EFFECT OF pH ON PACIFIC WHITE SHRIMP *Litopenaeus vannamei* GROWTH AND SURVIVAL

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Heterotrophic Culture Systems

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Shrimp Culture System

- It is super-intensive shrimp culture system, which is possible to have productivities up to 6 kg/m^2.

•Zero exchange water, high aeration, feeding based on high quality feeds and natural productivity.

•Heterotrophic environment to keep water quality and availability of supplemental feeding

Heterotrophic environment is based on bacterial floc

or

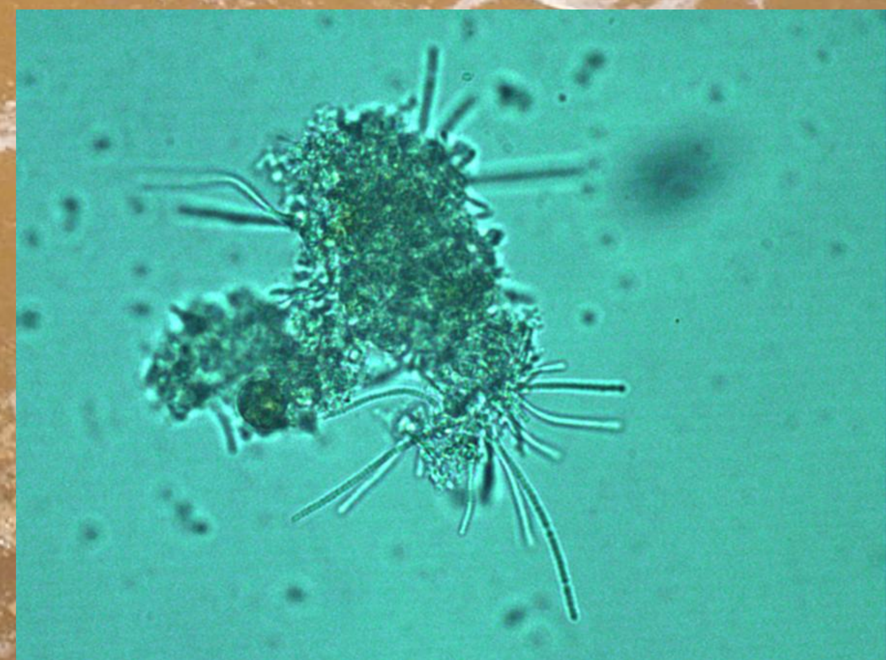
marine snow,

marine flake,

microbial floc,

moulinetes,

marine aggregates



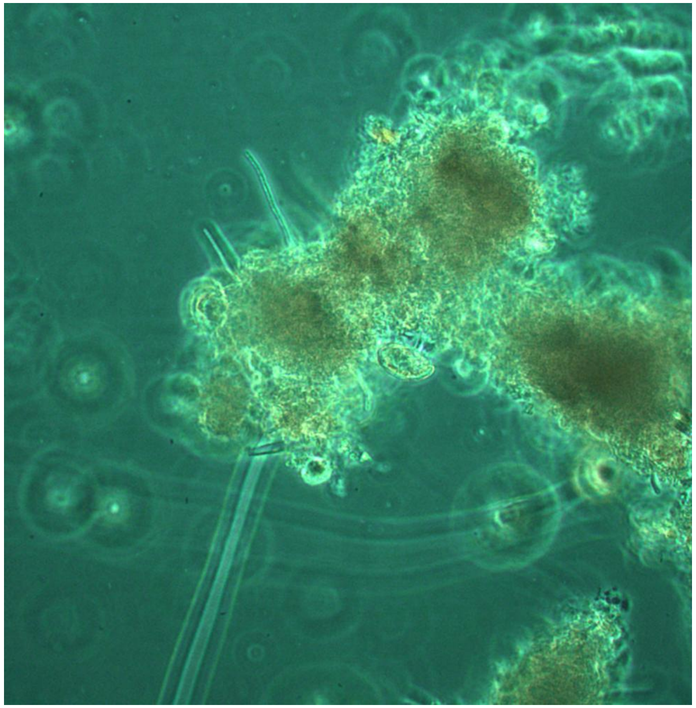
Bacterial Floc

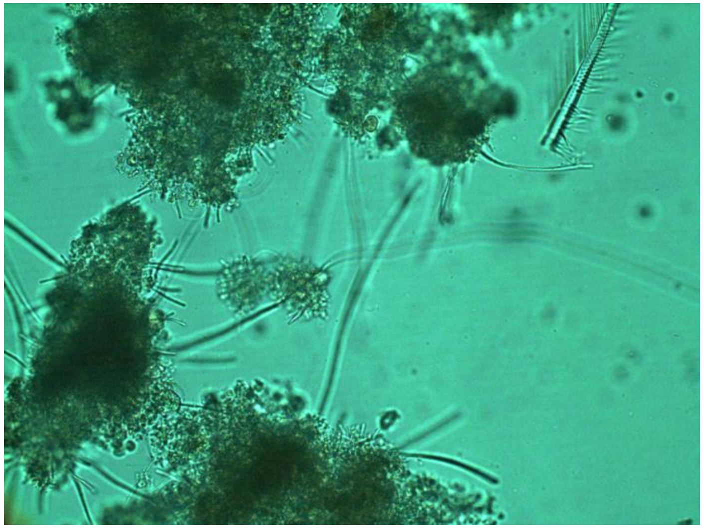
Improves water quality, removing nitrogen by products

Feed supplement for shrimps

It is possible to rearing in high stocking densities

Shrimp production up to 60 ton/ha.





Example of Shrimp Production

Shrimp per m^2	IW (g)	FW (g)	Prod. (Kg/m^2)	Time (Days)	Surv (%)
300	1.00	16.6	4.5	75	91
420	0.01	21.3	6.8	113	80
450	1.00	25.6	6.3	123	54

Source: Craig Browdy, 2006

- CO_2 concentration can be augmented in heterotrophic environment, due to high bacterial-, shrimp-, and other microorganisms respiration

- pH may be lowered

pH

Low pH can be a risk for Litopenaeus vannamei culture??????

Objectives

Analyze the effect of low pH on survival, growth and FCR of *L. vannamei*

- ⇨ **In clear water (experiment 1)**
- ⇨ **In a heterotrophic culture system (experiment 2)**

Experiment 1 – Effect of pH on *Litopenaeus vannamei* in clear water

Materials e Methods

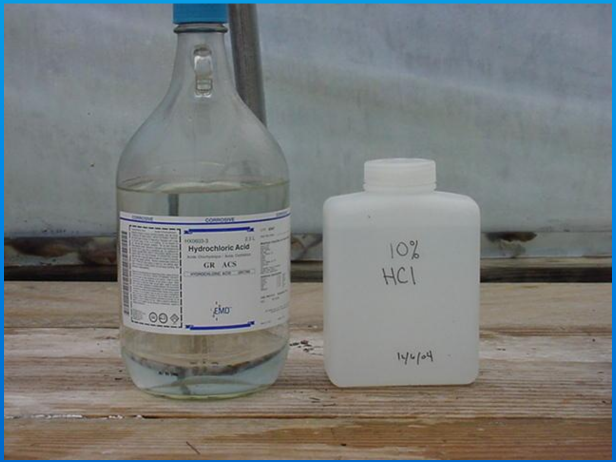
Greenhouse in WMC - SCDNR

Treatments (pH):

- **5,1**
- **5,9**
- **6,5**
- **7,0**
- **Control**

Experimental media

- HCl
- 200 L tanks
- 48 hour prior
- Monitoring 3 X / day



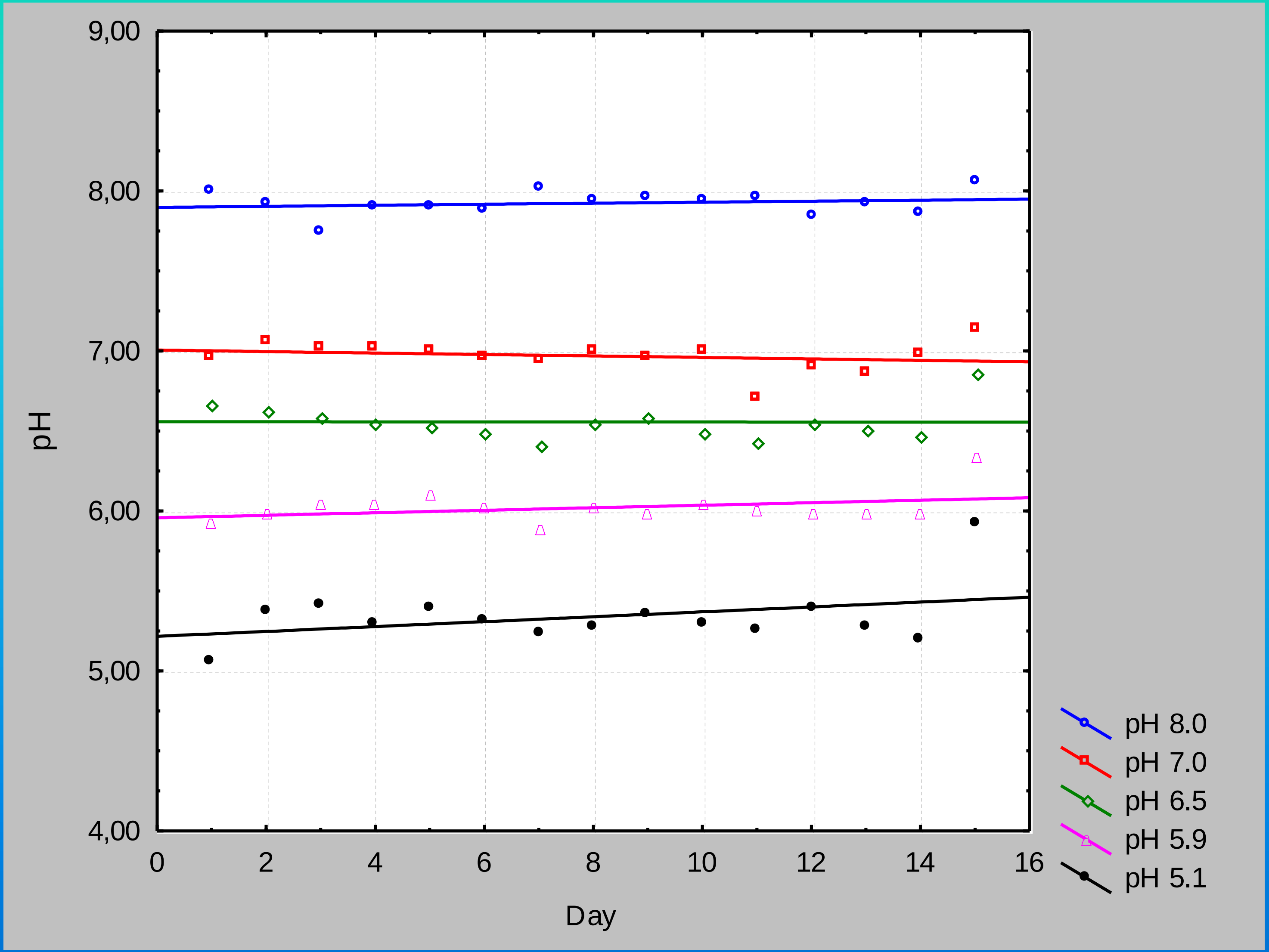
Experimental Units

- 15 X 50 L-tanks
- 5 treatments X 3 replicates
- 22 shrimps per tank (1,57 g)
- Stocking density: 150/m2
- Renewal: 50 % / day
- Commercial feed (42 % PB)
- Experimental time: 15 days

- **Monitoring:** 3 X / day
  - Temperature
  - Salinity
  - Dissolved oxygen
  - Ammonia (daily)

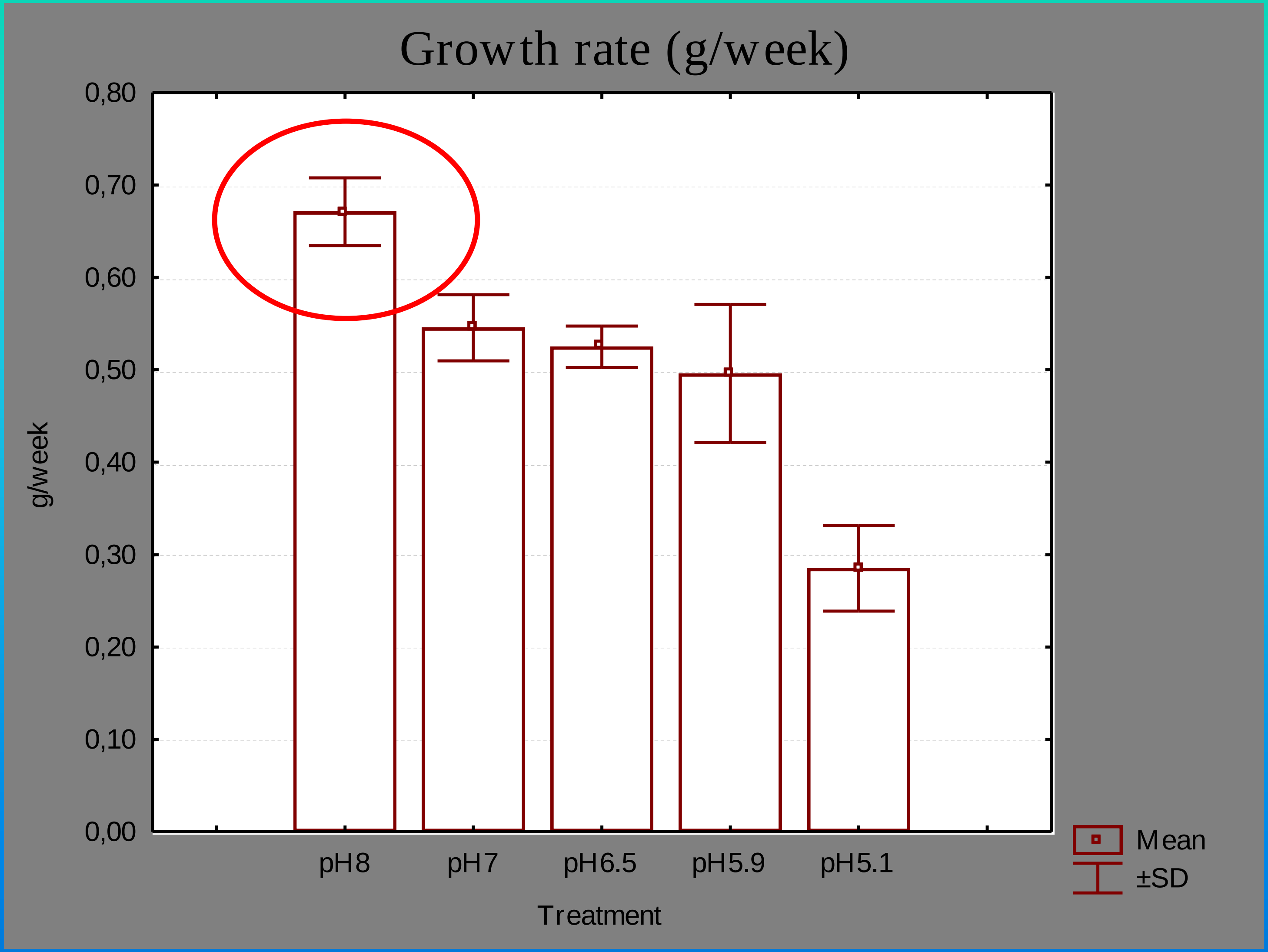
- **pH was checked and adjusted** 6 X /day

Results



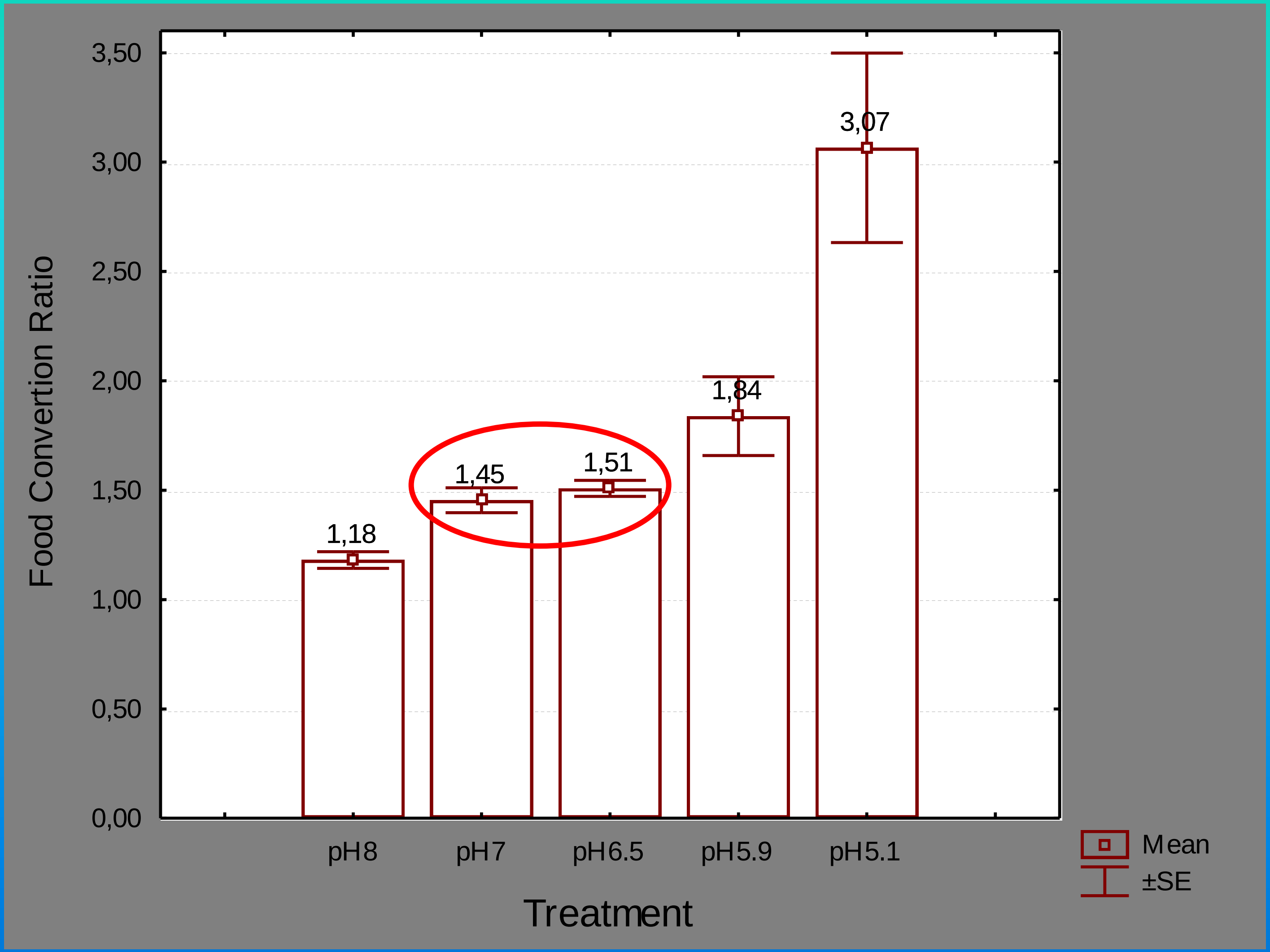
pH variation along the time in different treatments

	pH				
	5.1	5.9	6.5	7.0	Control
Mean survival	98.4	95.5	100	100	100
Final weight	2.19	2.51	2.58	2.71	2.90
Tukey test (Final weight)	A	B	B	CB	C



Weekly growth rate was significantly affected by pH ($p<0,05$)

FCR



FCR were significantly higher in all low pH the treatments ($p<0,05$)

Conclusion – Experiment 1

⇨ Survival was high even in low pH

⇨ pHs $\leq$ 7.0 affected significantly growth and FCR of *Litopenaeus vannamei.*

Experiment 2 – Effect of pH to *Litopenaeus vannamei* in heterotrophic environment

Materials and methods

Superintensive heterotrophic culture system

Microcosm System

constant renewal

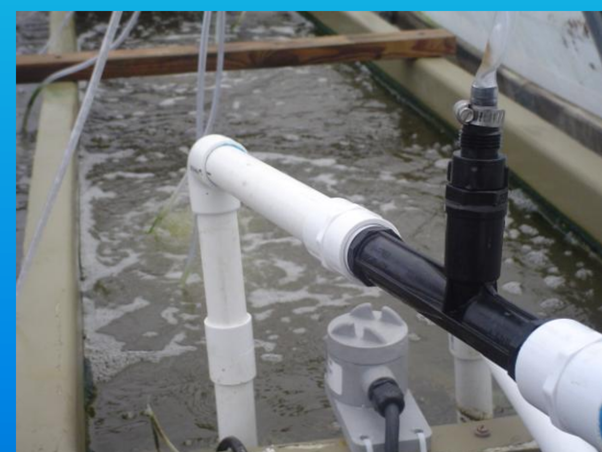
Two raceway with five 50L-tanks each.

Experiment 2 – Treatments

- Normal pH (control)
- Reduced pH (with CO_2)

pH was diminished with CO_2 injection

CO_2 bottle



Venturi tub to increase CO_2 injection efficiency in water

Experimental Units

- Two treatment X 5 replicates
- 44 shrimps per tank

  Stocking density: 300/m^2
- Renewal: Constant
- Commercial feed 30 % CP
- Experimental time: 30 days

Monitoring:

- pH: 3 X / day
- Temperature
- Salinity
- Dissolved oxygen
- Ammonia (daily)

pH adjustment: constant

Experimental Units

Feeding tray

- Designed feeding tray to regulate feed supplied.

Feed supplying :

- 9:00
- 15:00
- 21:00

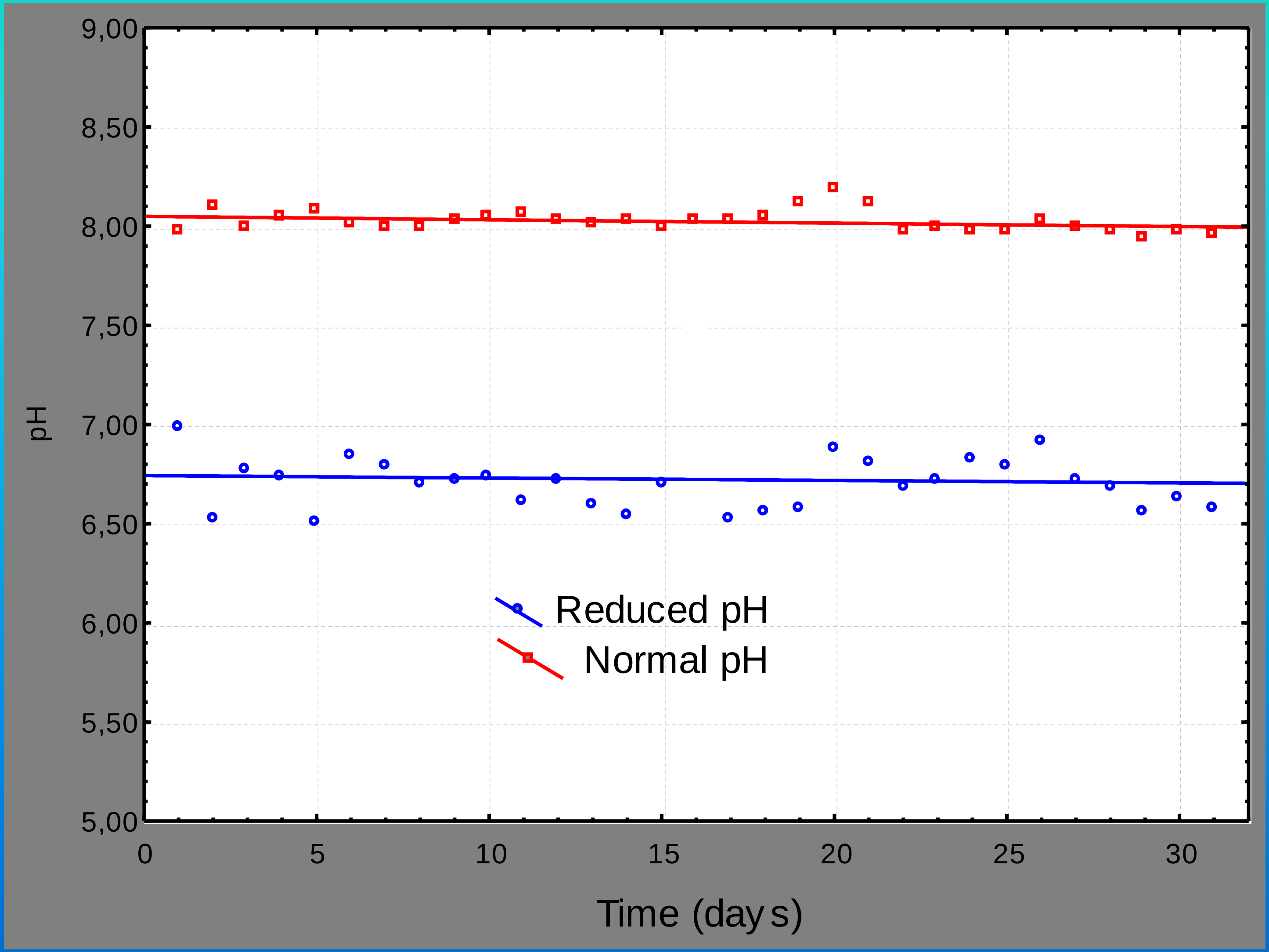
Example in clear water how the feed was spread in the tray

Remaining feed was removed daily from each bin.

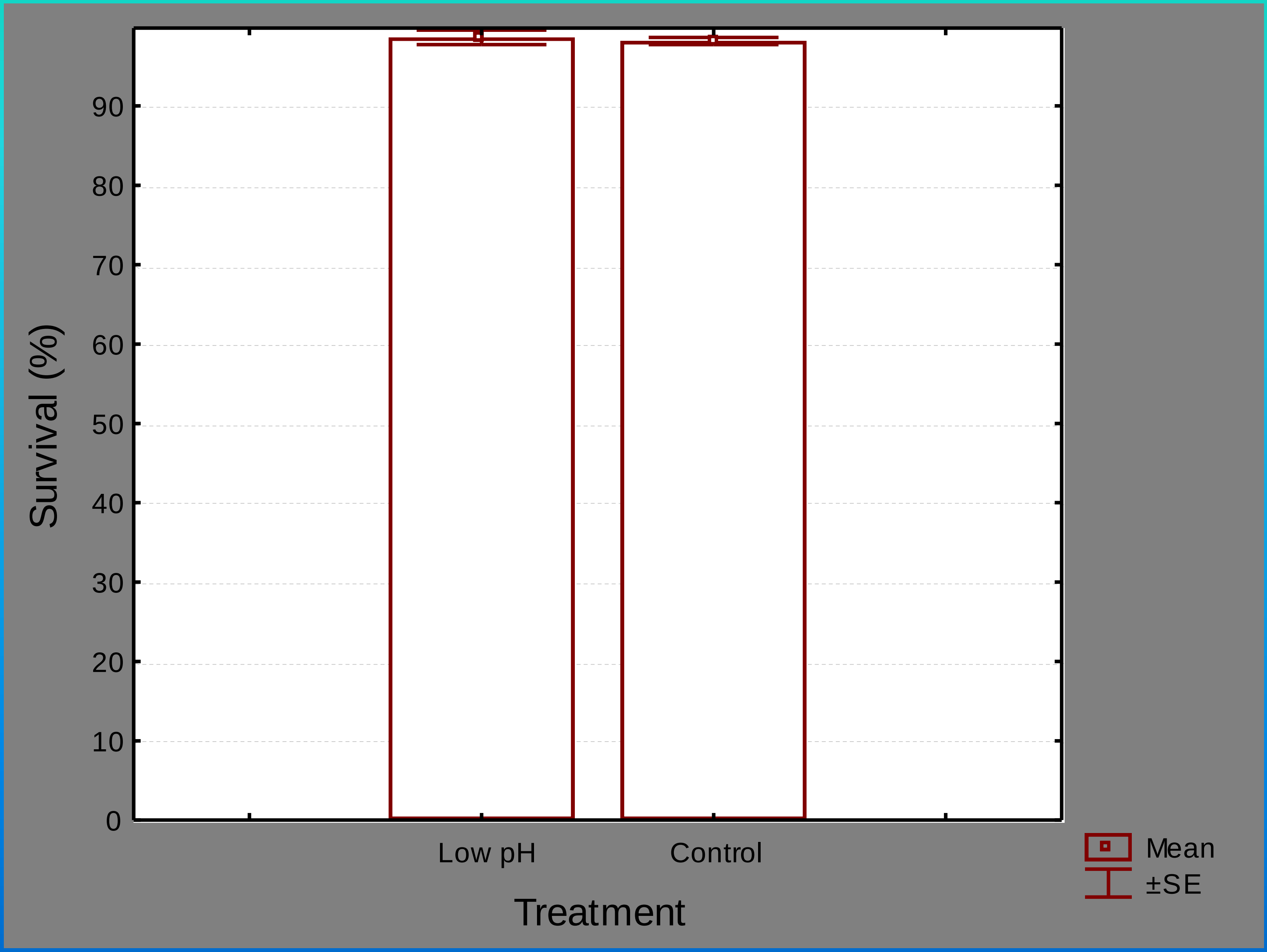
Rinsing the tray

Residual feed was removed daily and dried

Results - Experiment 2

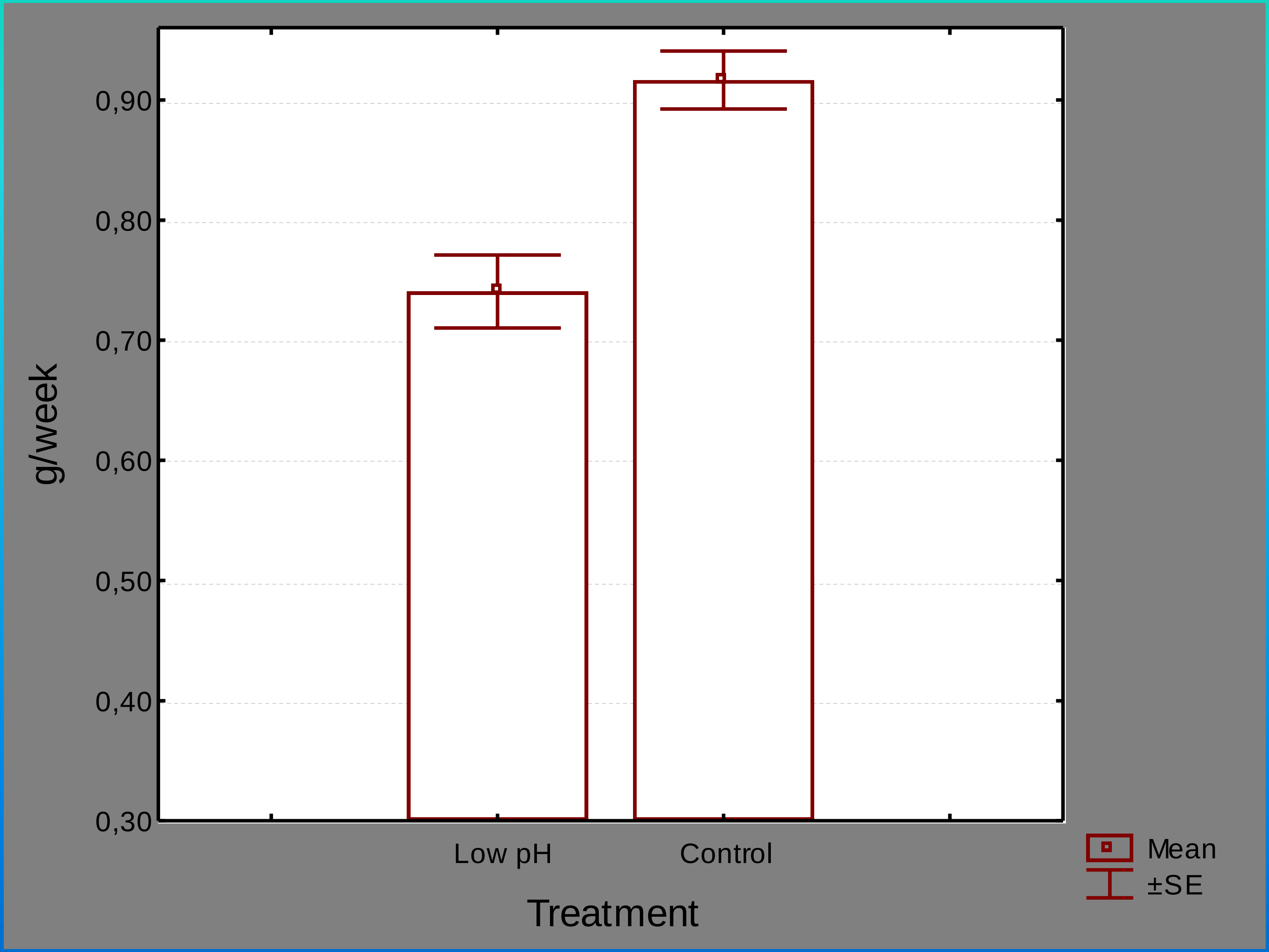


Survival

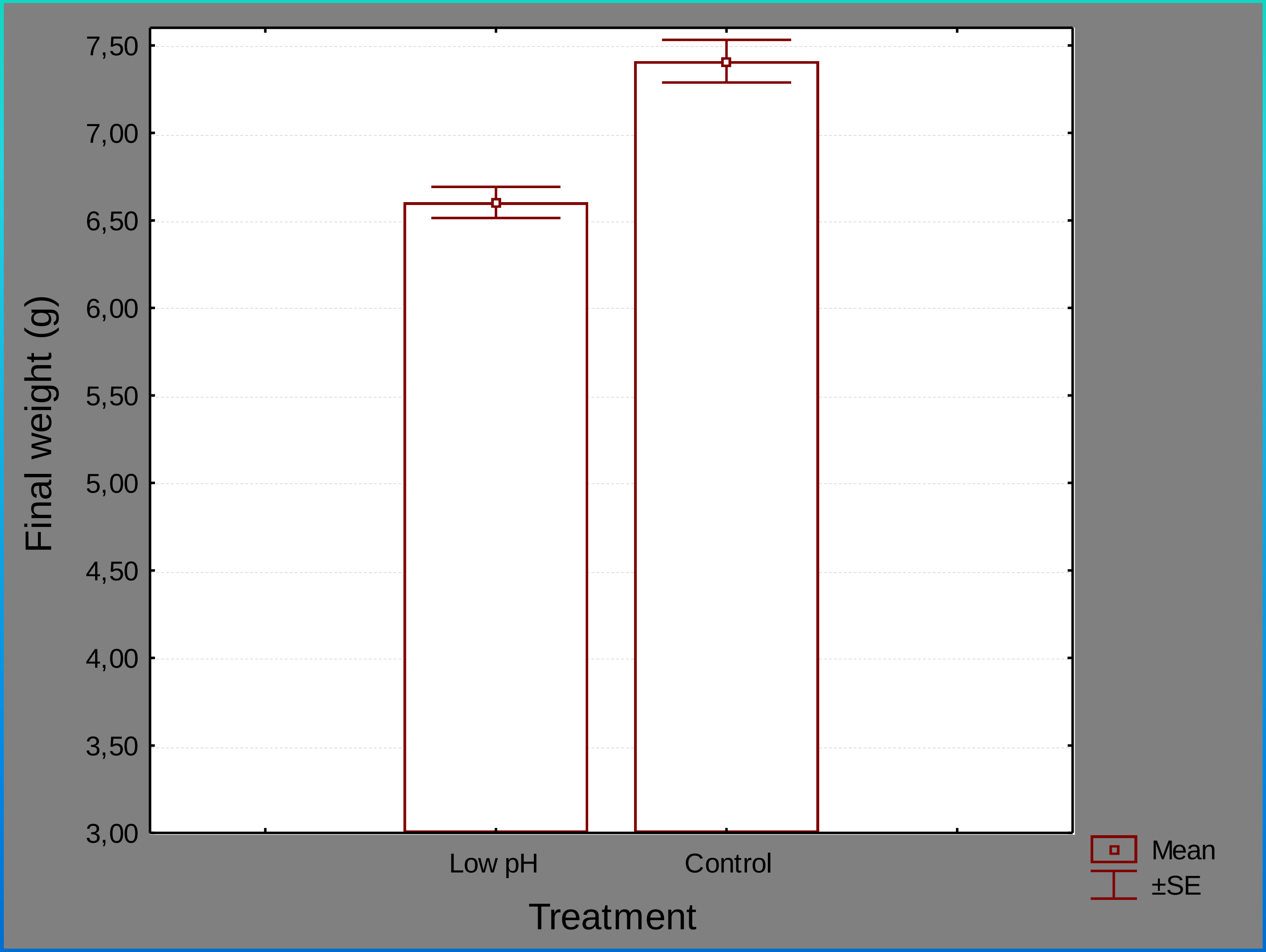


Survival (%)
0
10
20
30
40
50
60
70
80
90
Low pH
Control
Treatment
Mean
±SE

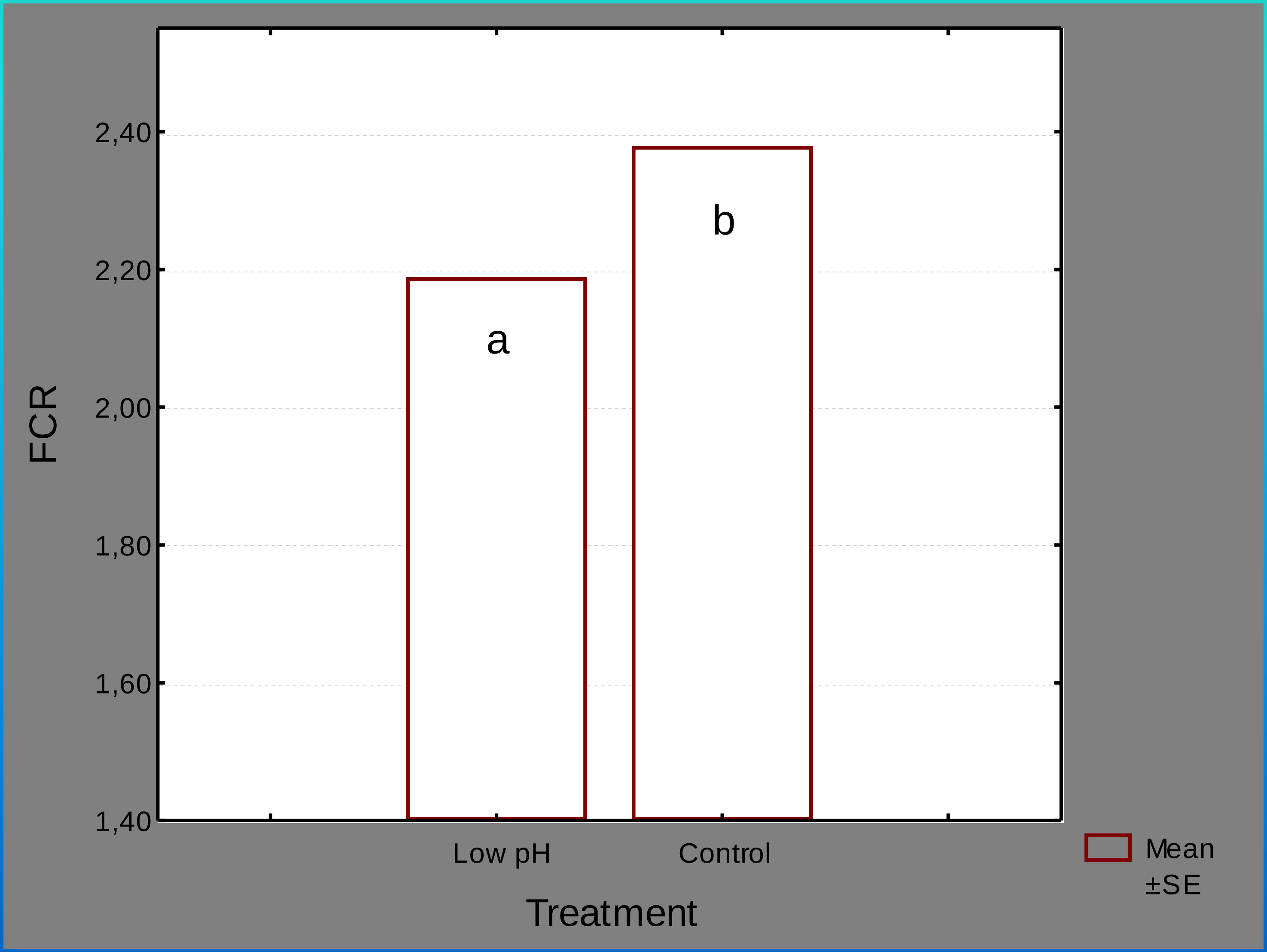
Weekly growth rate



Final weight



FCR



2,40
2,20
2,00
1,80
1,60
1,40
FCR
a
b
Low pH
Control
Treatment
Mean
±SE

Conclusion – Experiment 2

- Low pH did not affected significantly survival of *L. vannamei*, even in a long period;
- Results confirm that pHs below 7.0 can affect significantly growth rate of *L. vannamei*;

General conclusion

- Production costs of *L. vannamei* can be significantly affected in a heterotrophic culture system when pH is lower than 7.0, due to reduced growth and increased FCR

The authors would like to acknowledge to the US Marine Shrimp Farming Program (USDA) and Brazilian Council of Research, CNPq – Brazil (Process: 200039/04-0) for financial support


Thank for
your
attention!