VM87

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Sanitation Practices for Aquaculture Facilities[1]

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Introduction

Fish culture facilities should rely on a disease prevention program which includes: water quality and nutritional management, quarantine of new animals, and sanitation. Sanitation practices should include disinfection between groups of fish, cleanliness while fish are growing, and prevention of disease transmission by equipment, personnel, or water.

Sanitation Practices for Fish Ponds

Pond-reared fish can be raised in a system of continuous production (referred to as "topping" in the catfish industry) or a system of all-in-all-out production. Continuous production involves replacing the fish that are harvested, with an equal number of fingerlings. For example, if 50,000 market-size catfish are harvested from a pond, 50,000 catfish fingerlings would be stocked back into the pond. In this system, ponds are rarely drained (perhaps every 5-10 years). When these ponds are drained, it is best to allow the bottom soils, which contain accumulations of organic matter, such as fish feces and uneaten feed, to air dry for several months. The soil should then be tilled (to a depth of about 15 cm) to accelerate aerobic decomposition of organic material.

Ponds that are harvested in an all-in-all-out manner are drained at the end of each production cycle. Many all-in-all-out ponds are managed as described above; however, very small ponds (+/- 30,000 gallons) may be washed between groups of fish to facilitate removal of debris. Washing the pond with a high-pressure hose and pumping or draining water removes the organic debris. (However, the debris is deposited in the adjacent drainage canal and may need to be removed at a later date.) This pond can then be "treated" with hydrated lime, applied to damp mud at 1000-2000 kg/ha (181-363 lb/surface acre) as a sterilant. Hydrated lime will rapidly cause the pH in treated areas to rise above ten, which will be lethal to parasites and bacteria and aid in the elimination of ammonia tied up in the muds. Ponds treated with quicklime at the recommended rate can be refilled after 10-14 days and prepared for another production cycle. Check the pH in the water in treated ponds before stocking fish.

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In addition to decreasing the amount of organic matter and potential infectious particles by treatment of pond sediments, it is important to prevent the spread of pathogens by disinfecting the equipment between uses in different ponds. Any equipment (boots, waders, seines, boats, etc.) used in a fish pond should be thoroughly dried (preferably in direct sunlight) or chemically disinfected before being used in another pond. This will greatly decrease the potential for disease transmission between ponds.

Sanitation Pratices for Indoor Tank Facilities

Fish housed in tanks or aquaria are increasingly subject to disease as intensity of rearing increases. Increased organic load, associated with high feeding and stocking rates, creates an environment where opportunist bacteria, fungi and parasites can flourish. To minimize this, water exchange should be adequate for the stocking densities and feeding rates. Particulate matter (feces, uneaten food, etc.) should be removed regularly. Dead fish should be removed promptly as they are an important means of transmitting infectious disease to other fish in the system, as well as fouling the water as they decompose. Many facilities design a rotational system so that each housing unit is thoroughly cleaned once a week. Cleaning includes removal of debris by siphoning, manual removal of algae from tank walls, and removal of excess particulate matter from the biofilter or sponge filter.

It is important that siphon hoses, brushes, and other equipment used to clean tanks be chemically disinfected between uses. An easy way to disinfect cleaning equipment is to have 30-gallon garbage cans located strategically throughout the building where it can be dipped or placed between uses. Chemicals used should be minimally toxic to fish yet effective at removal of infectious particles, oils, and other organic debris likely to accumulate on equipment. Potassium permanganate (10 mg/l), Roccal-D[1],a quaternary ammonium compound, or Nolvasan-S[2],a brand of chlorhexidine diacetate, are effective for disinfection of equipment. Commercial disinfectants should be used according to label instructions. Equipment should always be rinsed in fresh water following disinfection and before use in a tank containing live fish.

Footbaths and areas for employees to wash hands with a disinfecting soap should be placed at the entrances to buildings and between rooms within buildings. Wasing hand and feet not only directly decreases the potential for spread of infectious disease, but also encourages employees to think about cleanliness.

There will be times when tanks or entire buildings must be thoroughly sanitized. Sodium hypochlorite (chlorine) is often used as a disinfectant in hatchery buildings. The granular form (i.e. HTH) should be used for disinfection of tanks that are not in use but are near tanks housing live fish. Granular chlorine does not volatilize as readily as liquid bleach. In a poorly ventilated room, fumes from liquid bleach can cause fish kills in adjacent tanks. Concentrations of 10 mg/l for 24 hours are effective for disinfections of tanks or submersed equipment. If equipment is to be disinfected by submersion in a chlorine solution, concentrations of 200 mg/l can be used for 30 to 60 minutes, or 100 mg/l for several hours. Chlorine can then be neutralized by adding sodium thiosulfate to the solution (5.6 grams of sodium thiosulfate will neutralize the chlorine present in one gallon of a 200 mg/l solution).

If a building is to be thoroughly cleaned and disinfected while no fish are present, formalin or chlorine bleach may be used in high pressure sprays. Employees must wear protective clothing, eye protection, and respirators, and professional advice should be sought on methods, concentration, and exposure time. This extreme practice is necessary only in rare instances.

Sanitation Practices for Recirculation Systems

Ultraviolet Light

Sunlight is a practical means for disinfecting field equipment. Ultraviolet (UV) light can also be incorporated into indoor filter systems to minimize the spread of infection from one unit to another. Systems should be designed so that one rearing unit never receives water discharged from another unit.

In many cases, however, water from multiple tanks drains into a common sump prior to filtration and recirculation. Filtering water through UV light into the system decreases the potential for pathogen transmission.

Manufacturers' recommendations should be followed to ensure that the UV unit selected is appropriate for the water flow rate. In addition, UV light bulbs must be cleaned and replaced regularly. Effectiveness of UV light is dependent upon the size of the exposed particles and the length of exposure time. For this reason, UV is more effective against tiny particles (i.e., viruses and bacteria) than larger ones (i.e., protozoa). For modern recirculating systems, UV filtration is recommended, but the aquaculturist must be familiar with the equipment, its limitations, and its maintenance requirements.

Ozonation

Ozone (O_3) has been used for disinfection of large marine systems (i.e., public aquaria) for years. Ozone acts as a free radical and nonspecifically oxidizes organic material. Ozonation plays an important role in maintenance of water clarity in large display aquaria and can help decrease the number of infectious particles in solution. Excess ozonation is hazardous to humans as well as fish. Ozone gas is colorless and odorless. Malfunctioning ozone generators may release ozone gas, which can be a serious health hazard to humans in the vicinity. The safety recommendations made by the manufacturer should be observed. Ozone gas that remains in solution and comes in contact with live fish is also toxic. It damages epithelial surfaces (i.e., skin and gills) and will kill the fish. Before the installation of an ozone generator, professional advice should be sought to determine if it is appropriate for the system in question, and to determine the type of equipment necessary.

Summary

Sanitation is one of the cornerstones of fish health management in modern aquaculture. A number of infectious diseases, particularly external fungal infections, may be directly attributed to accumulation of organic material in the culture unit. Ponds may be sanitized between groups of fish by draining, drying, and in some instances by use of chemical sterilant such as hydrated lime. For smaller systems such as tanks and aquaria, debris should routinely be removed from the system by siphon hose, equipment should be disinfected between culture units, and chemical disinfectant (i.e., sodium hypochlorite) should be used to disinfect fish-holding units between groups of fish. Ultraviolet light and ozone may be incorporated into recirculating culture systems to minimize the number of infectious particles in the solution. Professional advice should be sought before investing in this equipment.

Footnotes

[1.] Winthrop Laboratories, Veterinary Products Division, New York, NY 10016.

[2.] Fort Dodge Laboratories Inc., Fort Dodge, IA 50501.