Potential problems

Fry mortality may increase due to improper or careless management as well as from disease. Some causes of mortality are:

- Inadequate cleaning of rearing tanks, insufficient change of water, low recirculation rate or carelessness of the operator during siphoning.
- Spoiled food, under or overfeeding.
- Lack of proper observation of the condition of the larvae.
- Extended power cuts, leading to stoppage of water circulation and aeration and disruption of the temperature control system.
- Just before metamorphosis, the larvae tend to jump and die due to striking the tank walls.

Characteristics of healthy larvae

After feeding, observe the behaviour of the larvae regularly. Healthy larvae show the following characteristics:

- They move about in the surface water (particularly during the first ten days).
- They start taking food immediately.
- They look reddish-brown.
- They are not cannibalistic.
- They swim with their heads down, 'jumping' when contacting any surface. Healthy larvae swim actively and do not settle at the bottom of the beaker or tank.

On the other hand, unhealthy larvae

- look bluish;
- often exhibit black spots or irregularities in or on their bodies;
- do not take food;
- settle at the bottom of the tank or beaker; and
- swim in a downward spiral path.

Disease and its prevention

The known diseases of *M. rosenbergii* larvae are caused by bacteria, protozoa and nutritional deficiencies. All the disease-causing organisms are probably present in the rearing water and only affect larvae when they are stressed due to inadequate feeding, overcrowding and poor water quality. These types of infections are termed 'opportunistic'. That is why good **tank management and proper** feeding have been emphasized throughout these pages. "An ounce of prevention is worth a pound of cure!"

The major known diseases and their possible treatment are discussed below. It should be kept in mind that as the causes of some of these diseases are not known, no cure can be specified. Some treatments, however, do appear to work.

Mid-cycle Larvae Disease (MCD)

This disease is the most serious threat to production. It was first reported from Hawaii, but has since been experienced by hatchery operators in many countries. Typically, mortality begins around the end of the first third of the larvae rearing cycle, say Day 10. Mortality increases quickly for 3-5 days, then stops, or dramatically decreases. PL production may be reduced to 1 or 2 PL/l.

The cause of the disease is not known, but it is infectious and has an incubation period of about five days. After mortality has ceased, survival of the remaining larvae is good.

The symptoms of the disease are spiral swimming behaviour and poor feed consumption. The larvae assume a bluish-grey coloration.

MCD does not respond to any tested antibiotic. The best procedure is to discard the infected larvae and disinfect the affected tank.

If the infection spreads through the hatchery, general disinfectation may be required. Disinfectation requires thorough washing of all tanks, filters and equipment with formalin and/or chlorinated water, followed by drying for at least one week.

Bacterial Necrosis (BN)

Larvae affected by this disease turn bluish and stop feeding. The intestinal tract will be found to be empty. Small black spots and lesions can also be seen on the exoskeleton. Stage 4 or 5 larvae may suffer 100 per cent mortality, but older larvae and PL seem to be resistant.

The disease can be treated with the following antibiotics: bipenicillin-streptomycin @ 2 ppm, Furanace @ 0.1 ppm, or erythromycin phosphate at *0.65-1* ppm. Chloramphenicol may also be effective. Prophylactic treatment consists of giving the above dosages every three days, while daily treatments should be given if there is an outbreak of the disease. However, the prophylactic use of antibiotics is not recommended, as it usually leads to severe, untreatable disease problems later.

Exuvia Entrapment Disease (EED)

EED affects Stage XI larvae and early post-larvae. Infected larvae are unable to extricate themselves from their exuvia during moulting. The larvae generally have malformed appendages. Mortality usually ranges from 20-30 per cent.

It is believed that nutritional deficiencies are the principal cause of EED. For example, larvae of other shrimp species (Paleomon) experienced EED when fed *Artemia* nauplii from the Great Salt Lake, Utah, USA, whereas nauplii from the San Francisco Bay did not produce EED. Adding lecithin to the prepared feed may help to prevent, or reduce, EED.

Microscopic Epibiont Diseases (MED)

A variety of protozoa may be found attached to the exoskeleton of larvae. Some of these are illustrated in Figure 19 (see facing page). Some species may attack the eggs of broodstock. Others interfere with the feeding and moulting of larvae. They can be controlled by formalin treatment. One reason for giving spawners a formalin bath is to prevent the introduction of these ectoparasites into the larvae rearing system.

Filamentous and non-filamentous bacteria may also foul the external surfaces of broodstock, eggs and larvae. Antibiotic treatment may be effective in controlling outbreaks of bacterial fouling.

The use of antibiotic treatments in a recirculation system must be **done with care as many of the** commonly available antibiotics can 'kill' the biofilter so that it is no longer effective in eliminating ammonia and nitrite. Table 4 shows the effect of antibiotics on the nitrification in freshwater aquaria. Care should **be taken in applying these figures to brackishwater,** but they may serve as a guide. Some substances, such as malachite green, are clearly very toxic. Of course, their use in an open system could be freely determined by required therapeutic levels.

Table 4 Effects of antibiotics on nitrification in freshwater aquaria*.

Compound	*Concentration ppm*	*Inhibition (%)*
Chloramphenicol	50	0-84
Oxytetracychne	50	0
Sulfamerazine	50	0
Salfanilamide	25	65
Erythromycin	50	100
Nifurpirinol	1	0
Chlortetracycline	10	76
Formalin	25	0
		27
Malachite green	0.1	0
Methylene blue	5	100
Copper sulphate	1	92
	1	0
	5	0
Potassium permanganate	4	0
	1	86

* From Spotte 1979.

Fig. 19 Illustrations of some epibiont protozoan genera reported from M. rosenbergii.