Hatchery Sanitation and Disease Prevention

Presented by
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Overview of today’s presentation

- Sanitation defined
- Source of the problems
- Prevention, control, and management solutions
- Conclusions
Sanitation

• Those measures that we take before, during and after production runs to maximize health by minimizing the impact of diseases.

  – What are these measures?

  • Efforts to control movement of pathogens into and through the animals
  
  • Begins with water intake and facility design and encompasses entire range of movement of possible sources of infectious material throughout the production cycle
Sanitation

– Ideally with optimum sanitation one should see
  • High survivals in the hatchery (consistently >90%) and decreased costs of production per animal
  • Higher survivals in the farm due to decreased pathogen movement from and through the hatchery and stronger animals resulting from optimized husbandry
Poor sanitation results

Direct and Indirect

Direct-diseases that occur in the hatchery
- Filamentous bacteria
- Fungi
- Vibriosis
- Water Quality Related Diseases-obstruction and fouling

Indirect-diseases that pass through the hatchery
- Viral Diseases such as WSSV, MBV, IHHNV
- Likely also some bacterial diseases

These diseases may be seen together though one or more may appear to dominate
Diseases

• Major problems in the hatchery stem from bacterial pathogens
  – Filamentous bacteria
Other Bacteria

- *Leucothrix mucor*
Fungi

• *Lagenidium spp.*
Vibrios

- Common cause of mortality in hatchery and farms-likely kills more shrimp than all other diseases combined
  - Dozen or more strains have been associated with mortality
  - Z2 or Zooea Syndrome, vibriosis
  - many different strains cause disease
  - TCBS both yellow and green colonies can kill shrimp
Vibrios
Others

• Viral diseases that cause mortality in the hatchery
  – MBV
  – BP
  – TSV-not commonly
• Viral diseases that shrimp can carry through the hatchery and cause problems in the farm
  – WSSV
  – YHV
  – IHHNV
• Gill and surface fouling
  • Mechanical with particulates from high suspended solid loads
  • Protozoan
Where do the problems come from?

- Engineering/Facility Design considerations
- Water Quality
- Live and prepared feeds
- Maturation Facilities and the Seed
Engineering and Design Considerations

Water source, water quantity (is there enough), reservoir holding capacity, expansion capacity, water recirculation systems in maturation

Ease of water exchange, ease of cleaning and disinfection

Tank Design-configuration and composition

These issues can affect water quality directly but also affect the ability to properly clean the system
Water Quality

• Primary source of sanitation problems in the hatchery
  • Organic material
  • Bacteria/protozoa
  • Other contaminants—pesticides, herbicides, heavy metals, etc.
Live and prepared feeds

- **Algae**
  - Bacterial contamination

- **Artemia**
  - Bacterial contamination

- **Prepared Feeds**
  - Improper use or poor quality leads to polluted water, high suspended solid loads, high bacterial loads
Maturation Facilities and Seed

- From infected brood stock-vertically transmitted diseases such as WSSV, IHHNV
- From infected brood stock-false vertical transmission such as MBV, BP
- From seed directly, filamentous bacteria, vibrios and other bacteria and both ecto-parasites and endo-parasites
Solutions

Engineering
Water
Feed
Seed
Monitoring Success

• Success will produce obvious results
  – High survivals and better profits

• Quality Control
  – Monitoring of those critical points in the system where problems can originate from
    • Why do we do this? To ensure that when systems fail or begin to fail we know. To proactively maintain sanitation not to reactively fix problems. Insurance.
    • How do we do this? Running a microbiology lab using proper scientifically valid techniques.
Engineering

• Proper design of water system
  – Water source-beach, off shore, estuary, well; each with different potential requirements for sanitation
  – Reservoir capacity and design-cleanable surfaces
  – Plumbing should be accessible with no dead ends
  – Should be able to clean entire system with high levels of Chlorine or Formaldehyde

• Proper design of tanks
  – Cleanable surfaces-concrete not cleanable. Epoxy, fiberglass, plastic liners
    • Biofilm formation
  – No dead ends in water system to allow thorough drying and disinfection
  – Proper access to tanks and tank design to allow flushing of organics
Proper tank design
Water

• Minimize potential pathogen loads in the water both incoming and in system
  – Water treatment
    • Chlorination
    • Filtration-mechanical (low micron filters, bags, sand, carbon)
    • Disinfection - UV, Ozone
  – Cleanliness of what you add to the water
    • Feeds, “additives”, etc., Animals
Animals

• Breaking the Viral transmission cycle
  – Use Specific Pathogen Free (SPF) broodstock; usually produced in closed systems not on farms
  – Biosecurity protocols in place to prevent contamination
Maturation

- Use of SPF animals-prevents movement of specific viral and bacterial pathogens
- If not SPF screen for vertically transmitted diseases IHHNV, WSSV, and false vertically transmitted diseases MBV and BP.
- Use spawning techniques that optimize sanitation-individual spawning, remove females and eggs from spawning tanks ASAP. Avoid fecal contamination.
Maturation

• **Proper Sanitation in the Adult**
  
  – Infected feeds can cause problems
    • Includes use of feeds free of pathogens
      – WSSV in worms
      – Vibrios in bivalves
  
  – Pond animals-Surface disinfect animals-formalin 150 ppm for three days in row –min one hour
  – Treflan  5 ppm for one hour
  – 0.1 mg/L Cu using a chelated copper product (K-TEA or Cutrine) for several hours two days in a row
Seed

- **Surface Disinfection of Eggs and Nauplii**
  - Iodophors; Lots of clean water (the more the better)
  - 50-100 ppm for 60 to 120 seconds kills most pathogens but not all bacteria
  - Must be careful to avoid damage by excessive handling
  - Should be placed in clean environments, little point in cleaning animals and then putting them back into dirty environment
Hatchery Tanks

- Treflan (Trifluralin) a herbicide
  - To kill fungal hyphae in the water 2 to 100 ppb depending on problem. Problem usually is not enough.
  - Repeat applications needed as Treflan degrades very fast.
  - Spores are resistant to Treflan—need Chlorine (>500 ppm for 48 hours) and or Formaldehyde (50 ppm) to kill spores.
  - Entire system has to be dried and disinfected to rid the system of the spores. Thrive in systems with high levels of suspended organic material
  - Does not treat the disease only kills the hyphae
Hatchery Tanks

- EDTA to bind toxic metals
  - Facilitates hatching and molting
  - Makes critical metals unavailable for bacterial growth
    - Some bacteria require cations such as Fe for virulence
  - Levels vary from 5 to 20 ppm
Hatchery Tanks

• **CHLORION** a branded Chloramine T product-a chemical—not a drug or antibiotic
  - Long history of use in fish industry (more than 70 years)
  - Tamed chlorine compound-active component is Chlorine
  - Low toxicity
    • 96 hr LC 50 for juvenile PLs is 45 ppm
    • Wide range of life stages tolerate exposure from Mysis on up
  - Very wide spectrum of activity
    • Traditionally used for filamentous bacterial problems
    • Active against entire range of pathogens, dosage dependent
Hatchery Tanks

• CHLORION (continued)
  – Can be added directly to production tanks to prevent problems
    • Mysis 2.5 ppm
    • PLs 5 to 8 ppm daily
  – Can be added to treat problems-not an antibiotic-a chemical
    • Will kill vibrios and other pathogens
    • Shrimp can tolerate 20-30 ppm for short periods of time
Hatchery Tanks

• PROBIOTICS
  – Living micro-organisms that colonize the shrimp, the tank surfaces (biofilms) and the water
  – Best are Bacillus based
    • Shelf stable because of spores
    • Not all brands work the same; many not effective
  – Culture required
    • AQUAPRO-B
      – Out competes Vibrios by better accessing feed and consuming organic material
Hatchery Tanks

• Non Specific Immune Stimulants
  – Protection against failures of sanitary systems
  – MBXC-I; used by immersion during transfer of PLs or direct addition to the tanks
  – Feeds with similar materials in them (glucans, nucleotides, etc.)
MBX increases survival

Survival to PL 15 (fed at M1)

Control: 38%
MBX fed: 62%

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Hatchery Tanks

• Live feeds
  – Algae contaminated with vibrios
    • Start with clean and pure cultures, use sterile technique for transfers, use high quality sterile (by filtration and chemical) water, prepare nutrient solutions using bacteria free solutions
    • Avoid the use of mass culture outside tanks unless you have the ability minimize airborne particulate exposure and can use air that is not a source of contamination
    • Quality Control-count vibrios in algae at various stages of the process. Discard tanks with high levels of infection
Hatchery Tanks

• Live feeds
  – Artemia
    • Add 60 grams of CHLORION to 1000 liters of water before the addition of the Artemia cysts.
    • Will produce bacteria free Artemia

• Prepared feeds
  – Usually not a direct source of bacterial problems.
  – Excessive feeding-too much feed at once, fouling of gills (liquid diets)-feed less at greater frequencies
Conclusions

• Proper Sanitation begins with the design and construction of the facility
• Water treatment needs to be tailored to the water source and needs to be adequate to ensure very low bacterial loads
• QC is essential to monitoring and ensuring that sanitation protocols are functioning
• Animal Sanitation starts with the adults and flows through spawning, eggs, Nauplii through to PLs packed for shipment to the farm
• Successful hatcheries have very high survivals and produce high quality stress and disease tolerant animals