SHRIMP *Litopenaeus vannamei* PRODUCTION IN CLEAR WATER AND BIOFLOC SYSTEMS

Thomas H. Drury*, Andrew J. Ray, Adam Cecil

Research Assistant, Kentucky State University
Aquaculture Research Center
DruryT14@gmail.com

USDA

United States Department of Agriculture
National Institute of Food and Agriculture

Kentucky State University®
College of Agriculture, Food Science, and Sustainable Systems and Land Grant Program

Inland Shrimp Production

- One of the top seafood products consumed in the world
- Supply markets where availability is limited or seasonal
- Food Quality and Safety
- Sustainable method

Expanding Industry

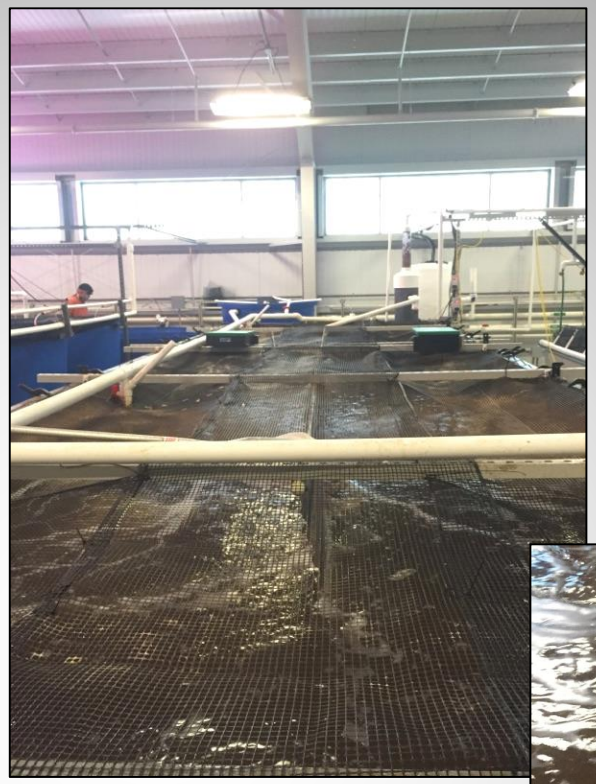
- Shrimp Farms throughout the Midwest
- Growing interest
- Zeigler Bros. feed company selling to 100 shrimp farms in the U.S.

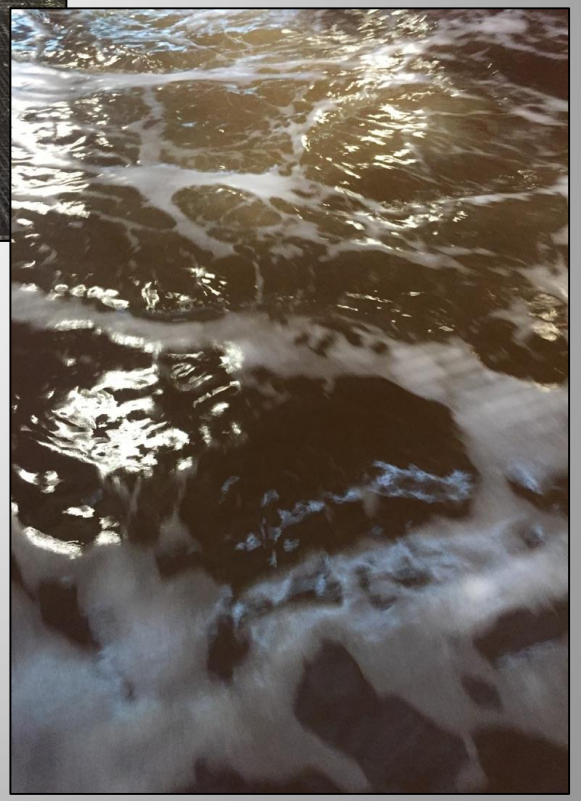
RecirculatingAquaculture Systems (RAS)

- Closed Systems
- Minimal Water Exchange
- Heat and Salt Retention
- Usually Indoors
- Allow inland shrimp production to be possible

Biofloc RAS Systems (BF)

- Dense and diverse microbial community within water column
- Biofloc particles (microbes, uneaten feed, detritus, feces)
- Performs Nitrification (Conversion of Ammonia to Nitrate)
- Lower FCR (feed conversion ratio)
- Decrease risk of pathogens
- Requires high aeration



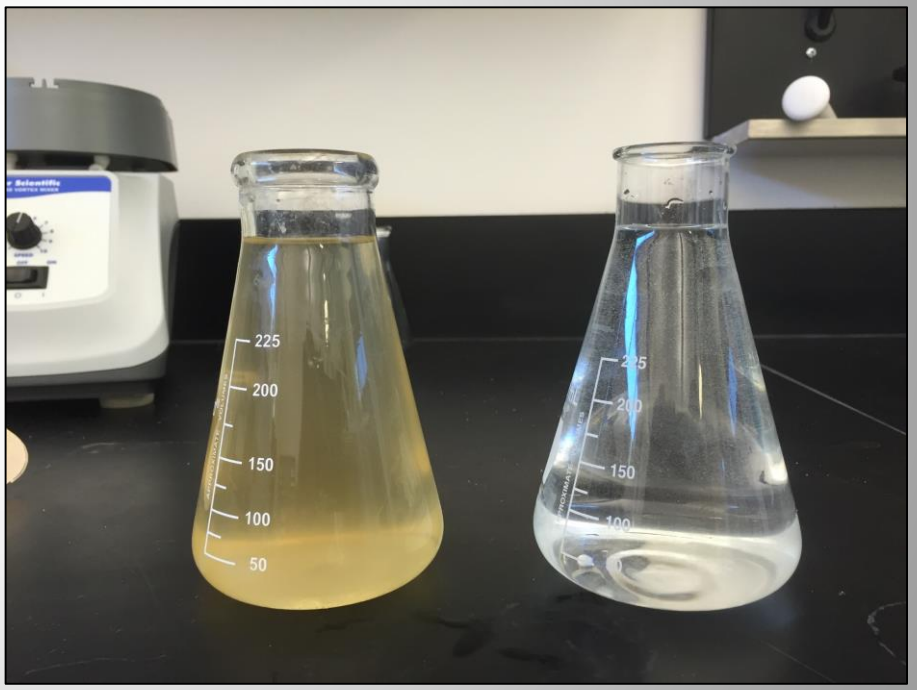


Clear Water RAS Systems (CW)

- External filtration
- Higher level of water quality control
- Scale filtration to match animal density
- Low turbidity
- Higher Costs

Clear Water (CW) vs. Biofloc (BF)

- **Purpose of Study**
  - Improve technology that will increase viability
  - Which system works best, pros and cons
  - Nutritional contribution from BF
  - Baseline information for further research



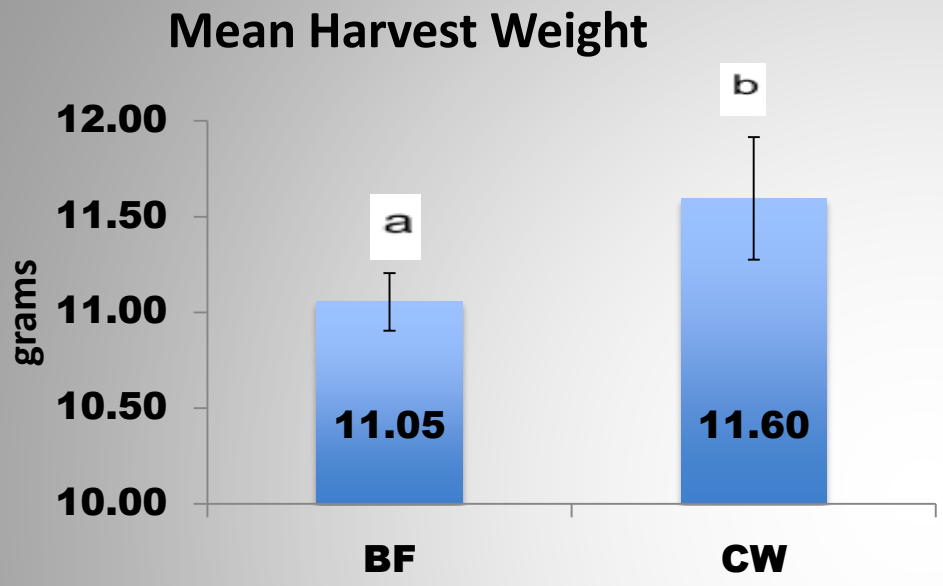
Experimental Design

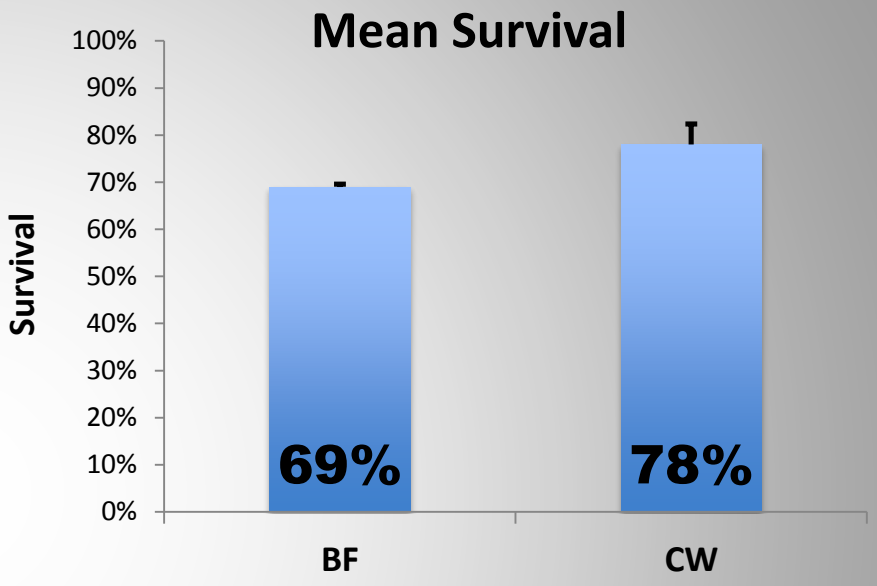
- Un-insulated sheet metal greenhouse with air, water, and electricity
- Gravel surface
- Six (1.36 m^3) tanks randomly assigned a treatment
- 3 BF and 3 CW
- CW (continuously ran filters)
  - Settling Chamber
  - Biofilter
  - 2 Foam Fractionators
- BF (used filters to manage turbidity)
  - Settling Chamber
  - One Foam Fractionator

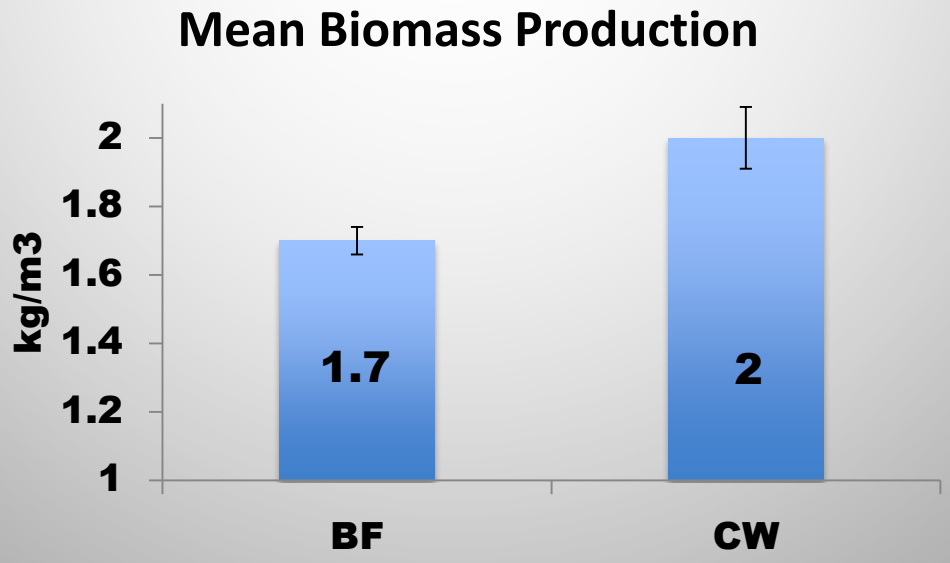
System Stocking and Management

- PLs from Florida hatchery
- Clear water nursery
- Stocked into experiment at a mean of 0.48 grams
- 250 shrimp per m^3
- Fed equal amounts of feed
- Dissolved Oxygen (DO), pH, Temperature, and Salinity
  - twice daily
- Total Ammonia (TAN), Nitrite, Nitrate, and Turbidity
  - once a week

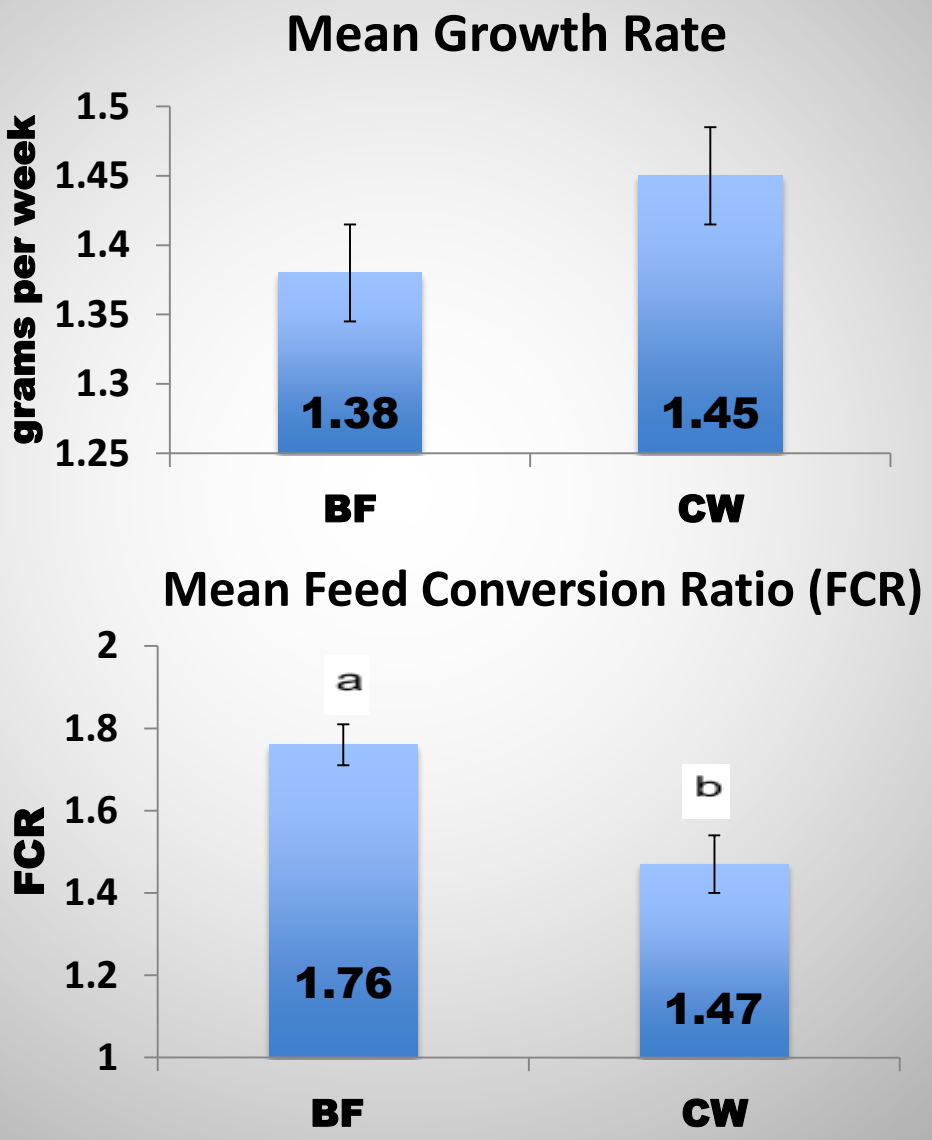
Production Results



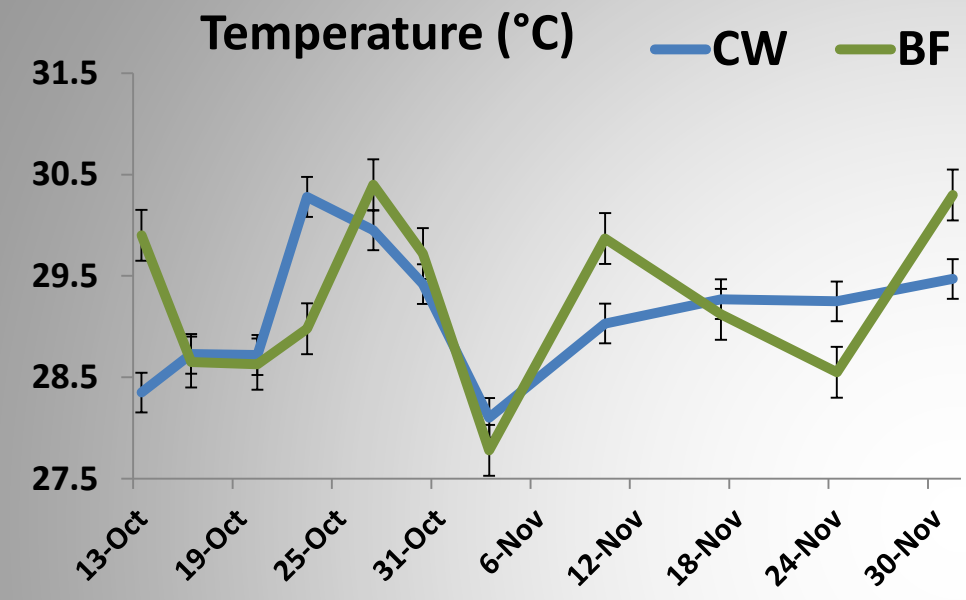


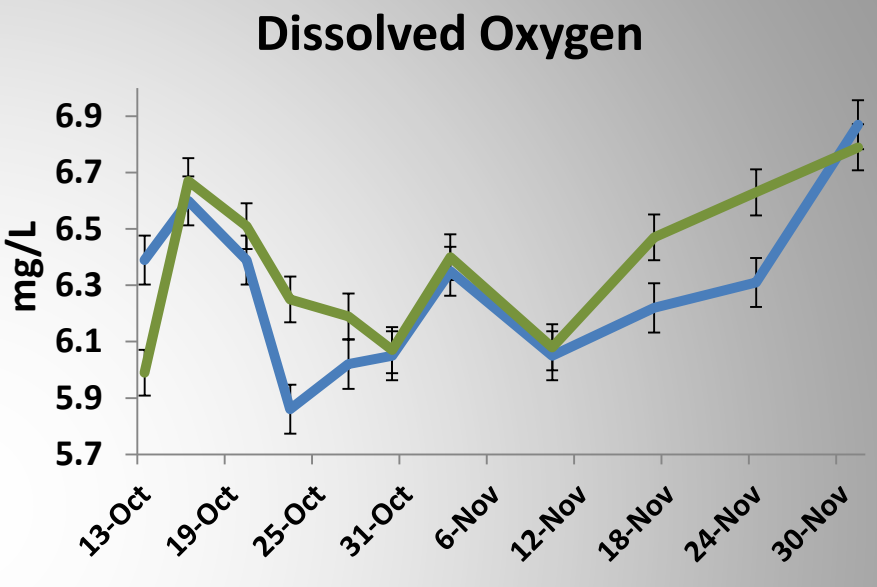


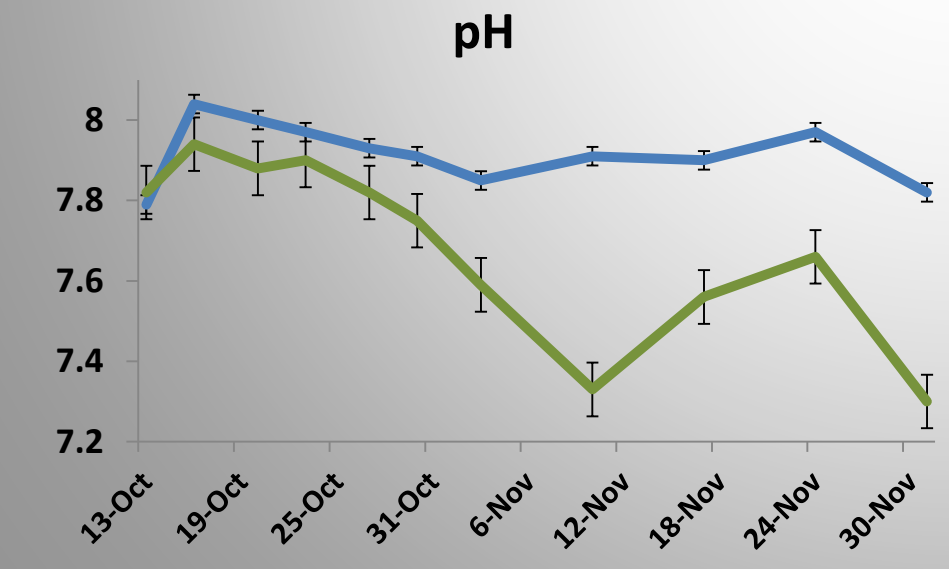
Production Results Cont'd

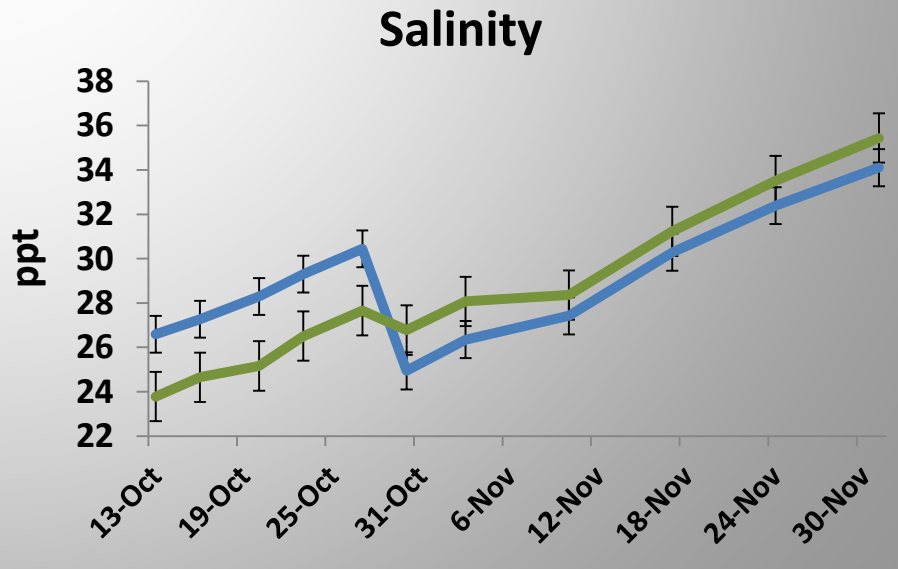


Mean Daily Parameters

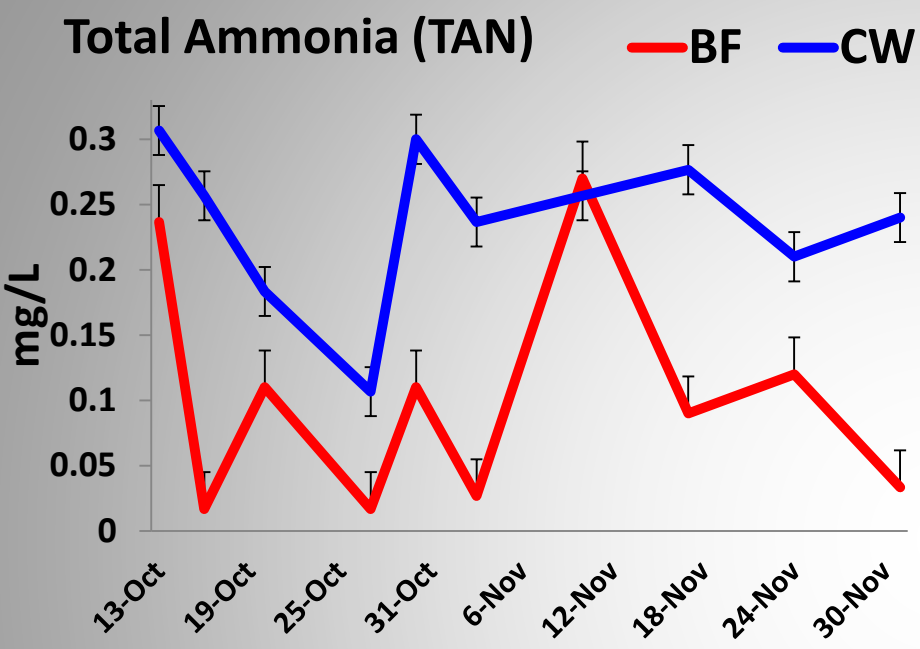


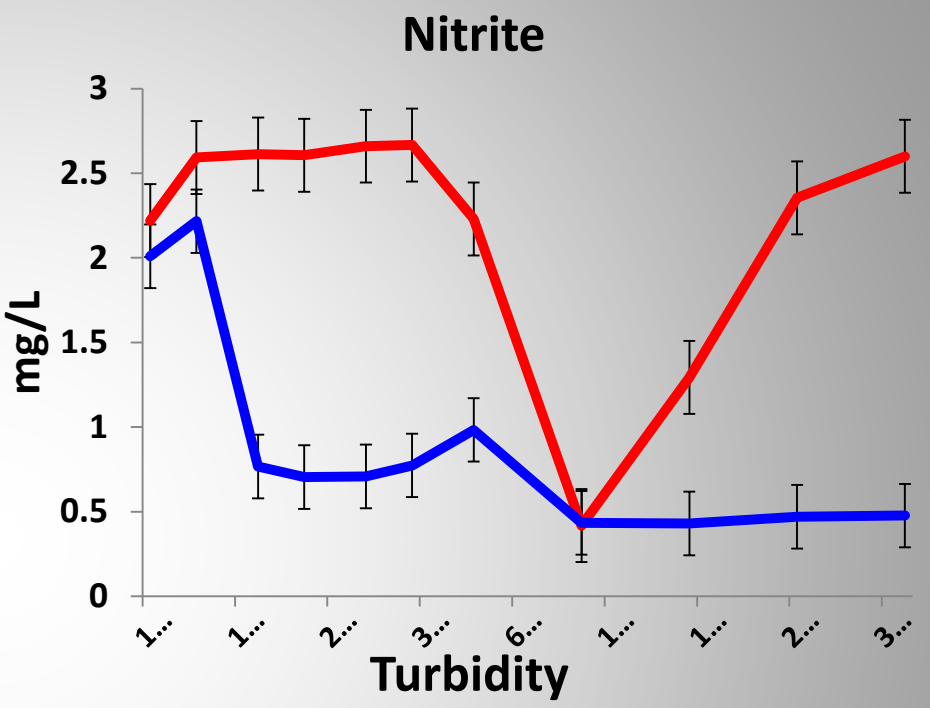


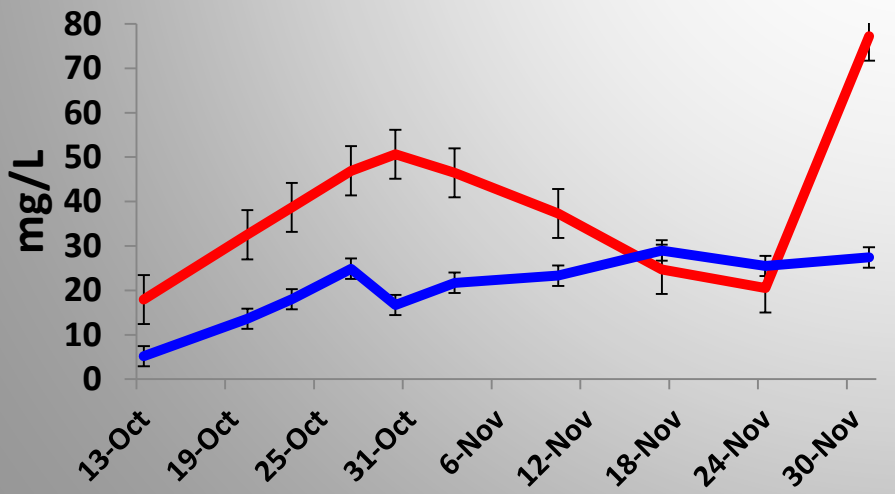


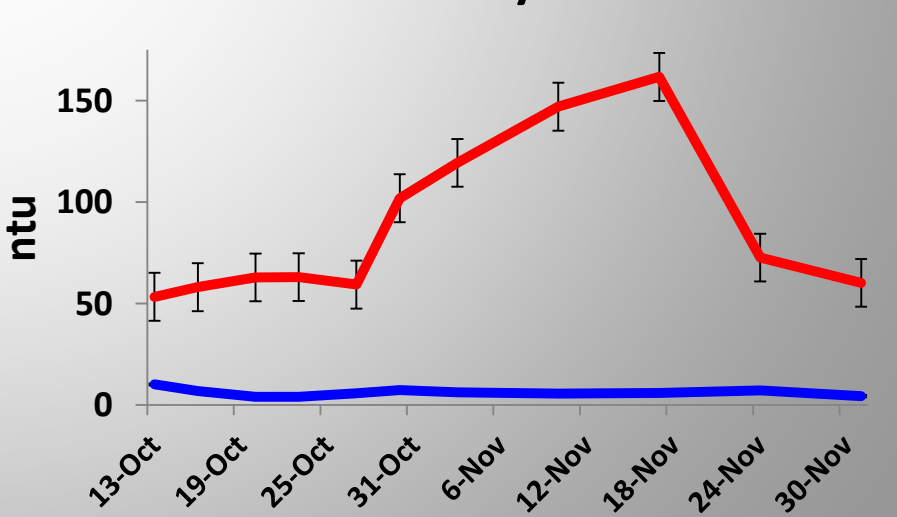


Mean Water Quality



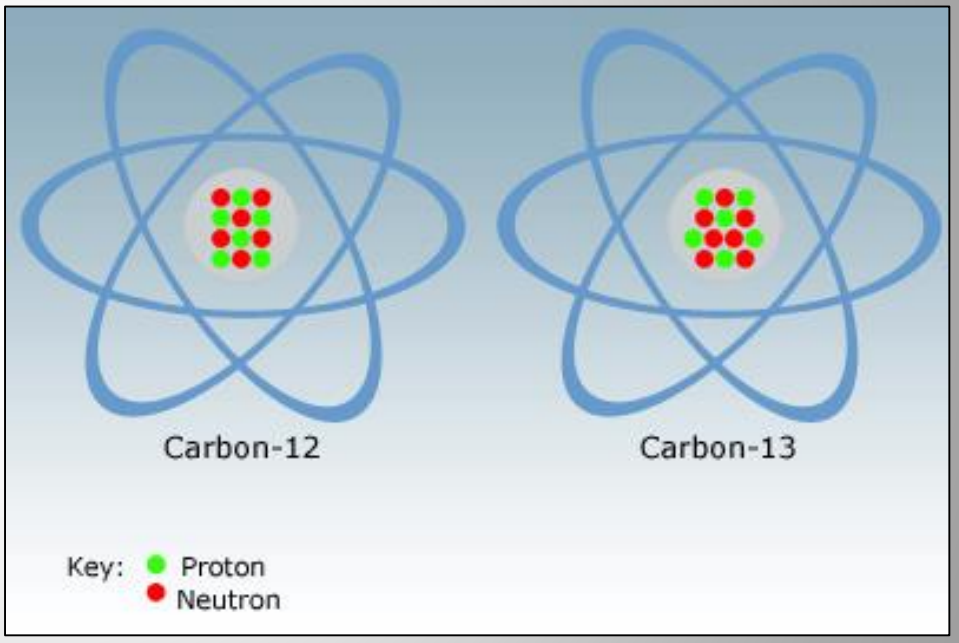






Stable Isotope Ecology

- Understanding biofloc nutritional contribution
- Different numbers of neutrons in the nucleus
- Lighter isotopes are excreted
- Heavier isotopes retained in tissue
- Tracer for element cycling
- Carbon (C^{13}) and Nitrogen (N^{15})

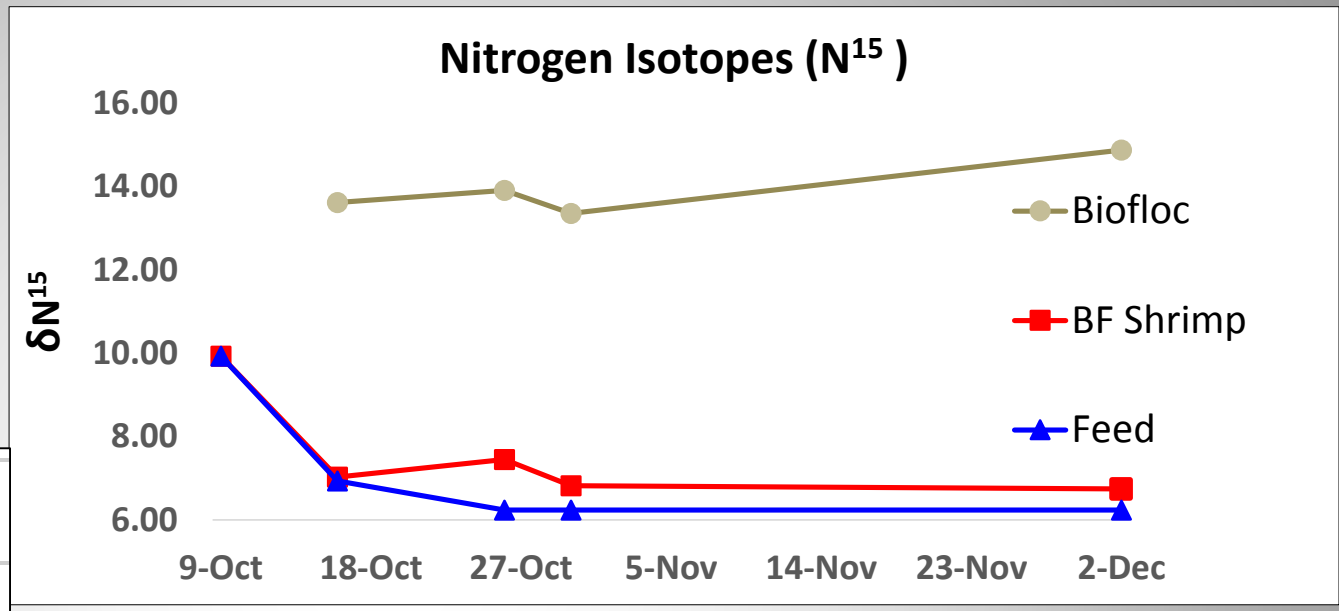


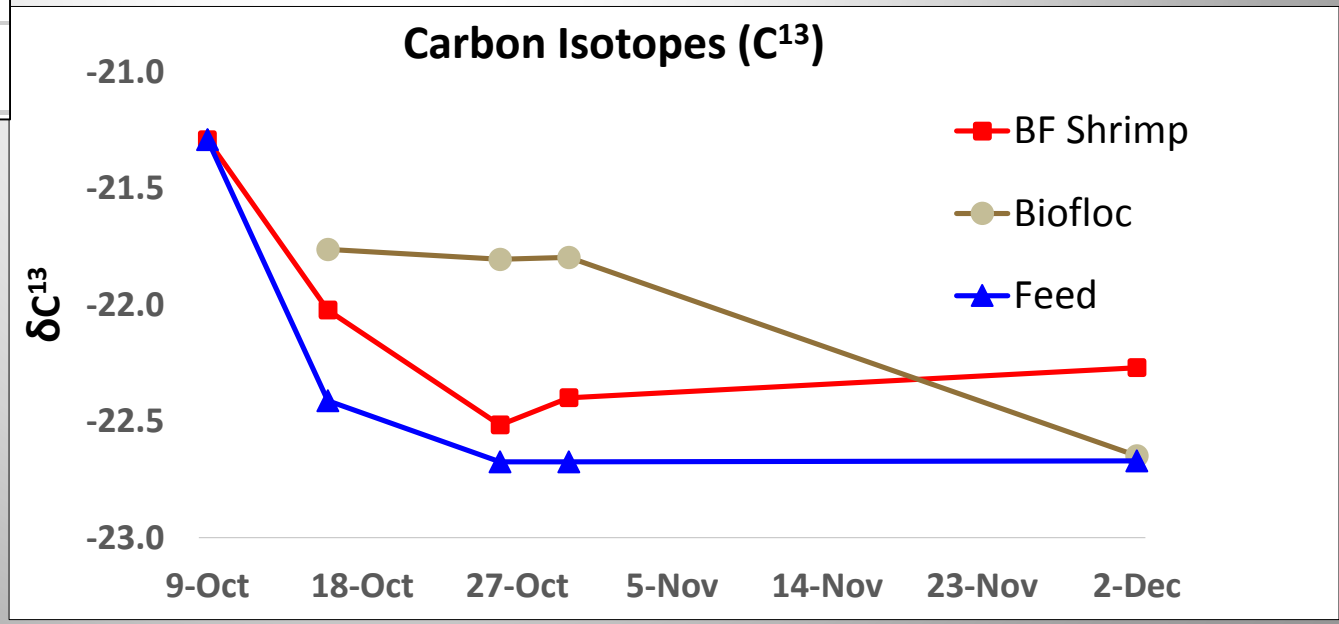
www.umces.edu

Stable Isotopes Results

	δC^{13}	δN^{15}
BF Shrimp	21.10 ± 0.1^{a}	9.74 ± 0.22
CW Shrimp	21.35 ± 0.18^{b}	9.26 ± 0.30

Data presented in Mean ± SE





Conclusions

- Shrimp weight and FCR significantly better in CW
- Mean survival and growth rates were better in CW
- Greater Biomass Production in CW
- More instability with BF water quality
- There may be some nutritional contribution from the BF, but this was not translated into better performance.
- Overall, CW performed better

Further Investigations

- Manage turbidity more closely
- Examine stress in shrimp
- Maintain consistent management protocols
- Longer project timeframe
- Further Stable Isotope Research

Future Topics

1. Economic Studies
- Feasibility
- Scale
- Marketing

2. Nutrition Research
- Biofloc Nutritional Value
- Beneficial Contribution

Thank you!

- **Kentucky State University**
- **USDA**
- **All my team members**

United States Department of Agriculture
National Institute of Food and Agriculture