Main stem Columbia River: In situ biogeochemical measurements

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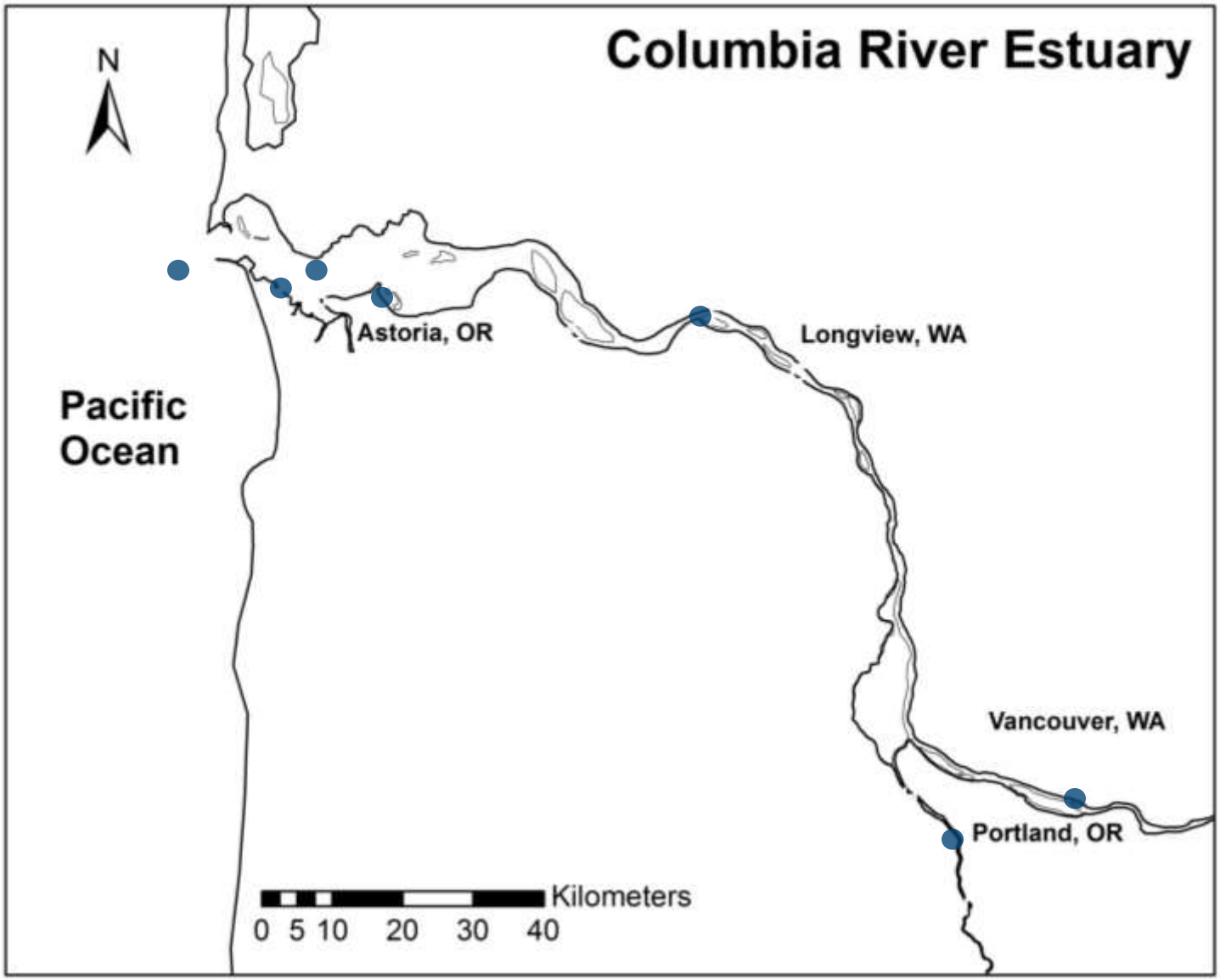
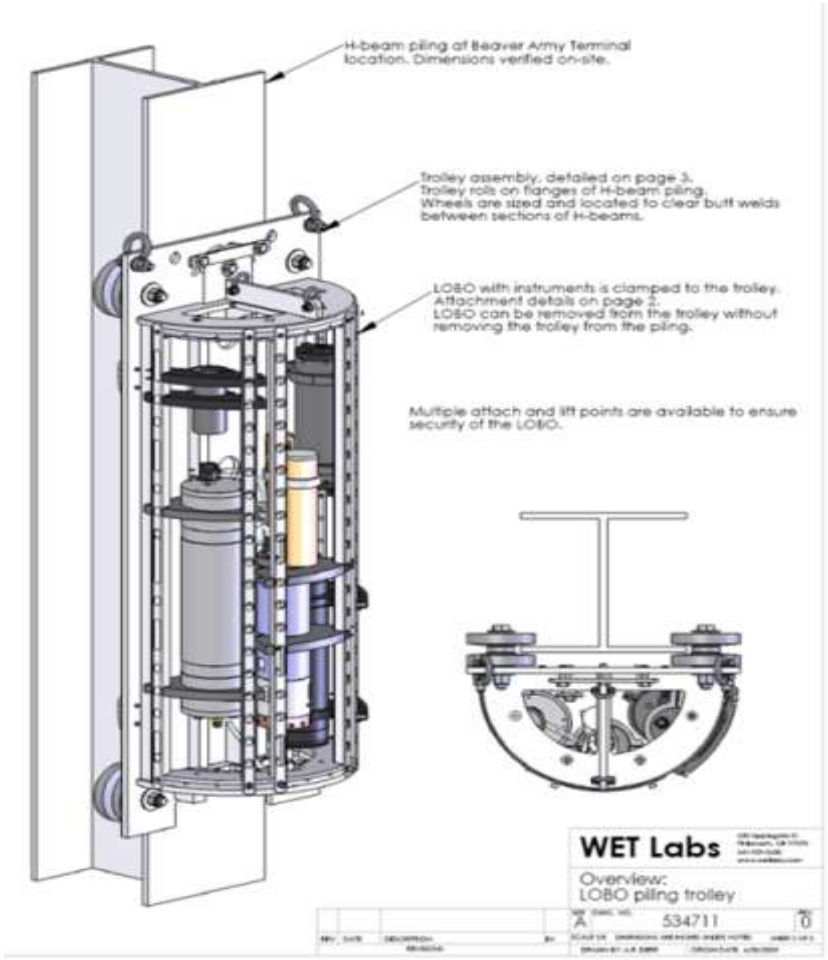
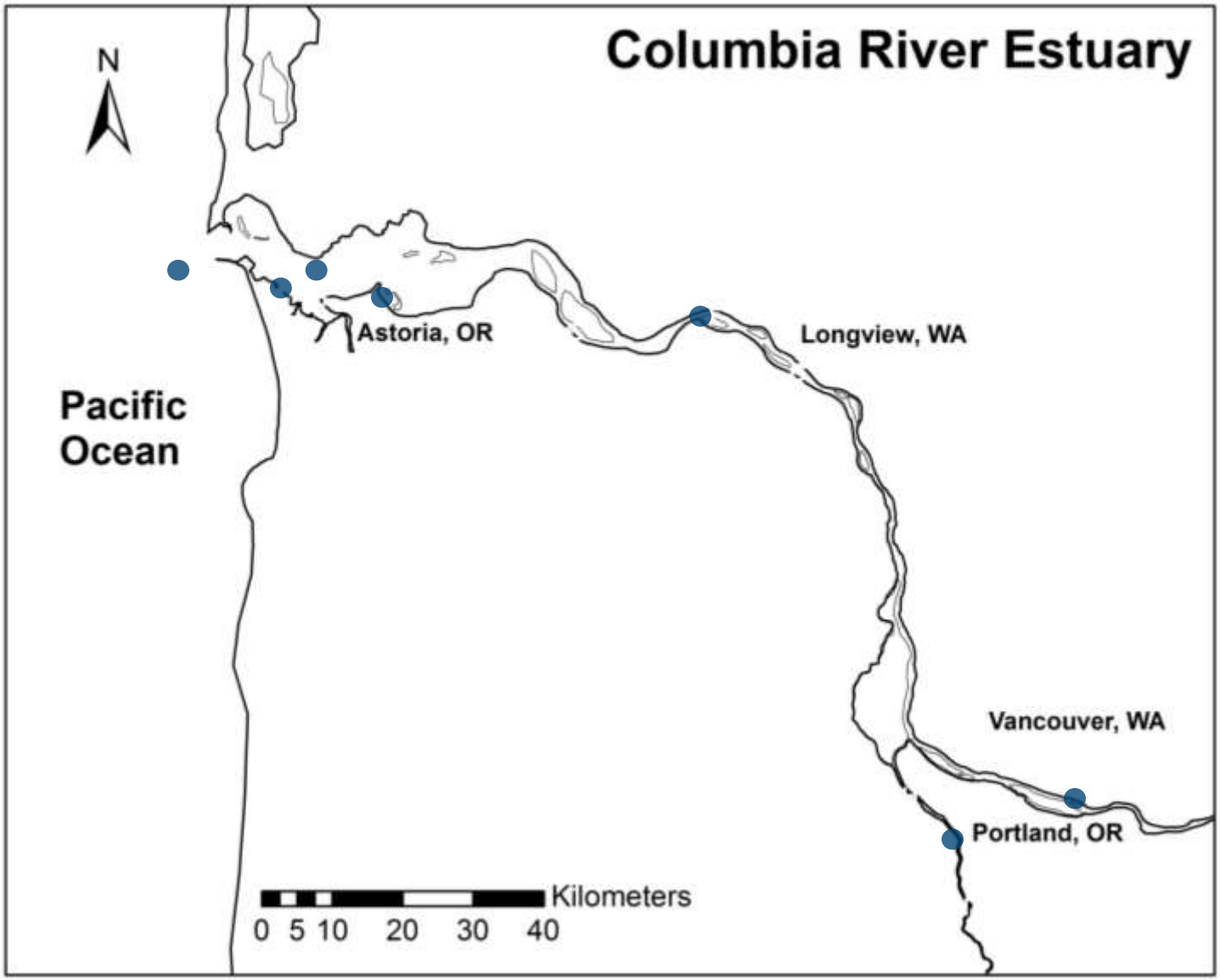
CMOP Instrument Platforms



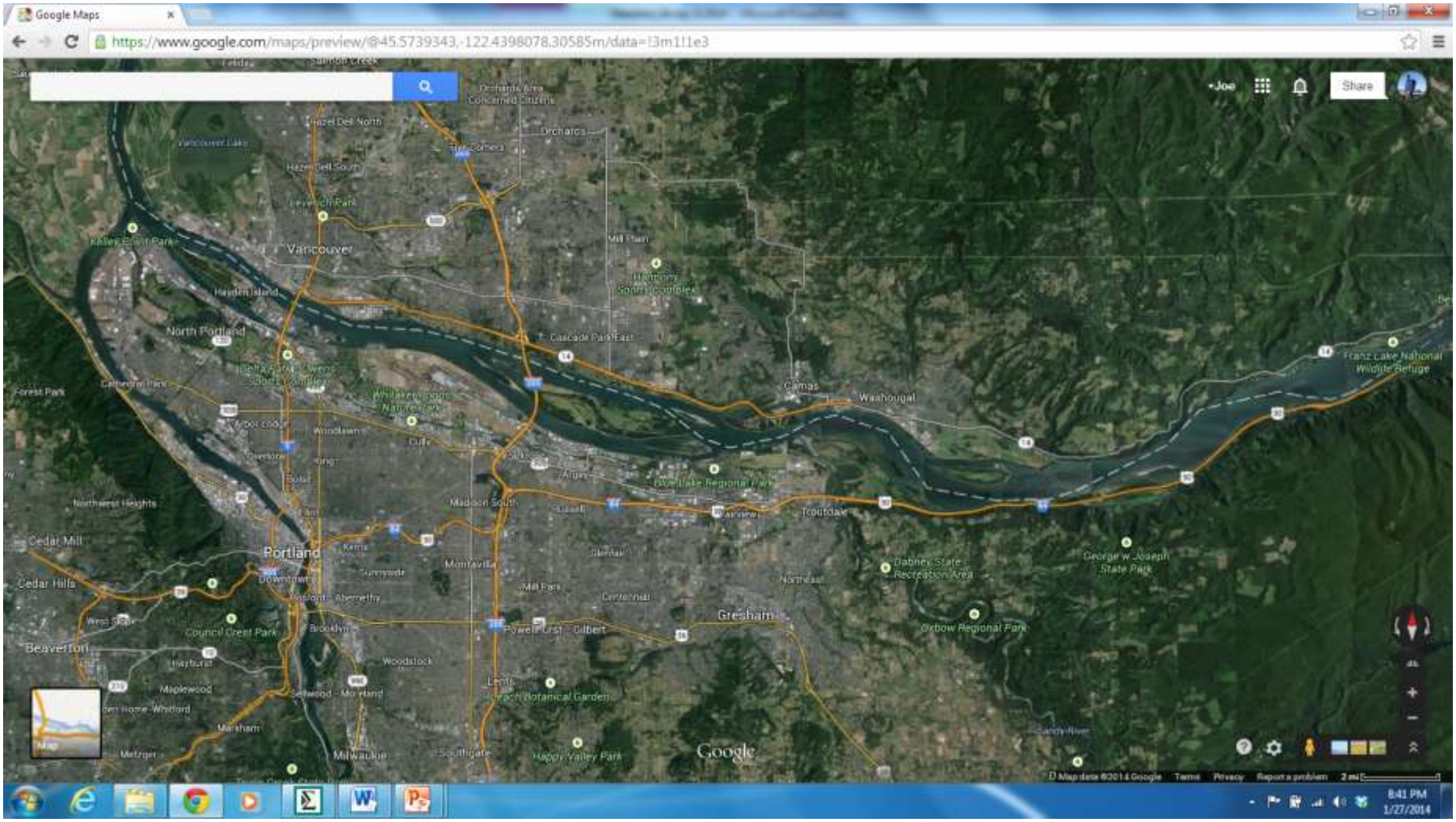
RM-53 (Beaver Army Terminal)



CMOP Instrument Platforms



RM-122 (Camas/Washougal)


Google Maps
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Share
Vancouver
North Portland
Portland
Cedar Mill
Cedar Hills
Beaverton
Hazel Dell North
Hazel Dell South
Orchards
Mill Plain
Camas
Washougal
Troutdale
Gresham
Oxbow Regional Park
Dabney State Recreation Area
George W Joseph State Park
Franz Lake National Wildlife Refuge
Madison South
Montavilla
Centennial
Woodstock
Maplewood
Marshall
Milwaukie
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Google
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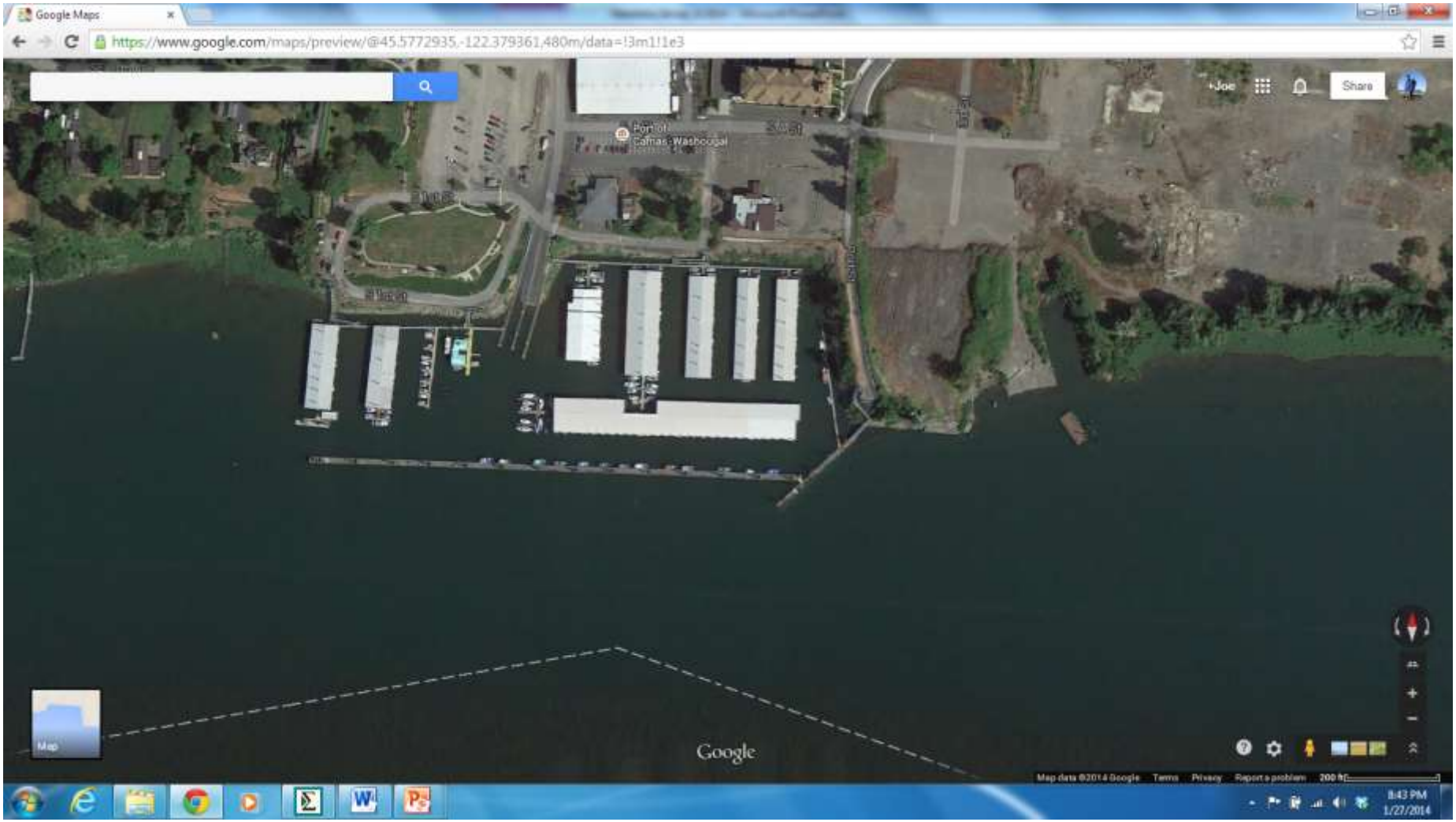
1/27/2014


Google Maps
https://www.google.com/maps/preview/@45.5772935,-122.379361,480m/data=!3m1!1e3
+Joe
Share
Port of Camas-Washougal
Google
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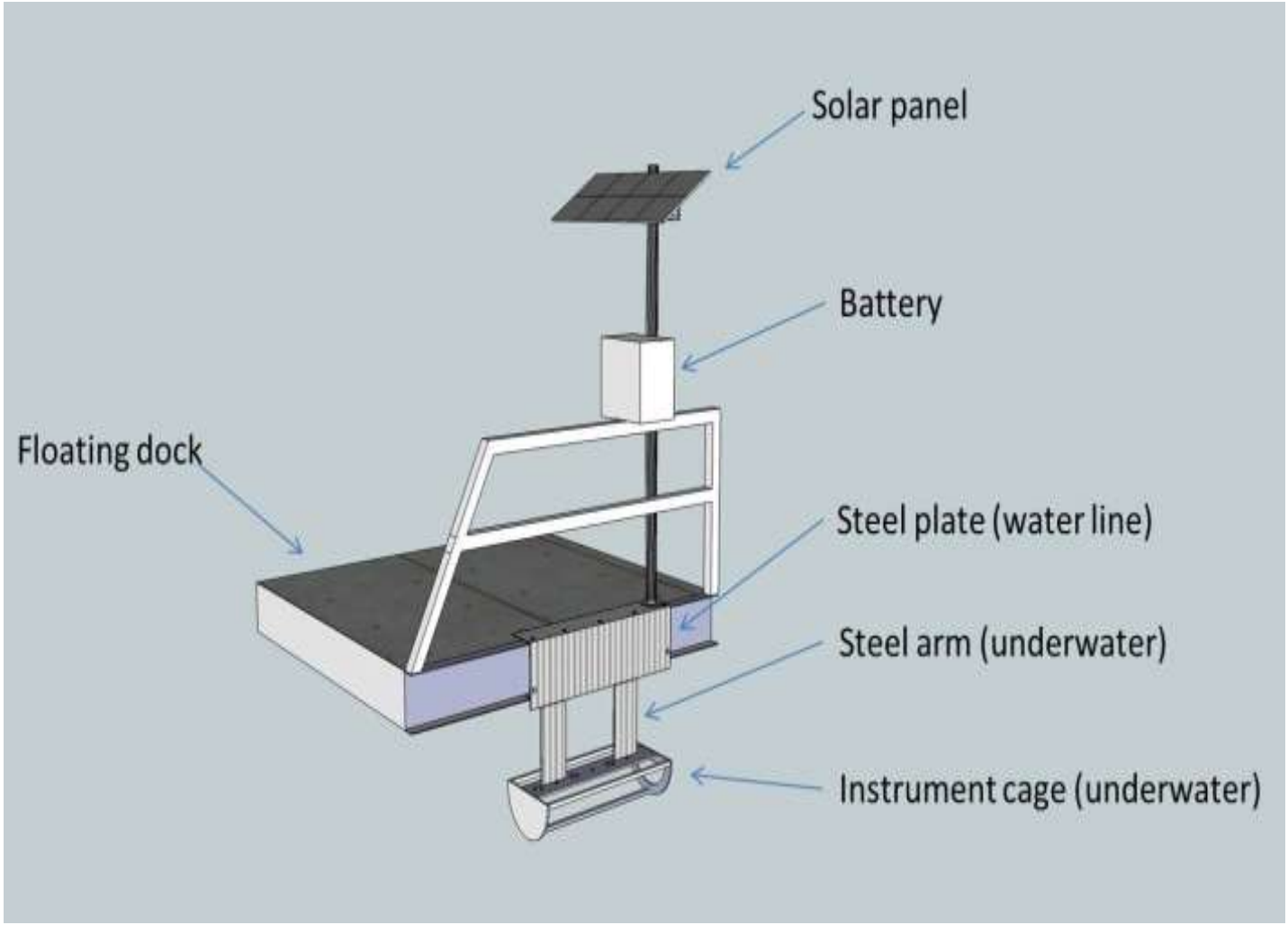
8:43 PM
1/27/2014

RM-122 Platform Design

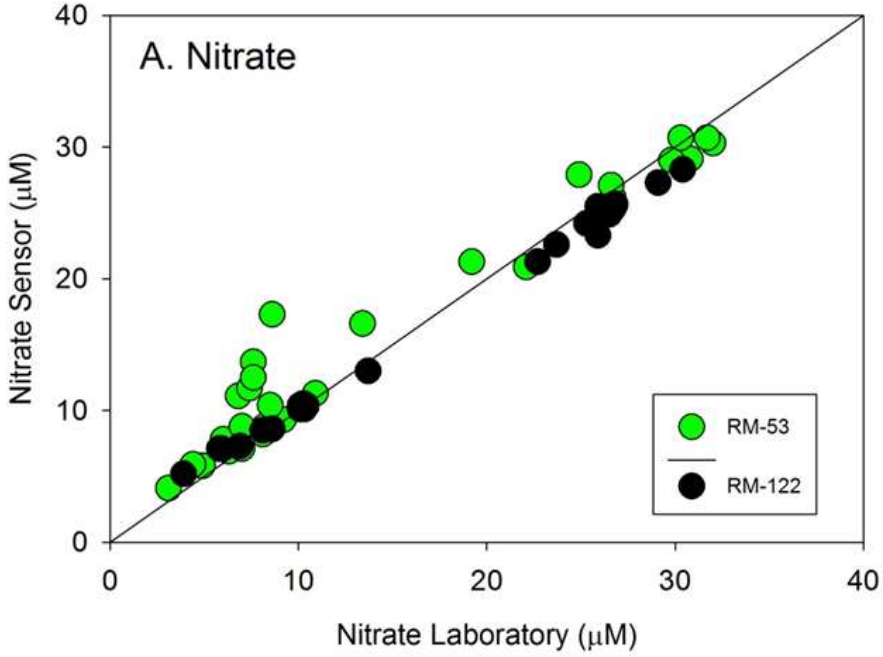


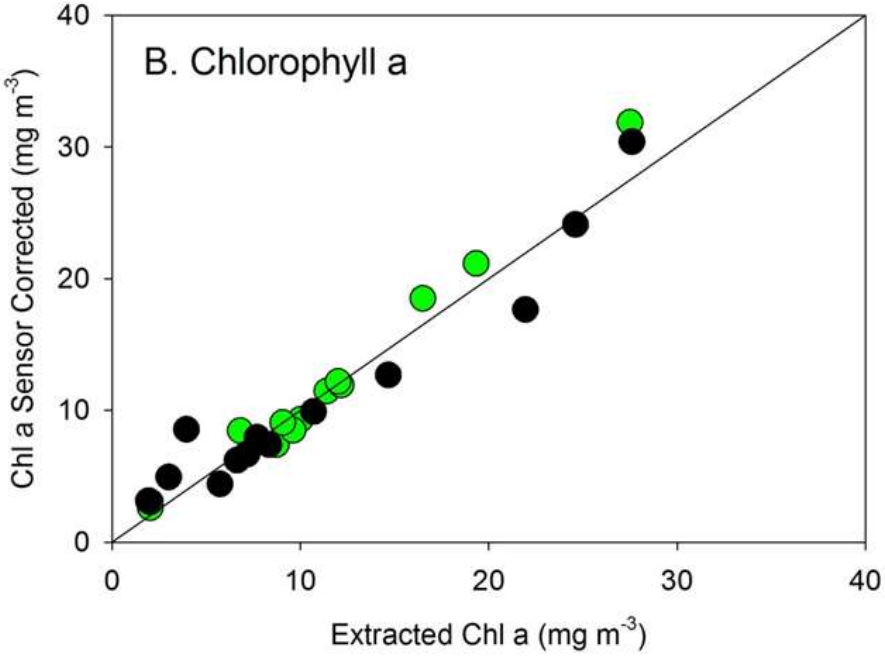
Instruments and Measurements

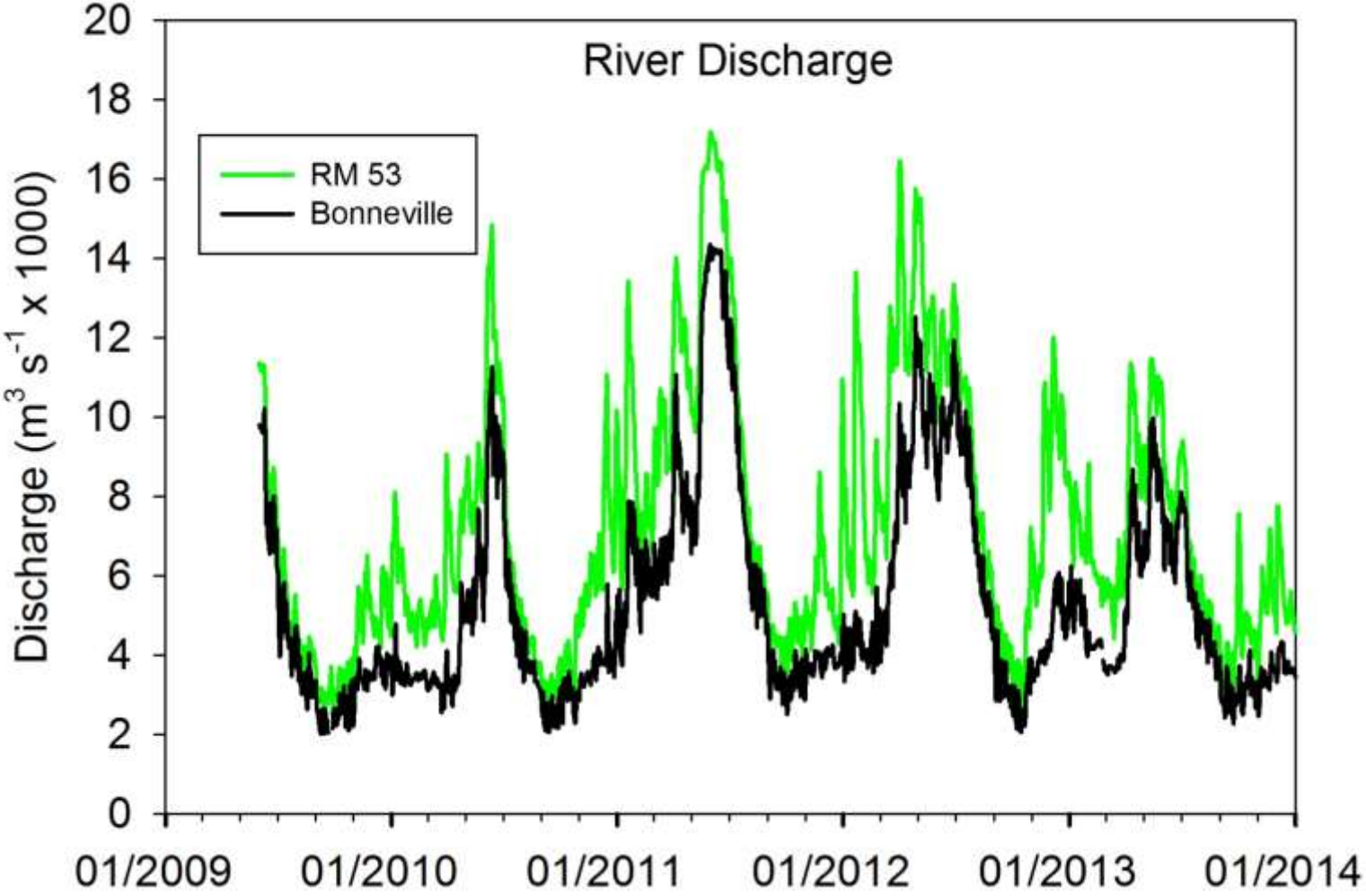
Company	Sensor	Parameters
Satlantic	LOBO	Power distribution Sensor control Wireless communication Data management
Satlantic	SUNA Nitrate	Nitrate Concentration
WET Labs	ECO-CDS	Colored Dissolved Organic Matter (CDOM)
WET Labs	WQM Water Quality Monitor	Conductivity, Temperature, Dissolved Oxygen, Turbidity, Chlorophyll Concentration
WET Labs	Cycle PO4	Ortho-Phosphate

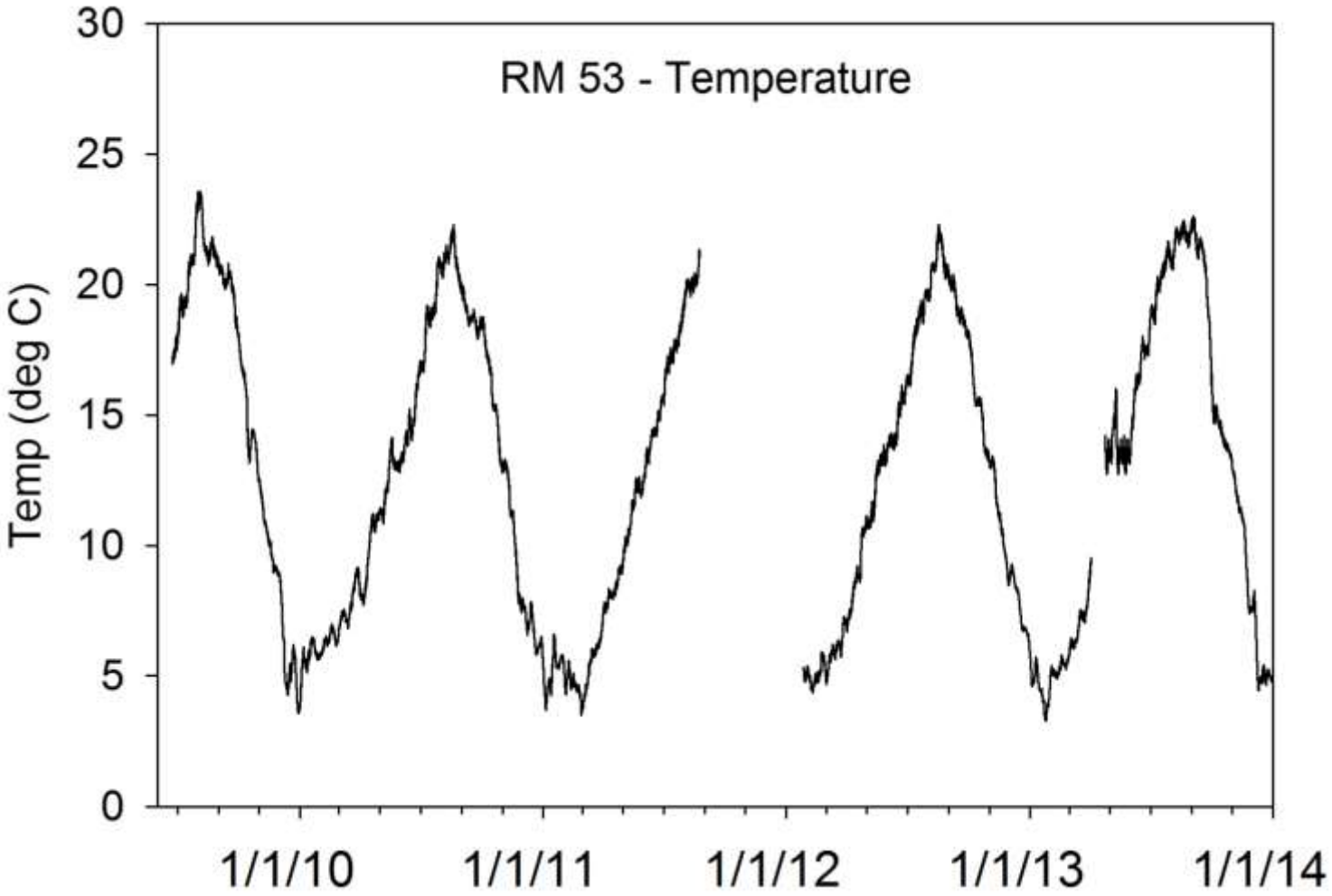
Maintenance

RM-53	RM-122
9/5/2012	9/5/2012
12/4/2012	12/10/2012
1/8/2013	1/16/2013
2/12/2013	2/7/2013
3/26/2013	3/27/2013
4/23/2013	4/17/2013
5/21/2013	5/29/2013
6/18/2013	6/27/2013
8/20/2013	7/15/2013
12/4/2013	8/6/2013
	8/14/2013
	9/3/2013
	12/15/2013

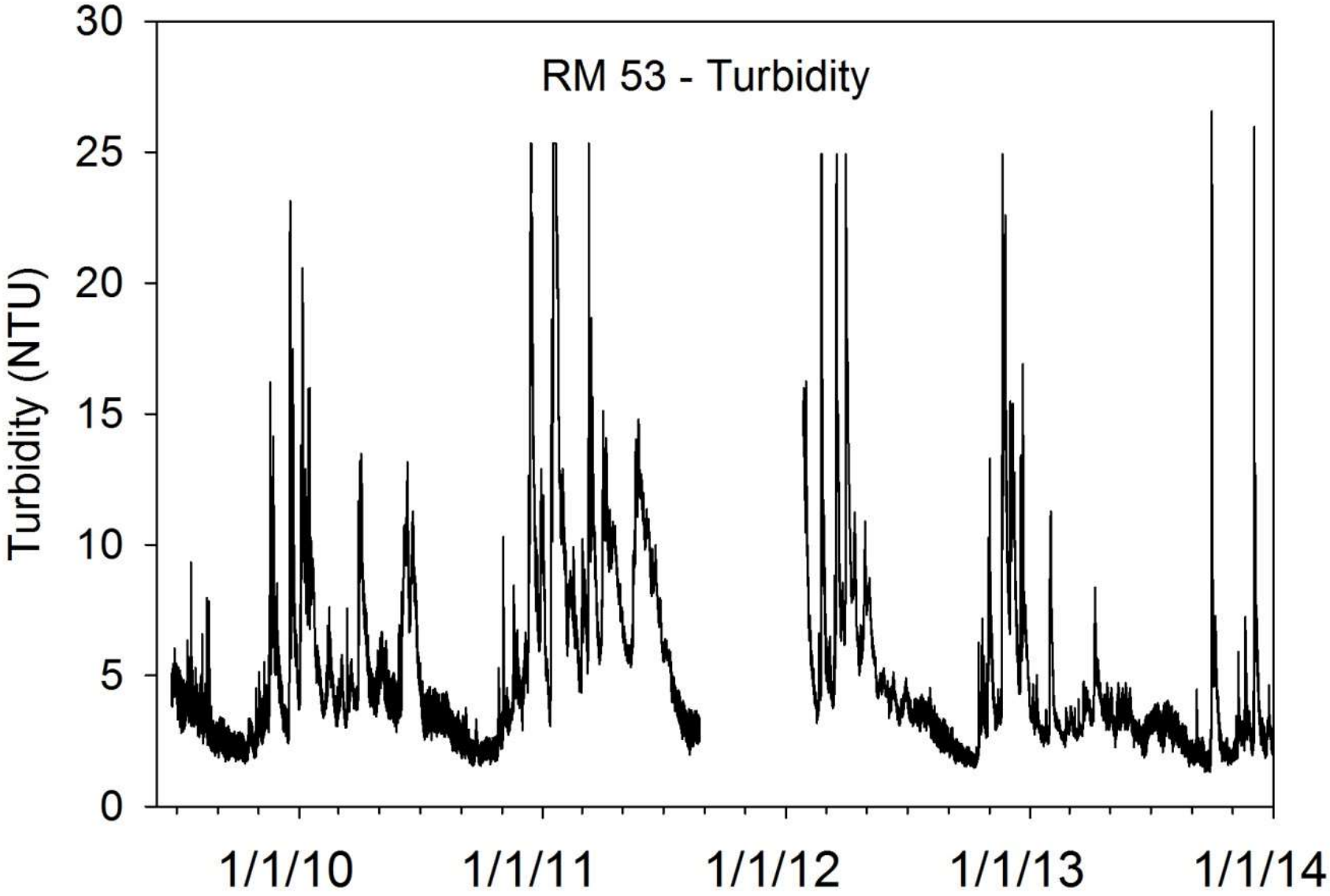

A. Nitrate
Nitrate Sensor (μM)
Nitrate Laboratory (μM)
RM-53
RM-122
0
10
20
30
40

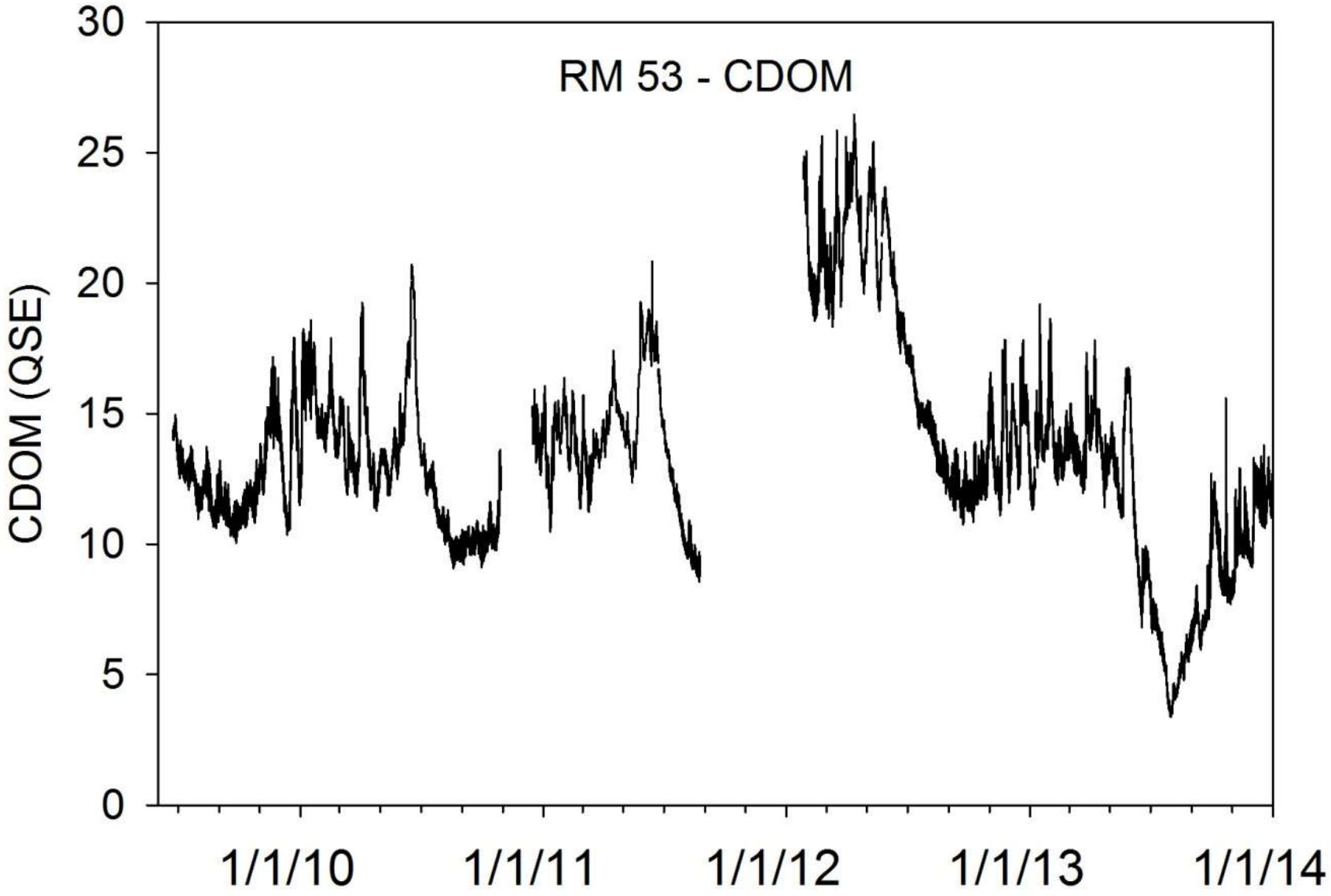

B. Chlorophyll a
Chl a Sensor Corrected (mg m-3)
Extracted Chl a (mg m-3)
0
10
20
30
40

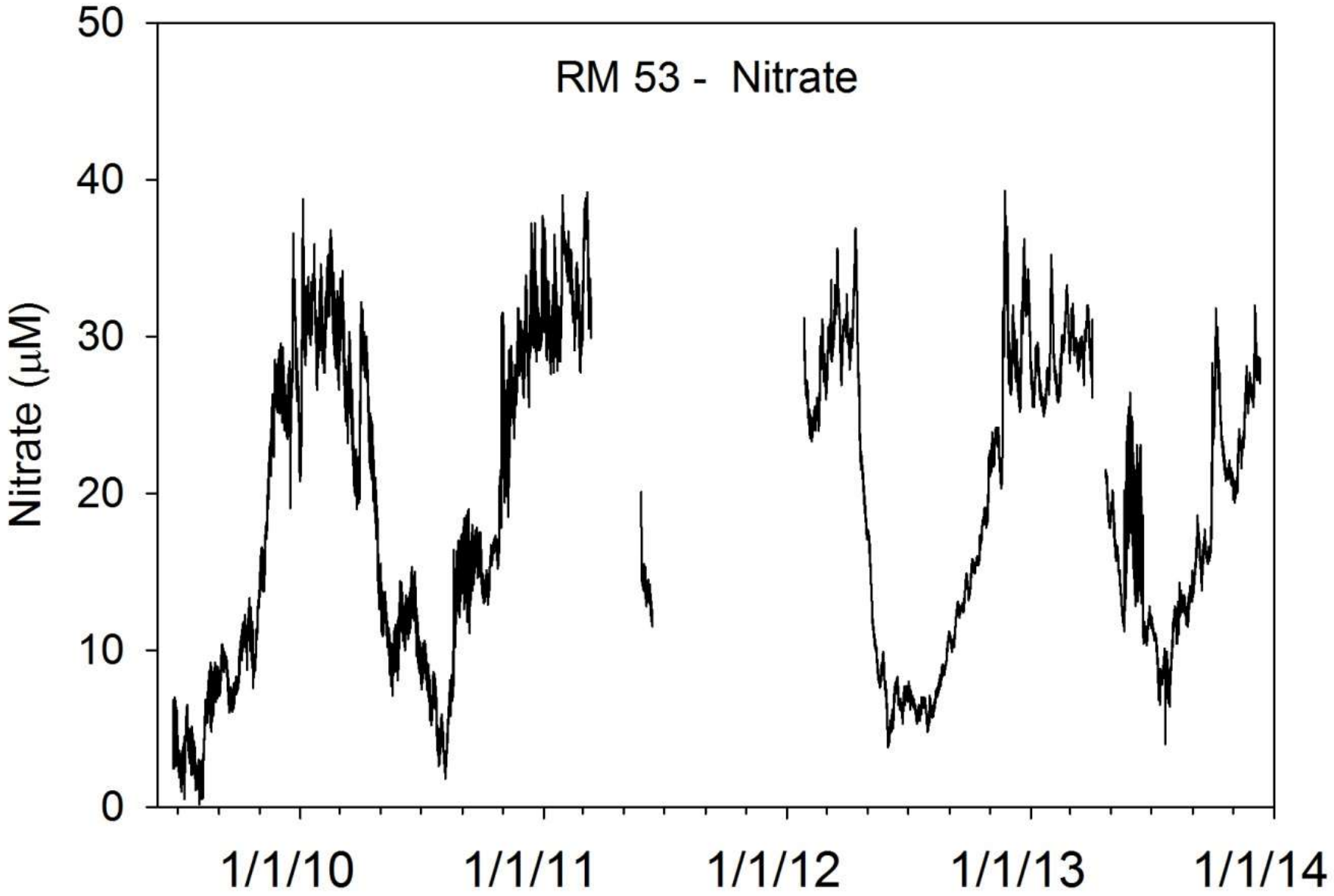

River Discharge
RM 53
Bonneville
Discharge (m3 s-1 x 1000)
0
2
4
6
8
10
12
14
16
18
20
01/2009
01/2010
01/2011
01/2012
01/2013
01/2014

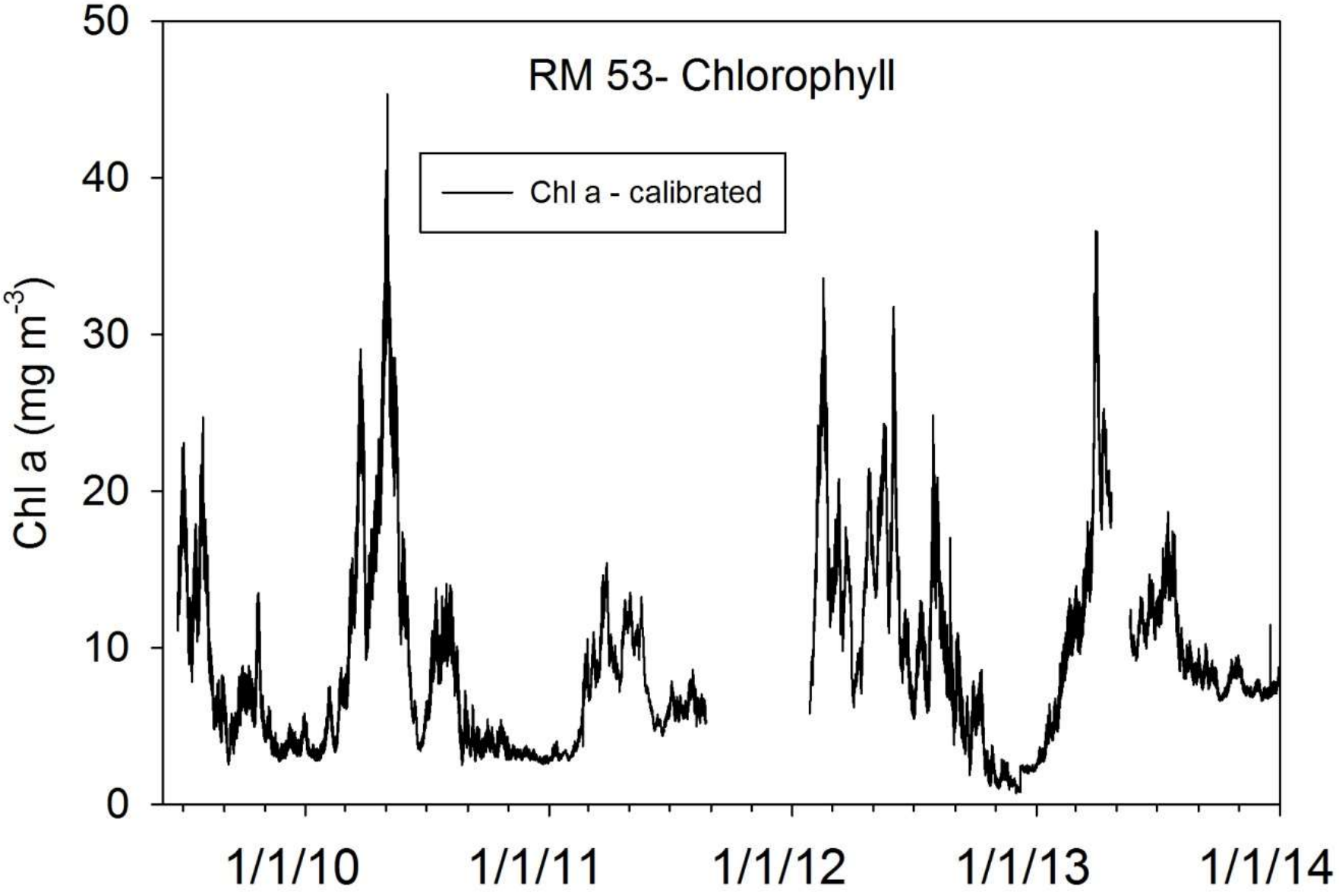


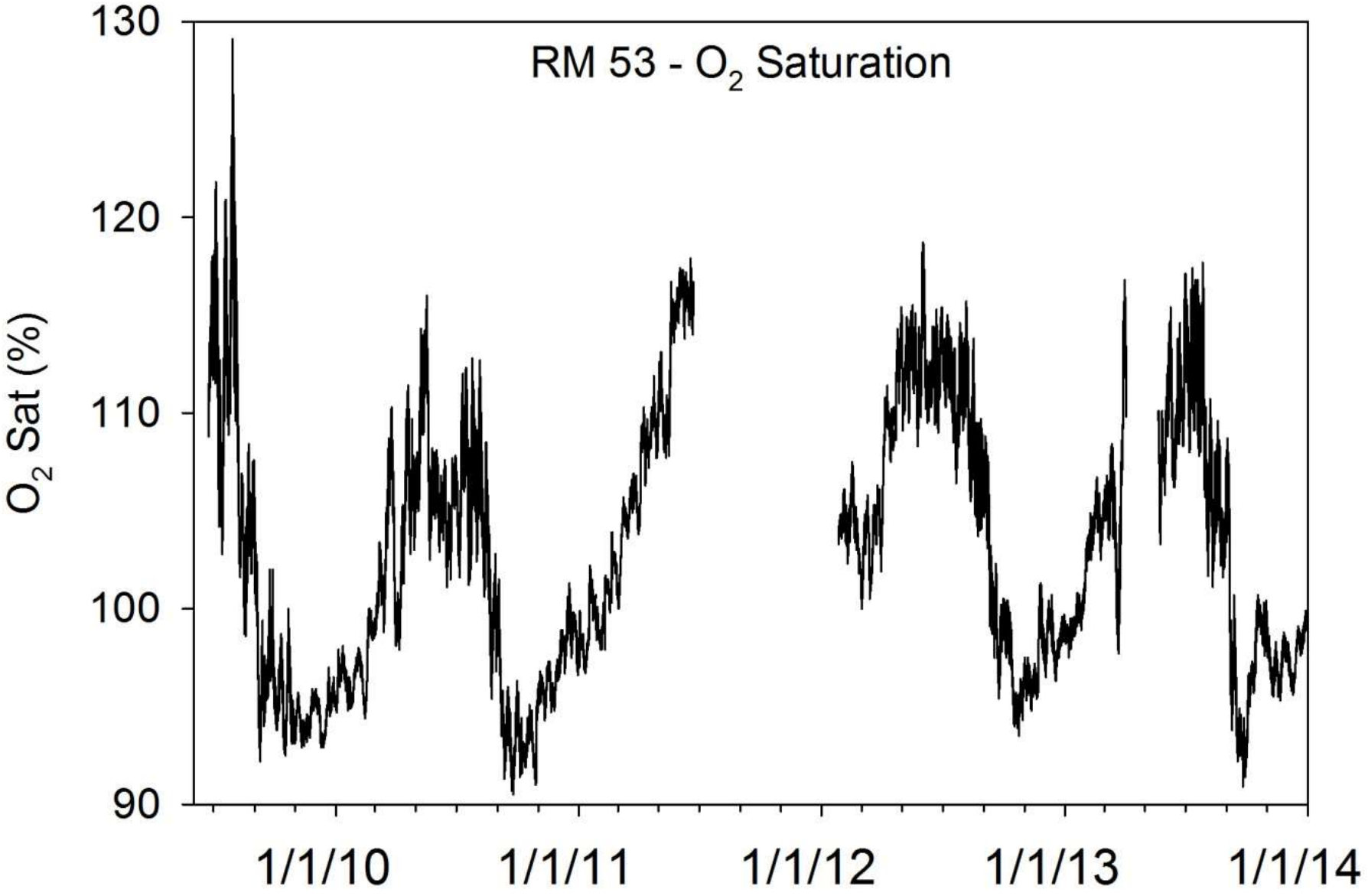
	2009	2010	2012	2013
Range 19-21 °C	70	49	53	67
Above > 21° C	11	2	2	14
Total > 19°C	82	51	55	81

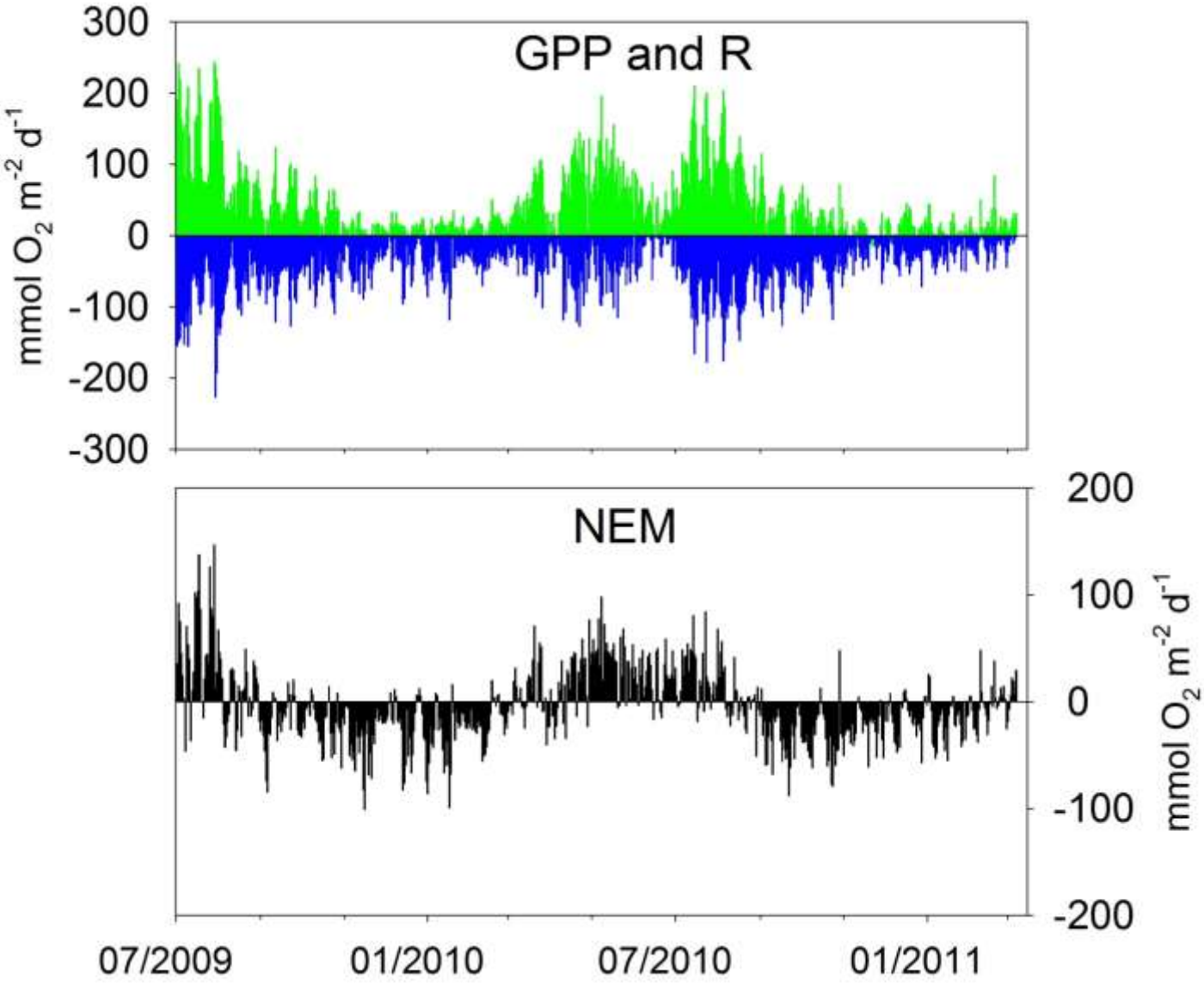

RM 53 - Turbidity
Turbidity (NTU)
30
25
20
15
10
5
0
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14


RM 53 - CDOM
CDOM (QSE)
30
25
20
15
10
5
0
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14


RM 53 - Nitrate
Nitrate (µM)
50
40
30
20
10
0
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14


RM 53- Chlorophyll
Chl a - calibrated
Chl a (mg m-3)
50
40
30
20
10
0
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14


RM 53 - O2 Saturation
O2 Sat (%)
130
120
110
100
90
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14

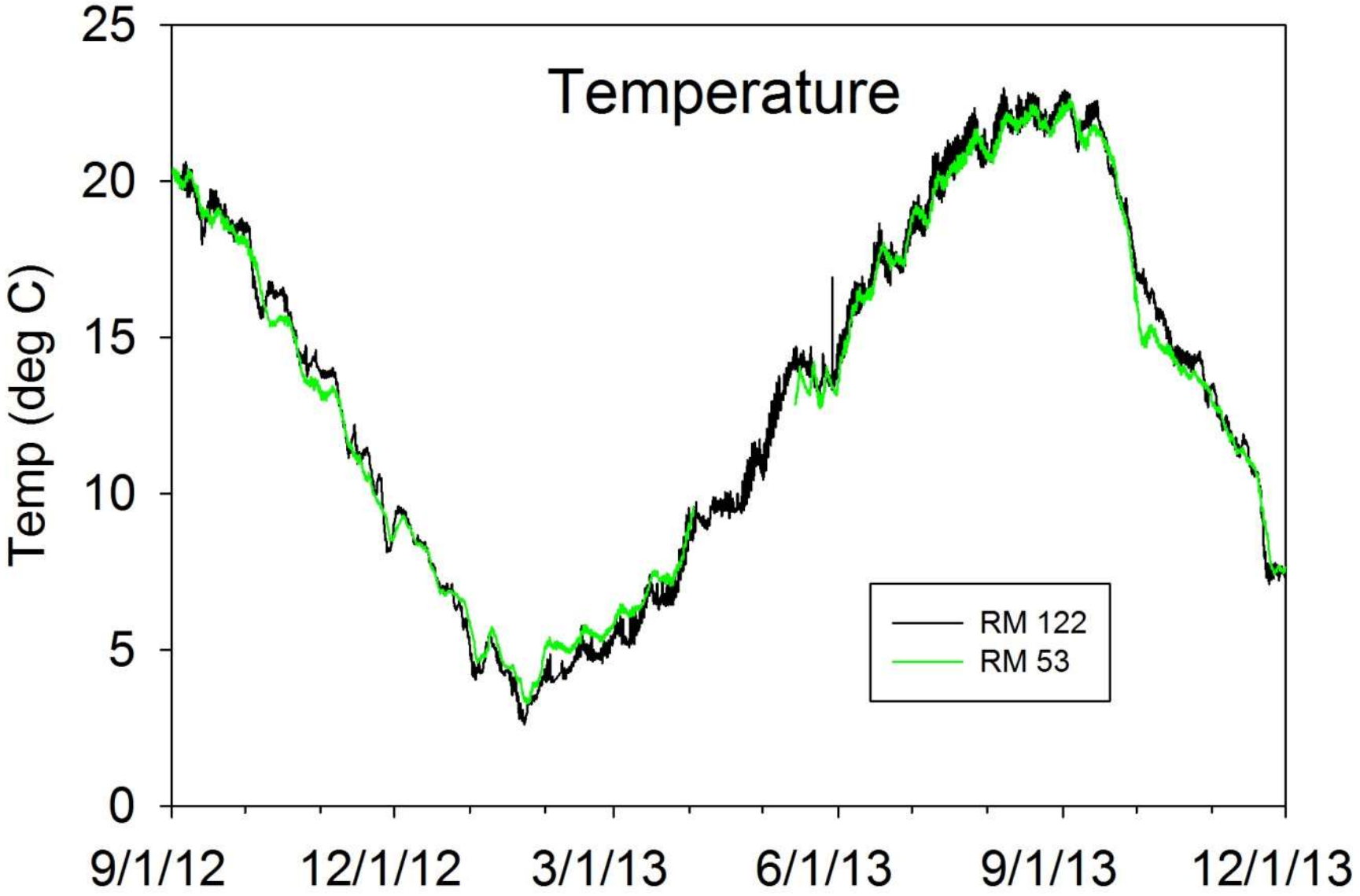


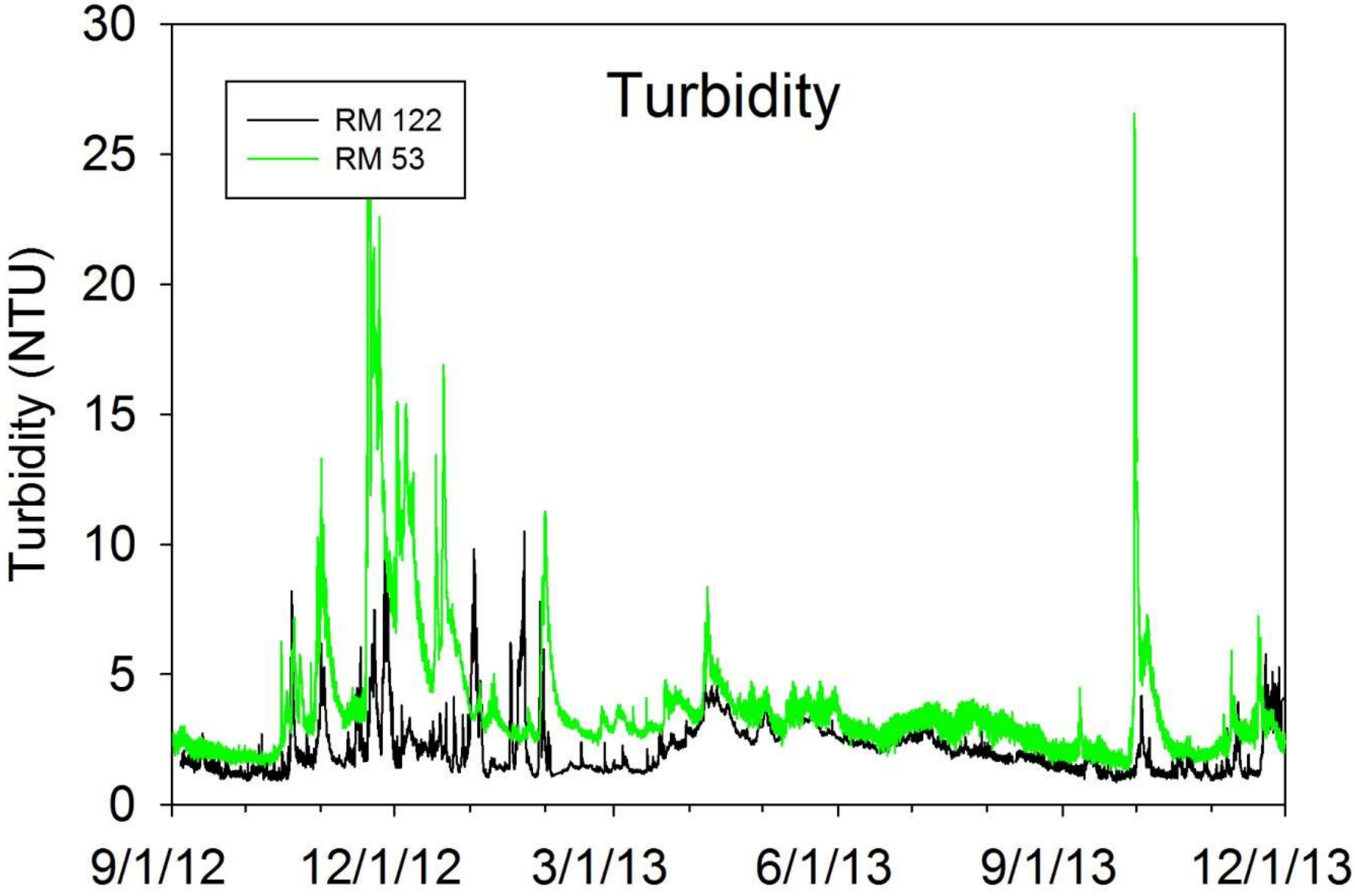
Ecosystem Metabolism Stoichiometry:

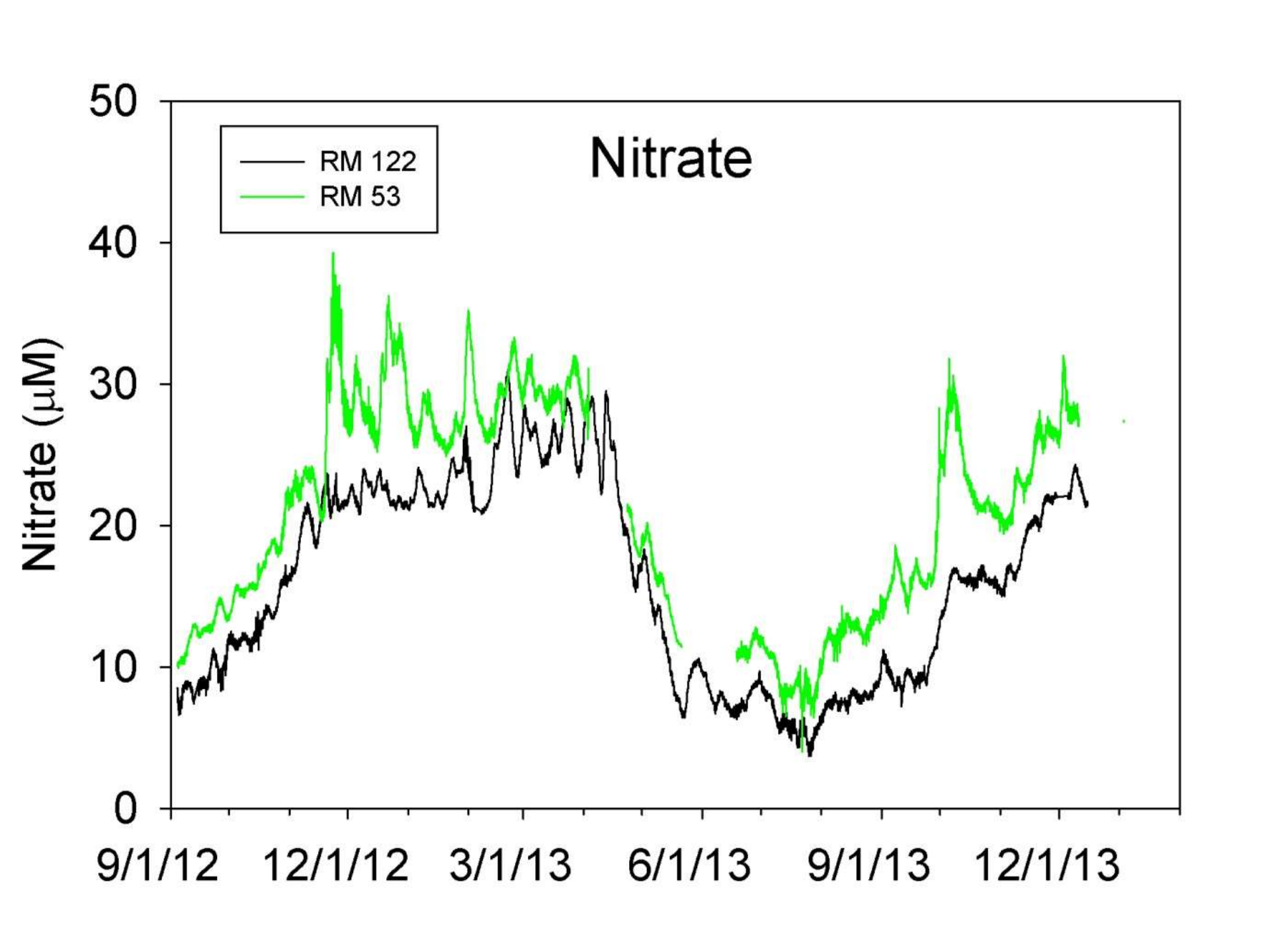
$106\ CO_2 + 16\ N + 1\ P$ ⇄ $Organic\ Matter + 150\ O_2$

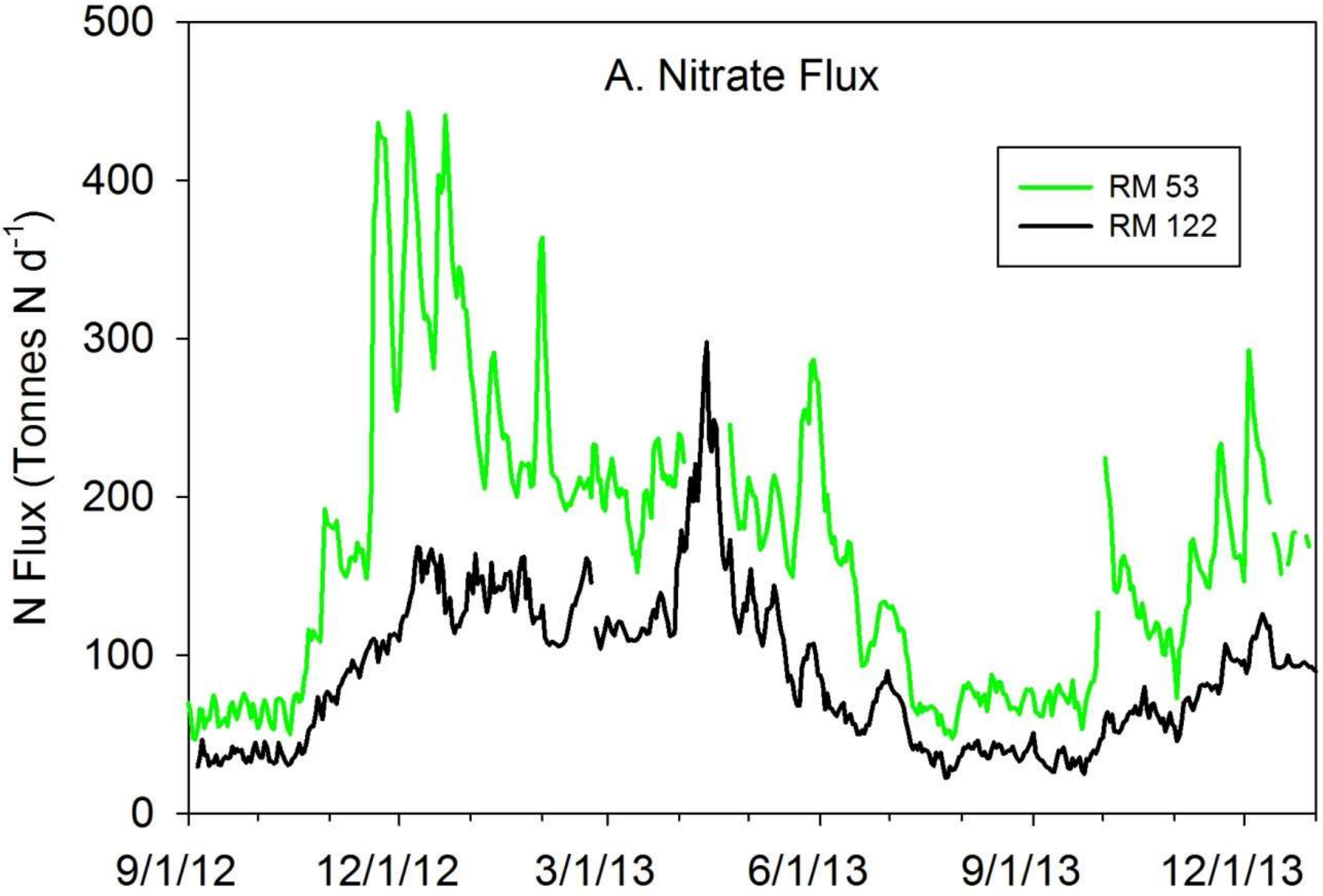
1° Production

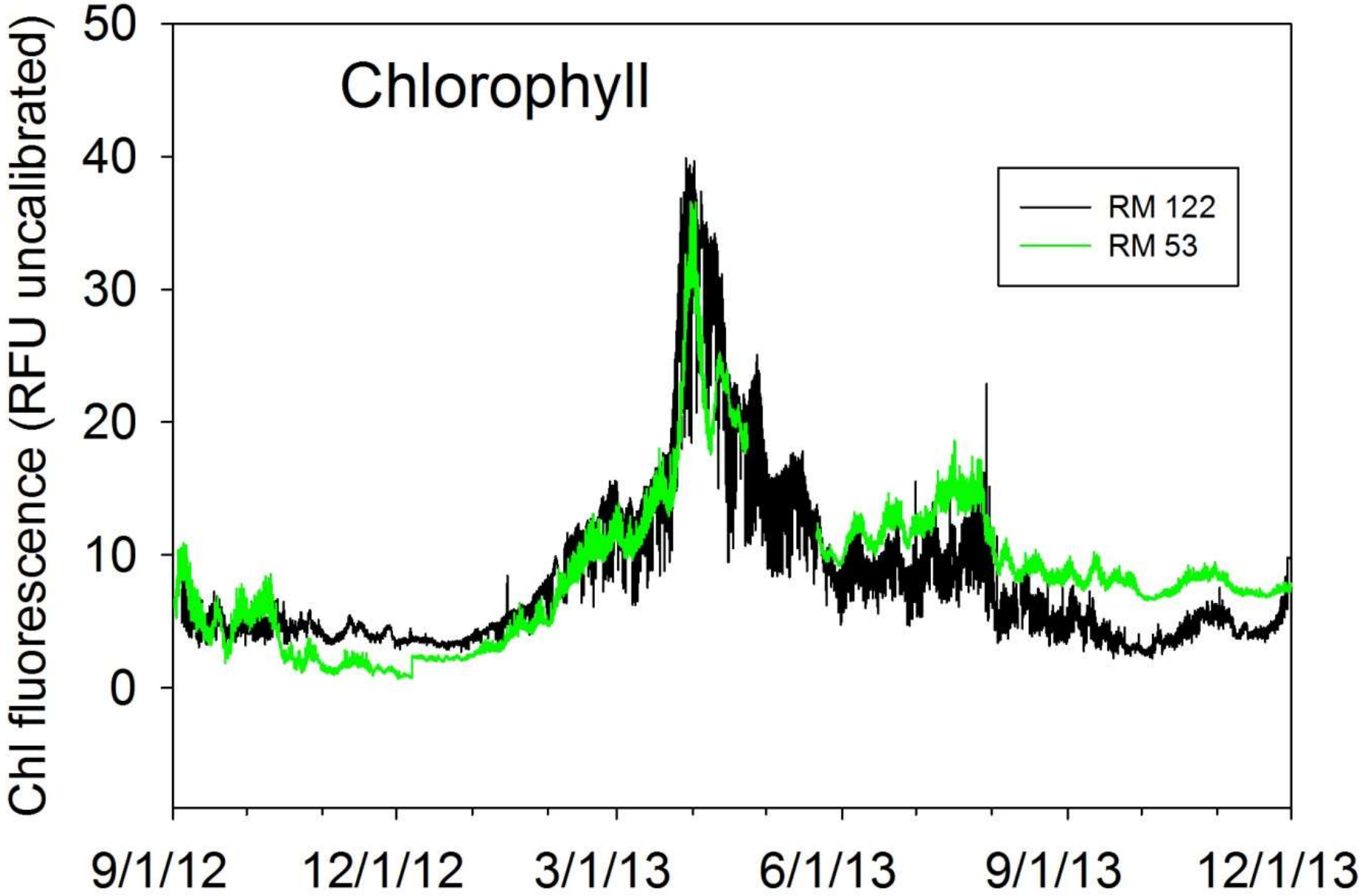
Respiration

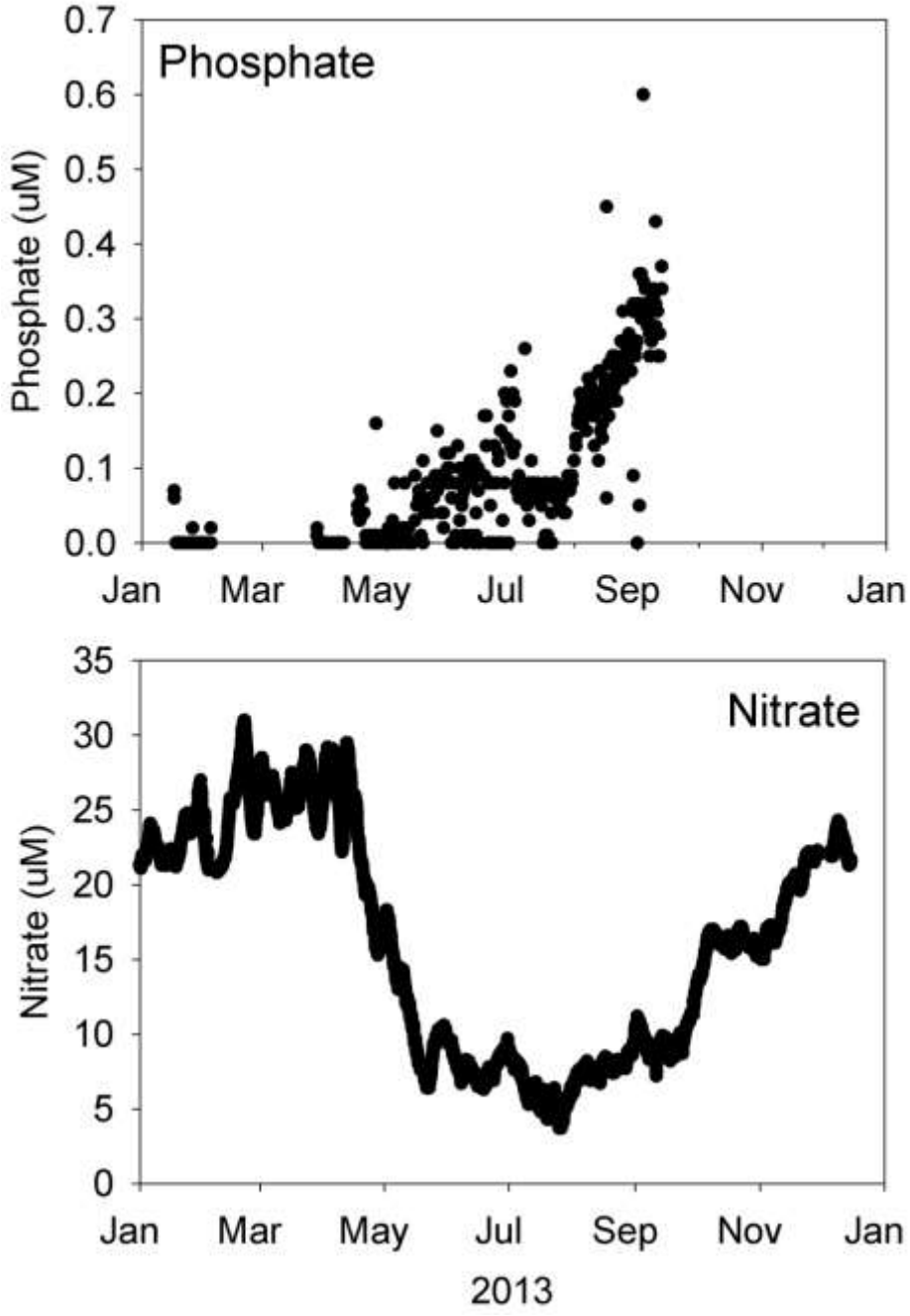

Temperature
Temp (deg C)
25
20
15
10
5
0
9/1/12
12/1/12
3/1/13
6/1/13
9/1/13
12/1/13
RM 122
RM 53

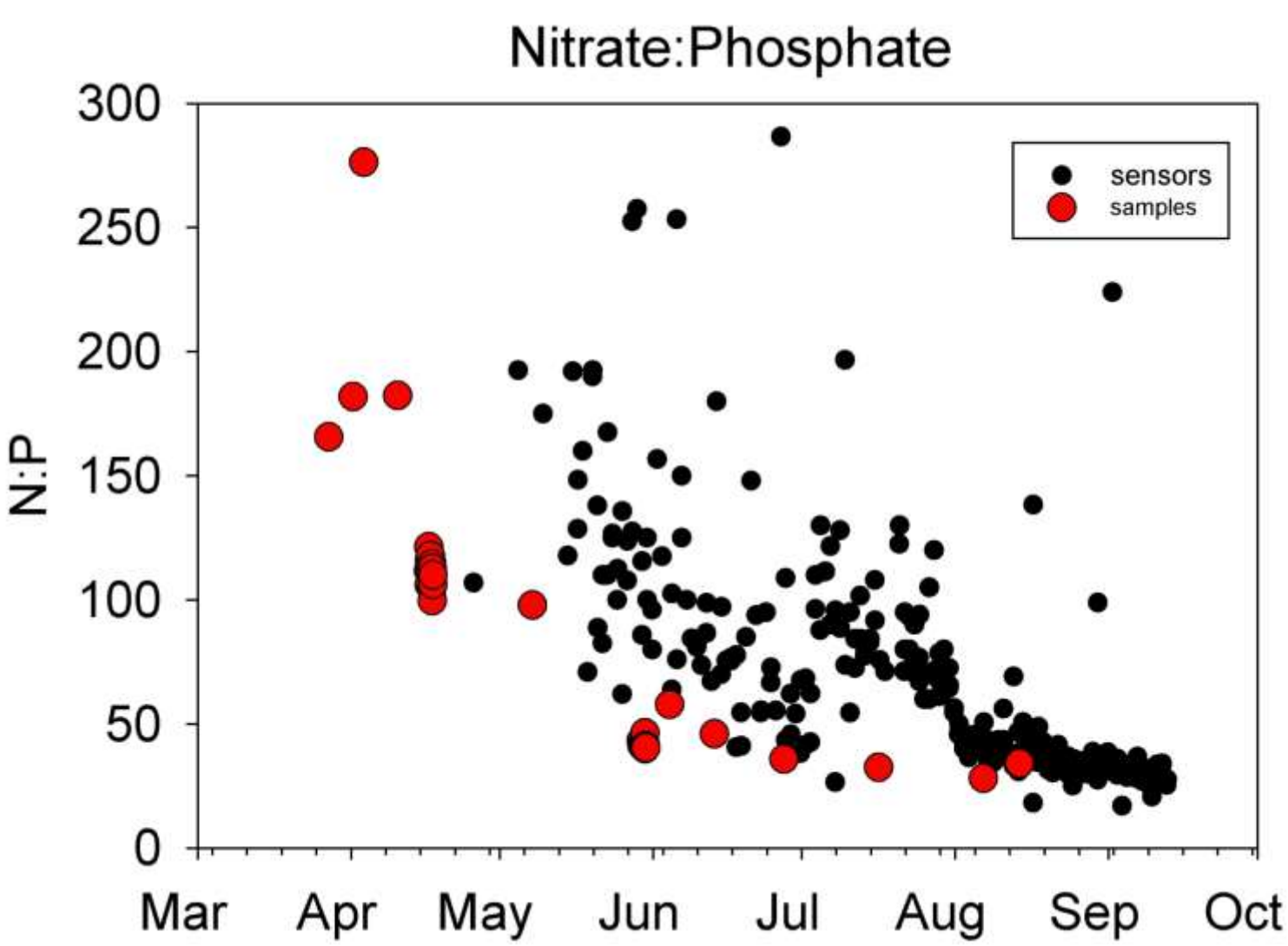

Turbidity
RM 122
RM 53
Turbidity (NTU)
30
25
20
15
10
5
0
9/1/12
12/1/12
3/1/13
6/1/13
9/1/13
12/1/13


Nitrate
RM 122
RM 53
Nitrate (µM)
50
40
30
20
10
0
9/1/12
12/1/12
3/1/13
6/1/13
9/1/13
12/1/13


A. Nitrate Flux
N Flux (Tonnes N d-1)
500
400
300
200
100
0
9/1/12
12/1/12
3/1/13
6/1/13
9/1/13
12/1/13
RM 53
RM 122


Chlorophyll
Chl fluorescence (RFU uncalibrated)
50
40
30
20
10
0
RM 122
RM 53
9/1/12
12/1/12
3/1/13
6/1/13
9/1/13
12/1/13


Phosphate
Phosphate (uM)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Jan
Mar
May
Jul
Sep
Nov
Jan
Nitrate
Nitrate (uM)
35
30
25
20
15
10
5
0
Jan
Mar
May
Jul
Sep
Nov
Jan
2013

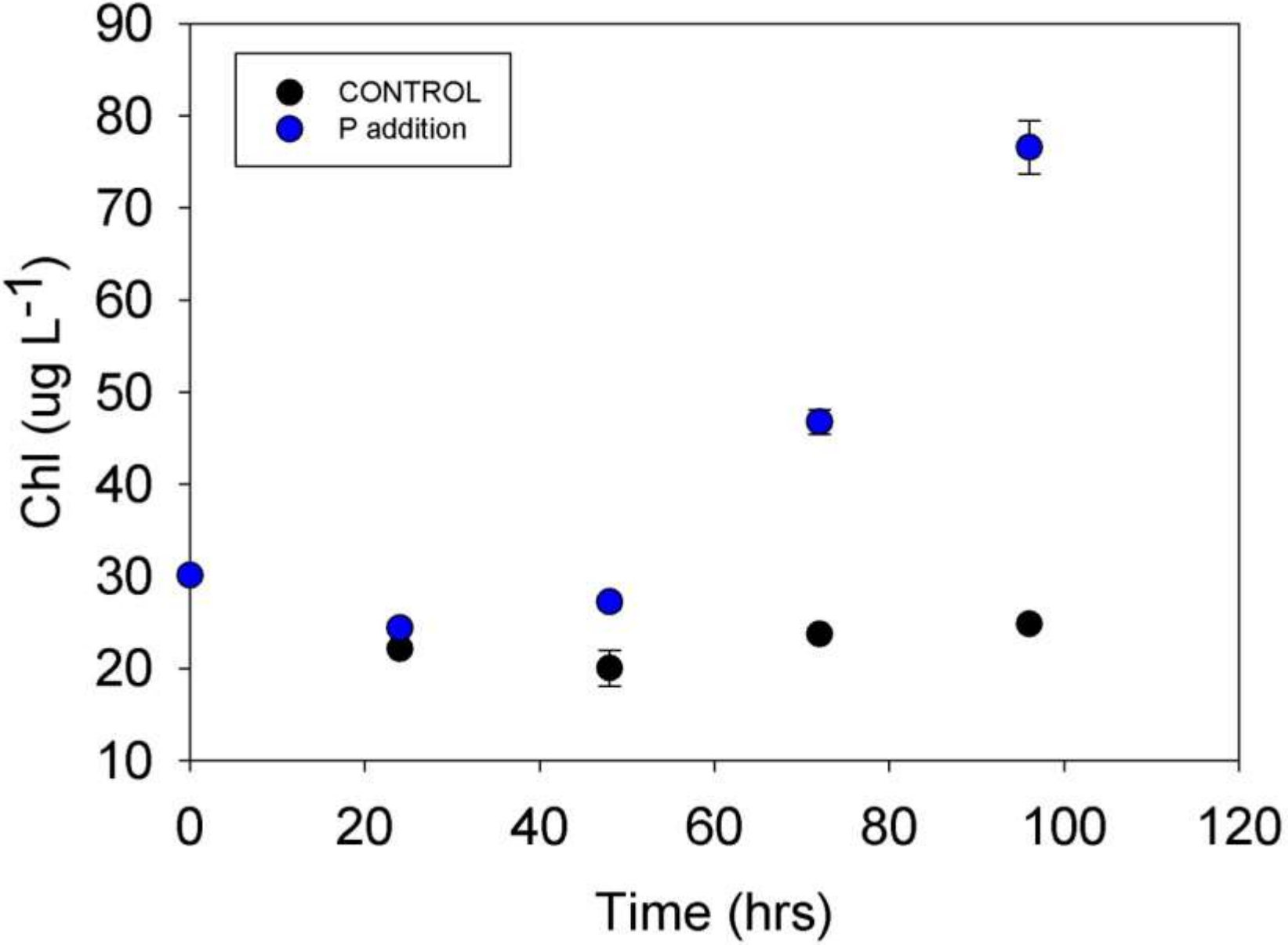


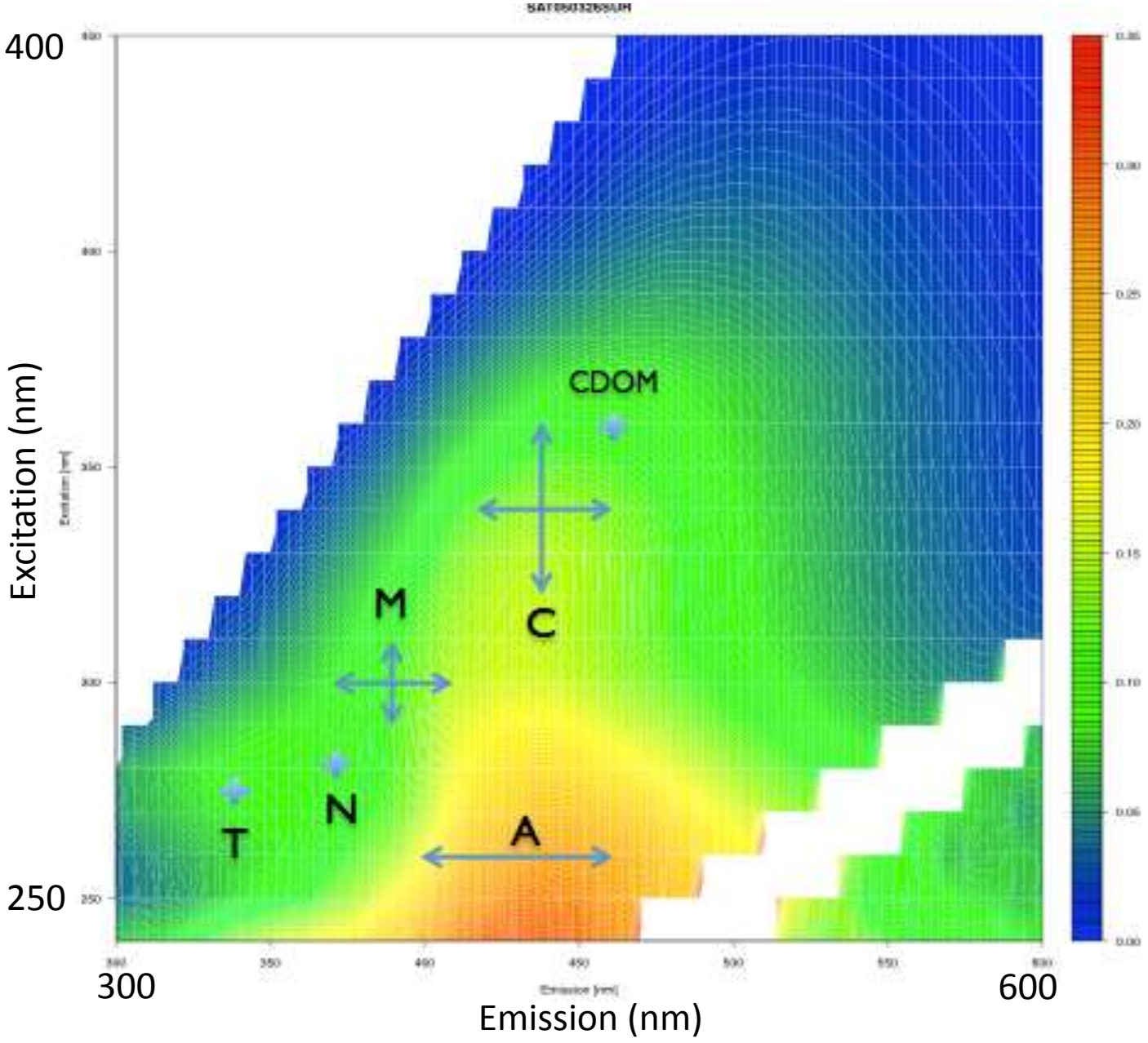
Ecosystem Metabolism Stoichiometry:

$106\ CO_2 + 16\ N + 1\ P \rightleftharpoons$ Organic Matter $+ 150\ O_2$

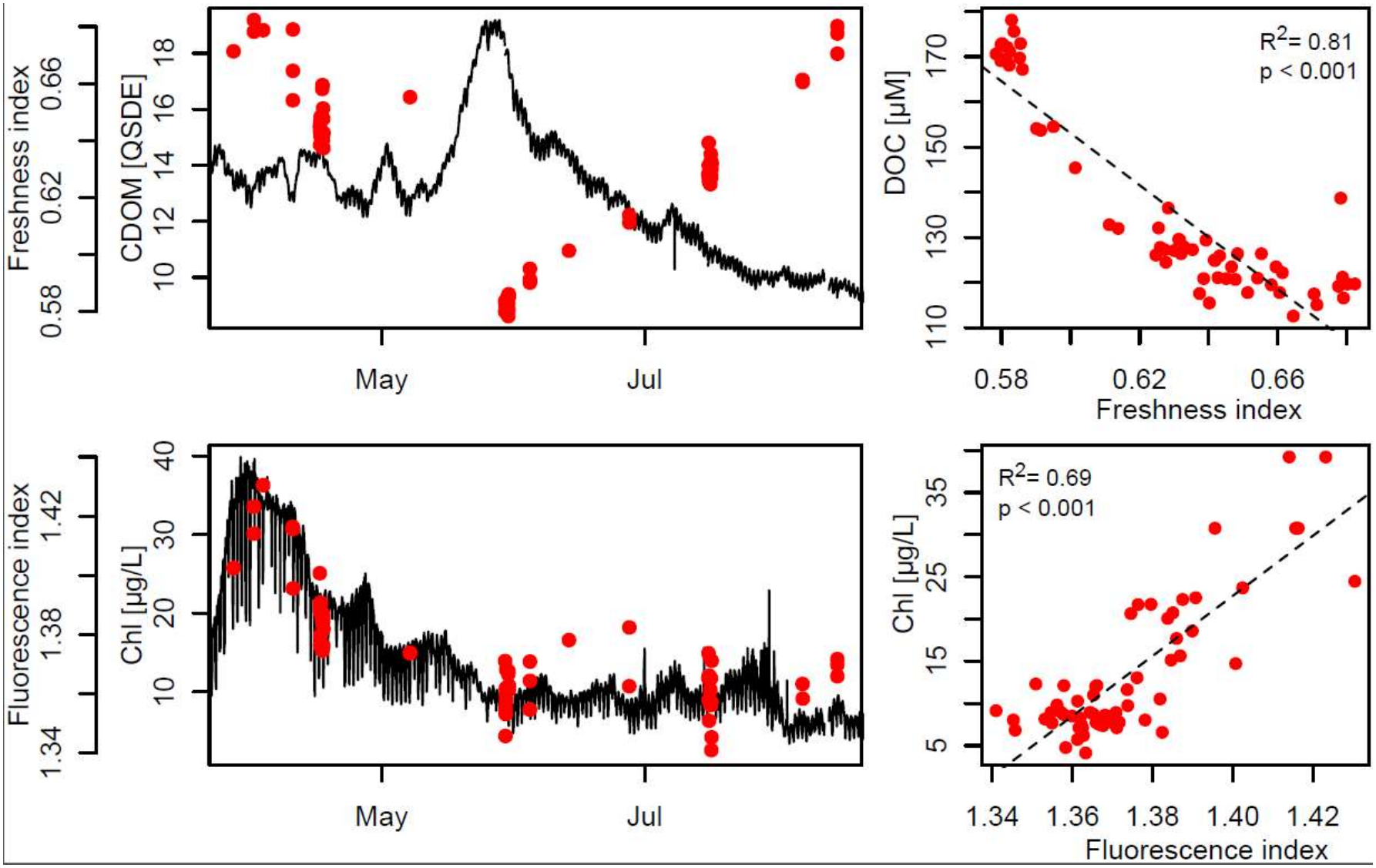
1° Production

Respiration


CONTROL
P addition
Chl (ug L-1)
Time (hrs)
90
80
70
60
50
40
30
20
10
0
20
40
60
80
100
120


400
250
Excitation (nm)
300
600
Emission (nm)
CDOM
C
M
N
T
A

RM 122 Fluorescence and DOC



Summary

- Time series:
  - RM-53: 2009-present
  - RM-122: 2012-present
- Fluxes from tributaries important for lower estuary nutrient and carbon loading to estuary
- Annual variability in all parameters, e.g. temperature, fluxes, chlorophyll
- Chlorophyll and ecosystem metabolism comparable throughout Lower Columbia River
- Periods of interest: Episodic winter storms, spring freshet, spring bloom, summer, episodic events
- Pelagic primary production limited by phosphorus
- Dissolved organic carbon influenced by spring bloom, freshet