REFINING BIOFLOC MANAGEMENT IN MESOHALINE, INTENSIVE SHRIMP *Litopenaeus vannamei* CULTURE SYSTEMS

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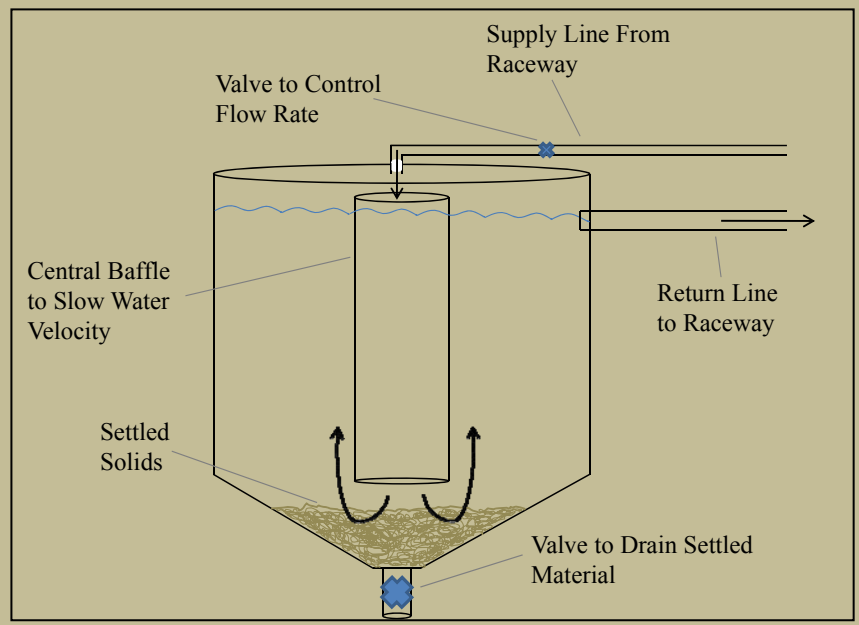
Biofloc-based Shrimp Culture Systems

- Little if any water exchange
- High animal densities
- Dense microbial community
  - N cycling
  - Supplemental nutrition
  - Biofloc particles
    - Control concentration
      = improved performance
- Purpose of this study
  - Refine biofloc concentration and management strategies

Materials and Methods

- Eight raceways
  - 50 m^3
  - 16 ppt. salinity
- Two treatments
  - Low solids (T-LS)
    - 1700 L Settling chambers
    - 20 LPM Flow rate
  - High solids (T-HS)
    - 760 L Settling chambers
    - 10 LPM Flow rate
  - Four replicates each
  - Shrimp (0.72 ± 0.20 g) stocked at 250 m^{-3}
  - Cultured 13 weeks

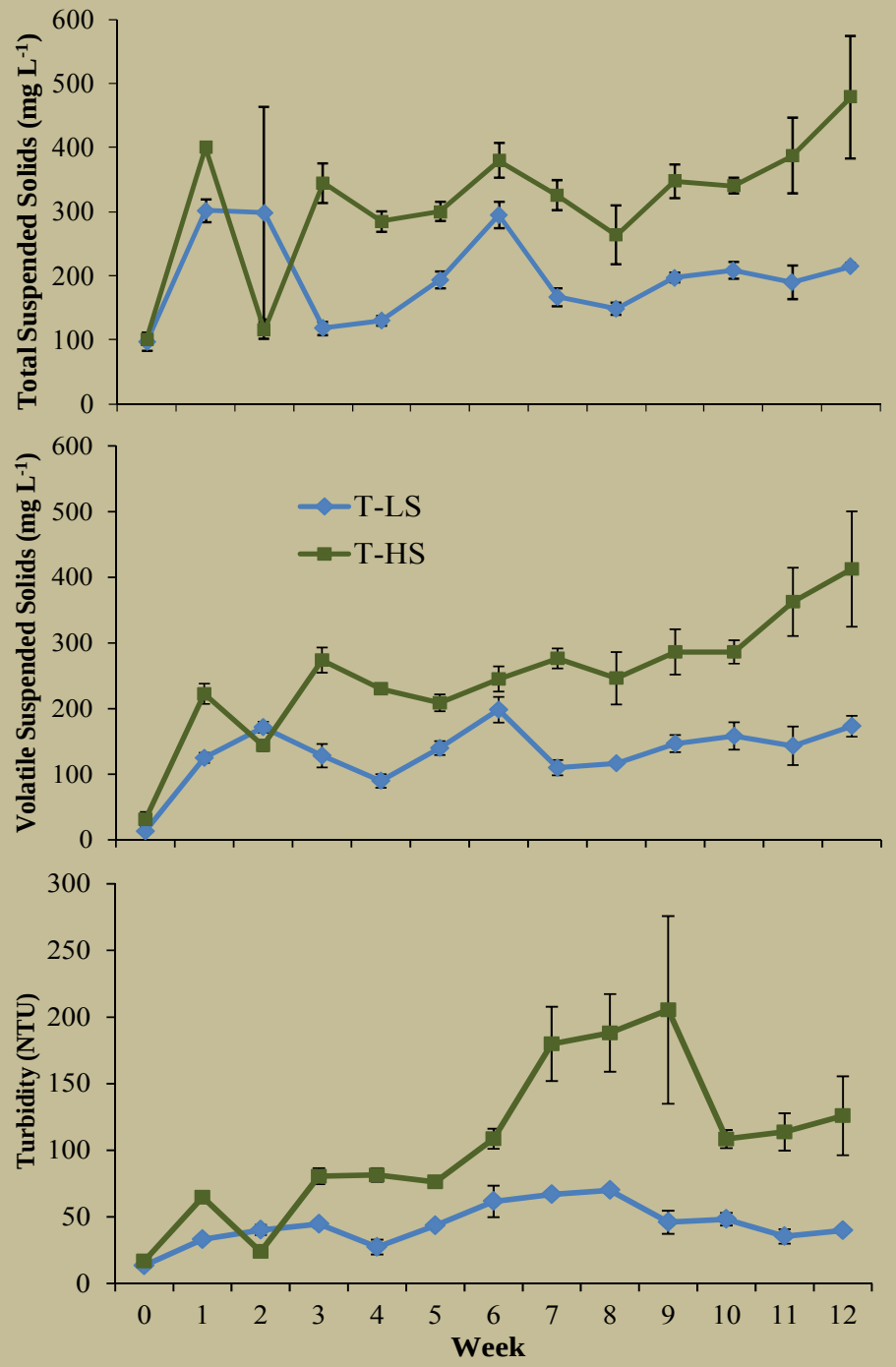


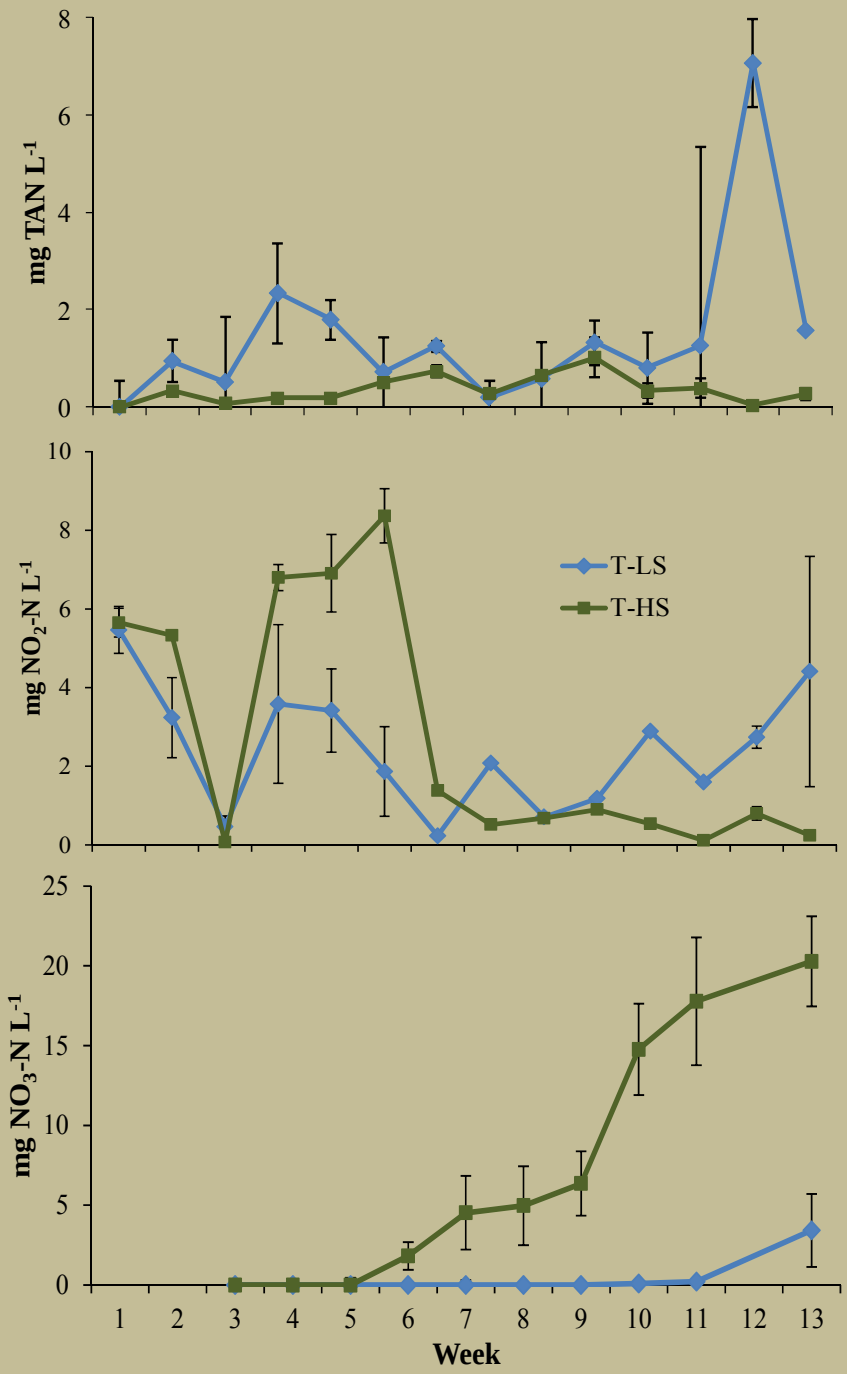
Results

	Treatment	
	T-LS	T-HS
Temperature (°C)		
AM	29.2 ± 0.1 (25.9-32.2)	28.9 ± 0.1 (26.1-31.5)
PM	30.7 ± 0.1 (27.0-33.8)	30.3 ± 0.1 (27.0-33.0)
Dissoved Oxygen (mg L^{-1})		
AM	7.9 ± 0.1 (4.2-13.4)	7.2 ± 0.1 (4.2-11.7)
PM	6.2 ± 0.1 (2.9-10.7)	6.1 ± 0.1 (2.7-10.7)
pH		
AM	7.6 ± 0.0 (6.7-8.3)	7.6 ± 0.0 (7.1-8.3)
PM	7.4 ± 0.0 (7.1-8.5)	7.5 ± 0.0 (7.1-8.5)
Salinity (g L^{-1})		
AM	16.3 ± 0.0 (15.6-18.3)	16.3 ± 0.0 (15.0-18.4)
PM	16.2 ± 0.0 (15.5-18.4)	16.2 ± 0.0 (15.0-18.4)

Mean ± S.E. (Range)

- Significantly reduced TSS, VSS, and turbidity in T-LS versus T-HS ($P \leq 0.003$)



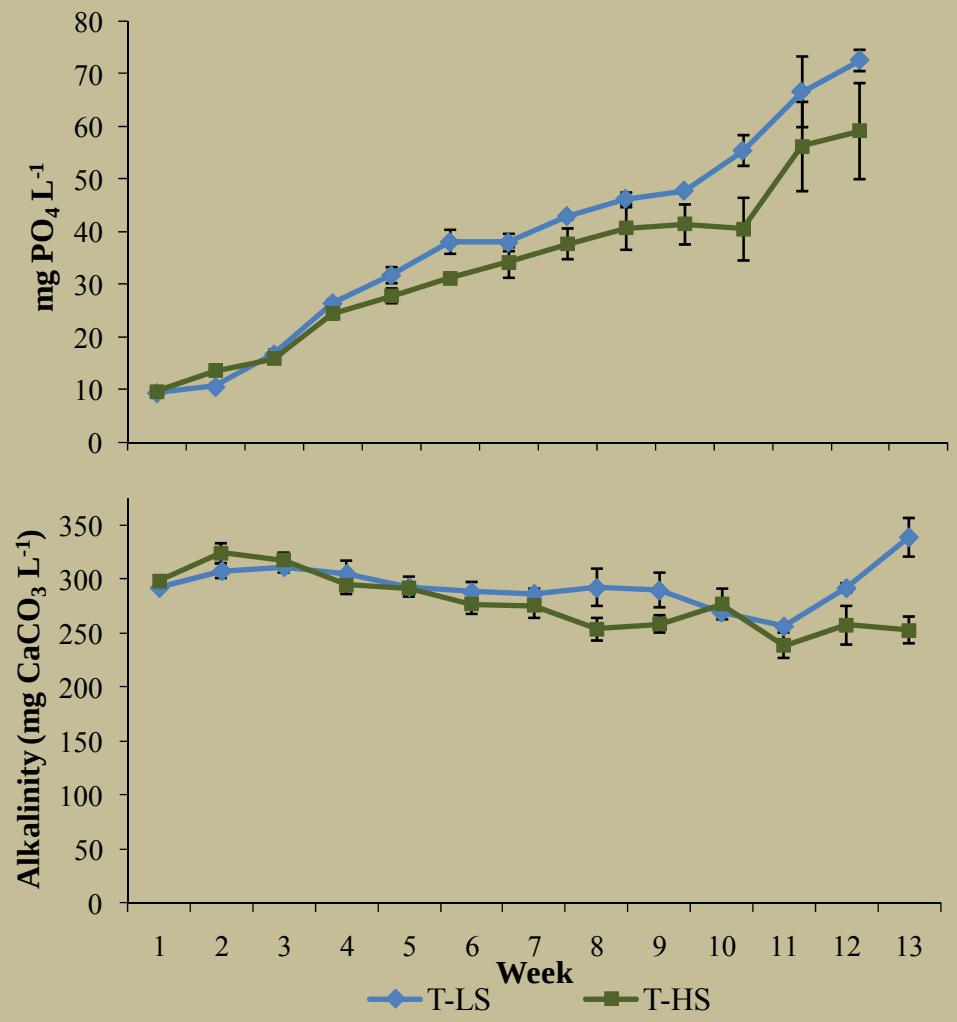


Results

- Significantly greater TAN in T-LS ($P = 0.021$)
- Significantly greater NO_2-N in T-HS ($P = 0.000$)
- Significantly greater NO_3-N in T-HS ($P = 0.007$)

Results

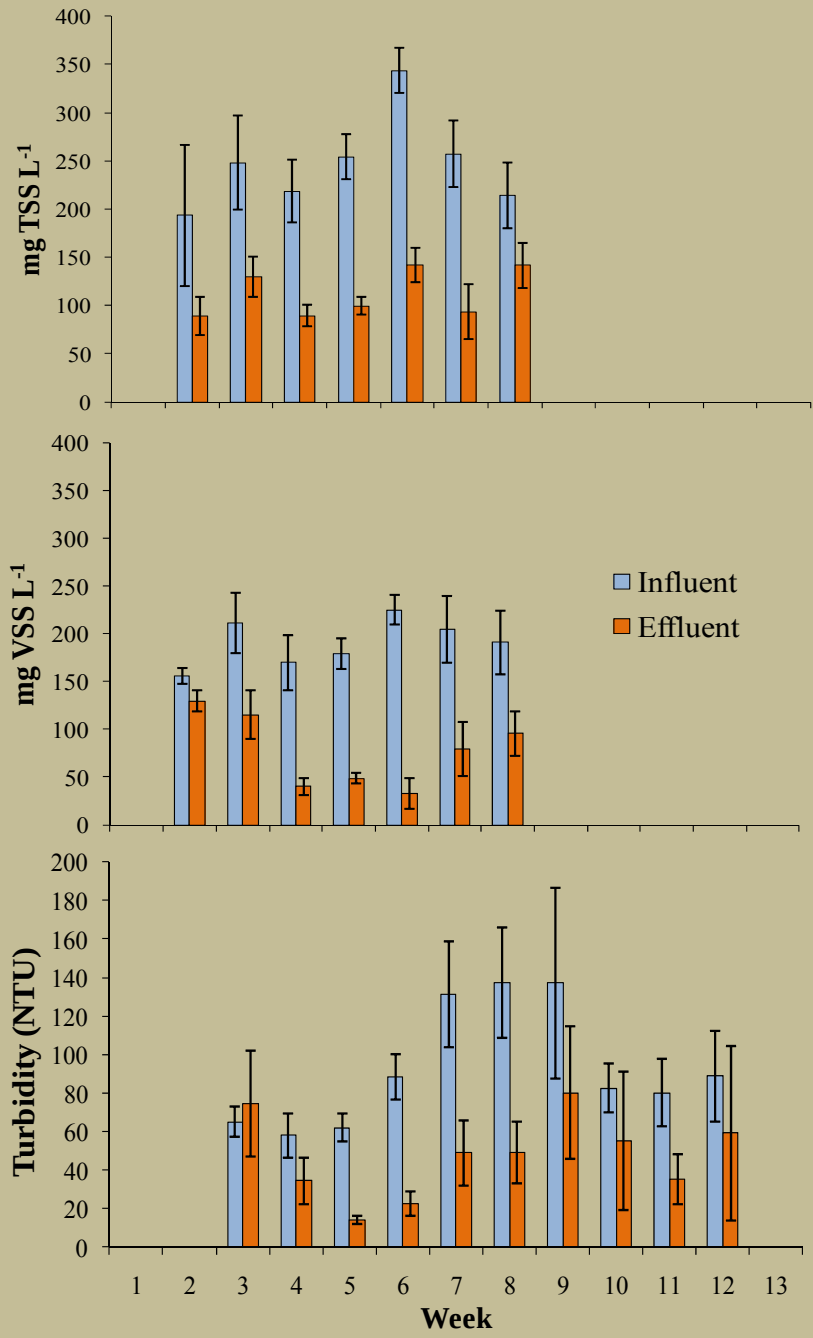
- Significantly greater orthophosphate concentration in T-LS ($P = 0.003$)
- No significant difference in alkalinity between treatments ($P = 0.055$)



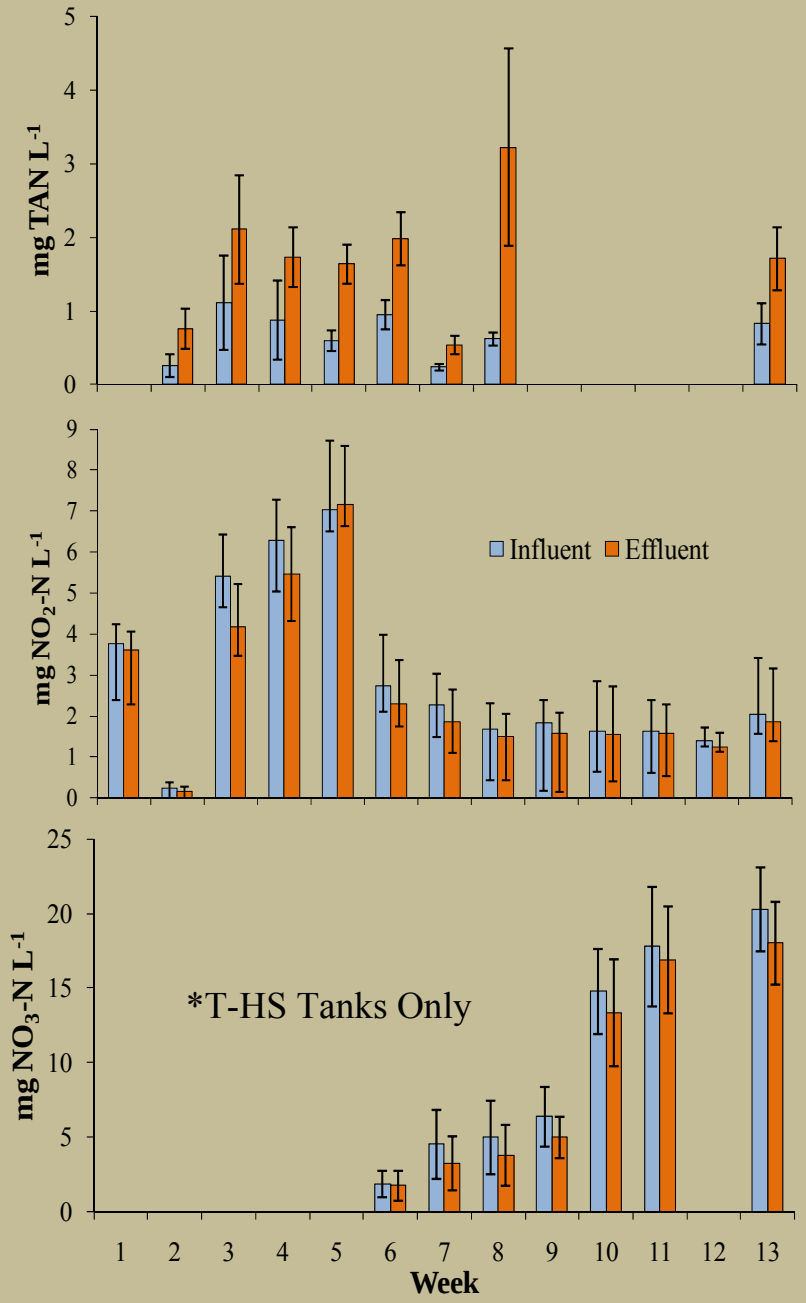
Effects of Settling Chambers

- Analysis
  - Percent change in influent and effluent over time between treatments
  - Overall influent versus effluent

- TSS, VSS, Turbidity
  - NSD in % change between treatments
  - Significantly reduced ($P \leq 0.001$)



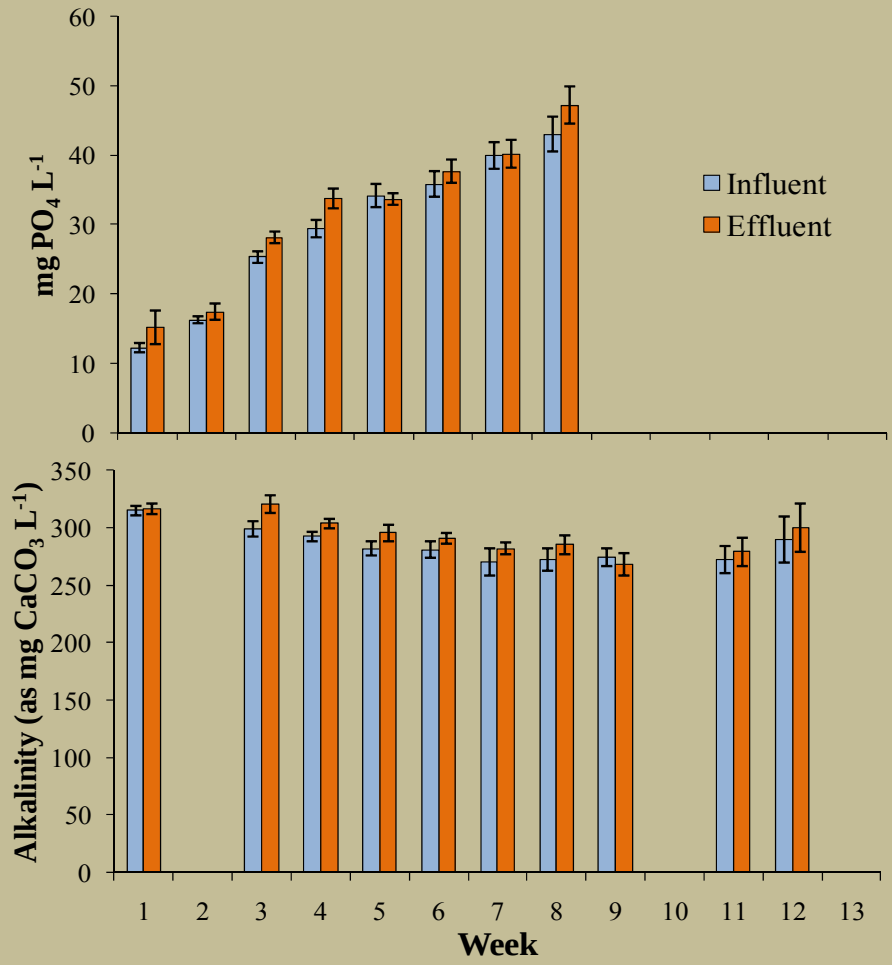
Effects of Settling Chambers



- TAN
  - NSD between treatments (% change)
  - Significantly greater in effluent ($P = 0.004$)
- NO_2-N
  - NSD between treatments (% change)
  - Significantly reduced in effluent ($P = 0.001$)
- NO_3-N
  - NSD between treatments (% change)
  - NSD between influent and effluent in T-LS
  - Significantly decreased in effluent versus influent of T-HS ($P = 0.005$)

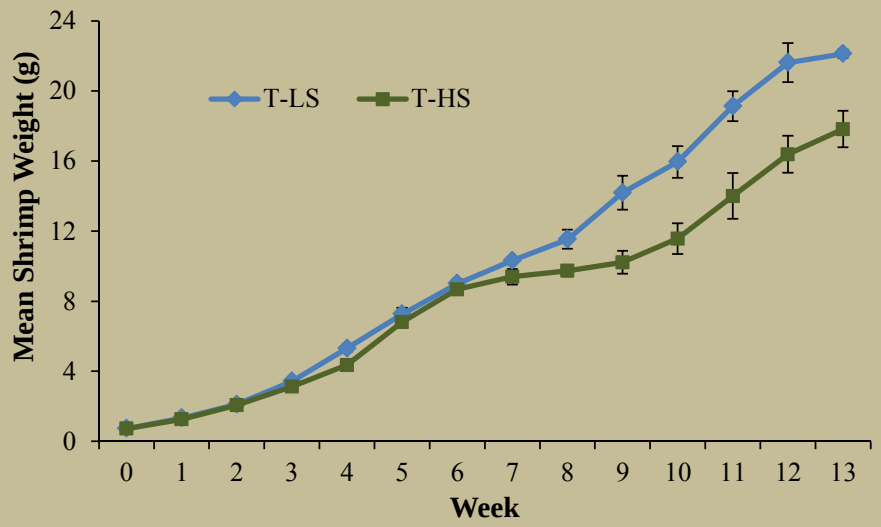
Effects of Settling Chambers

- PO_4 and Alkalinity
  - NSD between treatments (% change)
  - Significantly increased (P = 0.010, 0.003, respectively)



Shrimp Production

	Treatment	
	Low Solids (T-LS)	High Solids (T-HS)
Mean Final Weight (g)	22.1 ± 0.3 (21.7-22.7) a	17.8 ± 0.2 (15.3-19.7) b
Growth Rate (g week^{-1})	1.7 ± 0.0 (1.6-1.7) a	1.3 ± 0.1 (1.1-1.5) b
Biomass (kg m^{-3})	2.8 ± 0.1 (2.5-3.0)	2.2 ± 0.4 (1.8-3.3)
Feed Conversion Ratio	2.5 ± 0.1 (2.3-2.7)	3.3 ± 0.4 (2.0-4.0)
Percent Survival	49.7 ± 3.1 (43.9-54.5)	49.4 ± 5.9 (41.7-66.5)



- 22 gram shrimp in 13 weeks (T-LS)
- ↑ Growth rate and ↑ Final weight in T-LS (P = 0.019)
- Stocking mortality

Summary

- T-LS
  - ↓ TSS, ↑ TAN, ↑ PO_4, ↑ growth rate, ↑ final shrimp weight
  - Possibly no nitrification
    - Very little NO_3-N in raceways
    - NSD between influent and effluent NO_3-N of settling chambers
    - Too little surface area???
- T-HS
  - ↑ NO_2-N, ↑ NO_3-N
  - Nitrification
- Settling chambers
  - Denitrification?
    - decrease in NO_3-N, increase in alkalinity
  - Returning TAN… DNRA, decomposition?
  - NSD in percent change between two treatments for any parameter

Thank You

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