An Overview of Incubation Techniques for Cool and Coldwater Fish Species at the UWSP Northern Aquaculture Demonstration Facility

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Facility Information

• Located 5 miles north of Bayfield, WI in the town of Red Cliff on Hwy 13

• 8500 sq ft Aquatic Barn

• 2 high capacity wells

• Propane fired boilers and plate heat exchanger system

• Outdoor rearing ponds, external collection kettle and linear raceways

• Effluent settling basins and final treatment wetland
Walleye Egg Collection

• Eggs are collected from adult male and female walleyes in spring (April-May) utilizing fyke nets set in natural spawning areas.

• Eggs are fertilized, clayed and transported back to hatchery.

• Eggs are cleaned with fresh water and disinfected with 100 mg/L iodine/15 min.

• Water hardened eggs are measured and placed into bell jars.
Walleye Egg Incubation

- Initial water temperature 48-50°F
- Gently roll eggs in the beginning (0.4gpm) with aerated/degassed groundwater
- Increase water temperature slowly to 59°F to speed up hatching
- Increase flow rate to 0.7gpm once eggs are eyed up
Walleye Egg Incubation

Dead egg removal

• Dead eggs (white) accumulate at the top of jar
• Dead eggs need to be removed daily to limit fungus growth
• Use of simple siphoning tube constructed of piping and clear plastic hose
Walleye Egg Incubation
Chemical Treatment

- Modified chicken waterer with hole drilled in bottom ring

- Chicken waterer is placed to drip into water headtank feeding bell jar system

- Set up for 15 minute (1,600ppm) formalin drip daily based on flow rate

- Use safety equipment when using chemicals
Walleye Hatching and Fry Collection

- Discontinue formalin treatments
- **FORMALIN WILL KILL FRY!!!**
- Remove screens from bell jars to allow fry to swim out
- Fry swim out of bell jar into collection tanks
Walleye Hatching and Fry Collection

• Collection tanks have large box style screens over drains to maximize screen surface area

• Run bubble strips along screen to prevent clogging and clean frequently during hatching

• Strong swimming fry 3-5 days old can be concentrated in the collection tank utilizing a light source
The UWSP-Northern Aquaculture Demonstration Facility and the Red Cliff Tribal Fish Hatchery conducted a joint project to evaluate and demonstrate different culture parameters to maximize lake herring production on a commercial scale.

The project consisted of six different areas including:
1) Egg collection and disinfection
2) Egg incubation at various flows, temperature and water conditions
3) Fry production at various temperatures and with several different fry diets
4) Fingerling and grow out production
5) Economic analysis
6) Outreach/extension

Experiments were conducted inside the main Aquatic Barn at NADF and at the Red Cliff Tribal Fish Hatchery
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Lake Herring: Materials and Methods

- We enlisted the help of the “Eleanor B” commercial fishing vessel and Captain Craig Hoopman, Bayfield, WI for fish collection.

- Bottom Set Gill nets (2 ¾” mesh) set in depths of 120-150 ft. were utilized for one night sets to capture adult spawning Lake Herring in Lake Superior.

- Water temperature was 6.7º C
  Air temperature was <0º C

- Approx. 2.5 million eggs were collected December 7 and 12, 2007 by hand spawning ripe females and males directly on the boat (wet and dry methods).
Materials and Methods

- Eggs were transferred to Bell jar and Heath Tray Incubation Systems at NADF and RCTFH.
- Initial average water flow per jar was 0.6 gpm (2.5 L/min).
- Increased average water flow near hatching to 1.2 gpm (4.6 L/min).
- Bell jar head-tank Averages:
  - Water Temperature 45°F (7.7°C)
  - Oxygen 11.0 ppm
  - pH 7.8
  - TDGP 100%
- Eggs were treated daily with formalin drip at 1,600 ppm/15min utilizing a chicken waterer setup.
Materials and Methods

Three Egg Treatments in Bell jars:
(500 ml eggs per jar- six jars each treatment )

1) Control- No Iodine Treatment

2) Pre-water hardening iodine treatment (Pre-WHIT) of 100 ppm Iodine/55 minutes average

3) Post-water hardening iodine treatment (Post-WHIT) of 100 ppm Iodine/10 minutes
LAKE HERRING EGG INCUBATION RESULTS

Average Egg % Survival by Treatment In Bell Jars

- Control
- Post WHIT
- Pre WHIT

Treatment
Lake Herring Hatching and Fry Collection

• Similar to walleye

• Fry hatch and swim out of jars into shallow collection tank

• Fry easily collected in shallow tank

• Attracted to light for collection or feeding purposes
Coldwater Species: Brook Trout

- Typical coldwater species egg incubation methodology
- Other similar species rainbow trout, brown trout, salmon sp.
- Eggs are collected by hand from adult female fish from domestic or wild broodstock
Coldwater Incubation Systems

• Vertical Heath tray incubation systems - 16 trays

• Water flows from top to bottom

• Upwells within each tray

• Good water quality is important all the way to the bottom tray

• Use single pass groundwater when possible
Typical Water Quality Parameters

- Temperature 45-52°F
- Oxygen 10-12 ppm
- Flow rate 5-10 gpm per stack
- Tray egg capacity 10,000-25,000 depending on species
- Eggs hatch in trays
- Remove dead (white) eggs daily. Use baby nose aspirator or wire forceps
- Treat for fungus with daily drip of formalin (1,600 ppm) or hydrogen peroxide (500ppm -35% solution -one stack (stop as hatching nears)
Coldwater Incubation Systems

- “Cannon” Pipe Incubator
- Egg capacity: 150,000-180,000
- Similar water quality requirements as heath trays
- Less fungus issues
- Space saving
- Fry can be poured out into rcw
Hatching

- Eggs hatch in approx. 44 days at 50°F (799 DTU)

- DTU = Daily Temperature Units = every °F above 32°

- Colder the incubation temperature, longer time to hatch

Heath trays
- Remove eggs shells daily during hatching to prevent screen from clogging with small pieces of rigid mesh (1/16”) - usually the shells float.

- After hatching fry absorb yolk sacs and become more active, then can be moved to fry tanks and initially fed
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