SNP 2024 State of the Science Symposium

Make Every Day Count

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Overview of Recirculating Aquaculture Systems (RAS) & Raising High Omega-3 Fish

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Key Concepts

- High-omega 3 fish are good for you
- Growing seafood in USA and why salmon
- Why land-based fish farming

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Omega 3 Fatty Acids: You are what you eat

- Omega-3 PUFA are essential fatty acids—**the body can't make them but must get them from food**.
- Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) come mainly from fish
- EPA+DHA are Omega-3 that can reduce the risk of heart disease, depression, dementia, and arthritis, and improve overall happiness.
- Alpha-linolenic acid (ALA) is an omega-3 fatty acid found in vegetable oil and nuts
- The human body generally uses ALA for energy, and **conversion into EPA and DHA is very limited**.
- Seafood can have much higher levels of EPA+DHA and Omega 3 PUFA than other supposably good sources

EPA + DHA, mg per 100 g portion: Your fish are what they eat

✓Colombo and Maya (2020)

- 731 mg Net pen farmed Atlantic Salmon
- 634 mg Organic Farmed Atlantic Salmon
- 904 mg Organic Farmed Chinook Salmon
- 2490 mg Wild Chinook Salmon
- 204 mg Wild Pink Salmon

✓Eurofins results

- 2140 mg Superior Fresh Atlantic Salmon

✓Van Elswyk et al. (2014)

- 10-14 mg Grass-Fed Beef

✓USDA FoodData Central

- 862mg Tuna, canned in water
- 0 mg Almonds

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SALMON ARE A SUPERFOOD

One of the most nutritious foods on the planet

- High protein & low carbohydrate
- High omega 3 fatty acid (EPA & DHA)
  - Anti-inflammatory
  - Lower blood pressure
  - Improve heart and brain health
- Low omega 6 fatty acids in wild salmon & Superior Fresh salmon
  - Omega 6 fatty acids creates inflammation
- Low mercury in farmed salmon
- High in collagen, selenium, potassium, antioxidants, & Vitamin B

ATLANTIC SALMON

Most consumed fish in the USA

- Over 1 billion pounds produced for US market in 2020
  - Double digit growth in 2020 & 2021
  - **Over 95% imported into USA**
    - world's largest market for salmon

Over 5 billion pounds produced globally in 2020

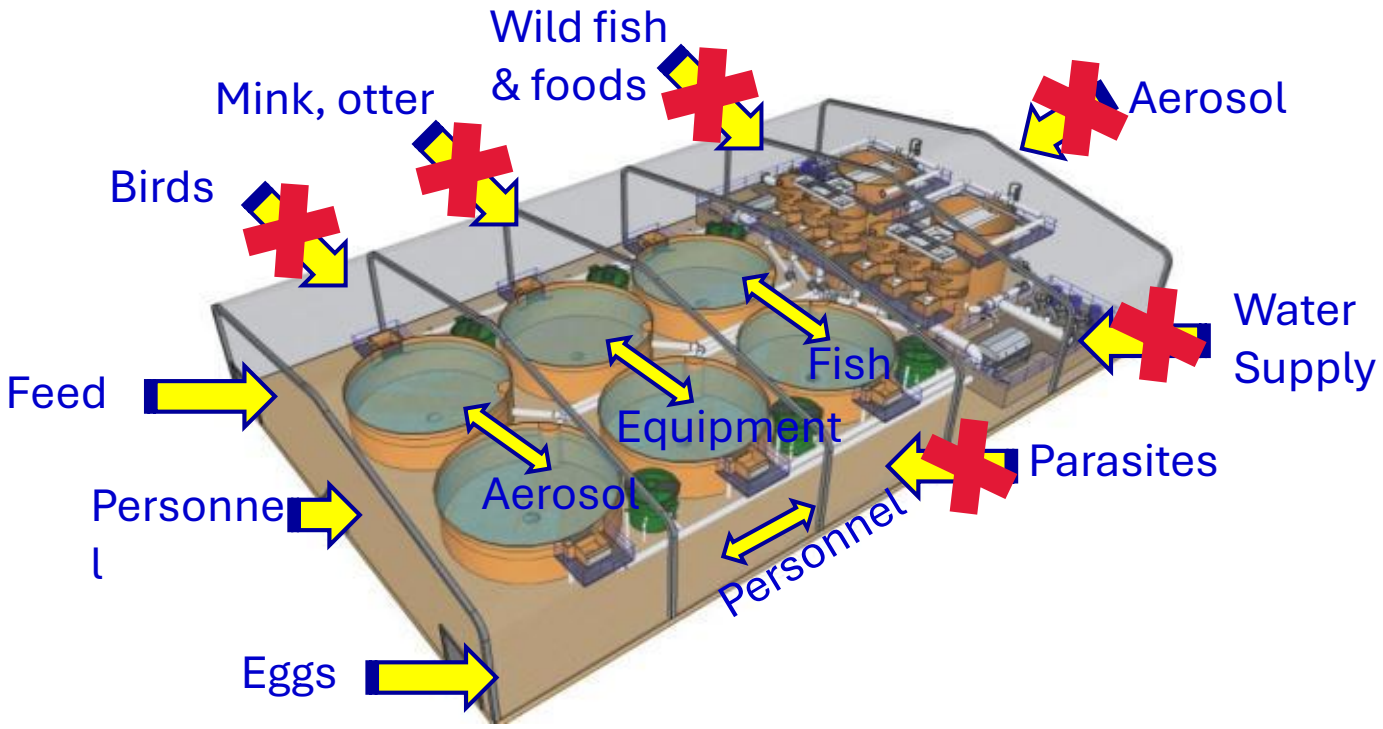
- Norway and Chile Produce over 80% of the worlds Atlantic Salmon
- Air freight to the US increases CO2 footprint
- 99+ % farmed in ocean cages

Why Atlantic Salmon?

- ✓**Salmonid eggs available year round**
  - Certified pathogen free & all-female
- ✓Rapid growth for inventory turnover
- ✓Schooling fish thrive at higher biomass density
- ✓Hearty when obligate pathogens excluded
- ✓Feed (low FCR; protein flexible carnivore)
- ✓Harvest quality matches consumer expectations
  - ✓Harvest size with low early maturation
  - ✓Color, texture, & flavor profile

Land-Based Farms Use Engineered Barriers

- Exclude Human & Fish Pathogens / Parasites
  - Enhance food safety
  - Reduce or eliminate vaccine, antibiotic, & pesticide use



Land-Based Salmon Produced in USA

- “Best Choice” by Seafood Watch
- Maximize food safety & traceability
- Avoid airfreight & reduce carbon footprint
- Minimize environmental impacts
  - Protect our water resources
  - Build soil & give back to the land
    - Regenerative farming

Benefits of Land-Based Aquaculture

- 99-99.9% of water is recirculated
- Reduced or zero wastewater discharge to surface waters
- Freshwater can be used
  - avoids salt that is toxic to terrestrial plants
- Regenerative agriculture practices
  - Spill water irrigated on native grasses & alfalfa
  - Hay is baled & used for livestock bedding/feed

Many Regenerative Agriculture Practices

- ✓ Biosolids are digested & dewatered
  - Builds soil organic matter when field applied as a soil amendment rich in phosphorus & micro-nutrients
- ✓ Windrows used to compost fish residuals with carbon
  - Builds soil organic matter when field applied

Key Takeaways

- Eating seafood provides EPA & DHA for health
- Salmon is a great choice to increase your seafood intake and omega-3s
  - Salmon is #1 fish consumed in the USA
- Salmon can be raised on land in RAS and can be located anywhere geographically
- Eating seafood caught & raised in the USA reduces airfreight & food miles from harvest to plate
- Raising salmon on land in freshwater
  - Captures waste
  - Supports nutrient recycling and regenerative agriculture
  - Excludes obligate fish pathogens & parasites
    - Avoids antibiotic and pesticides

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