The Middle Huron River, Jun-Oct 2003

- Data Overview
- Nutrients by River Segment
- Lake Dynamics
- Bloom Formation

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Grant # R830653-010

Objectives for this Talk

- Introduce the types of data
- Give examples of data analysis
- Raise some questions
- Invite more focused discussions

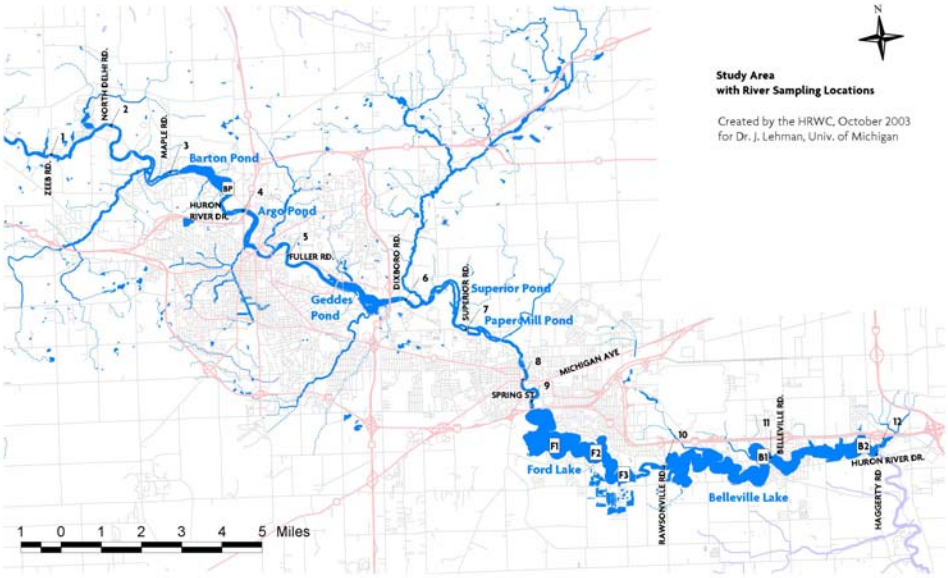
Special thanks to partners who contributed to our efforts:

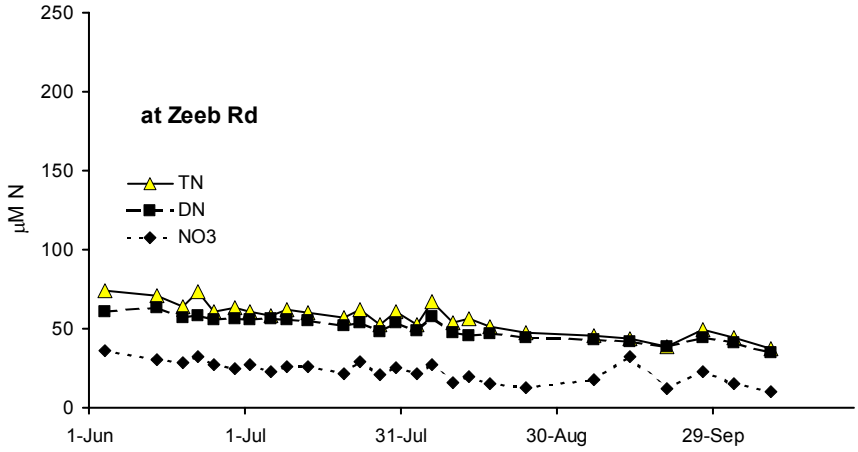
Ann Arbor Water Utilities:
Janice Skadsen and Ted Hejka

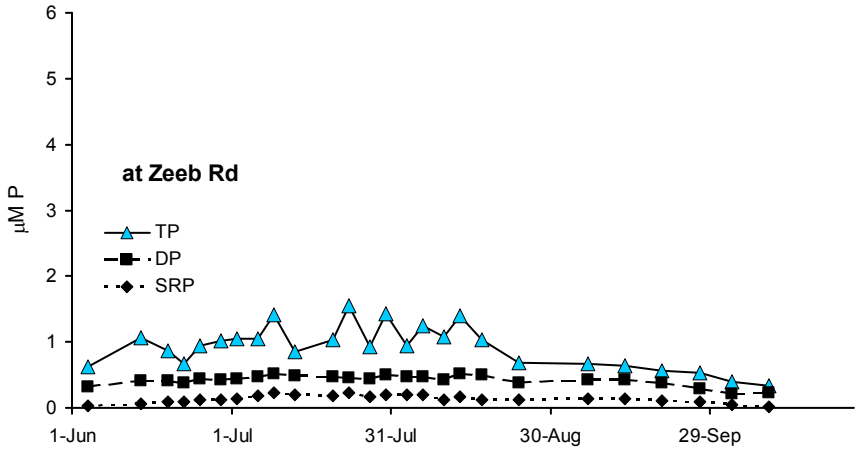
HRWC: Elizabeth Riggs

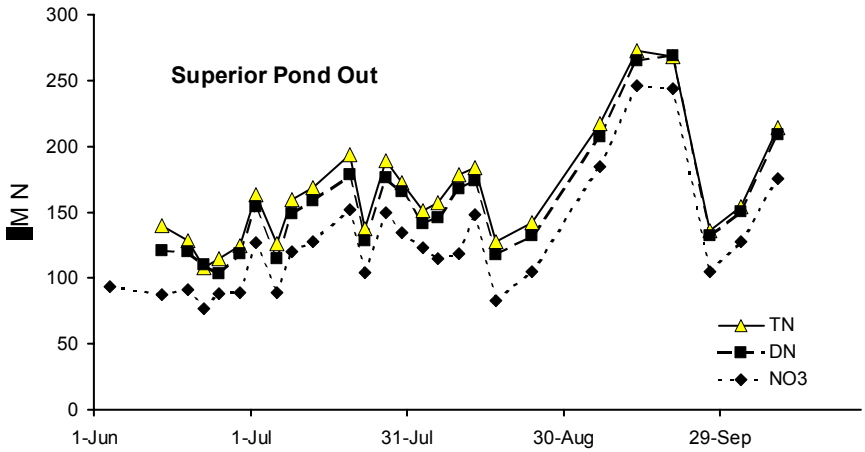
Van Buren Township: Dan Swallow

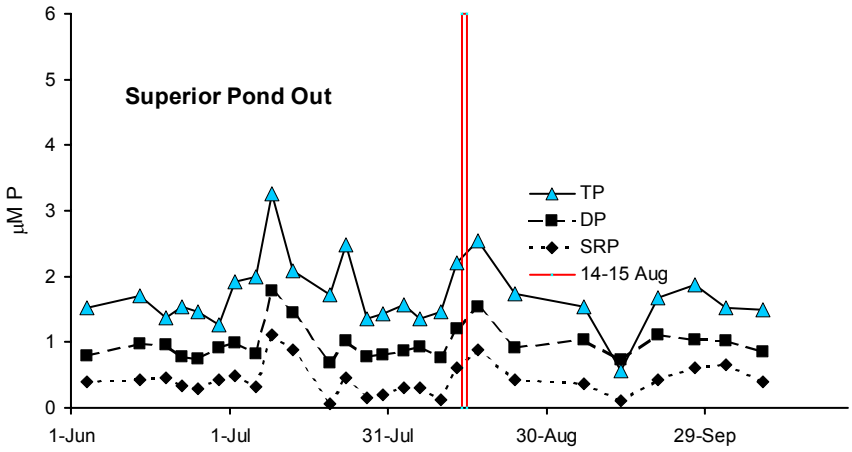
Ypsilanti Charter Township



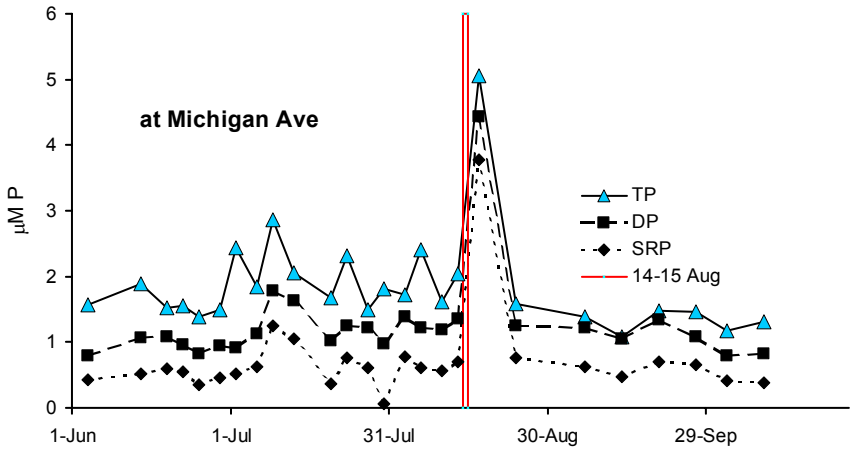

250
200
150
100
50
0
µM N
at Zeeb Rd
TN
DN
NO3
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep

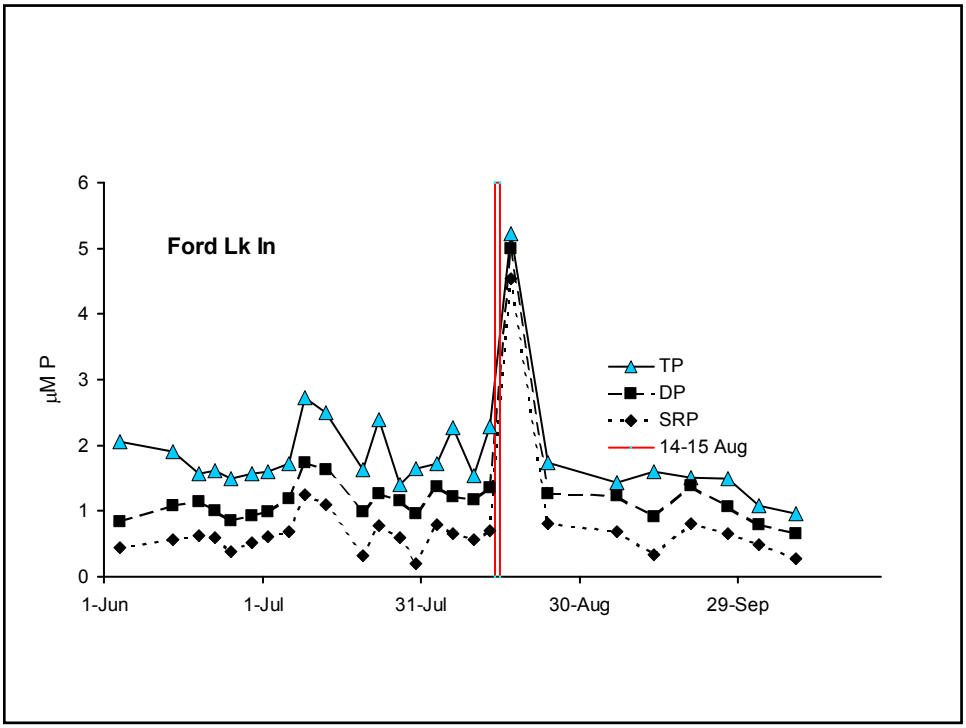

6
5
4
3
2
1
0
µM P
at Zeeb Rd
TP
DP
SRP
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep

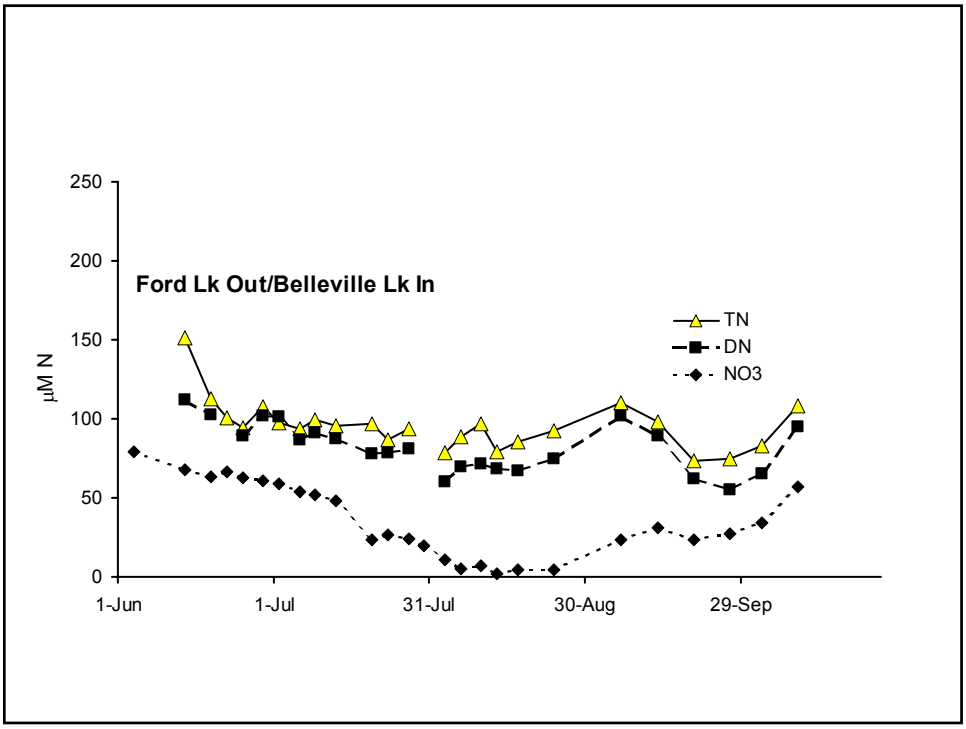

Superior Pond Out
µM N
300
250
200
150
100
50
0
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
TN
DN
NO3

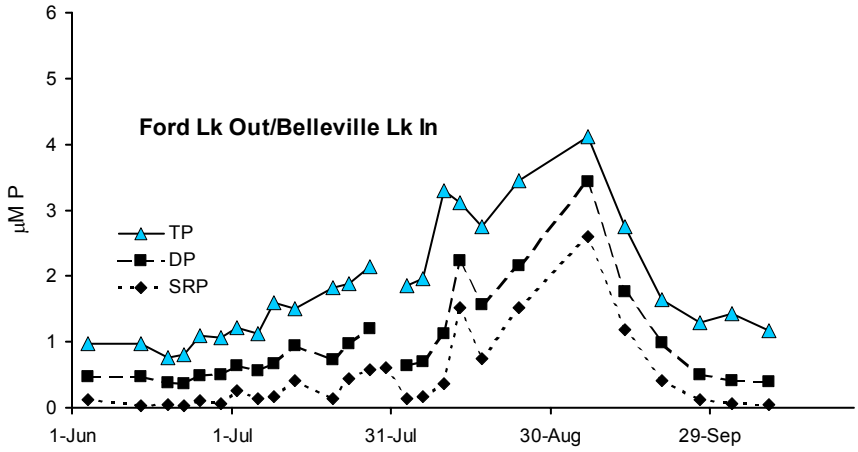

Superior Pond Out
µM P
6
5
4
3
2
1
0
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
TP
DP
SRP
14-15 Aug

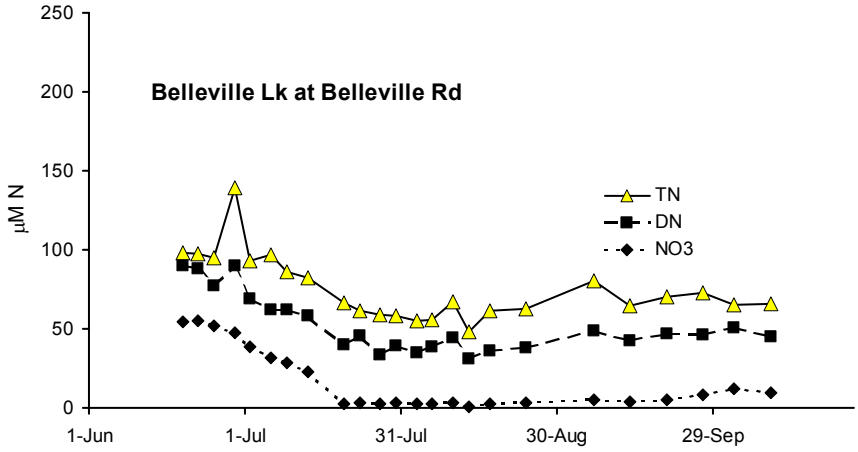
	HR at Wall St		
	CFS		m^3 day^{-1}
14-Aug-03	71		
15-Aug-03	172		
16-Aug-03	115		
17-Aug-03	88		
MEAN=	**111.5**		**272793**
Superior Pd vol=	625	acre-ft	
1 acre-foot =	1233.5	m^3	
Superior Pd vol=	770937.5	m^3	
Detention Time (d)	**2.8**		

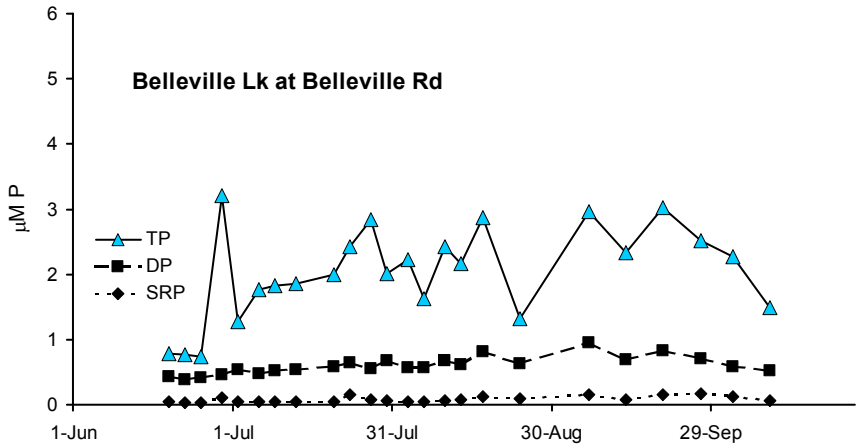



Ford Lk In
µM P
6
5
4
3
2
1
0
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
TP
DP
SRP
14-15 Aug


Ford Lk Out/Belleville Lk In
µM N
250
200
150
100
50
0
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
TN
DN
NO3

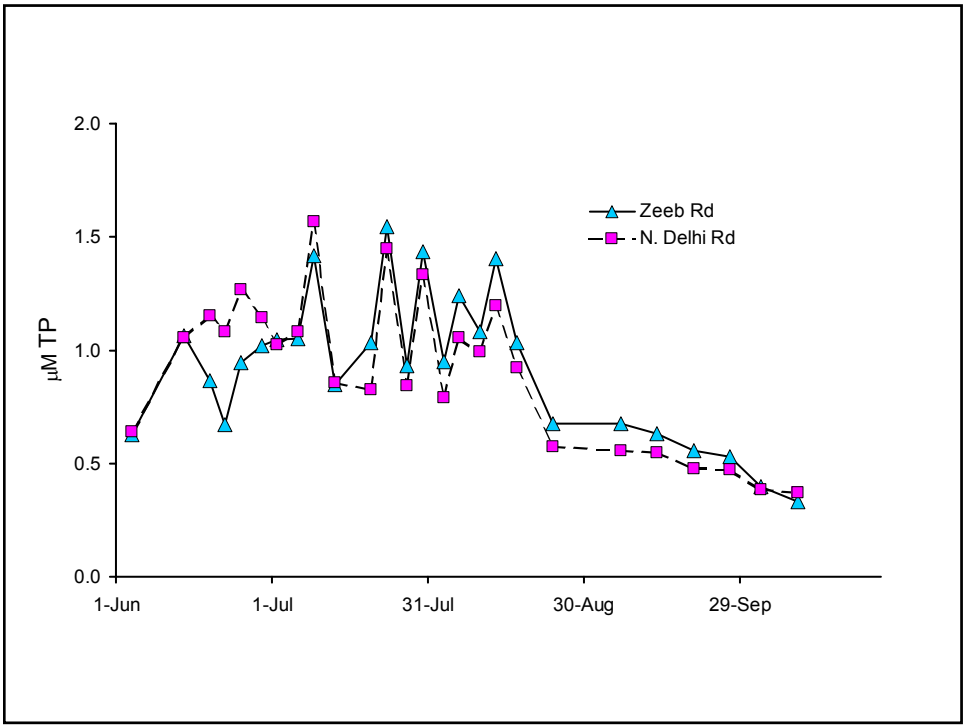

Ford Lk Out/Belleville Lk In
µM P
6
5
4
3
2
1
0
TP
DP
SRP
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep

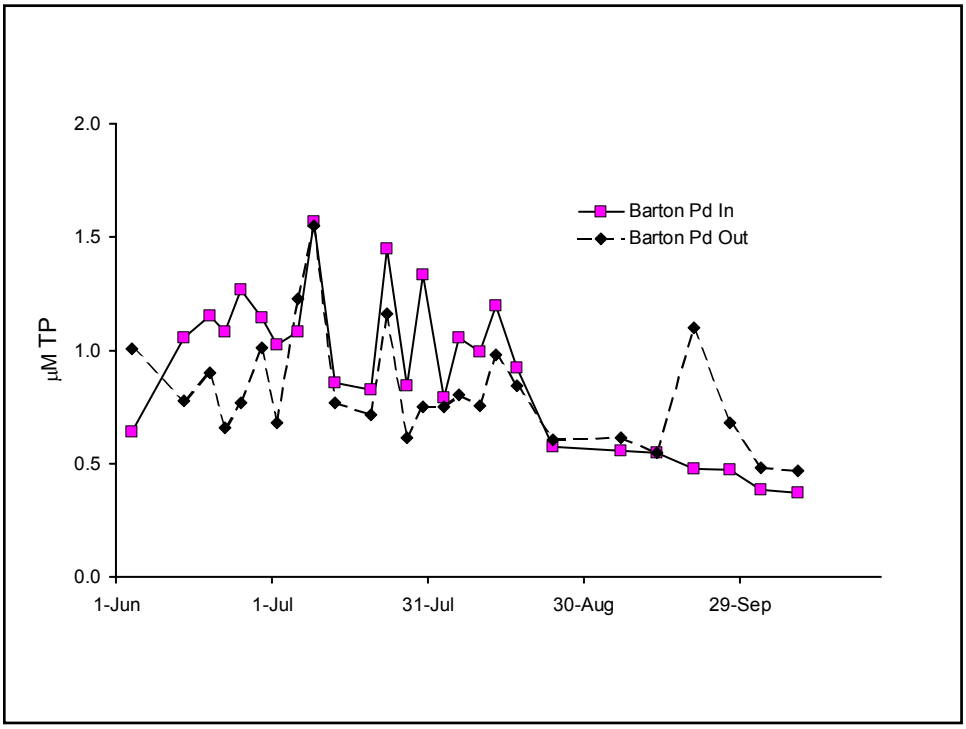

Belleville Lk at Belleville Rd
µM N
250
200
150
100
50
0
TN
DN
NO3
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep

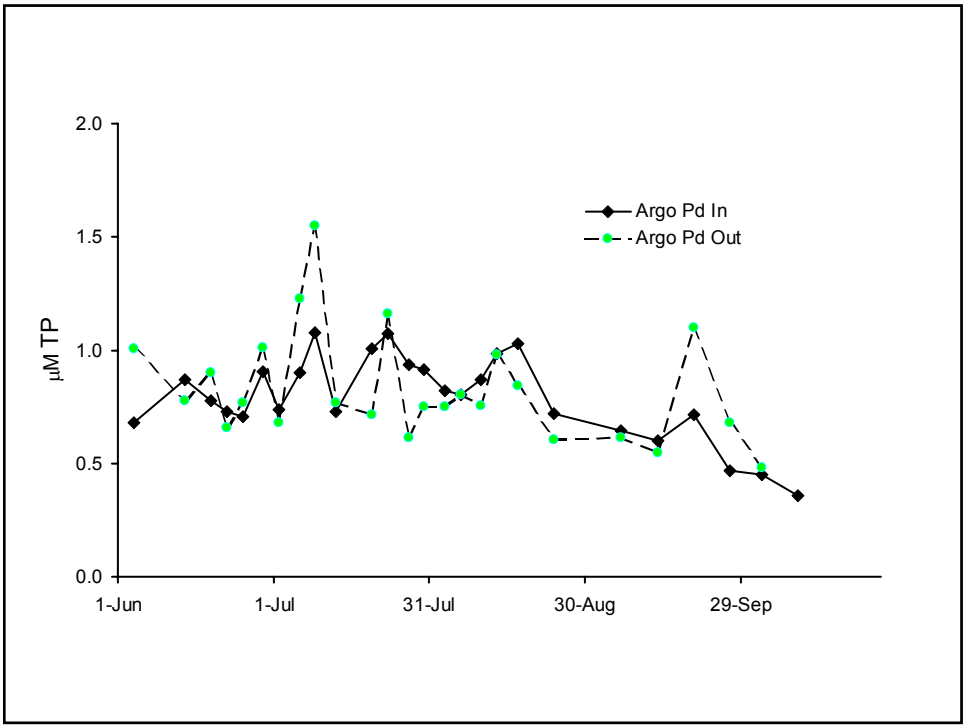


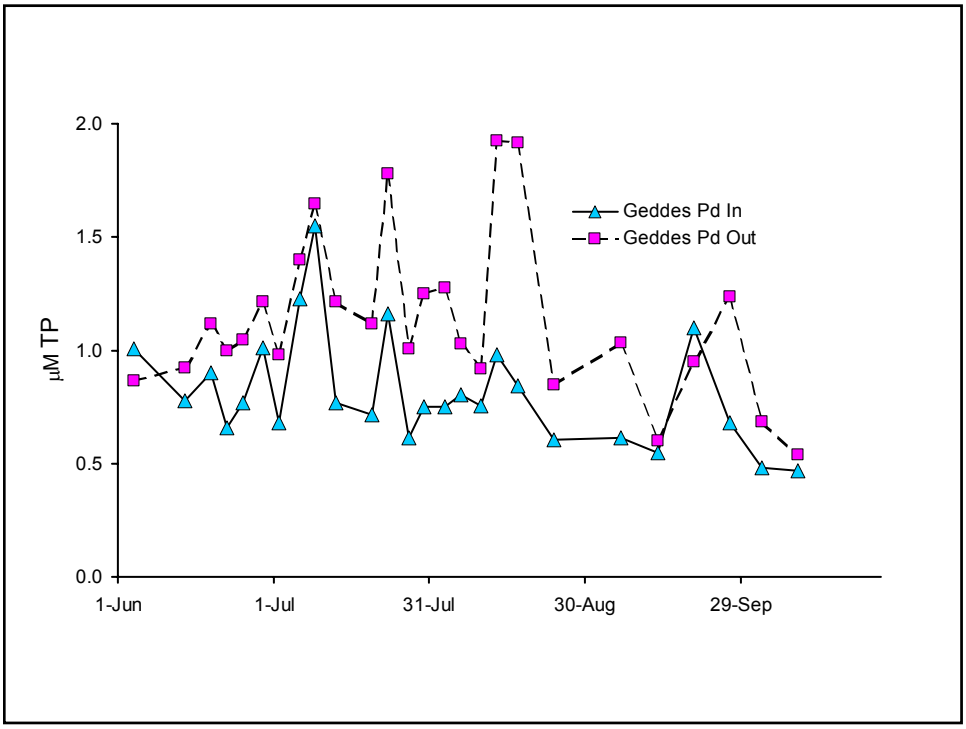
Nutrient Economy by River Segment

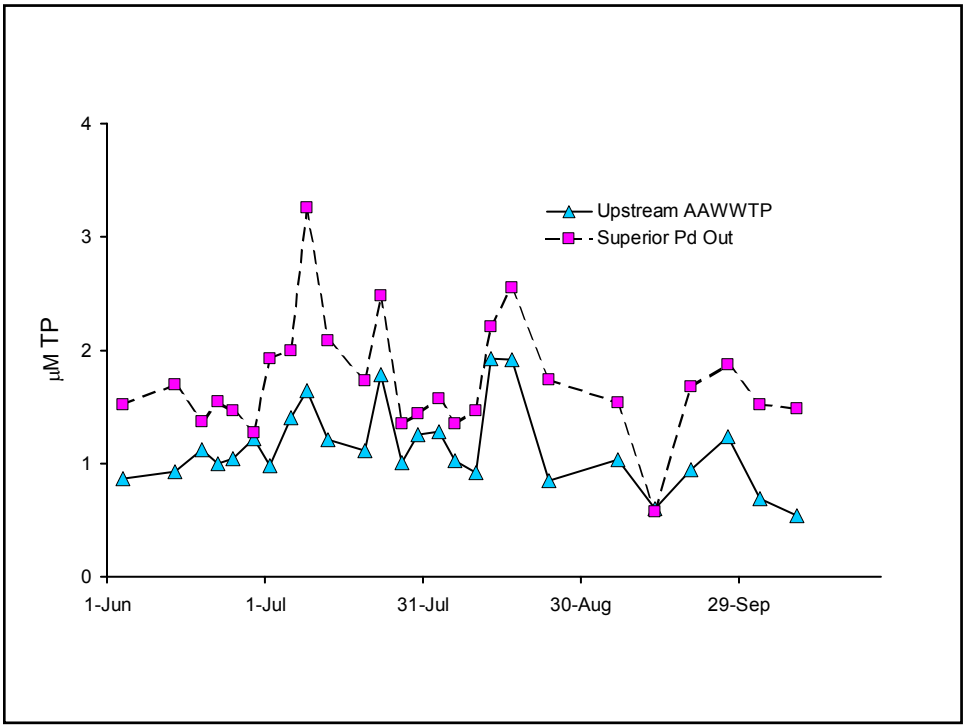
Input-Output Analysis

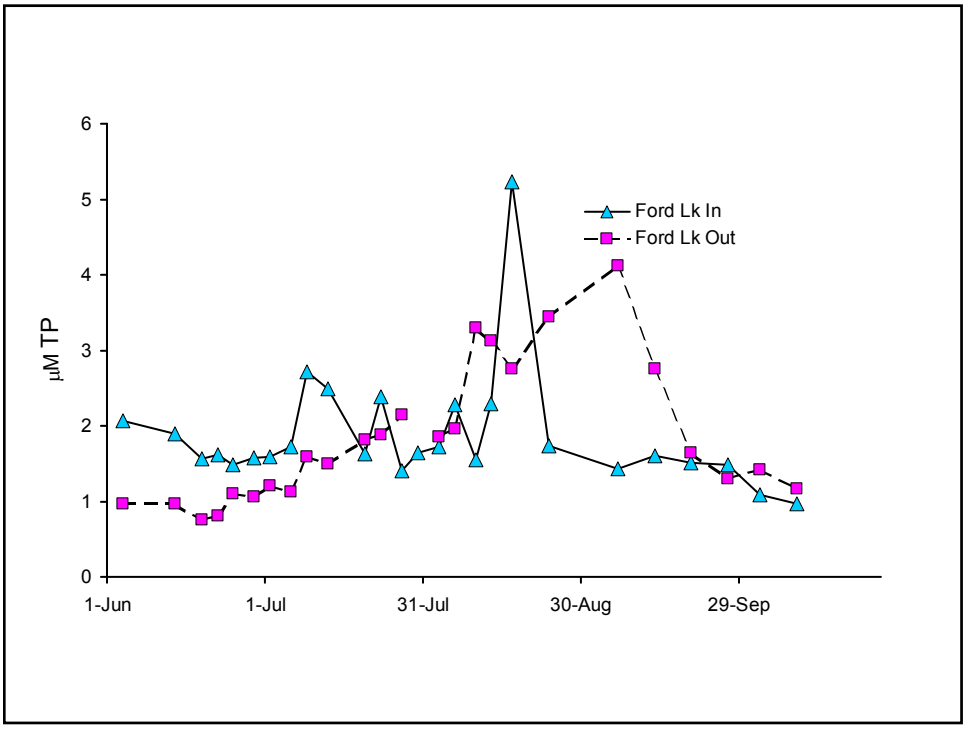

2.0
1.5
1.0
0.5
0.0
µM TP
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
Zeeb Rd
N. Delhi Rd

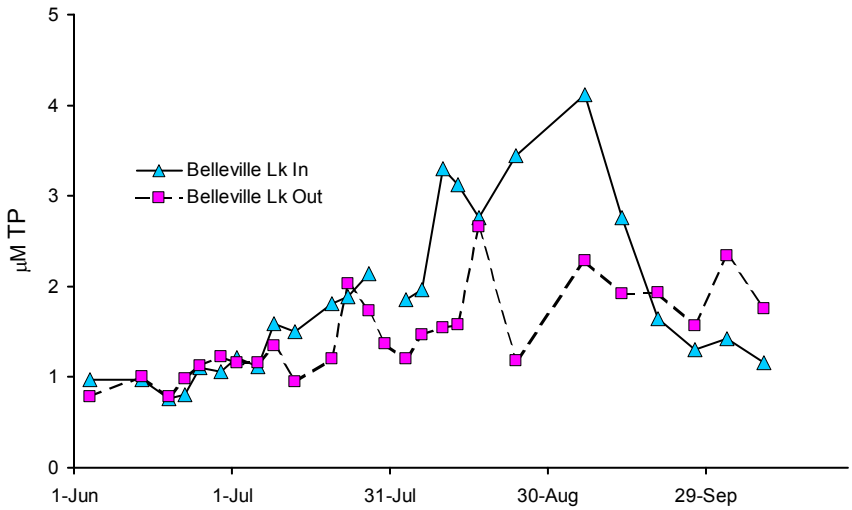

2.0
1.5
1.0
0.5
0.0
µM TP
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
Barton Pd In
Barton Pd Out


2.0
1.5
1.0
0.5
0.0
µM TP
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
Argo Pd In
Argo Pd Out


2.0
1.5
1.0
0.5
0.0
µM TP
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
Geddes Pd In
Geddes Pd Out


µM TP
4
3
2
1
0
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
Upstream AAWWTP
Superior Pd Out

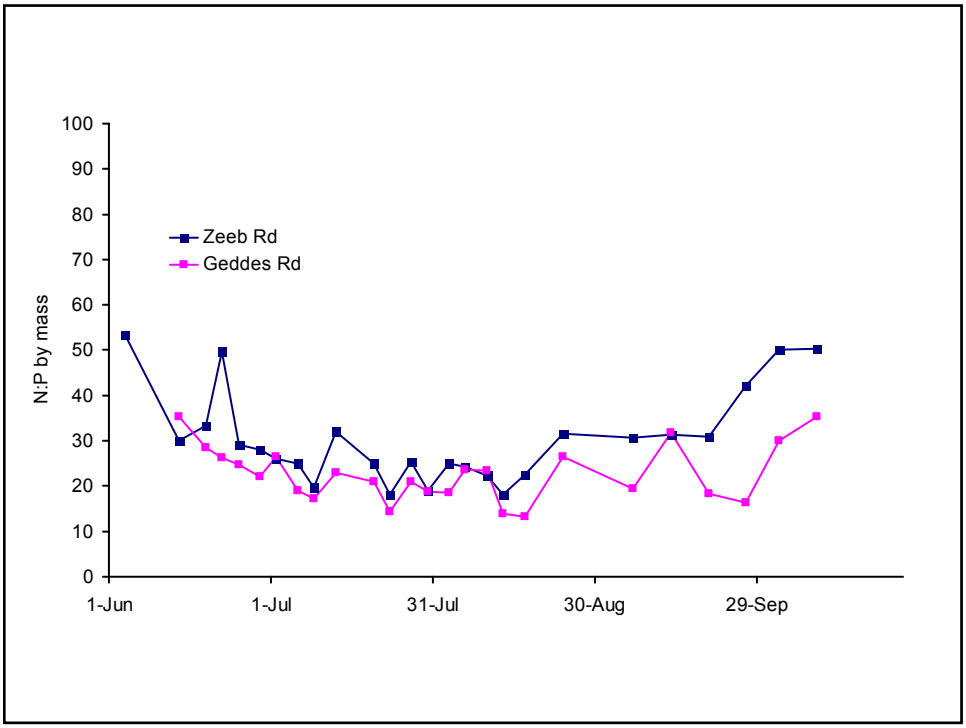

µM TP
6
5
4
3
2
1
0
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
Ford Lk In
Ford Lk Out

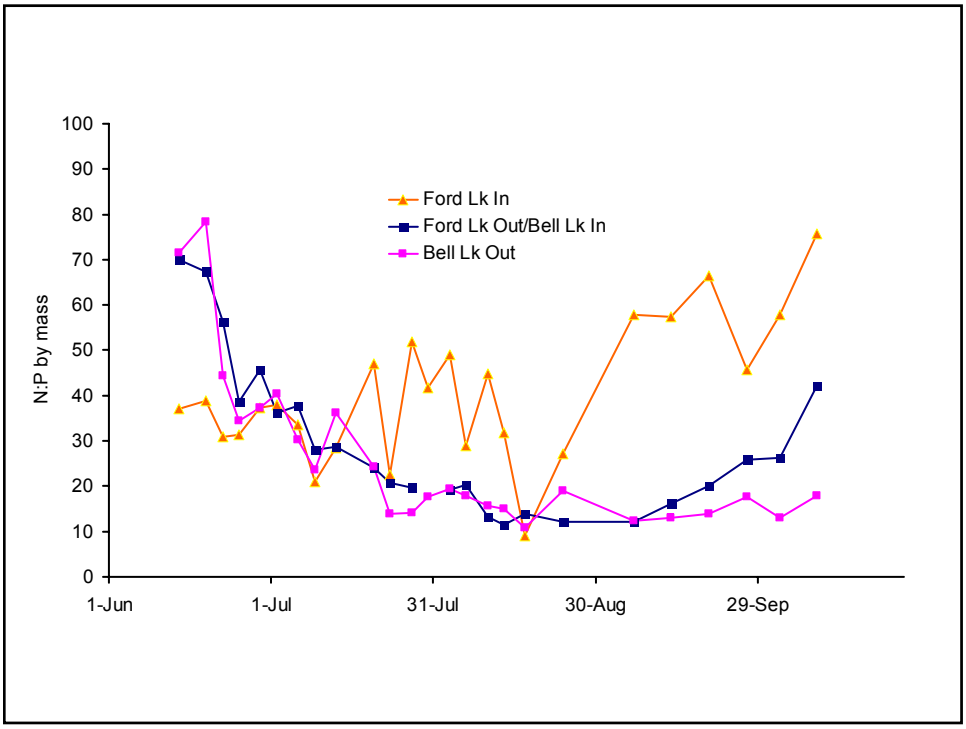


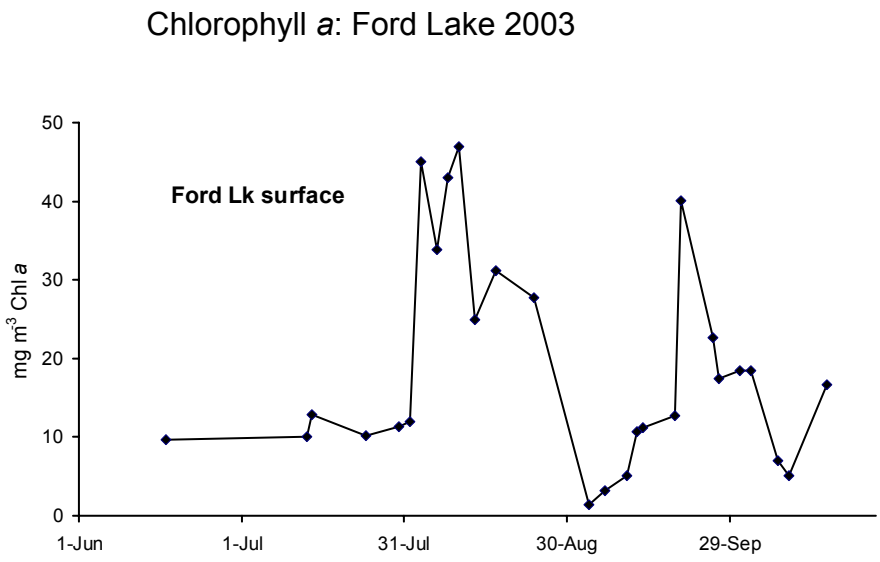
TN:TP ratios

Critical value for bluegreen blooms

30 by mass


100
90
80
70
60
50
40
30
20
10
0
N:P by mass
Zeeb Rd
Geddes Rd
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep


100
90
80
70
60
50
40
30
20
10
0
N:P by mass
Ford Lk In
Ford Lk Out/Bell Lk In
Bell Lk Out
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep



Thermister Array for Ford Lake, 2003

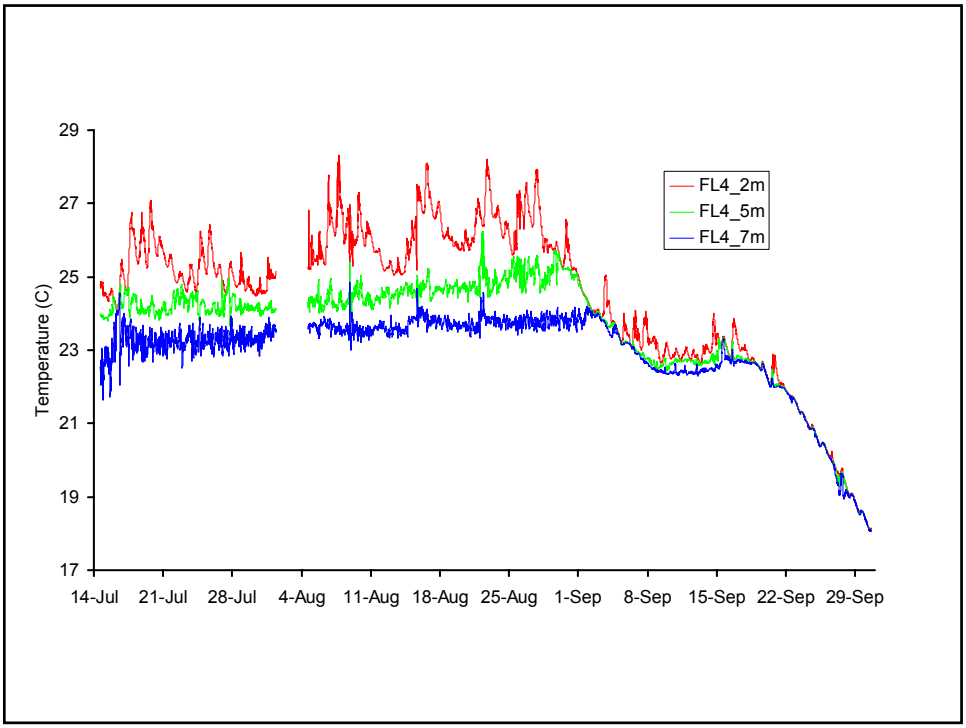
Shackle to buoy

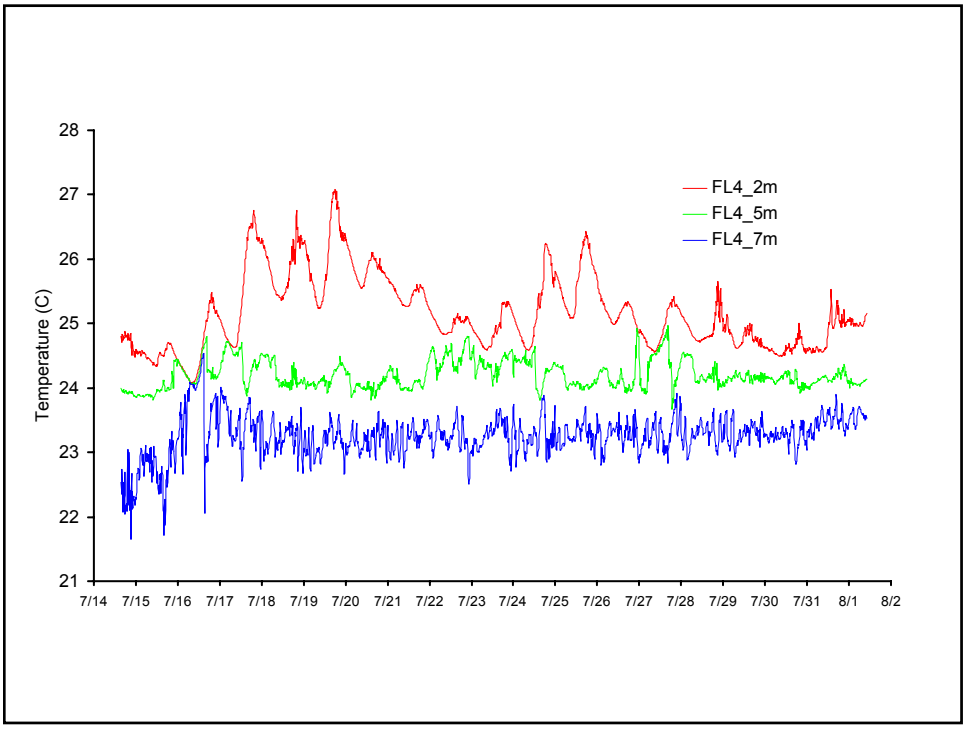
2 m

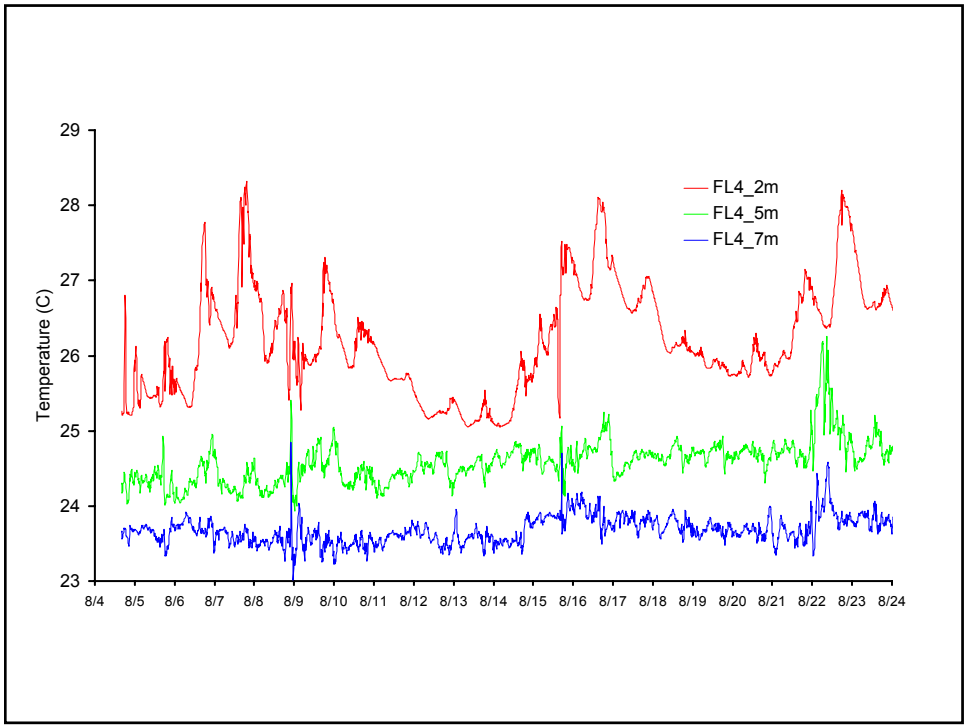
5 m

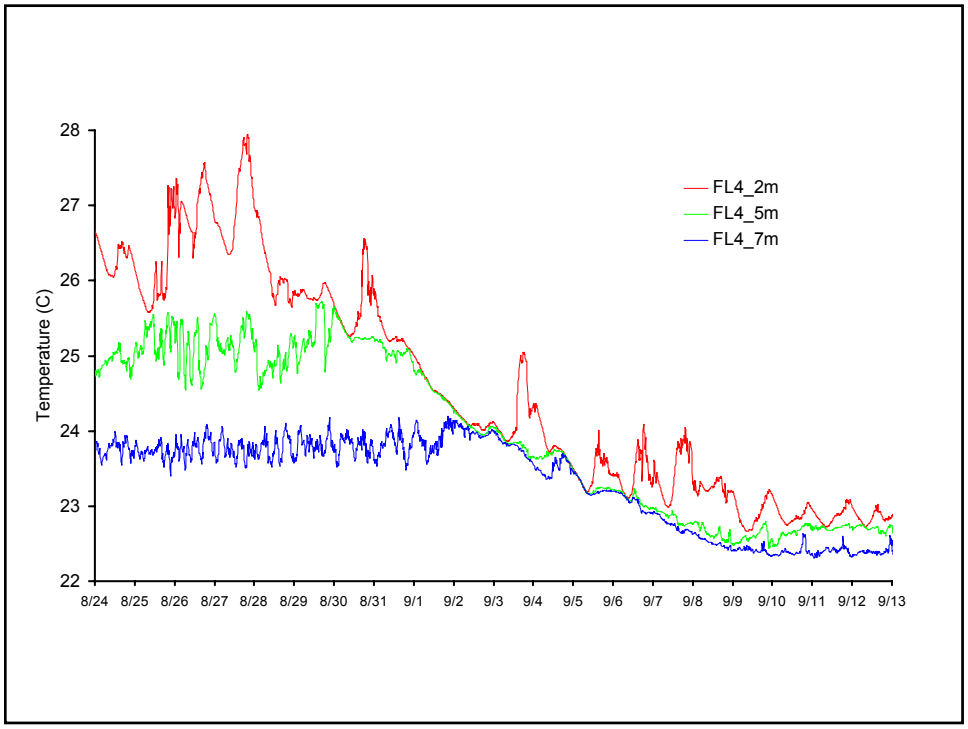
7 m

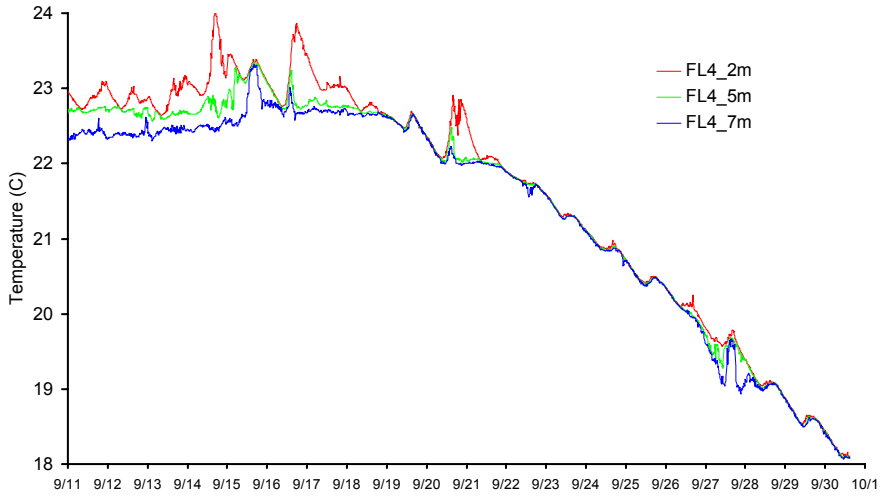
Anchor chain

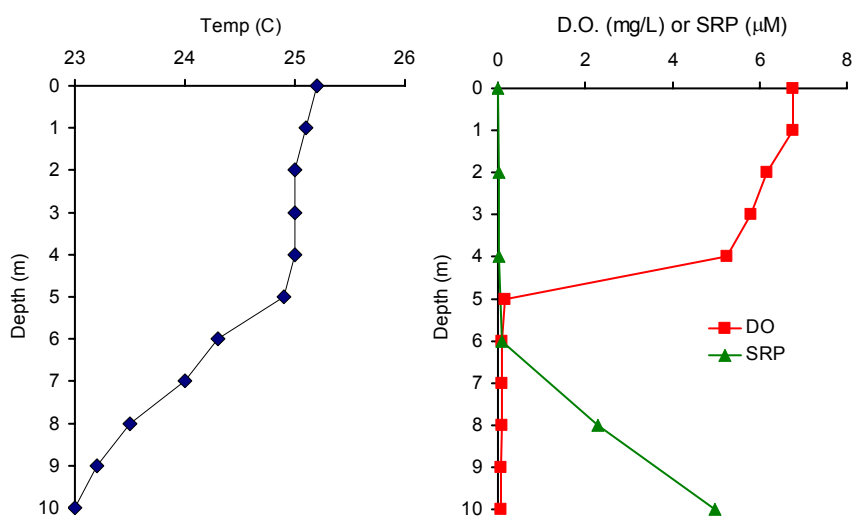

29
27
25
23
21
19
17
Temperature (C)
14-Jul
21-Jul
28-Jul
4-Aug
11-Aug
18-Aug
25-Aug
1-Sep
8-Sep
15-Sep
22-Sep
29-Sep
FL4_2m
FL4_5m
FL4_7m

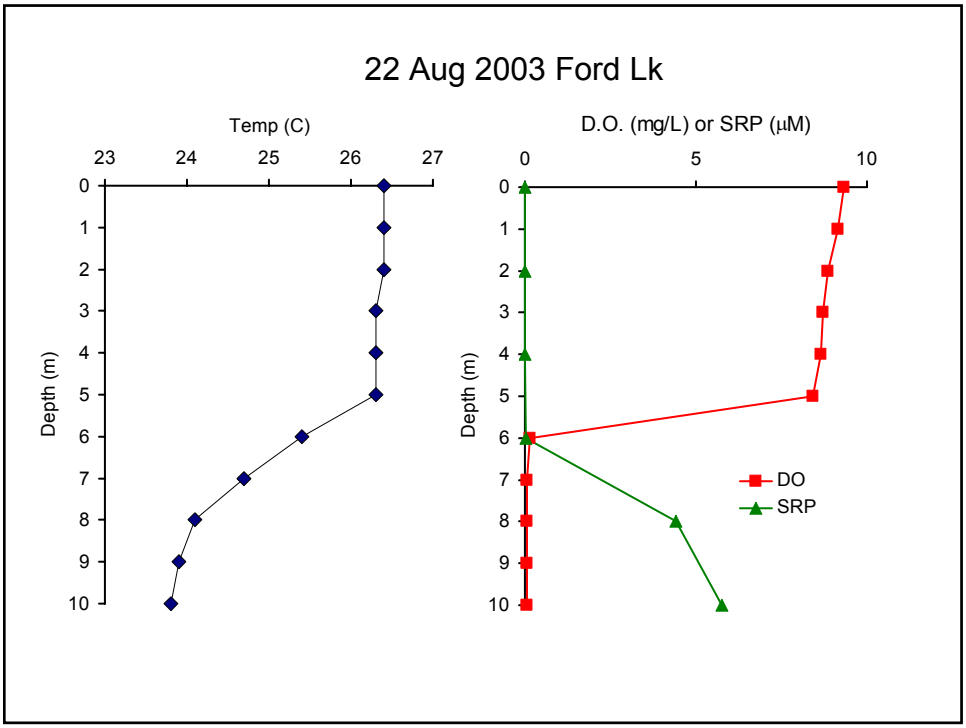

28
27
26
25
24
23
22
21
Temperature (C)
7/14
7/15
7/16
7/17
7/18
7/19
7/20
7/21
7/22
7/23
7/24
7/25
7/26
7/27
7/28
7/29
7/30
7/31
8/1
8/2
FL4_2m
FL4_5m
FL4_7m

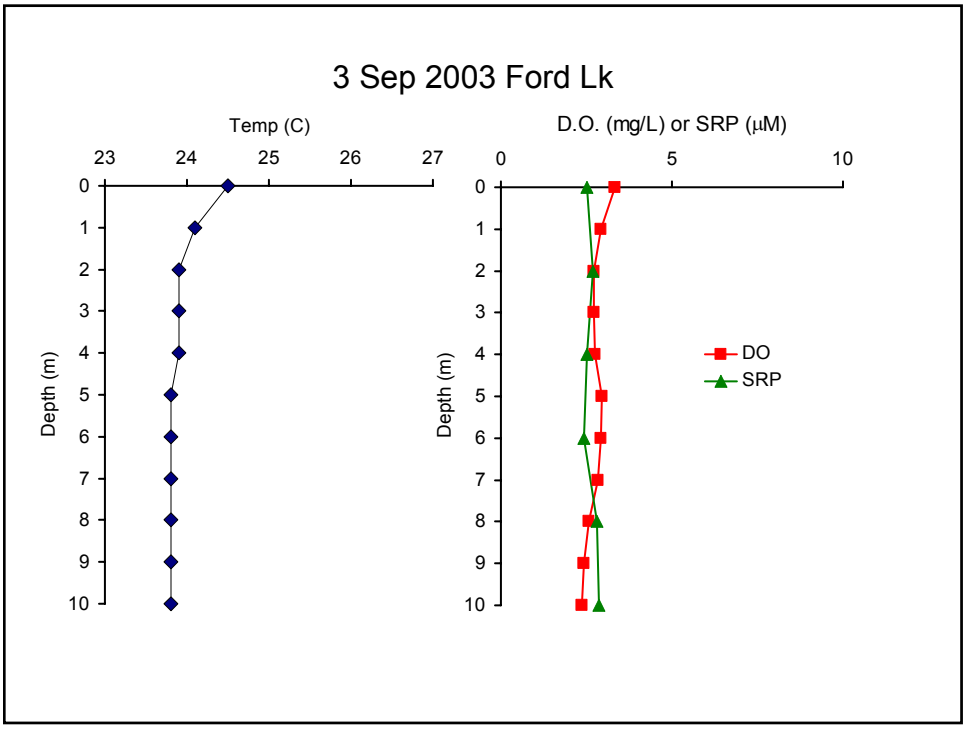

Temperature (C)
29
28
27
26
25
24
23
8/4
8/5
8/6
8/7
8/8
8/9
8/10
8/11
8/12
8/13
8/14
8/15
8/16
8/17
8/18
8/19
8/20
8/21
8/22
8/23
8/24
FL4_2m
FL4_5m
FL4_7m

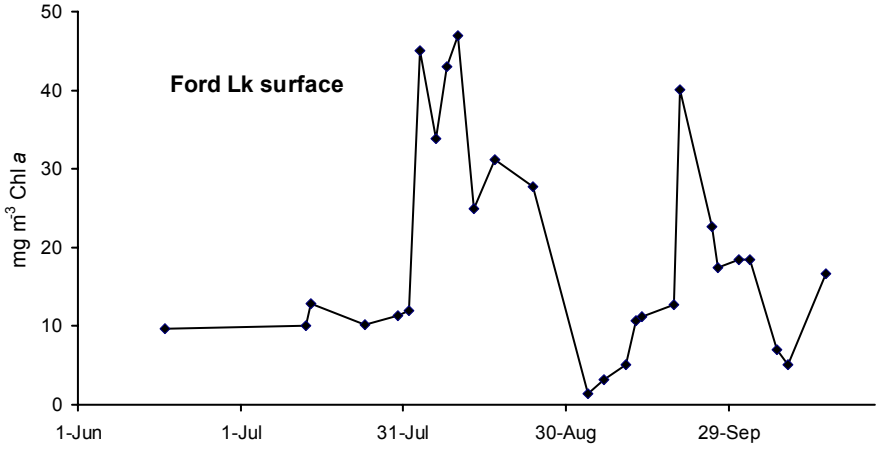

Temperature (C)
28
27
26
25
24
23
22
8/24
8/25
8/26
8/27
8/28
8/29
8/30
8/31
9/1
9/2
9/3
9/4
9/5
9/6
9/7
9/8
9/9
9/10
9/11
9/12
9/13
FL4_2m
FL4_5m
FL4_7m

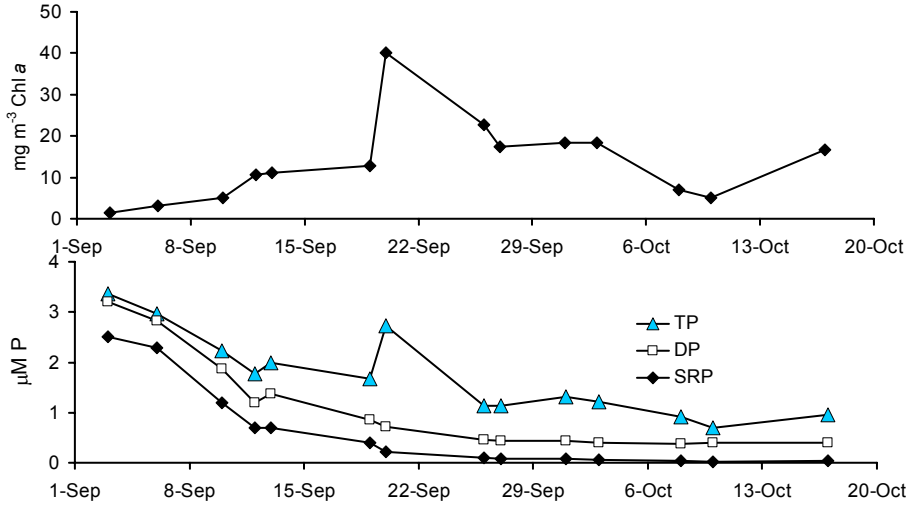

Temperature (C)
24
23
22
21
20
19
18
9/11
9/12
9/13
9/14
9/15
9/16
9/17
9/18
9/19
9/20
9/21
9/22
9/23
9/24
9/25
9/26
9/27
9/28
9/29
9/30
10/1
FL4_2m
FL4_5m
FL4_7m

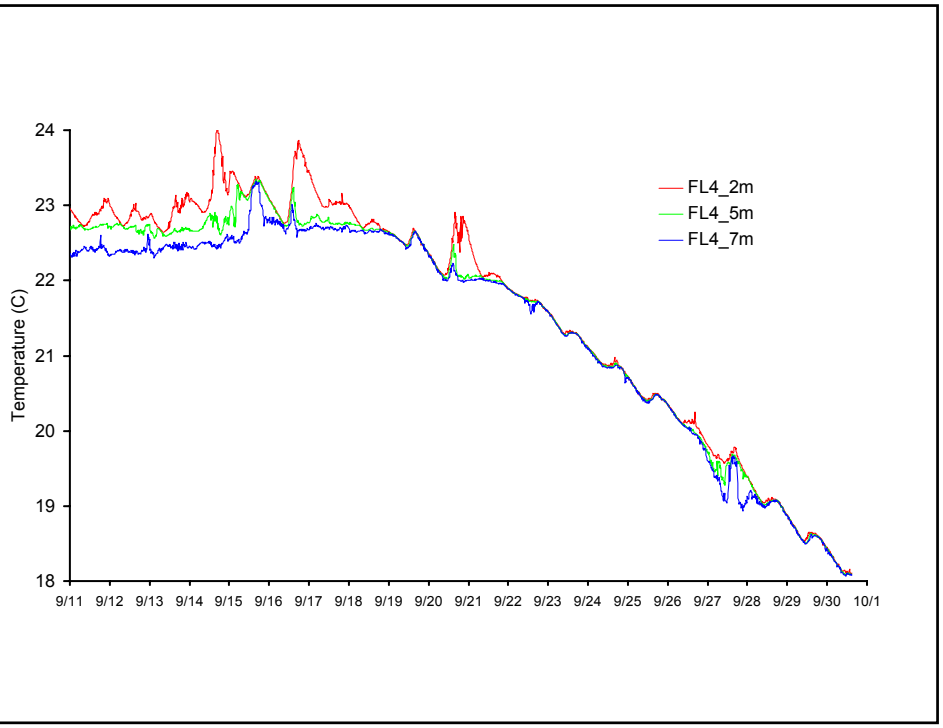

13 Aug 2003 Ford Lk
Temp (C)
23
24
25
26
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
D.O. (mg/L) or SRP (µM)
0
2
4
6
8
DO
SRP

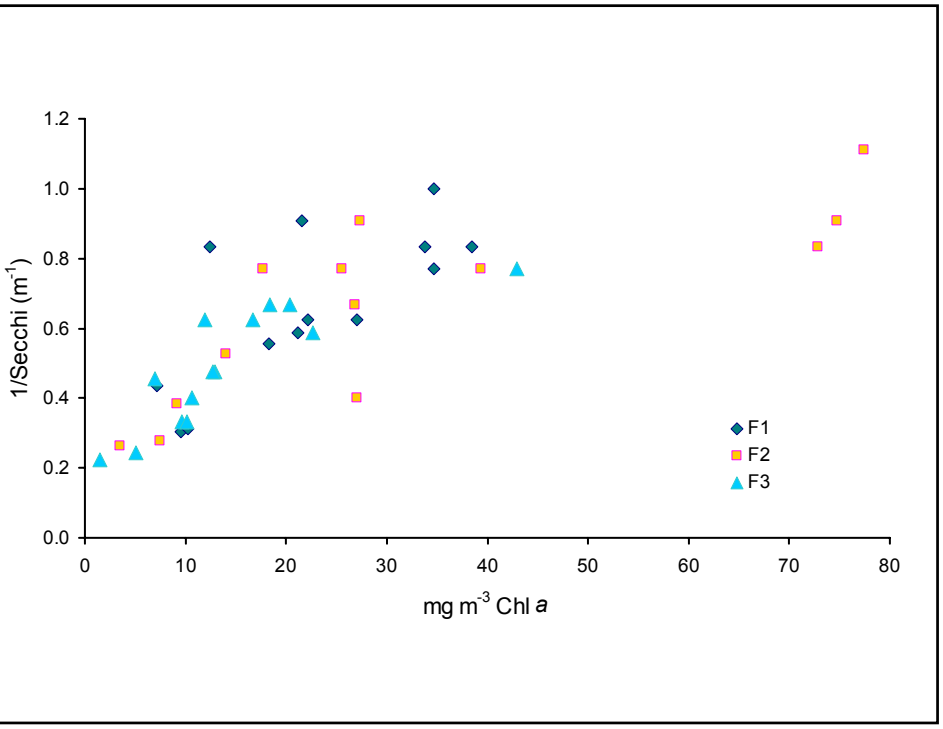

22 Aug 2003 Ford Lk
Temp (C)
23
24
25
26
27
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
D.O. (mg/L) or SRP (µM)
0
5
10
DO
SRP

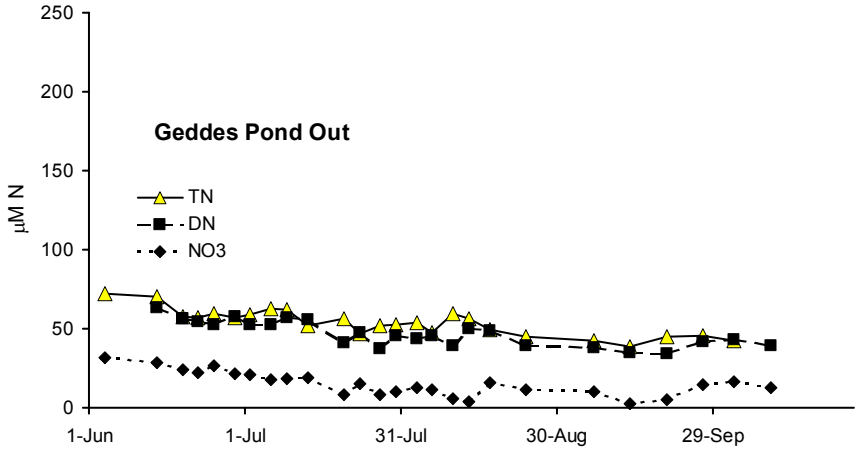

3 Sep 2003 Ford Lk
Temp (C)
23
24
25
26
27
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
D.O. (mg/L) or SRP (µM)
0
5
10
DO
SRP

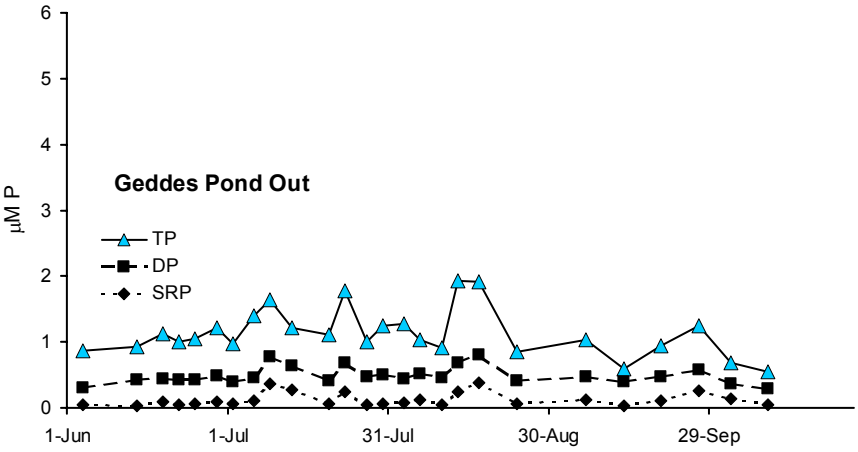

Ford Lk surface
mg m-3 Chl a
50
40
30
20
10
0
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep

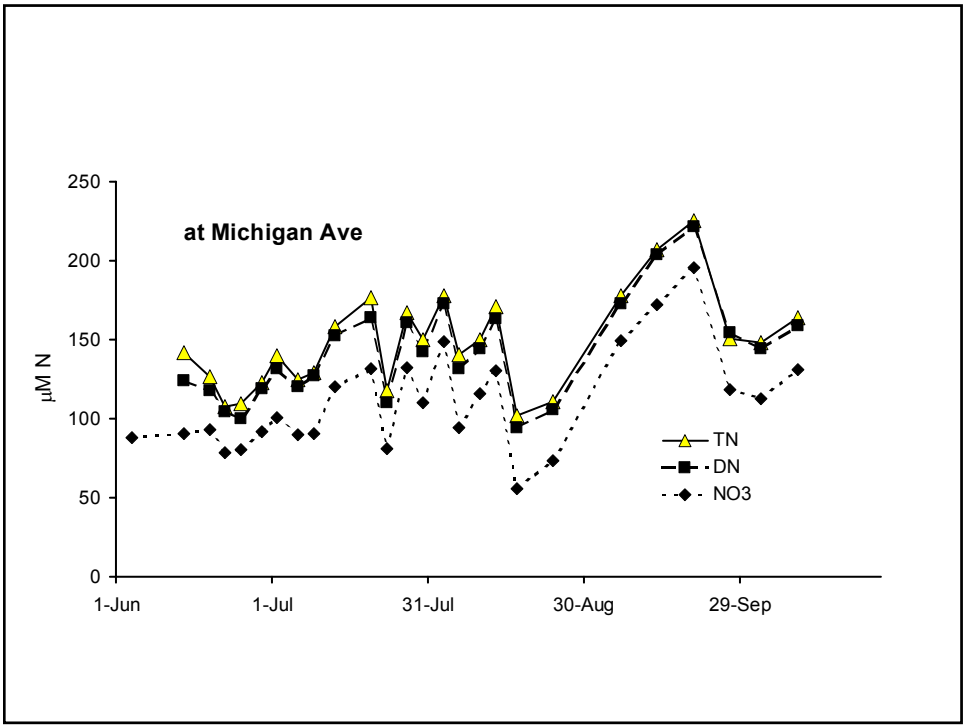

mg m-3 Chl a
50
40
30
20
10
0
1-Sep
8-Sep
15-Sep
22-Sep
29-Sep
6-Oct
13-Oct
20-Oct
µM P
4
3
2
1
0
TP
DP
SRP
1-Sep
8-Sep
15-Sep
22-Sep
29-Sep
6-Oct
13-Oct
20-Oct

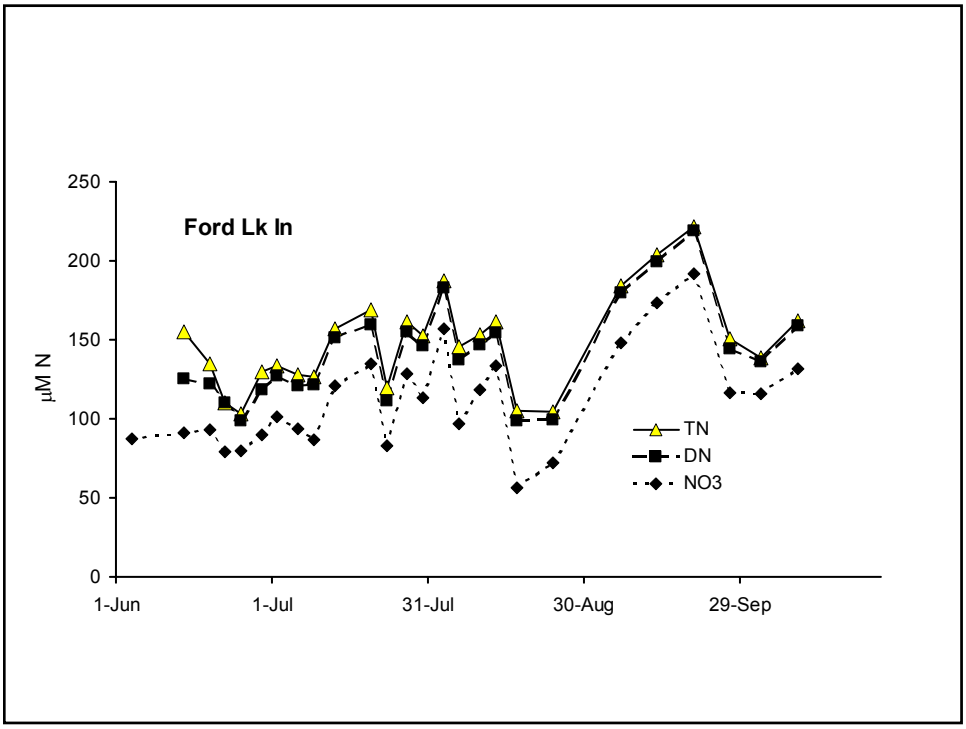

Temperature (C)
24
23
22
21
20
19
18
9/11
9/12
9/13
9/14
9/15
9/16
9/17
9/18
9/19
9/20
9/21
9/22
9/23
9/24
9/25
9/26
9/27
9/28
9/29
9/30
10/1
FL4_2m
FL4_5m
FL4_7m


1/Secchi (m-1)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
60
70
80
mg m-3 Chl a
F1
F2
F3


Geddes Pond Out
µM N
250
200
150
100
50
0
TN
DN
NO3
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep


Geddes Pond Out
µM P
6
5
4
3
2
1
0
TP
DP
SRP
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep


at Michigan Ave
µM N
250
200
150
100
50
0
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
TN
DN
NO3


Ford Lk In
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50
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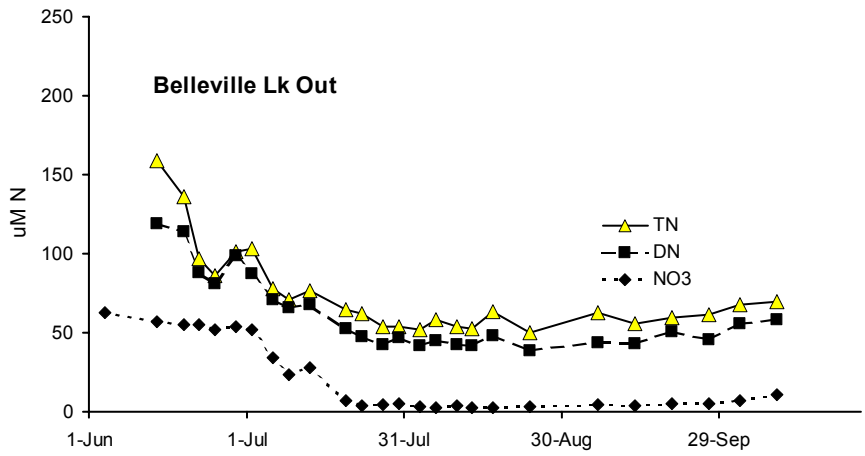
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
TN
DN
NO3


Belleville Lk Out
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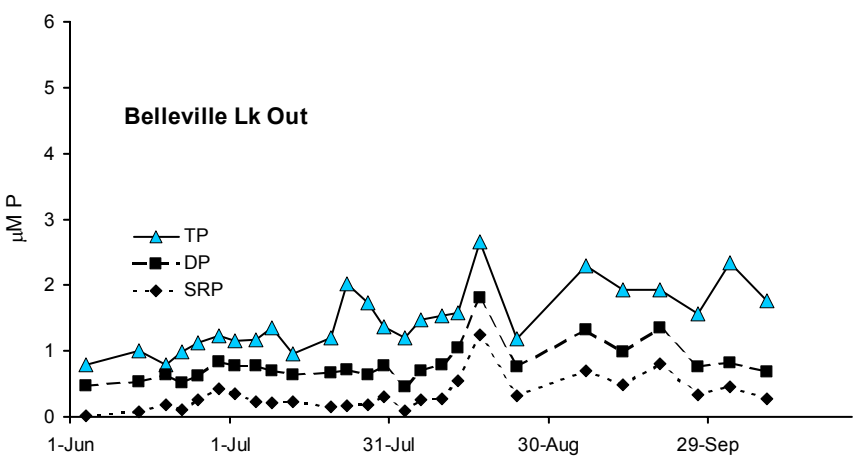
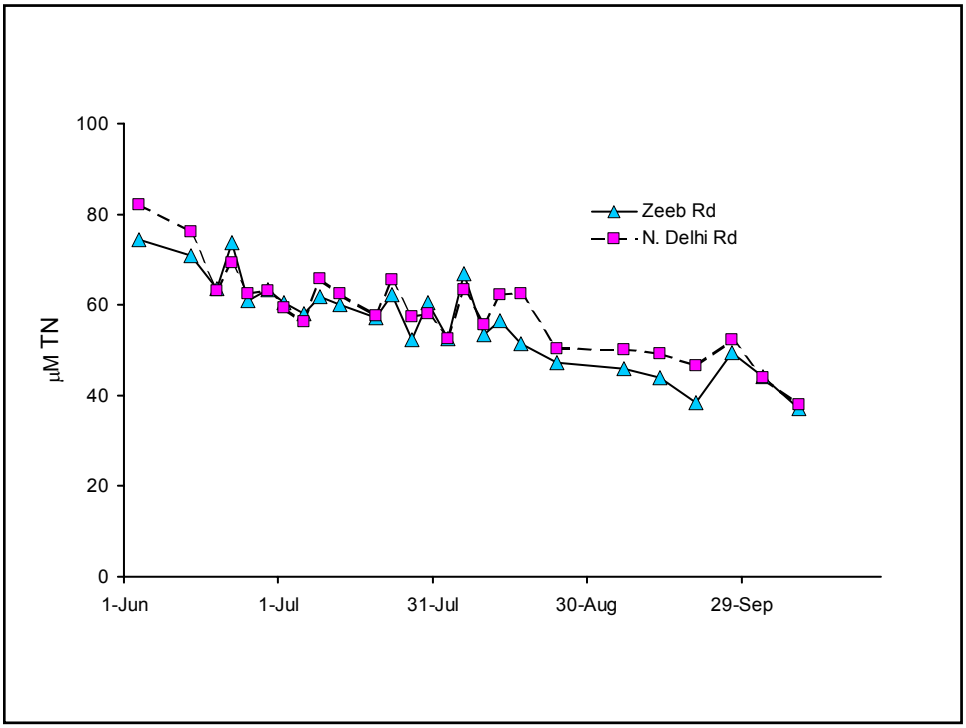
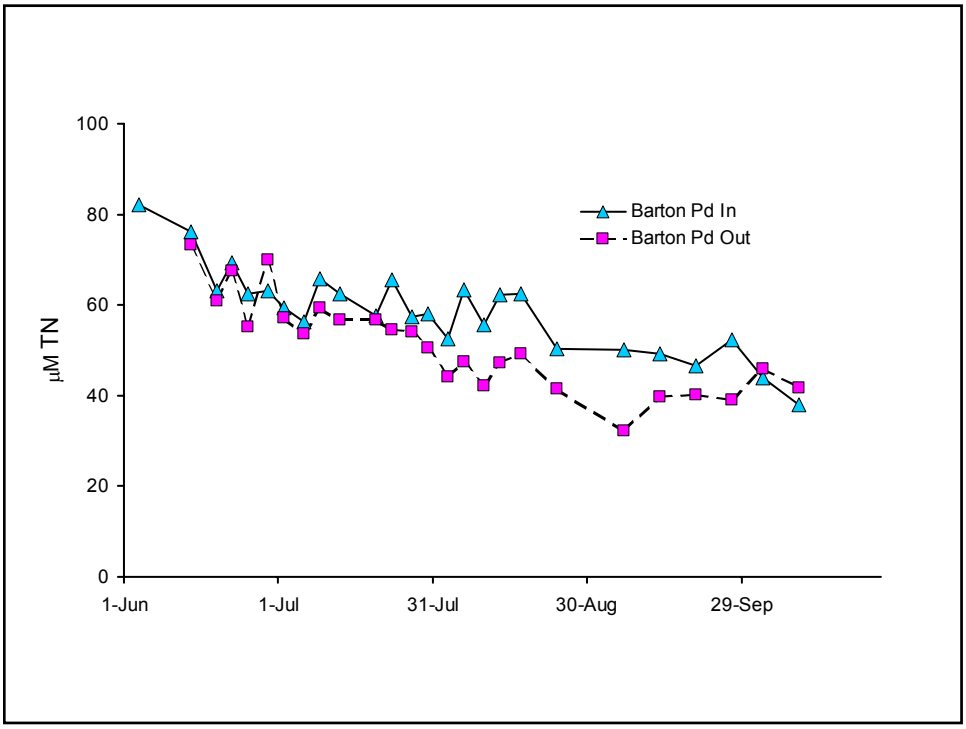
200
150
100
50
0
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
TN
DN
NO3


Belleville Lk Out
µM P
6
5
4
3
2
1
0
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
TP
DP
SRP


100
80
60
40
20
0
µM TN
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
Zeeb Rd
N. Delhi Rd


100
80
60
40
20
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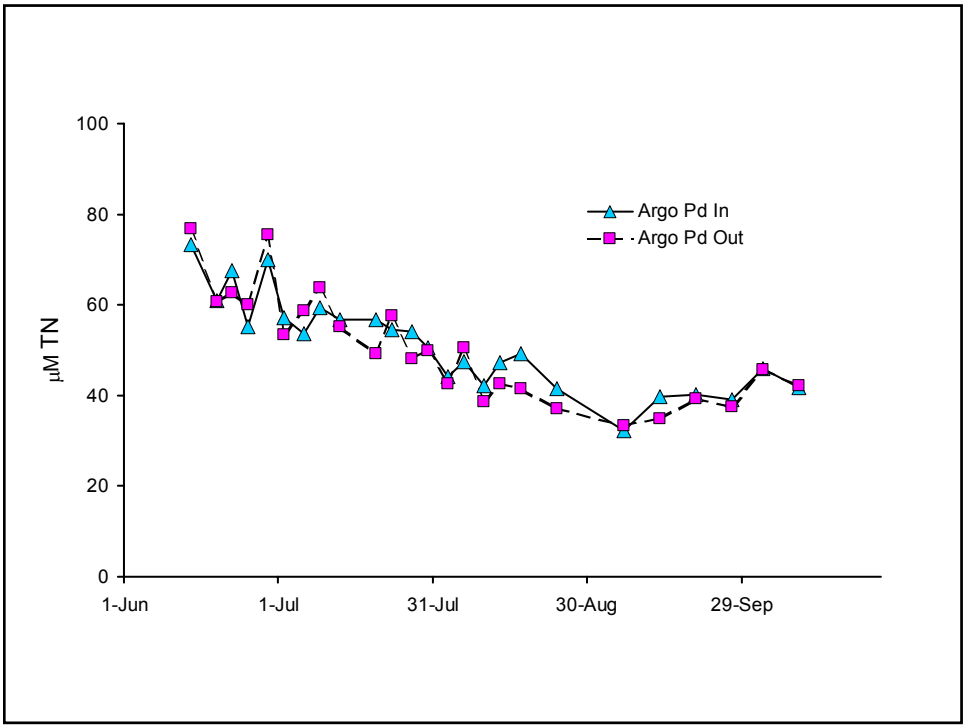
µM TN
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
Barton Pd In
Barton Pd Out


100
80
60
40
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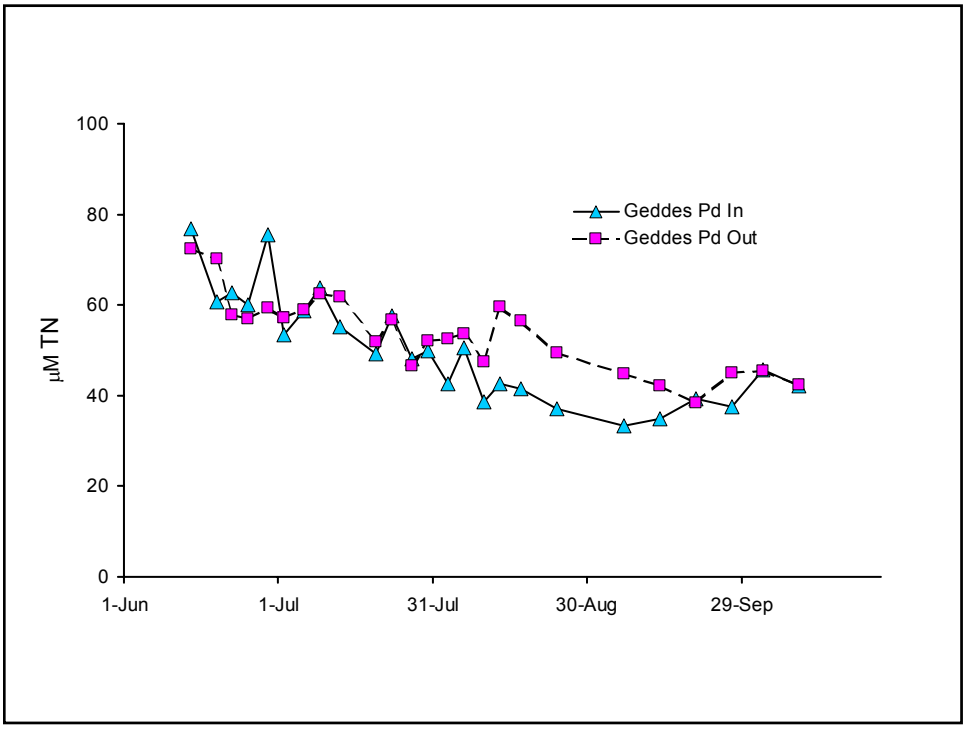
µM TN
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
Argo Pd In
Argo Pd Out


100
80
60
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20
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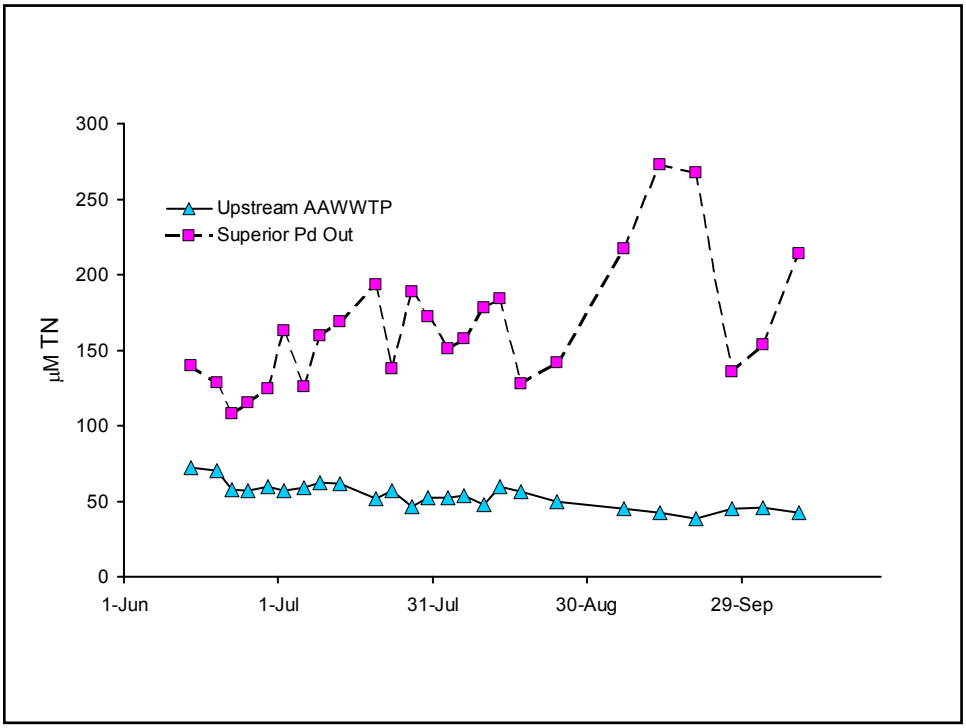
µM TN
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep
Geddes Pd In
Geddes Pd Out


300
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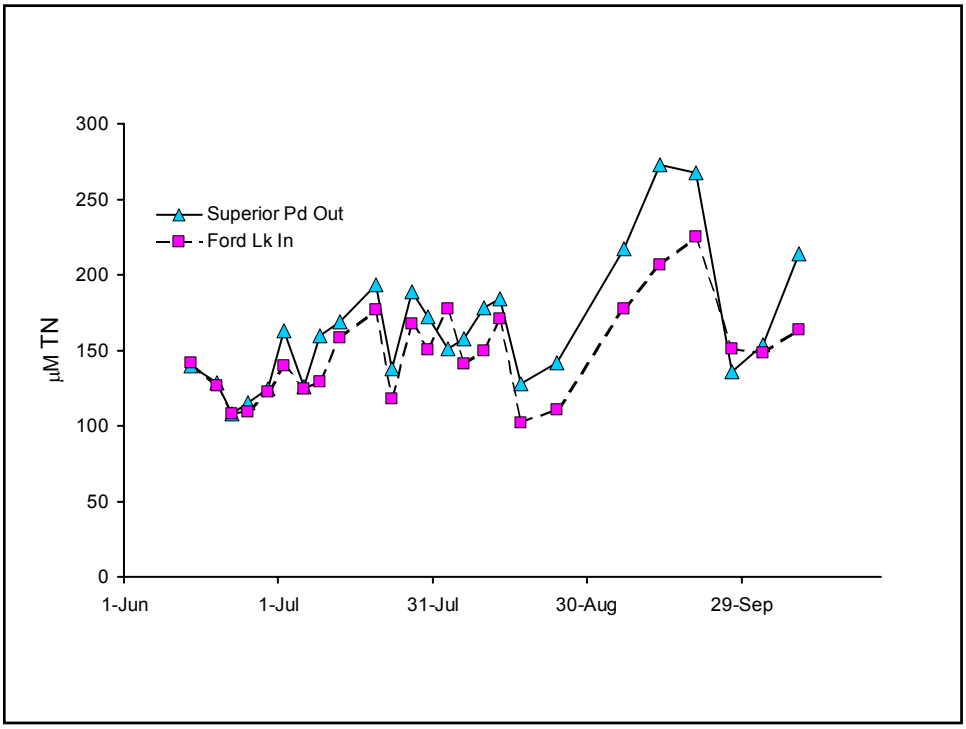
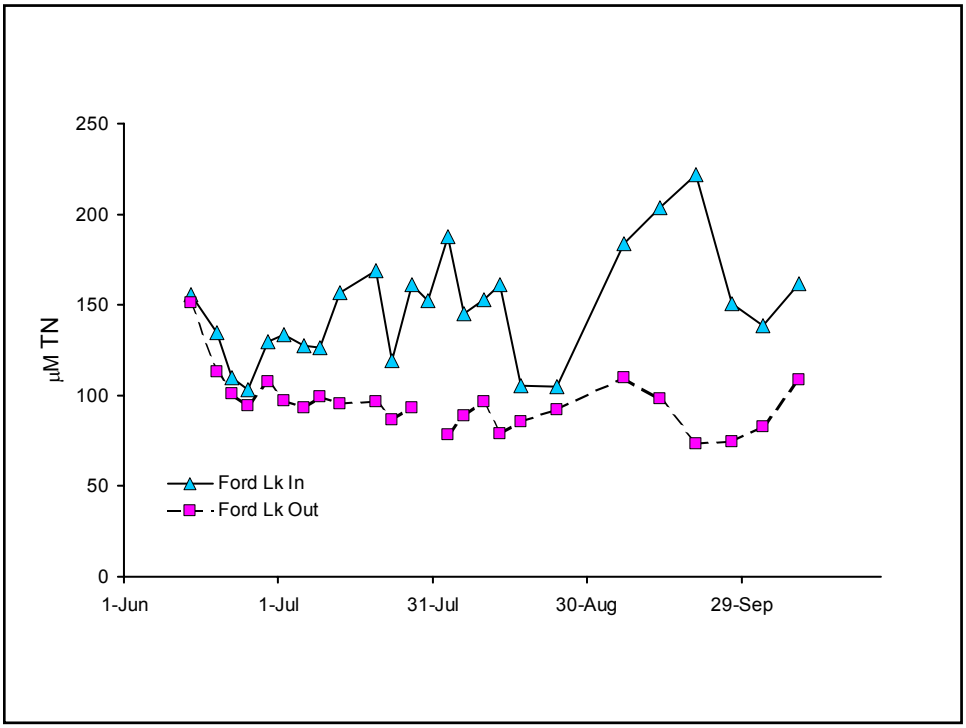
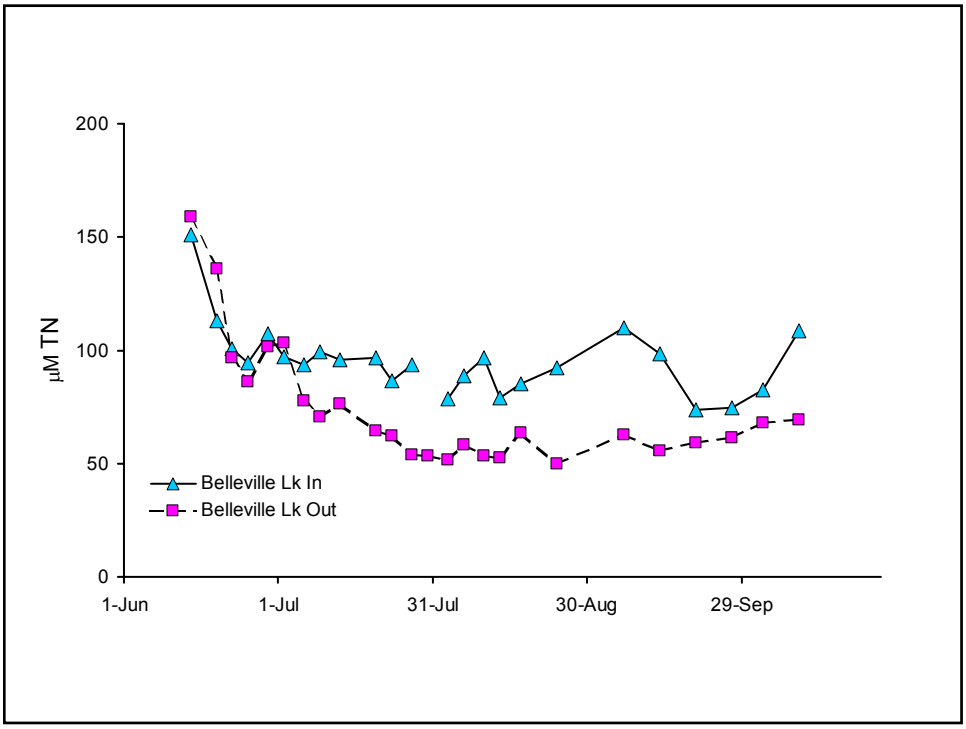
200
150
100
50
0
µM TN
Upstream AAWWTP
Superior Pd Out
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep


300
250
200
150
100
50
0
µM TN
Superior Pd Out
Ford Lk In
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep


250
200
150
100
50
0
µM TN
Ford Lk In
Ford Lk Out
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep


200
150
100
50
0
µM TN
Belleville Lk In
Belleville Lk Out
1-Jun
1-Jul
31-Jul
30-Aug
29-Sep