COMMERCIAL INDOOR SHRIMP NURSERY:

YEAR 2

Timothy C. Morris

Bowers Shrimp Farm
Collegeport, Texas, USA

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Introduction

- Bowers Shrimp Farm, Collegeport, Texas
- Established in 1989
- 370 acres of shrimp ponds
- 75 acres fish ponds

Introduction

Double Cropping

- Four outdoor nursery ponds have been used off and on over the past 10-12 years
- Nursery ponds are limited to stocking of the adjacent growout ponds
- In recent years some growout ponds have been double cropped using direct stocking
- However, direct stocking limits the culture period in the growout pond
- In 2013 the farm incorporated the use of an indoor nursery to extend the culture period, increase flexibility of stocking growout ponds, and take advantage of compensatory growth

Introduction

- Newly constructed 13,500 ft^2 indoor nursery
- Provided a head start for PLs in first crop
- Allowed for head starting PLs for the 2^{nd} crop while extending the culture period of the 1^{st} pond crop
- Allowed stocking any pond on the farm
- Nursery was also used, unexpectedly, to culture several batches of PLs that arrived when temperatures were to low for direct stocking or when ponds were not ready for stocking

Nursery

2013

- 2013 (Feb 18th to Aug 28th)
- 29 RWs during 5 cycles
- Produced 20 million juveniles

Goals

- Take advantage of low cost electricity
- Extend production period in ponds
- Increase final weights of shrimp from ponds
- Take advantage of compensatory growth
- Reduce the necessity for promoting zooplankton blooms
- Increase overall farm production

Bowers RW System

- Loosely patterned after the 100 m^3 RWs at the Texas AgriLife facility in Flour Bluff
- 8 concrete RWs
- 12 a^3 air injection nozzles (All Aqua Aeration, Orlando, FL)
- Two 3 hp pumps per RW
- 125 m^3 max volume
- Center partition
- No solids removal devices were included in 2013

Water

- Seawater from Matagorda Bay
- 25-30 ppt salinity
- Filtered through 540 micron sock
- 2013 water was not chlorinated
- 2014 water was chlorinated 10 ppm
- 25-75% of water was reused between cycles in 2013
- Only 10-15% of water was reused between cycles in 2014

Shrimp

- 24-26 hr live haul from SIS (Islamorada, FL)
- PL 7-11, mostly PL-8
- Acclimated on the truck
- Gravity drained into RWs

- Stocked at 11-20/L (11,000-20,000/m^3)
- Cycle 2 stocked at 5/L (5,000/m^3)
- Fed EZ-Artemia (Zeigler Bros.Gardeners, PA) during the acclimation process

RW Management

- Cycles were started using 6 nozzles with reduced flow
- Stirring of RW bottoms was required during the first week to prevent sedimentation
- Pump intake filters were cleaned several times each day
- System was maintained by 2 people during the day and 1 person at night
- Weekends & holidays- 1 person during the day and 1 at night
- Night person checked DOs and cleaned filters
- No monitors or alarm systems

RW Management

New 2014

Oxygen system

Solids removal

Feed

- Cycles 1-3 shrimp were fed either Zeigler PL RW Plus and EZ-Artemia or Rangen 45/10 and Zeigler EZ Artemia
- Cycles 4-7 shrimp were fed Rangen (Buhl, ID) #0,1,2 (45 % CP, 10% Squid) and Zeigler EZ-Artemia
- Four 24-h beltfeeders per raceway
- Feed consumption checked at least twice daily (8am-6:30pm)
- Feed rates were determined by feed consumption and observation of shrimp

Water Quality

- Ammonia, nitrite, nitrate, and alkalinity were tested using a LaMotte kit for saltwater
- DO was checked frequently using a hand-held DO meter (YSI 550A)
- pH was checked using a pH pen (pHtestr 10)
- Suspended Solids (SS) were checked using Imhoff cones

Water Quality

Nitrogen

- Ammonia levels during Cycle 1 reached 15 mg/L in a few RWs
- Nitrite levels during Cycle 1 reached 24-32 mg/L resulting in moderate to severe mortality in a few RWs
- Nitrite continued to be a problem throughout the 2014 season and molasses was added to prevent conversion of ammonia to nitrite
- Nitrate was checked infrequently due the short duration of cycles
- Ammonium chloride and sodium nitrite were used before and between some of the cycles to promote or maintain nitrification

Water Quality

- DO ranged from 7.5 to 3.7 mg/L but was usually between 4.5-6.0 mg/L
- Oxygen supplementation was required during periods of heavy molasses application
- pH ranged from 8.7-6.6 but was typically 7.3 to 7.5
- Alkalinity ranged from 140 to 360 mg/L
- Alkalinity was initially adjusted to 180 mg/L using calcium hydroxide
- Later in the season alkalinity was regularly adjusted to 220 mg/L to prevent dramatic drops in pH
- SS ranged from 0.5 to 25 mL/L

Harvest

- RWs were drain harvested
- Shrimp were dewatered, weighed, and loaded onto transport trailers

Transport

- Transported using liquid oxygen
- 10-15 minutes to pond
- Shrimp were released into the ponds without any additional acclimation

Summary of first year nursery cycles in eight 125 m^3 raceways from Feb-Aug 2013

Cycle	RWs (#/cycle)	Duration (days)	Temp (C)	Av. Wt. (g)	Survival (%)	FCR	Yield (kg/m^3)
1	8	48	25.7	0.17	67	0.95	1.1
2	2	27	25.0	0.10	76	1.05	0.8
3	3	22	25.9	0.05	136	1.1	0.5
4A	2	49	29.5	1.22	44	1.1	4.0
4B	6	41	29.6	0.74	44	1.07	3.1
5	8	25	30.0	0.18	72	0.96	1.2

Summary of second year nursery cycles in eight 100 m^3 raceways from Feb-Aug 2014

Cycle	RWs (#/cycle)	Duration (days)	Temp (C)	Av. Wt. (g)	Survival (%)	FCR
1	8	30	25.0	0.10	82	2.7
2	4	15	27.1	0.05	98	1.6
3	8	19	28.0	0.08	86	1.3
4	4	23	28.9	0.10	94	1.4
5	4	20	29.8	0.08	95	1.9
6	4	20	30.0	0.10	82	1.7
7	4	16	30.2	0.04	77	2.7
Average of 36 individual RWs	21	28.0	0.08	86.8	1.9	

Production

Nursery

- 1st Year 20 million juveniles
- 2nd Year 41 million juveniles

Farm

- 220 acres double cropped in 2014
- Total of 590 acres farmed in 2014
- 70 acres more than in 2013

Lessons Learned

- Arriving shrimp were much smaller than expected
- Required smaller feeds than we had on hand
- Nitrite kills
  - 12 mg/L still had good survival
  - 16-20 mg/L reduced feeding
  - > 20 mg/L mortality started

Future Considerations

- Target 0.08 g shrimp for increased survival
- Target 22 day cycles
- Limit reliance on nitrifiers
- Take advantage of heterotrophic bacteria as needed
- Try alternative carbon sources
- Initiate solids removal from Day-1

Future Considerations

- Develop feeding protocols to reduce FCRs and improve water quality
- Increase production by operating more RWs during the nursery season
- Utilize RWs in the off season (Sept-Feb) for *L. vannamei* growout or bait shrimp
- Insulate building better

Acknowledgments

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