

Fairbanks Experimental Fish Hatchery Fish Culture Evaluation in Fairbanks

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**State of Alaska Department of Fish and Game
Division of Sport Fish**

Fish Culture Evaluation 2004-5

Three forms of rearing experiments:

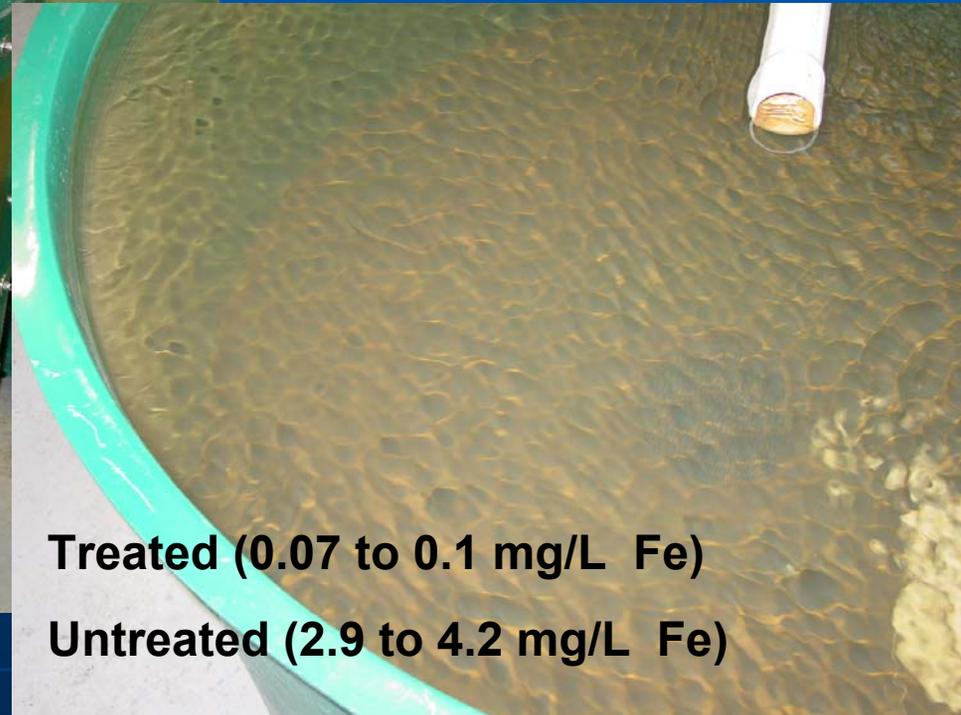
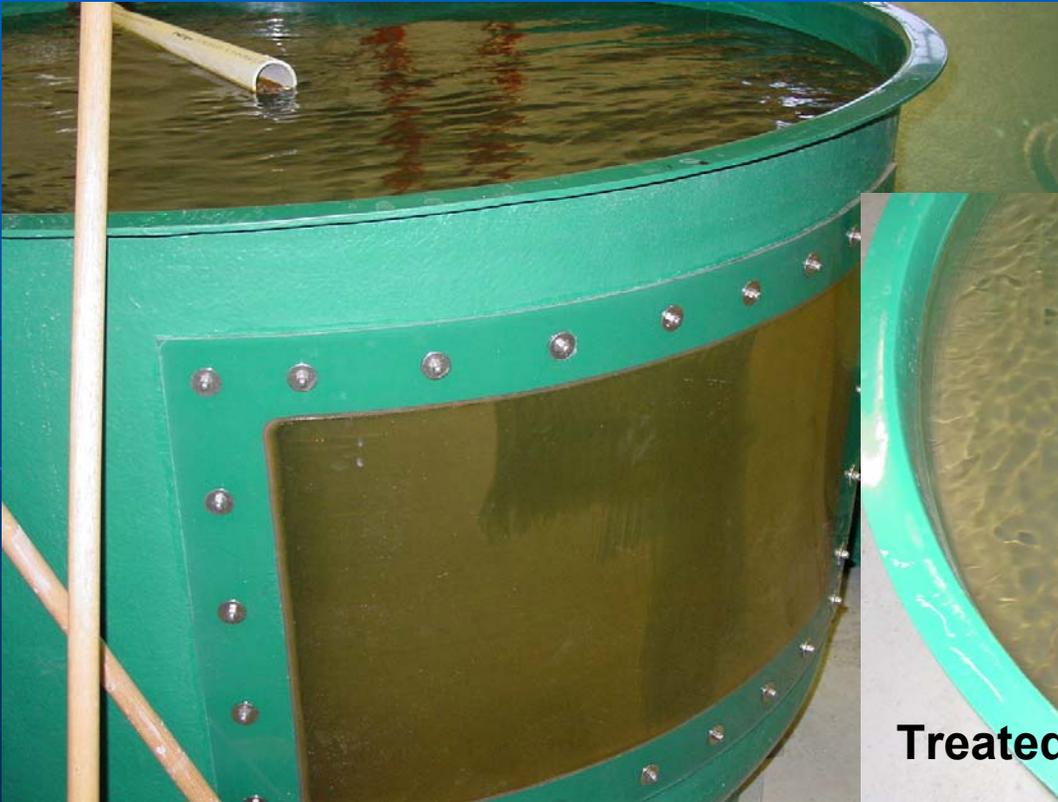
- Rearing in Untreated Water (28 days)
- Long-Term Rearing (11.5 mo) in Treated Water
 - To catchable size (120 g)
 - Periodic tissue sampling
- Incubation & First Feeding
 - Eyed eggs hatched in May/June



Fairbanks Experimental Fish Hatchery

💧 Rearing in Untreated Water (26 days)

100 fish untreated
200 fish treated



Treated (0.07 to 0.1 mg/L Fe)

Untreated (2.9 to 4.2 mg/L Fe)

Fairbanks Experimental Fish Hatchery

💧 Rearing in Untreated Water (26 days)

- 60% Mortality in untreated
- 0% Mortality in treated

💧 Fe particulates on slime layer, gill epithelium, oral cavity & nares

💧 Necrosis & fusion of gill lamellae

💧 Degeneration of epidermis

Fairbanks Experimental Fish Hatchery

After initial trial, studies transitioned to Long-term Rearing in treated Water to Catchable Size (120 g)

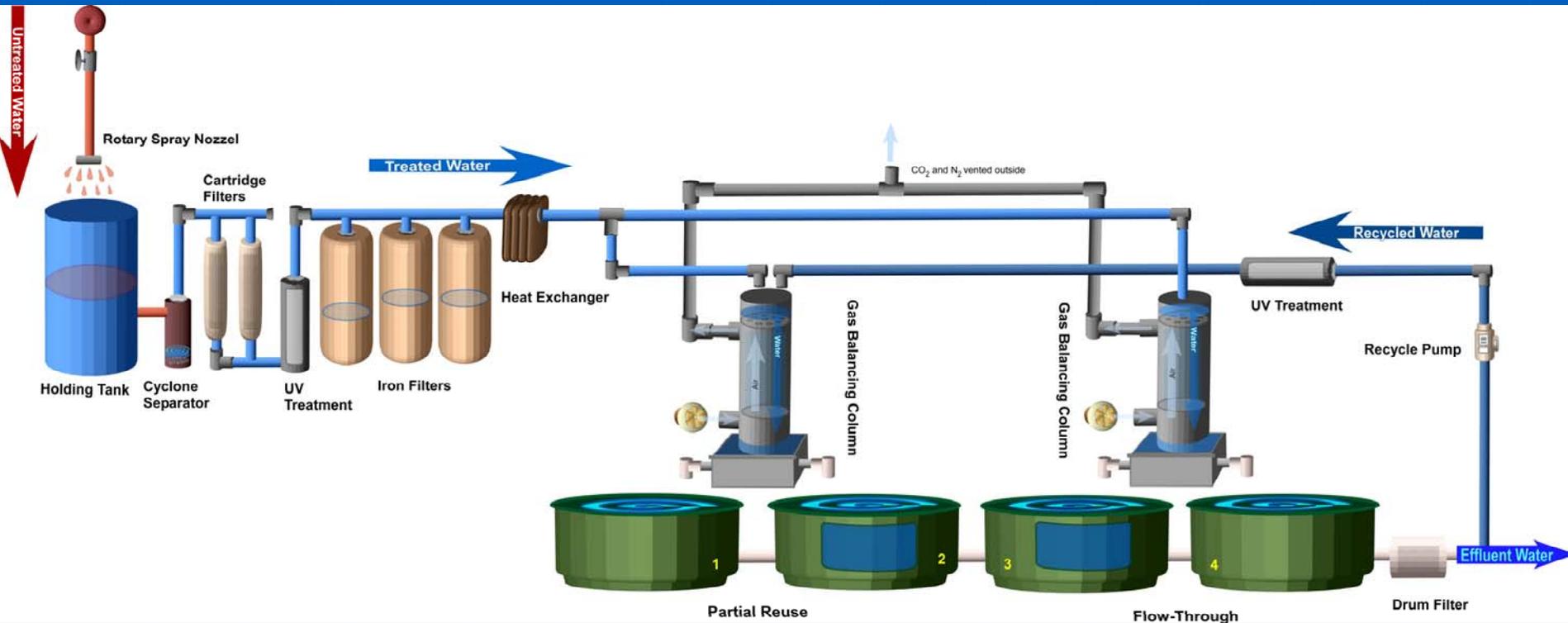
Two cohorts – long term rearing

- estimate survival rates
- estimate final mean lengths & weights
- Record gill condition
- Collect water quality data

Also included incubation and early life rearing

Fairbanks Experimental Fish Hatchery

Water treatment during 2004



Major components described in next slides →

Fairbanks Experimental Fish Hatchery

Water flows into a 1000 gallon holding tank to provide constant flow to the treatment system

Water is initially aerated, which removes H_2S & begins iron oxidation



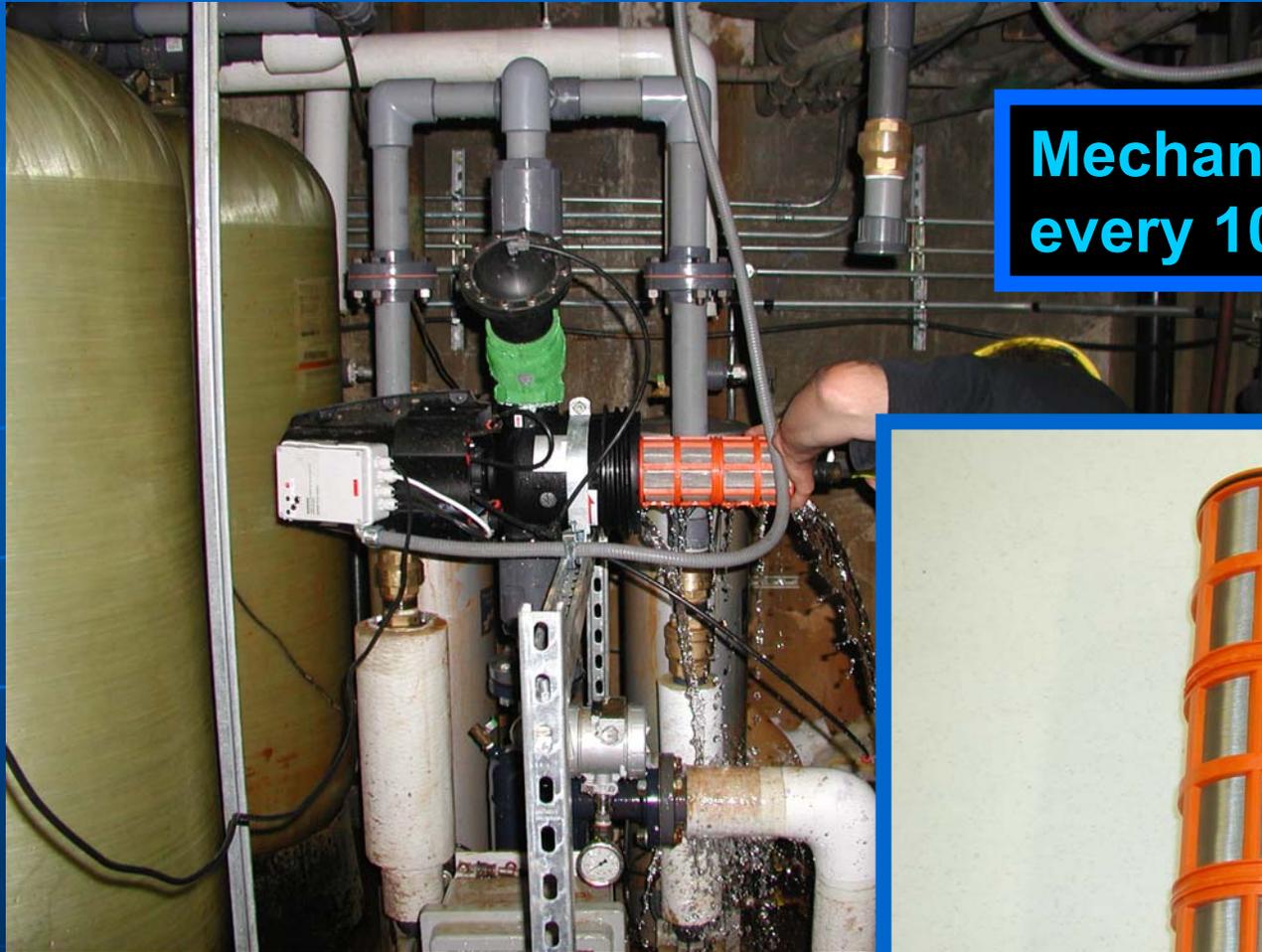
Fairbanks Experimental Fish Hatchery

**Cartridge filters removed
small suspended sediments**

**Required constant
replacement; eventually
discontinued**



Fairbanks Experimental Fish Hatchery



Mechanical filters clean every 10 minutes



Fairbanks Experimental Fish Hatchery

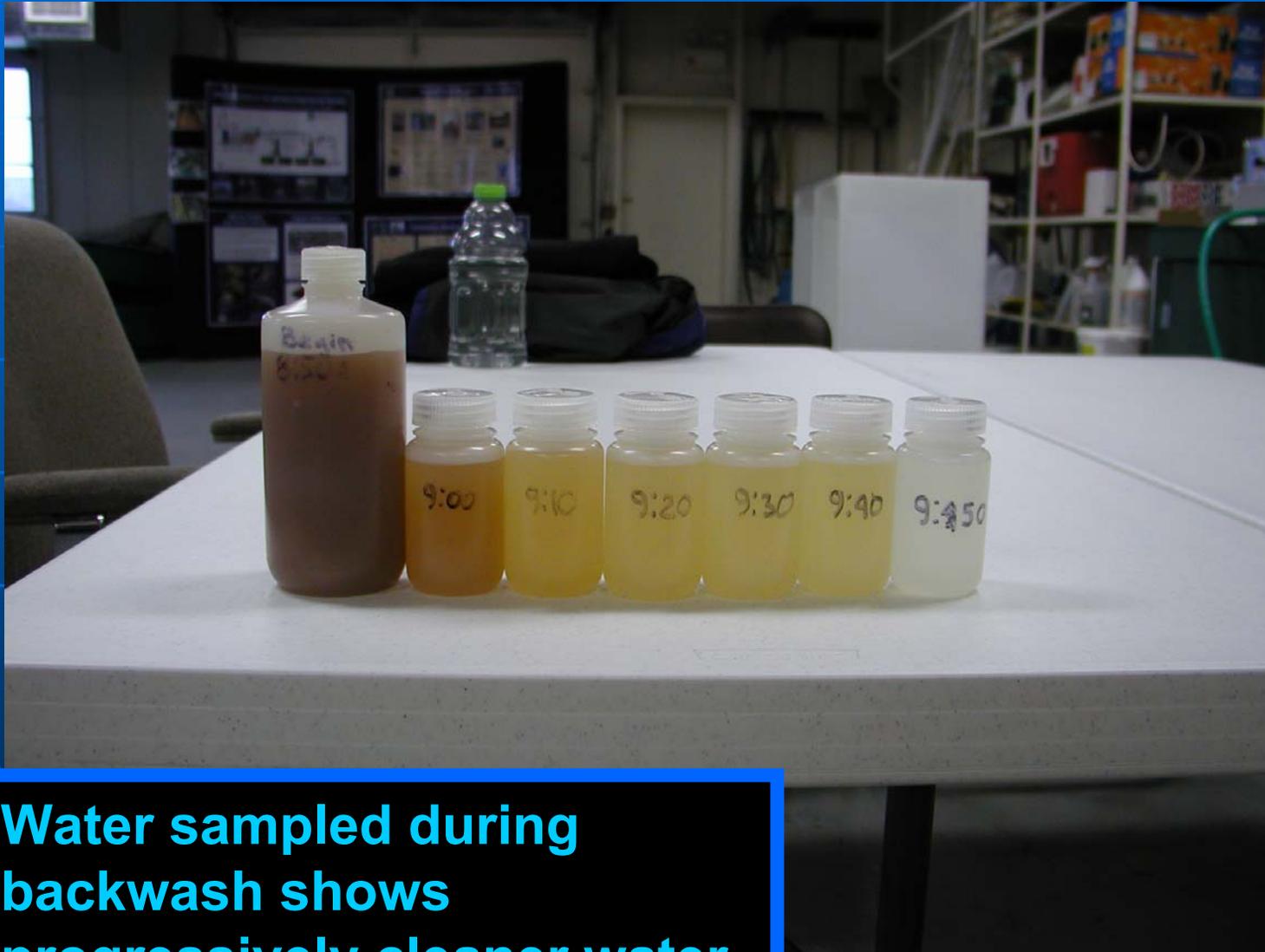


The iron filters are filled with Birm® media.



Iron filters need to be backwashed often

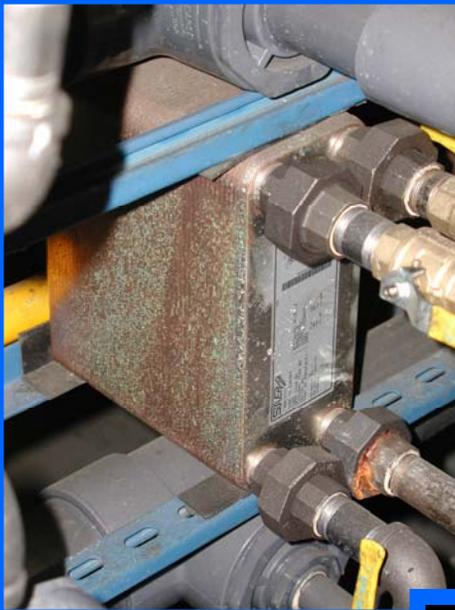
Fairbanks Experimental Fish Hatchery



**Water sampled during
backwash shows
progressively cleaner water**

Fairbanks Experimental Fish Hatchery

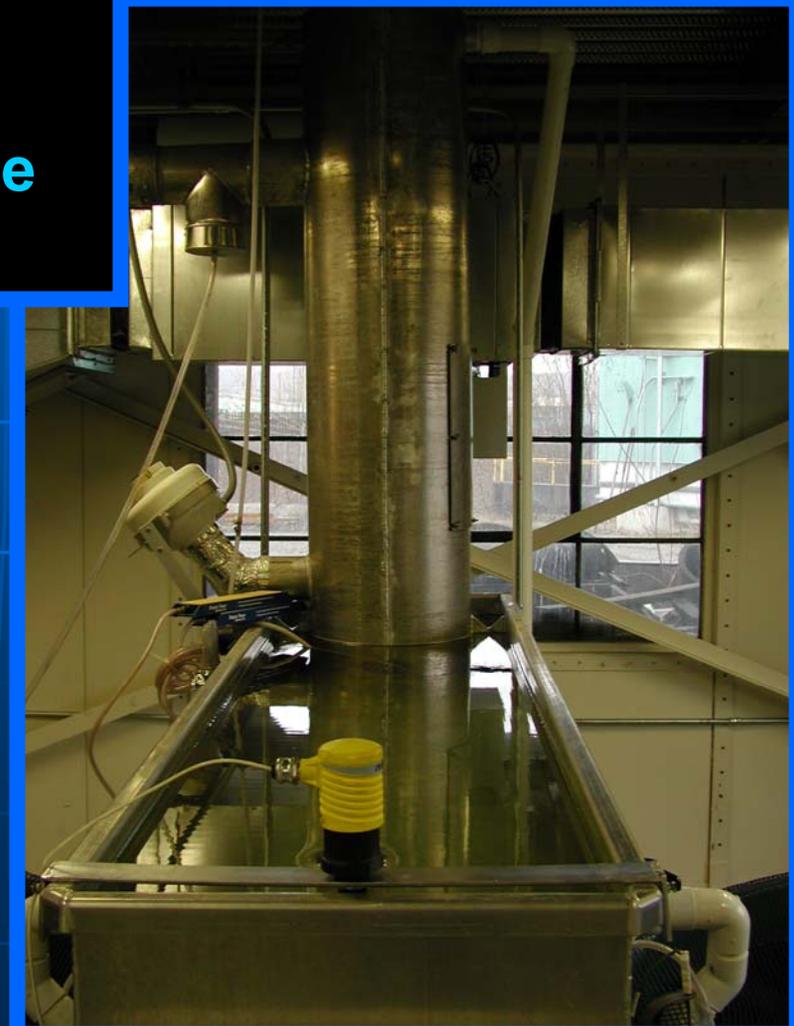
Water-to-water heat exchangers



The water is heated from 4 to 12°C with thermal effluent from Aurora Energy

Fairbanks Experimental Fish Hatchery

Gas stripping columns remove carbon dioxide (CO_2) and reduce nitrogen (N_2) from the water, while adding oxygen (O_2).



Fairbanks Experimental Fish Hatchery

**A drum filter catches
waste and food particles**



Fairbanks Experimental Fish Hatchery

Clean Water = Happy Fish

pH 7.5 to 7.6

Temp 8.0 to 9.0

ALK 185 to 200 mg/L

D.O. 11 to 12.5 mg/L

(95% to 105% Sat)

CO₂ 10 to 13 mg/L

N₂ & Ar 18 to 19 mg/L

TGP ~98% Sat

Fe 0.02 to 0.1 mg/L

Mn 0.6 to 0.74 mg/L



Fairbanks Experimental Fish Hatchery

Incubation (2004)

💧 Eyed eggs hatched in May/June (~40,000)



Fairbanks Experimental Fish Hatchery



Ponded
21-28 June
~0.1 to 0.15g

Combi-tanks with "Bio-mats"

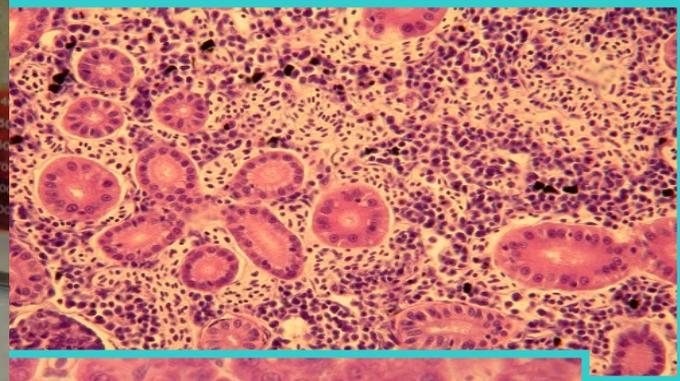
Fairbanks Experimental Fish Hatchery

**Long-Term Rearing in Treated Water (11.5 mo's)
Goal: 120 g catchable**

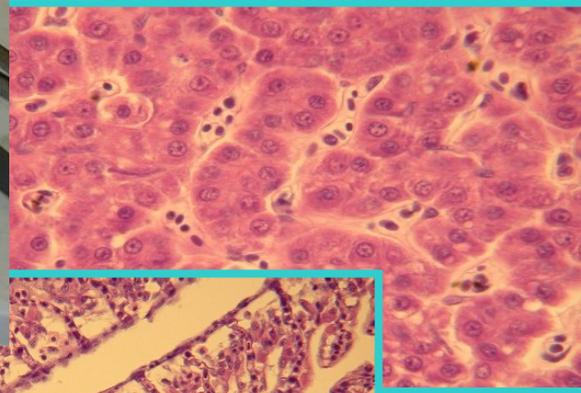


Fairbanks Experimental Fish Hatchery

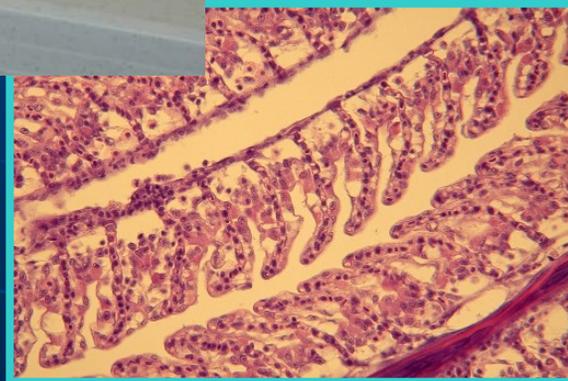
- Periodic tissue sampling from both cohorts



Kidney



Liver



Gill

Histopathology

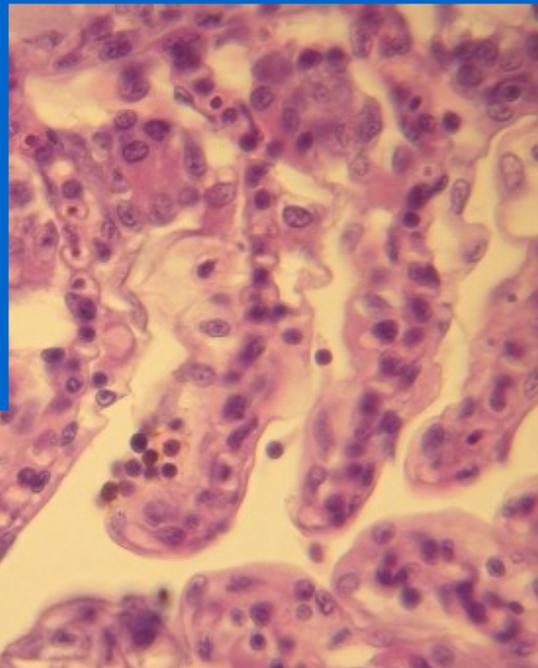
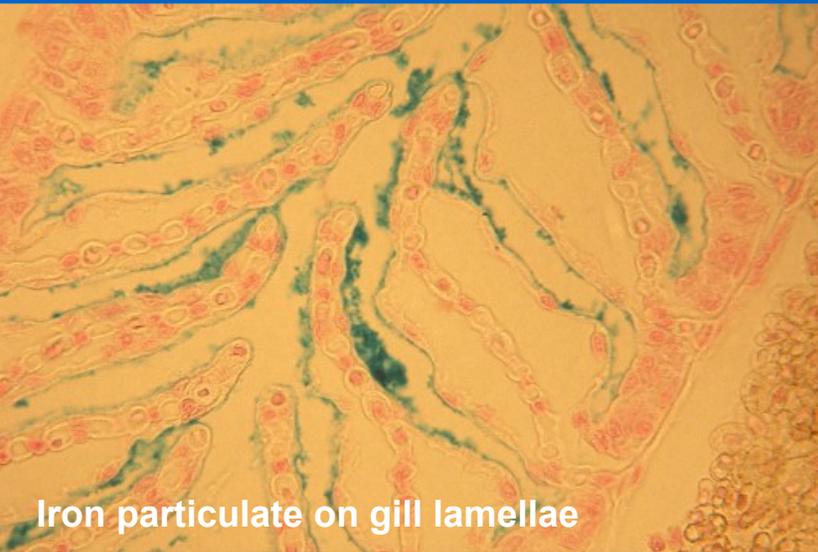
Charlie Smith

Bozeman, MT

Fairbanks Experimental Fish Hatchery

- Water treatment equipment malfunctions
- Lead to gill inflammation & iron deposits

From ~18 gram fish



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Fingerling rainbow trout:

Final Ave. Wt. 7.8 to 9.0 g after 8 months 7° to 9° C
~22,000 fish stocked into Quartz Lake



Fairbanks Experimental Fish Hatchery

💧 Long-Term Rearing in Treated Water

💧 To catchable size (Ave Wt. 188 to 212 g) 7° to 9° C



(largest fish ~400 g @ 12")

~3,700 fish stocked into Bathing Beauty Pond and other lakes

Fairbanks Experimental Fish Hatchery

💧 Long-Term Rearing Observations



- 💧 Iron can be removed from well water used for fish culture, and catchable-sized fish can be produced
- 💧 Iron deposits formed on gills during periods of equipment failure or extreme changes in water flow
- 💧 Supplemental O₂ may have lessened stress to fish
- 💧 Fish in tanks with windows grew larger
- 💧 Need to control water supply in future facility

Fairbanks Experimental Fish Hatchery

💧 Expansion in 2005

- Operate Recirculating Aquaculture Systems
 - Mimic production on pilot scale
- Test Super-Oxidation Water Treatment for Fe & Mn Removal
- Produce Catchable & Subcatchable Trout
 - 10,000 (120+ g) & 60,000 (12+ g)
 - 600 Kg/system
- Operate 3 years minimum

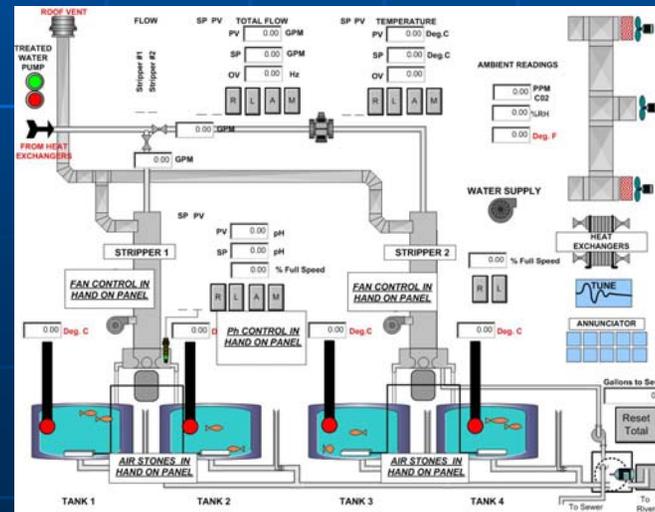
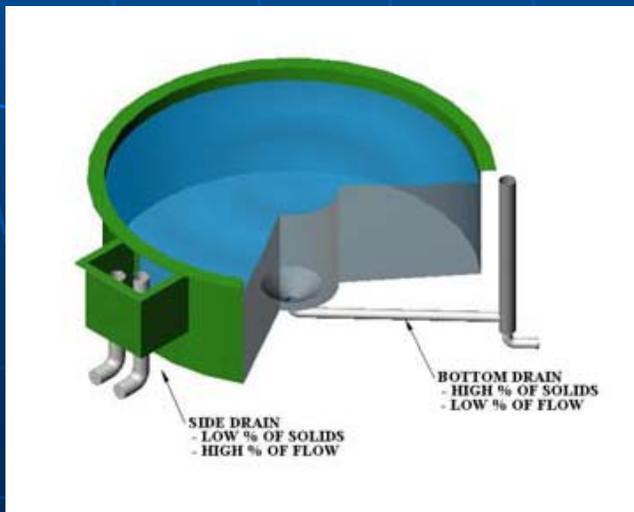
Fairbanks Experimental Fish Hatchery

Highlights of the Expansion

Two new 16' diameter circular tanks (20 m³ rearing volume)

Biofilter-Removes waste ammonia allowing the recirculation of 98% of the water

Continuous water quality monitoring integrated into the SCADA control system



Fairbanks Experimental Fish Hatchery

- Hatchery-related Research Projects
 - UAF Geological Engineering Department
 - Modeling groundwater dynamics for new hatchery
 - UAF Natural Resource Department
 - Hydroponics research
 - Effluent utilization

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