Potassium Ammendments: How Much is Enough?

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Greene Prairie Aquafarm, Alabama

Table 2. Comparison of production characteristics for 2001 and 2002 seasons.

	Production (lb/acre)		Mean weight (g)		Survival (%)	
Year	Mean	Range	Mean	Range	Mean	Range
2001	530	152 - 1,016	19	12 – 24	19	3 - 38
2002	3,622	1,349 - 5,072	18.2	15.4 - 25.0	67	19 - 105

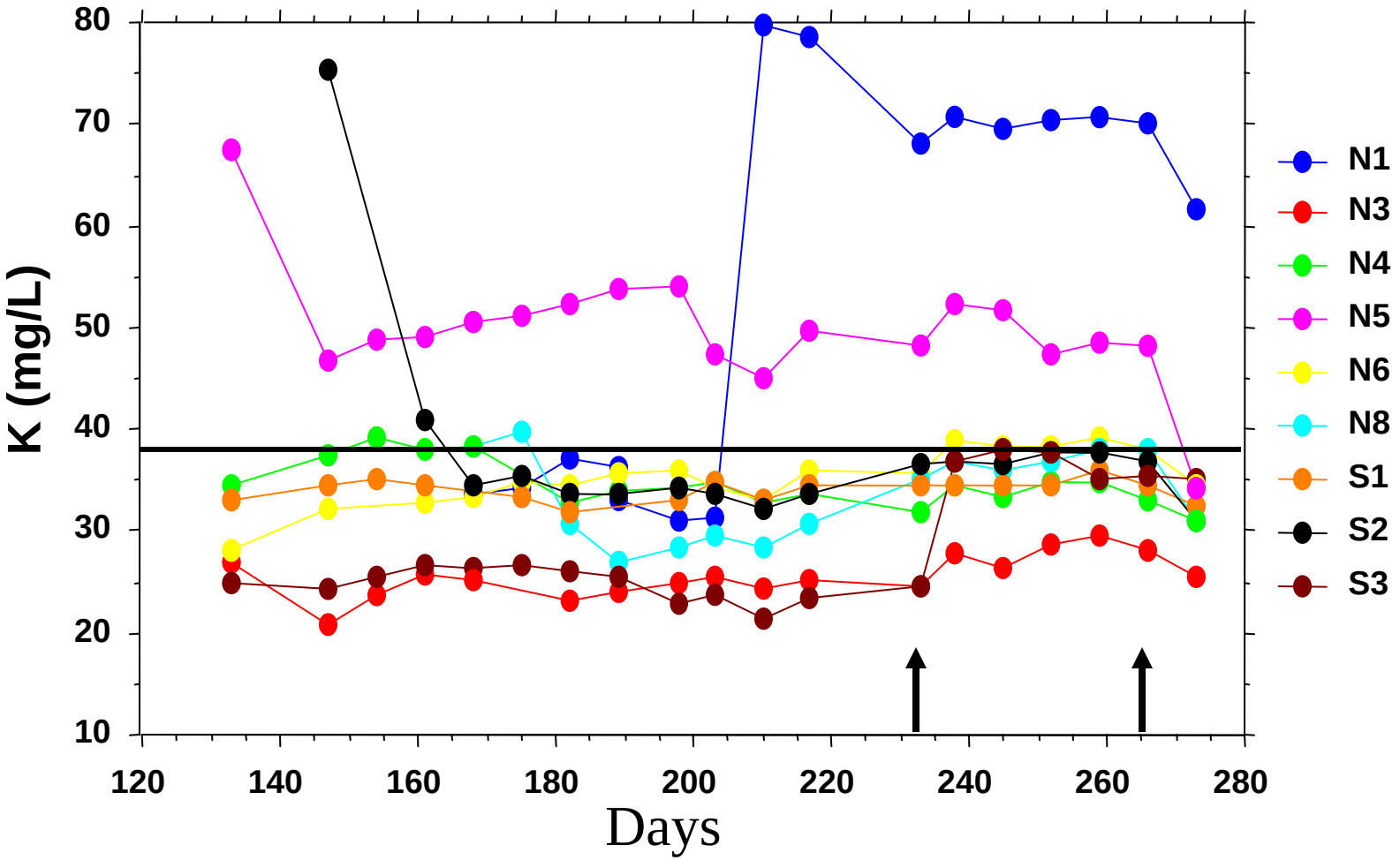
Conclusions in 2003

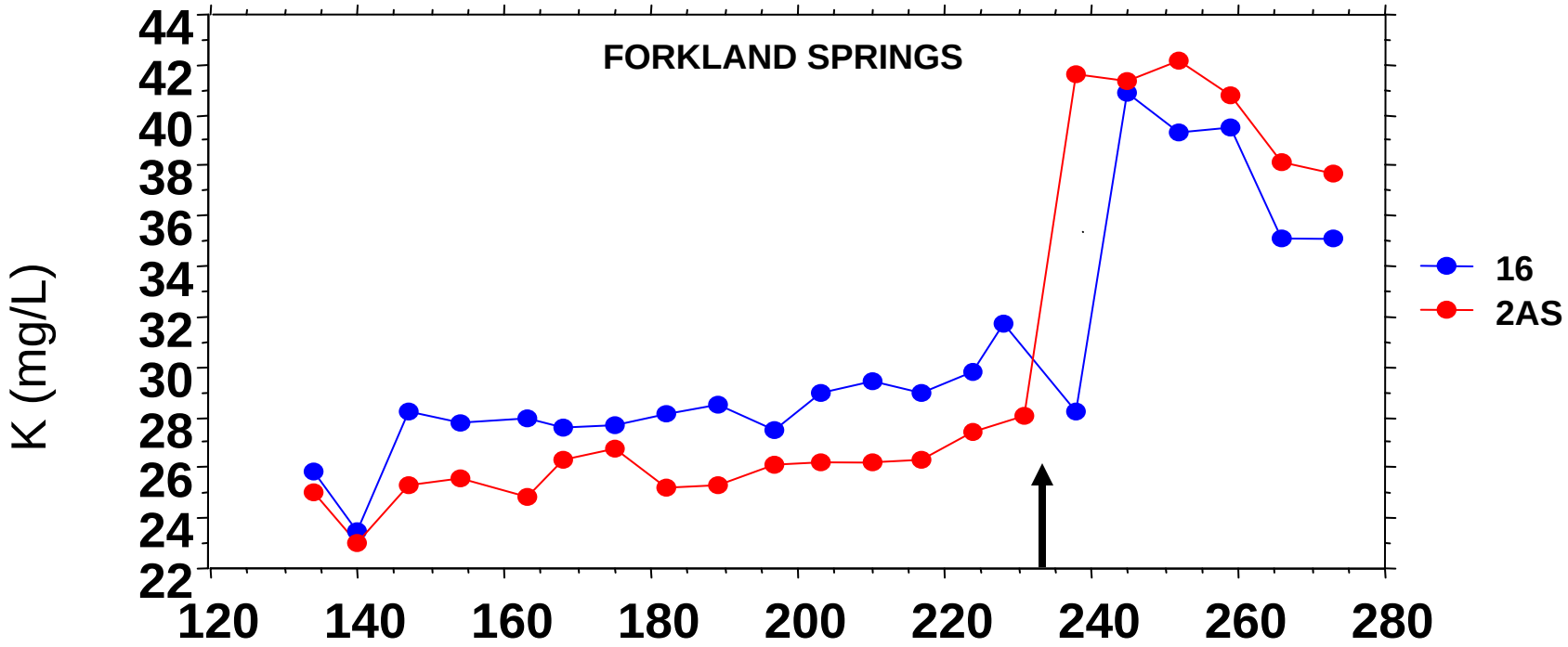
- Potassium amendments absolutely necessary for good survival in our water.
- Magnesium amendments appear to help, but the minimum concentrations are not known. We will continue to amend water with Mg to make Mg concentration at least 15 ppm.
- Until better information is available, K should be higher than 25 ppm.
- Ion balance, in addition to absolute ion concentration is likely important.
- These results probably are not directly transferable to other regions or aquifers.

- Our salinity is about 10% of seawater strength.
- I amended our K concentrations equivalent to a 10% seawater solution.
- But is that enough or too much?
- What about the other farmers with different K concentrations?
- Is there a required minimum concentration of K or should K amendments be based on a ratio?
- If a ratio, based on which ion? Cl? Na? Ca?

Selected water chemistry of well water on Alabama inland shrimp farms.

Farm	Salinity (ppt)	K^+(mg/L)	Mg (mg/L)	
Greene Prairie Aquaf.	3.5	8	11	
Forkland Springs	5.0	15.6	18.1	
Wiggins Farm	4.1	13.2	58.5	
Jackson	8.3	14.2	61.2	
Seawater (3.5 ppt)	3.5	37	135	


K (mg/L)
80
70
60
50
40
30
20
10
120
140
160
180
200
220
240
260
280
Days
N1
N3
N4
N5
N6
N8
S1
S2
S3


FORKLAND SPRINGS
K (mg/L)
44
42
40
38
36
34
32
30
28
26
24
22
120
140
160
180
200
220
240
260
280
16
2AS

Growth and survival of L. vannamei in artificial “low salinity” water (30 ppt) of different Na/K molar ratios.

Na/K Molar Ratio	K (mg/L)	WG (%)	Survival (%)
25.6	602	54.8 bc	81.3
34.1	457	67.3 c	87.5
47.3 control	332	55.4 bc	93.8
85.2	188	54.1 bc	100
119.3	133	48.1 b	87.5
153.3	105	32.7 a	87.5
187.4	86	-	0
C. Zhu et al./ Aquaculture 234 (2004) 485-496			

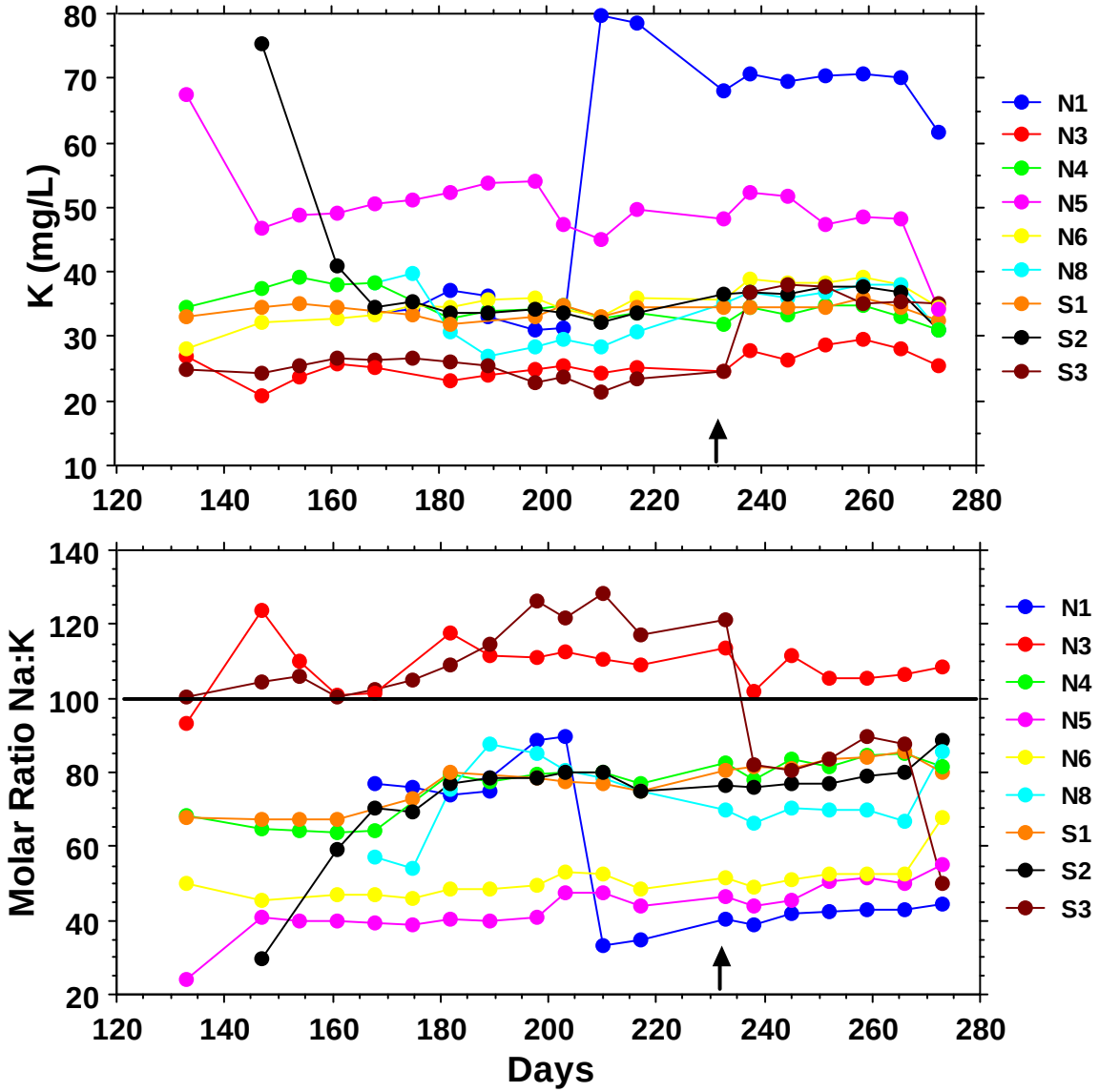
Survival and growth of juvenile Pagrus auratus in saline groundwater (20 ppt) ammended with KCl to provide K^+ concentrations equivalent to coastal seawater at a similar salinity.

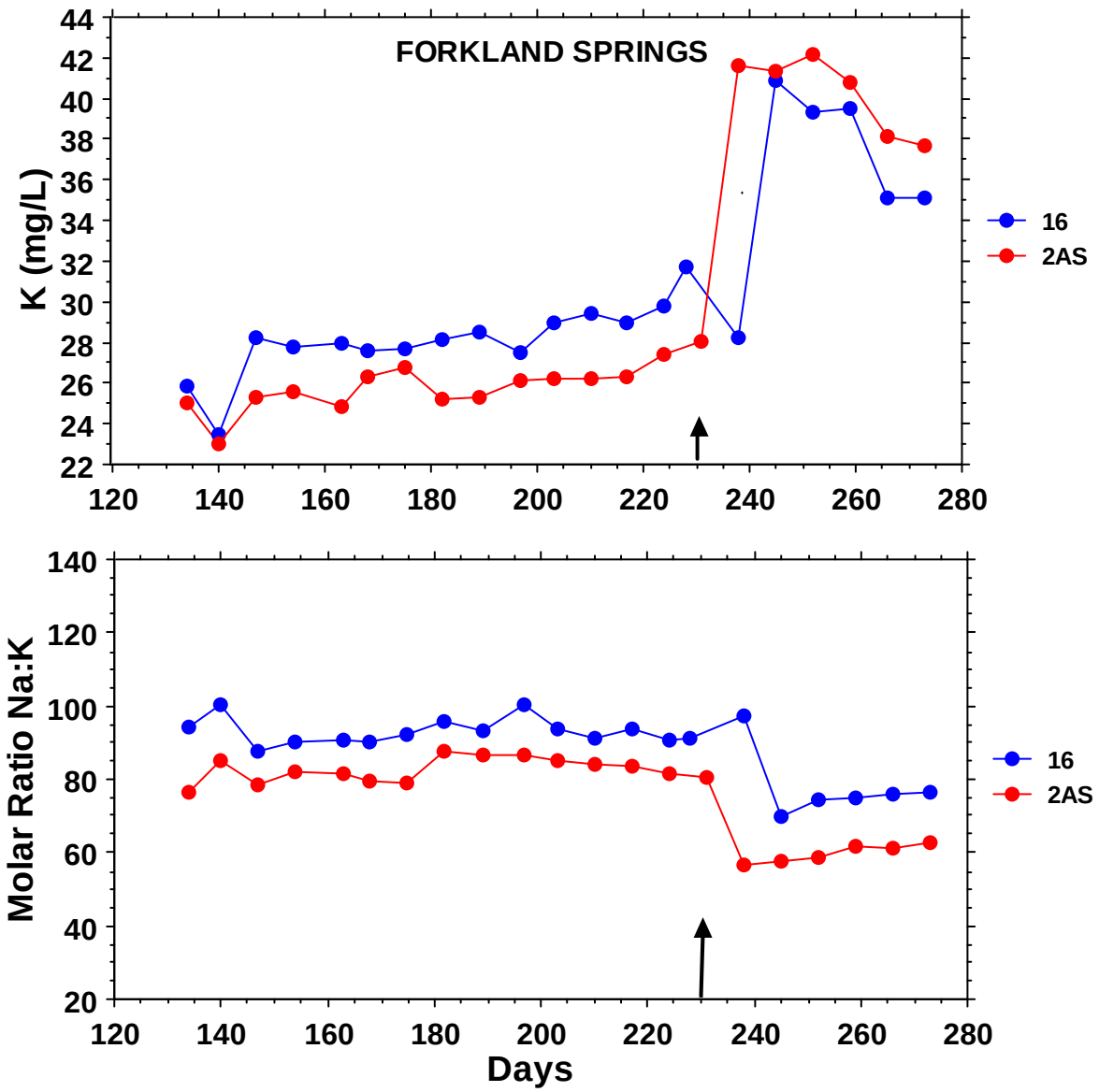
Treatment	K^+ (mg/L)	Survival (%)	Growth	Na^+/K^+ molar
Coastal seawater	207	100	Similar	44
Saline groundwater 100%	207	100	Similar	35
Saline groundwater 80%	166	100	Similar	43
Saline groundwater 60%	124	95.8	Similar	58
Saline groundwater 40%	83	91.7	Reduced	86
Saline groundwater 25%	54	0	0	133
Saline groundwater 0%	10	0	0	732

D.S. Fielder et al. Aquaculture 201 (2001) 73-90.

Selected water chemistry of well water on Alabama inland shrimp farms.

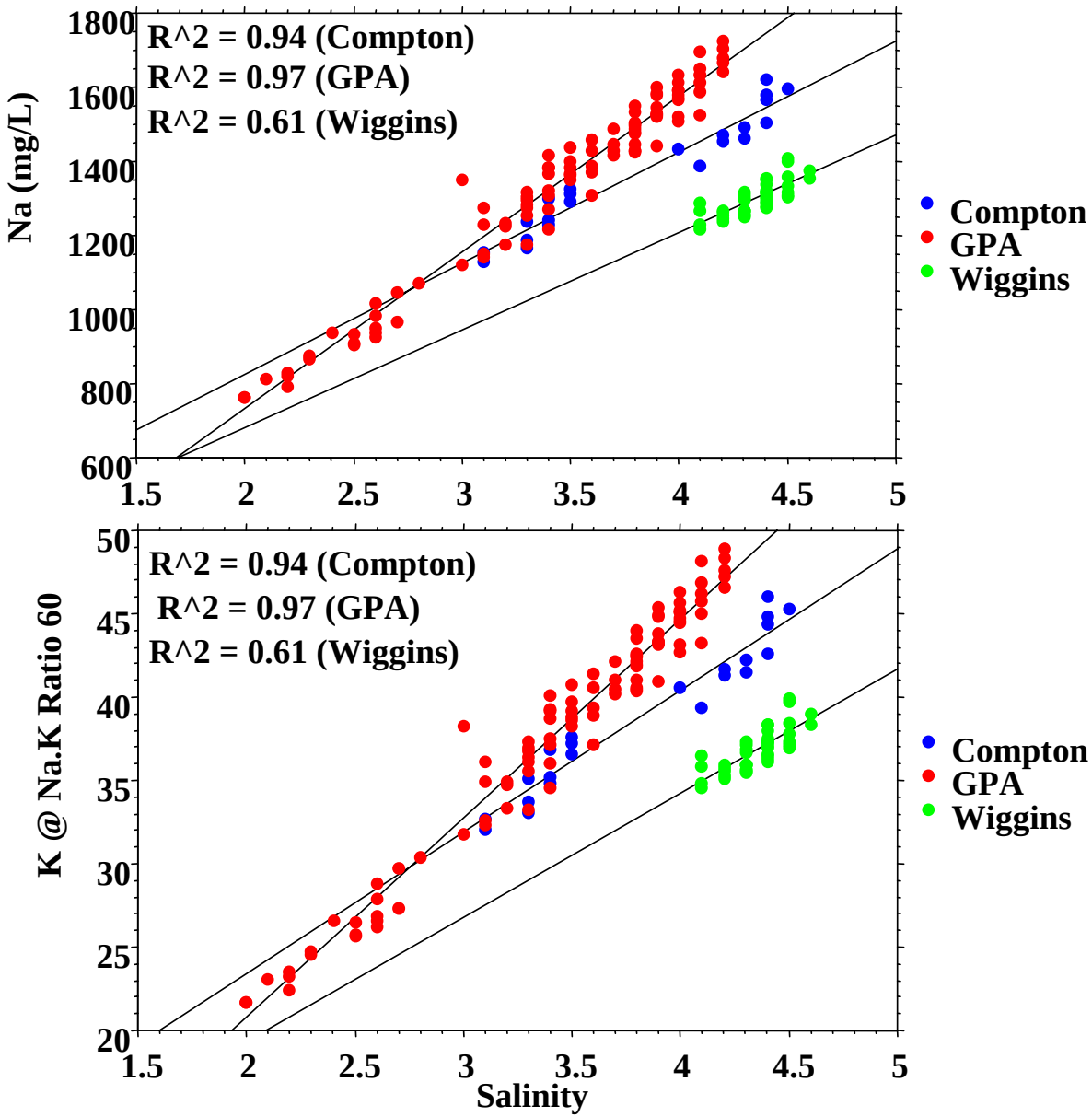
Farm	Salinity (ppt)	K^+ (mg/L)	Mg (mg/L)	Na^+/K^+ molar
Greene Prairie Aquafarm	3.5	8	11	235
Forkland Springs	5.0	15.6	18.1	208
Wiggins Farm	4.1	13.2	58.5	165
Jackson	8.3	14.2	61.2	301
Seawater (3.5 ppt)	3.5	37	135	46


K (mg/L)
Molar Ratio Na:K
Days
N1
N3
N4
N5
N6
N8
S1
S2
S3


FORKLAND SPRINGS
K (mg/L)
Molar Ratio Na:K
Days
16
2AS
16
2AS

Selected water chemistry of pond water during 2002 - 2004 on Alabama inland farms.

Farm		K (mg/L)	Mg (mg/L)	Na/K molar
2002				
Greene Prairie		37	17	76
Forkland Springs		31	18	82
Wiggins Farm		38	64	66
Jackson		38	60	111
Odom		-	-	-
Taylor		-	-	-
2003				
Greene Prairie		43	11	34
Forkland Springs		58	16	27
Wiggins Farm		42	41	37
Jackson		43	45	85
Odom		50	24	62
Taylor		31	12	45
2004				
Greene Prairie		57	12	24
Forkland Springs		83	18	18
Wiggins Farm		58	40	22
Jackson		75	64	38
Odom		93	29	26
Taylor		54	15	29


R^2 = 0.94 (Compton)
R^2 = 0.97 (GPA)
R^2 = 0.61 (Wiggins)
Na (mg/L)
1800
1600
1400
1200
1000
800
600
1.5
2
2.5
3
3.5
4
4.5
5
Compton
GPA
Wiggins
R^2 = 0.94 (Compton)
R^2 = 0.97 (GPA)
R^2 = 0.61 (Wiggins)
K @ Na.K Ratio 60
50
45
40
35
30
25
20
Salinity
Compton
GPA
Wiggins

Example from West Texas				
Salinity (ppt)	Na (mg/L)	K (mg/L)	Na/K mol ratio	Potash (lb/Ac)
14.1	4198	58	123	0
		89	80	668
		119	60	1318
		155	46	2095
Potash = 50% K				
Pond = 4ft average depth				

Conclusions

- K requirements are based on ratios to Na, not minimum concentrations
- Na/K ratios should be no greater than 80, but preferably 60.
- Ratios less than 35 may be counterproductive.
- Other factors also involved in sub-optimal survival and growth in inland water.