of massive death of cultured fish. Regular monitoring of the health of cultured fish can help identify sick fish and causes of the disease as early as possible and thereby provide the appropriate treatment.

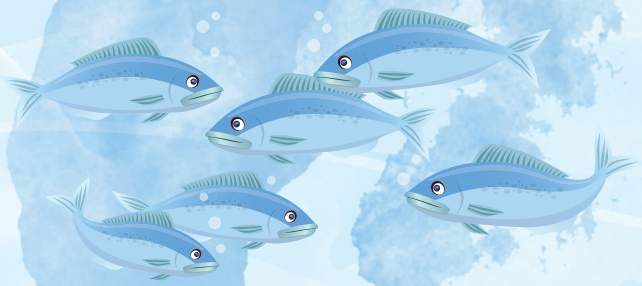


1 Prevention and Treatment of Fish Diseases

Causes of fish diseases

There are three main causes of fish diseases:

- Pathogens in the environment
- Weakened disease resistance of the fish
- Unsatisfactory conditions of the water bodies



In the natural water environment, there exists a certain amount of pathogens, such as bacteria, viruses, fungi and parasites. If the cultured fish are healthy, they have sufficient resistance to these pathogens and can adapt to moderate environmental changes or pressure.

If the amount of pathogens in the water body suddenly increases and the disease resistance of the cultured fish is not strong enough to defend against the attack of excessive pathogens, they will be susceptible to pathogen infection.

In addition, rapid changes in the water quality, such as proliferation of organic matter or a sudden rise/drop in water temperature, will weaken the physical health and disease resistance of the cultured fish, making them more susceptible to the risk of pathogen infection or death.

2 Daily Management Work for Preventing Fish Diseases

Fish farmers should take the following preventive measures which are targeted at the causes of fish diseases:

- Maintain a good culture environment and prevent deterioration of the water body environment; and
- Use hygienic and nutritious fish feed to strengthen the disease resistance of the cultured fish and prevent proliferation of pathogens in the water body environment.

2.1 How to prevent deterioration of the water body environment?

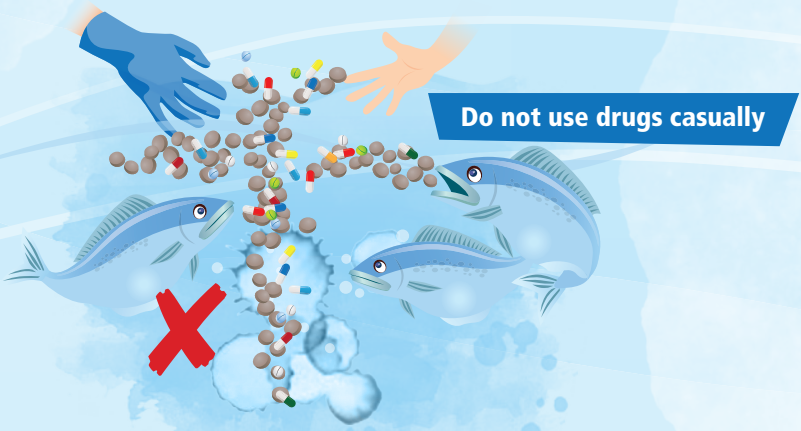
Avoid overfeeding to prevent deterioration in the hygienic condition of the water body due to accumulation of excessive organic matter on the pond bottom/seabed.

Remove dead fish from the fish pond/net cages at fish rafts as soon as possible in order to prevent deterioration in the hygienic condition of the water body due to accumulation of excessive organic matter on the pond bottom/seabed. Never dispose of garbage or dead fish into the water body.

Regularly remove the fouling organisms attached to the net cages at fish rafts to keep water flowing smoothly and flush away the organic matter effectively.

Please refer to the booklets "Good Aquaculture Practice Series 2 – Environmental Management of Mariculture" and "Good Aquaculture Practice Series 3 – Environmental Management of Pond Fish Culture" for more information on management practices related to the aquaculture environment.

Improper use of medications will contaminate the water body, leading to the development of drug resistance in bacteria and other issues. For more details, please refer to "Aquaculture: Code of Practice on the Cautious and Responsible Use of Antimicrobials" (Chinese version only). Consult a registered veterinary surgeon before using any drugs.



2.2 How to strengthen the resistance of cultured fish?

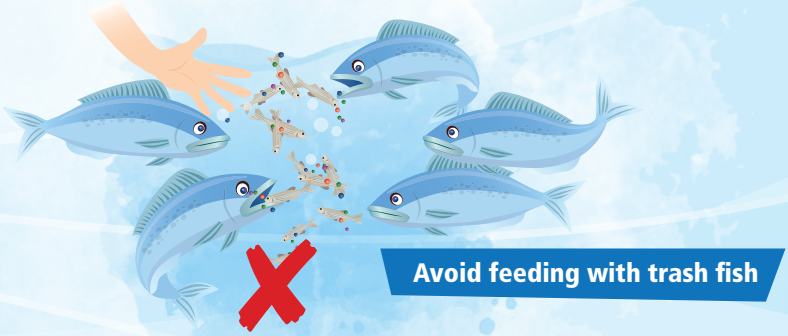
Maintaining an appropriate stocking density: A dense aquaculture environment will increase the risk of cross infection among the cultured fish and make them more susceptible to infections due to injuries from bumping into each other or friction.

Using a knot-free hand net: Reduce the risk of fish being infected due to injuries.

Avoiding feeding with trash fish: Trash fish contain imbalanced nutrients, which may weaken the resistance of the cultured fish. Besides, trash fish may carry pathogens that will increase the risk of infections among the cultured fish.

Using dry pellet feed: This type of feed is hygienic and allows the addition of appropriate amounts of vitamins and minerals on a case-by-case basis to further enhance the health of the cultured fish.

Please refer to the booklet "Good Aquaculture Practice Series 1 – Fish Feed Management" for more information on feed management practices.



Avoid feeding with trash fish

2.3 How to reduce pathogens in the water body?

Disinfecting fish ponds and culture gear regularly: Please refer to Table 1 on page 6 for methods to maintain environmental hygiene in the fish farm.

Storing dry pellet feed properly: Keep the feed in a covered and cool place to prevent excessive growth of bacteria in the feed.

Avoiding feeding with trash fish: Trash fish contain imbalanced nutrients, which may lead to proliferation of pathogens. Feeding with trash fish may introduce a significant amount of pathogens into the water body.

Table 1: Disinfection methods for fish farms and culture gear

Target	Method
Pond bottom	1. Drain and dry the pond under the sun for 3 months (using disinfectants can shorten the pond drying time).
	2. After sun drying the pond for 3 weeks, spread 500 g of lime (calcium oxide) on each square metre of the pond bottom. Sun dry the pond for about one more week before refilling it with water.
Culture gear, tanks and pipes	1. Disinfect with an electric steam gun for about 5 minutes.
	2. Soak in 1:4 000 formalin solution (i.e. a mixture of 250 mL of formalin and 1 000 L of water) for about 1 hour, and then rinse thoroughly with water.
	3. Soak in 1:2 000 household bleach (i.e. a mixture of 500 mL of bleach and 1 000 L of water) for about 3 hours, then neutralise with a large amount of baking soda (sodium bicarbonate) and rinse thoroughly with water.

Proper disinfection of fry

The fry may carry pathogens when they are transferred to the fish farm. The new fry should be disinfected with freshwater (applicable to marine fish) or by adding Condy's crystals (potassium permanganate) to the water before releasing them into the water body.

Purchase of high-quality fry

Fish farmers should purchase healthy fry issued with health certificates from reputable suppliers.

Fish farmers can submit fish fry samples to the AFCD for free testing for pathogens and harmful substances before the stocking of new fry.

Please refer to the booklet "Good Aquaculture Practices Series 5 – Fry Health Management" for more information on fry health management practices.

3 Fish Disease Monitoring

In addition to taking disease preventive measures, it is also important to strengthen monitoring of fish diseases. Fish disease monitoring can help detect fish diseases and identify the causes at an early stage for suitable treatment and prevention of the spread of fish diseases. Therefore, fish farmers are encouraged to join the Fish Health Inspection Programme of the AFCD and conduct simple health checks on their fish stock by themselves every day. If the cultured fish show symptoms of any disease, help should be sought from a registered veterinary surgeon.

3.1 Fish Health Inspection Programme of the AFCD

The staff of AFCD regularly visit fish culture zones and fish ponds to provide fish farmers with free health checks on their fish and introduce to them some preventive and treatment measures for fish diseases. Services provided under the programme include:

Physical examination of fish

Testing for bacteria, parasites, and viruses

On-site demonstration of water quality testing and the methods for preventing and treating fish diseases

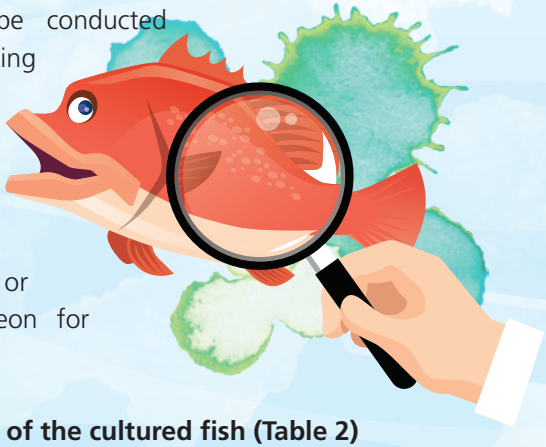
Introduction of simple methods for conducting fish health check

Fish farmers are welcome to enquire about the details of the programme and make an appointment for fish health check by phone:

Mariculture Development Section : 2150 7088
Inland Culture Development Section : 2471 9142

3.2 Methods for checking the health of fish by the fish farmers themselves

Fish farmers should conduct simple health checks on their fish stock every day by themselves. Firstly, observe the behaviour of the cultured fish (Stage 1) and note whether they have reduced their feed intake or shown any abnormal behaviour. If the abnormal behaviour is unrelated to environmental factors, a more thorough fish health check should be conducted immediately (Stage 2), including examining their body surface, fins and gills for any parasites. If any signs of infection are detected, immediate assistance should be sought from the AFCD or a registered veterinary surgeon for appropriate treatment.



Stage 1: Observe behaviour of the cultured fish (Table 2)

- **Feed intake**
  Reduced feed intake is the early symptom of most fish diseases. Fish farmers should maintain daily records of feed intake of their fish stock for easy comparison of their daily intake.
- **Abnormal behaviour**
  Cultured fish lying flat, rubbing against the pond bottom or net cage edges, jumping out of the water, circling in the water or losing buoyancy/balance indicates that they may be sick.

Table 2: Differentiation between sick and healthy fish

	Sick Fish	Healthy Fish
Behaviour	Swimming slowly, sluggish response	Swimming freely, responsive
Body Colour	Dull, darkened or discoloured	Bright and lustrous
Body Surface	With white patches or cotton-like growths	Intact
Body Shape	Emaciated	Well proportioned
Feed Intake	Poor appetite	Good appetite

Stage 2: Thorough check on the fish body

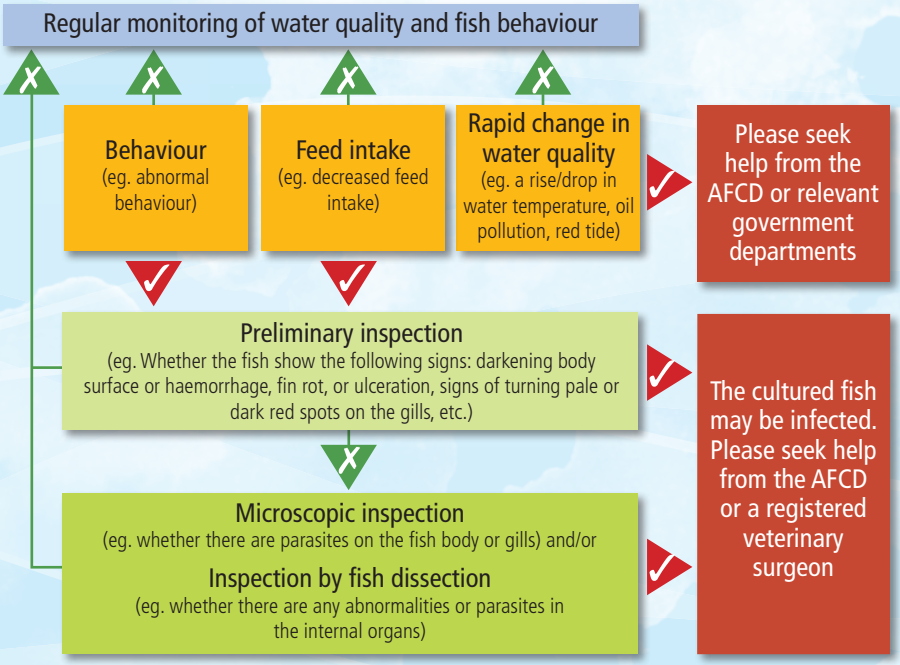
Checking the body surface and fins of the fish: Lesions on the body surface and fins are among the most obvious symptoms of infection. Symptoms of common fish diseases include:


Tail rot
Falling off of scales
Bulging eyes
Oedema

Checking the gills: Gills with ulcers, signs of turning pale, dark red spots, gill worms, excess mucus or substances that clog the gills indicate possible infection of the cultured fish or impairment of their gill functions.

Gill health check

Diagram 1: Flow chart illustrating the procedures of self-monitoring fish diseases



4 Understanding Fish Diseases

Common fish diseases may be caused by different pathogens, including parasites, fungi, bacteria and viruses. The eggs or spores of most pathogens are spread through water or direct contact.

Changes in the environment, deterioration in water quality, unbalanced nutrition of the cultured fish, and lesions on the fish body will weaken the disease resistance of the cultured fish, making them more susceptible to pathogen infection and as a result suffering from fish diseases.

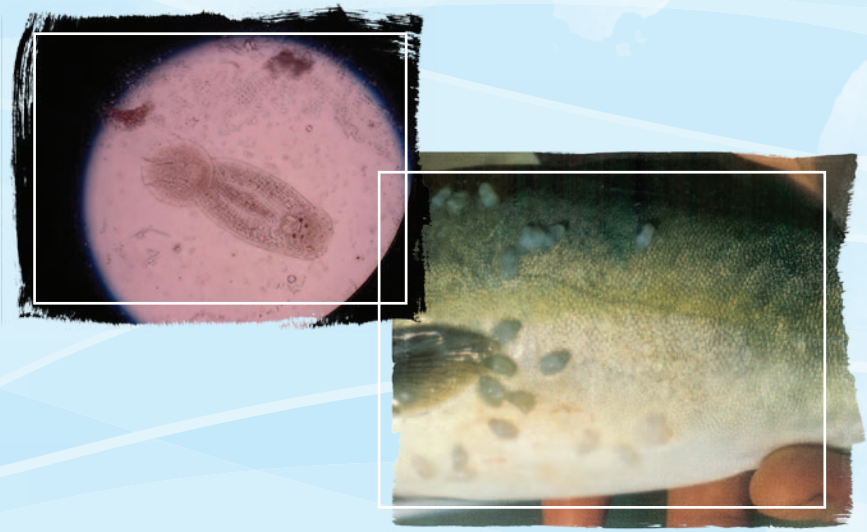
The common fish diseases in Hong Kong and their symptoms are set out below. If fish farmers find any abnormalities in the cultured fish, please seek help from a registered veterinary surgeon.

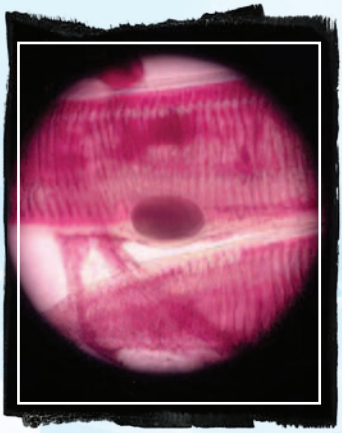
Table 3: Common fish diseases in Hong Kong

Cause of disease	Name of fish disease	Major affected aquaculture environment
Ectoparasitism	*Benedenia* sp.	Seawater
	Ichthyophthirius multifiliis	Freshwater
	Cryptocaryon irritans	Seawater
	Trichodina sp.	Seawater / Freshwater
	Brooklynella sp.	Seawater
	Chilodonella sp.	Freshwater
	Dactylogyrus sp.	Seawater / Freshwater
	Gyrodactylus sp.	Seawater / Freshwater
	Lernaea sp.	Freshwater
	Caligidae	Seawater / Freshwater
	Piscicola sp.	Seawater / Freshwater
	Isopoda	Seawater / Freshwater
	Saprolegnia sp.	Freshwater
Endoparasitism	Sanguinicolosis	Seawater / Freshwater
	Nematoda	Seawater
Fungal infection	*Glugea* sp.	Seawater
Bacterial infection	*Vibrio* sp.	Seawater / Freshwater
Viral infection	Viral nervous necrosis	Seawater
	Iridovirus	Seawater
	Spring viremia of carp	Freshwater
Not caused by pathogens	Fatty liver	Seawater / Freshwater

4.1 Ectoparasitism

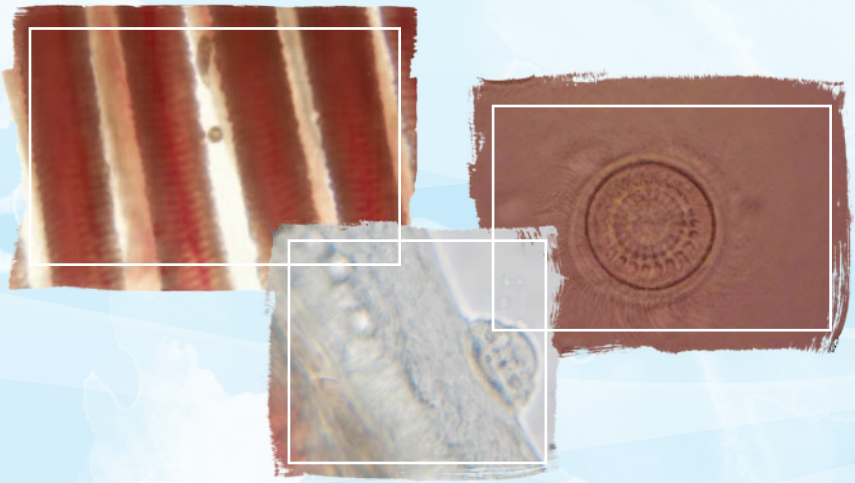
***Benedenia* sp.**	
Pathogen	*Benedenia* sp. is white and transparent, measuring 1 to 2 mm in length, and primarily parasitises fish cultured in seawater.
Modes of transmission	*Benedenia* sp. lays egg masses. After hatching, the larvae can survive in the sea for approximately one day to seek new hosts.
Infected areas	· Eyes · Fish body surface
Symptoms	· Emaciated body · Red, swollen and bloodshot eyes · Continuously swimming rapidly or rubbing body surface against other objects · Lesions on the body and fins
Causes of spread of disease	· Excessive stocking density · Polyculture of different batches of fish
Preventive measures	· Carry out health quarantine and/or freshwater bath for new fry





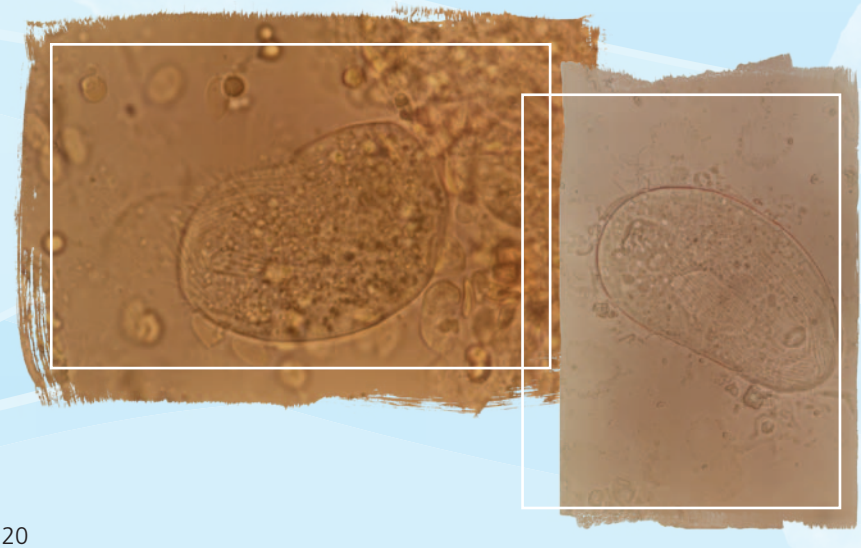
Ichthyophthirius multifiliis	
Pathogen	*Ichthyophthirius multifiliis* is white in colour, ovate or spherical in shape. It is covered with cilia, and measures from 40 to 400 μm in length. It primarily parasitises fish cultured in freshwater.
Modes of transmission	After leaving a fish, the larvae of *ichthyophthirius multifiliis* can survive in water for more than 15 days to seek new hosts and burrow themselves into the skin of the new hosts and grow.
Infected areas	· Gills · Fish body surface
Symptoms	· Darkening of body colour · Gradual loss of appetite · Gill lamellar hyperplasia and secretion of large amount of mucus · White spots on the body
Causes of spread of disease	· Excessive stocking density · Sudden drop in water temperature (for example, from 30°C to below 25°C) · Automatic falling off and death at a water temperature above 28°C · Inadequate disinfection of the fish pond after infection of the pond fish
Preventive measures	· Carry out health quarantine for new fry · Reduce the stocking density

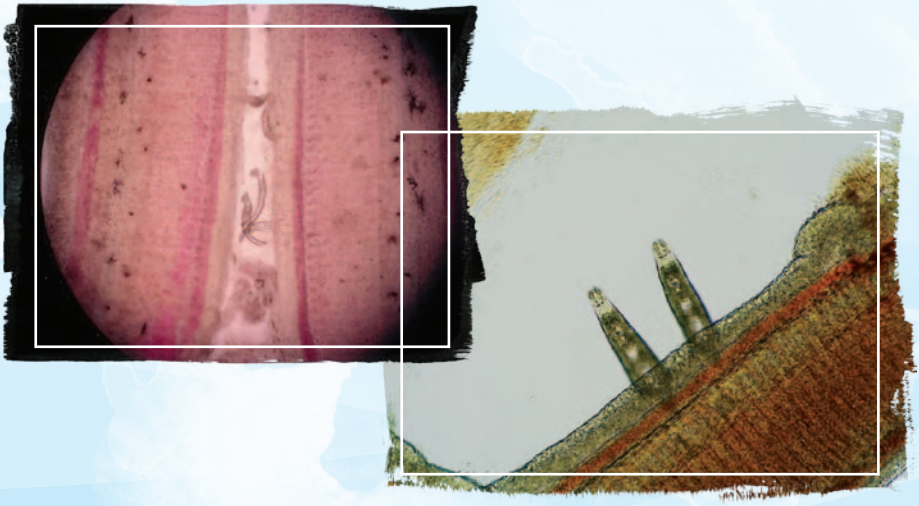
Cryptocaryon irritans	
Pathogen	*Cryptocaryon irritans* is the causative agent of white spot disease of the host, with the symptoms resembling the freshwater white spot disease caused by another pathogen. The life cycle of *Cryptocaryon irritans* consists of three stages: encysted trophont that feeds on the host, encysted tomont after leaving the host and theront that can swim in the water.
Modes of transmission	The theront can infect the cultured fish through contact in the water. The theront remains infectious after staying in the water for 15 days.
Infected areas	· Gills · Fish body surface
Symptoms	· White spots on the fish body · Rubbing its body against other objects · Increased secretion of mucus · Pale gills
Causes of spread of disease	· Excessive stocking density · Decreased water temperature · Improper operations causing stress to the cultured fish
Preventive measures	· Carry out health quarantine for new fry · Reduce the stocking density



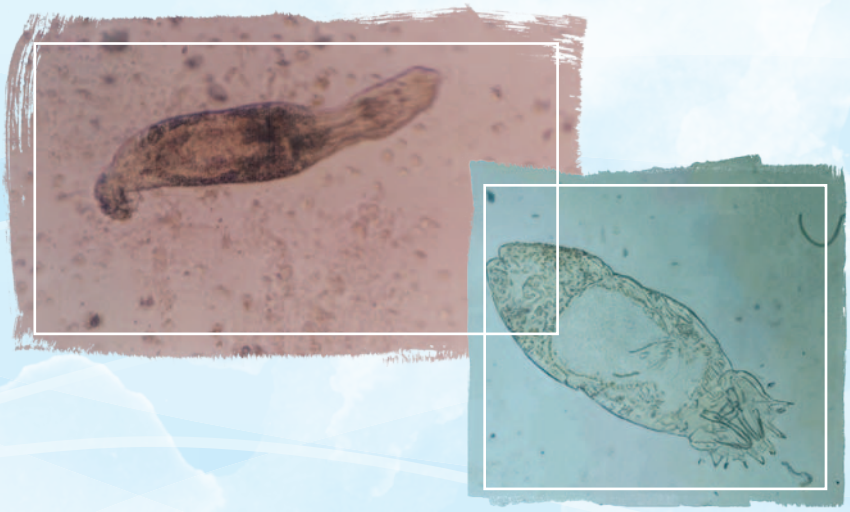
Trichodina sp.	
Pathogen	*Trichodina* sp., with cilia around its body and a length of approximately 100 μm, is a parasite which primarily lives in fish cultured in seawater or freshwater.
Modes of transmission	It seeks new hosts through direct contact in the water body.
Infected areas	· Fish body · Gills
Symptoms	· Pale gills · Rubbing its body against other objects · Secretion of a large amount of mucus from the gills and body surface · Weakened immunity
Causes of spread of disease	· Excessive organic matter in the water · Poor water exchange · Water temperature too low · Improper operations causing stress to the cultured fish
Preventive measures	· Reduce the stocking density · Water quality management: avoid accumulation of excessive organic matter (including residual feed) in the water

***Brooklynella* sp./ *Chilodonella* sp.**	
Pathogen	*Brooklynella* sp. primarily parasitises fish cultured in seawater whereas *Chilodonella* sp. primarily parasitises fish cultured in freshwater. They are relatively more active in an environment with lower temperature.
Modes of transmission	They undergo asexual reproduction through cell division in the fish body. After leaving the fish, they can survive for 12 to 24 hours to seek new hosts.
Infected areas	· Fish body · Gills
Symptoms	· Secretion of a large amount of mucus from the gills and body surface · Pale gills · Rubbing its body against other objects · Darkening of body colour
Causes of spread of disease	· Excessive organic matter in the water · Excessive stocking density
Preventive measures	· Reduce the stocking density · Water quality management: avoid accumulation of excessive organic matter (including residual feed) in the water





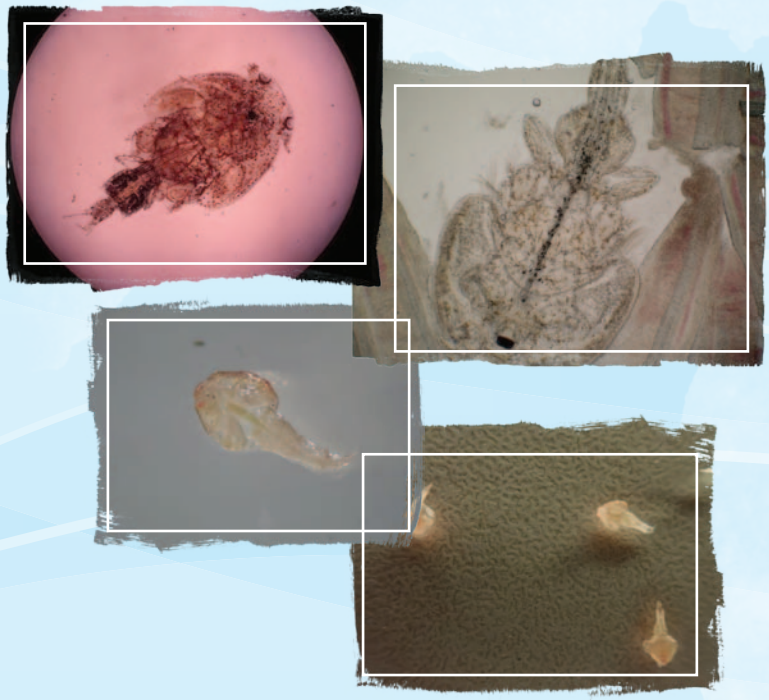
***Dactylogyrus* sp.**	
Pathogen	*Dactylogyrus* sp., characterised by its 4 anterior dorsal eye spots, is generally 0.5 mm in length. It primarily parasitises fish cultured in seawater or freshwater.
Modes of transmission	It can transmit diseases through direct contact with the fish body.
Infected areas	· Gills
Symptoms	· Swimming erratically near to the water surface · Darkening of the body colour · Gradual loss of appetite · Increased secretion of mucus from gill filaments or even haemorrhage
Causes of spread of disease	· Poor environmental hygiene · Excessive stocking density · Poor water exchange · Excessive organic matter in the water
Preventive measures	· Reduce the stocking density · Water quality management: avoid accumulation of excessive organic matter (including residual feed) in the water



***Gyrodactylus* sp.**	
Pathogen	*Gyrodactylus* sp. resembles *Dactylogyrus* sp. in its appearance except without the eye spots. It primarily parasitises fish cultured in seawater or freshwater.
Modes of transmission	Infectious larvae will detach from the parent. Fish become infected through contact with these larvae.
Infected areas	· Fish body surface
Symptoms	· Body colour turns dull with small blood spots appearing on the skin · Secretion of a large amount of mucus on the body surface
Causes of spread of disease	· Poor environmental hygiene · Excessive stocking density · Poor water exchange · Excessive organic matter in the water
Preventive measures	· Reduce the stocking density · Water quality management: avoid accumulation of excessive organic matter (including residual feed) in the water

***Lernaea* sp.**	
Pathogen	*Lernaea* sp. measures approximately 1 to 2 cm in length and primarily parasitises fish cultured in freshwater.
Modes of transmission	The larvae obtain nutrients from the gills of their host. Female adults may parasitise another host fish.
Infected areas	· Fish body · Gills
Symptoms	· The front end of the adult worm burrows into the host while the rest of its body remains exposed · Inflammation may occur at the part of the body parasitised by the female adult · Gill necrosis · Falling off of fish scales
Causes of spread of disease	· Fluctuation in water temperature · Inadequate disinfection of the fish pond
Preventive measures	· Carry out health quarantine for new fry · Disinfect the fish farm thoroughly · Bath the cultured fish in saltwater regularly

Caligidae	
Pathogen	The family *Caligidae* comprises over 500 species, with body lengths ranging from several mm to several cm. It mainly parasitises fish cultured in seawater or freshwater.
Modes of transmission	After hatching, the larvae grow in the water for a period of time before seeking a host.
Infected areas	· Fish body · Gills
Symptoms	· Swollen gill filaments and with wounds festering and becoming pale in colour · Lesions on fish skin
Causes of spread of disease	· Poor water exchange
Preventive measures	· Carry out health quarantine for new fry



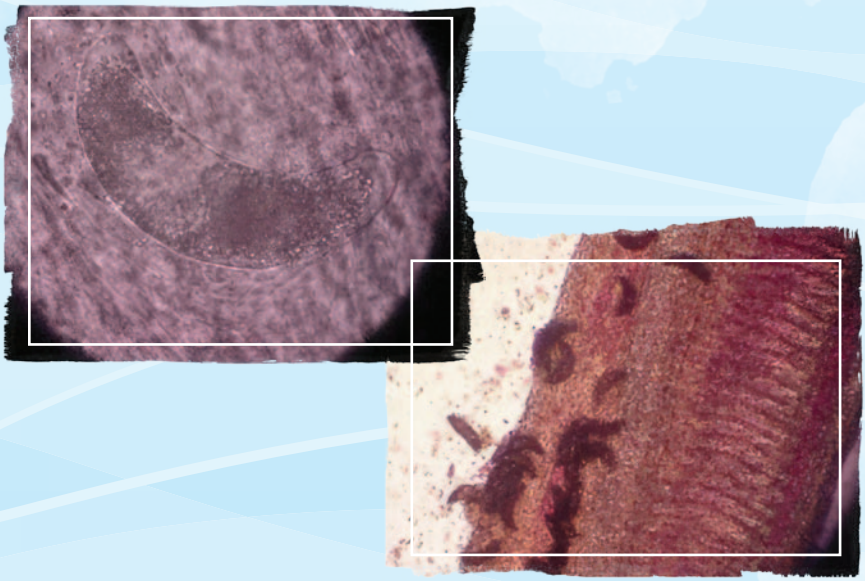
***Piscicola* sp.**	
Pathogen	*Piscicola* sp., which can measure up to 5 cm in length, mainly parasitises fish cultured in seawater or freshwater.
Modes of transmission	After feeding on a fish host, *Piscicola* sp. detaches from the fish and seeks a new host in the water.
Infected areas	· Fish body · Eyes · Mouth · Fins
Symptoms	· Parasites covering all over the infected areas like patchwork · Blood congestion at the infected areas
Causes of spread of disease	· Poor water quality · Inadequate disinfection of the fish pond · Feeding with trash fish carrying parasites
Preventive measures	· Water quality management: avoid accumulation of excessive organic matter (including residual feed) in the water · Disinfect the fish farm thoroughly · Use dry pellet feed

Order: Isopoda	
Pathogen	The order *Isopoda* comprises over ten thousand species, with approximately 5 000 species living in water, among which several hundred species have the record of parasitising fish.
Modes of transmission	· Larvae of some isopods (primarily from the family Cymothoidae) swim in the water after hatching, in order to seek new fish hosts. · Larvae of some isopods (primarily from the family Gnathiidae) parasitise the surface of fish bodies and detach from the host fish when they become adults. · Certain isopods (such as those from the family Aegidae) only attach on the body or gills of fish when feeding, and detach from the hosts to seek new hosts in the water body afterwards.
Infected areas	· Oral cavity · Fish body · Gills
Symptoms	· Showing anorexia · Rubbing its body against other objects · Ulceration at the infected areas
Causes of spread of disease	· Excessive stocking density
Preventive measures	· Carry out health quarantine for new fry · Reduce the stocking density

***Saprolegnia* sp.**	
Pathogen	*Saprolegnia* sp. causes the infected fish to exhibit white cotton-like growths on the body surface. Though resembling mould, it belongs to the category of algae. It primarily infects fish cultured in freshwater.
Modes of transmission	After the fish become infected, the parasitic *Saprolegnia* will release a large amount of spores. The spores will seek new hosts in the water, causing infections to other fish.
Infected areas	· Fish body · Fins and tail
Symptoms	· White cotton-like growths on the body · Ulceration on the skin, fins and tail · Falling off of fish scales
Causes of spread of disease	· Improper culture operations · Poor environmental hygiene · Sudden drop in water temperature · Excessive nutrients in the water
Preventive measures	· Reduce the stocking density · Replace the water body · Disinfect the fish farm thoroughly

4.2 Endoparasitism

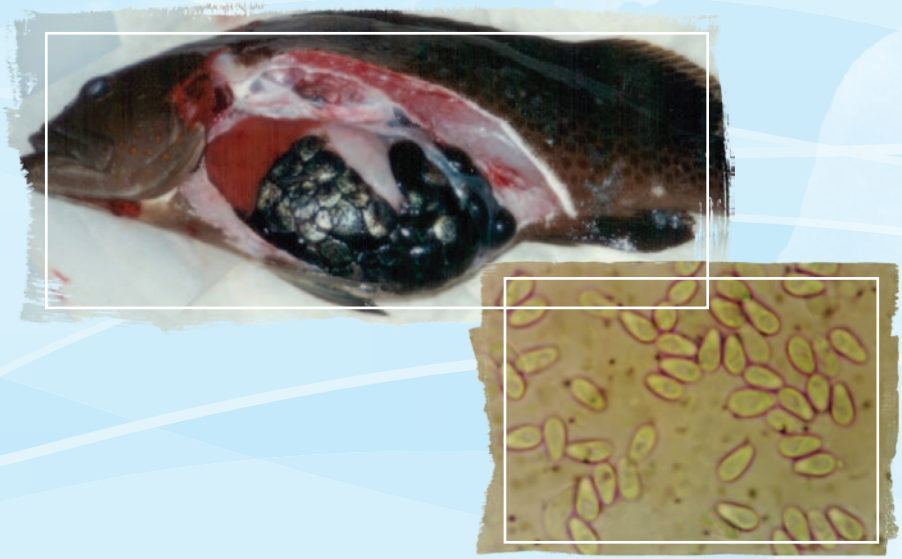
***Sanguinicola* sp.**	
Pathogen	*Sanguinicola* sp., measuring 10 to 20 μm in length, mainly parasitises fish cultured in seawater or freshwater.
Modes of transmission	*Sanguinicola* sp. enters the water through the fish gills and looks for polychaetes as intermediate hosts for reproduction. With fish as the definitive hosts, the larvae live in their blood vessels.
Infected areas	· Gills
Symptoms	· Skinning body · Pale, haemorrhagic or even necrotic gills
Causes of spread of disease	· Excessive fouling organisms in water · High stocking density
Preventive measures	· Reduce stocking density



Nematoda	
Pathogen	The phylum *Nematoda* comprises over 40 000 species and about 100 species of nematode that parasitise marine fish have been recorded in the neighbouring waters of China. Adult nematodes are thread-like in shape without segments.
Modes of transmission	· Nematode eggs together with the excreta of the infected fish are excreted and infect the hosts through animal feeding behaviour. · Direct consumption of fish or invertebrates infected with nematodes can also lead to infection.
Infected areas	· Almost all organs, but usually in the intestines
Symptoms	· Pale body · Skinny body
Causes of spread of disease	· Feeding with trash fish infected with nematodes
Preventive measures	· Use dry pellet feed

4.3 Fungal infection

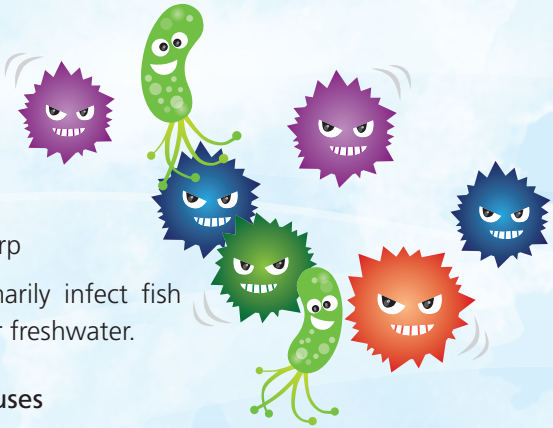
***Glugea* sp.**	
Pathogen	*Glugea* sp. with its sporangium measuring approximately 1 to 2 mm in length, is black and spherical in shape and contains a large amount of spores. It primarily parasitises fish cultured in seawater.
Modes of transmission	*Glugea* sp. will reproduce a large amount of spores inside the fish body. The mature spores will leave the fish body and float in the water. They infect new hosts through direct contact with them.
Infected areas	· Adipose tissue · Other internal organs
Symptoms	· Abdominal swelling · Black sporangia of various sizes appearing in the infected organs
Causes of spread of disease	· Poor water quality · Malnutrition
Preventive measures	· Maintain proper water exchange



4.4 Bacterial infection

Vibrio sp.	
Pathogen	*Vibrio* sp., which primarily infects fish cultured in seawater or freshwater
Modes of transmission	*Vibrio* sp. is present in water. Fish with weakened resistance or surface wounds or after eating trash fish carrying *Vibrio* sp. may get infected.
Infected areas	· Fish body · Gills · Fins and tail · Eyes
Symptoms	· Ulcers on the fish body · Necrosis of fins and tail · Bulging eyes
Causes of spread of disease	· Unstable salinity level · Excessive nutrients in the water · Improper operations causing stress to the cultured fish
Preventive measures	· Use dry pellet feed to minimise the entry of *Vibrio* sp. carried by fish feed into the water body · Regular replacement and cleaning of fish nets · Regular replacement of water body (applicable to fish ponds)

4.5 Viral infection



Pathogens

- *Betanodavirus* sp.
- Iridovirus
- Spring viremia of carp

These pathogens primarily infect fish cultured in seawater or freshwater.

Characteristics of viruses

- These viruses spread from trash fish, broodstock or infected fish to other fish. They can spread extremely fast and may infect all the fish in a fish farm within 12 to 24 hours.
- The mortality rate of infected fish (especially fish fry under one year of age) can be up to 100%.
- There is currently no drug that can completely cure this type of infection.

Viral nervous necrosis	
Pathogen	*Betanodavirus* sp., which primarily infects fish cultured in seawater
Modes of transmission	· Release of virus-carrying fry into the fish farm · Spread of viruses in the water body
Infected areas	· Brain · Retina · Spinal cord
Symptoms	· Abnormal swimming behaviour · Change of body colour
Causes of spread of disease	· Improper operations causing stress to the cultured fish
Preventive measures	· Purchase fry issued with a health certificate · Carry out health quarantine before releasing new fry into the fish farm · Remove fish carcasses as soon as possible and dispose of them properly

Iridovirus	
Pathogen	The family *Iridoviridae* comprises a number of pathogenic species causing similar symptoms. It primarily infects fish cultured in seawater.
Modes of transmission	· Release of virus-carrying fry into the fish farm · Spread of viruses in the water body
Infected areas	· Spleen
Symptoms	· Weakened immunity · Swollen spleen · Darkened body colour · Pale gills
Causes of spread of disease	· Improper operations causing stress to the cultured fish · A sudden change in water quality reduces the resistance of cultured fish
Preventive measures	· Purchase fry issued with a health certificate · Carry out health quarantine before releasing new fry into the fish farm

Spring viremia of carp (SVC)	
Pathogen	The family *Rhabdoviridae* mainly infects fish cultured in freshwater.
Modes of transmission	· Release of virus-carrying fry into the fish farm · Spread of viruses through parasites or birds
Infected areas	· Gills · Internal organs
Symptoms	· Abdominal swelling · Anal redness and swelling · Blood stasis in gills, skin and internal organs · Abnormal swimming behaviour · Bulging eyes
Causes of spread of disease	· A sudden change in water temperature
Preventive measures	· Purchase fry issued with a health certificate · Carry out health quarantine before releasing new fry into the fish farm

4.6 Fish diseases not caused by pathogens

Fatty liver	
Description of disease	Accumulation of excess fat in the liver, which will lead to anaemia. Both fish cultured in seawater and freshwater may suffer from the disease.
Possible causes of disease	· Prolonged consumption of feed with high fat content (such as trash fish) · Deficiency in certain vitamins (such as vitamins C and E) · Deficiency in the essential fatty acids
Preventive measures	· Use feed that specifically meets the nutritional requirements of the cultured fish · Seek advice from a registered veterinary surgeon on the addition of appropriate vitamin supplements to the feed

5 Treatment of Fish Diseases

Delayed treatment due to overlooking the infectious nature of fish diseases is the main cause of massive death of cultured fish. Upon detection of any infected fish, the sick fish must be isolated immediately for proper treatment or disposal to prevent the fish disease from spreading.

5.1 Guidelines for the use of fish drugs

According to the Harmful Substances in Food Regulations, Cap. 132AF of the Laws of Hong Kong, food must not contain prohibited substances, such as chloramphenicol (see Schedule 2 of Cap. 132AF), while certain substances such as malachite green, sulfonamides and tetracycline must not exceed the specific maximum concentrations (see Schedule 1 of Cap. 132AF).

Fish farmers must not use any fish drugs that are not prescribed by a registered veterinary surgeon. When using fish drugs, fish farmers are required to follow the instructions on dosage and the withdrawal periods for treated fish as given by the registered veterinary surgeon. Please contact the AFCD for any doubts about the use of fish drugs.

While the following drugs are not banned, fish farmers must adhere to the code of practice set out below for the use of these drugs and also consult a registered veterinary surgeon before using them.

Drug	Code of Practice
Hydrogen peroxide	Bathing fish in 30% hydrogen peroxide solution at a dilution ratio of 1:2 000 (i.e. a mixture of 500 mL of hydrogen peroxide and 1 000 L of water) for 1 hour.
Formalin	Bathing fish in formalin at a dilution ratio of 1:10 000 (i.e. a mixture of 100 mL of formalin and 1 000 L of water) for 1 hour. If necessary, the concentration of formalin can be raised to 1:4 000 (i.e. a mixture of 250 mL of formalin and 1 000 L of water). Do not use formalin with white precipitate.

Drug bathing

5.2 Correct use of fish drugs

Drug bath is one of the main approaches adopted in using fish drugs. The correct ways of preparing a drug bath are set out below:

- Pay attention to the expiry dates of the drugs. Do not use expired drugs.
- Follow the instructions of a registered veterinary surgeon when using drugs.
- Prepare a drug bath container of a suitable size along with sufficient aerating equipment.
- Switch on the aerator. Mix the drug with the water in the drug bath container at the prescribed ratio. Put a small number of fish into the container and observe their reaction to the drug. Only when it is confirmed that the fish do not react abnormally to the drug should the entire fish stock be transferred to the container.
- Continuously observe the reaction of the fish stock. Stop drug bathing and consider alternative treatment upon detection of any abnormalities.

Unless instructed otherwise by the AFCD or a registered veterinary surgeon, no cultured fish can be sold in the market for human consumption within 30 days after the drug bath.

5.3 Safety rules for using fish drugs

- Avoid contact with eyes, mouth, skin and clothing, or inhalation into the lungs.
- Wear appropriate personal protective equipment, such as goggles, protective gloves, headgear, protective clothing and masks. In case where formalin is used, a mask designed specifically to filter formaldehyde should be worn. In addition, fish drugs should be used in well-ventilated areas.
- Some fish drugs are highly volatile and so good ventilation should be maintained.
- Fish drugs must be stored in containers with appropriate labels. Do not reuse empty drug containers for other purposes to prevent residues of the drug from causing harm to humans or animals.
- When applying fish medications, keep away from fire and other hazardous chemicals, such as oxides, strong acids and strong bases.
- If the fish drugs come into contact with any part of the body, rinse immediately with plenty of water; and in the event of contact with eyes, open the upper and lower eyelids and rinse slowly with plenty of water for at least 5 minutes, and seek medical attention immediately.
- Store fish drugs in a cool dry place with good ventilation and avoid direct sunlight exposure.

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Technical Support

Fish farmers are welcome to contact the AFCD for free information and technical support services:

Aquaculture Technology :
2471 9142 (pond fish) / 2150 7083 (marine fish)

Fish Health and Disease Prevention :
2471 9142 (pond fish) / 2150 7088 (marine fish)

Red Tide and Water Quality Environment :
2150 7124

Antimicrobial Resistance :
3426 2284