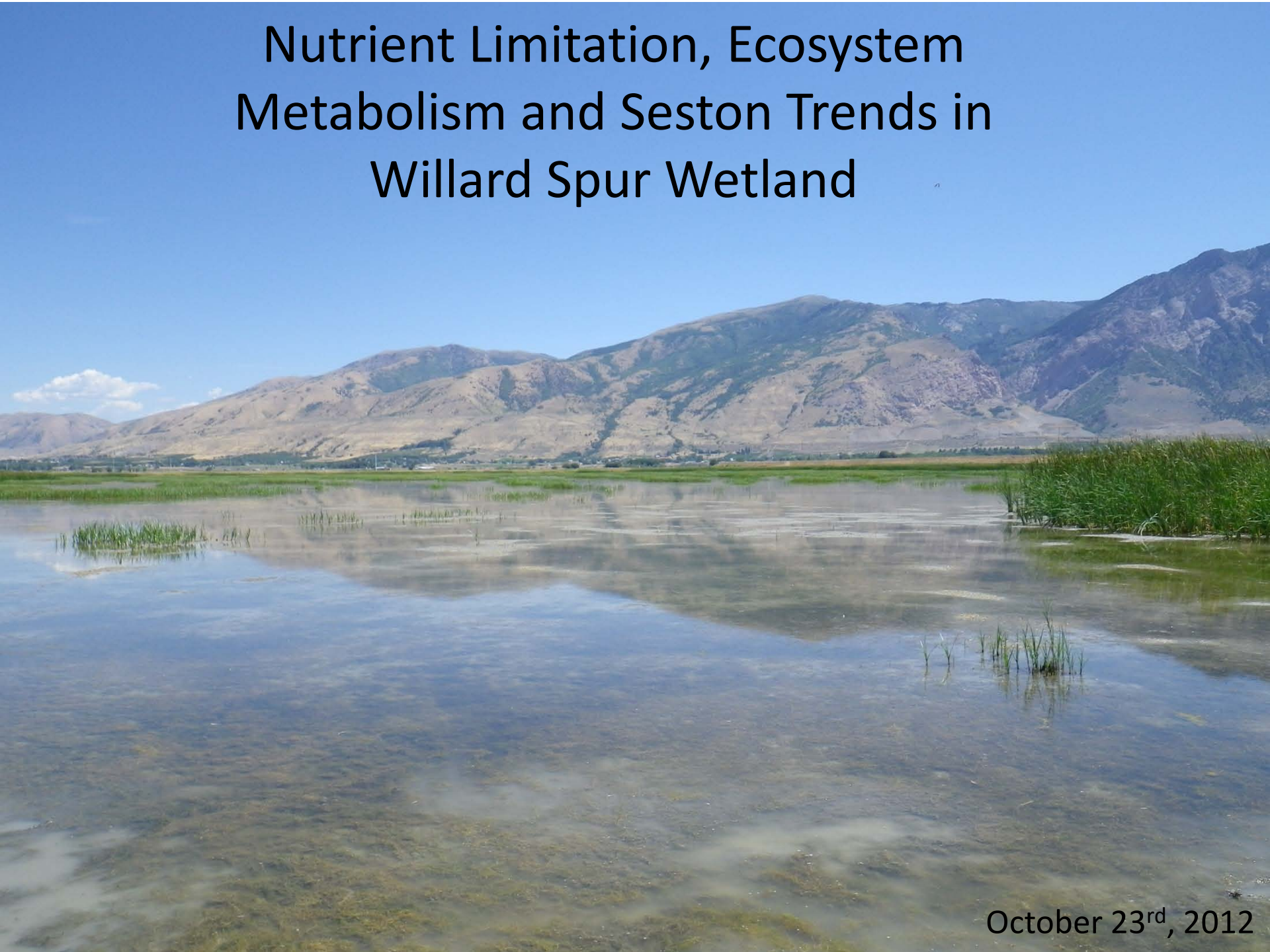
Nutrient Limitation, Ecosystem Metabolism and Seston Trends in Willard Spur Wetland

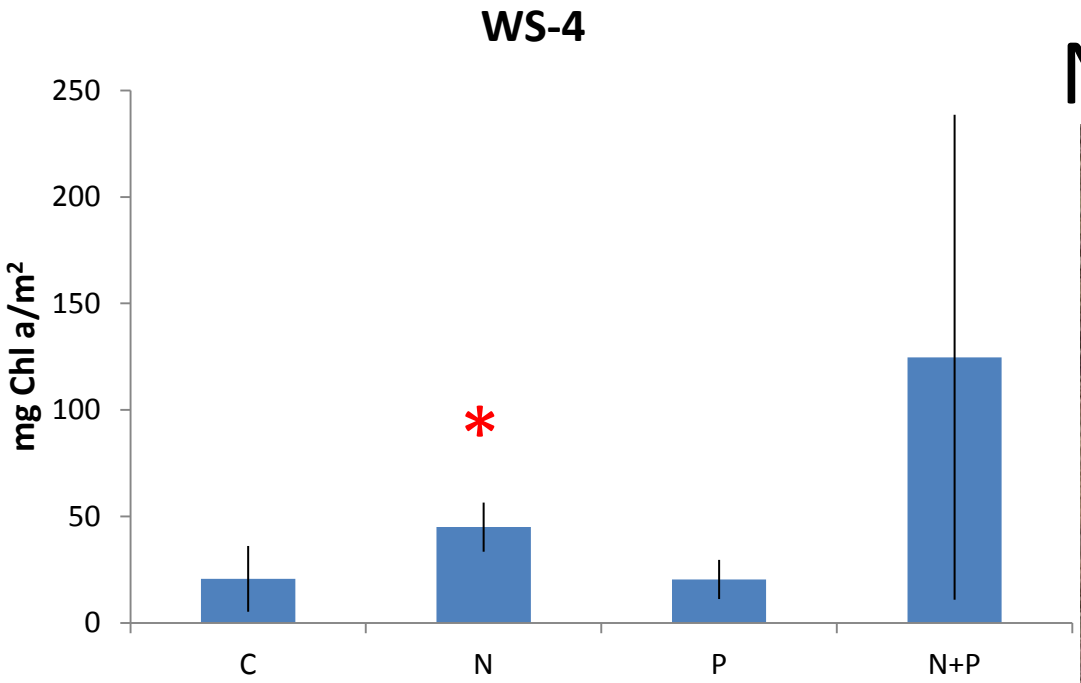


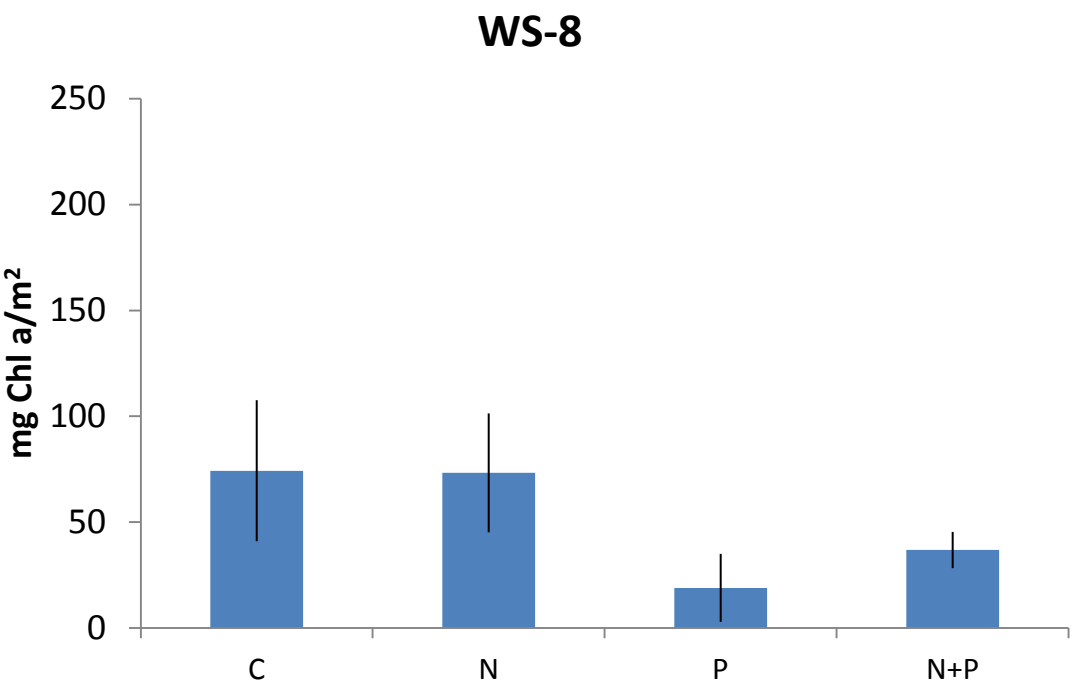
October 23rd, 2012

Nutrient Limitation

- Adding the limiting nutrient will have the greatest affect on algal growth
- Nutrient Diffusing Substrates (NDS)
- Control, N, P, & N + P
- Analyze algal growth under different nutrient additions

Nutrient Limitation





Pelagic Nutrient Limitation

<u>Treatments:</u>

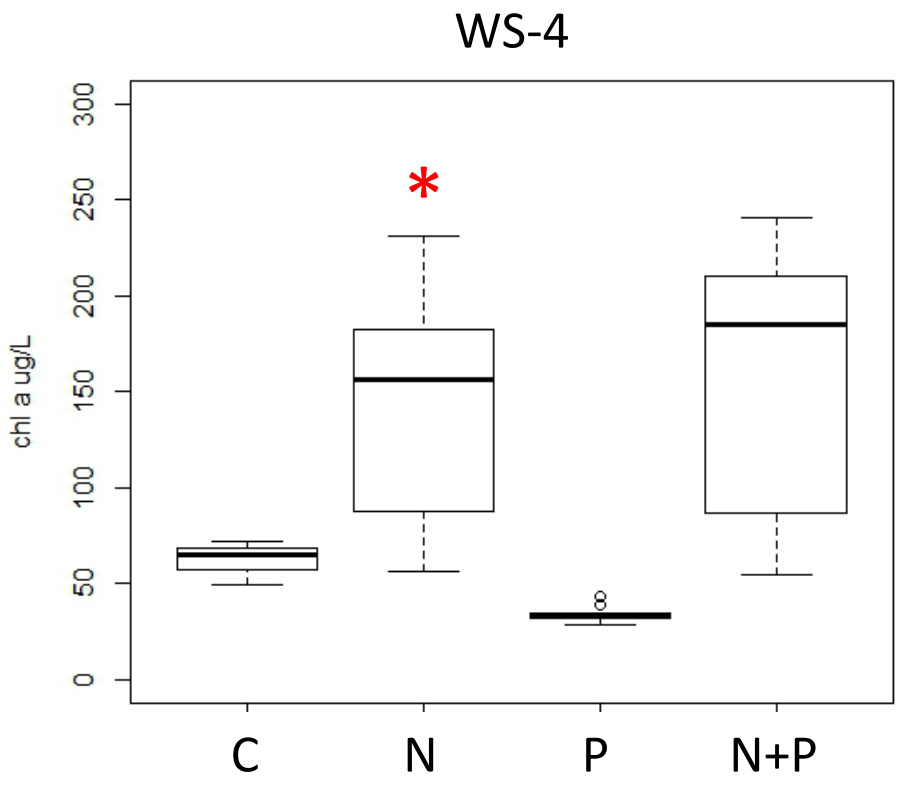
Control

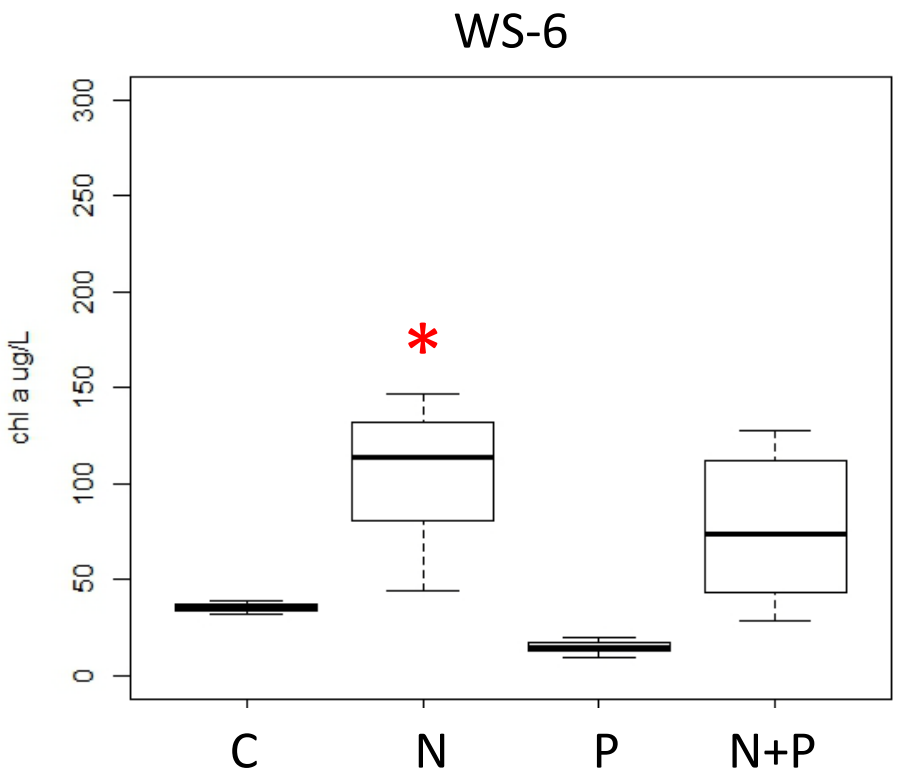
Nitrogen

Phosphorus

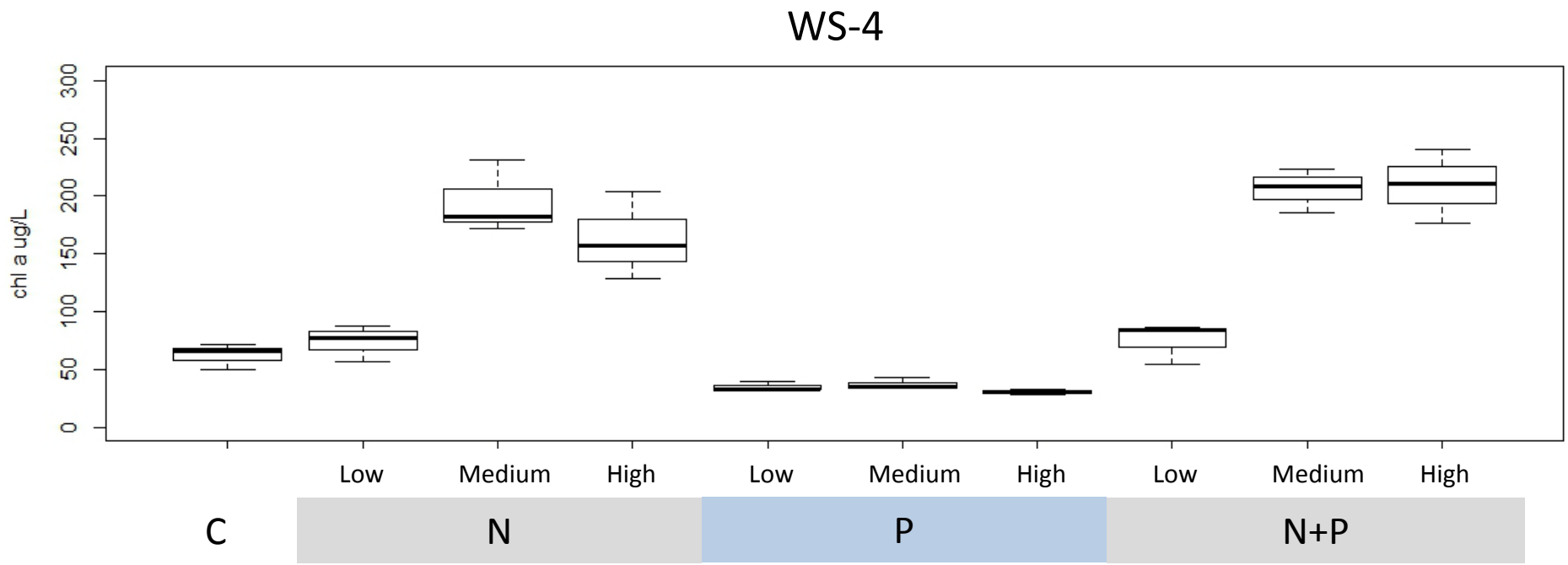
N + P

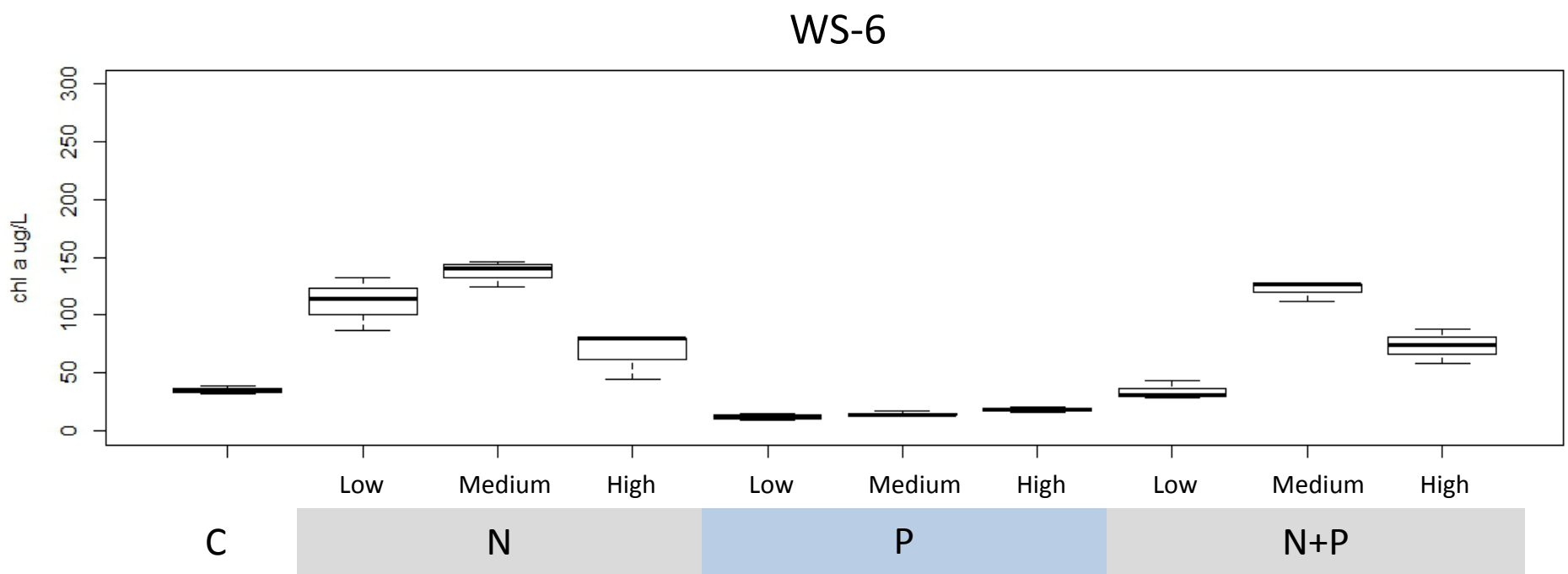
Low
Medium
High


WS-4
chl a ug/L
0
50
100
150
200
250
300
*
C
N
P
N+P


WS-6
chl a ug/L
0
50
100
150
200
250
300
*
C
N
P
N+P

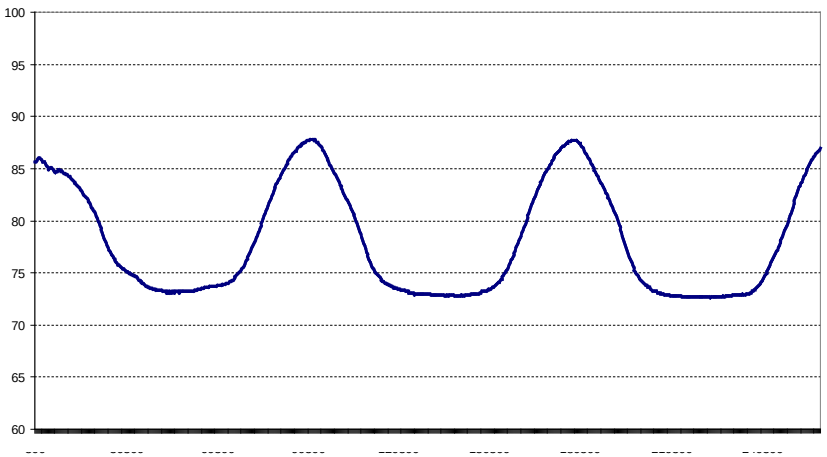
n=3, for all plots



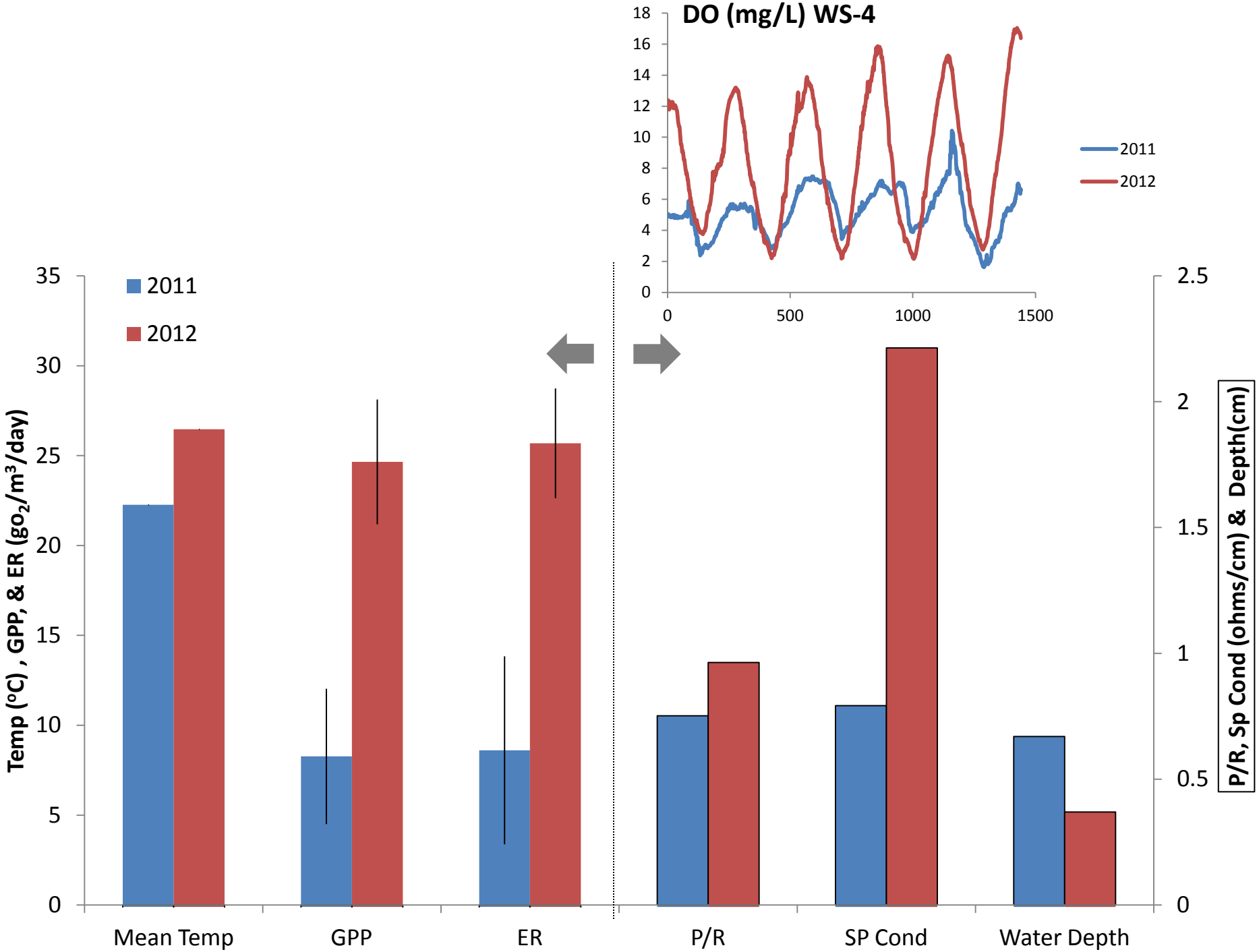


Metabolism Estimates

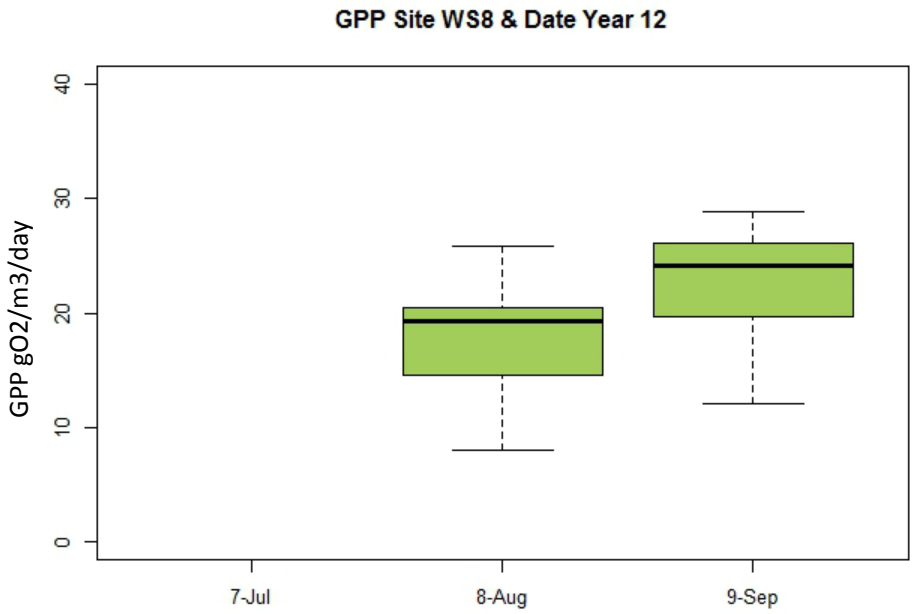
$$\Delta DO = GPP - ER \quad K$$

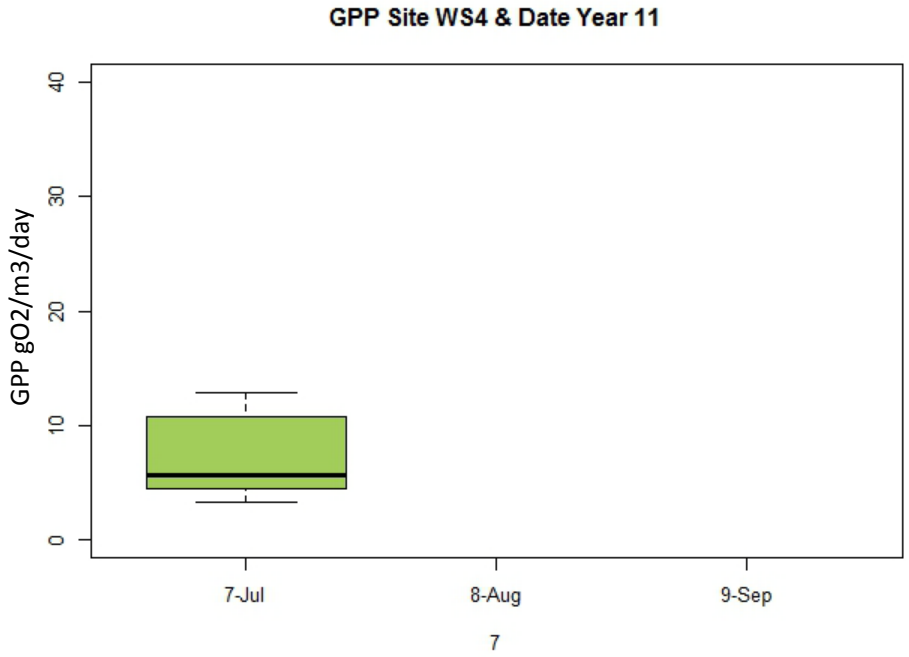


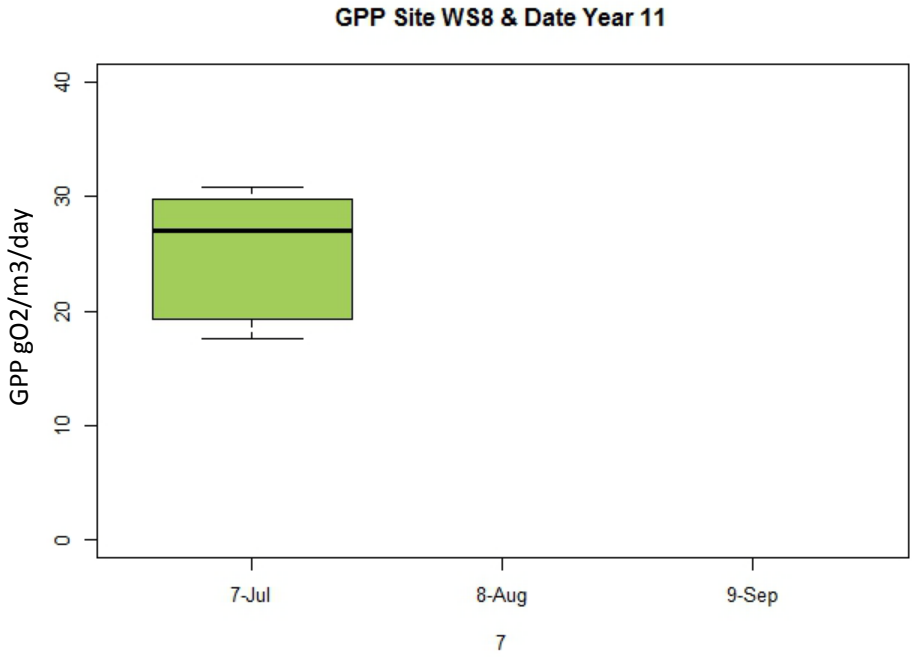
- Measures daily production & consumption of oxygen

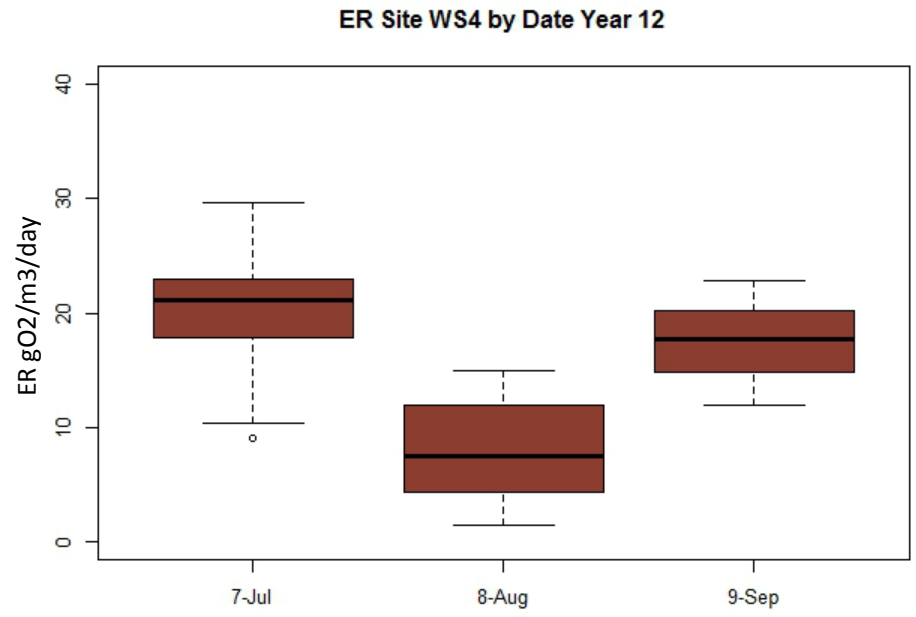

DO (mg/L) WS-4
18
16
14
12
10
8
6
4
2
0
0
500
1000
1500
2011
2012
35
30
25
20
15
10
5
0
2011
2012
Temp (°C) , GPP, & ER (go2/m3/day)
2.5
2
1.5
1
0.5
0
P/R, Sp Cond (ohms/cm) & Depth(cm)
Mean Temp
GPP
ER
P/R
SP Cond
Water Depth

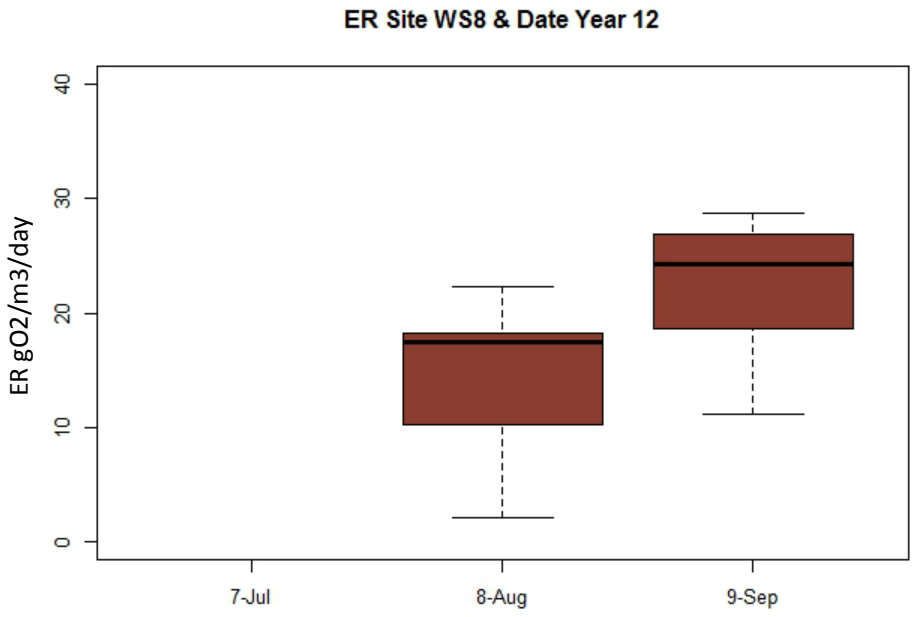
GPP Site WS4 by Date Year 12
GPP gO2/m3/day
0
10
20
30
40
7-Jul
8-Aug
9-Sep

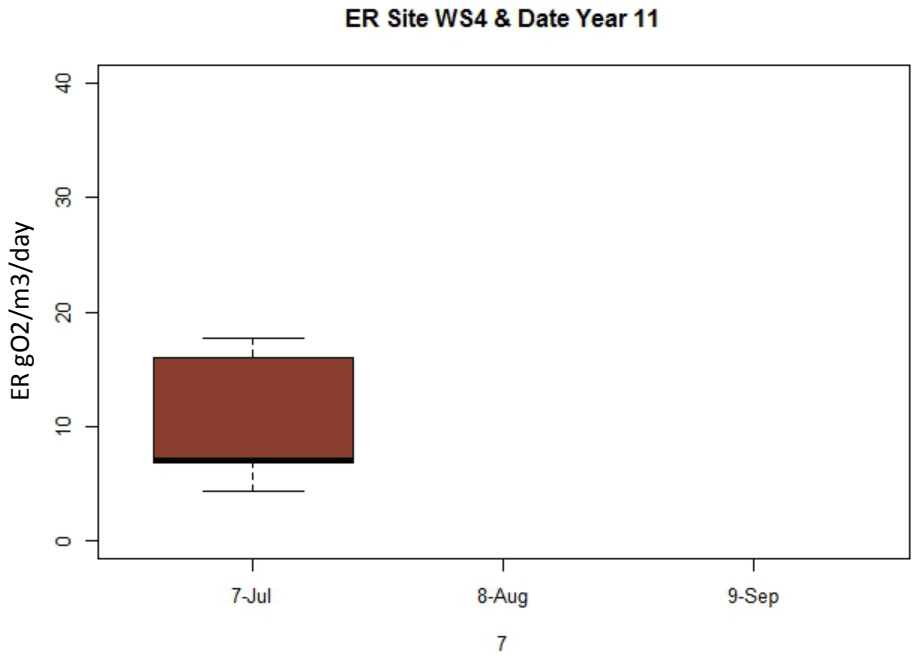

GPP Site WS8 & Date Year 12
GPP gO2/m3/day
0
10
20
30
40
7-Jul
8-Aug
9-Sep

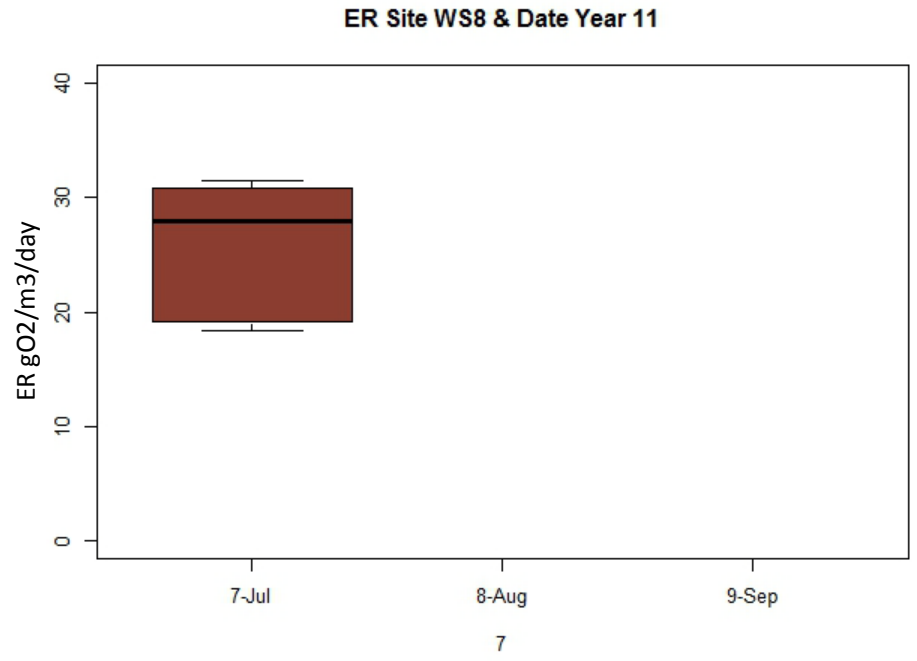

GPP Site WS4 & Date Year 11
GPP gO2/m3/day
0
10
20
30
40
7-Jul
8-Aug
9-Sep
7

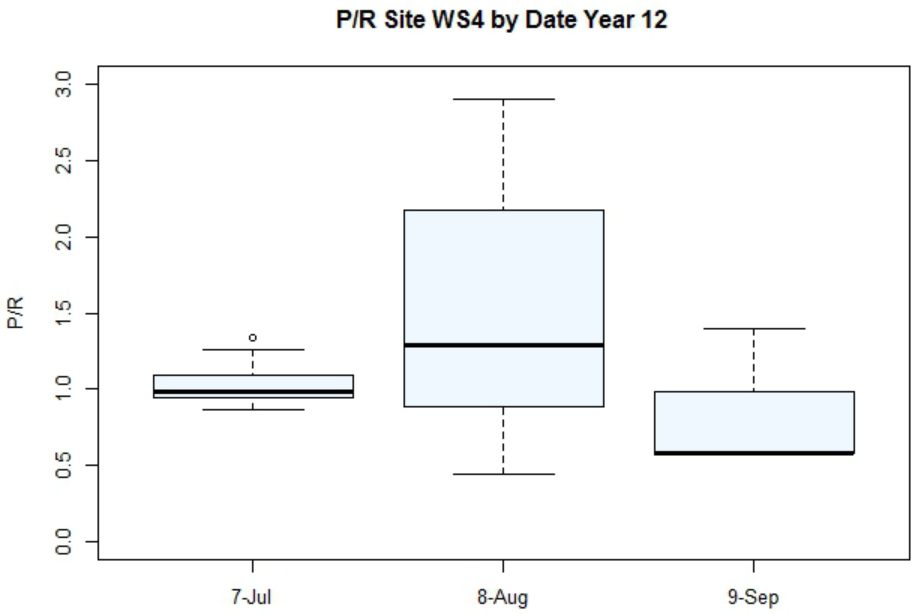

GPP Site WS8 & Date Year 11
GPP gO2/m3/day
0
10
20
30
40
7-Jul
8-Aug
9-Sep
7

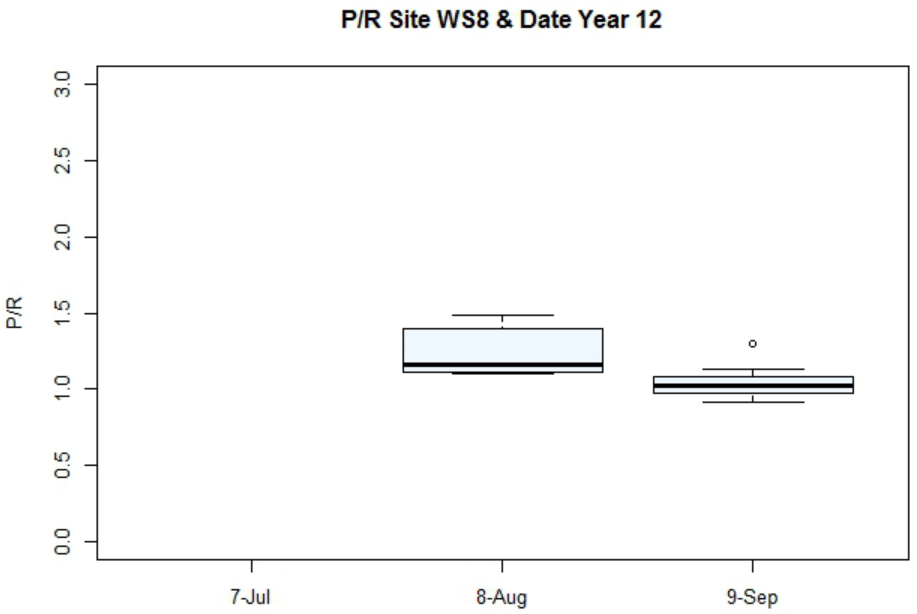

ER Site WS4 by Date Year 12
ER gO2/m3/day
0
10
20
30
40
7-Jul
8-Aug
9-Sep

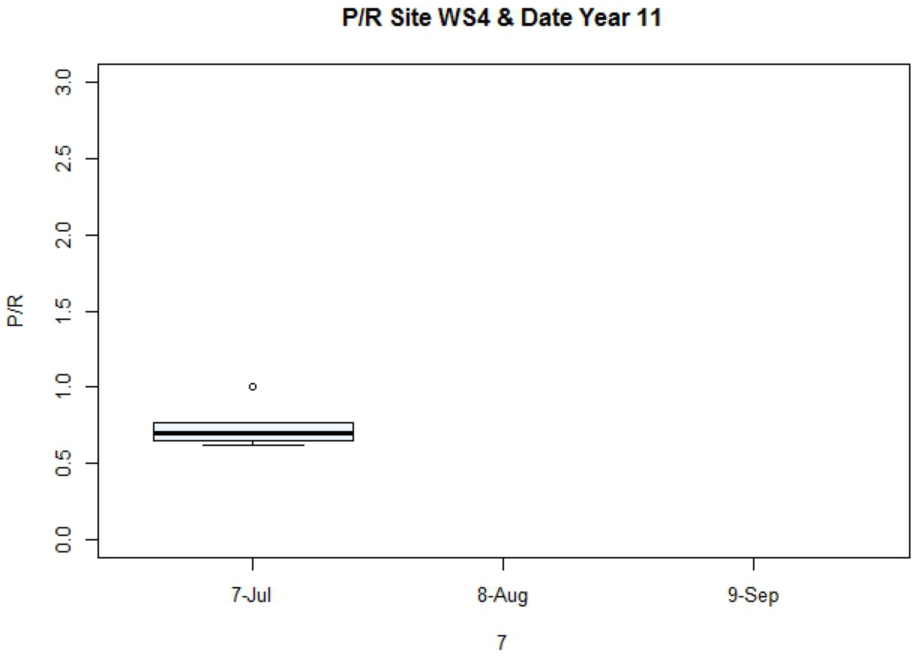

ER Site WS8 & Date Year 12
ER gO2/m3/day
0
10
20
30
40
7-Jul
8-Aug
9-Sep

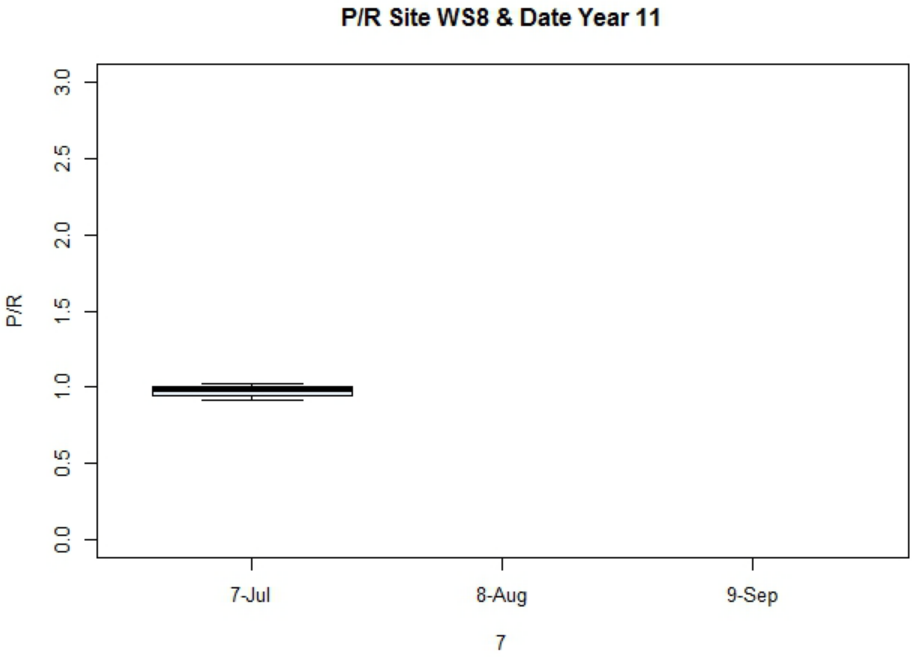

ER Site WS4 & Date Year 11
ER gO2/m3/day
0
10
20
30
40
7-Jul
8-Aug
9-Sep
7


ER Site WS8 & Date Year 11
ER gO2/m3/day
0
10
20
30
40
7-Jul
8-Aug
9-Sep
7

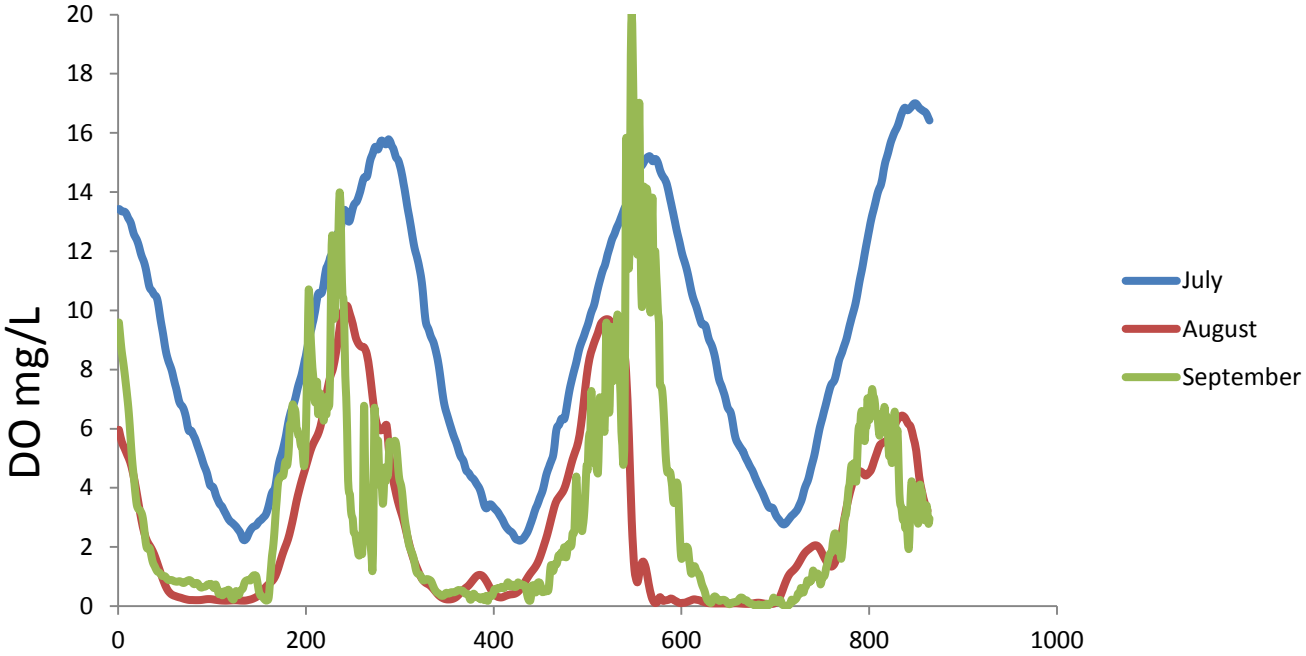

P/R Site WS4 by Date Year 12
P/R
0.0
0.5
1.0
1.5
2.0
2.5
3.0
7-Jul
8-Aug
9-Sep


P/R Site WS8 & Date Year 12
P/R
0.0
0.5
1.0
1.5
2.0
2.5
3.0
7-Jul
8-Aug
9-Sep

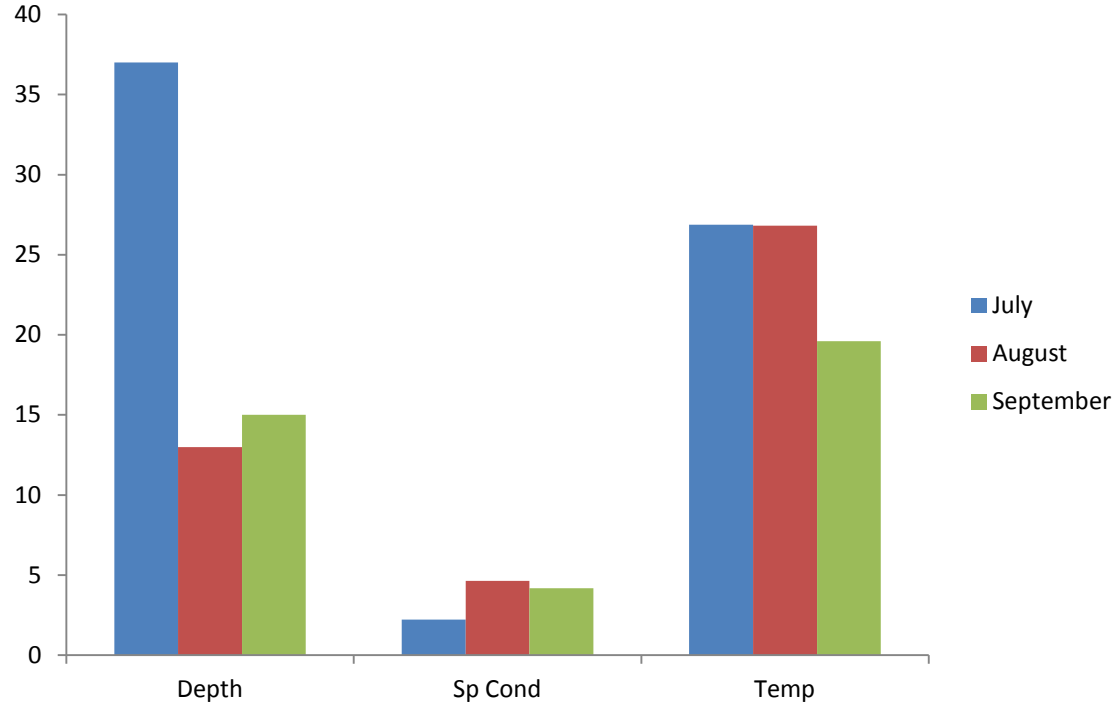

P/R Site WS4 & Date Year 11
P/R
0.0
0.5
1.0
1.5
2.0
2.5
3.0
7-Jul
8-Aug
9-Sep
7


P/R Site WS8 & Date Year 11
P/R
0.0
0.5
1.0
1.5
2.0
2.5
3.0
7-Jul
8-Aug
9-Sep
7

Site WS4 2012

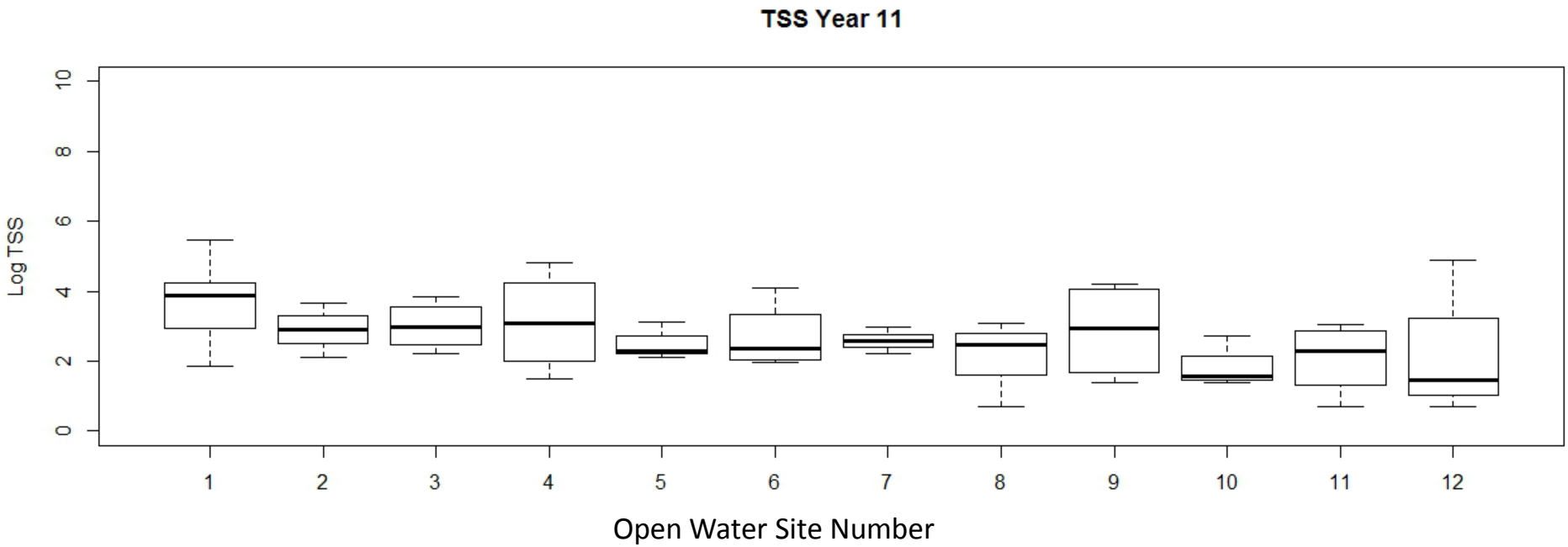


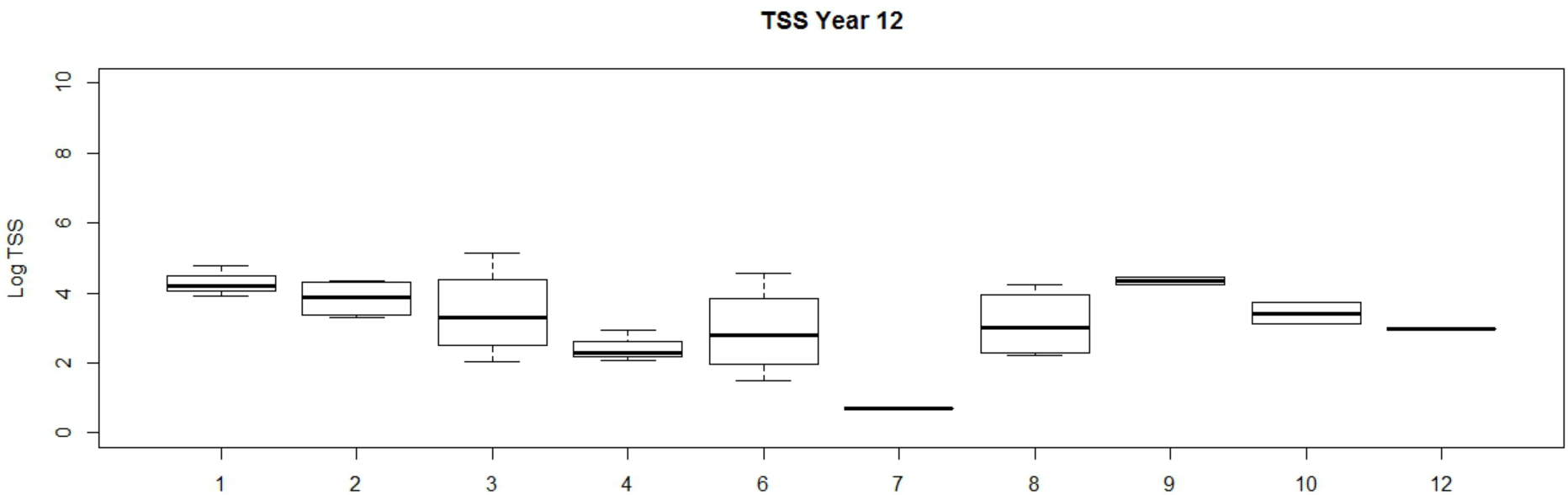
Depth (cm)
Sp Cond (ms/cm)
Temp (°C)

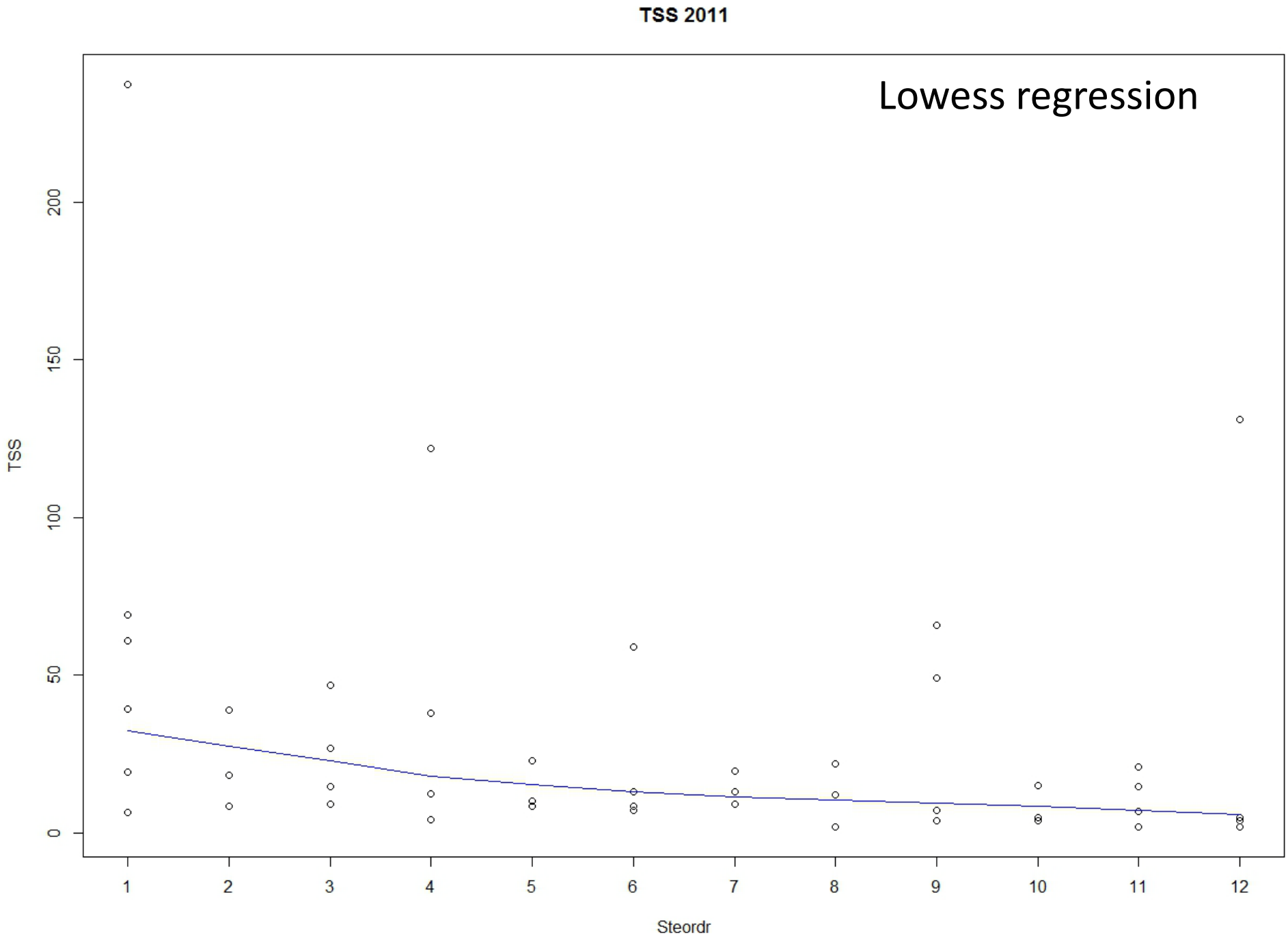


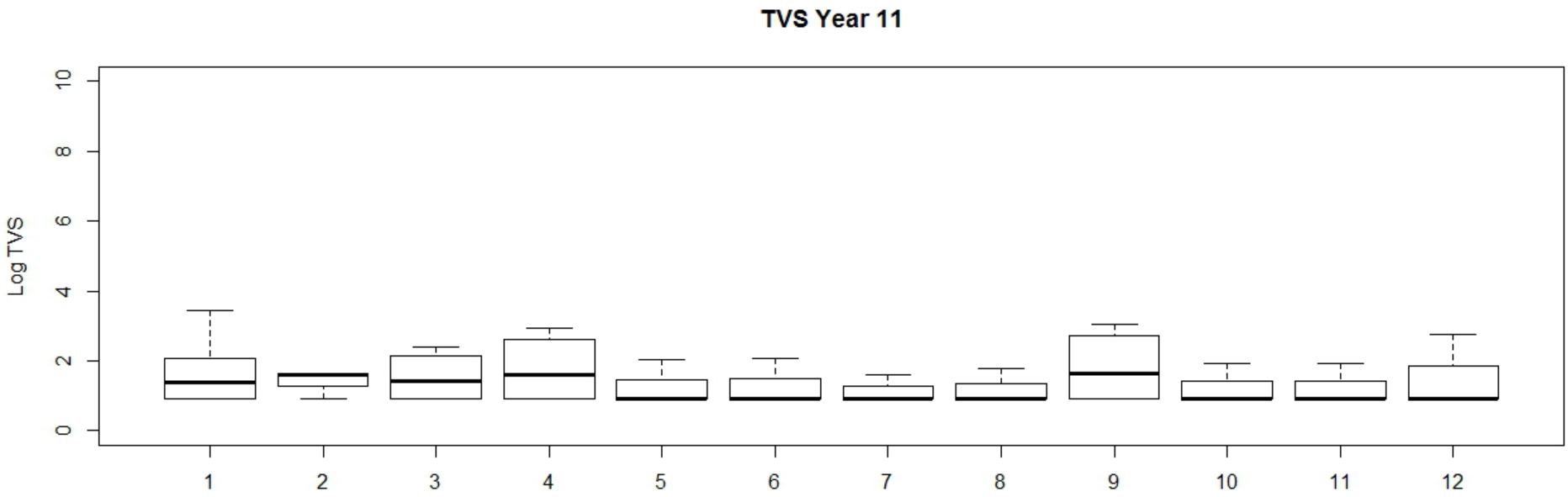
Seston Trends

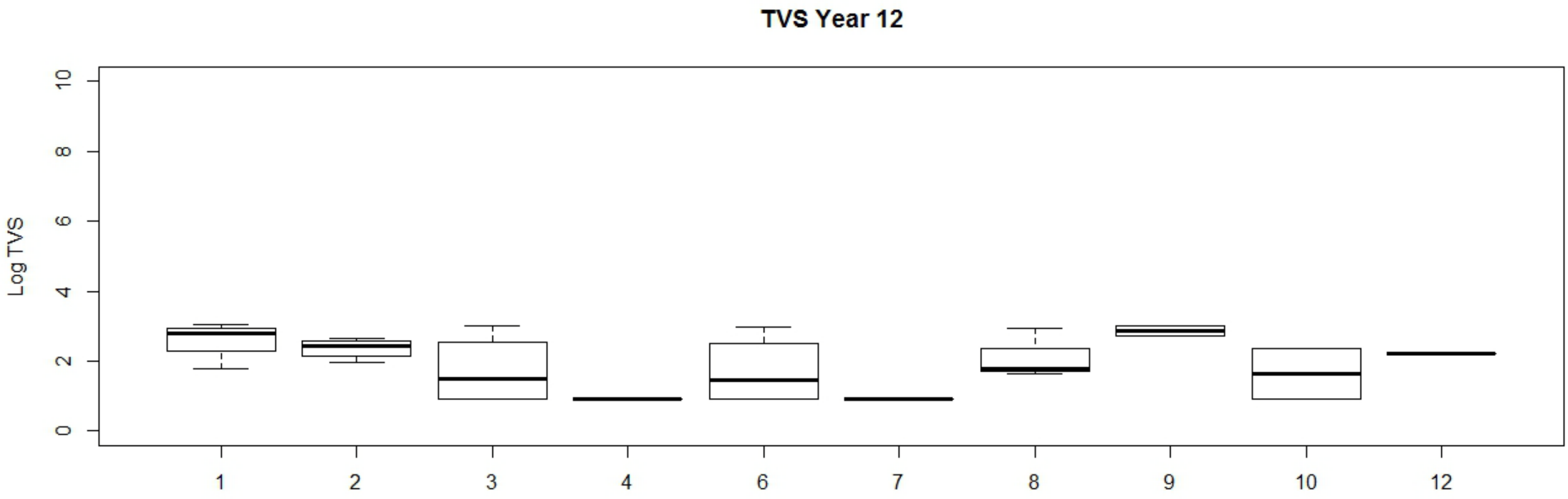
- Total Suspended Solids
  - Weight of all seston
- Total Volatile Solids
  - Weight of organics
- TVS/TSS
  - % of seston that is organic by weight
- Chl a


TSS Year 11
Log TSS
0
2
4
6
8
10
1
2
3
4
5
6
7
8
9
10
11
12
Open Water Site Number

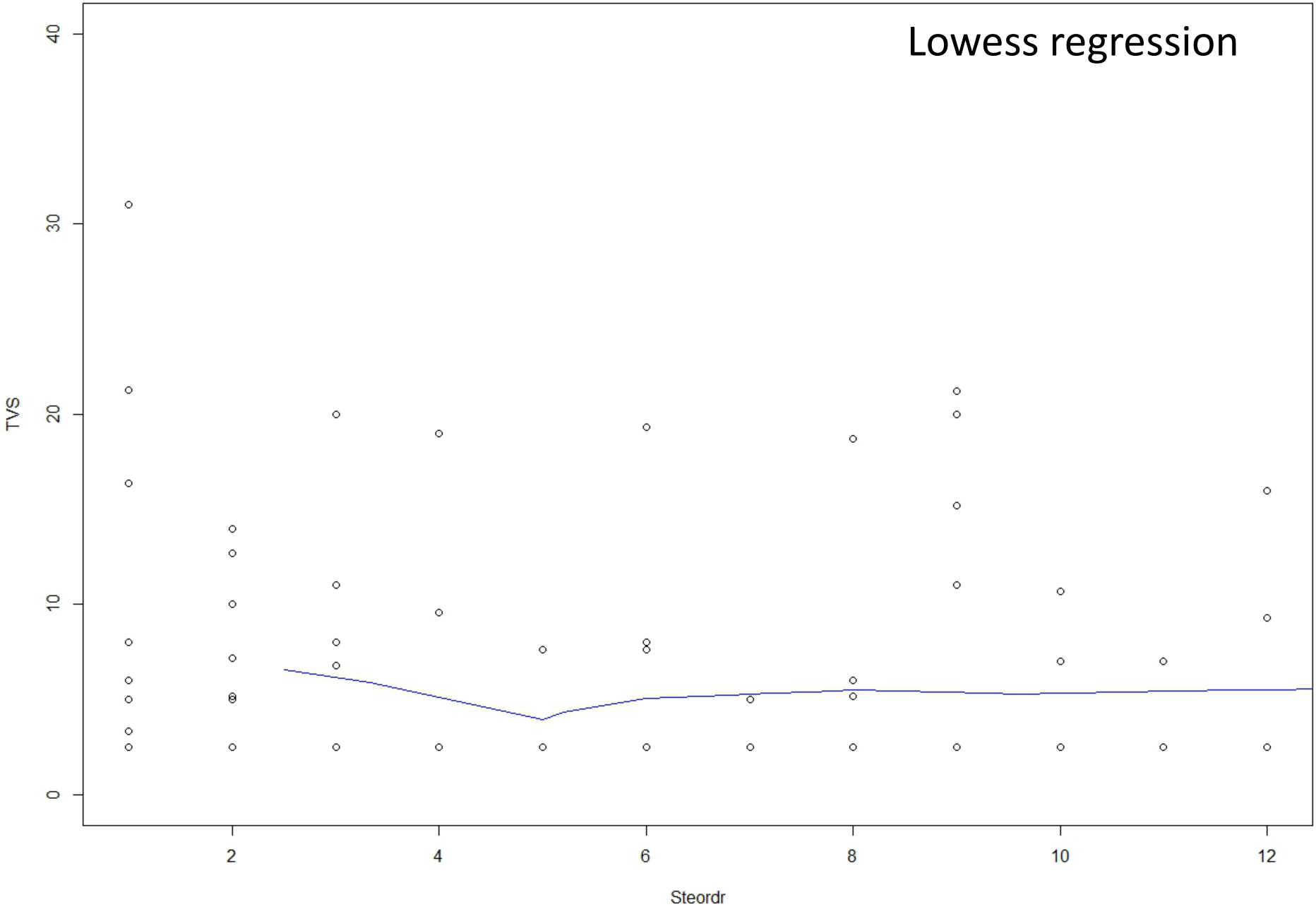

TSS Year 12
Log TSS
0
2
4
6
8
10
1
2
3
4
6
7
8
9
10
12

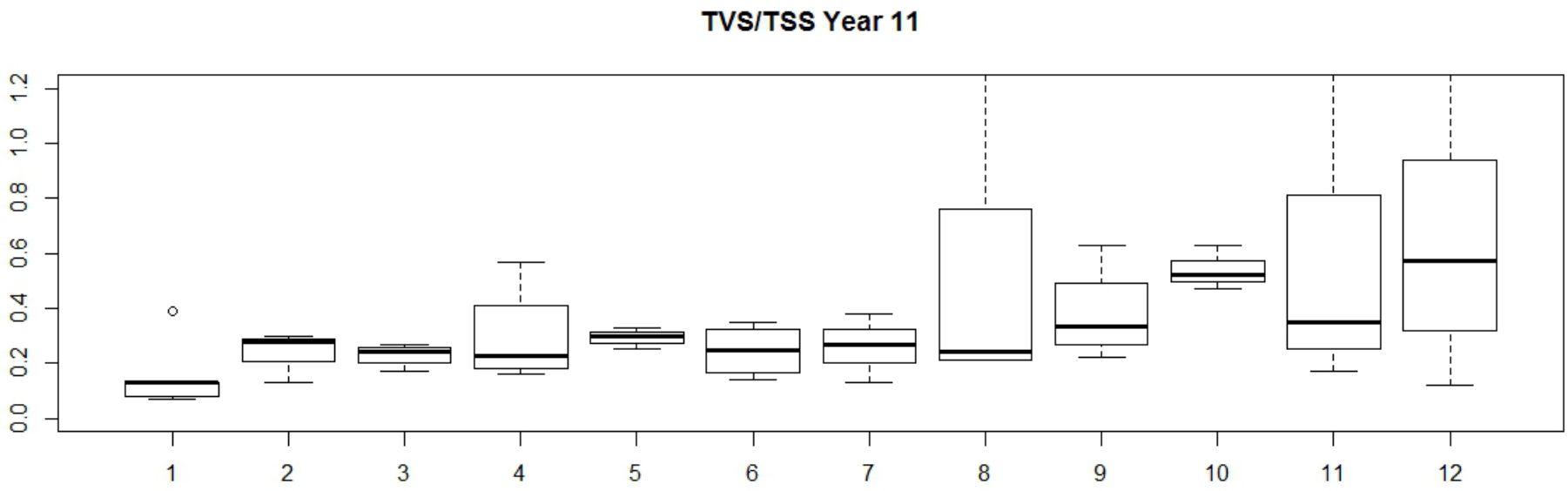

TSS 2011
Lowess regression
TSS
0
50
100
150
200
1
2
3
4
5
6
7
8
9
10
11
12
Steordr

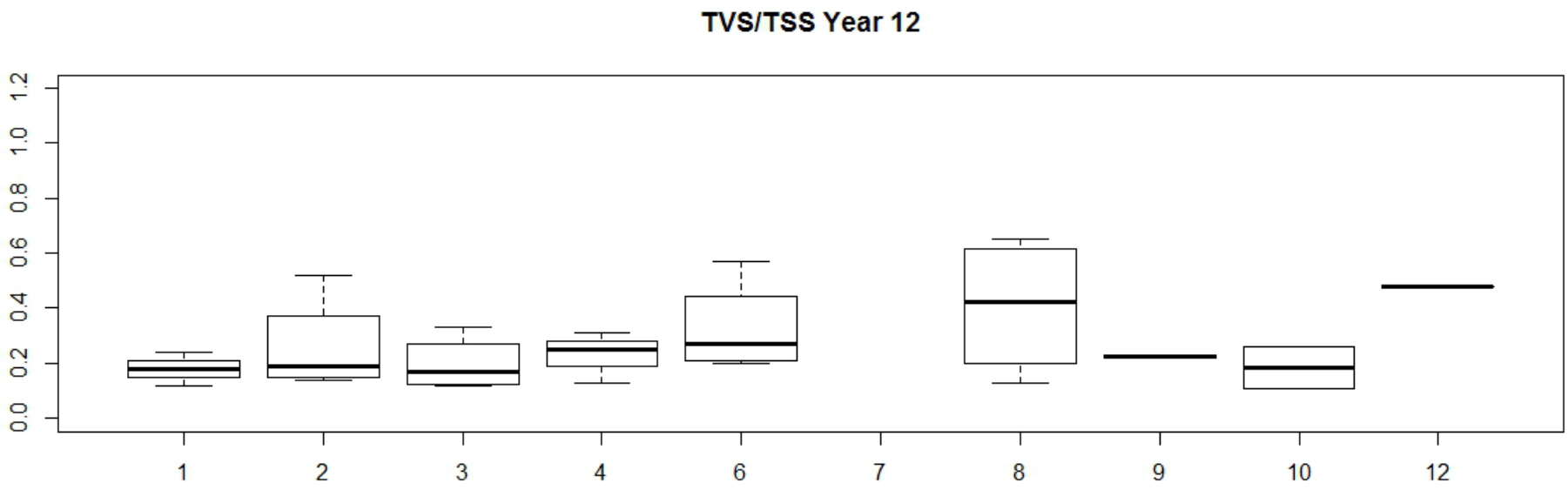

TVS Year 11
Log TVS
0
2
4
6
8
10
1
2
3
4
5
6
7
8
9
10
11
12

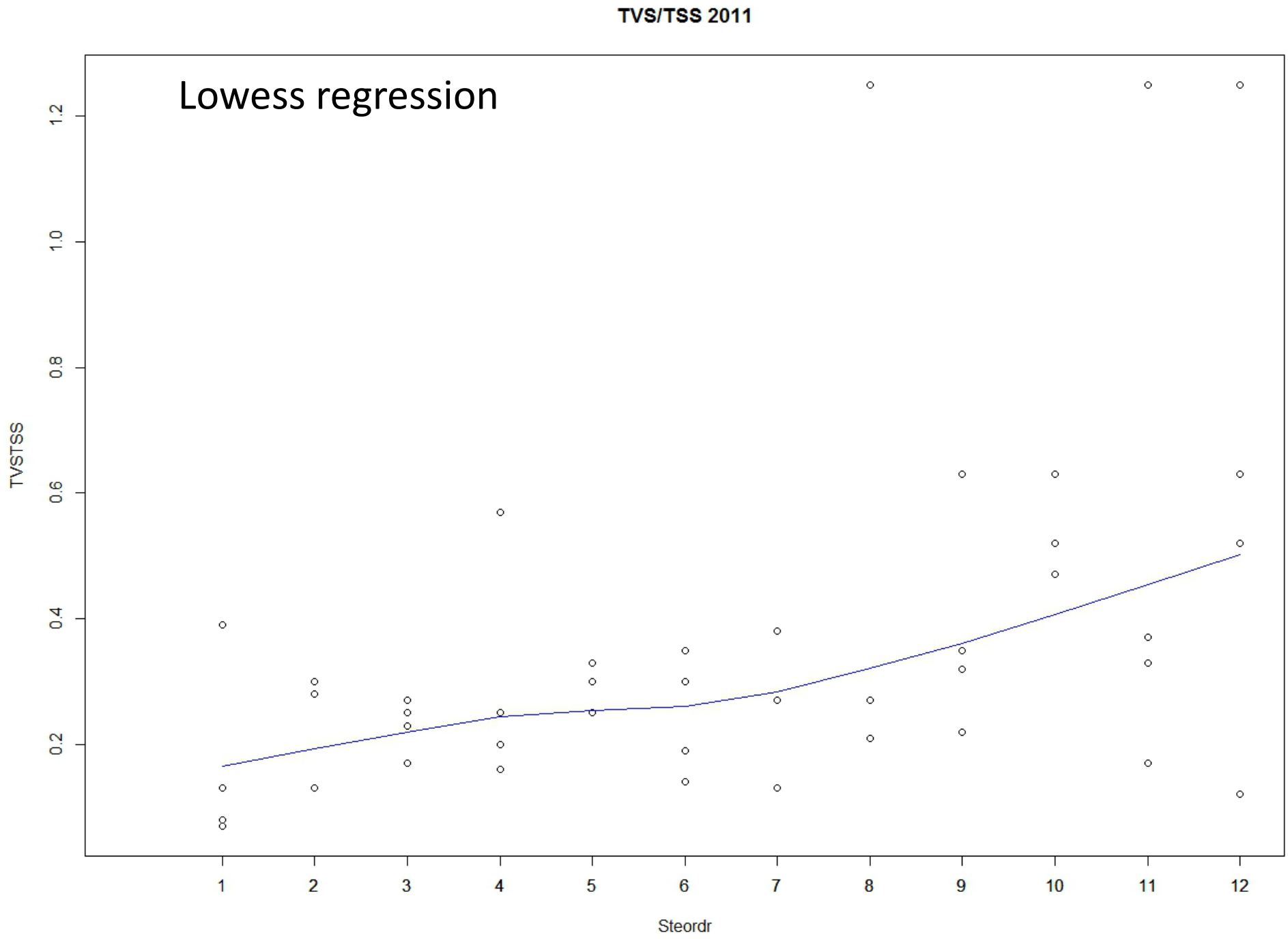

TVS Year 12
Log TVS
0
2
4
6
8
10
1
2
3
4
6
7
8
9
10
12

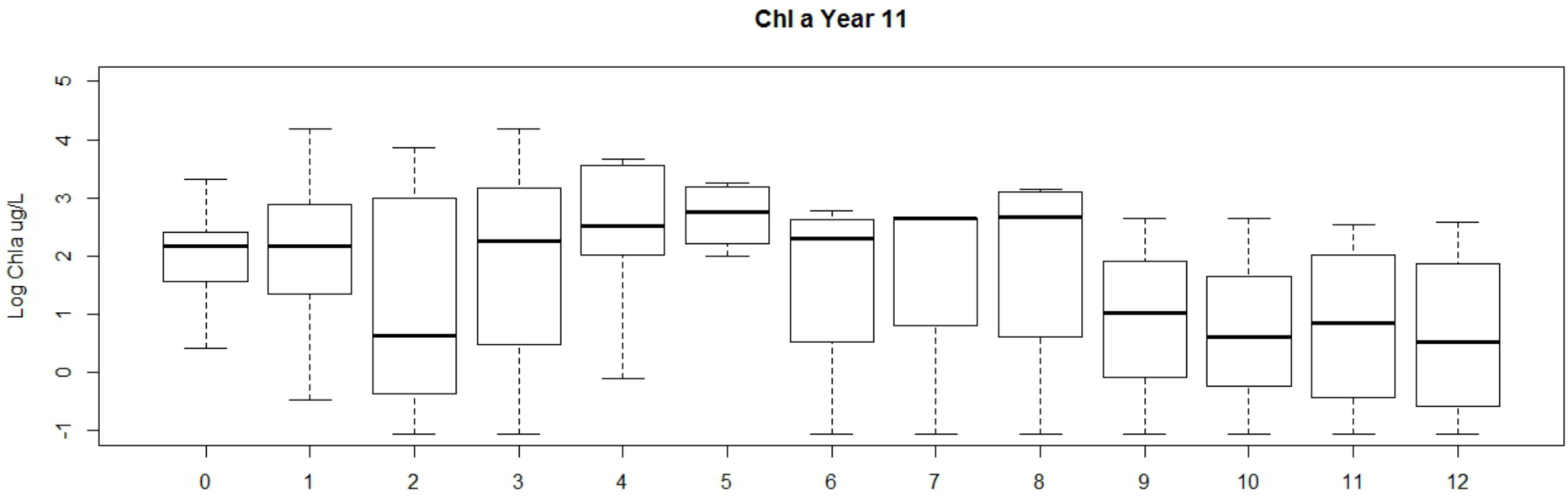
TVS 2011

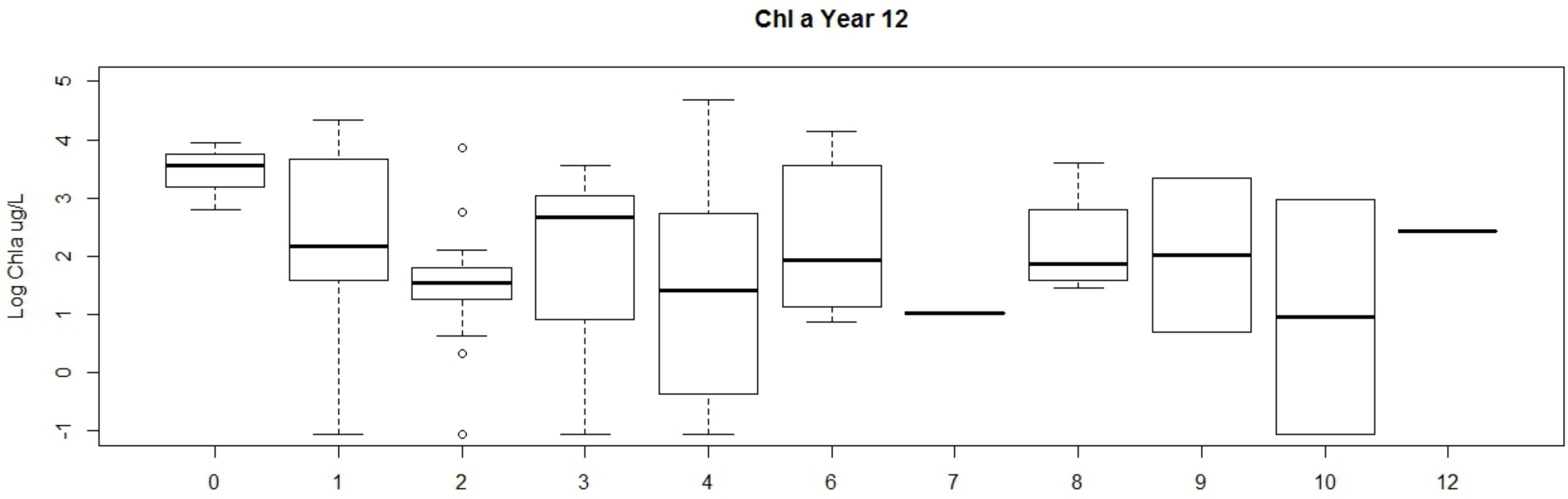


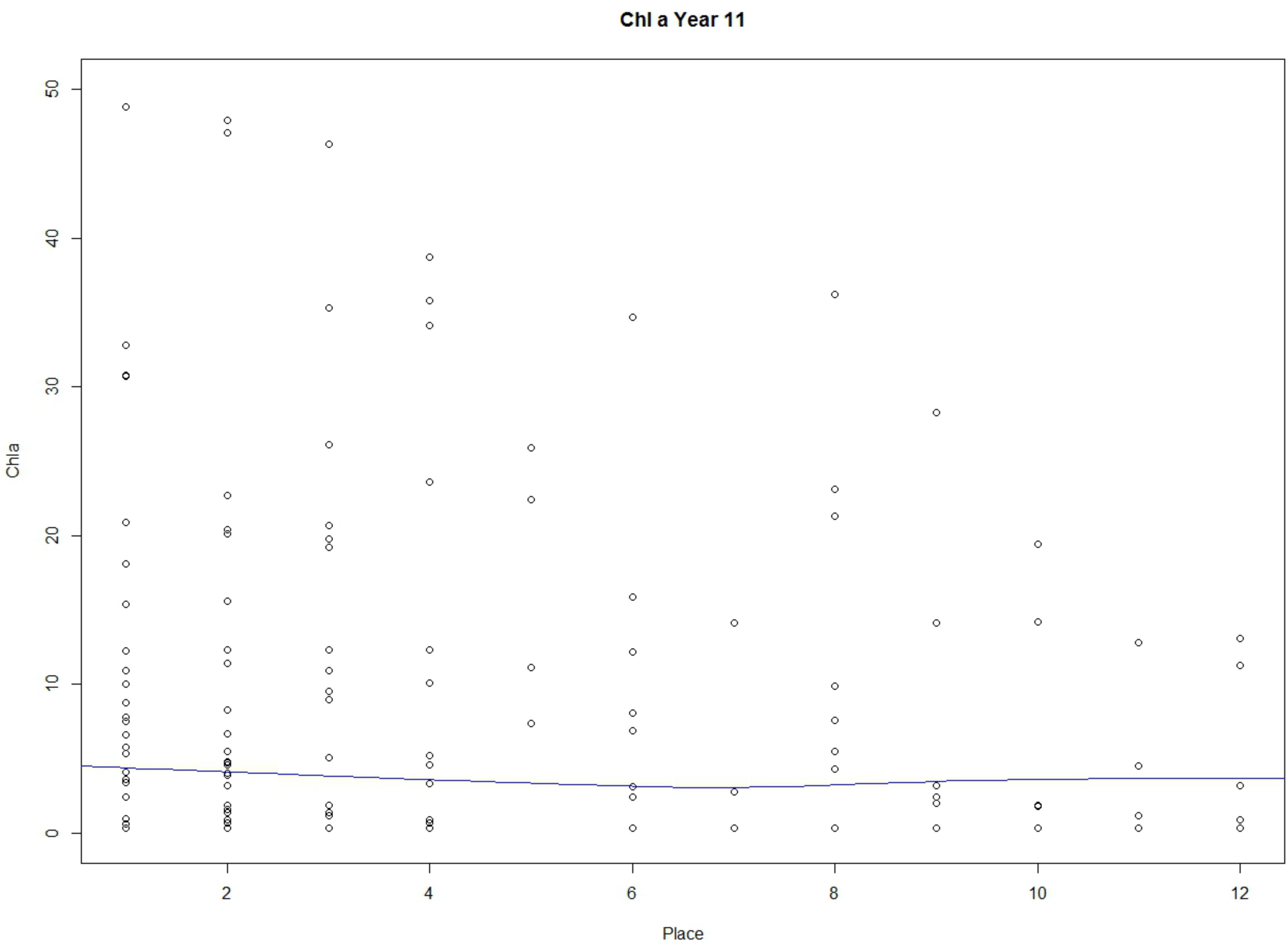

TVS/TSS Year 11
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1
2
3
4
5
6
7
8
9
10
11
12

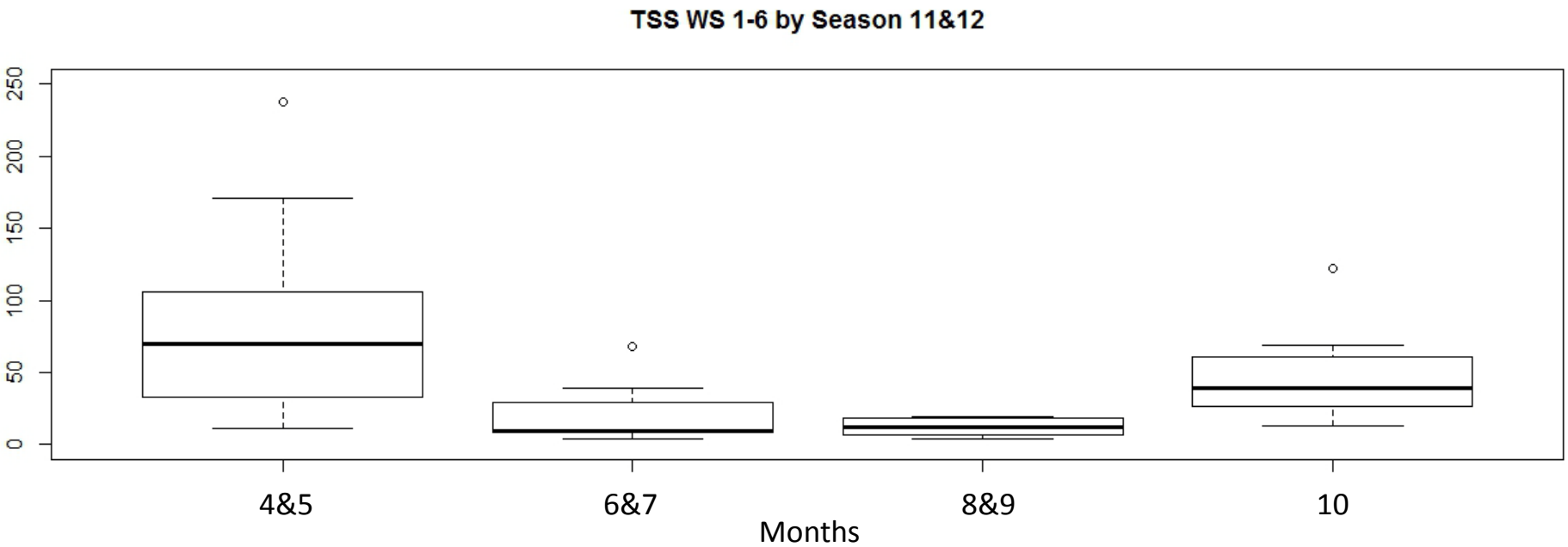

TVS/TSS Year 12
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1
2
3
4
6
7
8
9
10
12

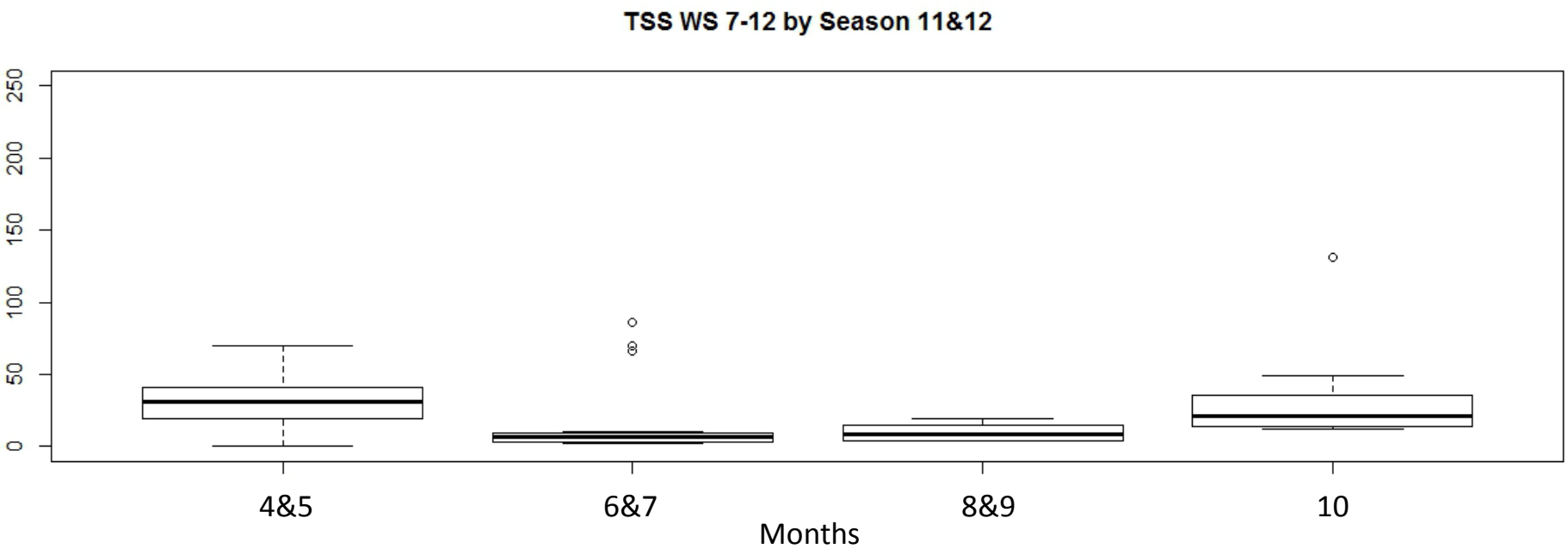

TVS/TSS 2011
Lowess regression
TVSTSS
0.2
0.4
0.6
0.8
1.0
1.2
1
2
3
4
5
6
7
8
9
10
11
12
Steordr


Chl a Year 11
Log Chla ug/L
-1
0
1
2
3
4
5
0
1
2
3
4
5
6
7
8
9
10
11
12

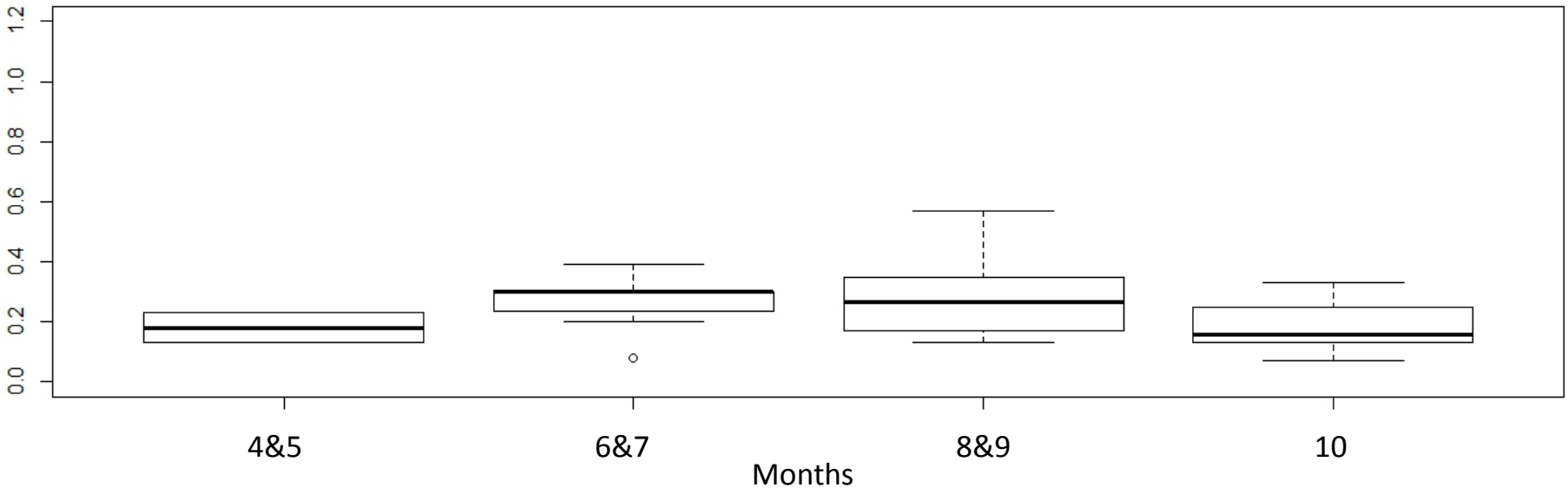

Chl a Year 12
Log Chla ug/L
-1
0
1
2
3
4
5
0
1
2
3
4
6
7
8
9
10
12


Chl a Year 11
Chla
Place
0
10
20
30
40
50
2
4
6
8
10
12

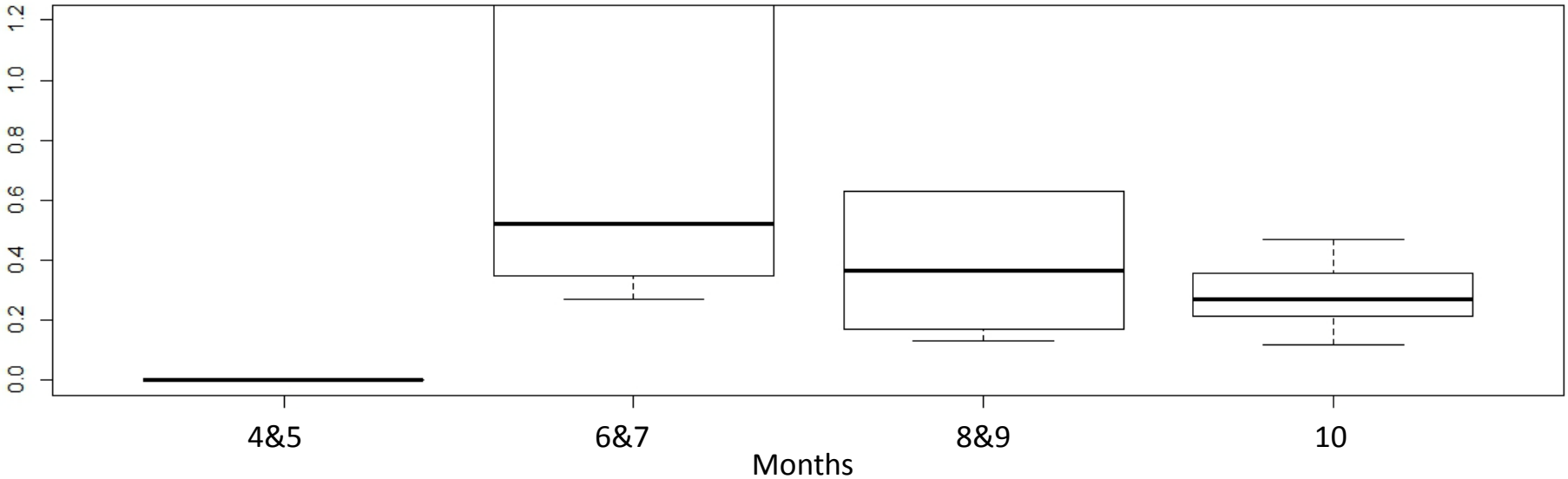

TSS WS 1-6 by Season 11&12
0
50
100
150
200
250
4&5
6&7
8&9
10
Months

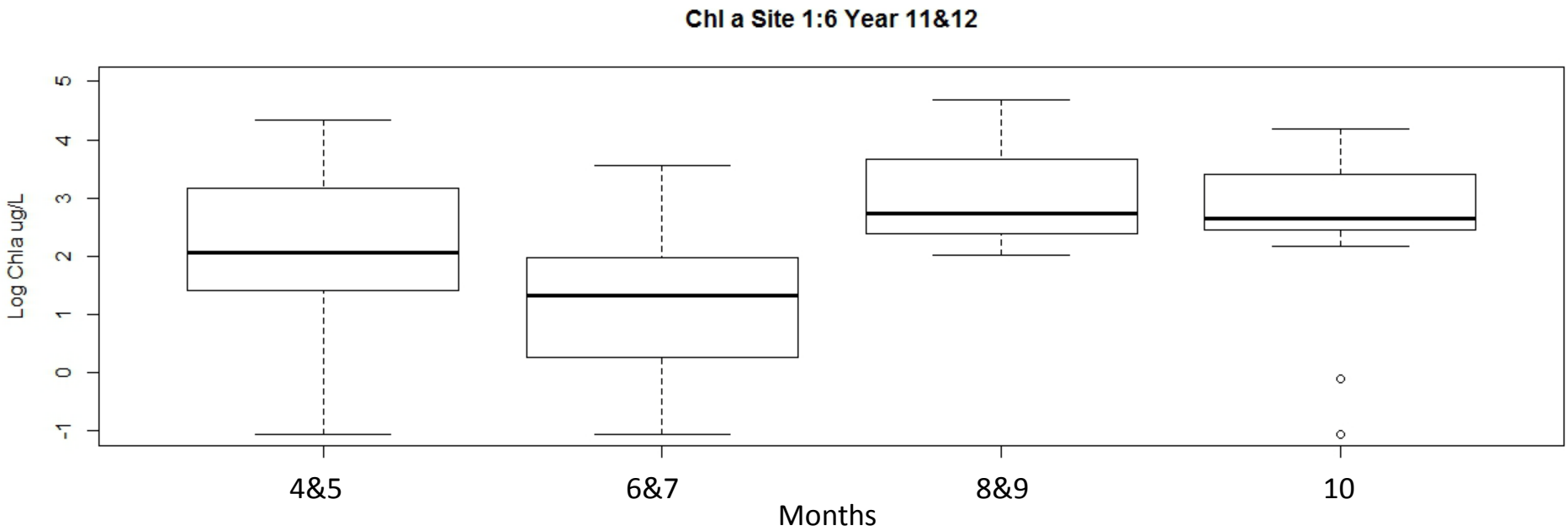

TSS WS 7-12 by Season 11&12
0
50
100
150
200
250
4&5
6&7
8&9
10
Months

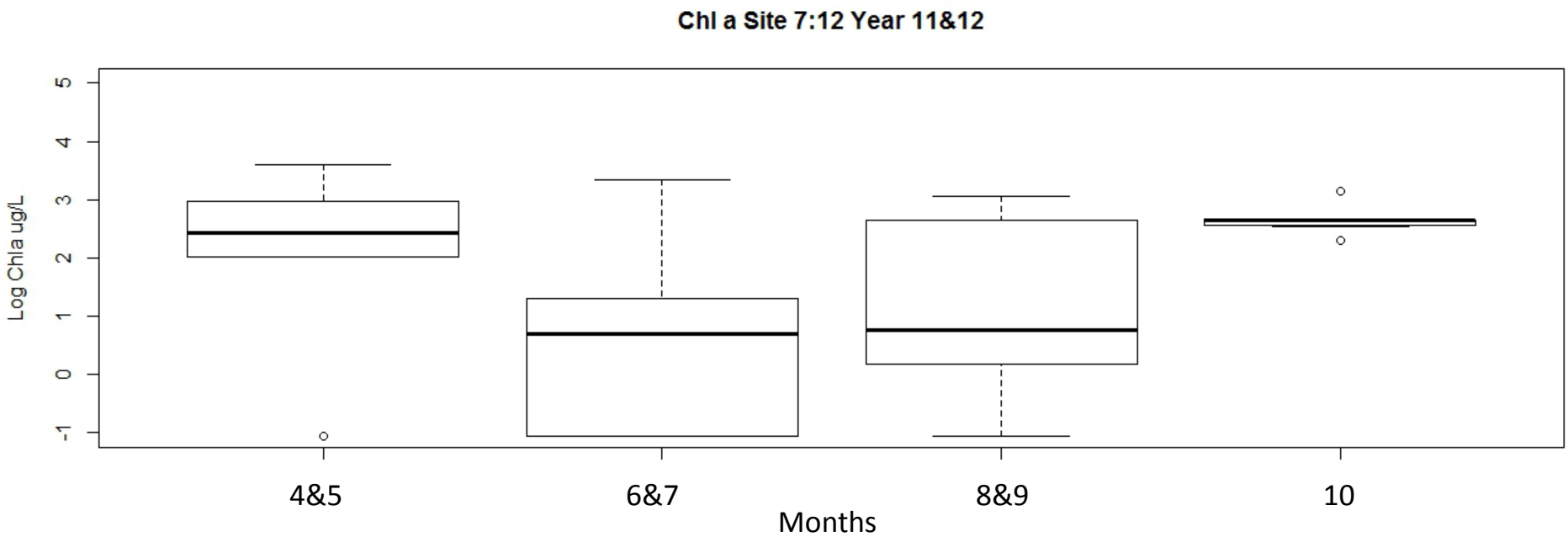
TVS/TSS WS Site 1-6 Year 11&12



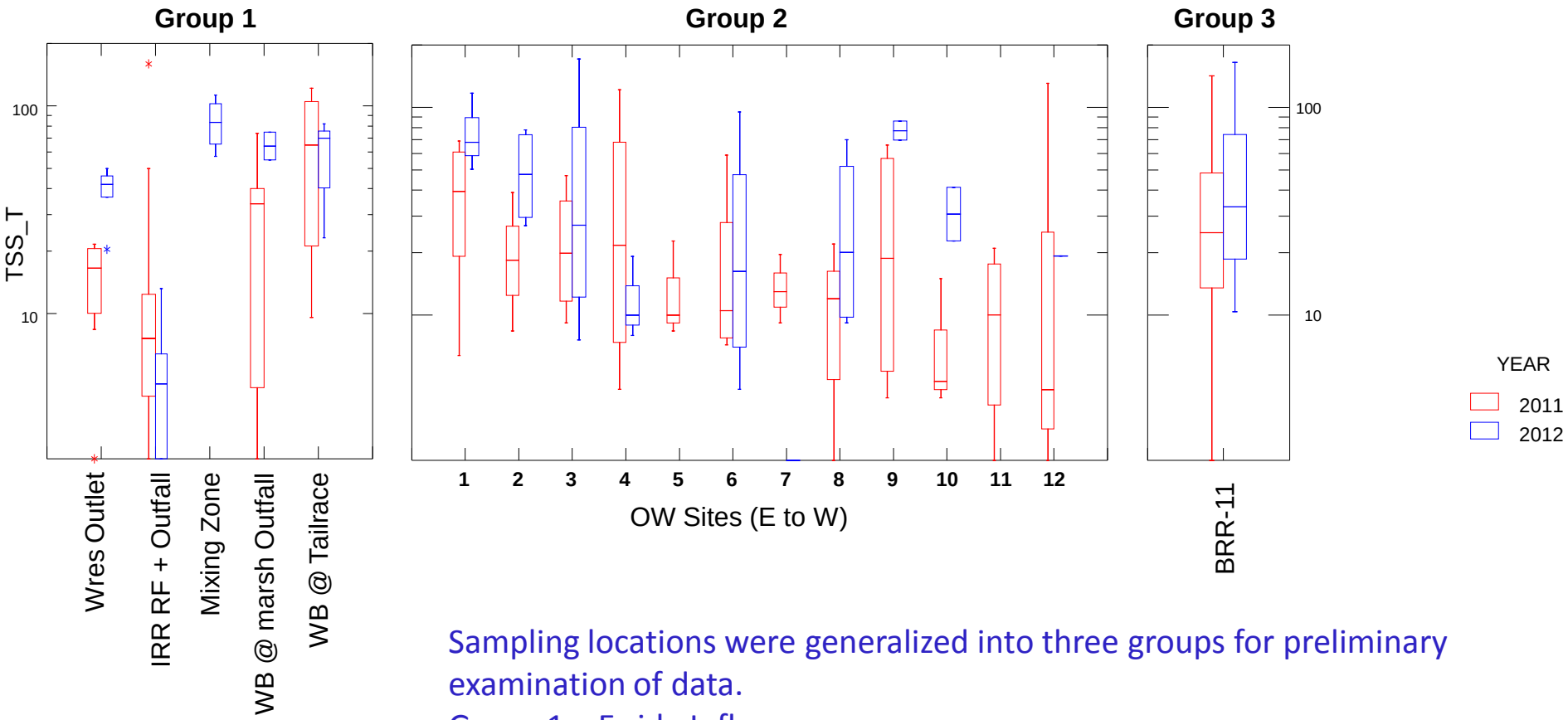
TVS/TSS WS Site 7-12 Year 11&12




Chl a Site 1:6 Year 11&12
Log Chla ug/L
5
4
3
2
1
0
-1
4&5
6&7
8&9
10
Months


Chl a Site 7:12 Year 11&12
Log Chla ug/L
5
4
3
2
1
0
-1
4&5
6&7
8&9
10
Months

Questions?



Sampling locations were generalized into three groups for preliminary examination of data.

Group 1 – E side Inflows

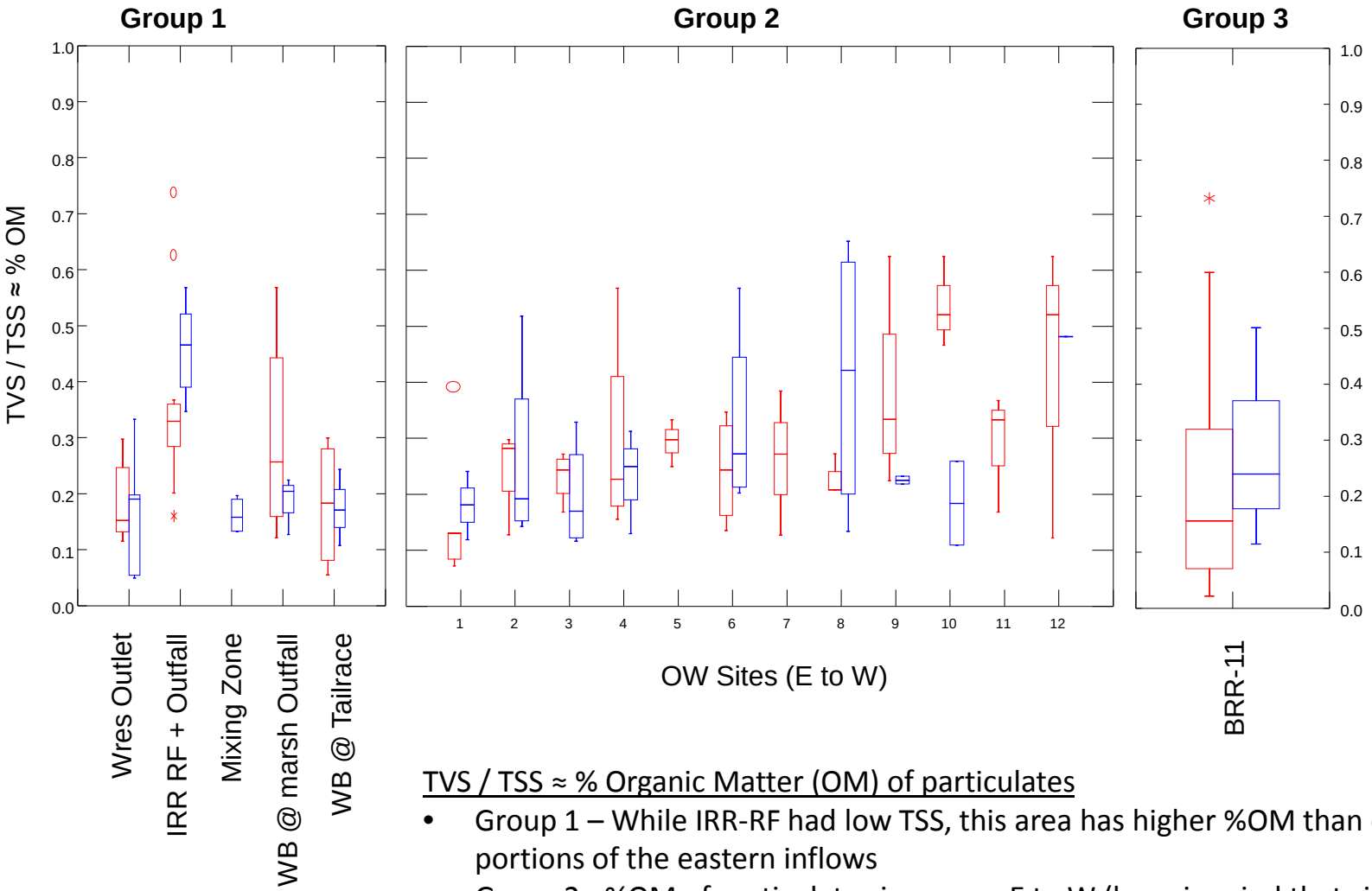
Group 2 – Open Water Transect

Group 3 – BRR Inflow #1 (@ BRR-11, Unit 5C)

Group 1 – TSS (or particulates) increase from the Willard Reservoir outlet to the confluence w/ the Spur, from ~ 50 to 80-100 mg/L. Interestingly, the irrigation returnflow has some of the lower TSS values observed

Group 2 – TSS gradually decreases from E to W (w/ the flow). Higher values in western portion (site 9+) in 2012 likely due to the hydrologic separation of WSpur from the rest of BRBay.

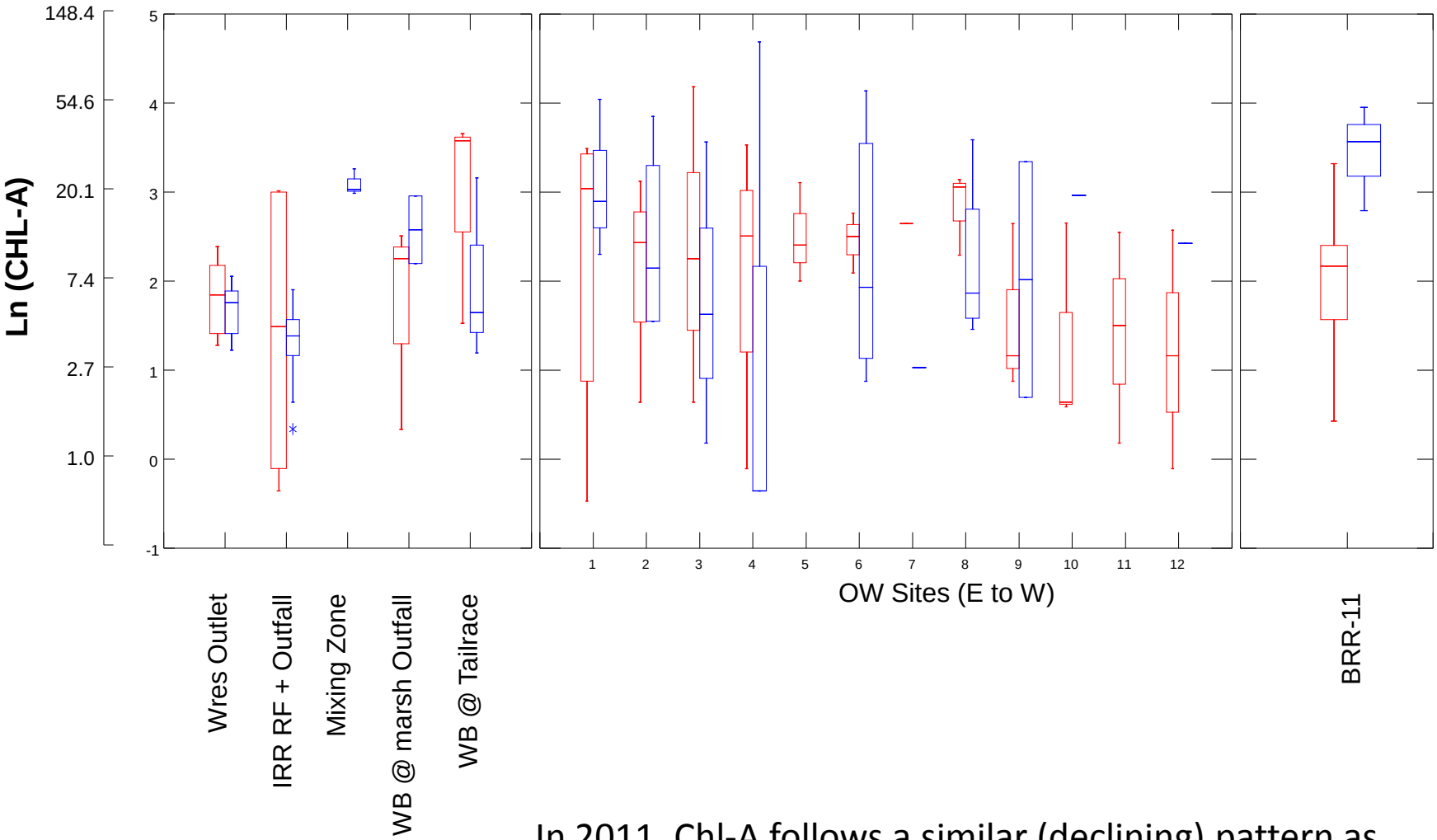
Group 3 – TSS values generally similar to the eastern portion of WSpur (Group 2) and the eastern inflows (Group 1), ~ 20-40 mg/L



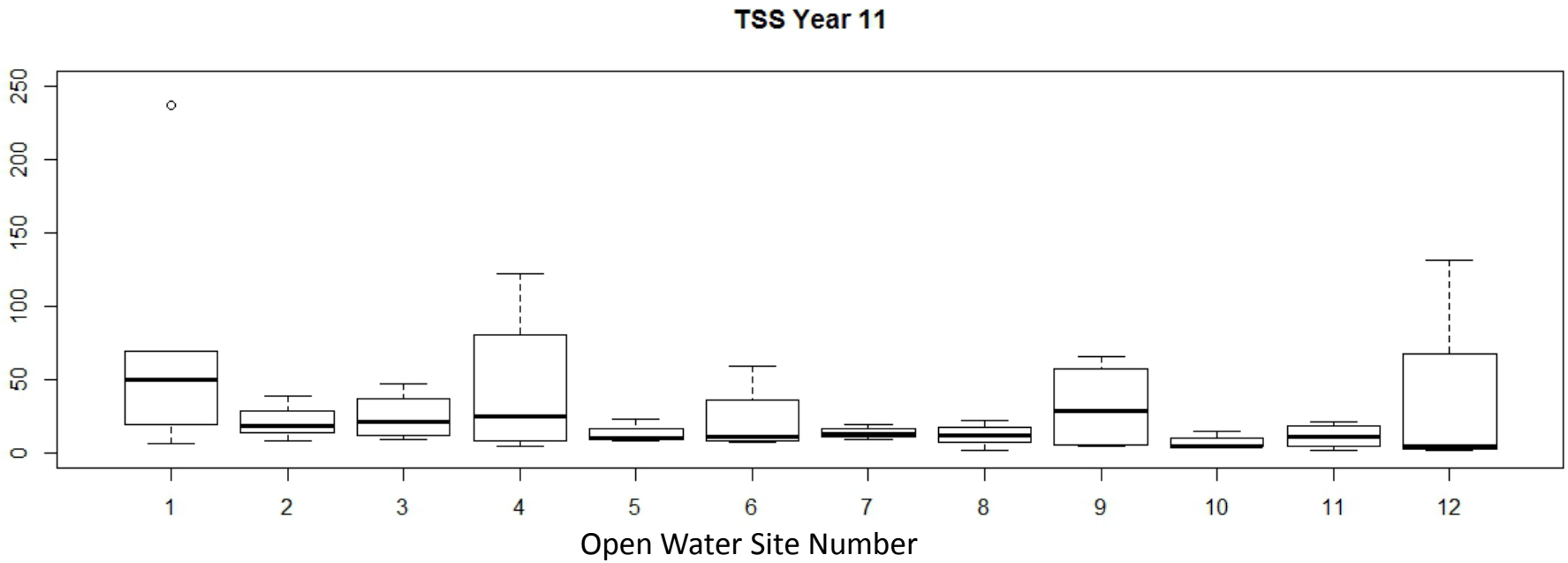
TVS / TSS ≈ % Organic Matter (OM) of particulates

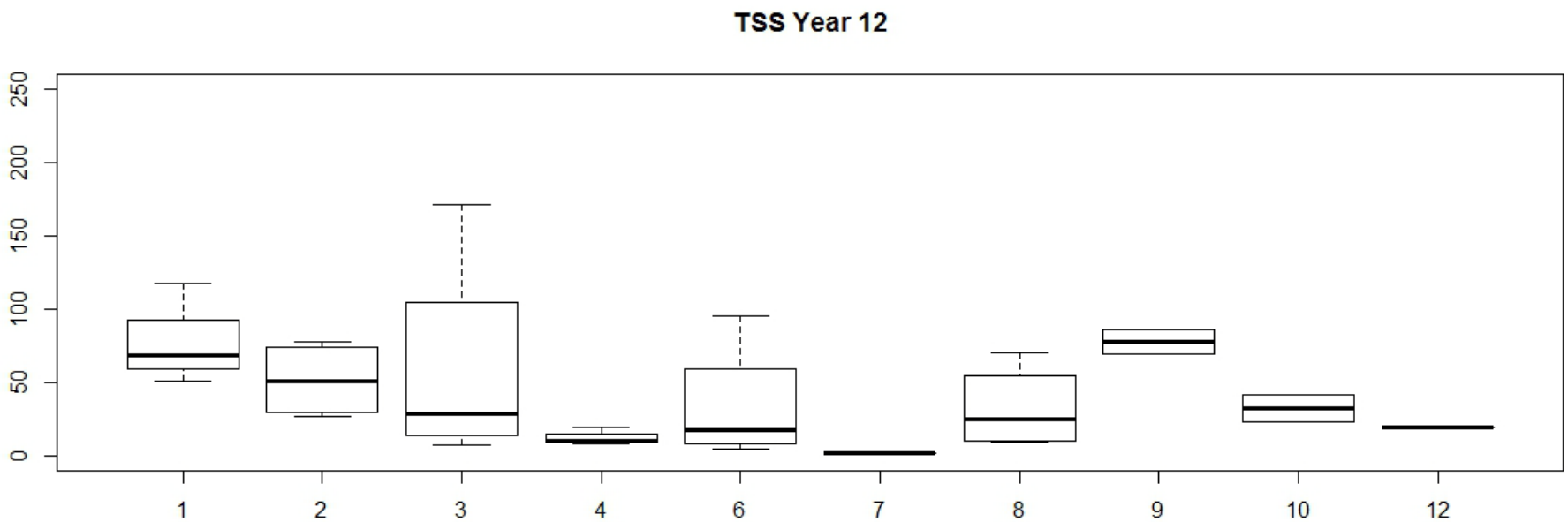
- Group 1 – While IRR-RF had low TSS, this area has higher %OM than other portions of the eastern inflows
- Group 2 - %OM of particulates increases E to W (keep in mind that sites 12 to 9 became progressively unsampleable during 2012 due to lack of water)
- Group 3 – slightly higher than eastern inflows; similar to middle of OW transect

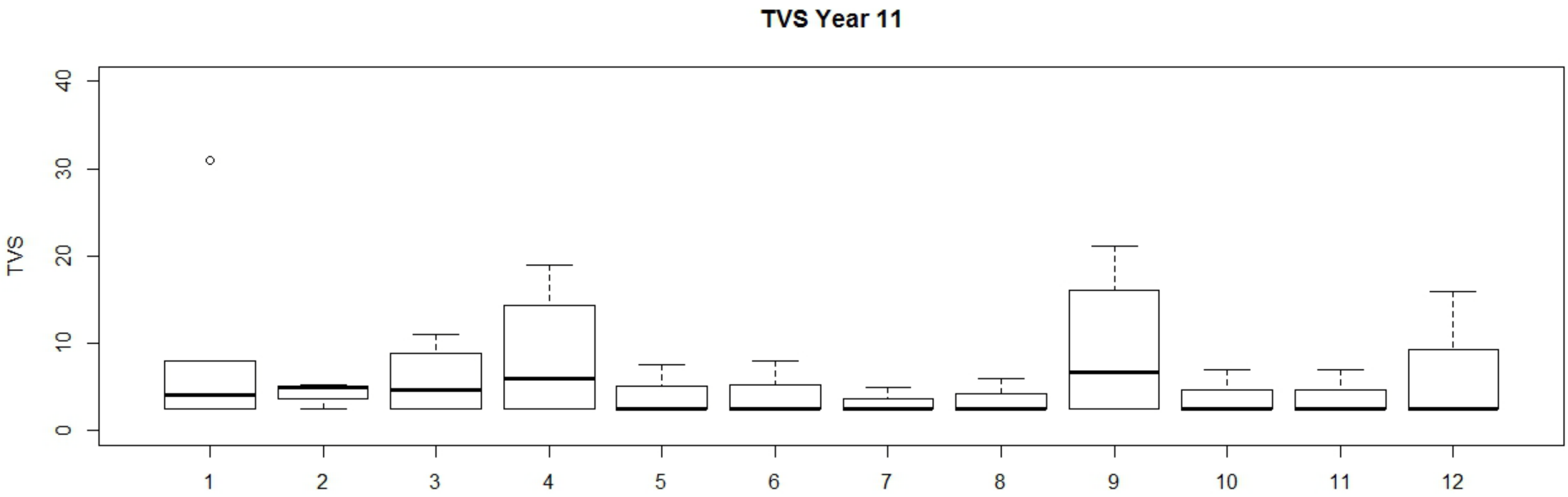
Broadly, suspended particulates appear to be transformed into OM across the WSpur transect. It is not obvious whether this is due to a reduction in inorganic particles settling out (associated with thick SAV beds in middle of Group 2), or an actual transformation of inorganic constituents into OM (via CNP cycling across OW transect)

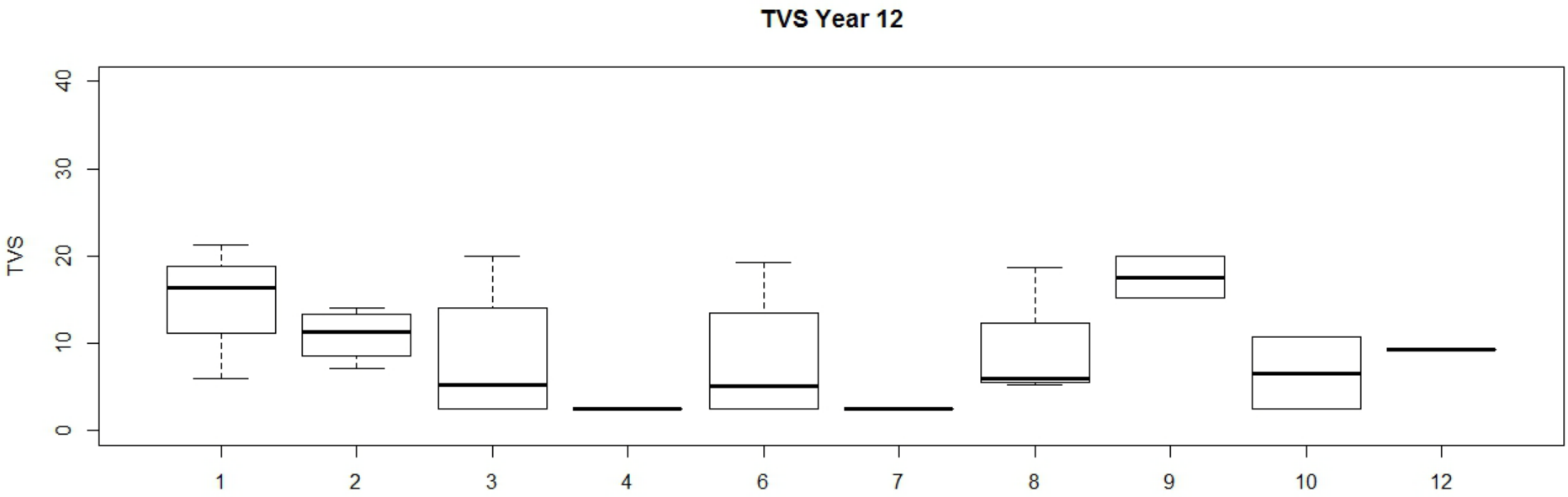


In 2011, Chl-A follows a similar (declining) pattern as TSS across the OW transect (Group2)


TSS Year 11
0
50
100
150
200
250
1
2
3
4
5
6
7
8
9
10
11
12
Open Water Site Number


TSS Year 12
0
50
100
150
200
250
1
2
3
4
6
7
8
9
10
12


TVS Year 11
TVS
0
10
20
30
40
1
2
3
4
5
6
7
8
9
10
11
12


TVS Year 12
TVS
0
10
20
30
40
1
2
3
4
6
7
8
9
10
12