Flavobacterium
psychrophilum

A Holistic Management Approach

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Freshwater Fisheries Society of BC
The History
Prior to 2004 yellow pigmented bacteria outbreaks at FFSBC facilities were reported out as ‘systemic myxobacteria infections’

Once agglutination confirmation test was available outbreaks were identified as *Flavobacterium psychrophilum*
History

- The following 4 slides are excerpts from an update I presented at our 2002 fall planning meeting.

- What was then known as ‘Myxobacteria’ infections (and what we now identify as the ‘cold water disease’ form of Flavobacterium psychrophilum) were just starting to appear in our hatchery facilities.
“Ken’s 2n/3n study”
(FVTH 2002)

“Some interesting fish came in near the end of the study. It is amazing that these fish were still alive as some of the lesions had eroded into the body cavity and internal organs were exposed”
Taylor 3n pitted lesions on dorsal (RPU area 2002)

Pitted lesions appeared to be a form of coldwater disease; only saw through one season.
Skin scraping of pitted area
(RPU area 2002)
Gram stain of kidney smear
extensive ‘systemic Myxobacteria’
(2002)
Fraser Valley 3N in RPU
(2003)
By 2005 we were experiencing heavy losses between swim up and fry stage.

3 out of 5 major production facilities were taking substantially heavy losses.

Conducted a facilities tour/workshop on Fish Health and the correlation between stress and disease outbreaks.
After initial attempts to eliminate the problem were unsuccessful, the Freshwater Fisheries Society formed a sub-committee to:

- Identify problem areas
- Focus research needs
- Develop management tools to combat bacteria

Sub-committee was comprised of representatives from the following areas:

- Fish Health
- Research and Development
- Hatchery Staff
- Management
Problem areas initially identified included:

- Disinfection techniques
- Developed a disinfection apparatus which would allow circulation of the Iodophore to all surfaces of the egg with minimal egg movement
New upwelling disinfection system for eggs
Well water testing

- Well water testing using basic filtration system, gridded filter papers and Sheih’s media

- Still being implemented but have done some initial screening of well water at two facilities to test for presence of *F. psychrophilum* in water.

- Hope to implement a consistent screening process in 2008
Water Sterilization

- UV water sterilization
- To date has been unsuccessful
- Will be moving the sterilization unit to another location where more time can be focused on working with the unit
Bio-Security

- Review and upgrade Biosecurity procedures at facilities
- In spring of 2007 hatchery facilities tour
- Identified areas where needing biosecurity upgrading: minors and majors
Minors

- Traffic patterns within facilities
- Segregation of equipment
- Pass through windows from outside into incubation
- Dedicated boots, nets, brooms and buckets on all rearing containers

Coro-plast dividers between stacks

Pass thru windows from outside into incubations
Minors cont.

- Brushes and sieves mounted up off ground
- Dedicated boots for entering incubation area
- Segregation of equipment
- Separate trolleys and feed buckets for each rearing unit
Individual siphons and buckets for picking eggs and alevins

Disinfection areas: Rinse organic matter, disinfect, rinse and dry
Containers, Buckets and individual brooms and nets for each rearing area plus several sets of sampling equipment
Majors

- Incubation room re-vamp

Remove archive files to another location and move benches to create a boot and apron exchange area.
Trough room re-vamp

- Small troughs have:
  - Spacing issues
  - Are shallow
  - Hold smaller numbers of fish
  - Intensive husbandry

- Replace some trough with larger troughs for large groups of rainbows
Converting storage containers into mobile spawning sheds and storage facilities

Removable flooring in incubation to allow better cleaning and disinfection of area

Building special areas to create drying rooms for field gear
Clear signage

Isolation incubation areas

Keeping areas clean and organized during shut down periods
Converting step down troughs to isolated single pass troughs
Fish Husbandry Practices Checklist

- Developed as an annual review tool for hatcheries
- Developed as an orientation tool for new and returning auxiliary employees
- Focus: to reduce prevalence and spread of *Flavobacterium psychrophylum*

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<tr>
<th>Action Item</th>
<th>Done</th>
<th>Not Done</th>
<th>Corrected</th>
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<tbody>
<tr>
<td><strong>STAFF ORIENTATION AND TRAINING</strong></td>
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<td>The following checklist is to be reviewed annually in a special meeting of all staff. All new staff are to be fully apprised of the following checklist and any future standard operating protocols for fish husbandry during their orientation session and advised who to discuss practices with when uncertain. All fish culture staff should train and provide direct supervision of junior and subordinate staff to ensure compliance with all fish husbandry practices.</td>
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<td><strong>INCUBATION FACILITIES</strong></td>
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<td>Staff to only enter incubation rooms for incubation tasks. Staff entry via single-entry door only.</td>
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<td>Install barrier curb with rubber boots placed on incubation side and staff to step directly into boots across curb.</td>
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<td>Wear waterproof aprons when working in incubation. Incubation rooms to have dedicated equipment with no additional equipment entering or exiting these rooms.</td>
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<td>Label all equipment as incubation room use only. Provide open meat shredders to keep all equipment off contaminated floor. Anything touching floor is considered contaminated and must be disinfected before use.</td>
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<td>All incoming eggs to enter facility through dedicated pass-through window or door. If using door, it must have a pull gate closed across door bottom as an obvious barrier to staff entry/exit. Door to be labeled as no staff entry/exit.</td>
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<td>Install corrugated or similar impermeable plastic material between all incubation stacks to prevent splashing between stacks. Side barriers to extend at least 6&quot; in front of stacks to create distinct incubation zones.</td>
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<td>Provide inoculum lab record sheet that includes the date the inoculum was changed and any “top-up” dates and the quantity of inoculum used at top-up.</td>
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<td>Use separate equipment for picking of eggs and eggs in stacks and locate this equipment or immediately beside each stack and between its splash guard barrier.</td>
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<td>Ensure a separate egg wash/mortality freezer is kept in incubation rooms and only store incubation rooms in this freezer prior to disposal.</td>
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<td>All clean-up fry to be passed from incubation room through pass-through window or door directly onto trough room cart. Cart to have a high-sided drip tray to catch any dripping water such that no water drips continuously to parking location.</td>
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<td>Wash hands with soap and hot water before entering and upon exiting incubation room.</td>
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<td><strong>TROUGH REARING FACILITIES</strong></td>
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<td>Label all equipment as trough room use only. Each trough or pair of step-down troughs to have its own mortality scoop, cleaning brush and mortality sheet and they are to be located at outlet end of trough. Trough brush to dip into trough outlet and not onto floor. Any equipment shared between troughs to be thoroughly disinfected before each use. If necessary purchase sufficient equipment to ensure an adequate inventory. Large trough mortality bucket to be labeled as such and is not to be carried by staff whenever possible but rather slid along the floor by foot minimizing contact. Loss scoop is not to touch mortality bucket.</td>
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**2007**

- *Flavobacterium* continues to be an issue in two of our production facilities

- Ex: % survival from swim up to fry *(1 facility)*

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<th>2002</th>
<th>2007</th>
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<tr>
<td>NRT</td>
<td>92%</td>
<td>69%</td>
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<tr>
<td>2n RBT</td>
<td>92%</td>
<td>78%</td>
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<td>3n RBT</td>
<td>86%</td>
<td>80.5%</td>
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Positive outcomes

- Kootenay trout hatchery has had minimal production loss to *Flavo* for two years
- Have identified carrier stocks
- Have identified susceptible stocks
- Staff are more conscience of modes of horizontal transmission and try to minimize stressful events
- Staff have accepted changes in production methods
- Staff actively participate in identifying areas needing improvement and developing new techniques
Activities for 2008

- Starter diet comparison study
- Strain variance and drug sensitivity work
- Study comparisons in hatching out and larval clean-up methods
- Facility disinfection - including pipes
- More structural bio-security related upgrades
- Development of Bio-standards for specific stocks and genotypes.
We invite other organizations to share their ideas in their management approach to this bacteria.

Thank you!