

# Indoor Marine Shrimp Production at Kentucky State University

Andrew J. Ray\*, Adam Cecil,  
and William P. Auberry

\*Andrew.Ray@kysu.edu

Assistant Professor, Kentucky State University



COLLEGE OF  
AGRICULTURE,  
FOOD SCIENCE, AND  
SUSTAINABLE SYSTEMS



United States Department of Agriculture  
National Institute of Food and Agriculture

# Why Grow Shrimp in the US?

- #1 Most Popular Seafood Item in the US
  - About 4 Pounds/Person/Year
- > 85% is Imported
  - Trade Deficit
  - Food Security?
  - Food Safety
    - Antibiotics
    - Hormones
    - Environmental Contaminants



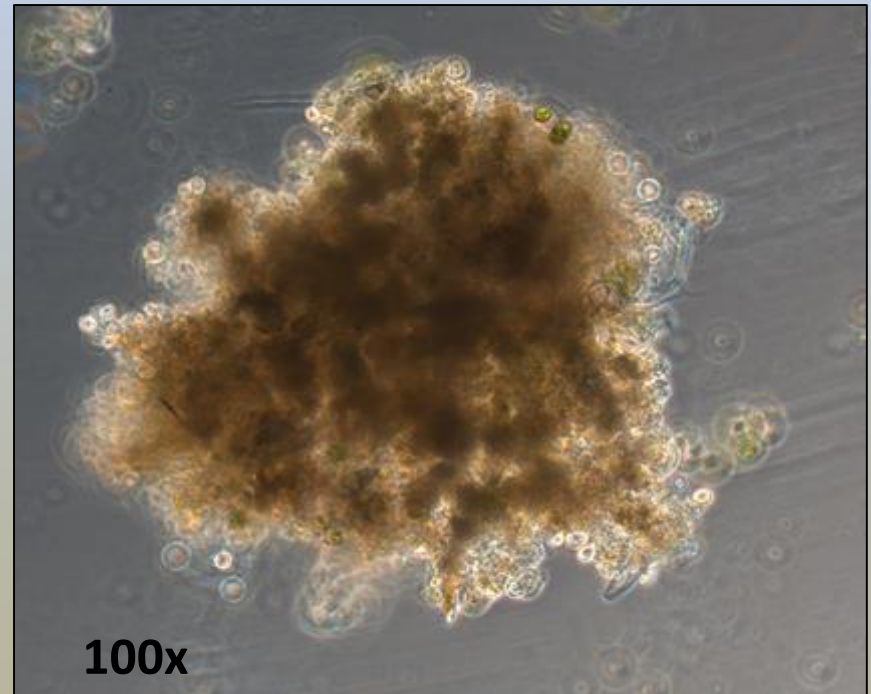
# Recirculating Aquaculture Systems

- Low Water Exchange
  - Salt Conservation = Inland Marine Operation
  - Biosecurity
  - Temperature Control
- High Animal Density
  - Indoor Operation
    - Climate Control
    - Diverse Regions



# Biofloc Aquaculture Systems

- Limited External Filtration
  - Solids Filtration Common... essential for intensive systems
  - No External Biofilter
- Biofloc Particles
  - Microorganisms
  - Convert Ammonia to Nitrate and Biomass
  - Nutritious
  - Recycling Nutrients
    - Low Feed Conversion Ratio

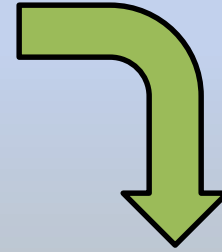


# Solid Buildings

- Thermally Insulated
    - Independent of Climate
    - Can be Sited Anywhere
  - Biosecurity
- Consistent Conditions
  - Availability
    - Ag. Infrastructure
      - Ex. Hog Barns
    - Urban Infrastructure
      - Ex. Warehouses



# Recent Work at KSU



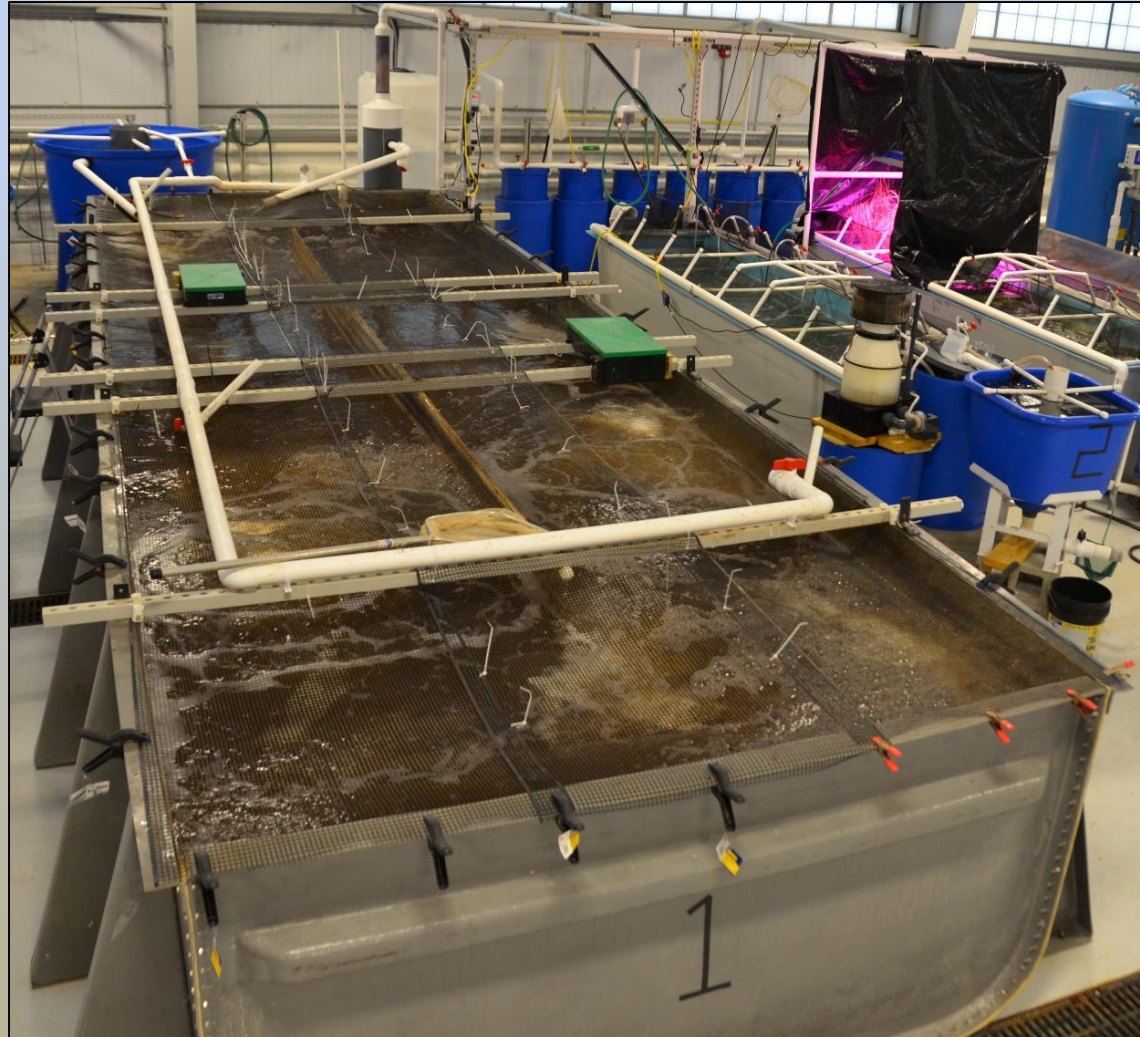
# Kentucky Shrimp

- 3.4 m<sup>3</sup> Nurseries with Biofilters and Settling Chambers
  - Shrimp from Florida hatchery
  - 30-40 days



# Kentucky Shrimp

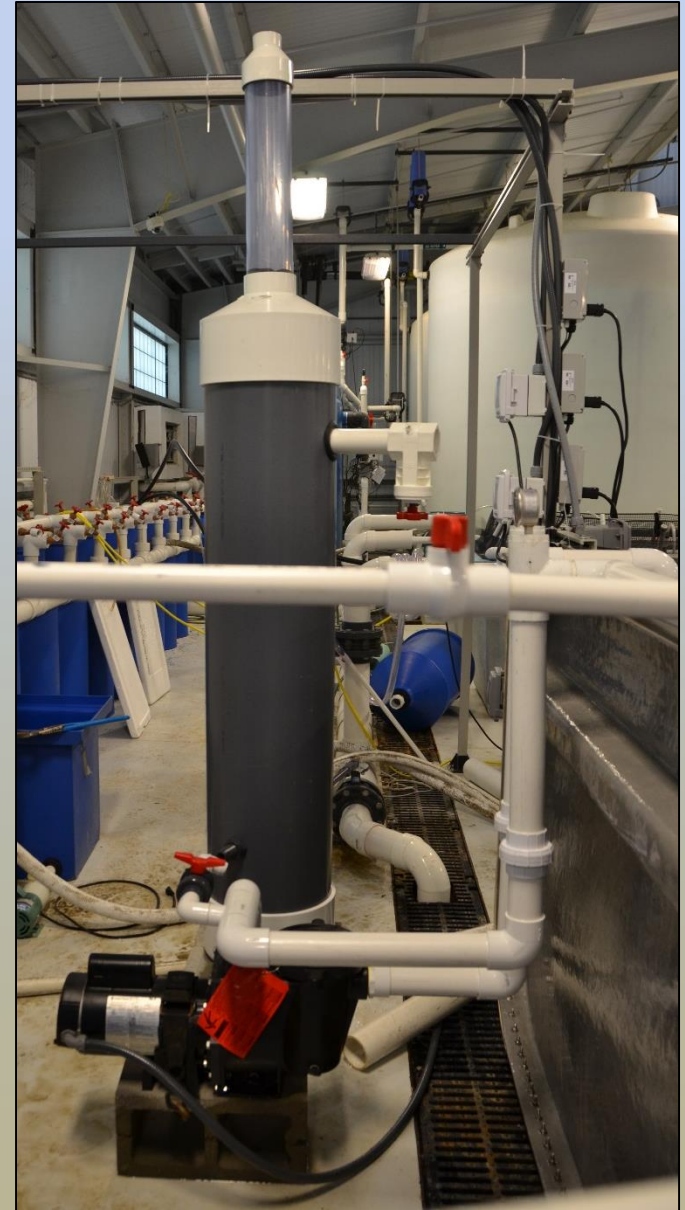
- Production Tank
  - 20 m<sup>3</sup>
  - A<sup>3</sup> aeration system
    - 1 HP Pump
  - Electric heat
    - Is what's available
  - 3 hand feedings, feeders at night
  - Foam Fractionator
    - 95% of the solids removal
  - Settling Chamber





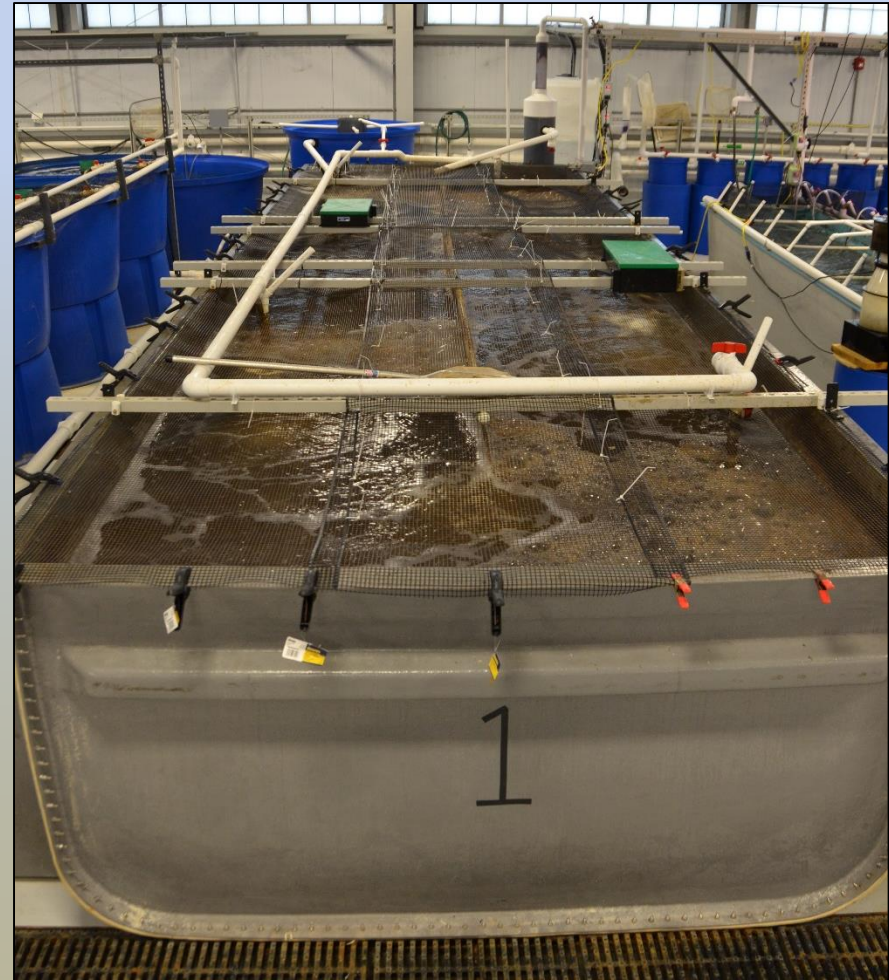
# Growout Phase

- 20 ppt. Salinity
- 98 Days
- Starting at 0.55 g
- 250 shrimp/m<sup>3</sup>



# Production and Marketing

Parameter	Value
Final Weight (g)	24.3
Growth Rate (g/wk.)	1.7
Biomass (kg/m <sup>3</sup> )	4.6
FCR	1.3
Survival (%)	69.1



- Produced about 200 Pounds
- Gave them to KY chefs, seafood distributors, and sold 83 pounds at the Franklin County Farmers' Market in 1.5 hours

# Can \$\$\$ be Made?

- Sold for \$12/pound (\$26.40/kg)
- Recurring Costs of Production  $\approx$  \$5.50/pound (\$12.10/kg)

## Question (range of options)

Chefs (n = 5) Consumers (n = 27)

What is your opinion of the KY-grown shrimp?

**Taste** (1-5, where 1 is the best)

2.0  $\pm$  0.0

1.3  $\pm$  0.1

**Texture** (1-5, where 1 is the best)

2.2  $\pm$  0.5

1.3  $\pm$  0.1

**Freshness** (1-5, where 1 is the best)

1.0  $\pm$  0.0

1.0  $\pm$  0.0

**Size** (1-5, where 1 is the best)

2.2  $\pm$  0.2

1.3  $\pm$  0.1

**Overall** (1-5, where 1 is the best)

2.2  $\pm$  0.2

1.1  $\pm$  0.1

**Appearance** (1-5, where 1 is the best)

1.8  $\pm$  0.2

1.1  $\pm$  0.1

**What would you expect to pay?** (open question) - USD/Kg

21.6  $\pm$  2.4

25.9  $\pm$  2.3

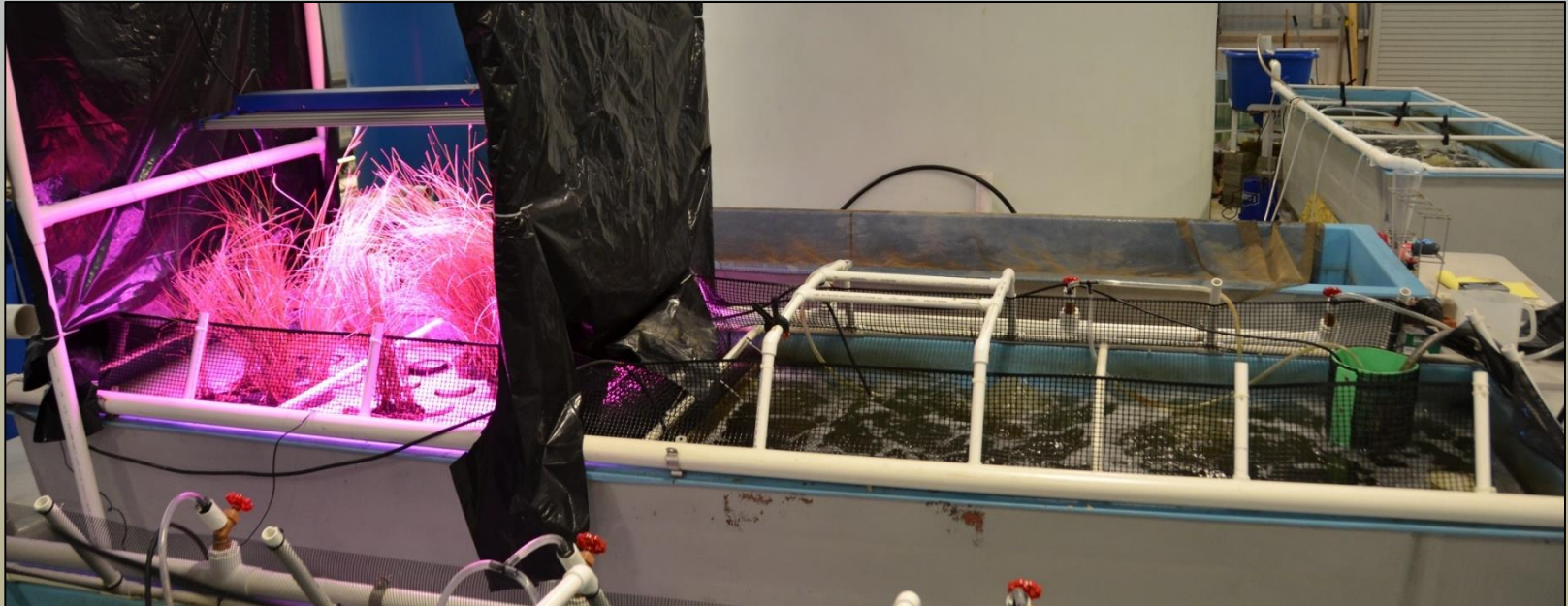
**What is the maximum you would pay?** (set selections) - USD/Kg

26.0  $\pm$  2.5

28.6  $\pm$  1.5

# Future Directions...

- Increase Density and Production
- Continual Water Reuse
  - Marine Aquaponics, Denitrification
- Biofloc Alternatives
- Other Species, High Tunnel Production



# Summary

- Unique Opportunities
  - Biosecurity, Food Security, Indoor Culture, Reduced Feed Costs, Intensive Production, Fresh Seafood Inland and Year-Round,...
- Encouraging Production Levels
  - Push the System Further
  - External Biofiltration?
- Research
  - Aeration, Nutrition, Lighting, Waste, Water Reuse, Marketing

# Thank You!



- Biofloc Video:  
[https://www.youtube.com/watch?v=IwbDqB0C\\_-Y](https://www.youtube.com/watch?v=IwbDqB0C_-Y)
- Biofloc Webpage: <http://www.aesweb.org/biofloc.php>
- KSU Aquaculture Webpage:  
<http://www.ksuaquaculture.org/>
- KSU Aquaculture Facebook Page