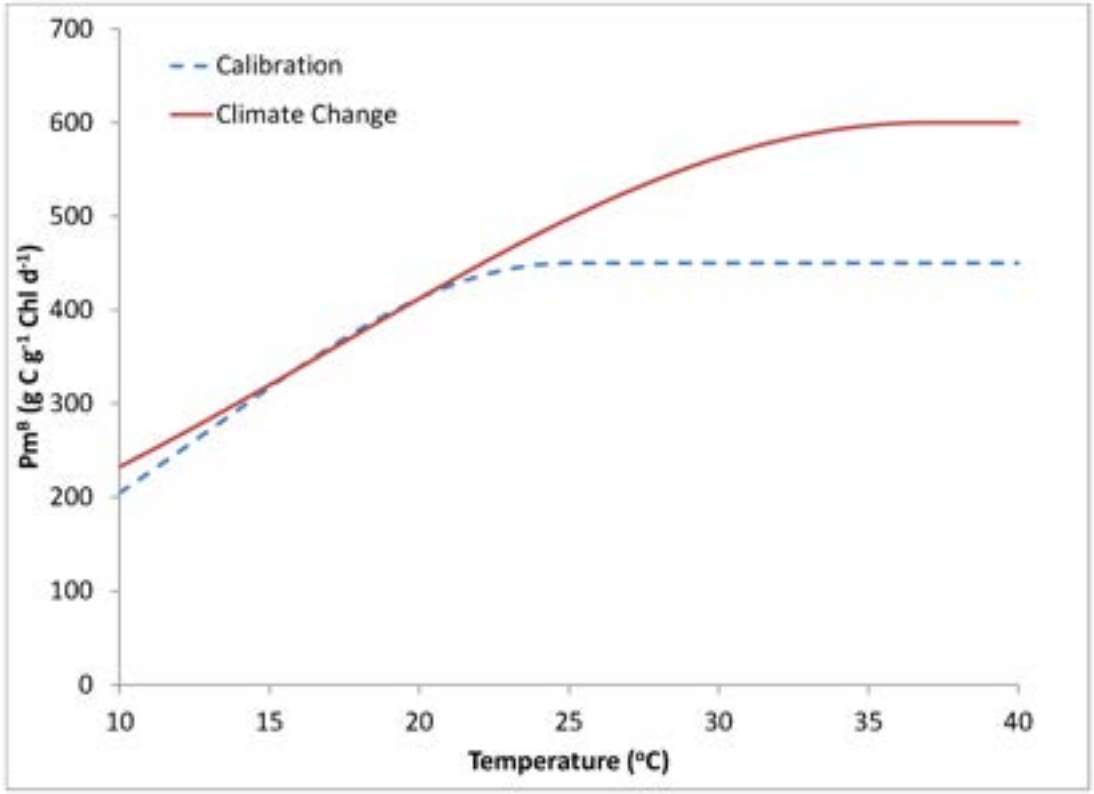


Algal photosynthetic rate versus temperature for Group 3 algae with calibration and climate-change parameter sets.

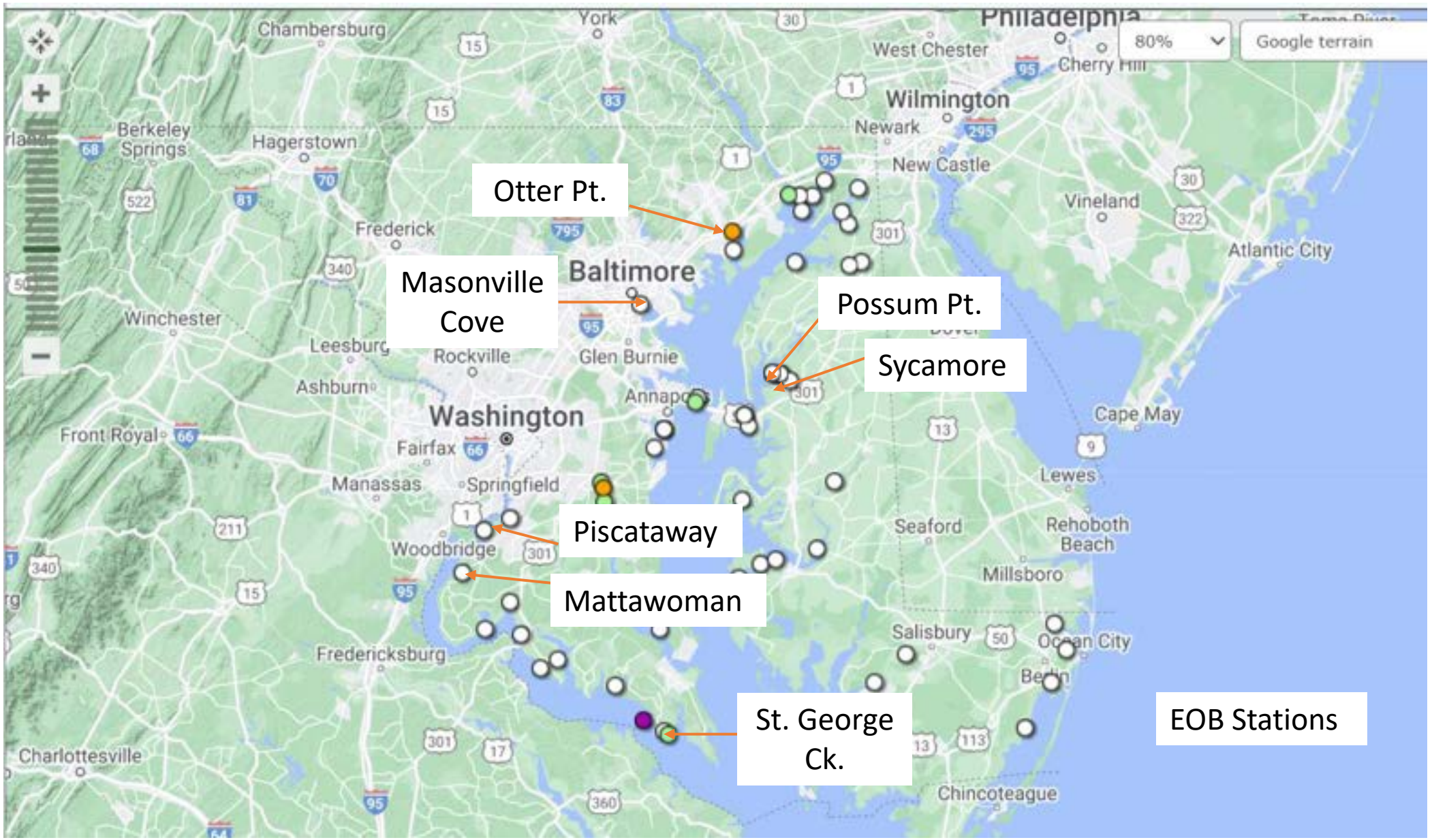
The Plan – Examine existing chlorophyll and temperature data for indications of temperature dependence.

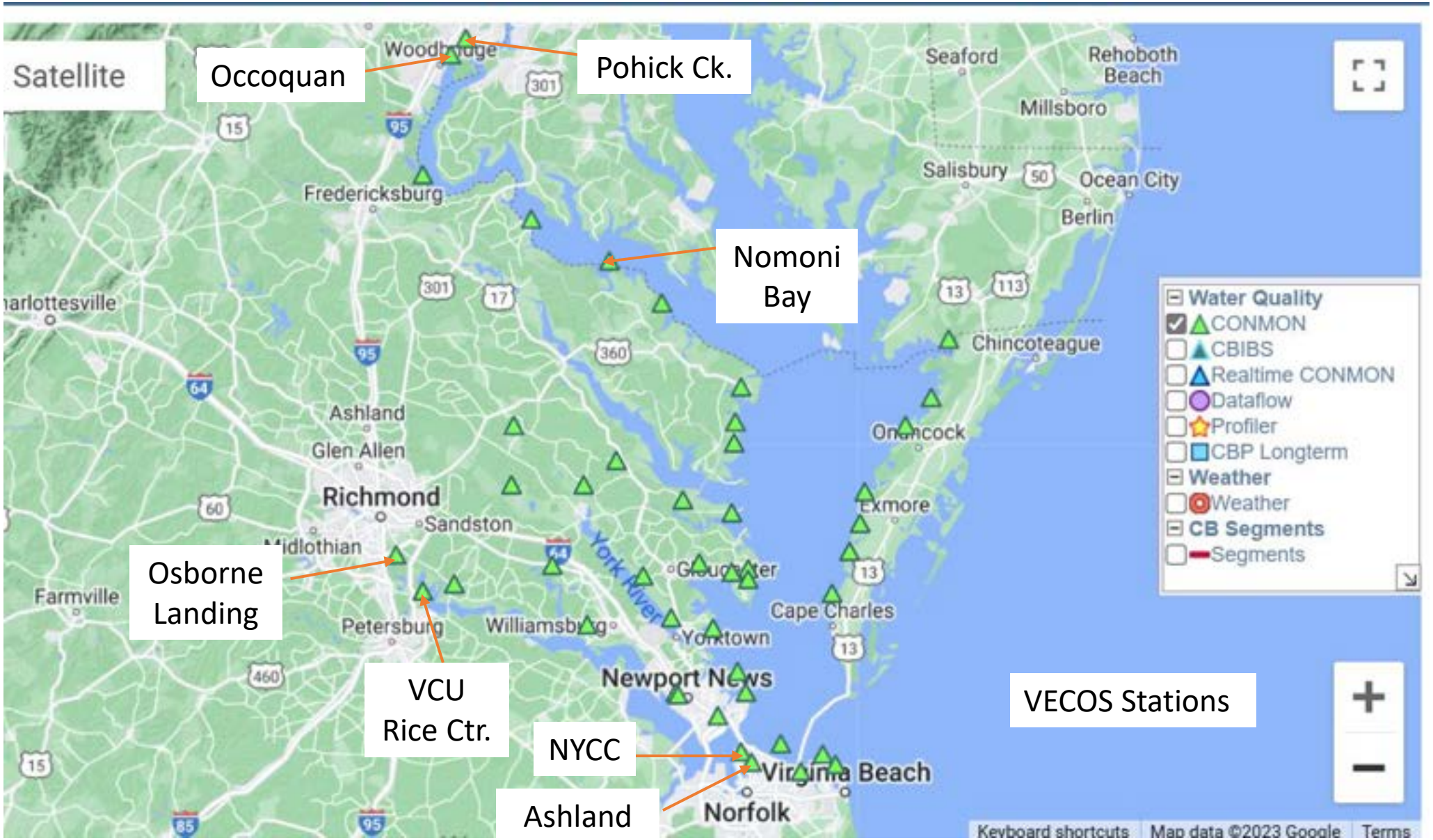
Data Sets

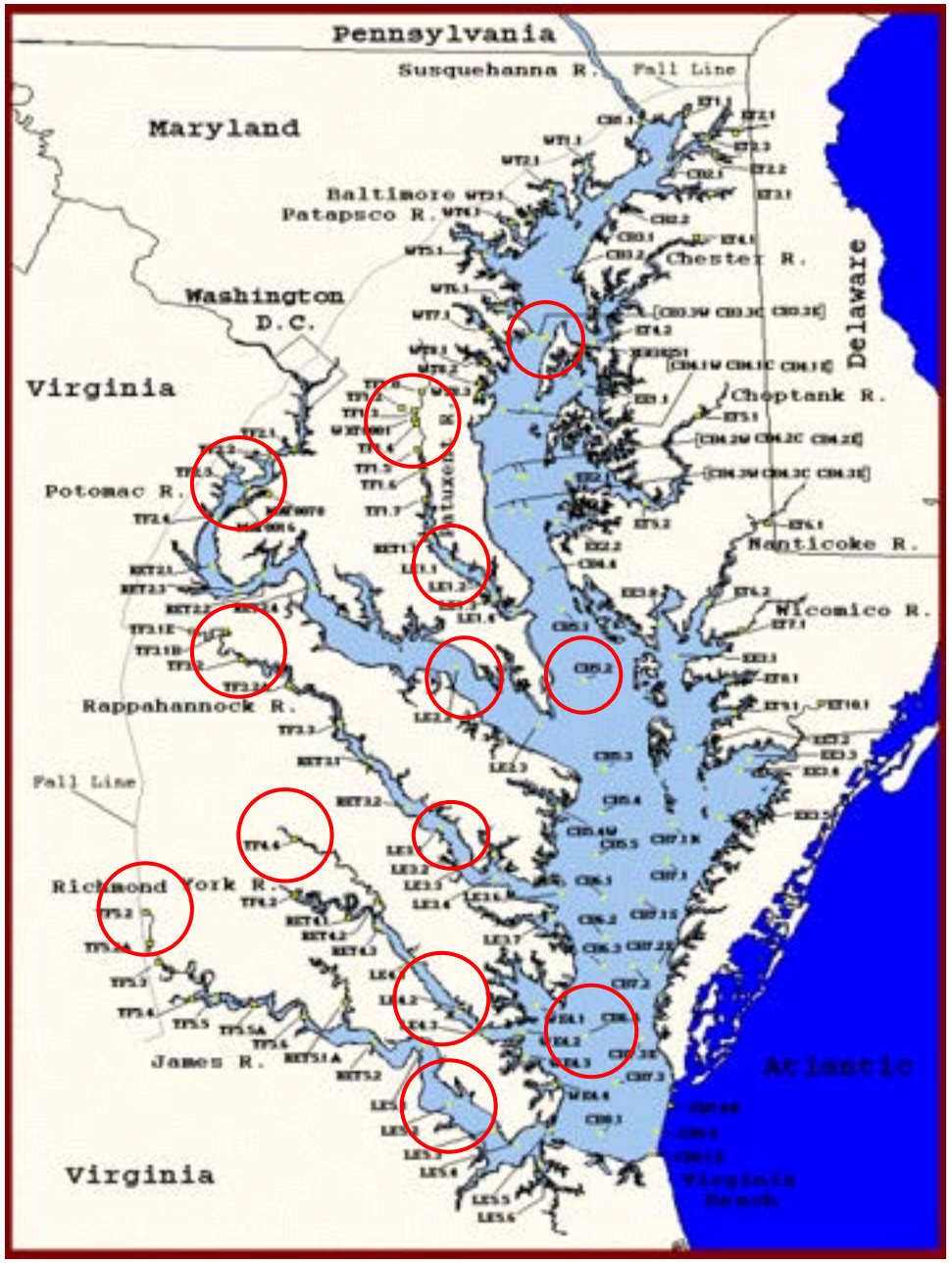
MD “Eyes on the Bay” – Continuous (15 minutes) observations of chlorophyll (fluorescence) and temperature at stations around the Bay perimeter.

VA “Virginia Estuarine and Coastal Observing System” – Continuous (15 minutes) observations of chlorophyll (fluorescence) and temperature at stations around the Bay perimeter.

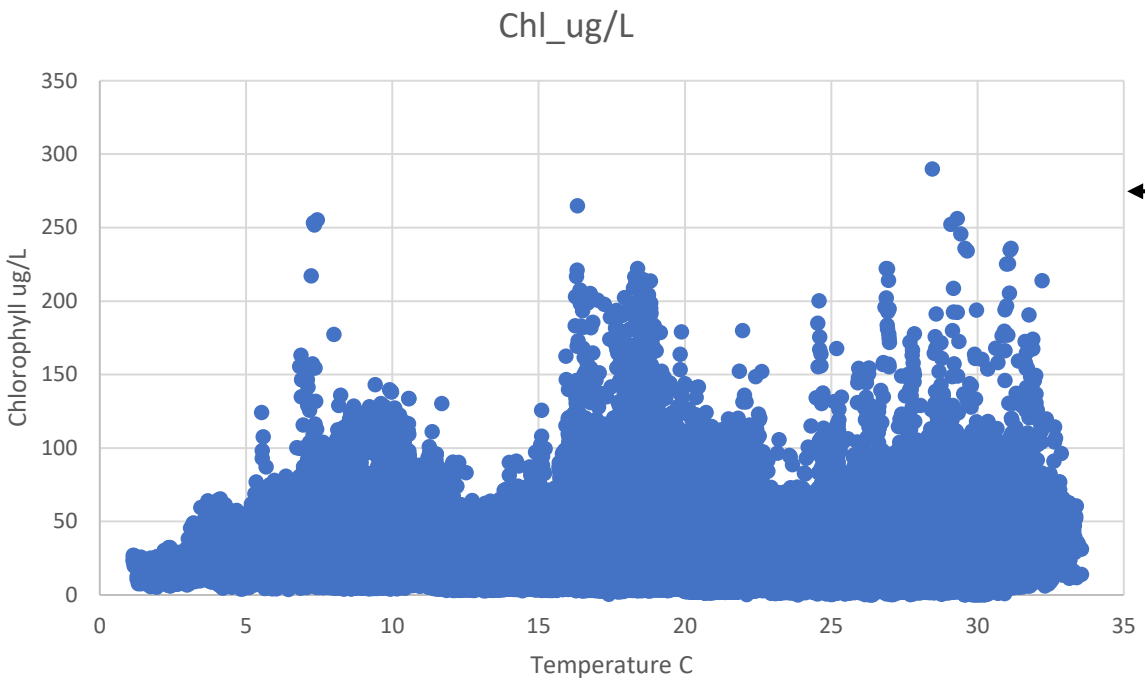
CBP Monitoring Program – Discrete sampling of chlorophyll (laboratory) and temperature (≈20/annum) in mainstem Bay and major tributaries.


Otter Pt.
Masonville Cove
Possum Pt.
Sycamore
Piscataway
Mattawoman
St. George Ck.
EOB Stations
Baltimore
Washington
Philadelphia
Wilmington
Atlantic City
Cape May
Lewes
Rehoboth Beach
Seaford
Millsboro
Salisbury
Ocean City
Chincoteague
Frederick
Hagerstown
Chambersburg
York
Winchester
Leesburg
Rockville
Glen Burnie
Ashburn
Annapolis
Fairfax
Springfield
Manassas
Woodbridge
Fredericksburg
Charlottesville
Front Royal
Berkeley Springs
Newark
New Castle
West Chester
Cherry Hill
Vineland
80%
Google terrain


Satellite
Occoquan
Pohick Ck.
Nomoni Bay
Osborne Landing
VCU Rice Ctr.
NYCC
Ashland
VECOS Stations
Water Quality
CONMON
CBIBS
Realtime CONMON
Dataflow
Profiler
CBP Longterm
Weather
Weather
CB Segments
Segments
Fredericksburg
Richmond
Ashland
Glen Allen
Sandston
Petersburg
Farmville
Williamsburg
Yorktown
Newport News
Virginia Beach
Norfolk
Cape Charles
Chincoteague
Ocean City
Berlin
Salisbury
Millsboro
Seaford
Rehoboth Beach
Exmore
York River
Keyboard shortcuts
Map data ©2023 Google
Terms

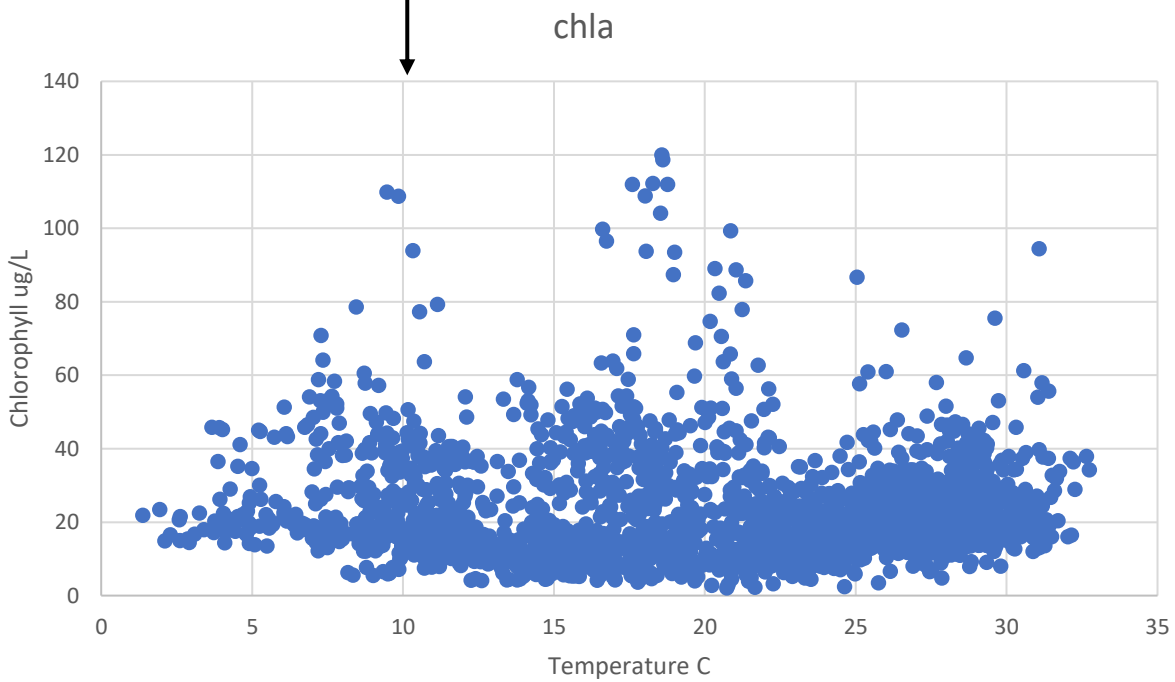


CBP Monitoring Stations

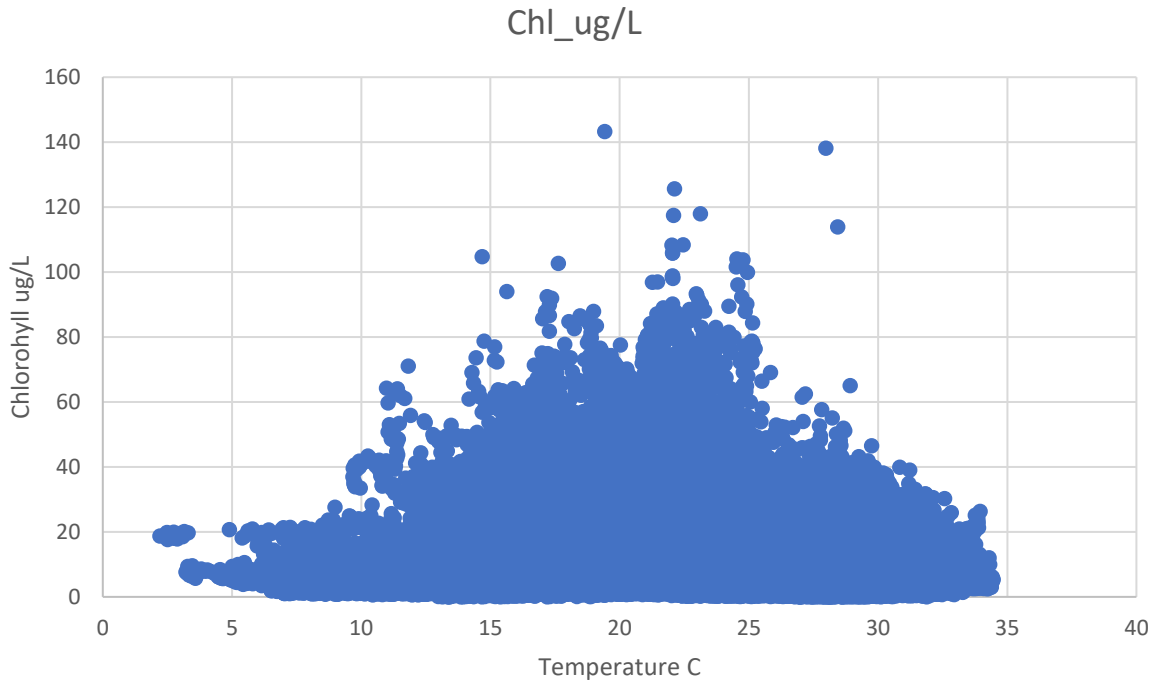


Discrete Data

Daily Average



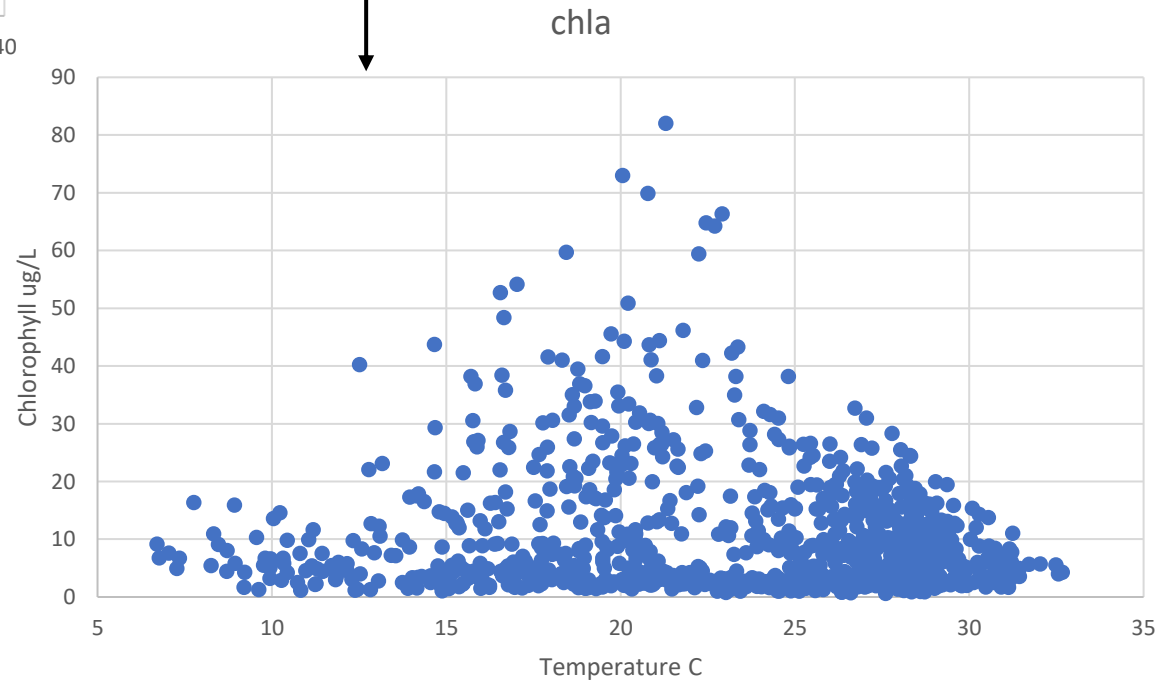
Possum Point, Corsica River

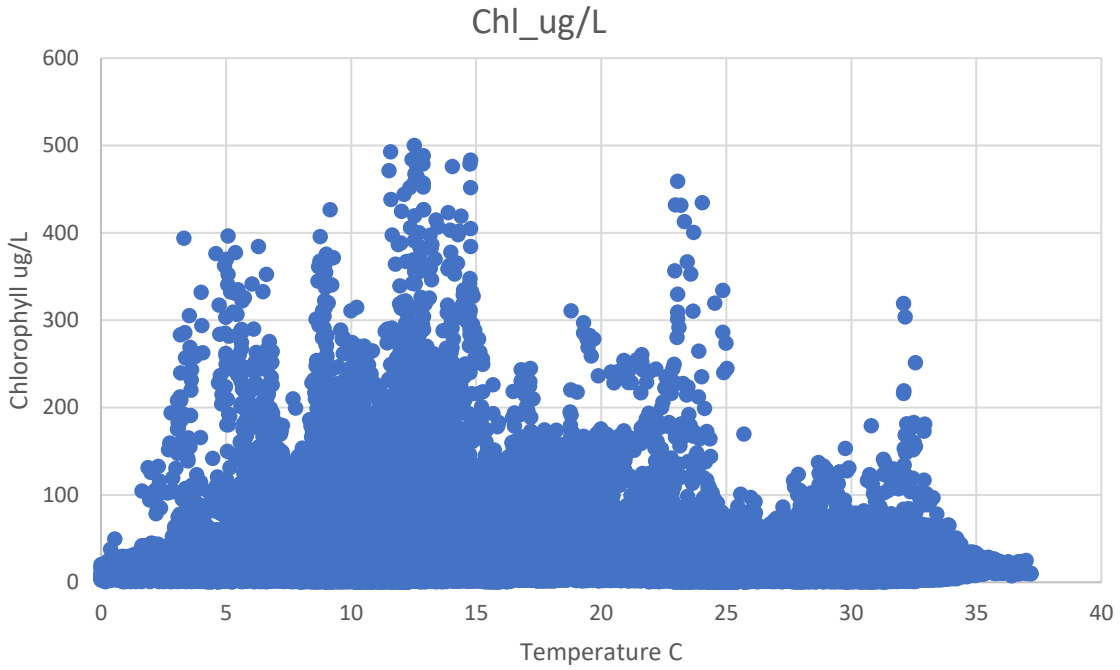


Discrete Data

Piscataway, Potomac River

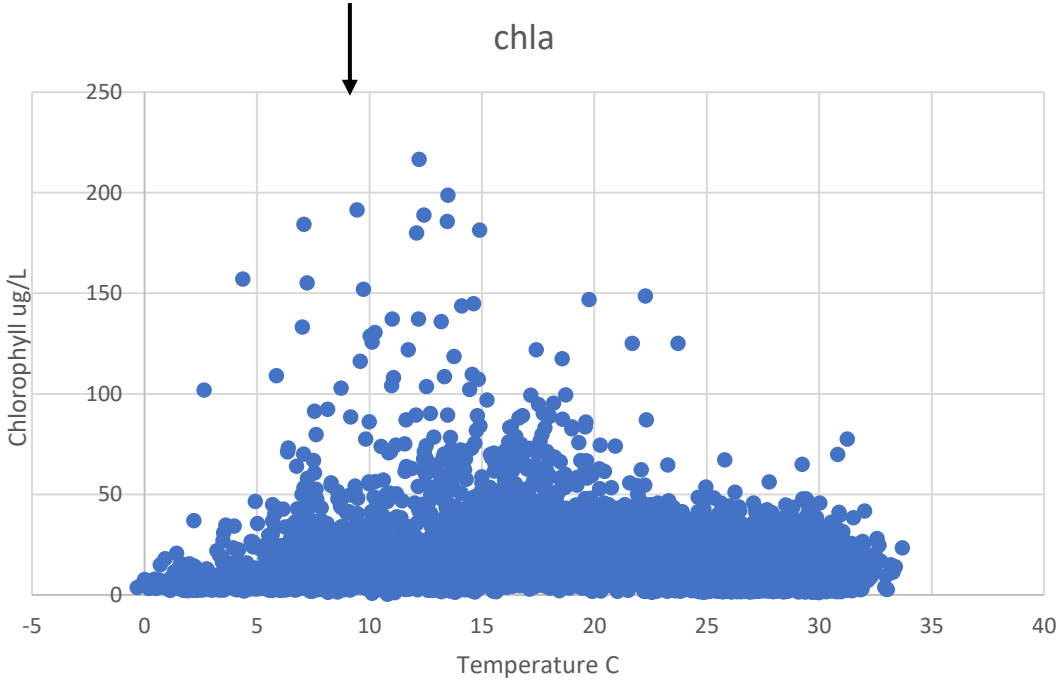
Daily Average



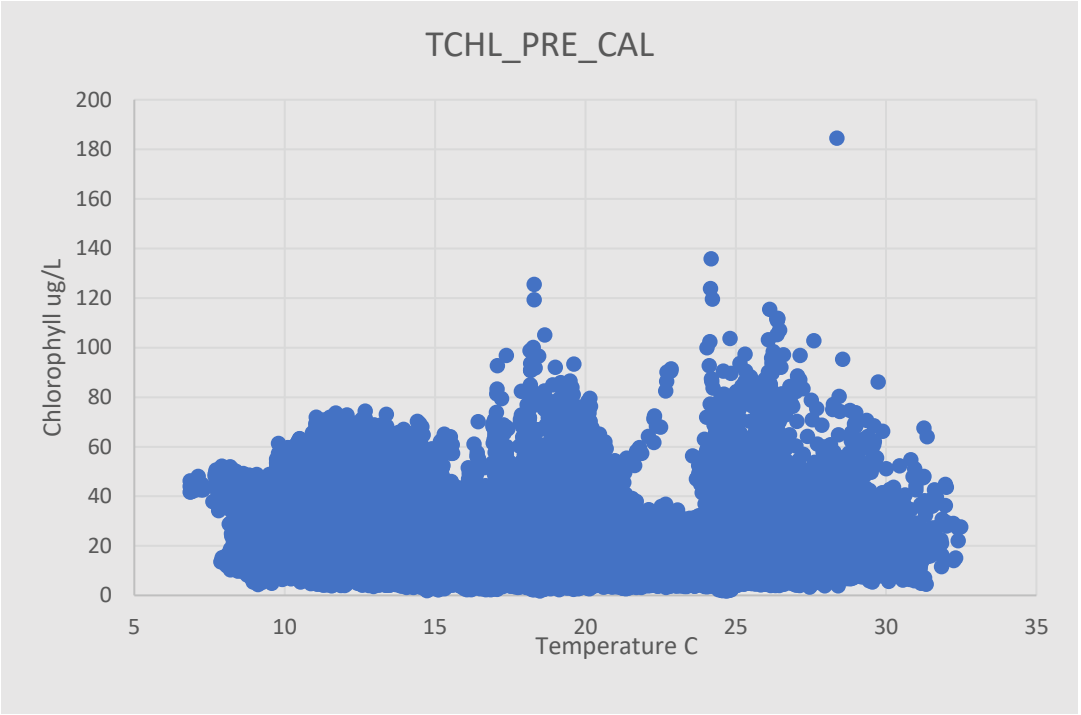


Discrete Data

Daily Average



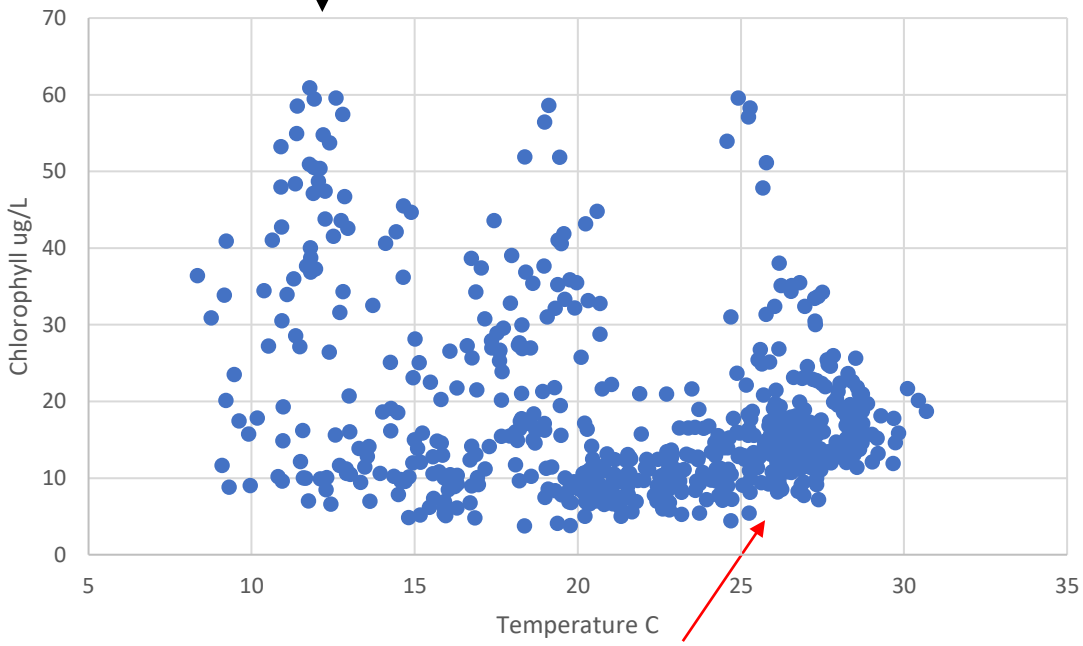
Otter Pt., Bush River

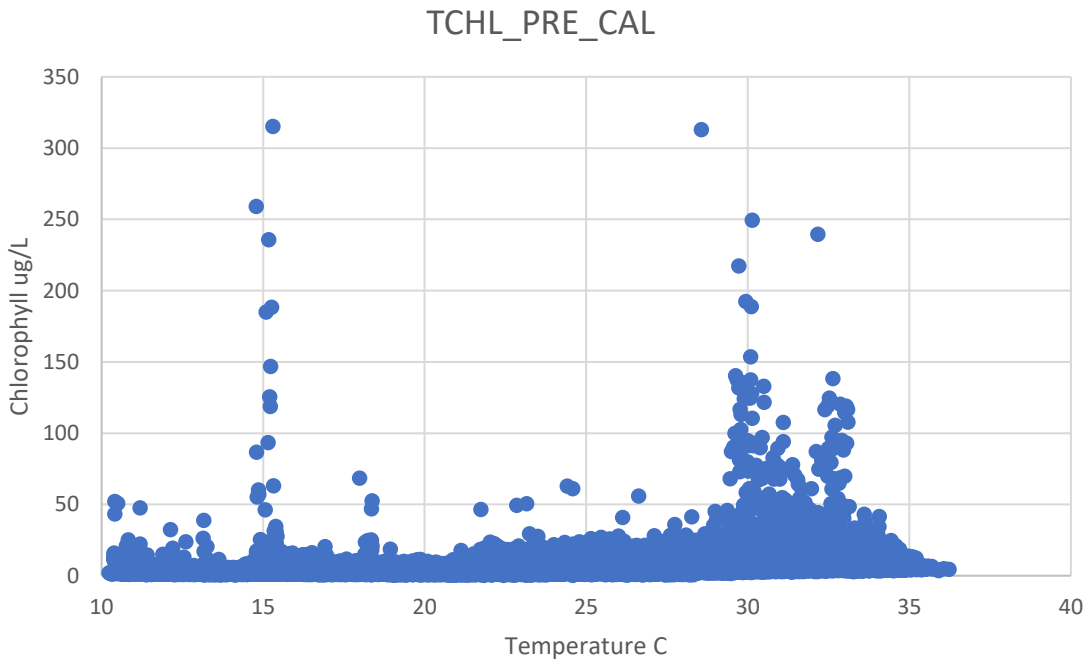


Discrete Data

Nomini Bay

Daily Average

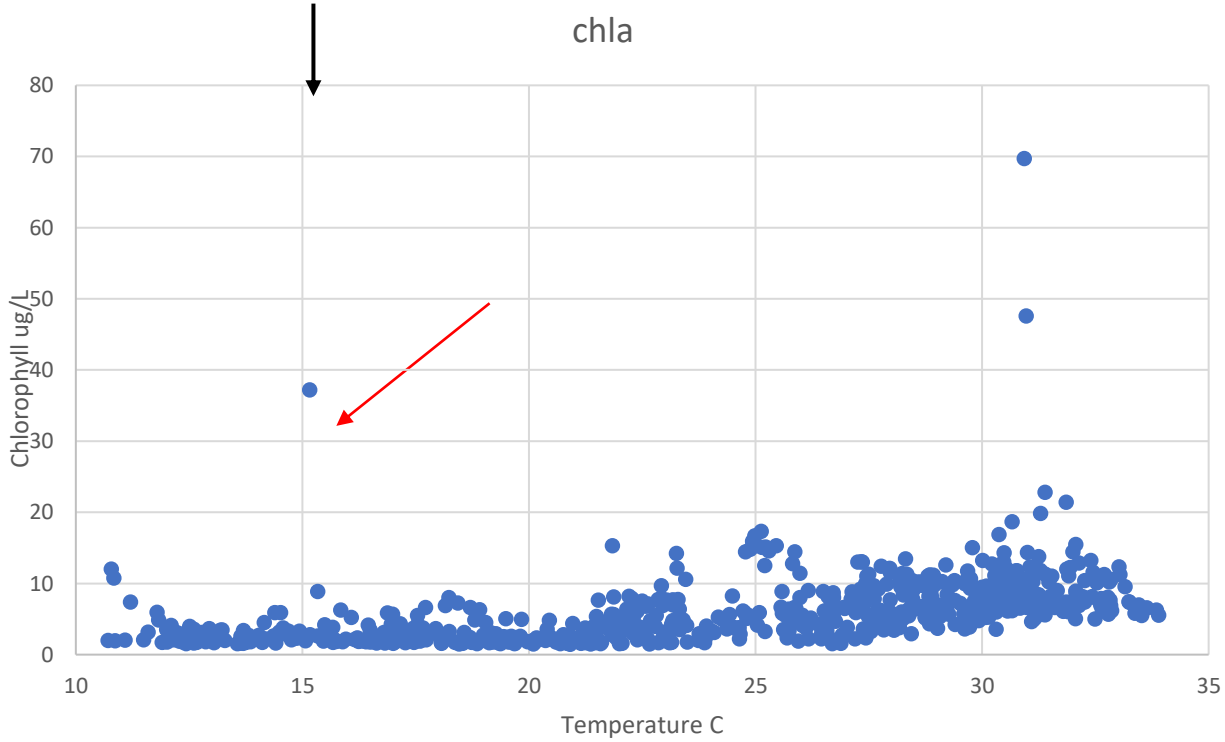


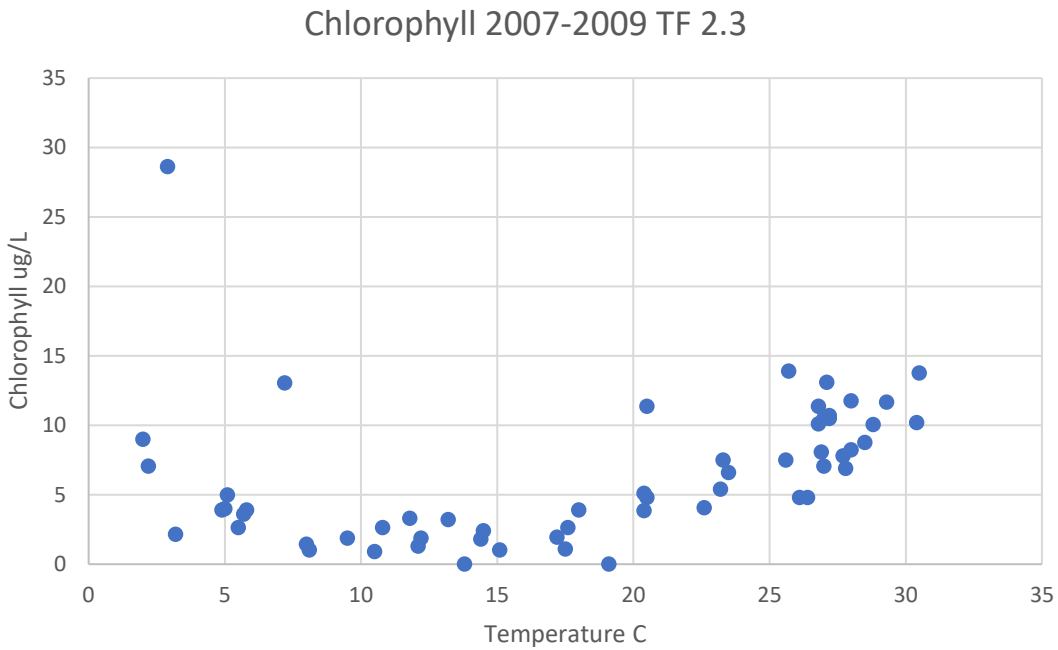


Discrete Data

Osborne Landing, James River

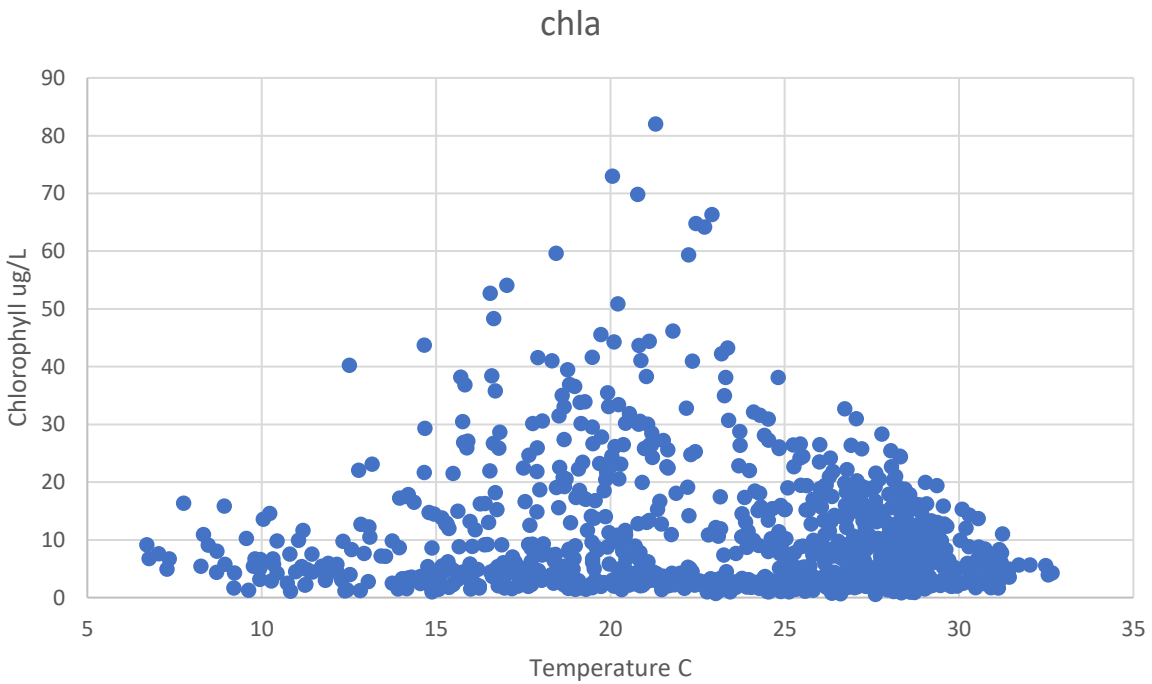
Daily Average

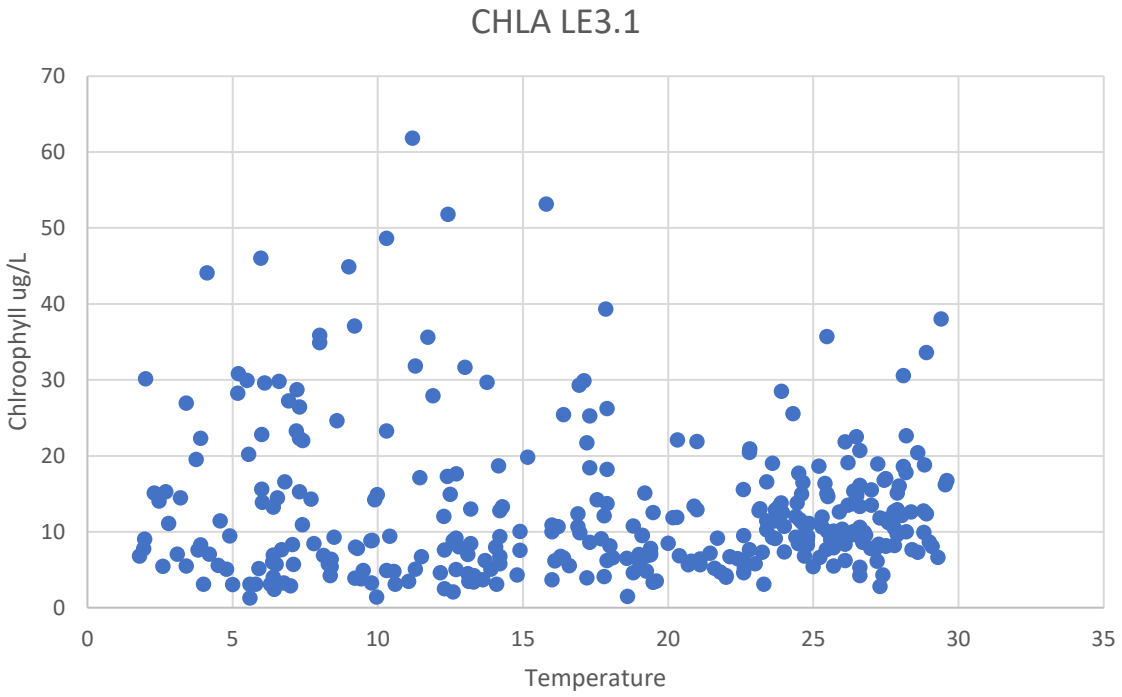


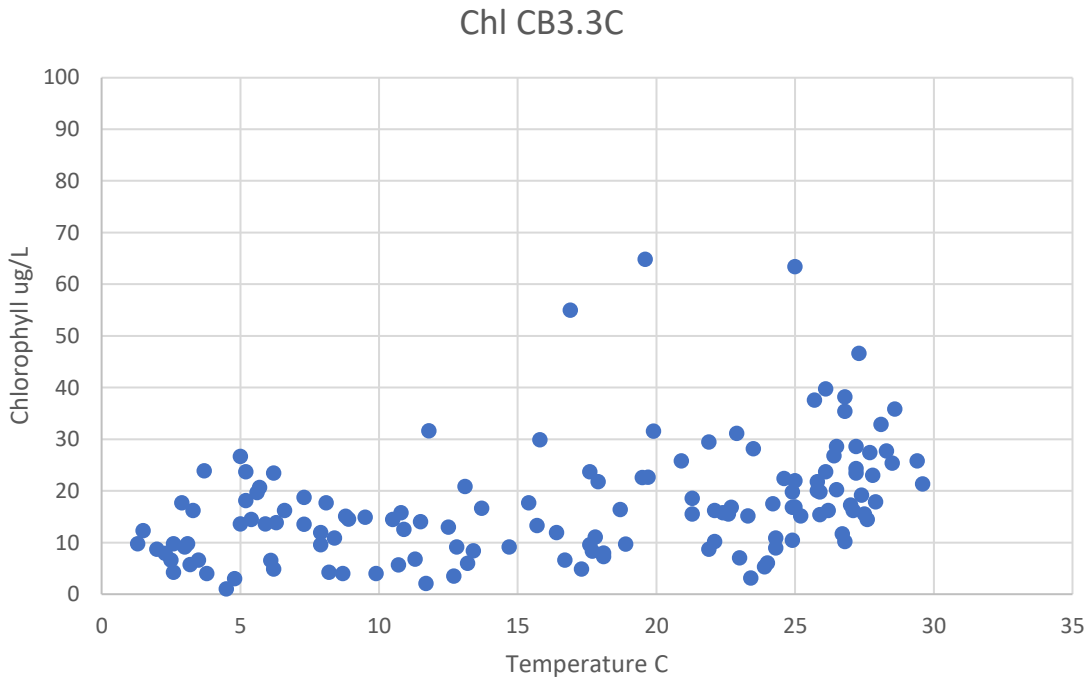


Monthly Observations, Tidal Fresh Potomac River

Daily Averages, Nearby Embayment, Piscataway Creek



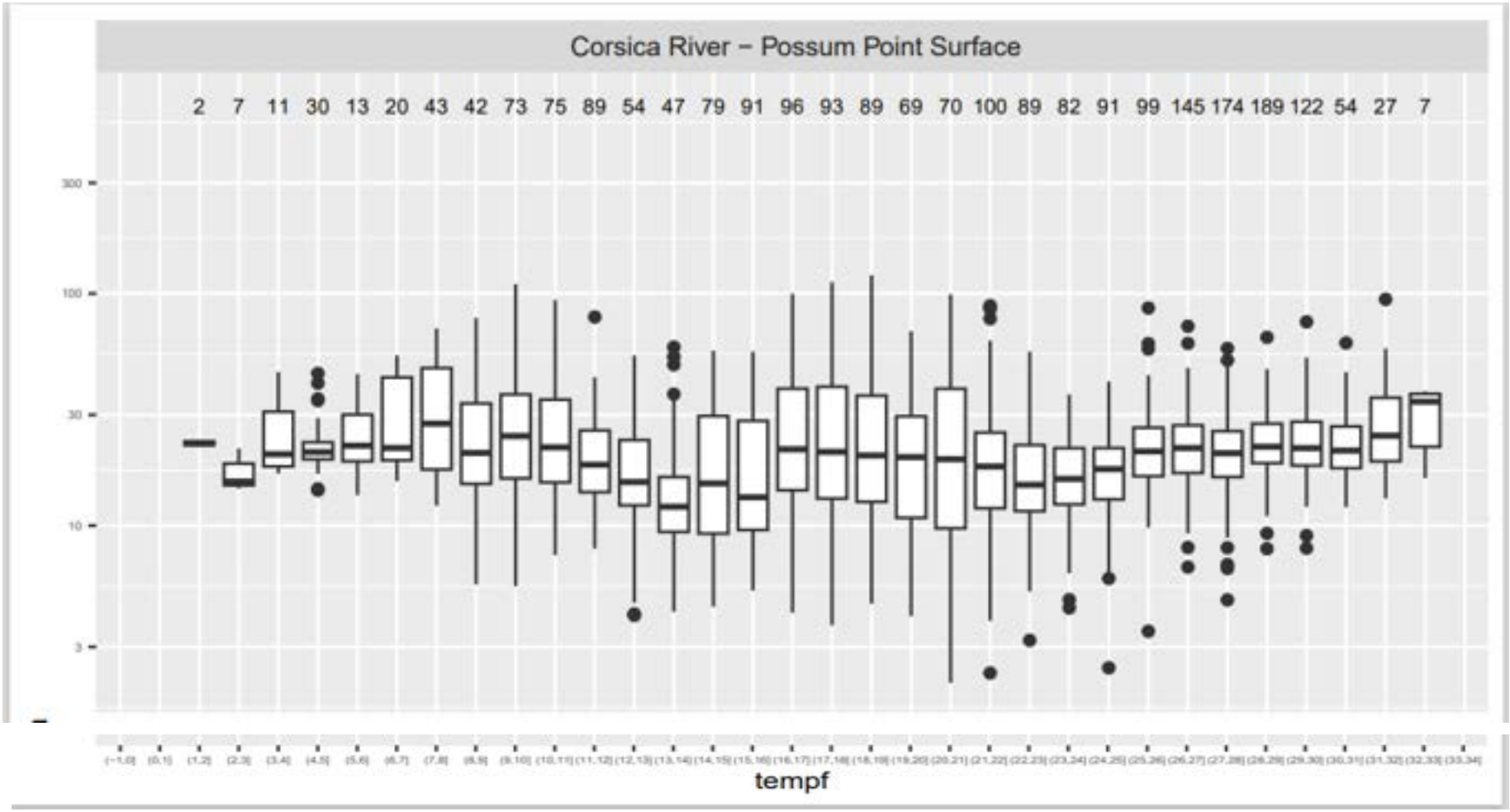

CHLA LE3.1
Chlroophyll ug/L
Temperature
0
10
20
30
40
50
60
70
0
5
10
15
20
25
30
35

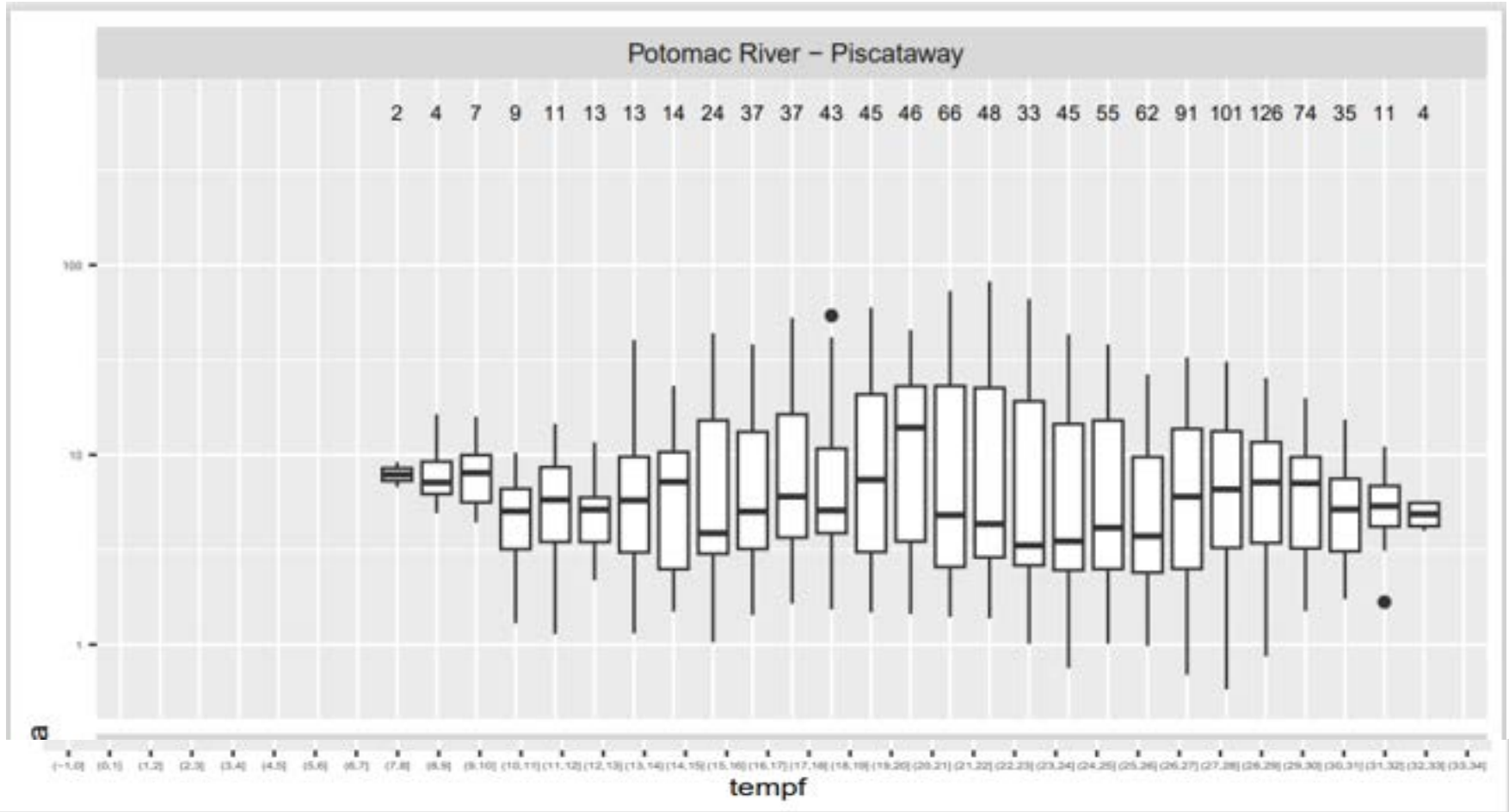

Chl CB3.3C
Chlorophyll ug/L
Temperature C
0
10
20
30
40
50
60
70
80
90
100
0
5
10
15
20
25
30
35

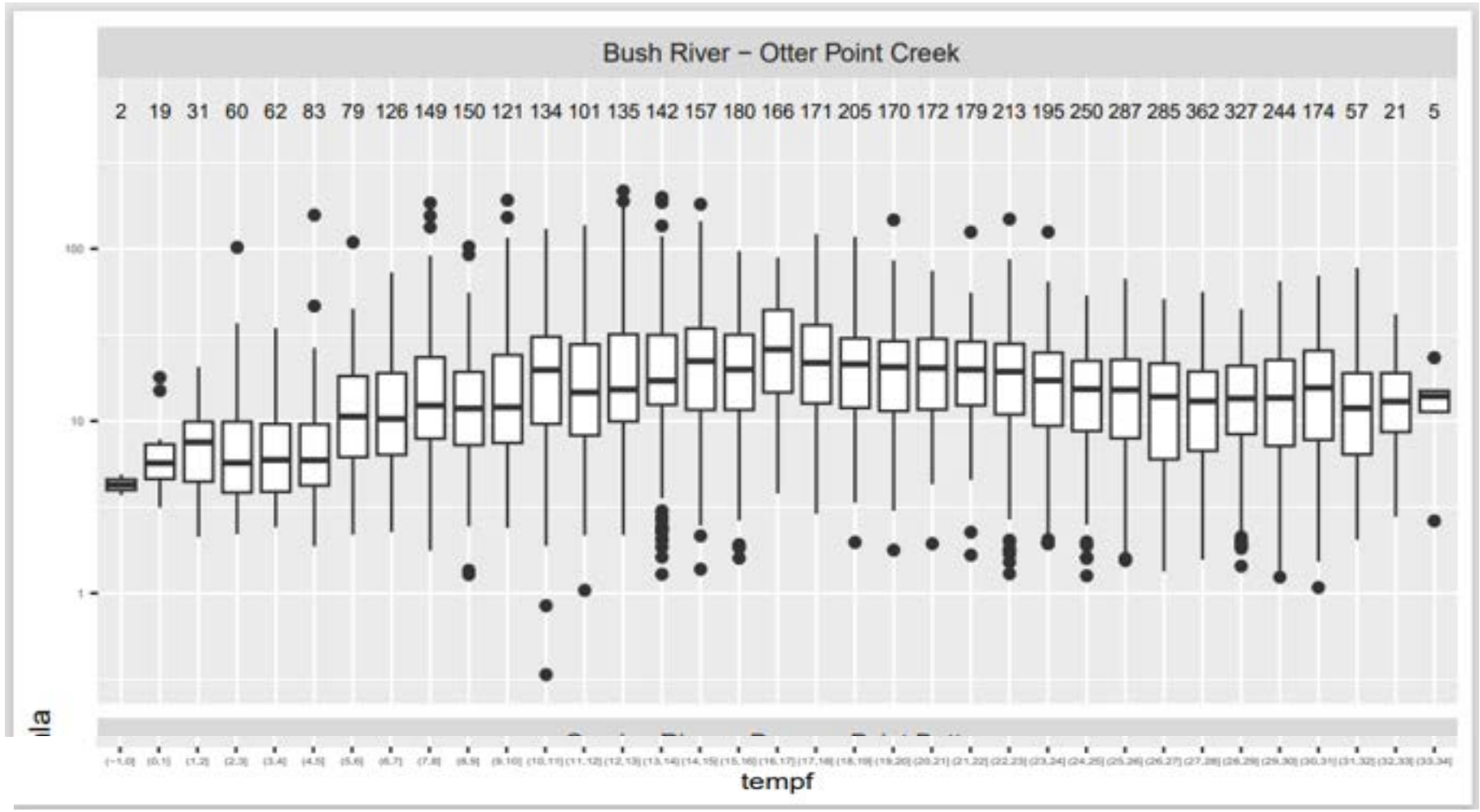
Indications

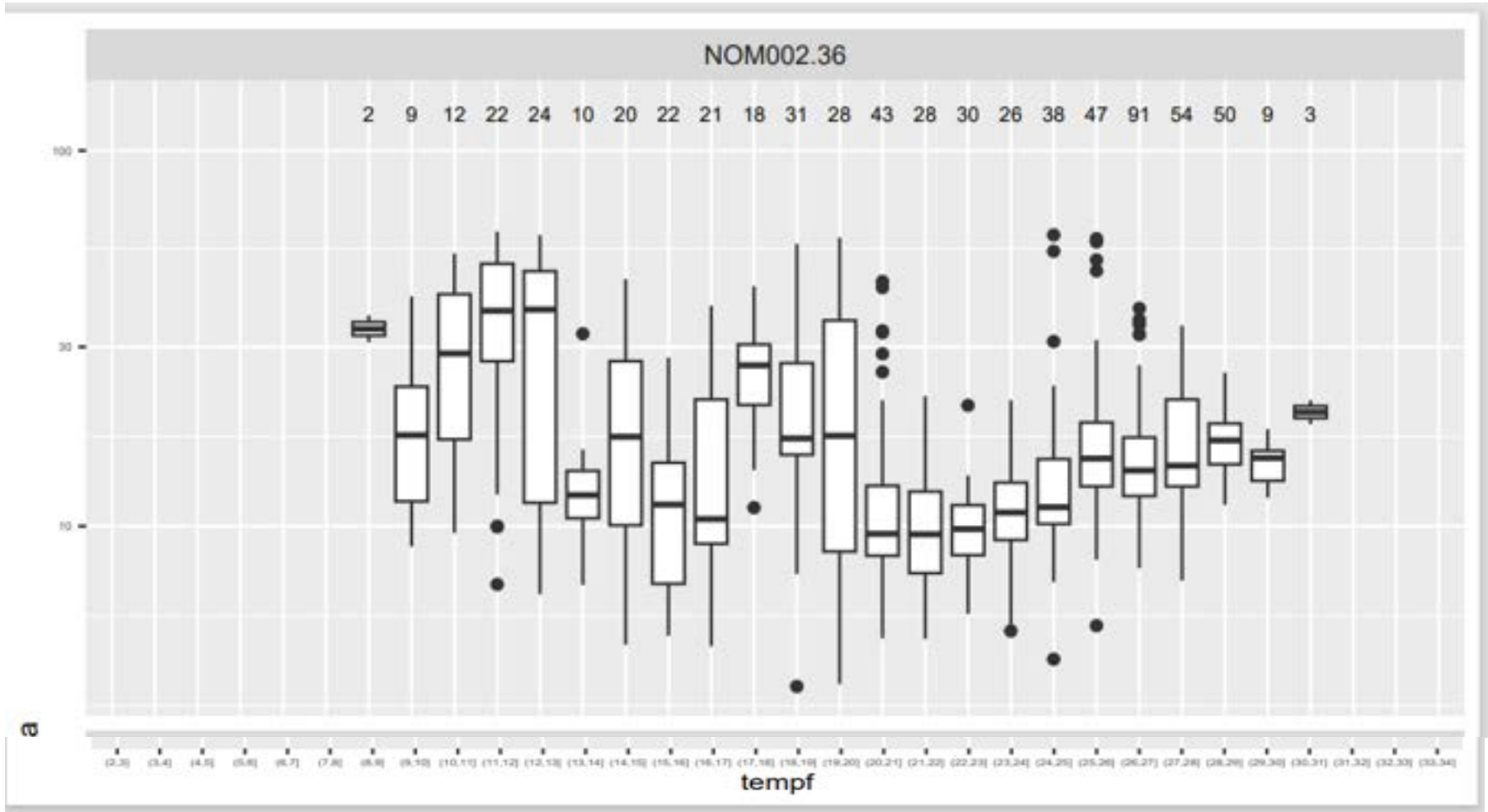
Chlorophyll mostly drops off for T > 30 – 32 C

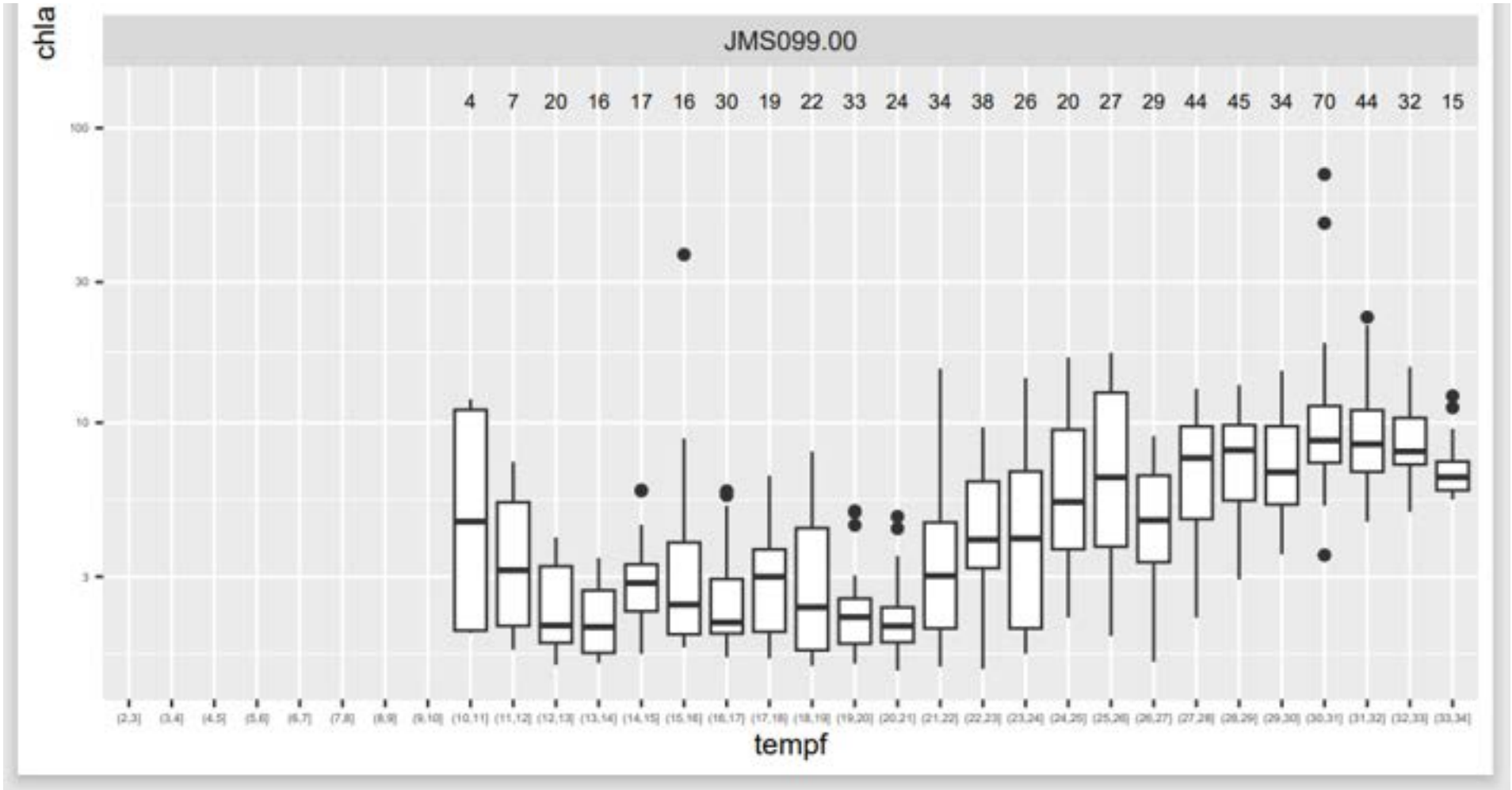
Few CBP observations at T > 30 C, difficult to interpret

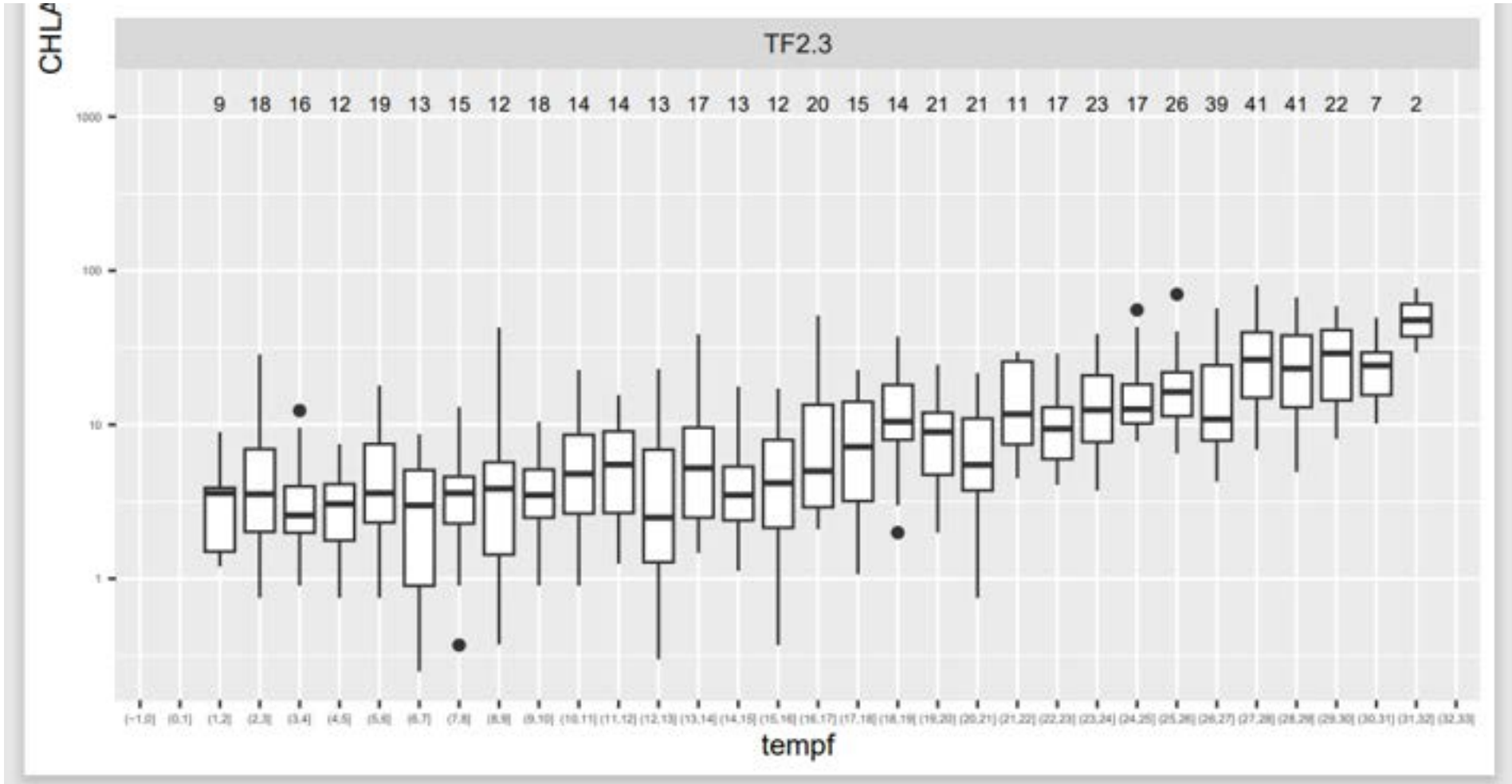

Corsica River – Possum Point Surface
2 7 11 30 13 20 43 42 73 75 89 54 47 79 91 96 93 89 69 70 100 89 82 91 99 145 174 189 122 54 27 7
300
100
30
10
3
tempf

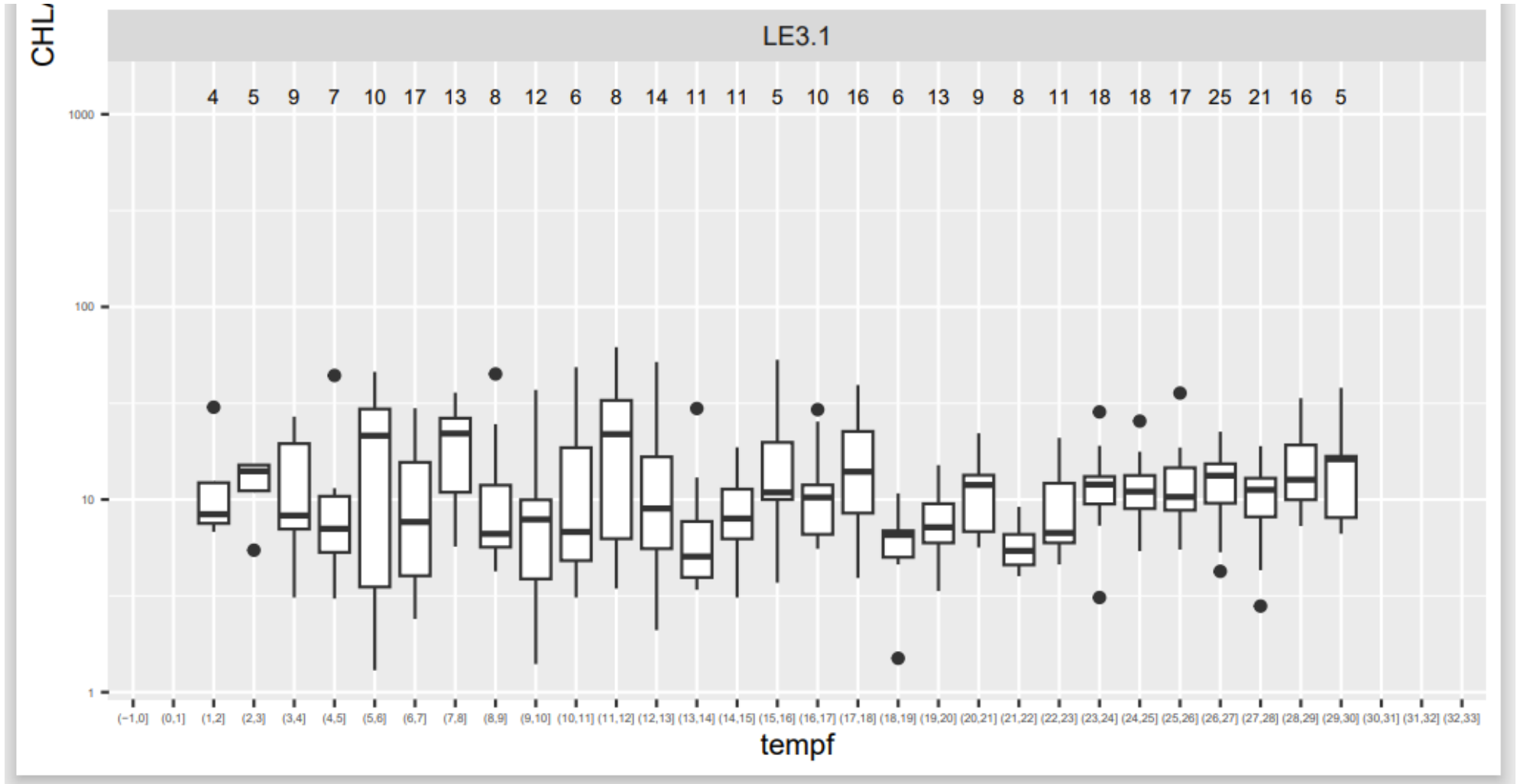

Potomac River − Piscataway
2 4 7 9 11 13 13 14 24 37 37 43 45 46 66 48 33 45 55 62 91 101 126 74 35 11 4
100
10
1
tempf

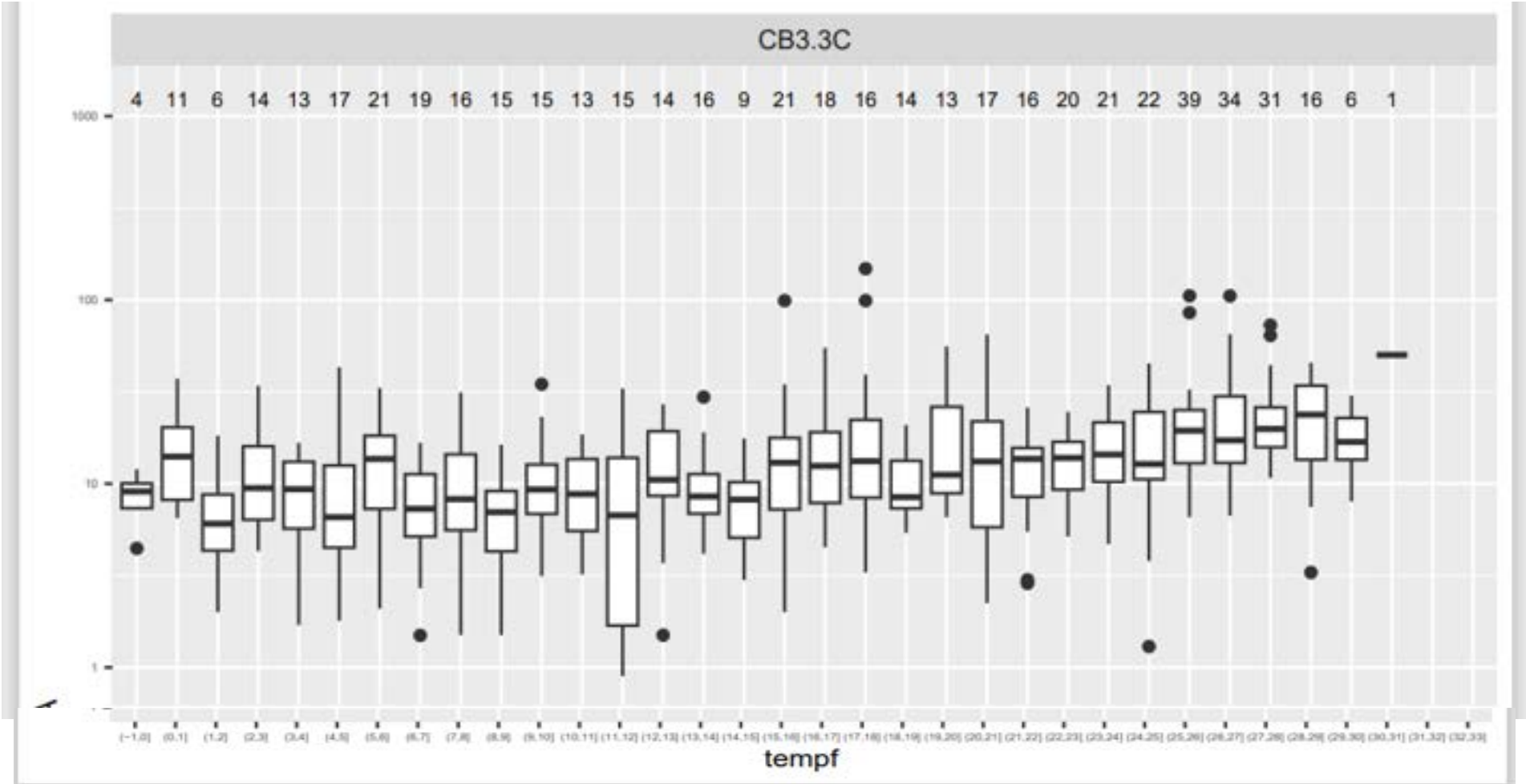

Bush River − Otter Point Creek
2 19 31 60 62 83 79 126 149 150 121 134 101 135 142 157 180 166 171 205 170 172 179 213 195 250 287 285 362 327 244 174 57 21 5
100
10
1
tempf


NOM002.36
2 9 12 22 24 10 20 22 21 18 31 28 43 28 30 26 38 47 91 54 50 9 3
100
30
10
a
tempf


chla
JMS099.00
4 7 20 16 17 16 30 19 22 33 24 34 38 26 20 27 29 44 45 34 70 44 32 15
100
30
10
3
(2,3] (3,4] (4,5] (5,6] (6,7] (7,8] (8,9] (9,10] (10,11] (11,12] (12,13] (13,14] (14,15] (15,16] (16,17] (17,18] (18,19] (19,20] (20,21] (21,22] (22,23] (23,24] (24,25] (25,26] (26,27] (27,28] (28,29] (29,30] (30,31] (31,32] (32,33] (33,34]
tempf


CHLA
TF2.3
9 18 16 12 19 13 15 12 18 14 14 13 17 13 12 20 15 14 21 21 11 17 23 17 26 39 41 41 22 7 2
1000
100
10
1
tempf

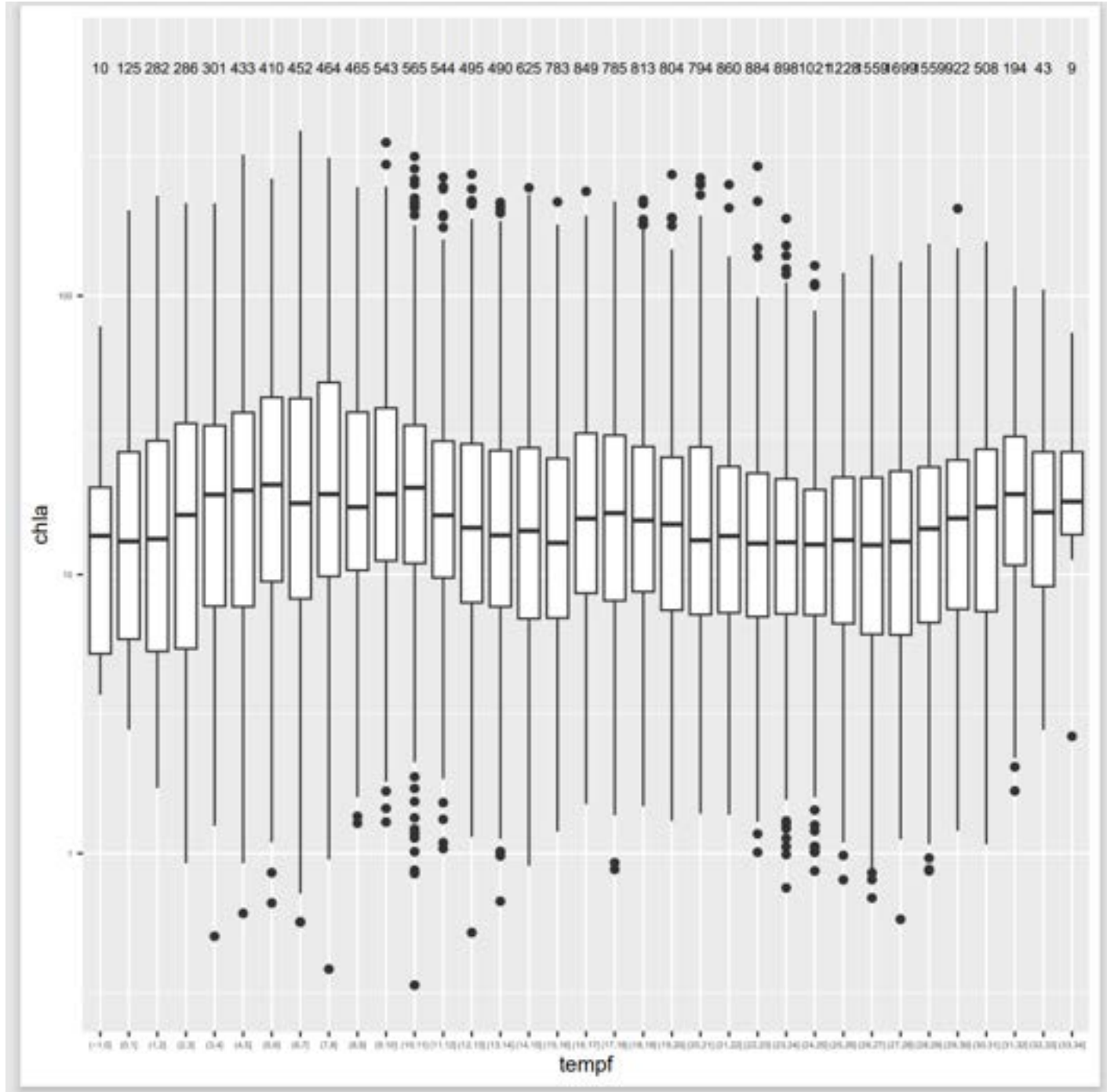

CHL
LE3.1
4 5 9 7 10 17 13 8 12 6 8 14 11 11 5 10 16 6 13 9 8 11 18 18 17 25 21 16 5
1000
100
10
1
(−1,0] (0,1] (1,2] (2,3] (3,4] (4,5] (5,6] (6,7] (7,8] (8,9] (9,10] (10,11] (11,12] (12,13] (13,14] (14,15] (15,16] (16,17] (17,18] (18,19] (19,20] (20,21] (21,22] (22,23] (23,24] (24,25] (25,26] (26,27] (27,28] (28,29] (29,30] (30,31] (31,32] (32,33]
tempf


CB3.3C
4 11 6 14 13 17 21 19 16 15 15 13 15 14 16 9 21 18 16 14 13 17 16 20 21 22 39 34 31 16 6 1
1000
100
10
1
tempf

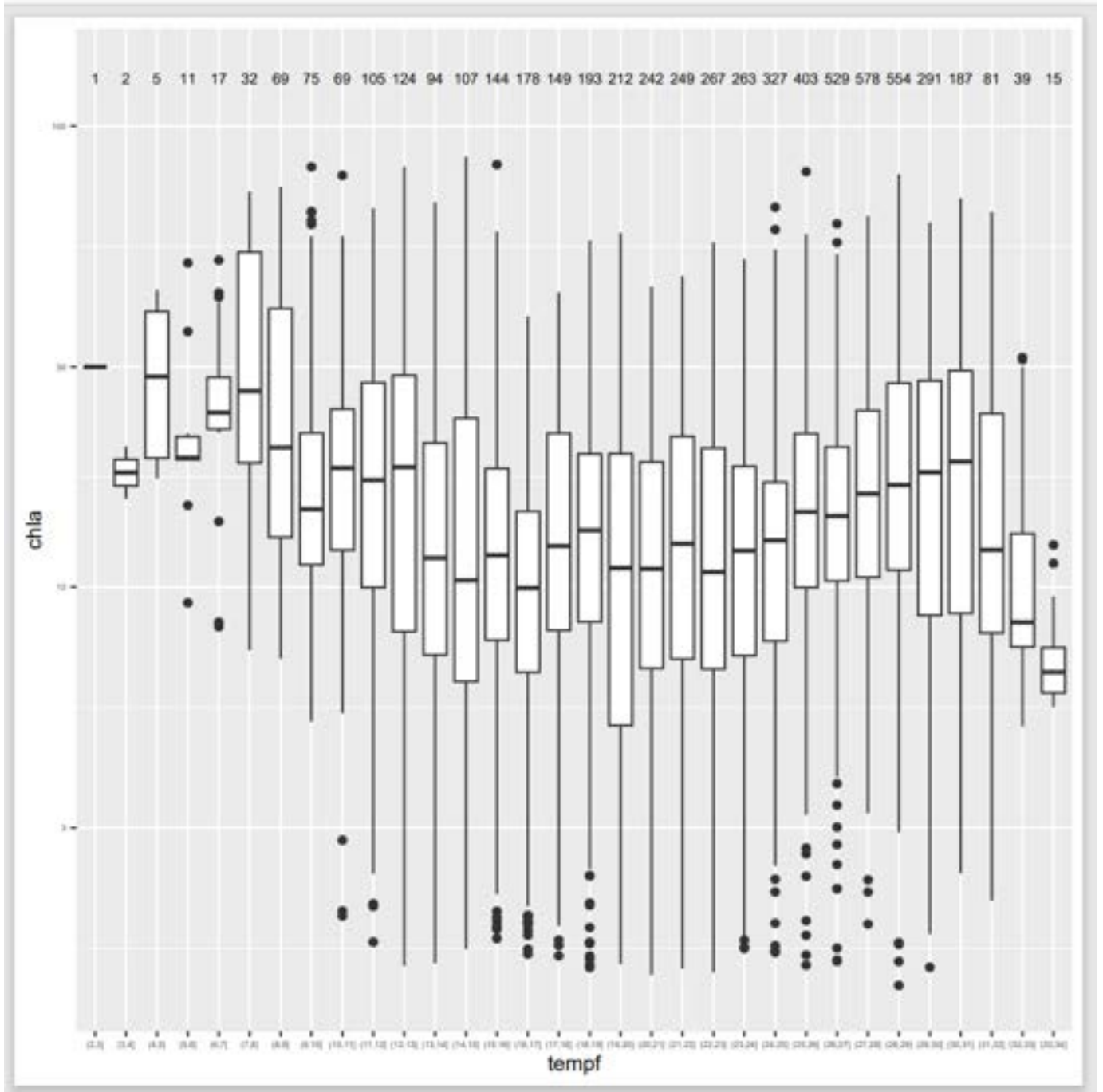
Indications

Box and Whisker plots results similar to scatterplots. Chlorophyll mostly drops off at T > 30 – 32 C

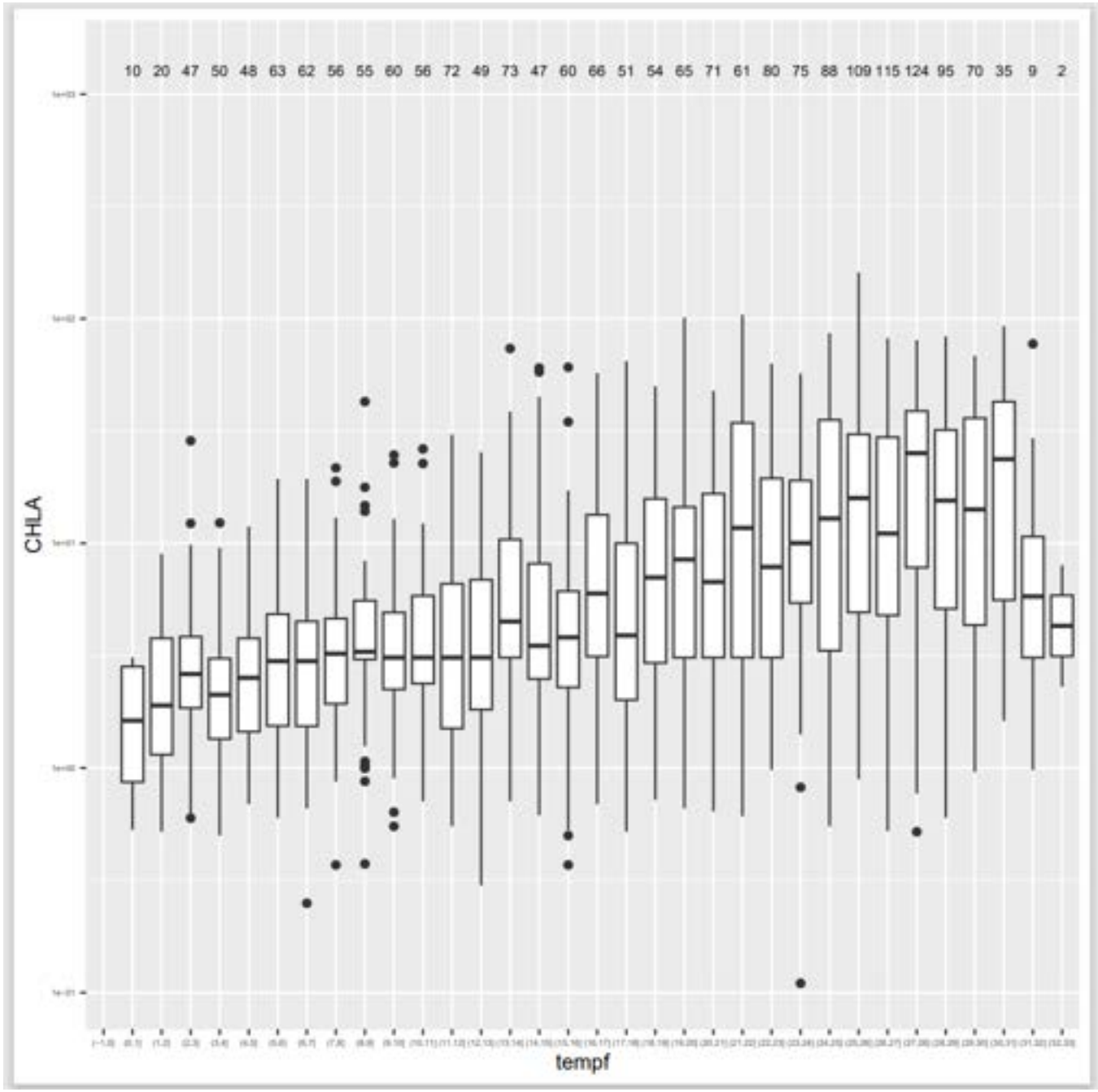
Once again, CBP data is difficult to interpret due to lack of observations at T > 30 C



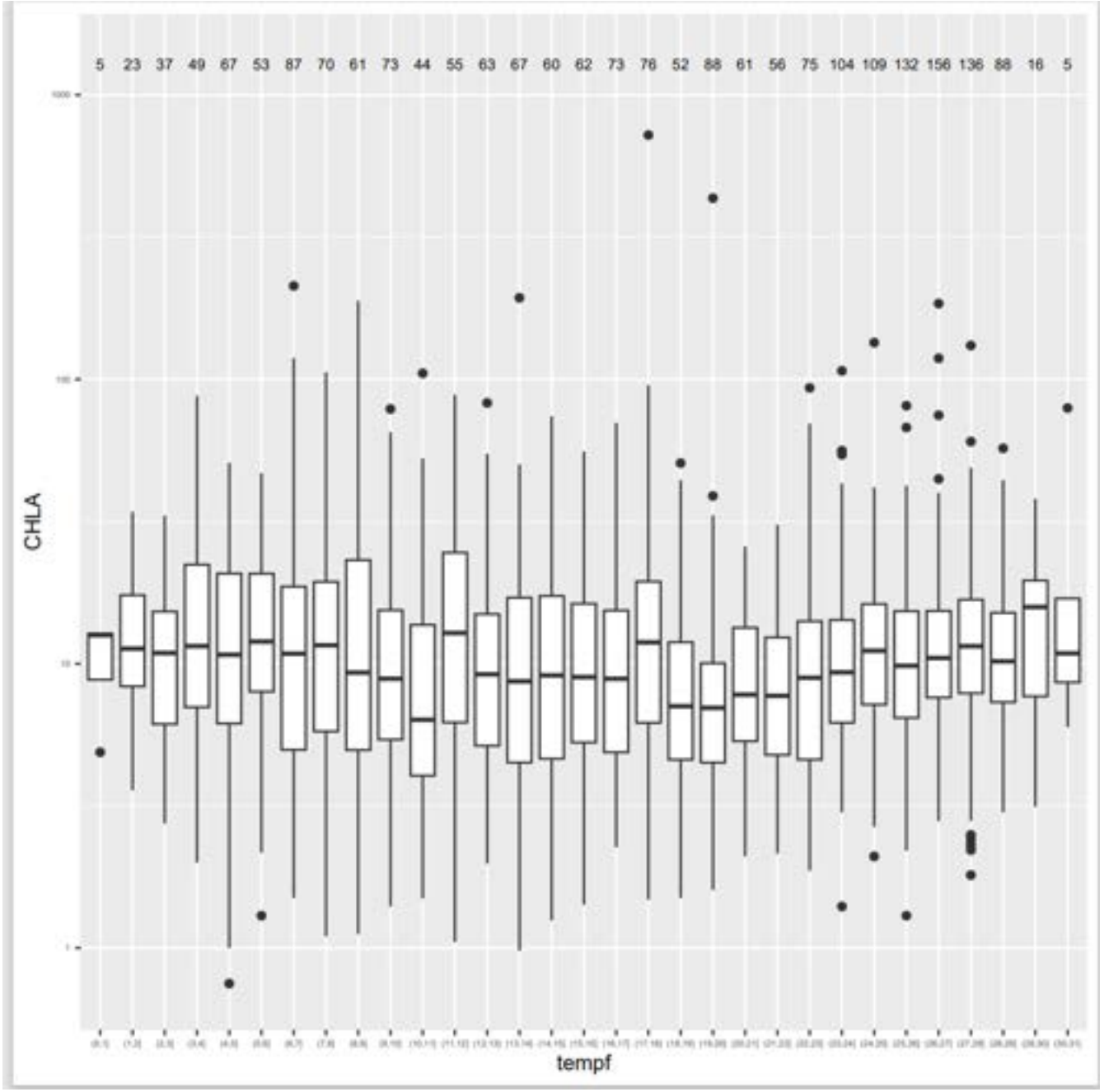
All EOB stations



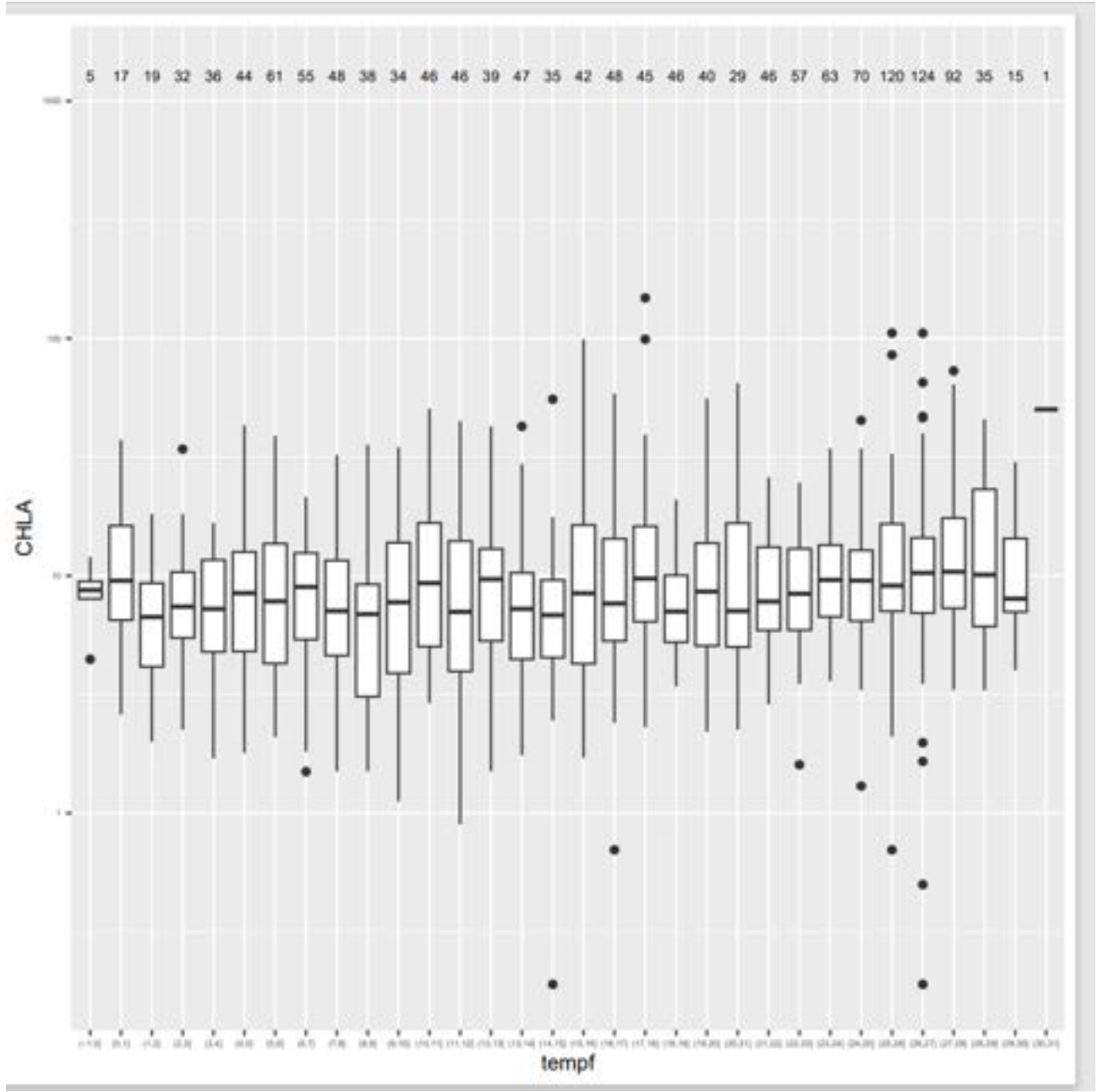
All VECOS stations



All CBP TF stations



All CBP LE stations



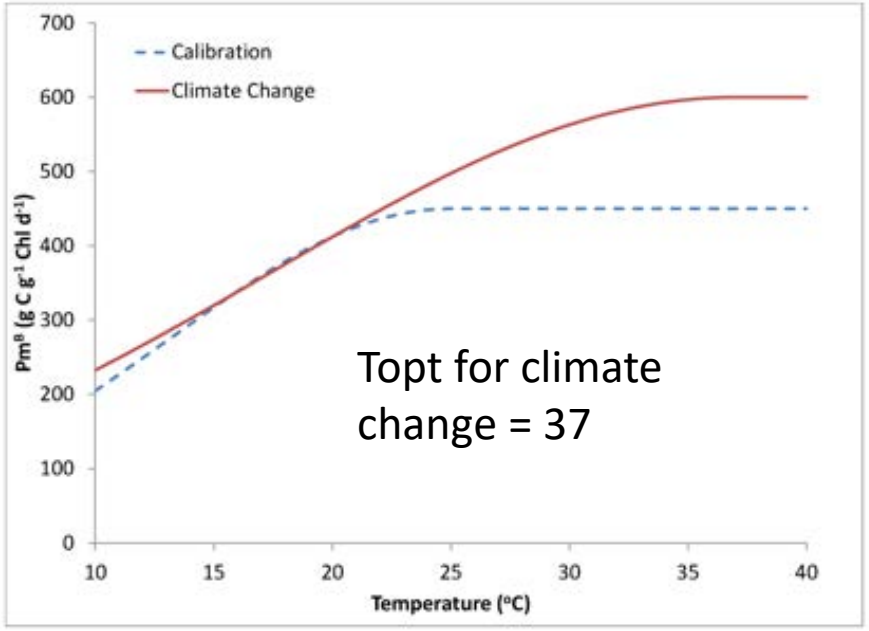
All CBP Mainstem Bay stations

Indications

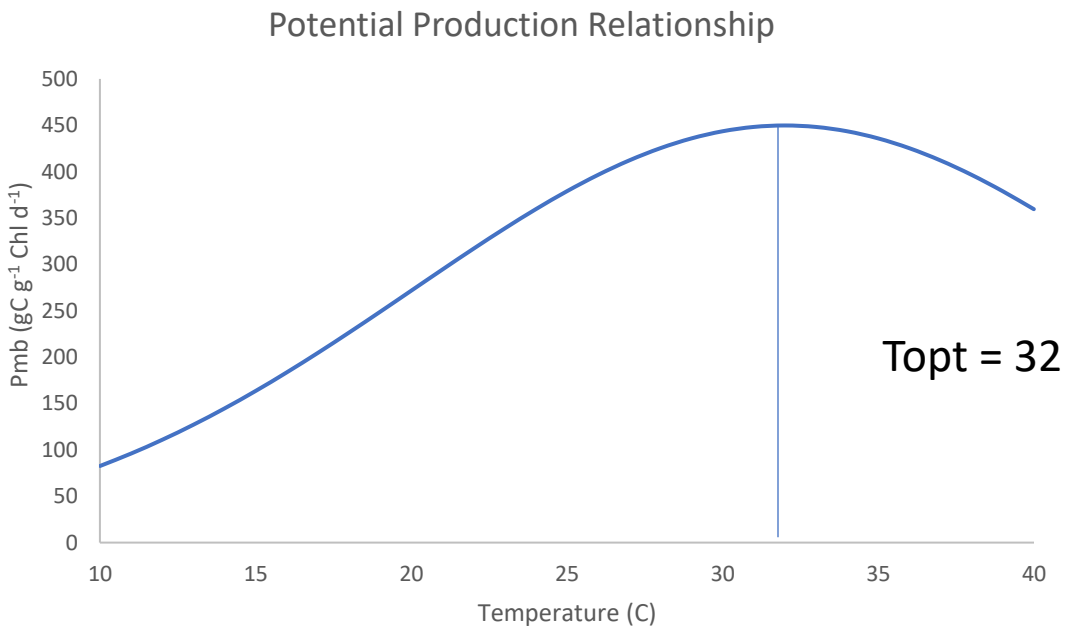
Pooling the stations makes the relationships a little stronger at EOB, VECOS stations. Some CBP regions are still difficult to interpret due to scarcity of observations.

Conclusions - Recommendations

- Results show a lot of variance. Individual stations can be selected that show different patterns
- Overall, there is no evidence for continuous increases in chlorophyll indefinitely with temperature
- We should employ a growth curve which flattens out and decreases for $T > \approx 30$



Topt for climate change = 37



Topt = 32

Precautions

- We are looking at standing stock, not growth rate. Standing stock is growth minus respiration.

- Conclusions are based mostly on data from shallow water and smaller embayments. Conclusions are difficult to reach in mainstem Bay and lower western tributaries due to scarcity of data at T > 30 C.

- Currently, temperature in the mainstem Bay and larger tributaries rarely exceeds 30 C. Climate change scenarios add 2 C so the suggested growth curves are likely acceptable.