Stocking Rate Effects in a Tilapia Biofloc Production System

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Bartholomew W. Green

USDA Agricultural Research Service
Harry K. Dupree Stuttgart National Aquaculture Research Center
P.O. Box 1050, Stuttgart, AR 72160
bart.green@ars.usda.gov

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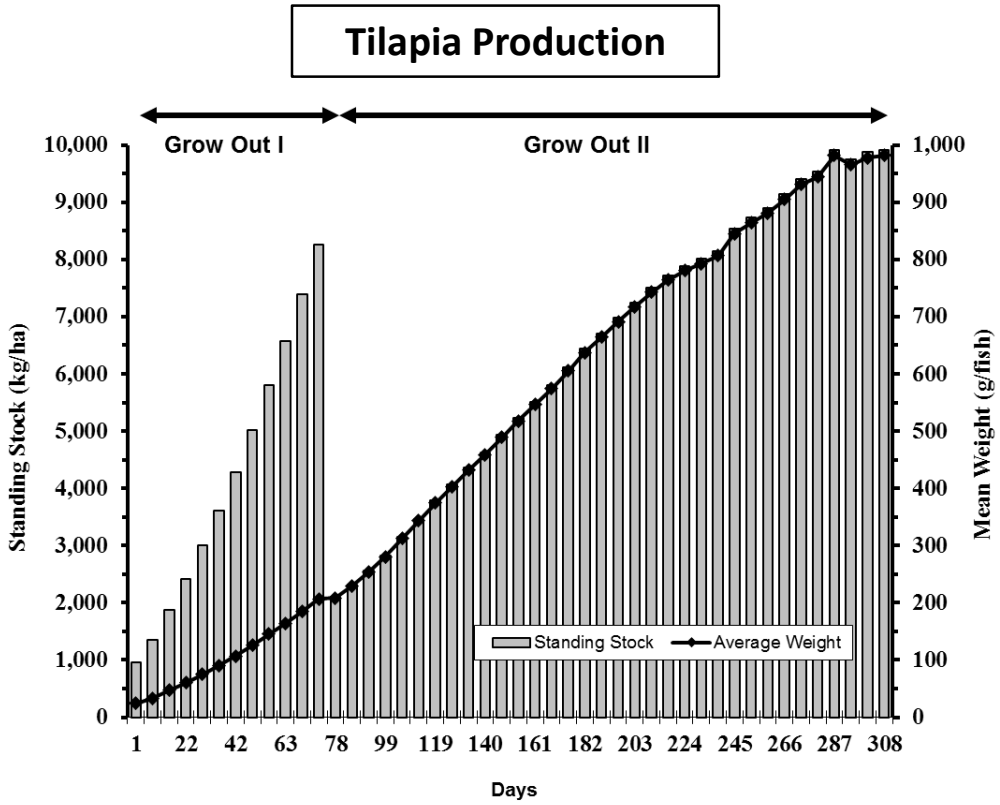
Intensive Production

- Increase efficiency of input/resource utilization
- Stocking rate & initial biomass manipulated to obtain fast growth & high yields
- Variety of management strategies
- Outdoor biofloc production
- Produce larger tilapia fingerlings (100- to 150-g stockers) for stocking into food fish production units
- Structured dose-response experiment conducted to quantify the tilapia stocking rate/initial biomass – growth/yield relationship
  - Impact on water quality variables determined



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Biofloc Production System

Outdoor System at SNARC

- 9 HDPE-lined tanks (18.6 m^2, 15.7 m^3)
- 130-L (117-L operating volume) settling chamber
- 1.865 kW (2.5 hp) regenerative blower per 3 tanks
- Well water seeded with plankton & fertilized
- Chloride concentration supplemented
- Dried molasses as C source initially
- Sodium bicarbonate added as needed
- No water exchange, but losses replaced
- DO/Temp monitored continuously by data logger

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Methodology

Stocking Rate (fish/m^2):	**50, 75, 100, 125, 150, 175, 200, 225, 250**
Fish:	**Hybrid tilapia (*Oreochromis aureus* ♀ x *O. niloticus* ♂), Aquasafra, Inc. 6.1 g/fish initial weight**
Duration:	**18 May – 7 October, 141 d**
Feed:	**Apparent satiation, 2x/d until 11 September**
	Aquaxcel 45/12, 1.5 mm, 19 May – 5 June
	Aquaxcel 45/12, 2.2 mm, 6 – 25 June
	Triton 40/10, 3.2 mm, 26 June - harvest
Fertilizer:	**Urea (46-0-0), 1x @ 13 g/m^3**
	Sweet45 dried molasses, 3x @ 115 g/m^3
Salt:	**1,124 g/m^3, $\bar{x}$ = 586 mg Cl^-/L**
Solids Removal:	**Settling chambers activated at TSS ≈ 400 mg/L (6 July), flow = 3 L/min**

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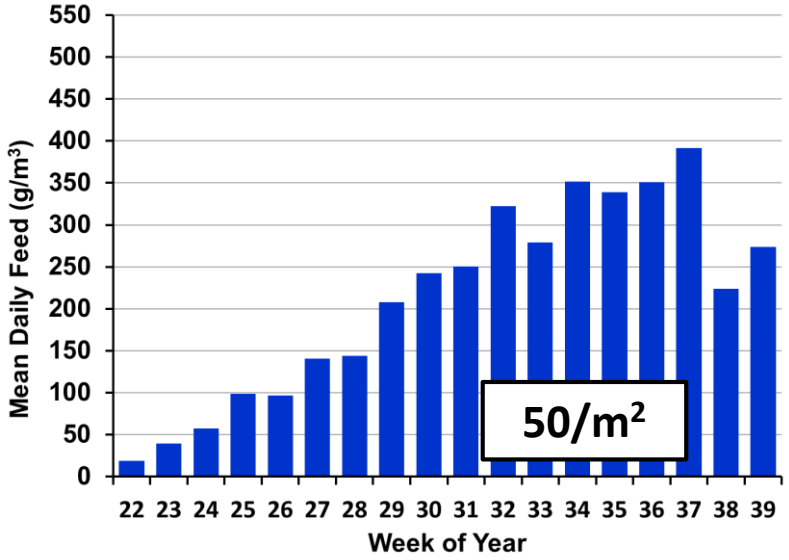
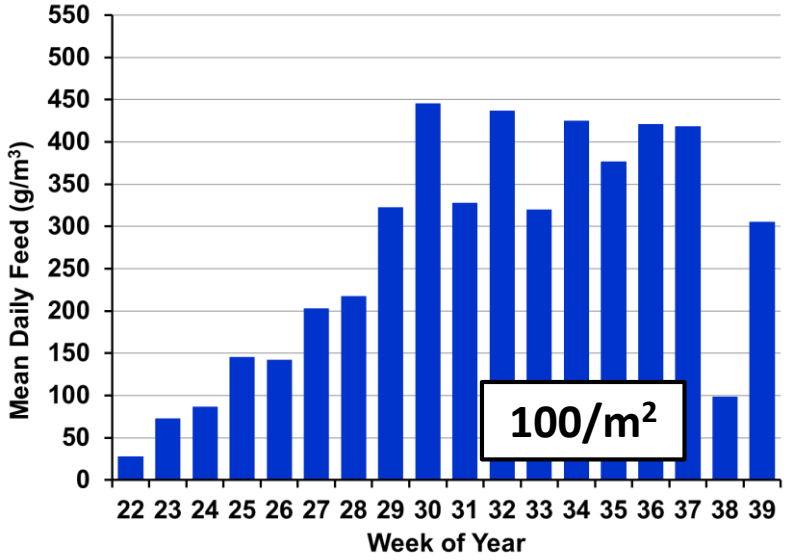
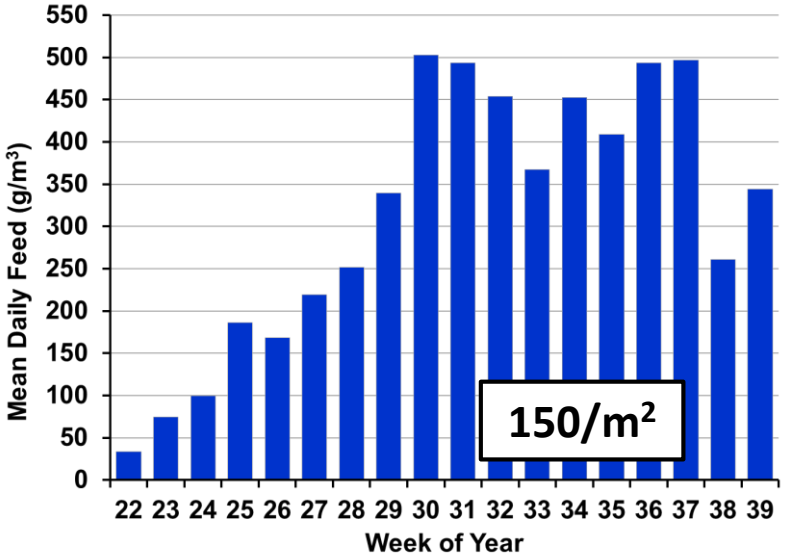
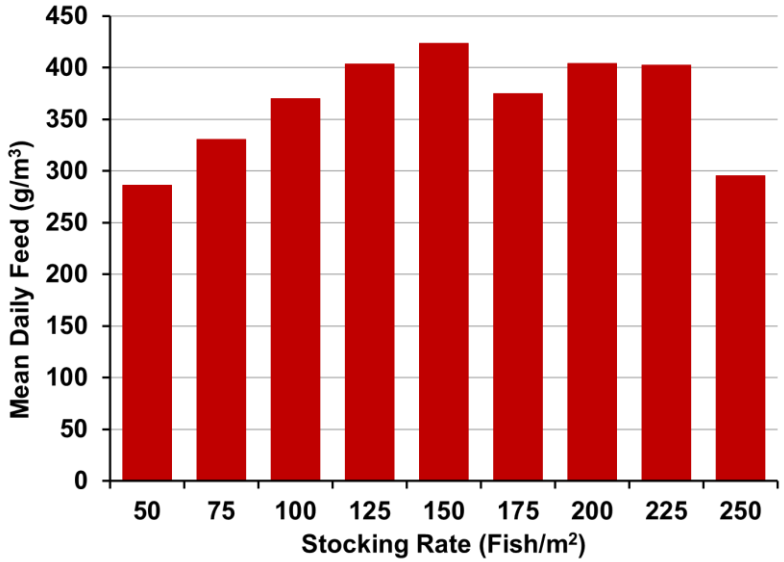
Feed Loading



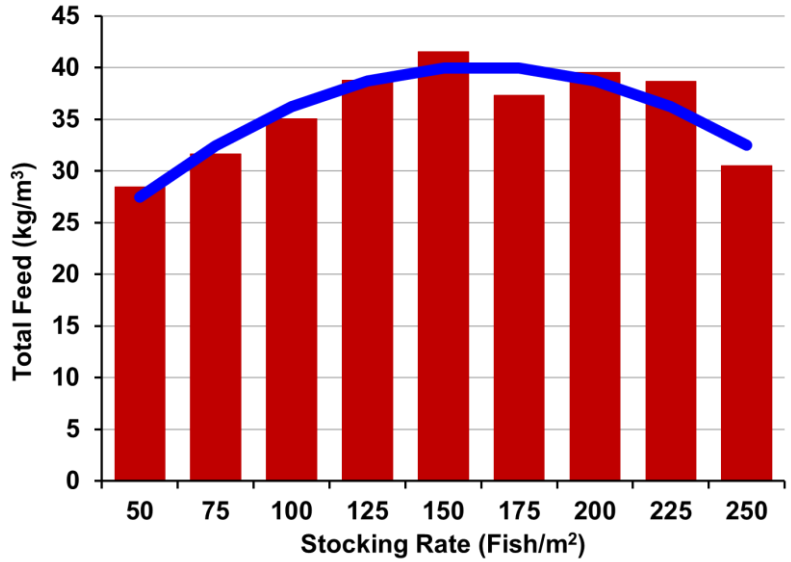




Peak Feed Consumption (1 Jul – 8 Sep)



Total Feed



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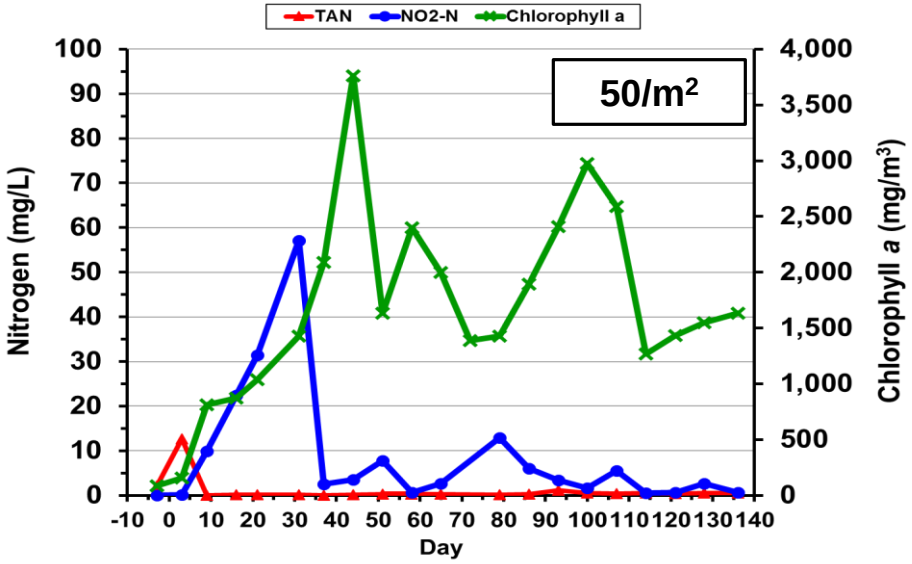
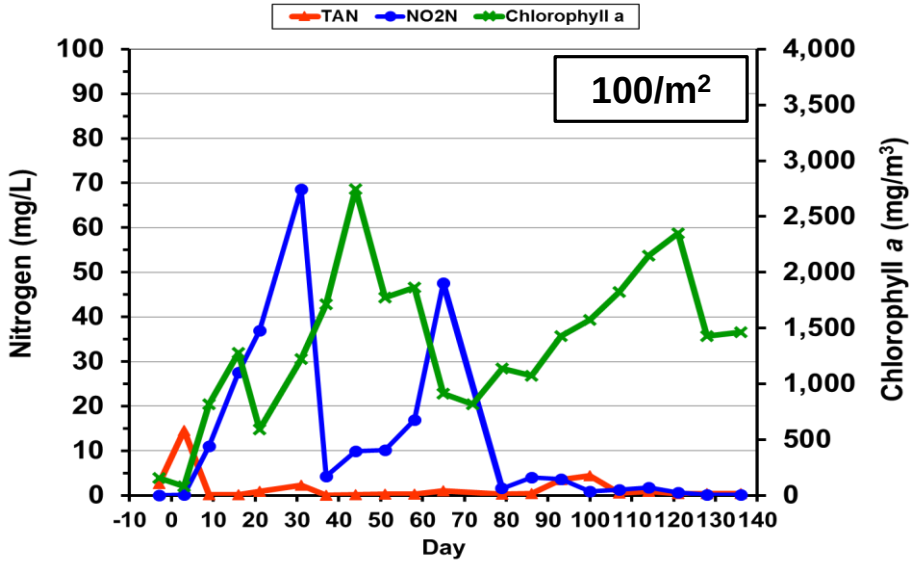
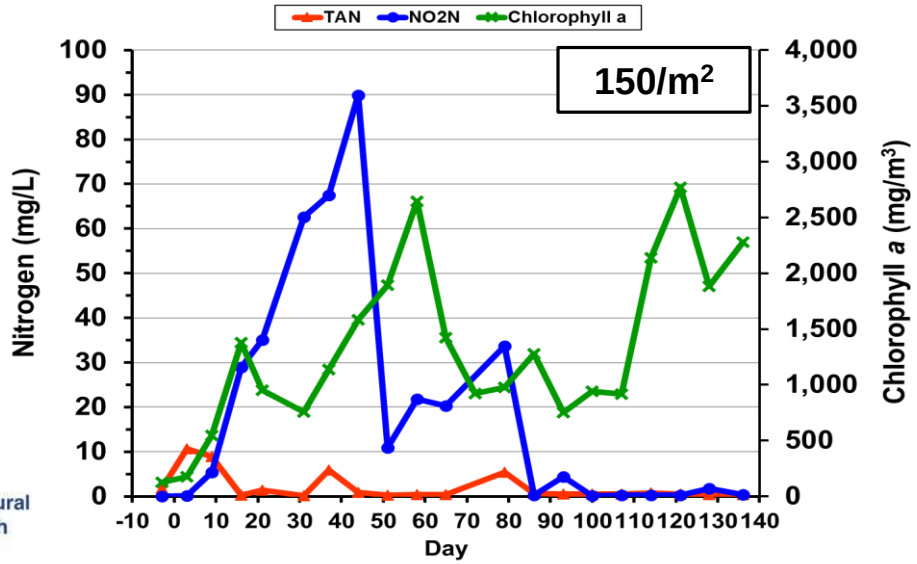
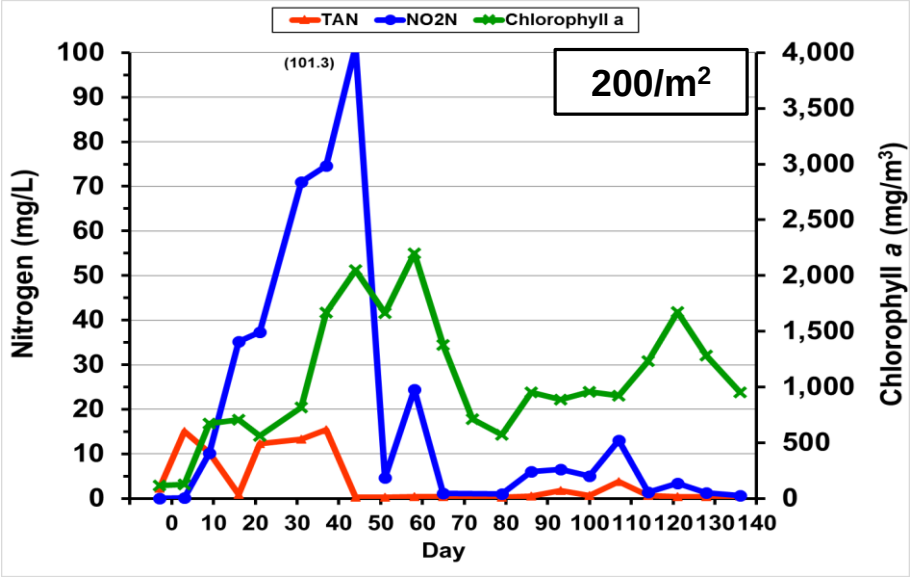
Water Quality









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Water Quality Means

Fish/m^2	TAN†	NO_2N†	NO_3N†	PO_4P†	pH	Alkalinity†	TSS†	SS‡	Chlorophyll *a**
50	1.03	8.6	217.9	11.0	7.4	151.0	460.4	22	1,659
75	1.58	10.8	283.7	14.5	7.4	105.6	520.2	27	1,348
100	1.67	12.4	286.8	16.1	7.3	99.8	529.2	34	1,352
125	2.46	19.3	304.2	19.1	7.3	118.2	596.8	35	1,344
150	2.04	19.2	324.1	17.1	7.3	122.2	571.3	28	1,308
175	2.63	14.9	326.9	17.6	7.3	117.3	557.4	34	1,522
200	4.00	19.9	296.6	17.2	7.3	118.7	498.2	27	1,053
225	4.00	17.6	273.7	14.6	7.4	135.5	568.1	35	1,118
250	3.84	15.9	236.5	11.9	7.4	125.9	573.6	32	1,029

† mg/L; ‡ mL/L; * mg/m^3

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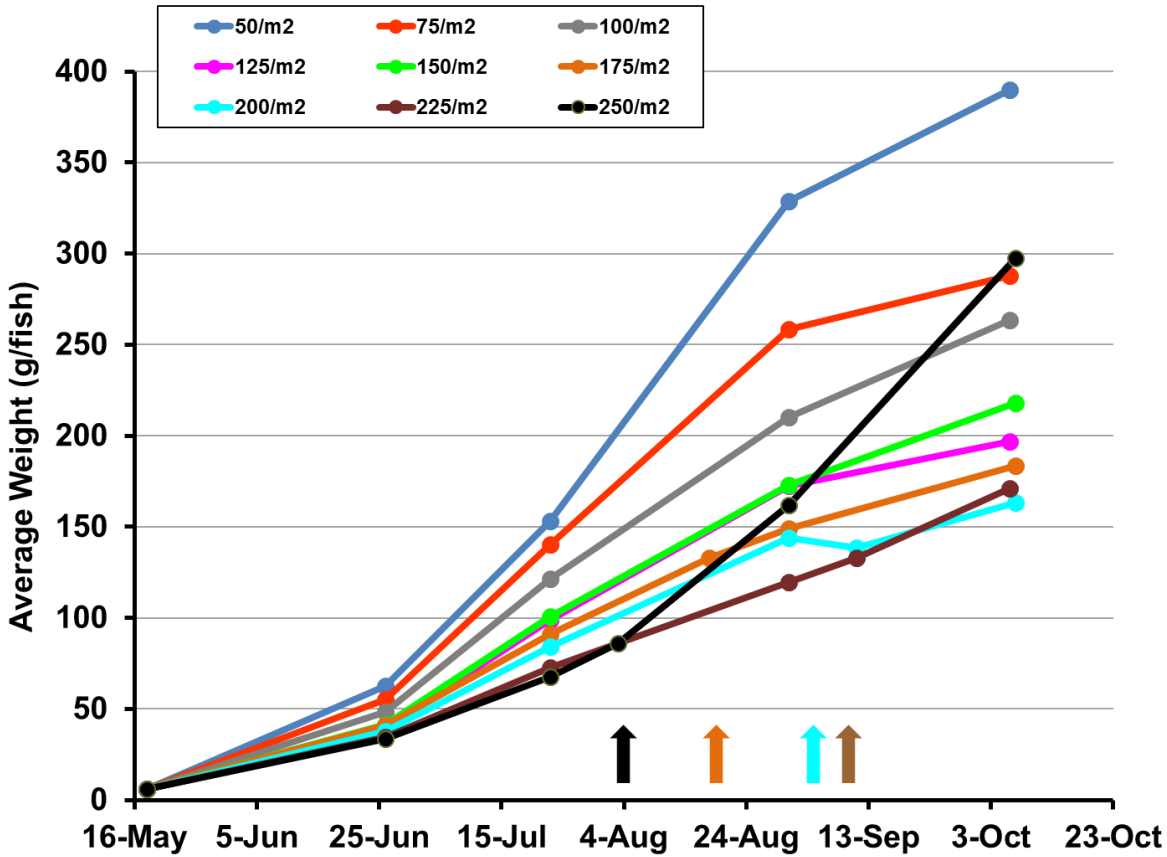
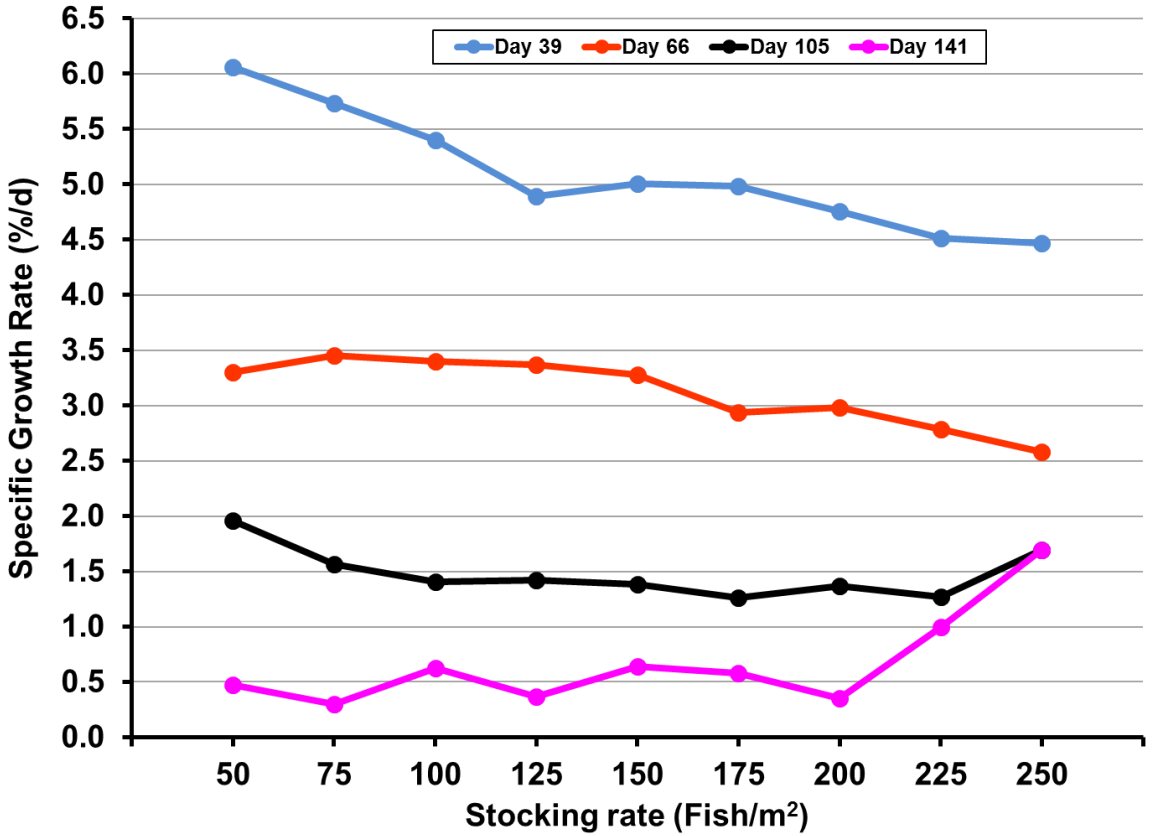
Linear Relationships

Variable	Stocking Rate (Fish/m^2)	Total Feed (kg/m^3)
TAN (mg/L)	(+), $R^2 = 0.894$, $P < 0.001$	$R^2 = 0.141$, $P = 0.319$
NO_2N (mg/L)	(+), $R^2 = 0.457$, $P = 0.046$	(+), $R^2 = 0.709$, $P = 0.004$
NO_3N (mg/L)	$R^2 = 0.012$, $P = 0.782$	(+), $R^2 = 0.690$, $P = 0.006$
PO_4P (mg/L)	$R^2 = 0.141$, $P = 0.319$	(+), $R^2 = 0.704$, $P = 0.005$
Chlorophyll *a* (mg/m^3)	(-), $R^2 = 0.624$, $P = 0.011$	$R^2 = 0.095$, $P = 0.421$
Settleable Solids (mL/L)	$R^2 = 0.267$, $P = 0.155$	$R^2 = 0.159$, $P = 0.288$
TSS (mg/L)	$R^2 = 0.273$, $P = 0.149$	$R^2 = 0.257$, $P = 0.164$

Growth





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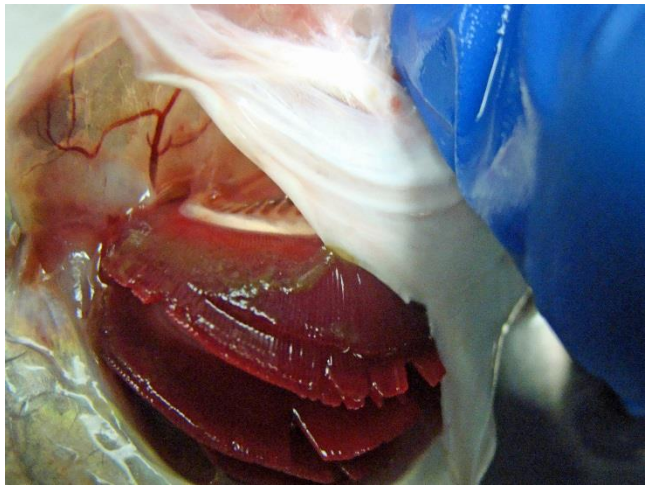
Mortality Events

Fish/m^2	Day No.	% Mortality	DO (% Sat.)	pH	NO_2N (mg/L)	TSS (mg/L)
250	77 – 80	85	> 35%	≈ 7.3	≈ 3.00 ↓	≈ 700
175	89 – 93	25	> 35%	≈ 7.3	≈ 6.00 ↓	≈ 650
200	110 – 119	7	> 20%	≈ 7.1	≈ 8.00 ↓	≈ 700
225	115 – 118	39	> 25%	≈ 7.5	< 1.00	≈ 750

Necropsy Results	
Gross appearance:	Unremarkable; no lesions
Gills:	No parasites; bright red, but puffy
Internal organs - appearance:	Unremarkable
Bacterial culture - liver:	Negative
Bacterial culture - brain:	Negative



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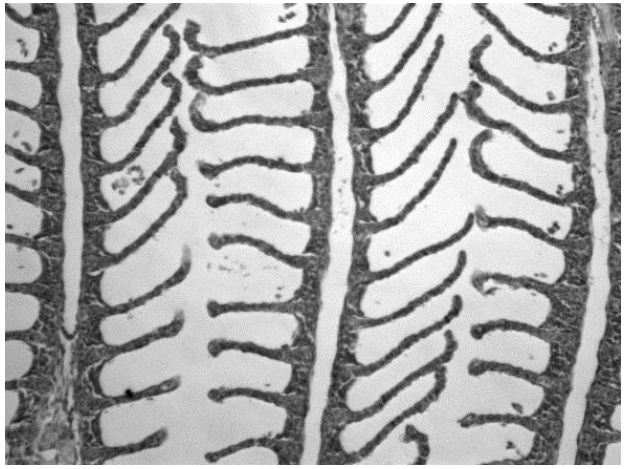
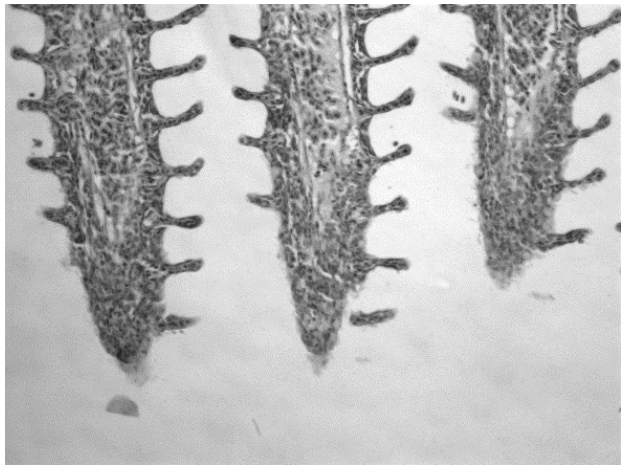
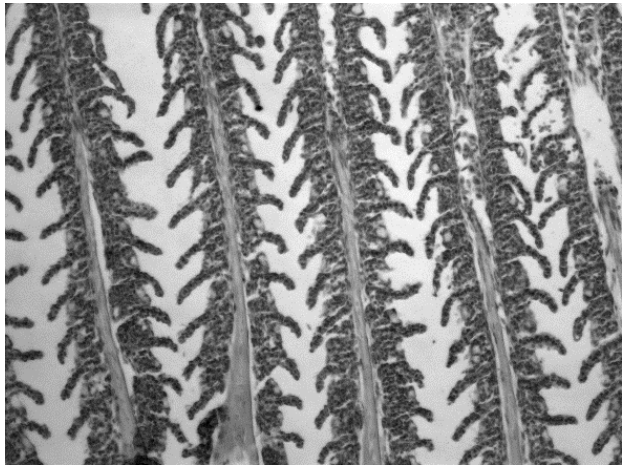
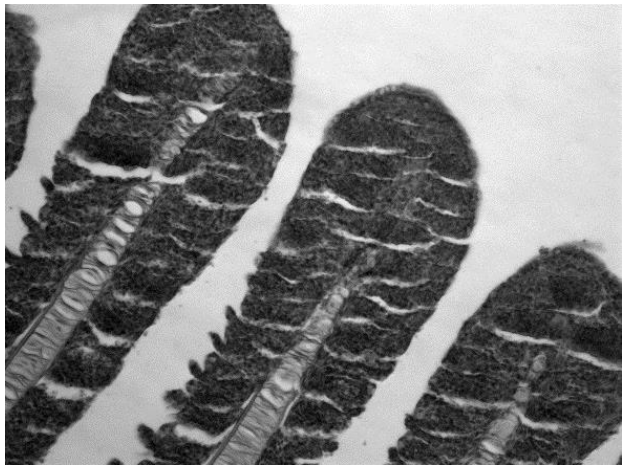
Gill Histology





Original fish maintained in flowing well water.





Moribund fish (175 fish/m^2), TSS ≈ 650 mg/L

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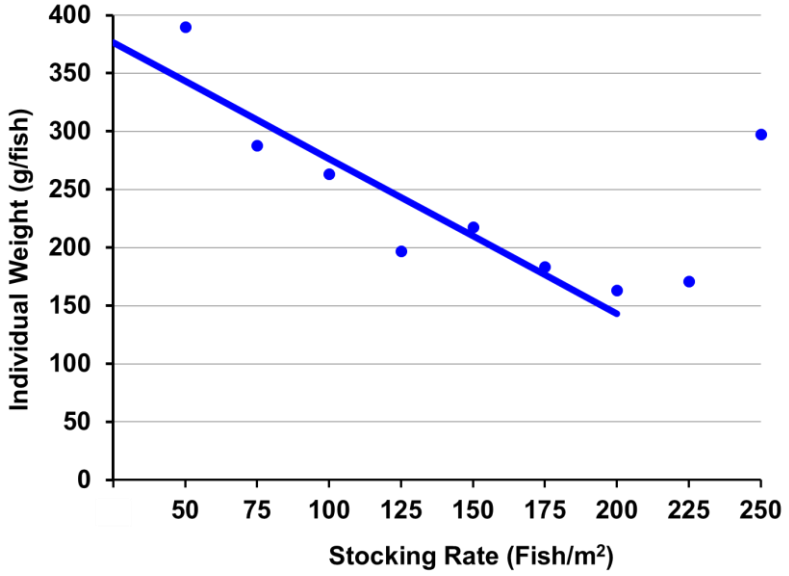
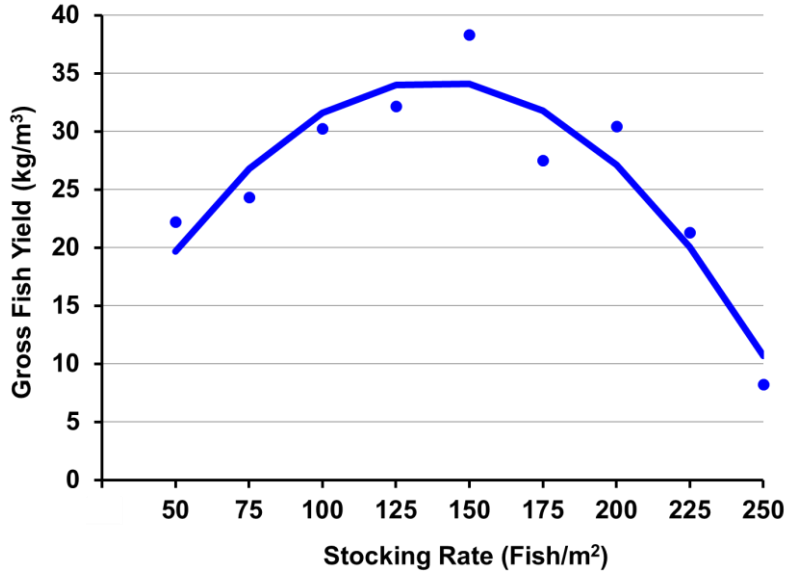
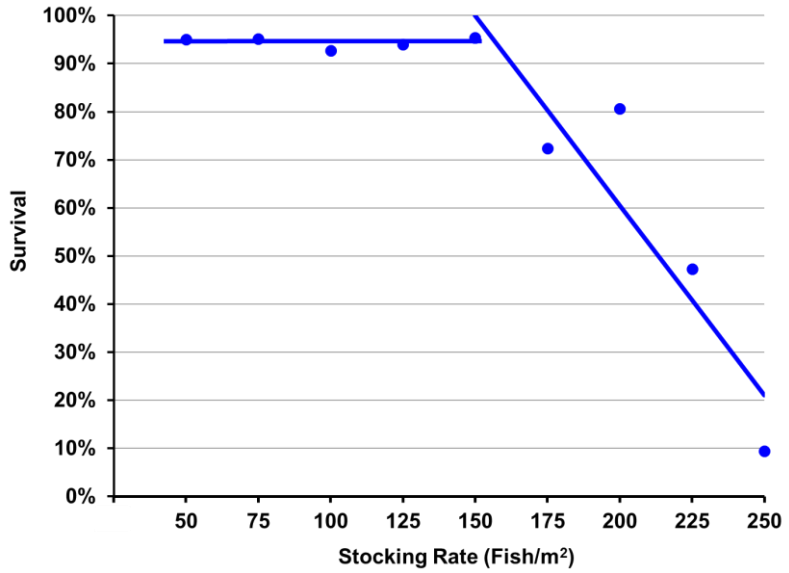
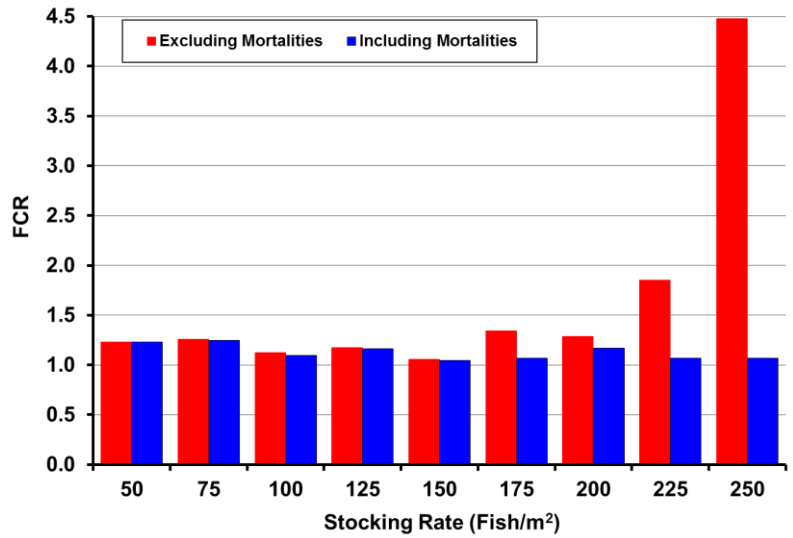
Stocking Rate Relationships









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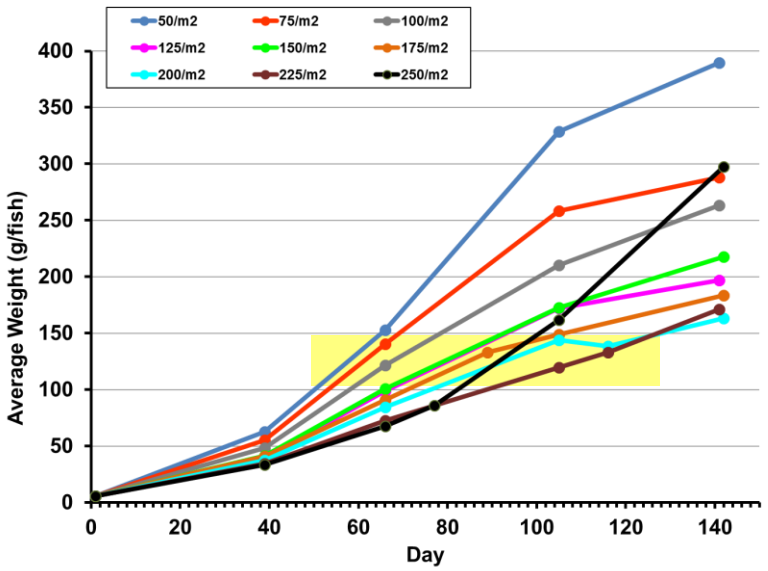
Summary



Solids control may be important

	Stocking Rate (Fish/m2)						
Variable	**50**	**75**	**100**	**125-150**	**175**	**200**	**225**
100 g/fish							
Days	**50**	**54**	**58**	**66**	**72**	**76**	**90**
GFY	**5.9**	**8.9**	**11.9**	**16.9**	**18.6**	**21.8**	**25.8**
Crops/150 d	**3**	**2**	**2**	**2**	**2**	**1**	**1**
Sum GFY	**17.7**	**17.8**	**23.8**	**33.8**	**37.2**	**21.8**	**25.8**
150 g/fish							
Days	**66**	**70**	**79**	**94**	**105**	**108**	**128**
GFY	**9.0**	**13.2**	**17.7**	**26.5**	**26.3**	**32.5**	**37.5**
Crops/150 d	**2**	**2**	**1**	**1**	**1**	**1**	**1**
Sum GFY	**18.0**	**26.4**	**17.7**	**26.5**	**26.3**	**32.5**	**37.5**

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