

AquaSeed's SweetSpring™ Salmon

By
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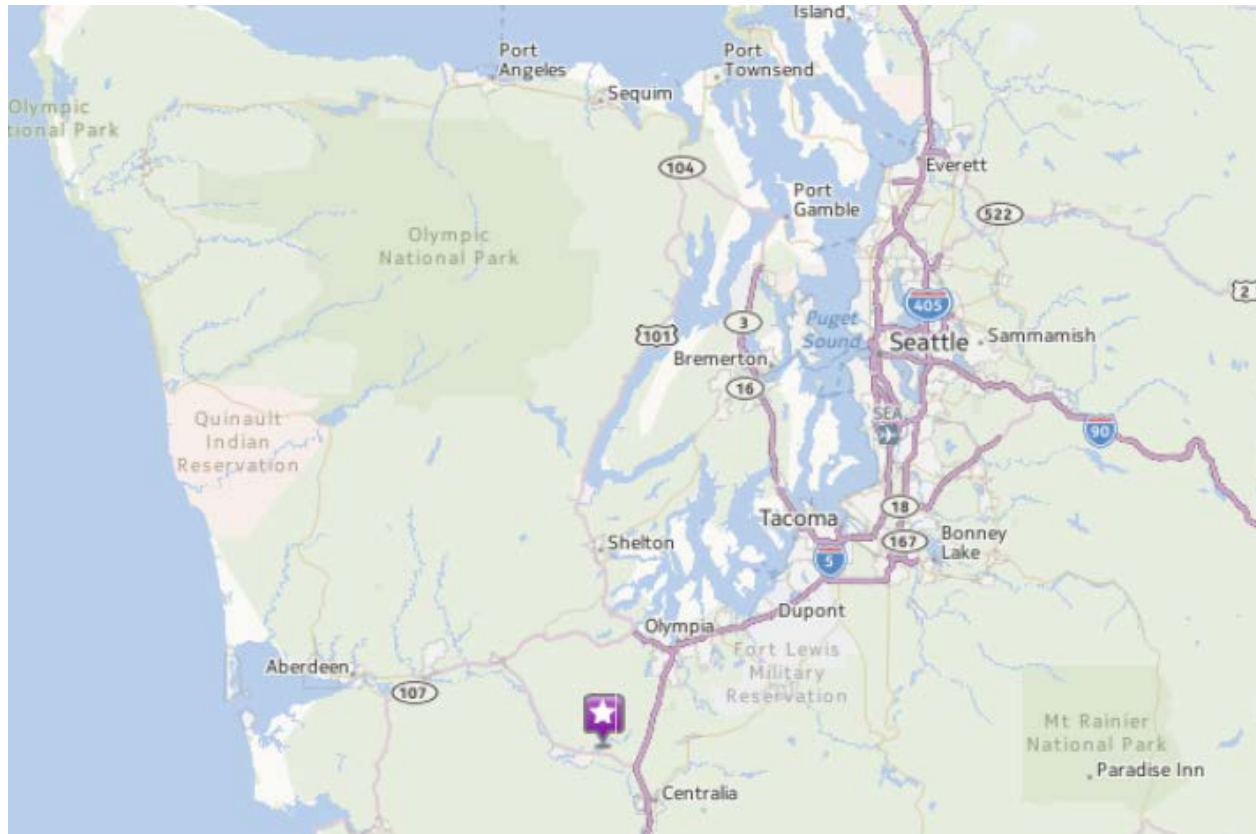


Overview

- Who We Are
- First Step – Partial Reuse System
- Nursery (smolt) RAS
- Grow-out RAS
 - Tanks
 - Feeding System
 - Filtration System
 - Purging System
 - Fish Transfer and Harvesting System
- Fish growth (photoperiod and other growth trigger studies)

Who we are

- SweetSpring Salmon (formerly Aquaseed)
- Located in Rochester, WA



Domsea Heritage

- Domsea[®] Coho pedigree stock
 - founded by Union Carbide in 1969
 - Acquired by Campbell Soup in 1979
 - Acquired by AquaSeed and relocated to Swecker Salmon Farm in 1991
- Longest pedigree bred salmon: 20 generations (40 yrs)

First Step - Partial Reuse System



Nursery (smolt) RAS Description

- HTE microbead biofilter and CO₂ stripper
- One 1.8 m. x 0.9 m. first feeding tank (photoperiod and 10C temperature)
- Two 4.6 m. x 1.2 m. tanks (photoperiod)
- Two radial flow separators
- Drum filter – 60 micron
- Foam fractionator with ozone
- Two Low Head Oxygenators (LHOs)
- Advanced oxidation system (Ozone + UV)

Smolt RAS



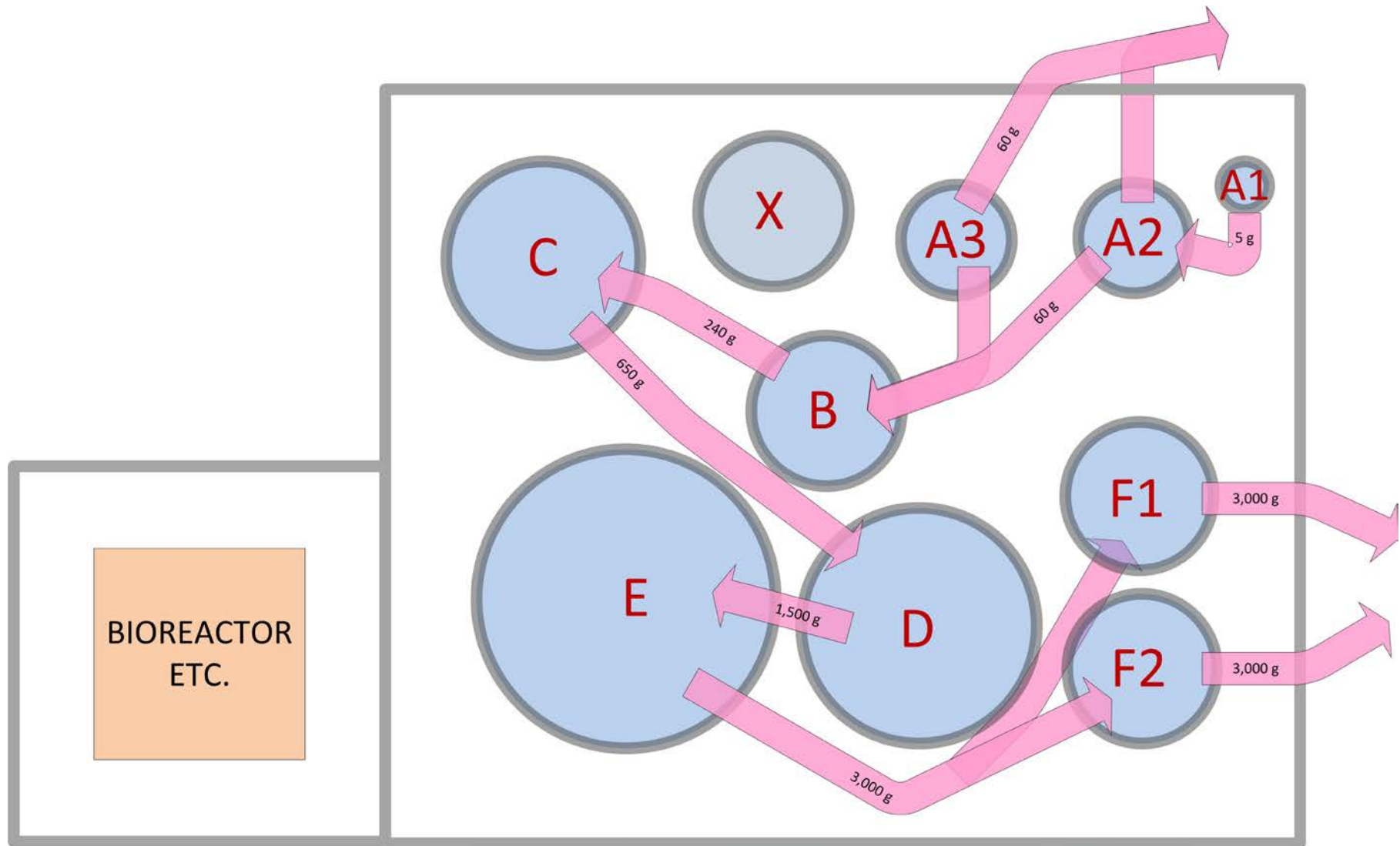
Advanced Oxidation System



Nursery (smolt) RAS Parameters

- 2650 l/m recirculating flow
- 27 l/m replacement water
- 100% system volume replacement per day
- 15 minute system turnover rate
- Optimum 15C growing temperature
- Capable of producing 24,000 smolts @ 60 grams every two months
- Maximum feed load – 55 kg/day
- Maximum fish density – 80 kg/m³

Grow-out RAS Bio-plan



Grow-out RAS Bio-plan Goal

- Produce 181,000 kilos of 3 kilo fish per year
- New crop added every two months
- Each crop moved to a larger tank every two months
- Eight month grow-out from 60 grams to 3 kilos

Grow-out RAS Tanks

- One 6.1 m. x 1.5 m. tank (juvenile photoperiod)
- One 6.1 m. x 1.5.m. tank (special projects)
- One 7.9 m. x 2.0 ft. tank (juvenile photoperiod)
- One 9.1 m. x 3.1 m. tank (24 hour light)
- One 12 m. x 3.1 m. tank (24 hour light)
- Tank number and sizing for 8 month grow-out
- Tanks have built in adjustable inflow nozzles

Grow-out RAS Parameters

- Total RAS water flow – 37,800 l/m (18,900 l/m to tanks and 18,900 l/m to biofilter)
- Replacement water – 190 l/m
- System cycle rate, tanks – 35 minutes
- Water reuse rate – 99%
- 20% system volume replacement/day
- Maximum feed load – 800 kg/day
- Maximum fish density – 85 kg/m³



Grow-out RAS Feeding System

- Hybrid system consisting of Arvo-tec feeders and Cablevey cable disc refilling system
- Feeder hoppers located in tank center
- 360 degree electric spreaders for optimum feed distribution
- Fed by three silos outside building

Grow-out RAS Filtration and CO2 Stripper Description

- Four 20 hp. vertical turbine axial flow propeller pumps
- Split flow – two pumps supply LHO, other two supply two below grade FSB biofilter cells
- Drum filter – 80 micron
- CO2 stripper is combined with the pump sump
- Two air blowers pull air from the pump end of the sump under the stripper nozzle deck



LHO System Description

- Two aluminum LHO cells (one for each pump) with concrete reservoir
- Pump RPM controlled by pressure transducer to maintain proper reservoir water level
- Reservoir bottom sloped 10 degrees to center bottom discharge
- Reservoir designed to provide 1 m. of pressure head at each tank – important to enable up to 2 body lengths/sec. swim speed
- Ozone added to oxygen inflow - ORP and pH sensors are also located on reservoir wall

LHO Reservoir Tank



LHO Cells and Reservoir Tank



Purging System Description

- Two 6.1 m. x 3.1 m. deep tanks
- One stacked CO₂ stripping tower and LHO
- Two pumps located in tank side boxes
- 5680 l/m total recirculating flow
- 380 to 760 l/m replacement water
- Capacity – 8,000 kilos of fish per tank to provide 12 harvests per year

Purge System



Fish transfer and Mortality

Collection Sump Description

- Pneumatically actuated tank center drain screens
- Central fish handling sump
- Transvac twin canister vacuum pump
- Fish are pumped tank to tank from the central fish handling sump using the tank center screens

Pneumatically Actuated Tank Center Drain Screen Installation



Fish Transfer to Purge Tanks and Harvesting

- Fish are pumped with pneumatic fish pump using the transfer sump
- Fish are dewatered and piped to a counter extended over the purge tank lip
- Fish are held in purge for up to 10 days
- Fish are pumped to a stunner/bleeder and then to an ice slurry filled tote

Fish Transfer and Mortality Collection Sump



Fish Transfer Using Seine



Fish Counting



Partial Reuse System Fish Transfer



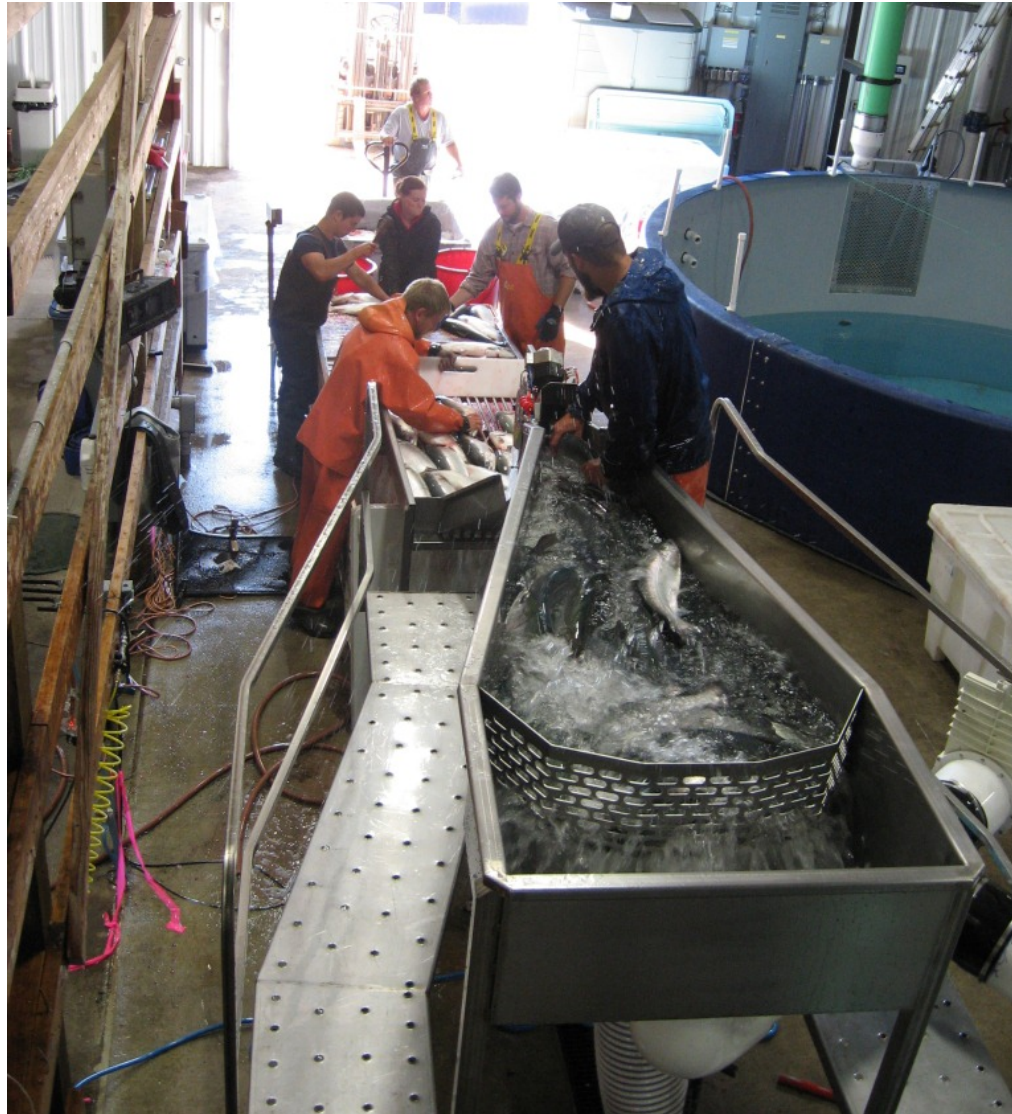
Fish harvesting - Preparation



Fish Harvesting - Operation



Wet Table and Stunner/Bleeder



Ongoing Coho Growth Optimization

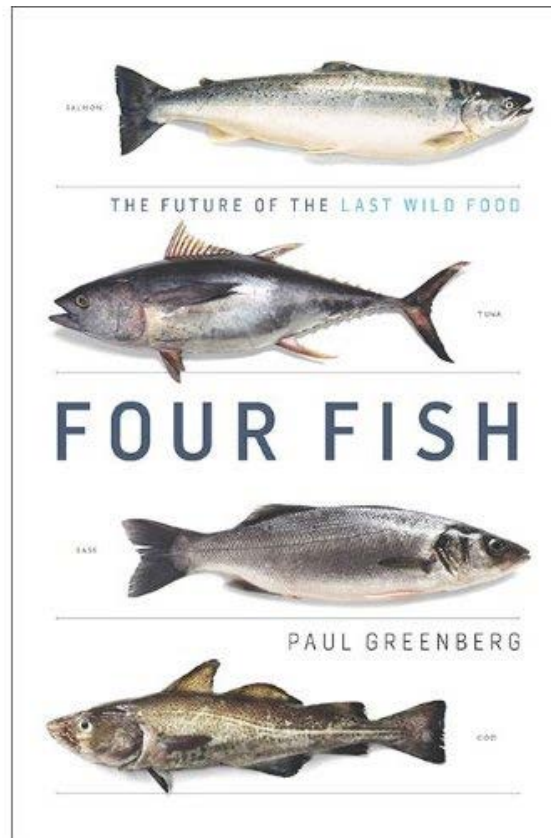
- Natural hormonal triggers
 - Photoperiod
 - Water temperature
- Genetic improvement for RAS environment
 - DNA identification of individual fish
 - Growth at 15 degrees C.
 - Higher temperature tolerance
 - Growth with 24 hrs. of light
 - Feed trials

Photoperiod Control



Collaborative Innovation





“Let the fittest, most closed system survive and reap the economic benefit inherent within that victory.”

Paul Greenberg, 2010 (pg 74)

Thank You...



www.sweetspringsalmon.com