Polyculture of Pacific white shrimp, *Litopenaeus vannamei*, and juvenile tilapia, *Oreochromis niloticus*, in indoor biofloc aquaculture systems

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National Institute of Food and Agriculture

Purpose

- **Grow out production of shrimp along with nursery production of fish**
- **Secondary product without extra inputs – fish left to eat <u>only biofloc</u>**
- **The effects of tilapia on shrimp production & water quality**

Purpose

- Can more biomass be produced using the same inputs (feed)
- Does addition of Tilapia affect biofloc composition?
  - Nutrition
  - Minerals
- Do Tilapia affect Shrimp and biofloc Carbon and Nitrogen make-up?

Materials and Methods

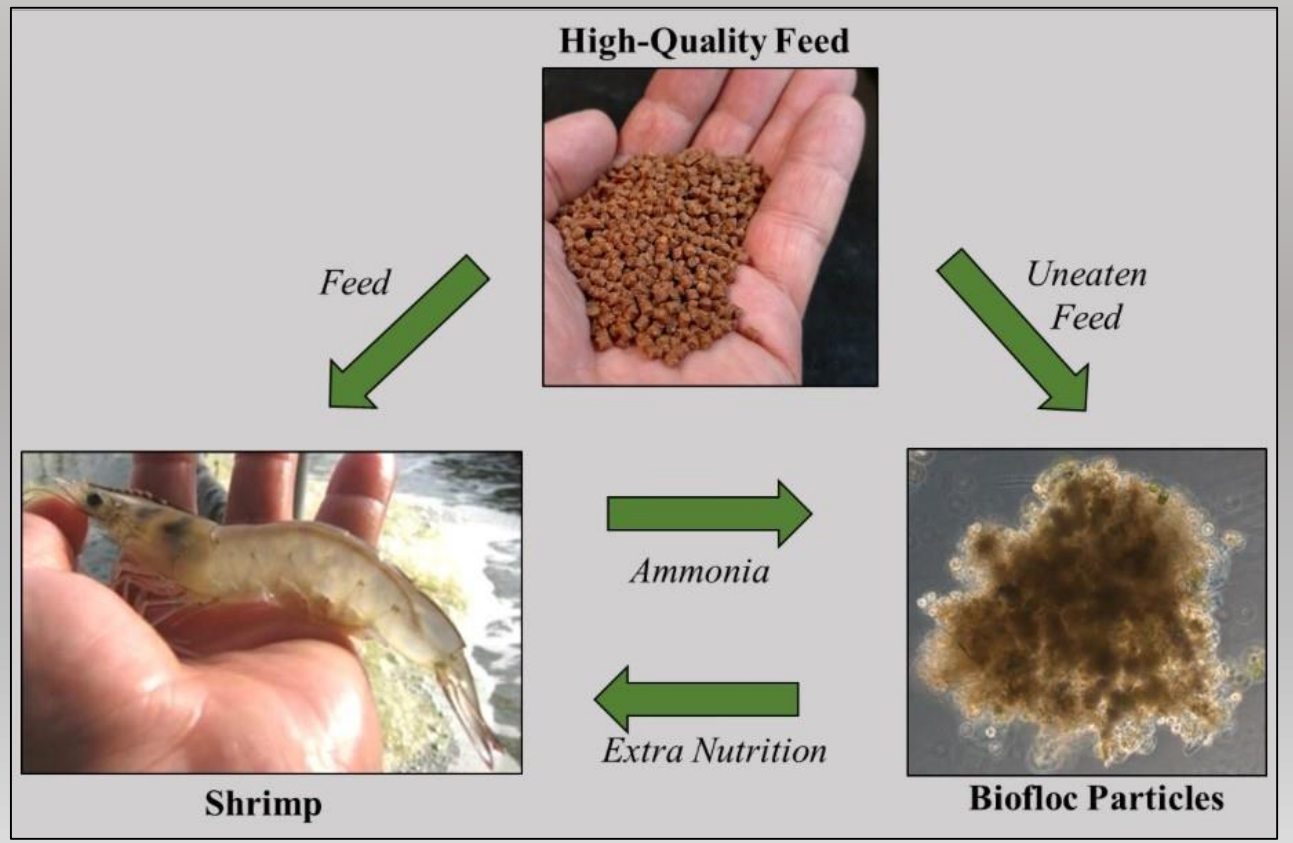
- Climate controlled building, electric water heaters
- 8 pairs of 1m³ tanks
- One tank from each pair raised about 18 cm above the other
- Water pumped into higher tank and gravity fed back to lower tank
- Screens prevented animal/feed movement between tanks
- Two treatments – 4 replicate pairs each
  - Shrimp and Tilapia (ST)
  - Shrimp Only (SO)
- 90 day experiment

Materials and Methods

- Shrimp (1.4 g) stocked in all upper tanks
- Tilapia (0.3 g) stocked only in the ST lower tanks
- Shrimp fed 35% protein diet – same amount in each pair of tanks
- Tilapia not fed, left to eat
  biofloc particulates in water column
- Systems “seeded” with existing
  biofloc water
- 15 ppt. salinity
- Home-made foam fractionators
  air stone based

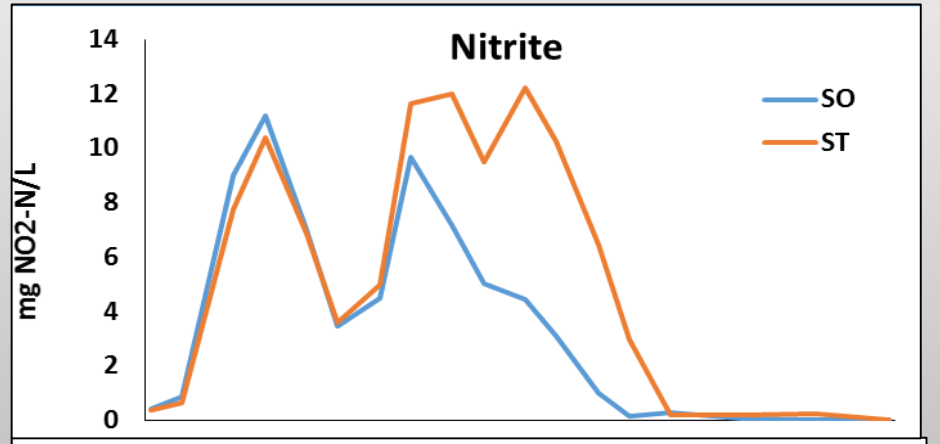
Stable Isotopes

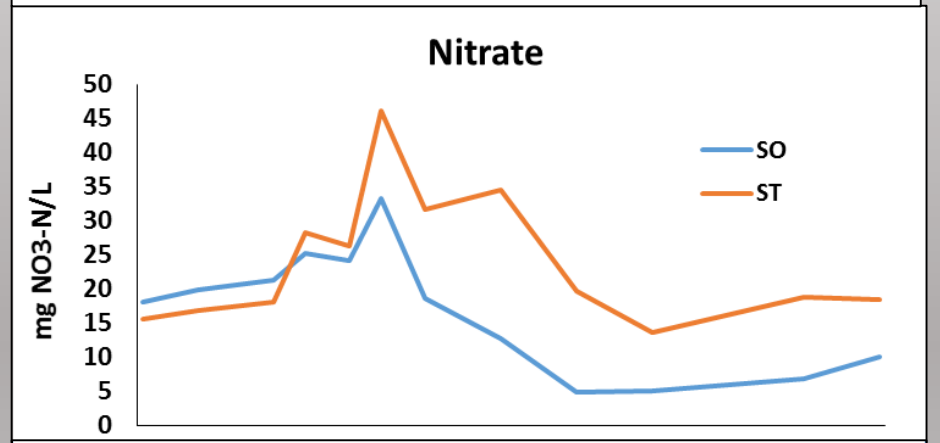
- $\delta = \left(\frac{R_{sample}}{R_{standard}} - 1\right) \times 1000$
  - R = the ratio of heavy over light isotopes ($^{13}C/^{12}C$ or $^{15}N/^{14}N$)
- Indicates sources of C and N
- Organisms will look similar to food sources
  - Slightly heavier due to fractionation… organisms retain heavier isotopes over time

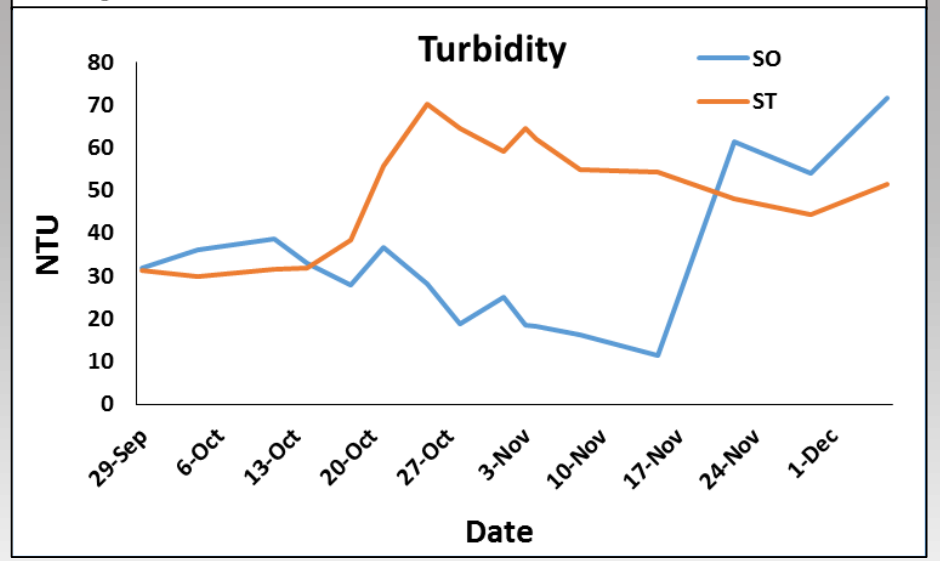


Water Quality

- Significantly higher nitrite, nitrate, and turbidity levels in ST treatment
- Nitrate levels dropped off throughout the study
- Turbidity consistently higher in ST systems until end of study (some settling did occur in SO systems)
- Alkalinity significantly lower in ST systems







Dissolved Components

- Most items significantly higher in the ST treatment
- With tilapia these components entered a dissolved phase more quickly?
- Tilapia helping to mineralize the biofloc?

	Shrimp Only	Shrimp + Tilapia
NO_3	131.7	227.5
Li	85,150.0	89,725.0
Na	2,750,000.0	3,470,000.0
Mg	311,250.0	363,750.0
P	3,330.0	4,760.0
K	3,330.0	5,292.5
Ca	62,450.0	84,250.0
Cr	27.5	23.9
Fe	631.3	474.7
Ni	95.9	136.5
Cu	23.2	23.8
As	114.8	121.9
Sr	3,370.0	4,242.5
Cd	0.9	3.3
Ba	29.6	32.8
Hg	1.8	1.9
Pb	0.2	0.2

Mean concentrations (ug/L; NO_3 = mg/L)

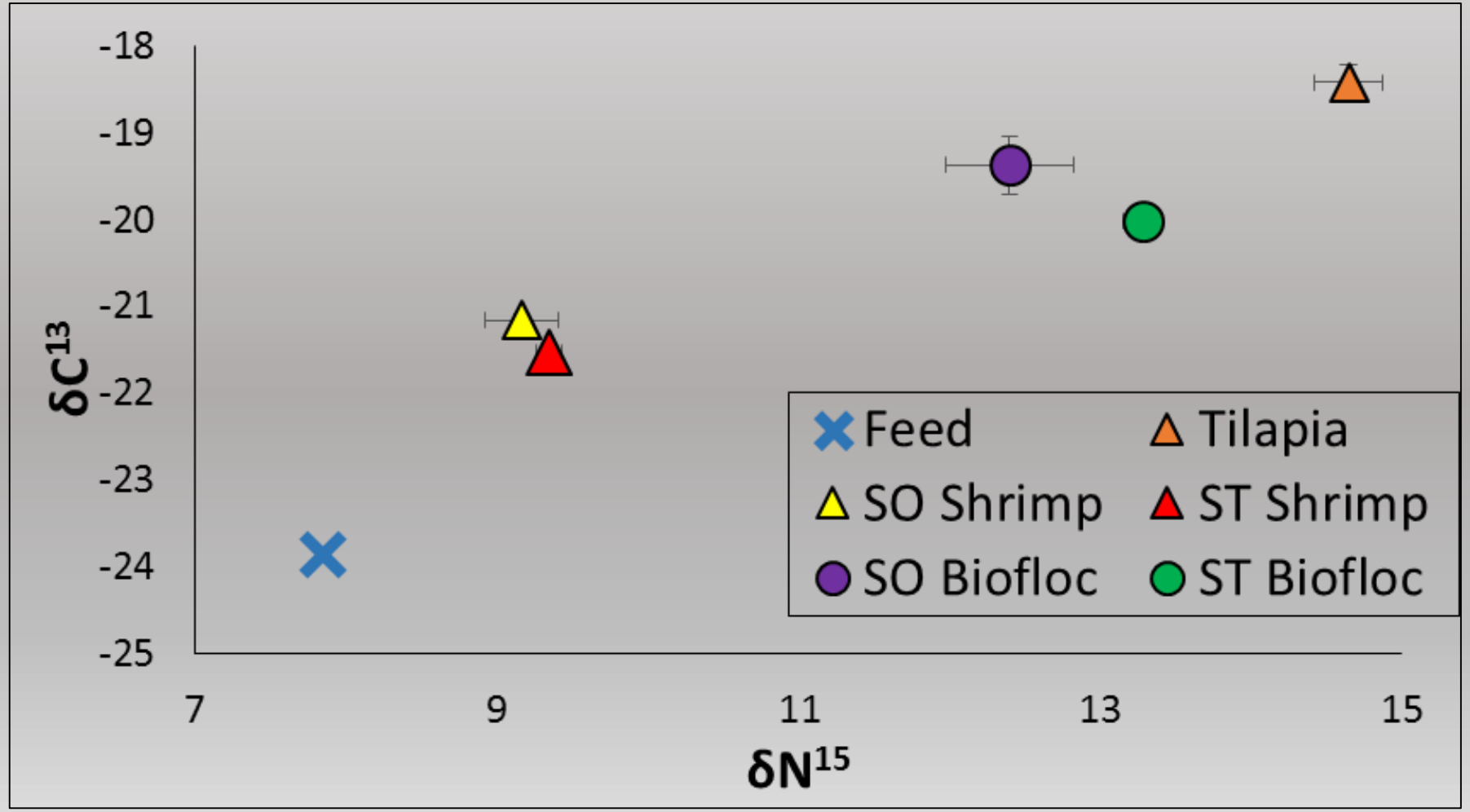
Production Results

	Treatment	
	Shrimp Only (SO)	Shrimp/Tilapia (ST)
Shrimp Weight (g)	10.8 ± 0.3	10.0 ± 0.2
Shrimp FCR	1.3 ± 0.1	1.4 ± 0.1
Shrimp Suvival (%)	95.2 ± 0.9	89.7 ± 1.0
Shrimp Biomass (kg)	3.3 ± 0.1	2.9 ± 0.1
Total FCR	1.3 ± 0.1[a]	1.1 ± 0.1[b]
Total Biomass (kg)	3.3 ± 0.1[a]	3.5 ± 0.1[b]

- Tilapia = 2.6 ± 0.2 g, nearly 100% survival
- 2.5% per day SGR

Stable Isotopes

- Consumers higher than their diet = fractionation
- Tilapia more similar to biofloc
- Shrimp more similar to feed



Summary

- Water quality more of an issue with tilapia
  - Higher dissolved N concentrations
  - Lower alkalinity
  - Higher level of mineralization
  - Fish converting organic to inorganic?
- Greater overall biomass production with tilapia
  - Tilapia had effect on biofloc composition
  - Slightly smaller shrimp
  - Lower FCR = Better use of feed

Summary

- Nutritional composition of shrimp tissues and biofloc
- More external filtration
- Longer duration
- Denitrification

Thank You!

- Supported by a Grant From the USDA, National Institute of Food and Agriculture's 1890 Capacity Building Grant Program

- Website: http://www.ksuaquaculture.org/
- YouTube Video: https://www.youtube.com/watch?v=IwbDqB0C_-Y