



EFFECT OF SUSPENDED SOLIDS ON REARING OF *Litopenaeus vannamei* BIOFLOC TECHNOLOGY CULTURE SYSTEM

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Rio Grande, Brazil



Location



Southern Brazil

**Rio Grande do Sul State
(32°S)**



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Laboratories:

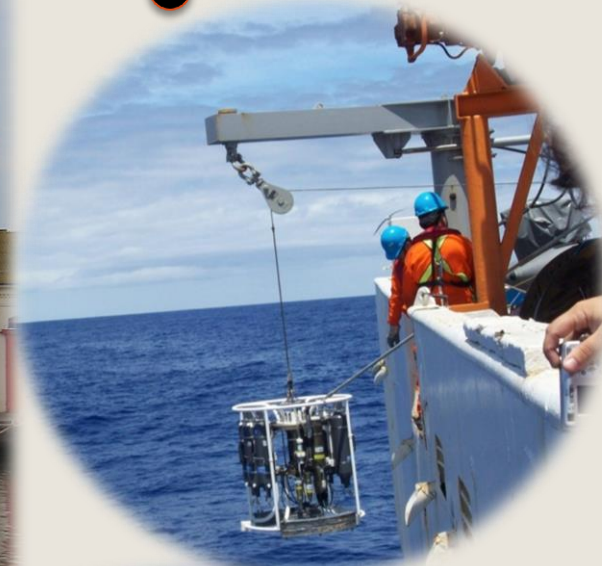
Crustacean Biology, Ecology of Benthic Communities, Marine Mammals, Coastal Management and Ecology, Ictiology, Fisheries Resources and Technology, Phytonkton and Zooplankton, Hydrochemistry, Marine Biochemistry... **MARINE AQUACULTURE** (50 researchers)



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University
focused to
the sea



MARINE STATION AQUACULTURE

**Since
2005**



Courtesy: Paulo Iribarrem

MARINE STATION AQUACULTURE

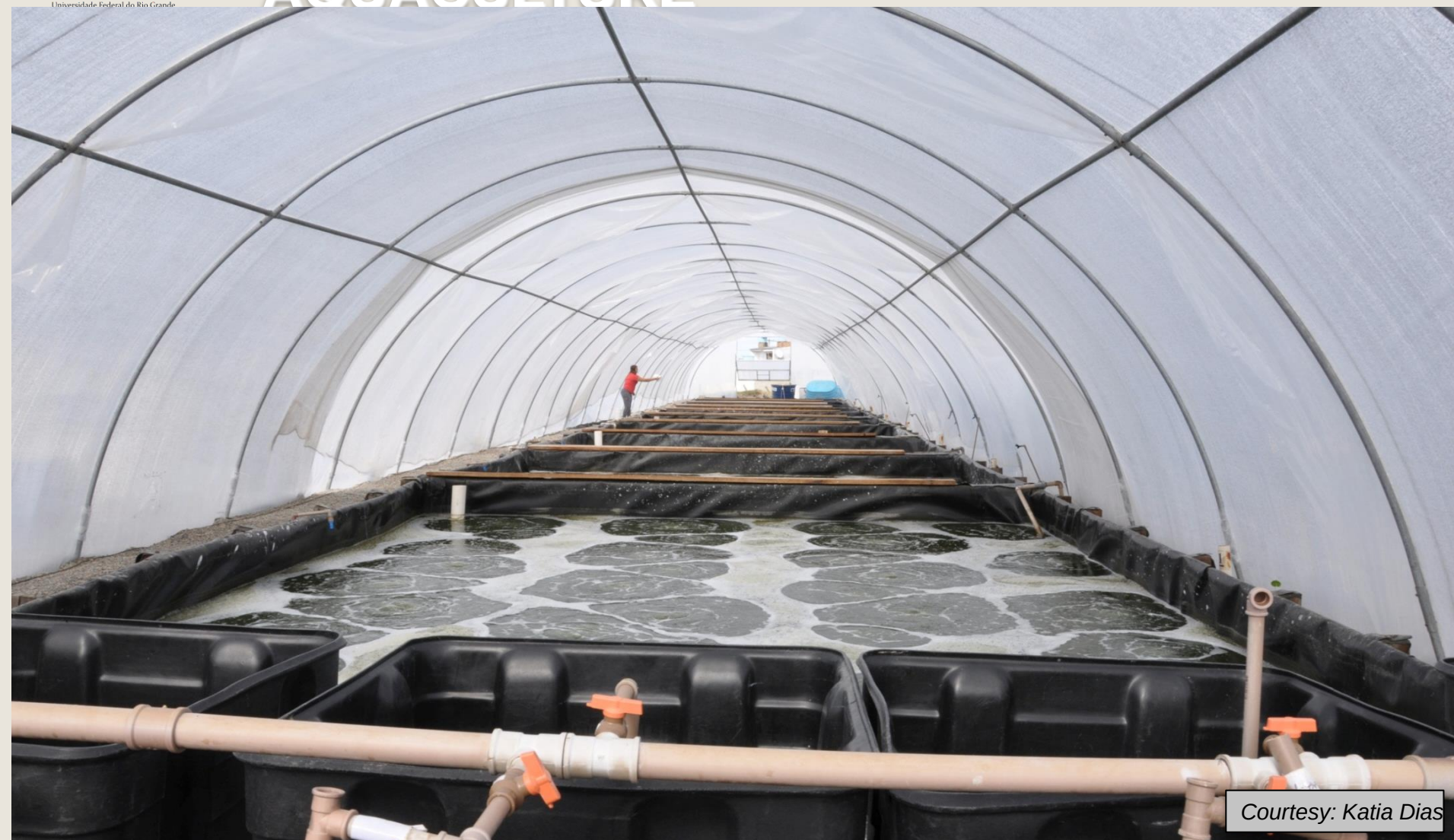
**Since
2005**



Courtesy: Paulo Iribarrem

BIOFLOC – Lined ponds

MARINE STATION AQUACULTURE



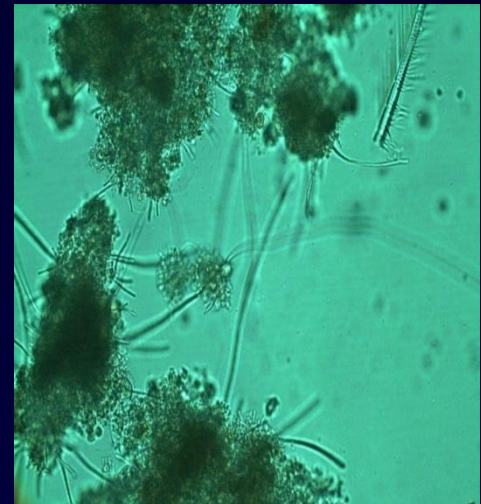
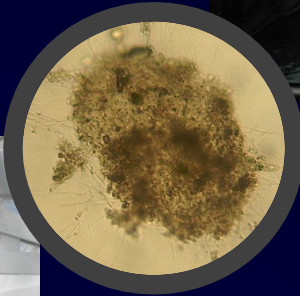
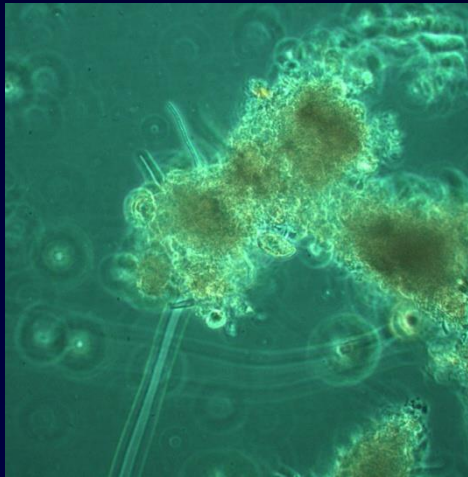
Courtesy: Katia Dias

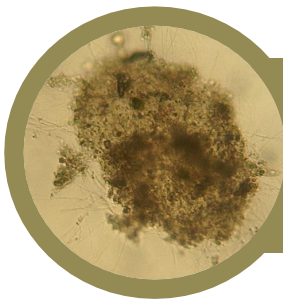
GREENHOUSE



MARINE STATION OF AQUACULTURE

Greenhouse BFT system

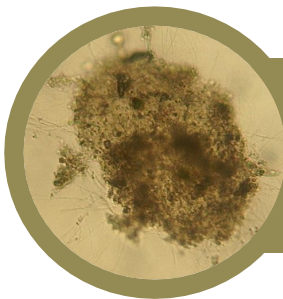




Biofloc Technology System

- Microbial aggregates
Increase concentration of
nutrients and organic matter
- Increasing biofloc
production

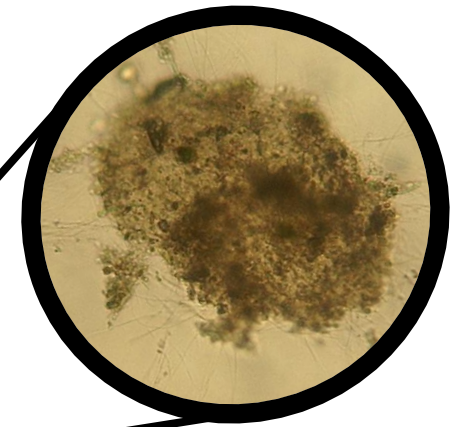




Biofloc Technology System

- How this increase of TSS affect shrimp culture?????
- Increases oxygen consumption
- Increases CO₂ concentration
- Decreases pH
- Decreases alkalinity
- Gill clogging
- Maybe increases nitrite concentration





Photos: Gaona

Three objectives

1. THE EFFECT OF CLARIFICATION PROCESS ON GROWTH PARAMETERS AND WATER QUALITY OF *LITOPENAEUS VANNAMEI* IN BFT CULTURE SYSTEM .
2. THE EFFECT OF HIGH CONCENTRATION OF TOTAL SUSPENDED SOLIDS ON THE REARING OF *LITOPENAEUS VANNAMEI* IN BFT SYSTEM;
3. THE “PHYSICAL EFFECT” OF HIGH CONCENTRATION OF TOTAL SUSPENDED SOLIDS ON THE REARING OF *LITOPENAEUS VANNAMEI* IN BFT SYSTEM;

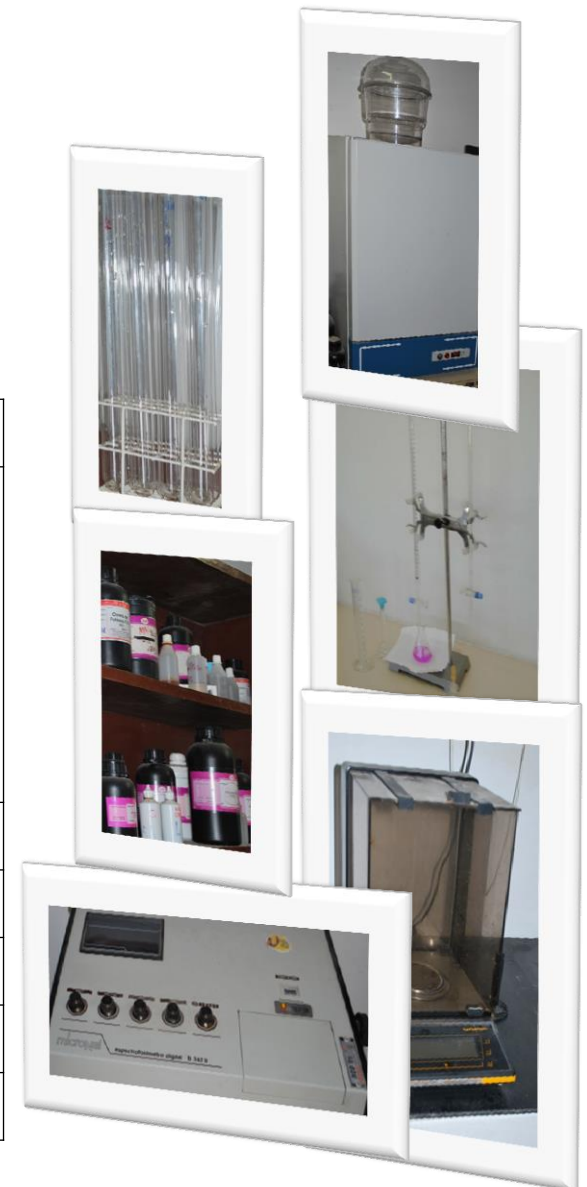
Materials and Methods for • Trial I, II and III

- Commercial feed
 - Active 38% CP (Guabi)



- Physical e chemical parameters

Parameter	Method
Temperature	Multiparameter YSI® mod. 556
pH	
Salinity	
Dissolved Oxygen	
TAN	UNESCO 1983
Nitrite	Bendschnider and Robinson, 1952
Nitrate	Aminot and Chaussepied, 1983
Alkalinity	APHA 1998
TSS	Strickland e Parsons 1972 e AOAC 2000



**TRIAL I - THE EFFECT OF CLARIFICATION
PROCESS ON GROWTH PARAMETERS
AND WATER QUALITY OF *LITOPENAEUS*
VANNAMEI IN BFT CULTURE SYSTEM**

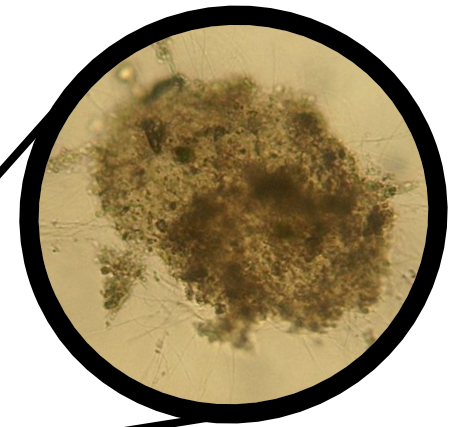
Gaona et al 2011

Materials and Methods

Trial I

- Overview
 - 17 weeks
 - Pilot structure
 - Tank: six 35 m³
 - Shrimp stocked
 - an average weight of 0.18 ± 0.06 g
 - at a density of 350 / m²
 - **It was started with clear water**





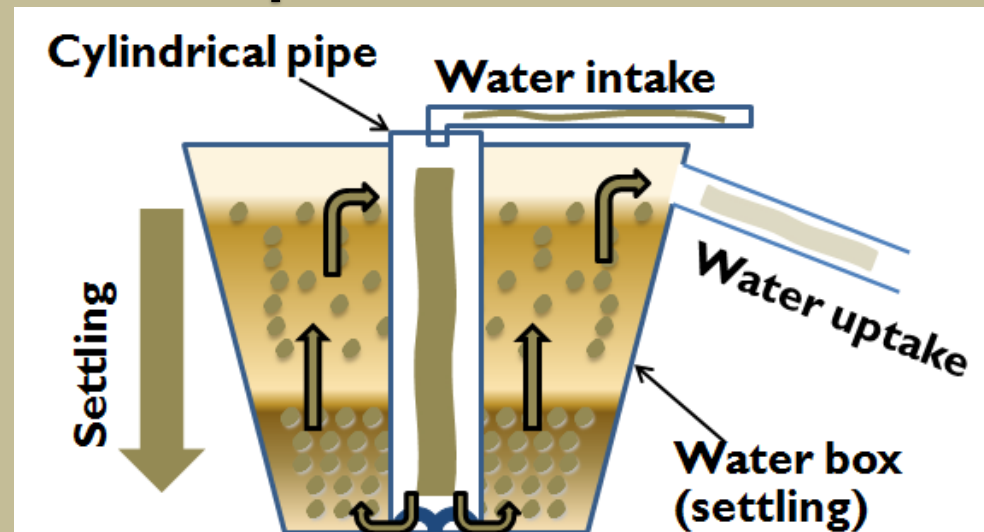
Photos: Gaona

➡ **Clarification** – It is an important tool to remove suspended solids

→ **Gravity action**

- brings the particles to the bottom

→ **Sedimentation / settling**
(It is a physical process)



Materials and Methods

Trial I



- Two treatments:
 - with clarifying (C);
 - with no clarifying (NC)

} Three replics
- Control of concentration of TSS
 - clarifier

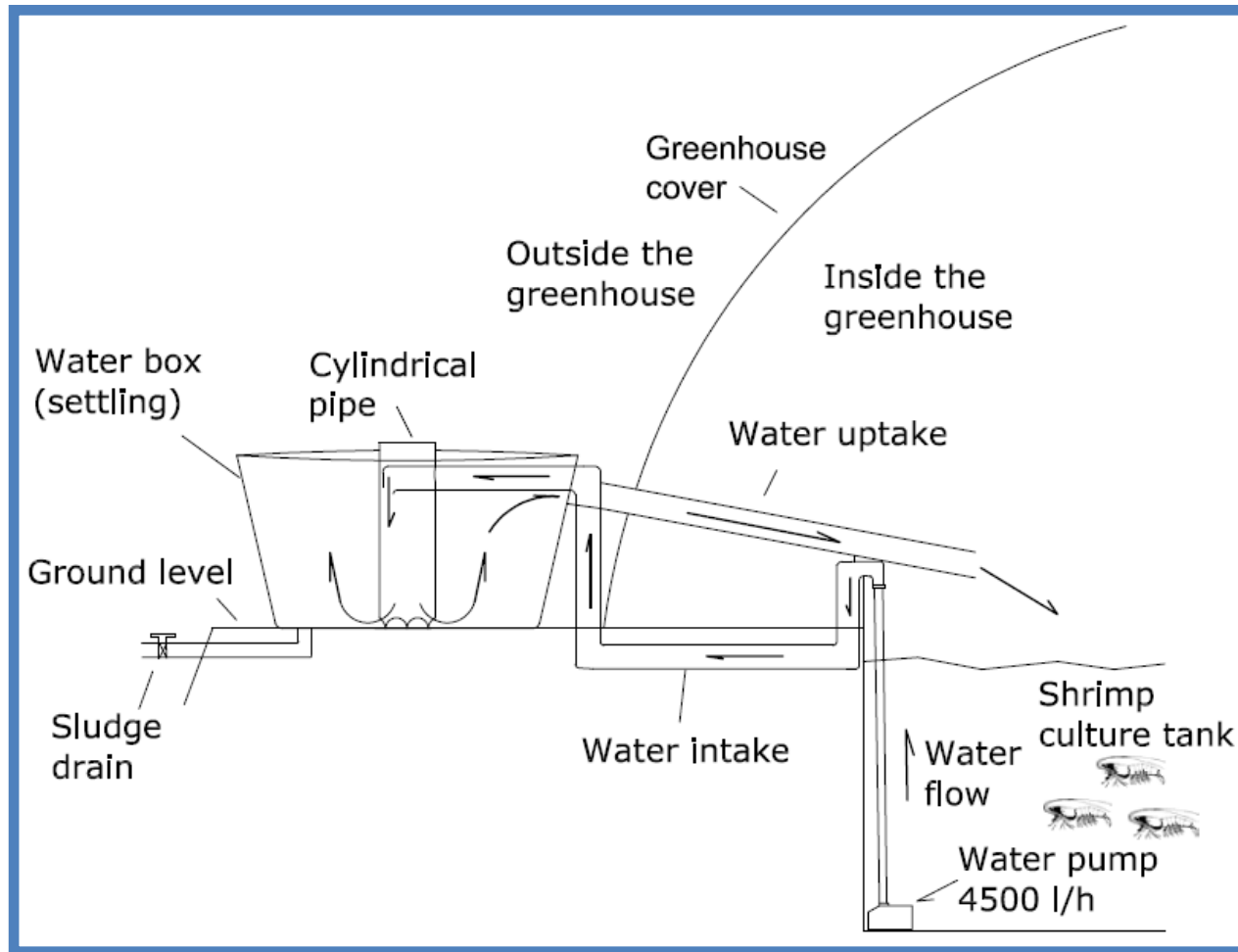
Materials and Methods

- Clarification
 - Total Suspended Solids (TSS) > 500 mg/l (Samocha et al., 2007)
 - Each application lasted for 6 continuous hours



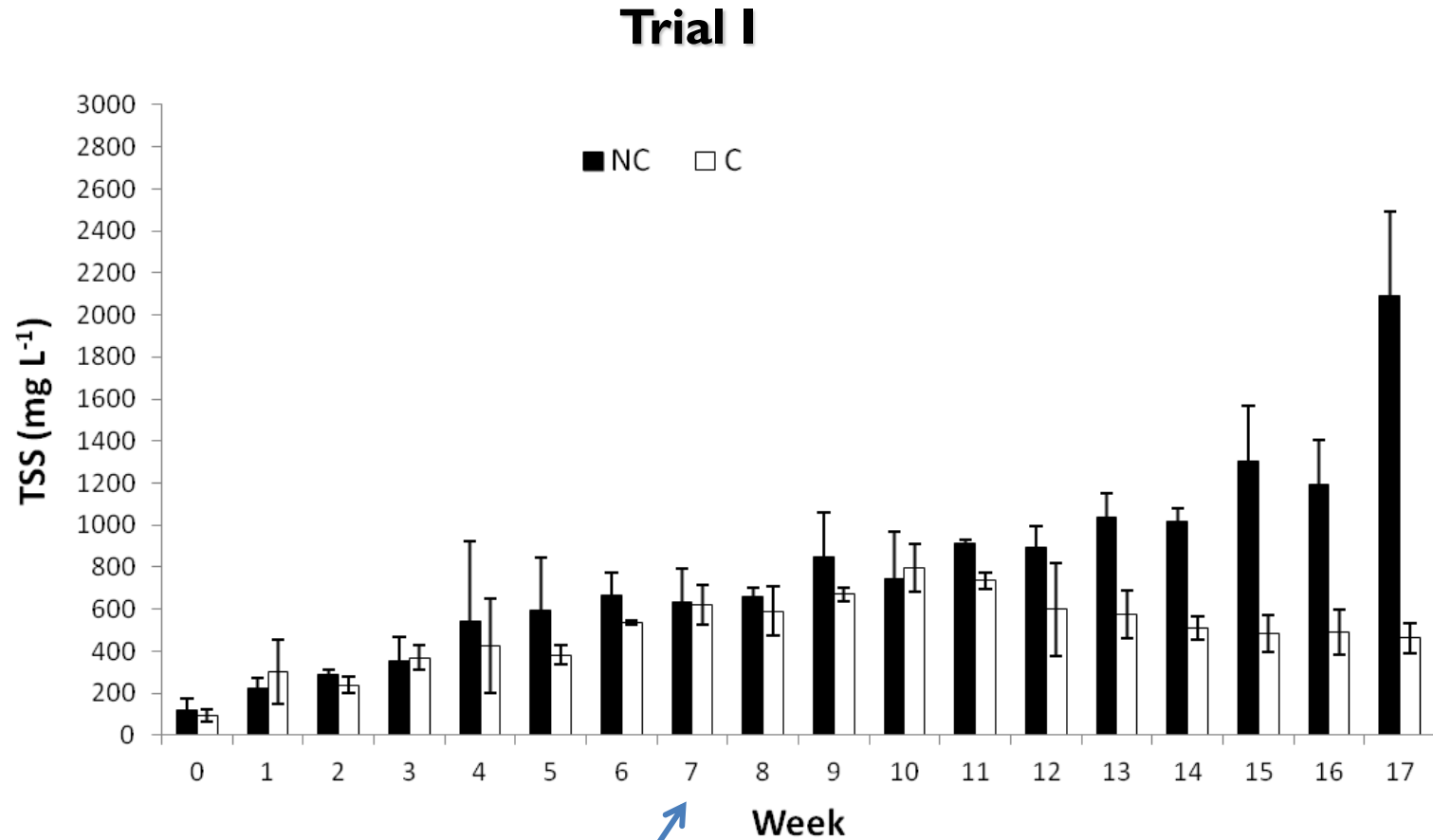
- Some solids removal methods

Main process



Gaona et al., 2011

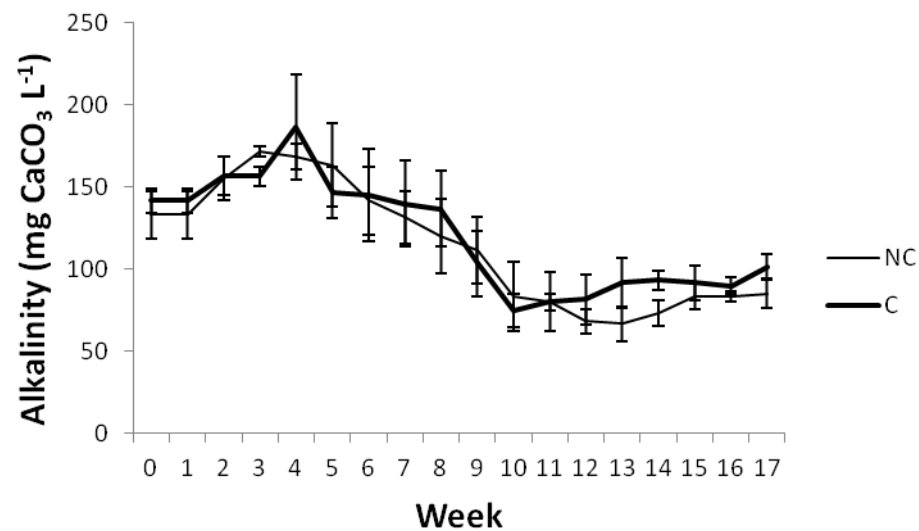
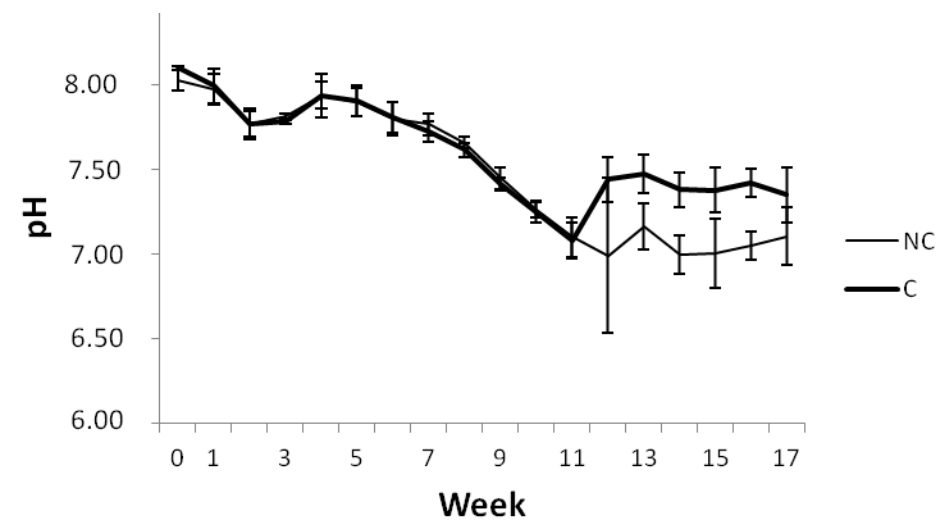
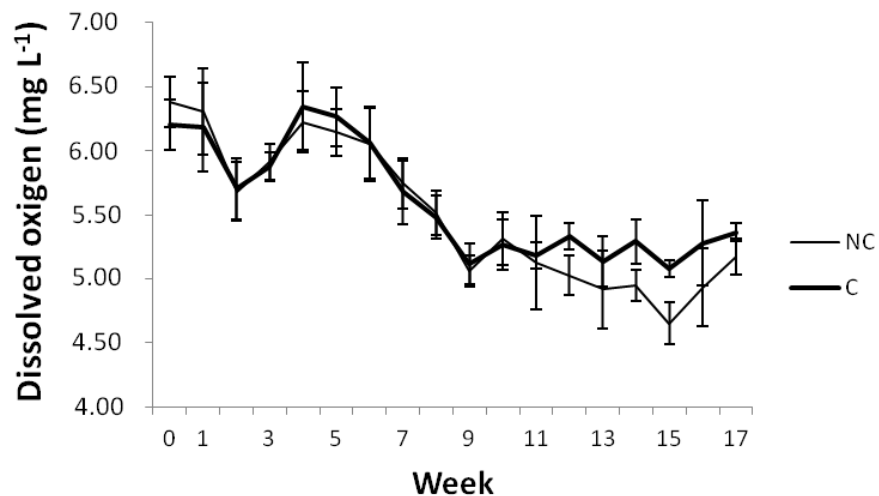
Results



Solids removal

Results

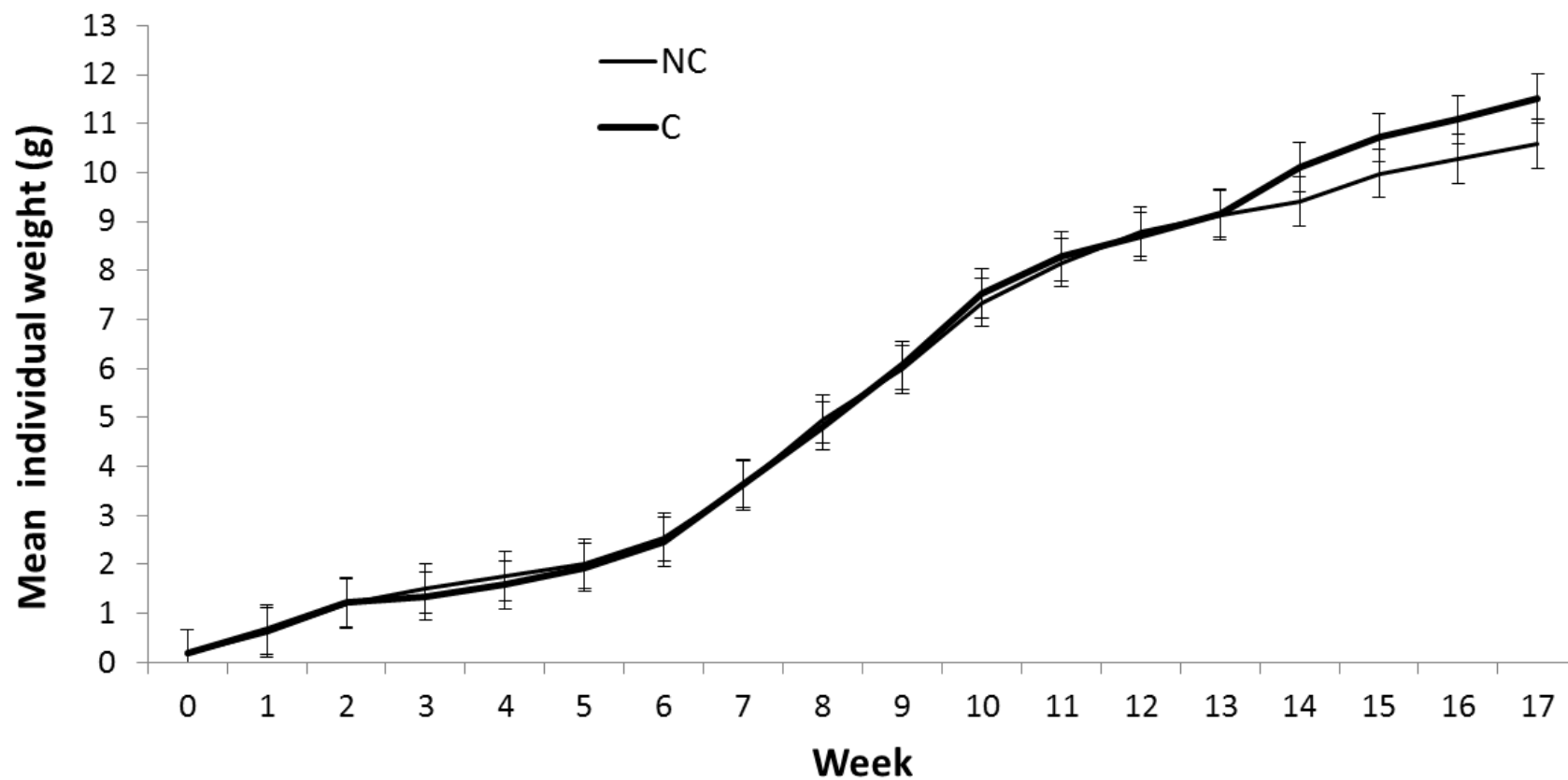
Trial I



Results

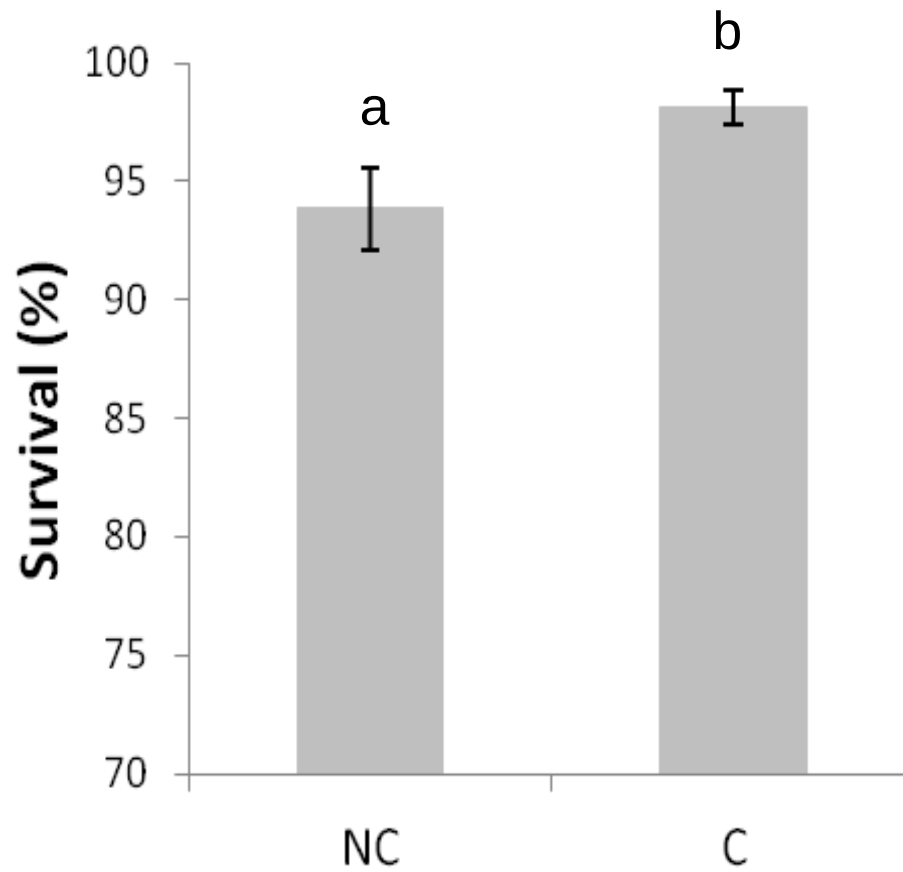
Trial I

29 °C



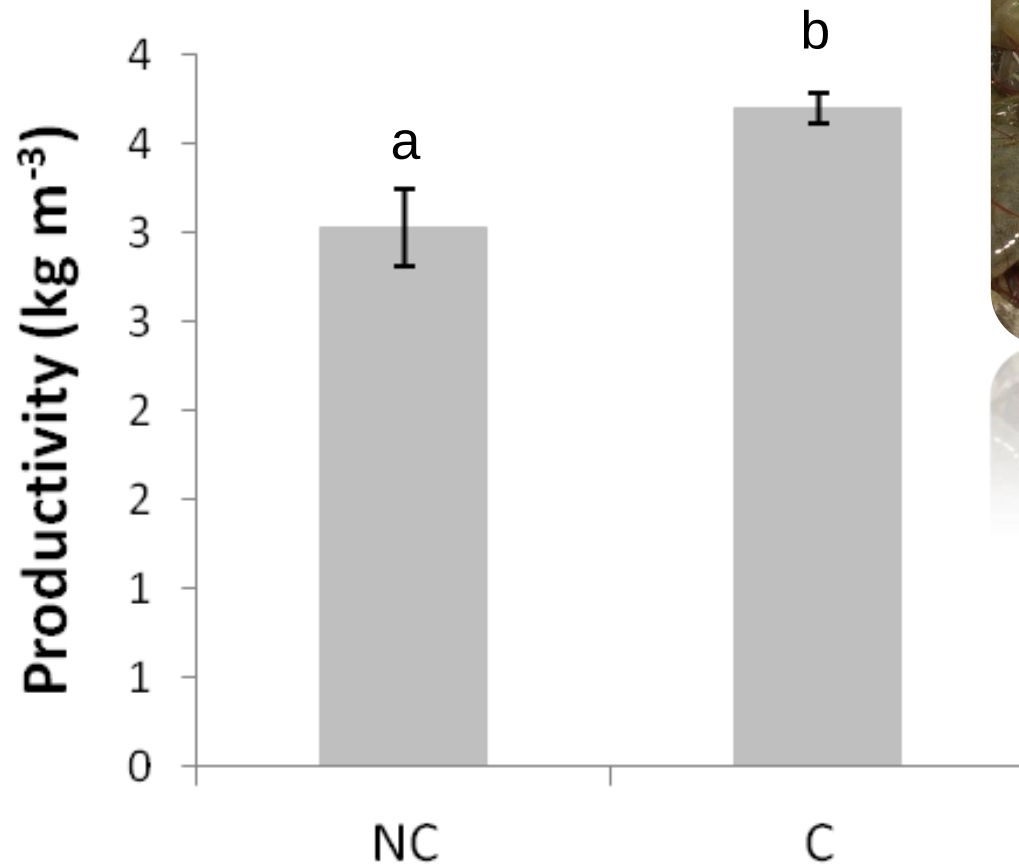
Results

Trial I



Results

Trial I



Conclusion

Trial I

- The system used for clarification was effective for the maintenance of total suspended solids at 500 mg/l
- The removal of total suspended solids improved water quality and resulted in the better growth performance of *L. vannamei*.



**TRIAL II -THE EFFECT OF DIFFERENT
CONCENTRATION OF TOTAL
SUSPENDED SOLIDS ON THE REARING
OF *LITOPENAEUS VANNAMEI* IN BFT
SYSTEM**

Materials and Methods

Trial II

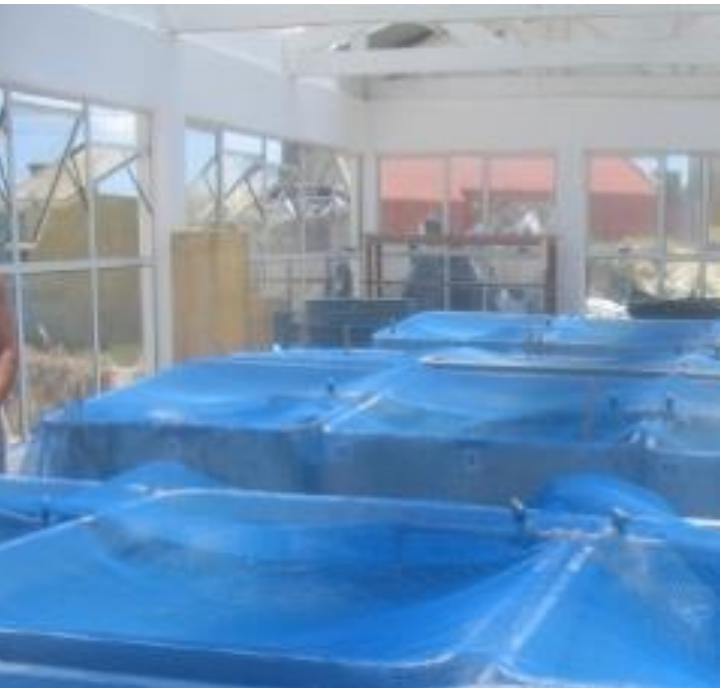
- Conditions
 - 42 days
 - **Forming biofloc**
 - Strong aeration
 - 5 mg L⁻¹
 - TAN → low concentrations
 - Nitrite → high concentrations
 - Tank: 800 L



Materials and Methods

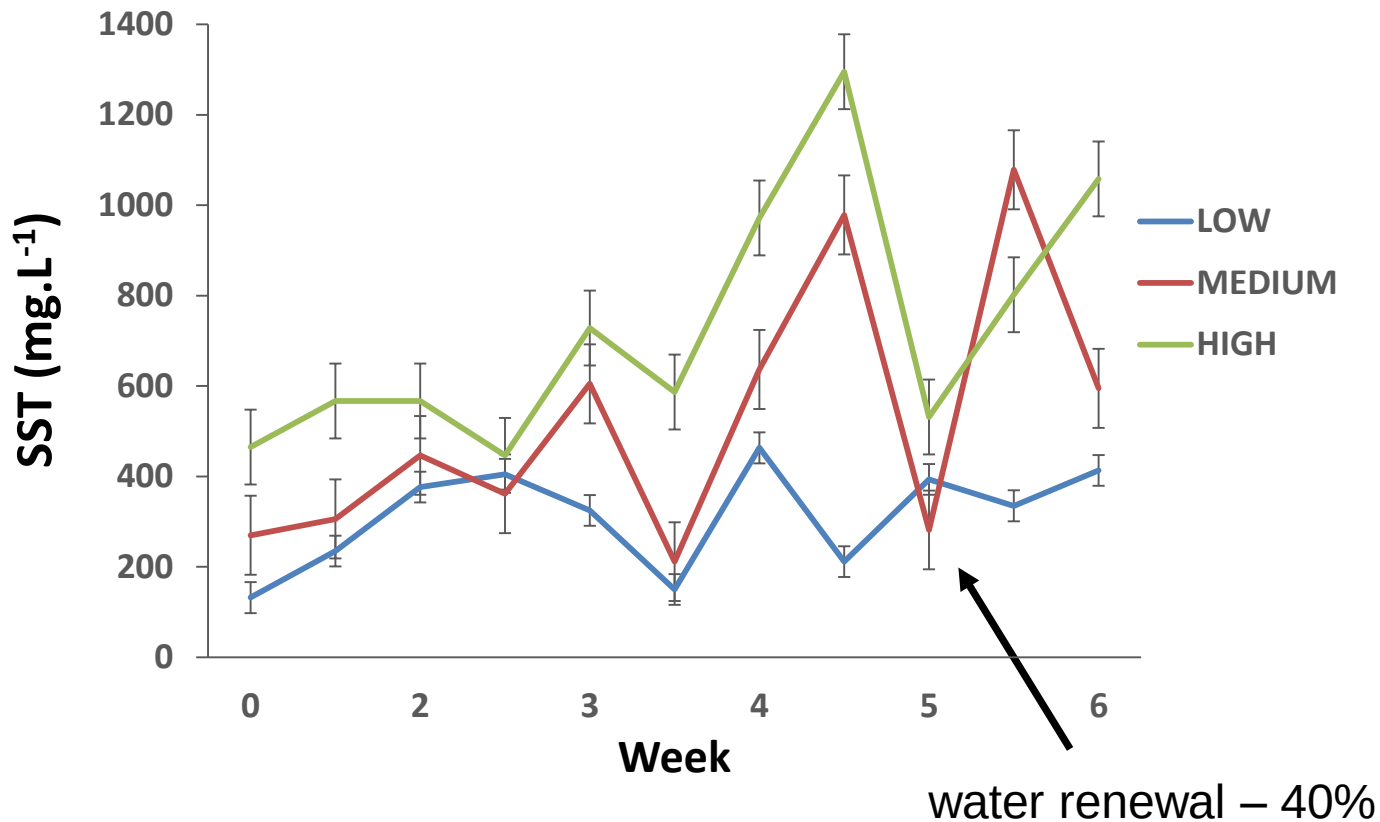
Trial II

- Conditions
 - Three treatments: LOW, MEDIUM and HIGH (TSS)
 - Shrimp stocked
 - an average weight of 4.54 ± 1.19 g
 - at a density of $265 / \text{m}^2$
 - Organic fertilization
 - Molasses
 - C:N – 20:1 } To begin culture with high TSS



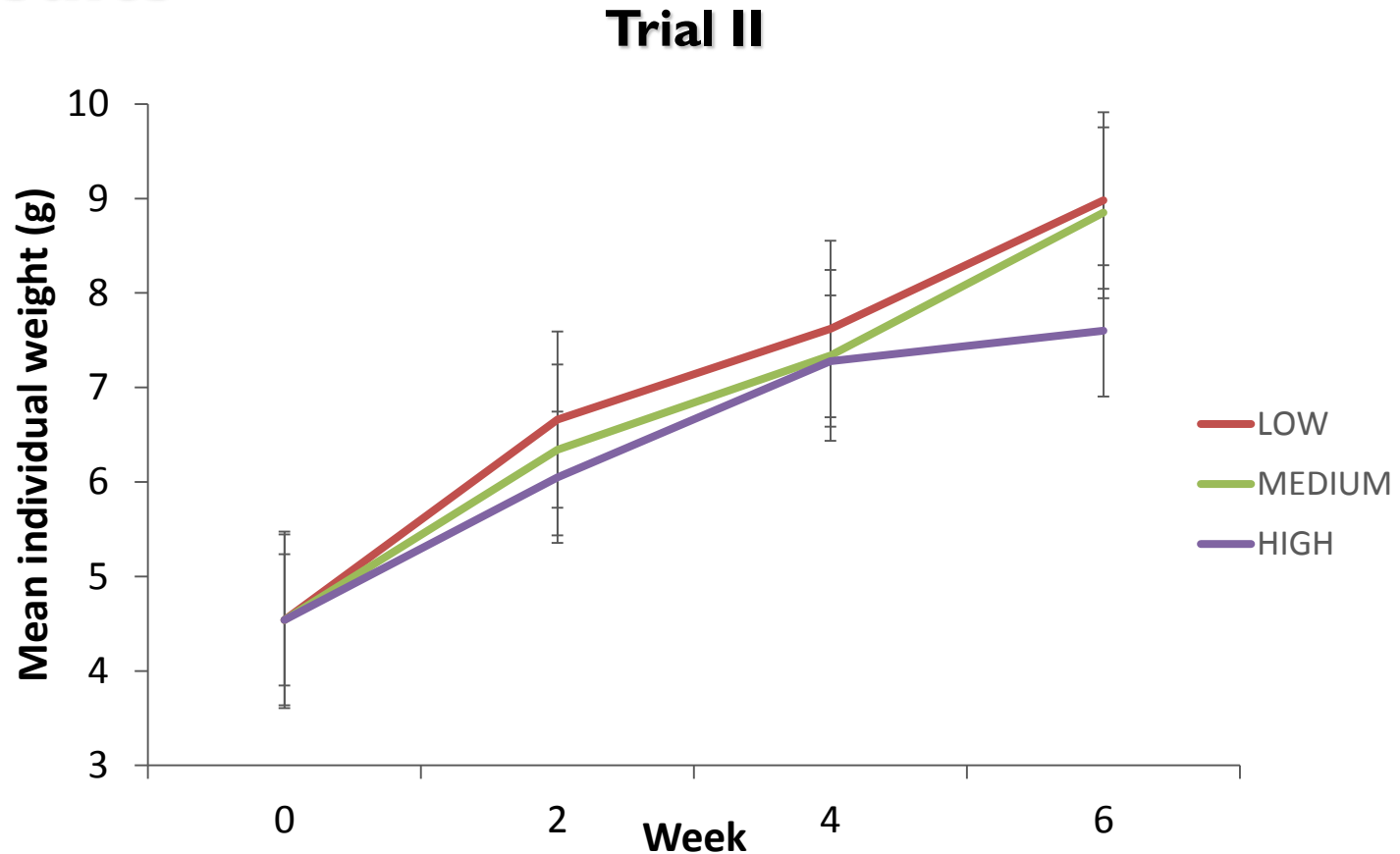
Results

Trial II



Treatment	Low	Medium	High
Mean TSS	312,76	524,64	728,97

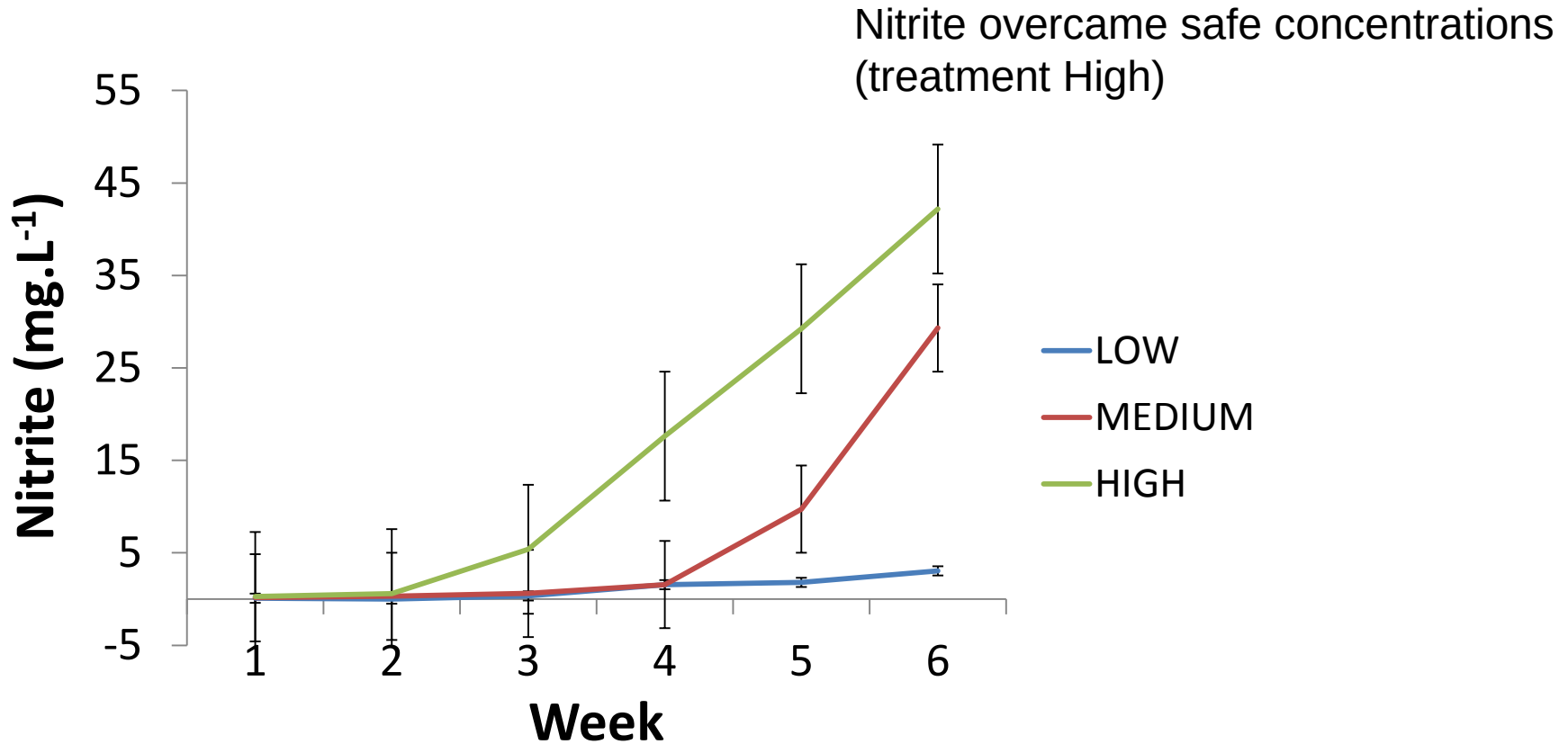
Results



**Low TSS concentration (100)
→ improved final weight**

Results

Trial II



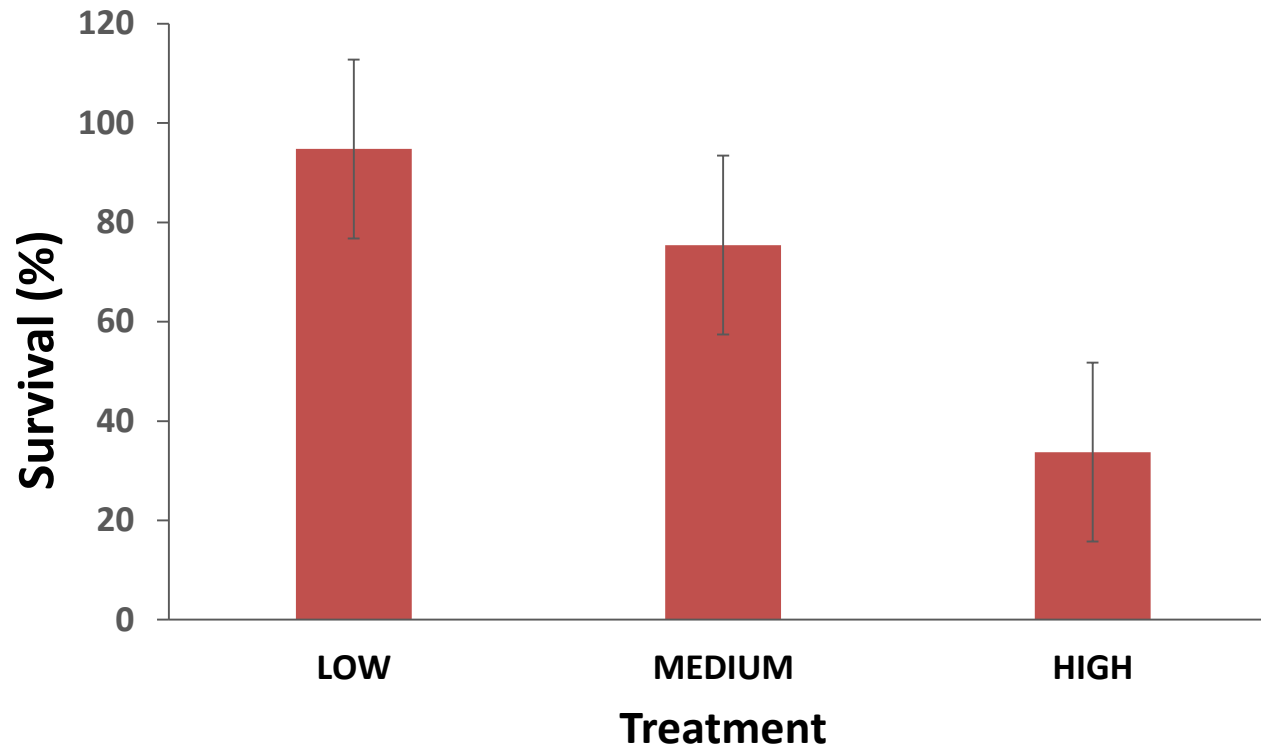
Below 500 mg.L⁻¹ (TSS)

→ nitrite safe level

→ improved survival

Results

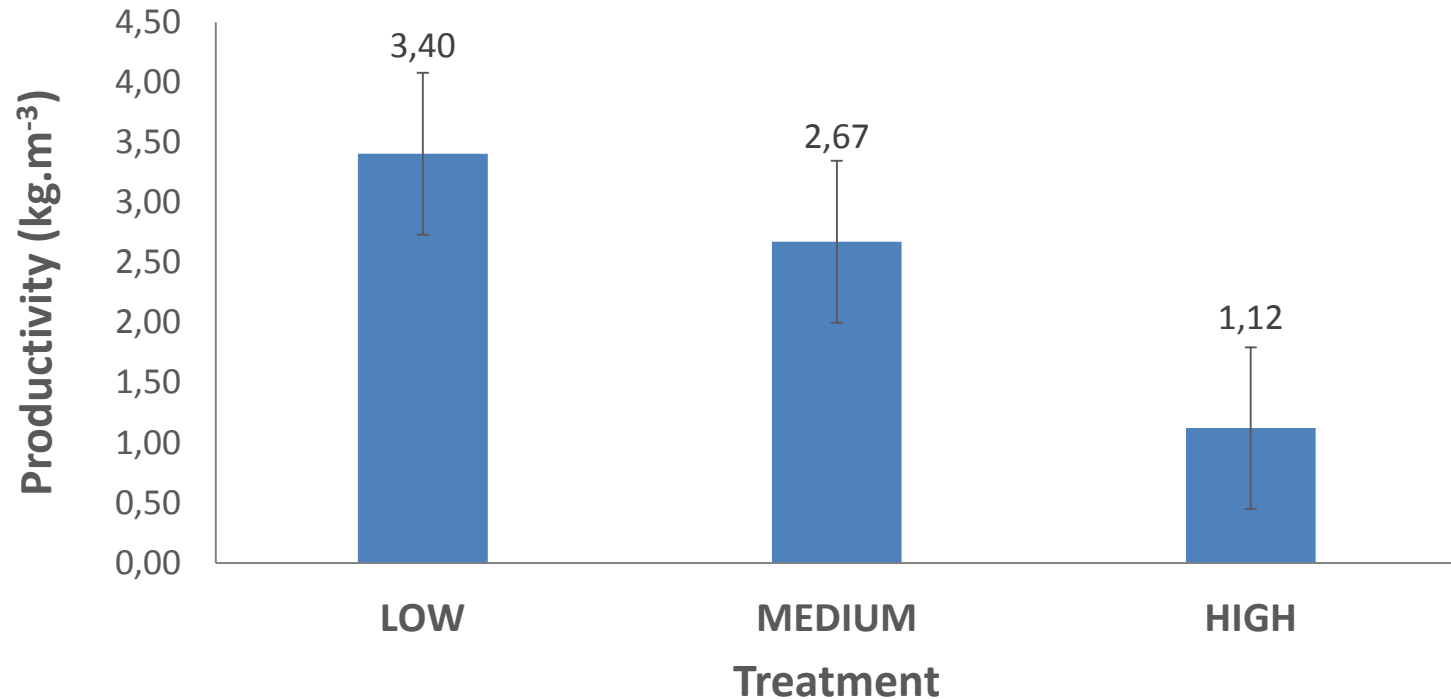
Trial II



**Low TSS concentration (100)
→ improved survival**

Results

Trial II



**Low TSS concentration (low)
→ improved productivity**

Results

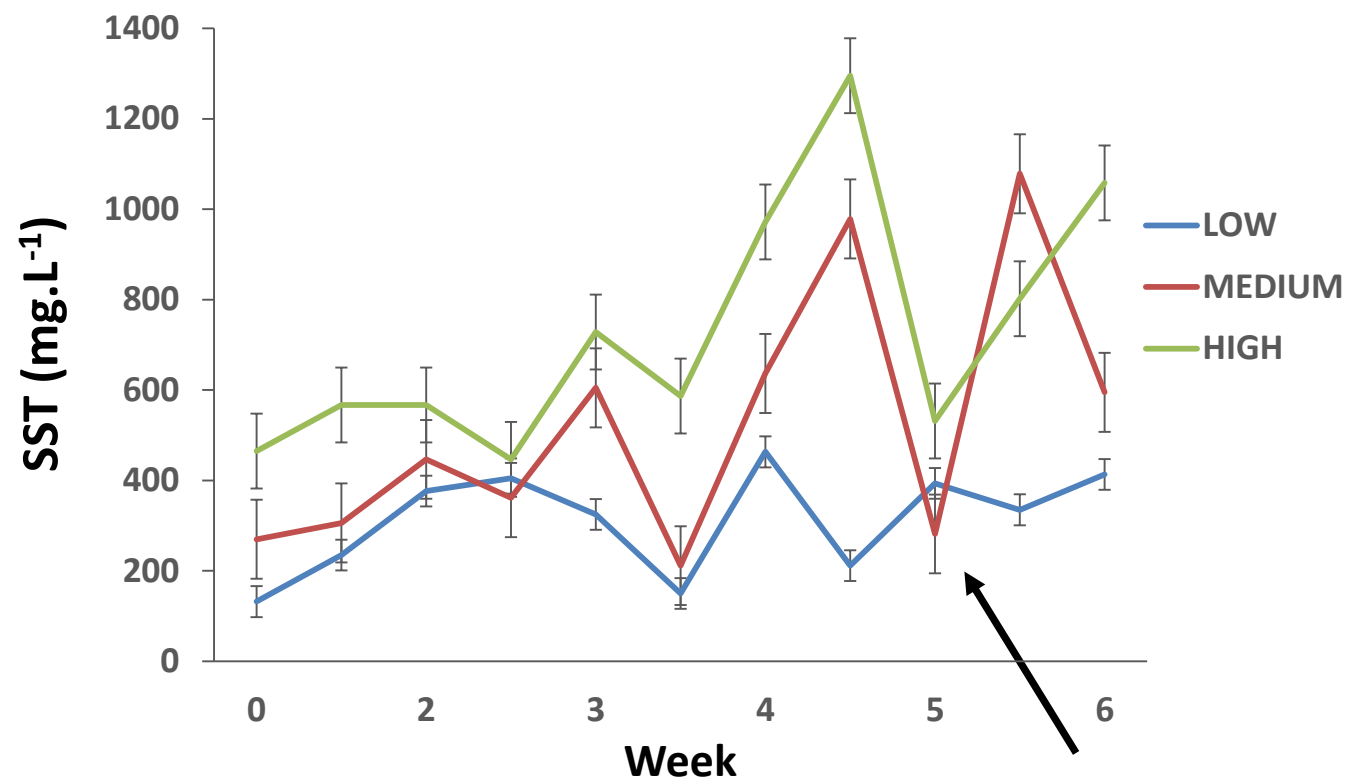
Trial II

Water quality	TREATMENTS		
	LOW	MEDIUM	HIGH
Temperature (°C)	27.86±1.37	28.07±1.42	28.17±1.45
Dissolved oxygen (mg.L ⁻¹)	5.85±0.64	5.76±0.69	5.68±0.71
pH	7.93±0.23	7.86±0.25	7.74±0.31
Alkalinity (mg CaCO ₃ .L ⁻¹)	159.29±19.96	136.43±20.88	116.71±43.75
Salinity	37.23±3.13	37.69±2.92	38.49±2.95
Turbidity (NTU)	75.72±41.85	123.47±74.94	196.87±94.69
Ammonia (mg.L-1)	3.42±3.01	3.33±3.03	2.54±3.25
Nitrite (mg.L-1)	0.73±1.08	3.66±8.00	10.28±14.25
Nitrate (mg.L-1)	0.38±0.63	0.46±0.72	1.73±2.11
Phospahte (mg.L-1)	0.60±0.63	0.57±0.46	1.46±1.44

Within the tolerance range of the specie

Results

Trial III



TSS



water renewal – 40%

Treatment	Low	Medium	High
Mean TSS	312.76±113.11	524.64±289.59	728.97±274.61

Considerations

- ❖ Low concentrations of total suspended solids (below 500 mg.L⁻¹) is beneficial to water quality and improves survival and growth
- ❖ Dissolved oxygen concentration above 5 mg.L⁻¹
 - ❖ prevents animal health – high TSS
- ❖ Low concentration of TSS (i.e. 100mg/L) improves water quality
 - ❖ prevents nitrite high level

**TRIAL III -THE “PHYSICAL EFFECT” OF HIGH
CONCENTRATION OF TOTAL SUSPENDED
SOLIDS ON THE REARING OF *LITOPENAEUS*
VANNAMEI IN BFT SYSTEM**

Materials and Methods

- Overview

- 42 days
- **Reuse of concentrate BFT water**
- Strong aeration
 - $> 5 \text{ mg L}^{-1}$
- TAN and Nitrite
 - low concentrations
- Tank: 1,000 L

Trial III



Greenhouse



- Shrimp stocked
 - an average weight of $4.57 \pm 1.07 \text{ g}$
 - at a density of $277 / \text{m}^2$
- Five treatments: 250, 500, 1000, 2000 and 4000 mg L^{-1} (TSS)
- Control of TSS by filtration – 50μ mesh

Intervenção

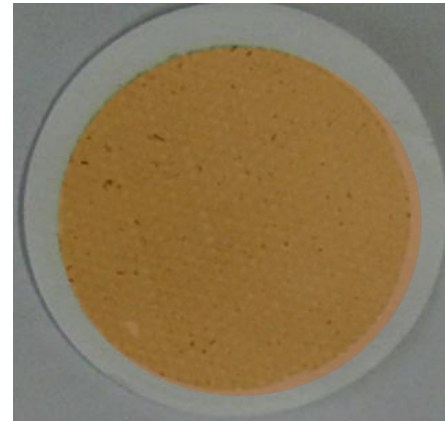
Cone Imhoff

- 10 ml/L



Sólidos Suspensos Totais

- 500 mg/L



Controle

Métodos

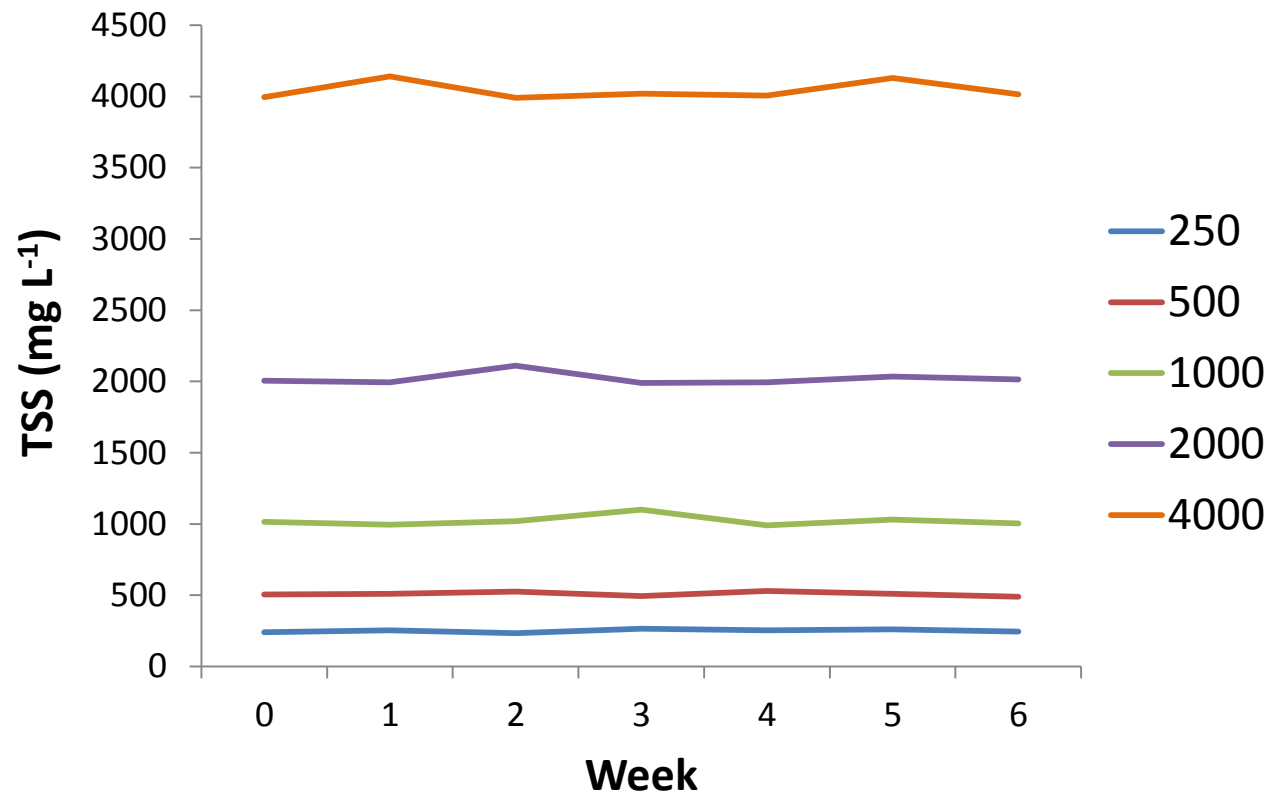
- Filtragem mecânica – barreira física retendo material particulado



Results

Trial III

☐ Intensive control of concentration of TSS in all treatments



Results

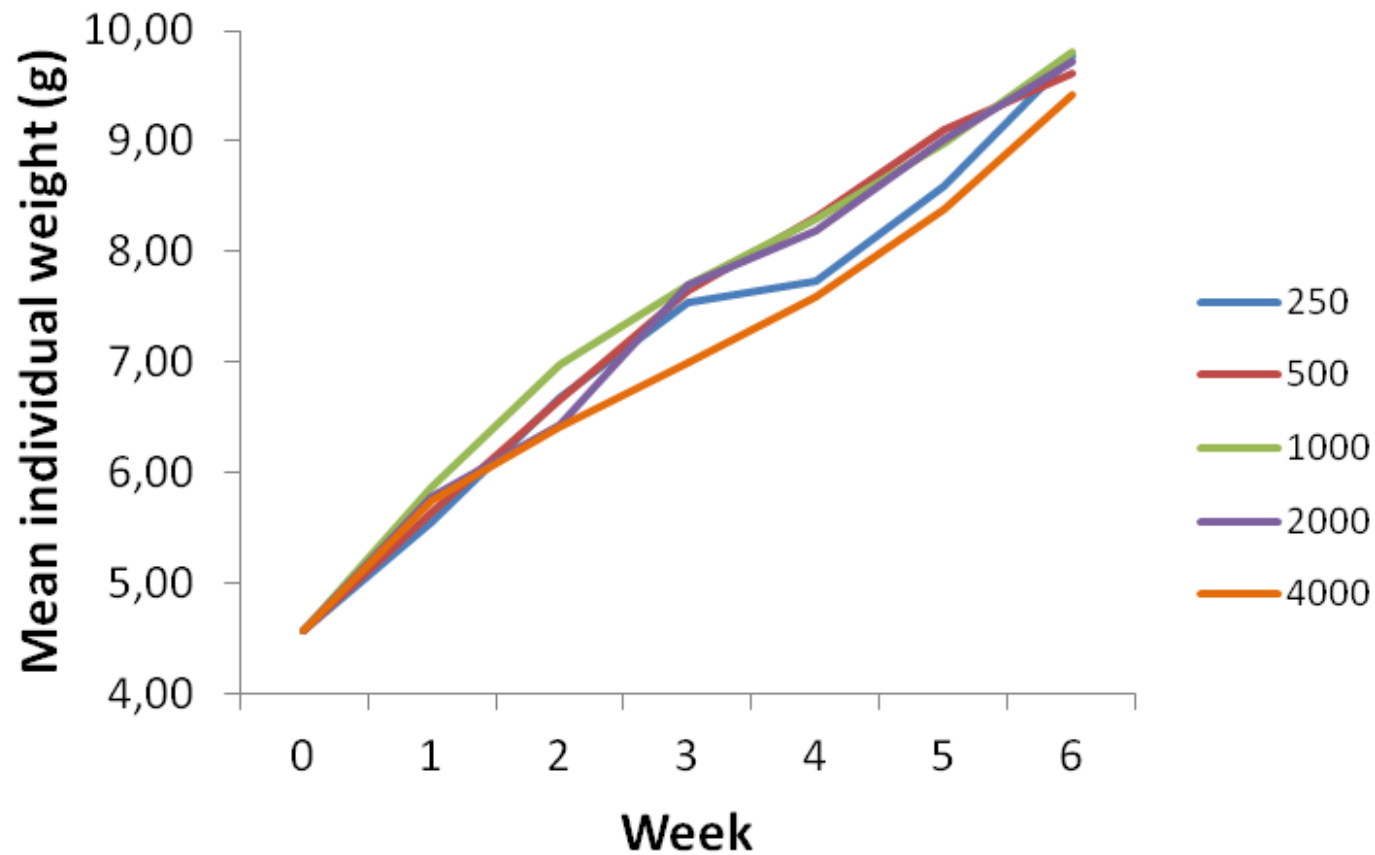
Trial III

Water quality	TREATMENTS				
	250	500	1000	2000	4000
Temperature (°C)	27.48±2.01	29.28±2.15	29.17±1.45	29.10±2.07	29.12±1.81
Dissolved oxygen (mg.L ⁻¹)	6.11±0.32	5.87±0.36	5.91±0.33	5.95±0.35	5.87±0.35
pH	8.07±0.33	7.71±0.43	7.48±0.38	7.49±0.35	7.37±0.41
Alkalinity (mg CaCO ₃ .L ⁻¹)	118,75±31.19	100.00±28.58	100.00±21.21	95.00±26.14	93.75±7.50
Salinity	34.30±0.56	34.40±0.60	34.10±0.35	33.90±0.60	34.50±0.40
Ammonia (mg.L-1)	0.33±0.28	0.17±0.08	0.14±0.09	0.12±0.07	0.12±0.06
Nitrite (mg.L-1)	4.76±4.51	0.22±0.20	0.08±0.03	0.06±0.03	0.04±0.02
Nitrate (mg.L-1)	26.90±14.45	59.42±19.82	193.40±30.84	225.70±55.35	225.00±72.56
Phospahte (mg.L-1)	7.09±6.37	5.53±2.41	10.22±4.49	16.40±12.92	13.33±6.59

Within the tolerance range of the specie

Results

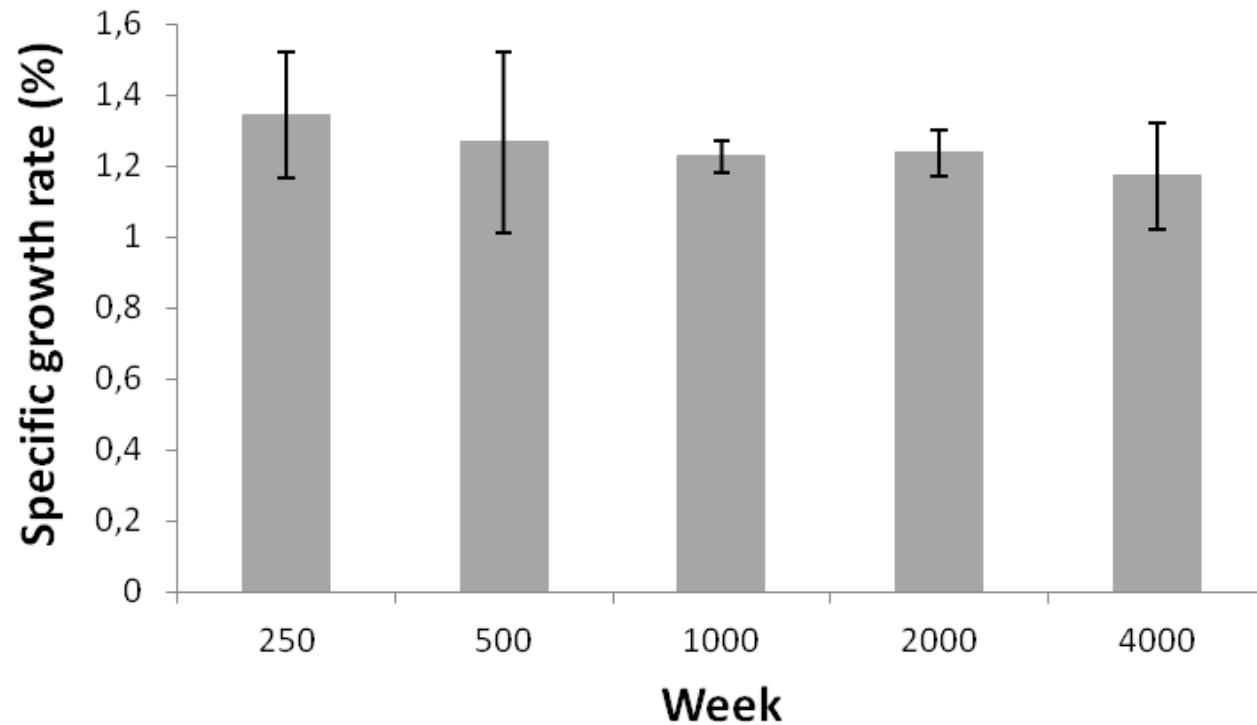
Trial III



No significant differences

Results

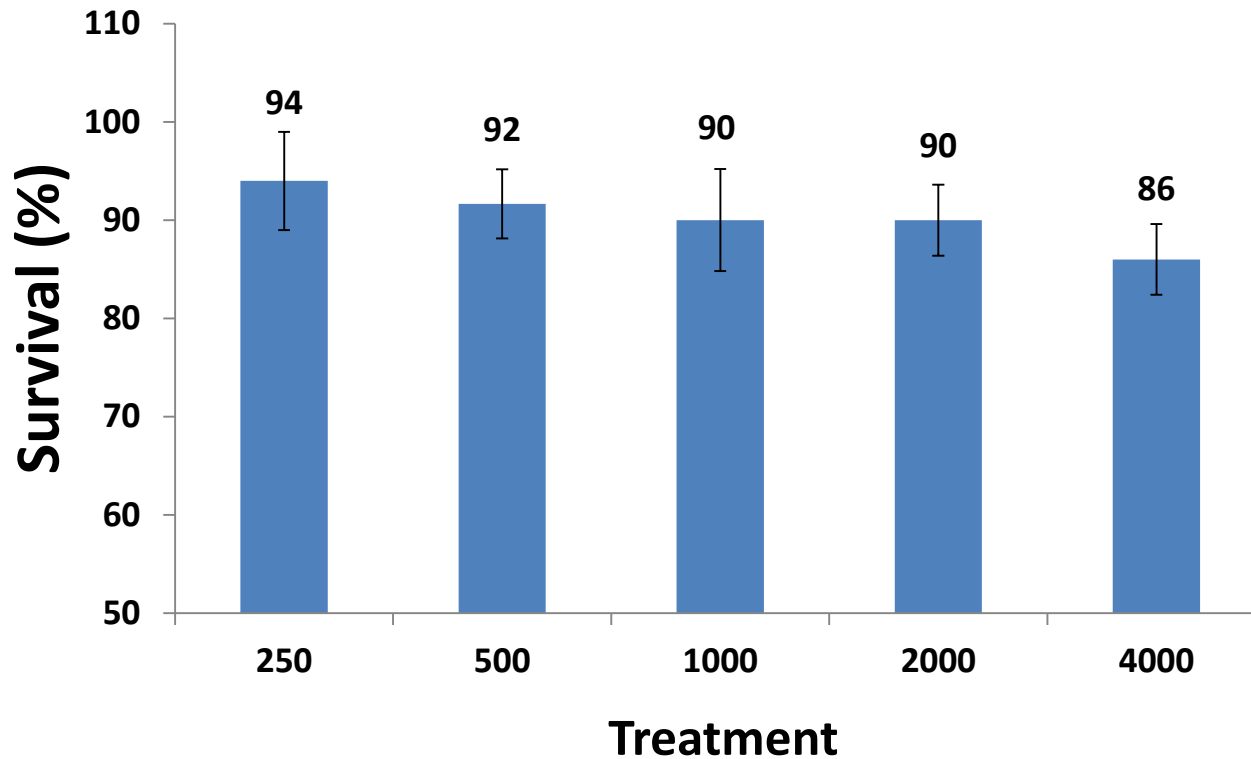
Trial III



similar growth

Results

Trial III

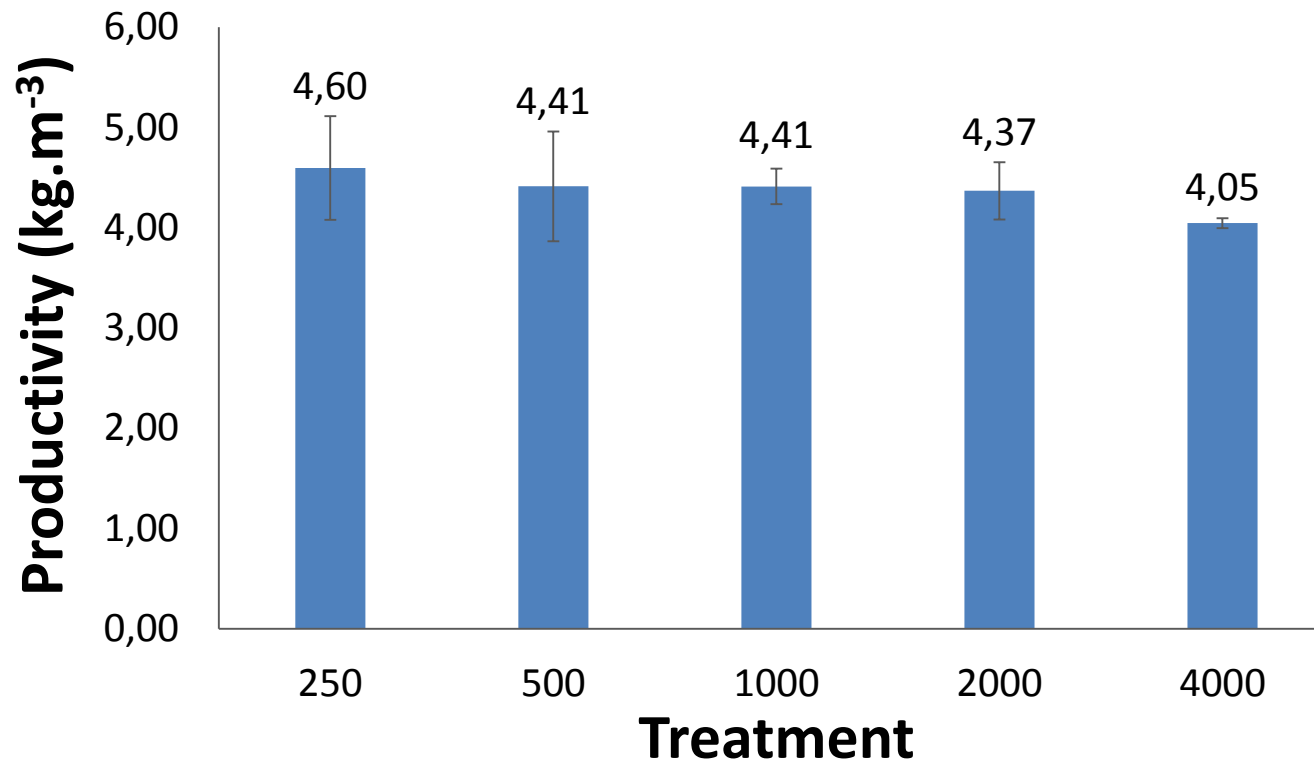


Survivals ranged from 86 to 94 % ($P > 0.05$)

similar survival

Results

Trial III



Productivity ranged from 4,05 to 4,60 kg.m⁻³ ($P>0.05$)

similar productivity

Conclusion

Trial III

Biofloc formed: low concentrations of TAN and nitrite

Under strong aeration and dissolved oxygen concentrations above 5 mg L⁻¹

↑ TSS is not problem



ACKNOWLEDGEMENTS





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- BRASIL

Thanks for
your attention!

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