BIOSECURITY FOR FISH FARMERS –
A PROACTIVE APPROACH TO DISEASE PREVENTION AND PATHOGEN MANAGEMENT

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Micro Technologies, Inc., an aquatic animal health diagnostic laboratory in Richmond, Maine, has worked with fisheries, growers, state aquaculture coordinators and fish health officials affected by a 2006 emergency USDA-APHIS Federal Order issued after the identification of Viral Hemorrhagic Septicemia virus (VHS) virus in the Great Lakes region in 2005. The USDA Order, as amended May 4, 2007, prohibits interstate movement from defined affected and at-risk states and Canadian provinces of certain (known VHSV-susceptible) species unless the fish are tested and certified to be free of VHSV. Some of the species on the known susceptible VHSV list may be required to be certified free of other pathogens, like the muscle parasite Heterosporis and additional viruses, to gain access to live fish markets in other states and provinces. Micro Technologies’ USDA-approved laboratory was well-equipped to tackle a fish health and import/export emergency like this one – the firm has been performing biosecurity audits, certification, fish health screening and diagnostic testing for VHSV and other aquatic pathogens in North America for more than a decade.

VHS is a serious viral disease of finfish worldwide. Until the late 1980s, this virus, which causes affected fish to bleed internally and die, was thought to be a problem mainly for trout in freshwater systems in Europe. However, different strains of VHSV have since been discovered in many marine and anadromous fish species in both the Pacific and Atlantic oceans, and now the virus has been blamed for some die-offs of additional freshwater species (including muskellunge, freshwater drum, gizzard shad, round goby, emerald shiners and yellow perch) in the Great Lakes watersheds.

Fisheries managers and aquaculturists throughout the United States and Canada are concerned about the spread of this lethal virus from populations of wild freshwater fish in the Great Lakes into the aquaculture industry, as such an occurrence could lead to additional, large-scale, direct losses from disease and further trade restrictions. To lessen this threat, many agencies in both countries have placed restrictions on the movement or fish or fish products that could encourage the spread of VHSV beyond the known geographic range. The new regulations vary by state and province, however, and are sometimes prohibitively expensive for growers and fish dealers. As testing requirements evolve, the aquaculture industry must adapt its practices accordingly to maximize fish health and minimize pathogen transmission, starting at the farm level.
One of the most affordable and effective things fish culturists can do to preserve the health of their fish and their investment is to construct and implement a sound biosecurity program on the farm. For the purposes of this article, biosecurity for aquaculture is the prevention, control and eradication of aquatic animal disease – at the farm level. Note that biosecurity programs are designed to protect your operation from ALL types of pathogens, not just VHSv, although this is an import motivator. Fish farmers need to develop best management practices (BMP) specific to their facilities, consulting with fish health experts, which may include specially trained veterinarians, local university extension agents with aquaculture experience, and others. If biosecurity is a new concept on the farm, this can be a daunting task. To start, fish farmers should consider the following areas as priorities for evaluation, and use the sample Biosecurity Audit Questionnaire at the end of this article to identify places on the farm where there’s room for biosecurity-related improvement. Once problem areas have been identified, you can work with a local and/or a recommended fish health specialist to design a program that suits your facility and maximizes the fish health and production capacity of your farm.

ESSENTIAL ELEMENTS OF A BIOSECURITY PROGRAM:

1. **Employee education & written record** – discuss the changes (new footbaths, dedicated equipment locations, disinfection protocols, etc) with ALL workers. The most effective biosecurity programs are written down as part of the permanent Standard Operating Procedures of the facility. Workers should be expected to memorize any biosecurity protocols relevant to their areas, but a written reference should be readily available to remind anyone of the agreed-upon procedures.

2. **Knowing the needs of your operation** – any biosecurity plan should be tailored to YOUR facility – the species you collect or grow, your water source, your market (import/export regulations,) etc. *SEE SAMPLE BIOSECURITY AUDIT QUESTIONNAIRE, below.*

3. **Surveillance** – Know what might be present on your farm. “It’s not just a good idea, it may be the law!” From a regulatory standpoint, the level of surveillance may be species dependent – e.g. federal level (U.S. Fish & Wildlife Service): sets surveillance requirements on fish coming into the country under terms of 50CFR Section 16. For salmonids, these requirements are known as Title 50 certification. Prior to the identification of VHS in the Great lakes, IMPORTATION OF MOST ORNAMENTALS and NON-SALMONIDS was NOT FEDERALLY REGULATED. States have the option to be more restrictive than the feds, but not less restrictive. BE PROACTIVE – protect yourself by having regular check-ups on your facility.

4. **Quarantine & Restrictive Access** – Keep new fish in separate containers, and ideally on a separate water source to prevent introduction of pathogens or parasites. There is always the chance, particularly if surveillance at the source facility is a new phenomenon, that the new fish may be carrying something. Transport and handling are stressful for fish, so fish that normally appear healthy but carry a pathogen (“carriers”) may show signs of illness after arrival at a facility. LENGTH OF QUARANTINE? Recommendations are based on incubation times for a disease – new arrivals should be placed in quarantine for a minimum of 14 days, though 21-28 days is recommended. Require visitors to your facility to leave vehicles in an area remote from the fish and wear clean, protective clothing (provided and maintained by you) on site, and/or require visitors to disinfect their vehicles, clothing, hands, footwear and any equipment brought from off-site at a disinfection station at the entry point to the farm.
5. **Disinfection** – POSSIBLE VECTORS (routes of transmission) ABOUND: from holding unit to holding unit via infected fish or infected water; via shared equipment; by personnel. DISINFECT: materials, containers, hands, protective clothing, equipment.

6. **Appropriate fish husbandry** – Clean water, clean tanks, *appropriate density* (depends on species and size of fish), timely removal of dead fish & uneaten food, separation of equipment between tanks/rearing units, good quality nutrition, etc.

7. **Disease treatment** – Establish a relationship with aquatic animal veterinarian, and consult her/him for diagnosis of problem. Treat only with approved product(s) and consider vaccination for certain conditions (if available and effective.) Remember that many diseases are “treated” or minimized with good husbandry practices.

8. **CONSISTENCY** – establish biosecurity standards and practice them – always!

9. **ACCOUNTABILITY** - In culture facilities, the ability to avoid disease introduction and control disease transmission IS UNDER YOUR CONTROL. Know what’s out there (on your farm), screen your population at least annually, but ideally every six months to rule out diseases, address problems as they arise, and only bring in stock from reputable growers or designated (specific disease-free) areas.

10. **GOOD COMMUNICATION** - Provide an environment where your workers feel comfortable giving feedback about how the animals are doing – daily records, weekly fish health meetings, whatever it takes. Communication with local fish health folks – extension agents, fish health officials, veterinarians – about questions or concerns you may have.
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HATCHERY BIOSECURITY AUDIT QUESTIONNAIRE –
A Sample to help identify biosecurity “holes” at your facility

Hatchery name_______________________________________
Location_____________________________________________
Date of audit__________________________________________
Primary contact person at site____________________________
Auditor________________________________________________

General Background
SECTION SUMMARY: Interview facility manager to obtain information about employee numbers & qualifications/experience; and to determine whether or not any kind of biosecurity is practiced at the facility, and if so, to what level.
Sample questions:
- Is someone specifically designated at the hatchery to develop and implement biosecurity-related protocols? If yes, who?
- Does the facility participate in a formal (state, regional, federal or internationally required) fish health surveillance program?
- Define the type and frequency of fish health surveillance program (e.g. OIE facility-level inspections, semi-annual; annual inspection consistent with 2007 New York state regulations for salmonids, etc.)

Physical Plant
SECTION SUMMARY: Questions about year the facility was built, types of tanks and other equipment or housing types used, as well as amount of money allocated for facility maintenance gives auditor a sense of what level of biosecurity could be practiced at the facility. Plant diagrams are helpful, especially if the auditor is not conducting an on-site visit. In addition, this section helps determine the ability of a facility to effectively separate (physically, as well as by water source) fish lots is a fundamental piece of good biosecurity.
Sample questions:
- Age of hatchery_____________
- Construction type____________________
- Annual maintenance budget for facility__________________________________________
- Number of species at hatchery______________________________________________
- Number of Lots____________________________________________________
- Is a facility blueprint available?

Disinfection
SECTION SUMMARY: Detailed information about products used for disinfection and what protocol are used (concentrations, contact time, etc.) are essential elements to evaluate and revise if necessary.
Sample questions:
Disinfection protocols_____________________________________
Disinfectant type(s)________________________________________
Disinfectant changed how often?_______________________
Are footbaths dirty/contain organic material?_____________
How is disinfectant concentration measured?______________________________

**Water Specifics**

SECTION SUMMARY: *Water source and quality play key roles in fish health and facility biosecurity. Questions should be asked to identify all possible water sources – and possible contamination of those sources with pathogens (e.g. from wild fish, from terrestrial animals if surface runoff used, etc.) – on a facility. Bear in mind that elements of water quality, including temperature, pH and mineral content, can greatly influence fish health and pathogen survival/proliferation.*

Sample questions:
Water Source(s)___________________________________________________________
Runoff gradients nearby__________________________
Water Quality Parameters
  - Temperature____________
  - PH____________________
  - DO___________________
  - Hardness (Total alkalinity)________________
Types of WQ Instrumentation_________________________________________________
How frequently is WQ checked____________________________________________
Average highest water temp_________ Month________
Average lowest water temp_________ Month________

**Fish Specifics**

SECTION SUMMARY: *Fish sourcing (wild vs. cultured, own broodstock vs. supplier-raised) and husbandry practices are more key elements of a biosecurity evaluation. Auditor should seek specific information about all sources of fish and what kind of attention is paid to morbidity/mortality levels and overall fish health to get a sense of what level of attention is paid to this important potential source of pathogens.*

Origin of individual lots
  - Source________________________________
  - Does source facility provide fish health certification?_____ If yes, what kind?_______
  - Type (eggs, fry, fingerlings)____________________________
Quarantine Procedures_______________________________________________________

**Broodstock designation specifics**

Origin_______________________________________________________________
Egg disinfection protocols
  - Disinfectant used________________________________
  - Concentration________________________________
  - Sequence/method of water-hardening/disinfection/shocking________________________

**Pathogens/Diseases**

SECTION SUMMARY: *This section gives auditor a sense of if and what kinds of pathologies are seen at this facility, and how infection or disease is managed when they occur. Questions should be tailored to the parasites and diseases specific to species raised at the facility or to conditions that are problematic in the region. Some questions should also target any preventative health measures taken at the facility.*
Pathogens/Parasites/Diseases routinely screened for: ______________________________
Screening by whom___________________________________________________________
Types of Screening Tests_________________________________________________________________
Prophylactic parasitic treatments? ________________________________________________
  Frequency_____________________________
  Type _______________________________
  Concentration_______________________
  Duration____________________________
Prophylactic antibiotic treatments? _______________________________________________
  Type_______________________________
  Concentration_____________________  
  Frequency____________________________
  Duration____________________________
Therapeutic antibiotic treatments? _________________________________________________
  Type________________________________
  Concentration_______________________
  Frequency____________________________
  Duration_____________________________
Vaccinations? _________________________________________________
  Type used (immersion, injection, other)_____________________________________________
  Manufacturer________________________________________
  Age/Size at vaccination________________________________
  Anesthesia used?____________________________________
  Average mortality (hatchery) per month___________________________
  How, where and by whom are mortalities recorded?_______________________________
  Number of mortalities that constitute an alarm threshold___________________________
  Does the facility have a veterinarian (on staff or on call)__________________________

Other details
To obtain meaningful, useful results, the Biosecurity audit questionnaire MUST be tailored to the operation under review. Other key elements that one might consider for review are: nutrition, more info about suppliers (including a request for fish health certificates for stocked fish and the suppliers’ or transporters’ biosecurity practices), predator control on the facility, and visitor traffic (especially for fee-fishing or multi-use farms.)