Finalizing the 2017 Water Quality and Sediment Transport Model (WQSTM)

Modeling Workgroup Quarterly Review
October 17, 2017

Carl Cerco, Lew Linker, Richard Tian,
and the CBP Modeling Team

Chesapeake Bay Program
Science, Restoration, Partnership

"In my new role as Chair of the Principals' Staff Committee (PSC), I am committed to following through on the necessary decisions and work deliverables on time so we can proceed forward with developing and implementing our Phase III WIPs with the best available information and data. I am asking you as the WQGIT leadership and members to work collectively…. so that you can bring the WQGIT's recommendations to the [December] PSC retreat. We cannot afford any further delays in reaching agreement on the models and tools supporting our decision making as well as the needed decisions on how we are going to develop the draft Phase III WIP planning targets."

Secretary Ben Grumbles
August 2, 2017

SCHEDULE FOR PHASE 6 WATER QUALITY AND SEDIMENT TRANSPORT MODEL (WQSTM) COMPLETION

October-November Timeline

September 29 – Receive WQSTM Alternate Final Runs 214 and 223. **DONE (Already Had Run 196 (August run) and Run 199 (September run.))**

September 30-Oct 2 – Benchmark Runs 214 and 223. **DONE**

October 3-5 – Run 196 (August WQSTM calibration) Run 199 (September WQSTM calibration), Run 214, and Run 223 on the same Base input from September Phase 6 WSM **DONE**

October 6-10 – Using chlorophyll assessment from CoE ERDC and hypoxia volume day assessment from CBPO [3] and weighting toward the hypoxia calibration select the WQSTM version that has the highest fidelity to the observed data. **DONE**

October 12 – WQGIT: report out progress and completed products at WQGIT conference call **DONE**

October 11-16 – Run key scenarios on September P6 WSM calibration. Key scenarios needed in priority order are: WIP2 LOE, WIP2+Cono Infill, WIP2+Cono Infill+CC, E3, 1993, 2013, No Action, 1985, and All-Forest. **IN PROCESS**

October 17 – Mod WG Quarterly - Review selection approach for WQSTM and selected final WQSTM version as well as draft key scenarios. **DONE**

SCHEDULE FOR PHASE 6 WATER QUALITY AND SEDIMENT TRANSPORT MODEL (WQSTM) COMPLETION

October 18-25 – Complete new geographic isolation runs on final WQSTM.

October 23 – WQGIT: report out progress and completed products at WQGIT conference call

October 26-Dec 3 – Develop presentations and analyses for combined Mod WG & WQGIT meeting, PSC, and other meetings.

November 9-16 – Final key scenarios [2] completed by the WSM now run on the final WQSTM including 2010 No Action, 1985, 1993, 2013, 2010 WIP2 LOE, 2010 E3, All-Forest, and other scenarios.

November 13-24 – Estimate Bay assimilation capacity. Estimate change in assimilation capacity due to Conowingo Infill. Estimate change in assimilation capacity under 2025 climate.

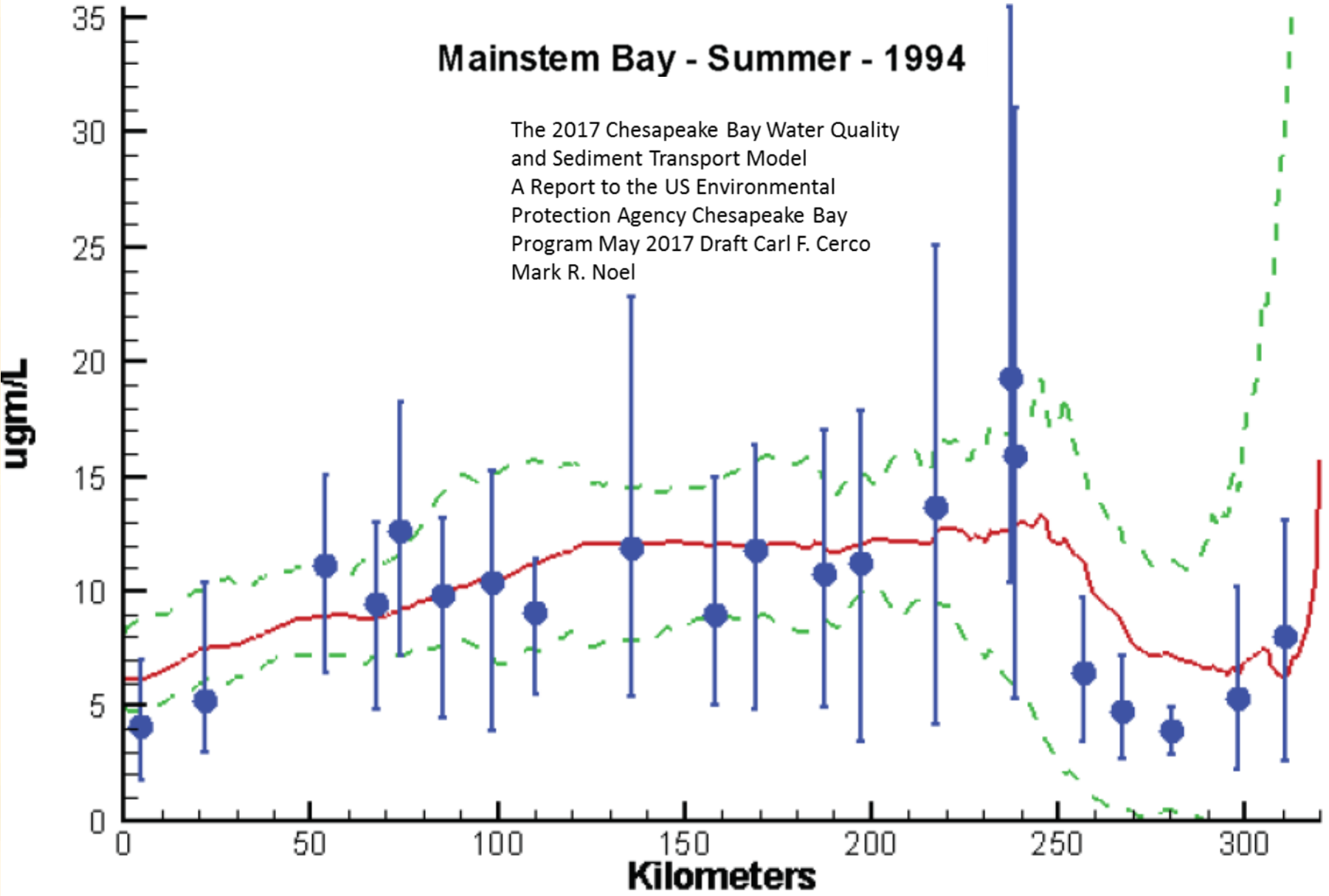
November 13 – WQGIT: report out progress at WQGIT conference call

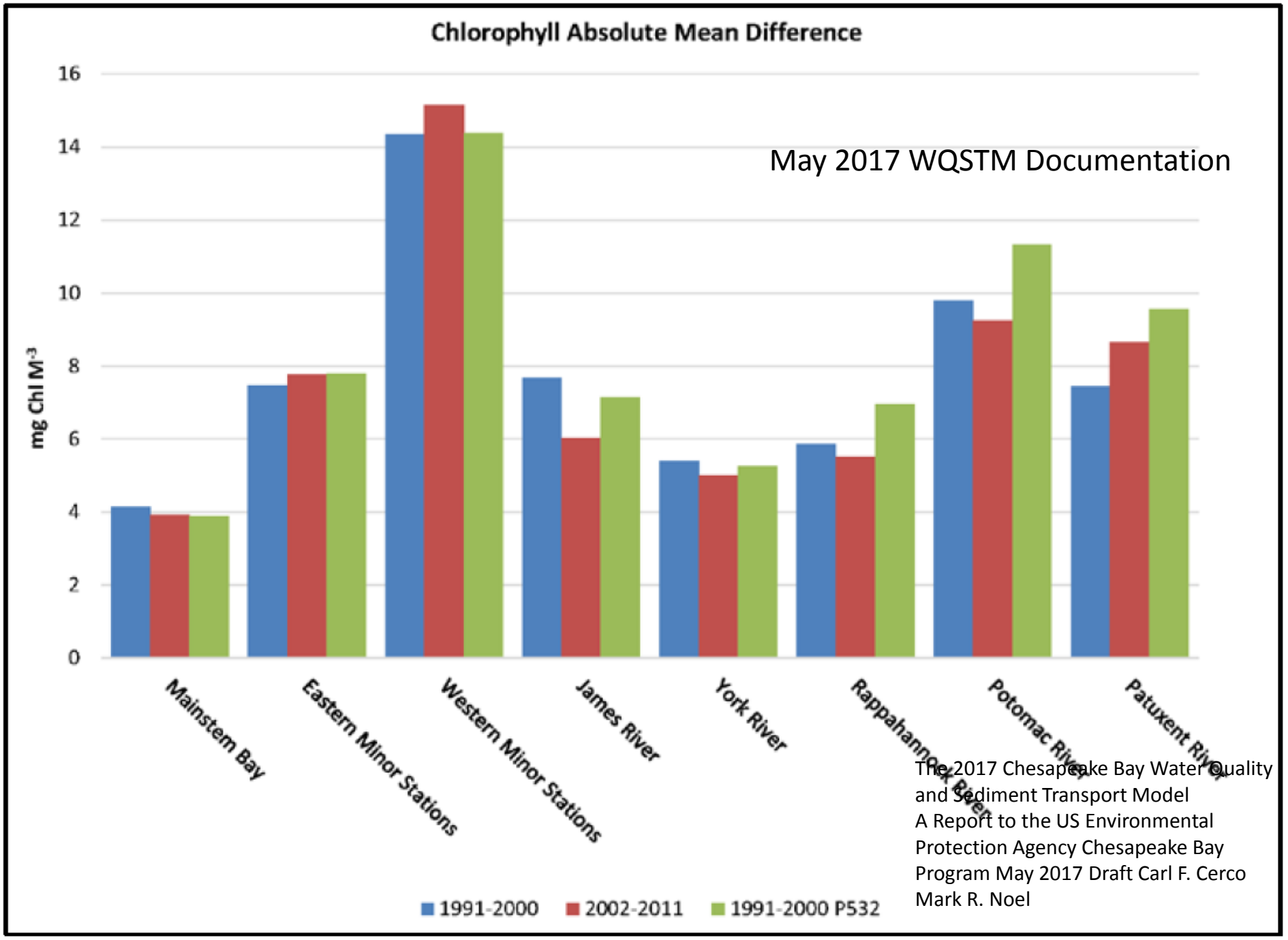
November 27 – WQGIT: report out progress at WQGIT conference call

December ~4-6 – Combined Mod WG & WQGIT 2-day meeting at MDE.

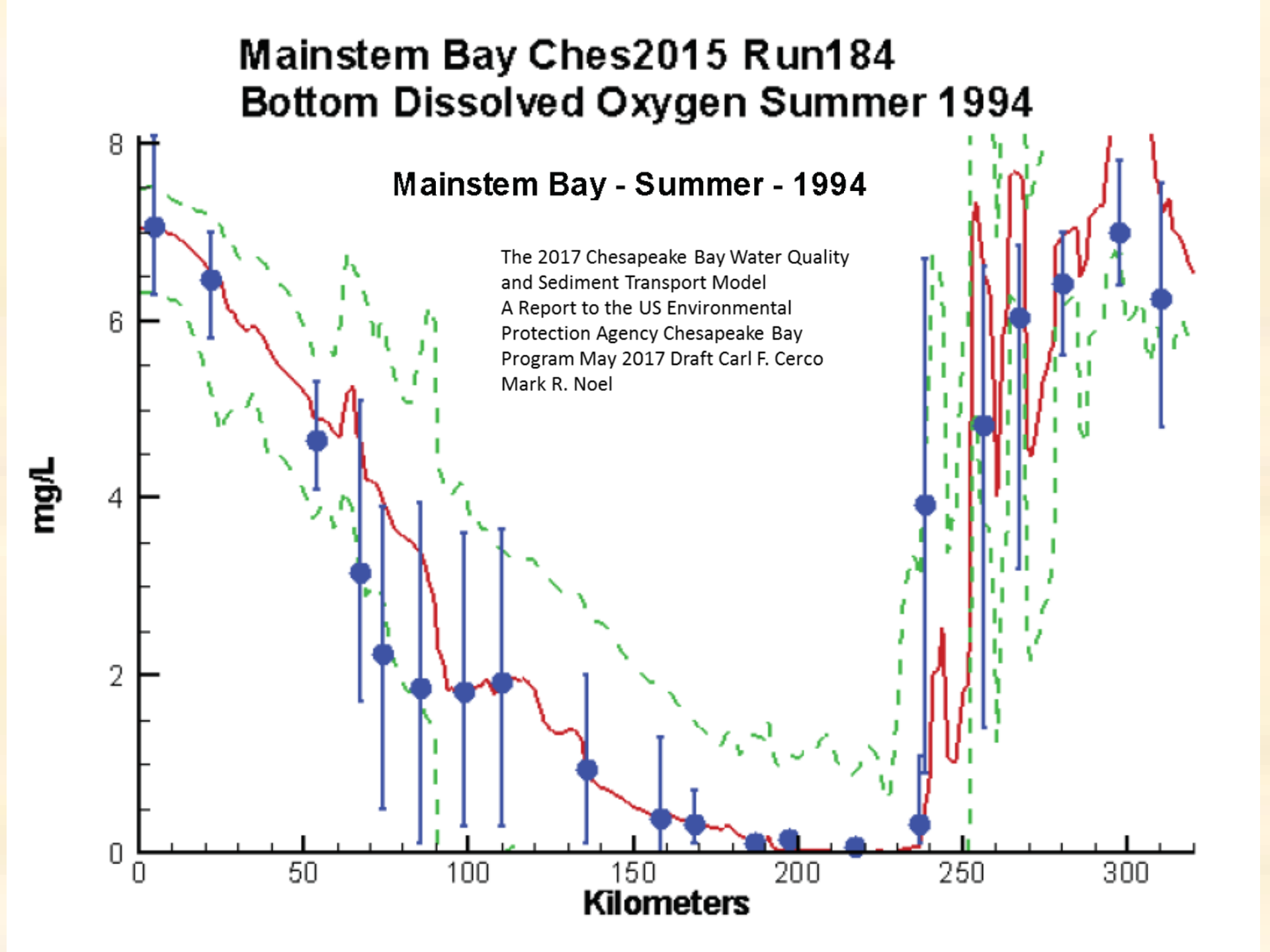
December 19-20 – PSC Meeting

Mainstem Bay Ches2015 Run184
Surface Chlorophyll Summer 1994





The 2017 Chesapeake Bay Water Quality and Sediment Transport Model
A Report to the US Environmental Protection Agency Chesapeake Bay Program May 2017 Draft Carl F. Cerco Mark R. Noel


Mainstem Bay Ches2015 Run184
Bottom Dissolved Oxygen Summer 1994
Mainstem Bay - Summer - 1994
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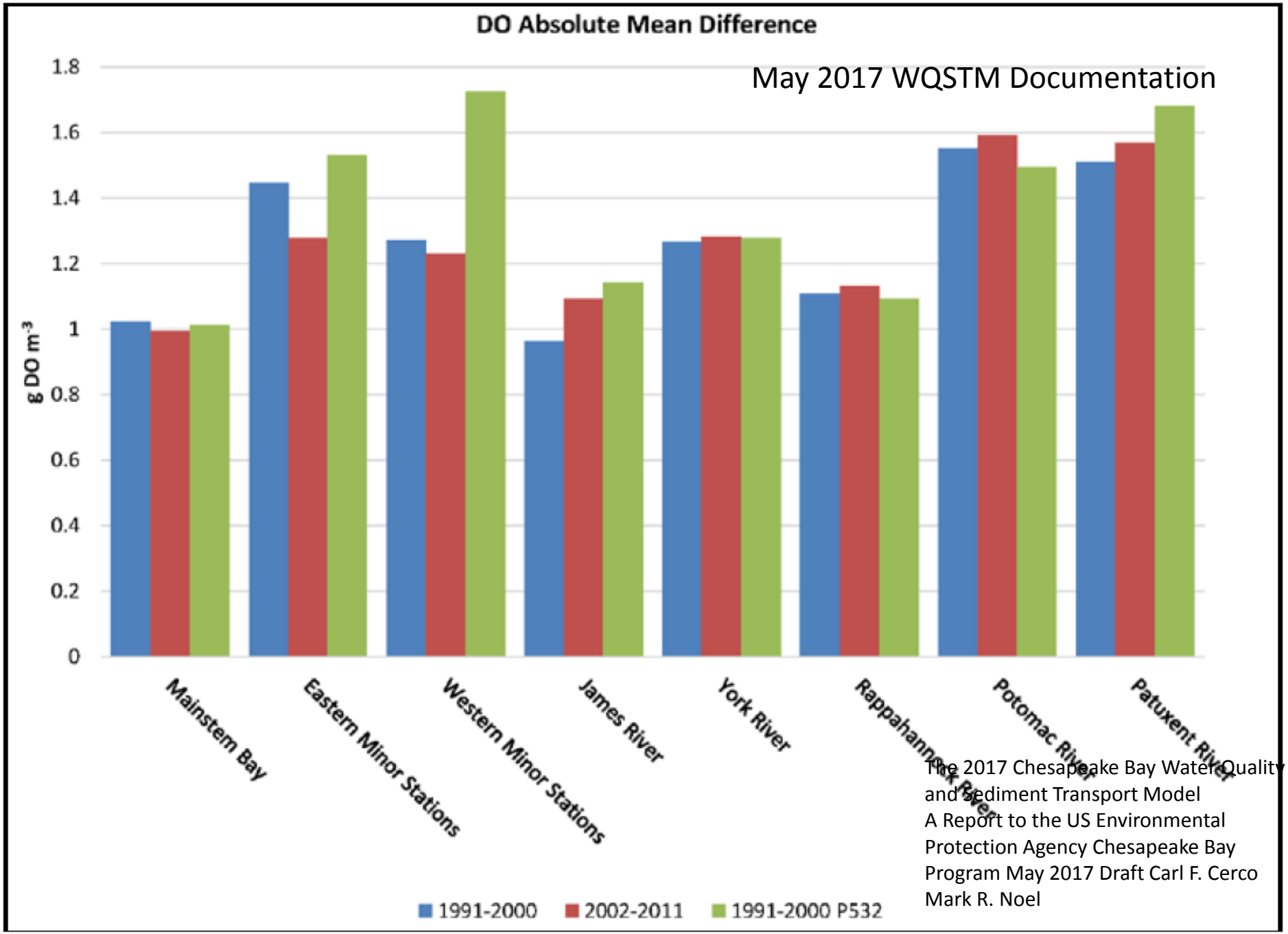
mg/L
0
2
4
6
8
0
50
100
150
200
250
300
Kilometers



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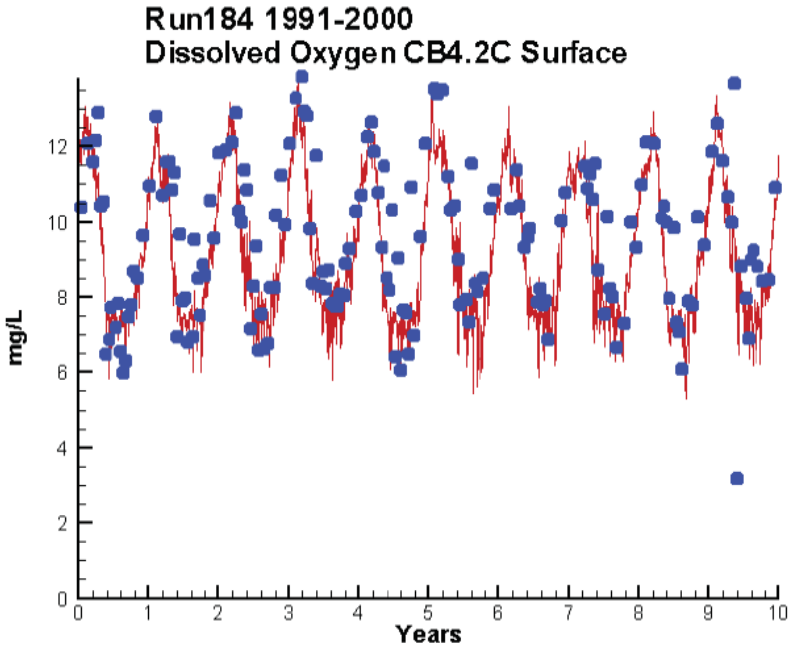
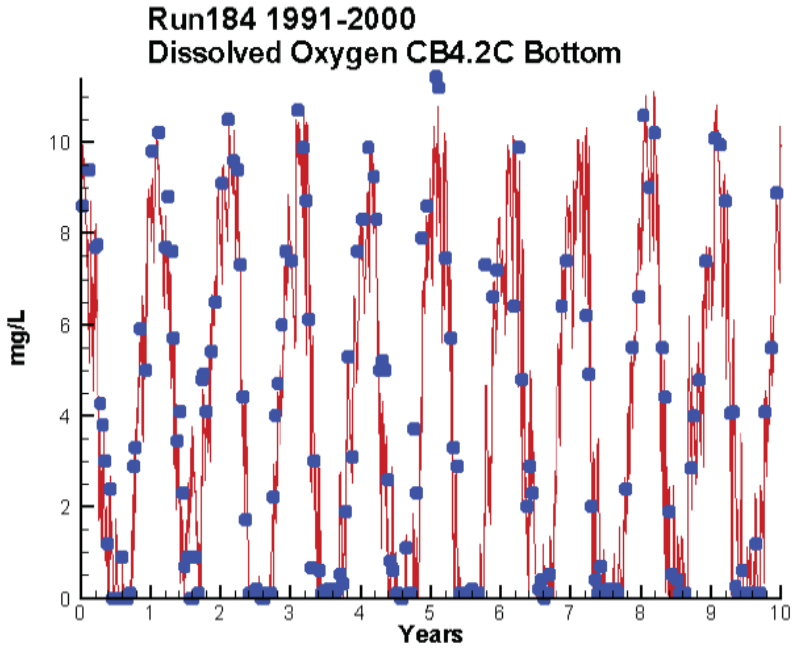
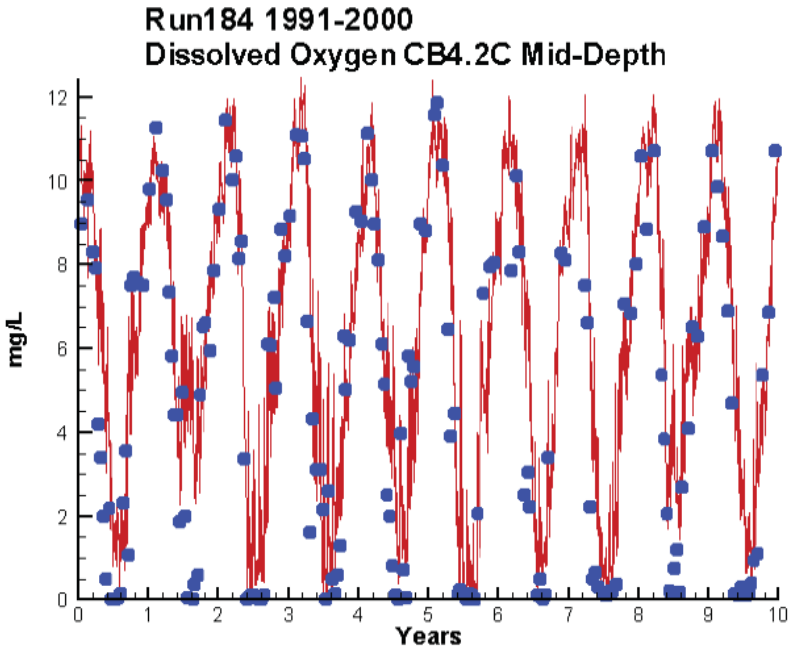
Station CB4.2C







	Mean Difference	Absolute Mean Difference
Top DO	-0.5558	0.9104
Mid DO	1.0242	1.4851
Bot DO	-0.3929	0.9321

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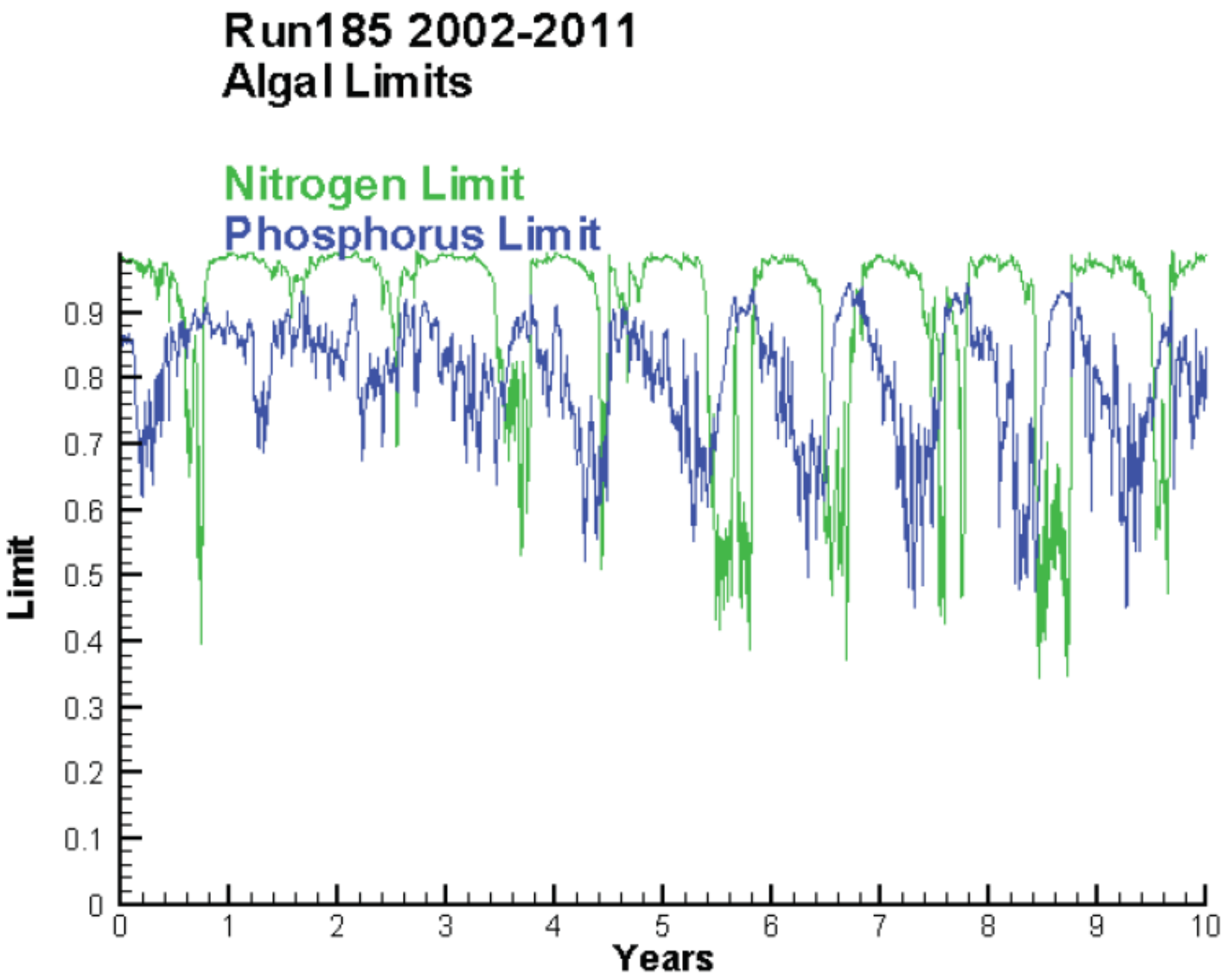
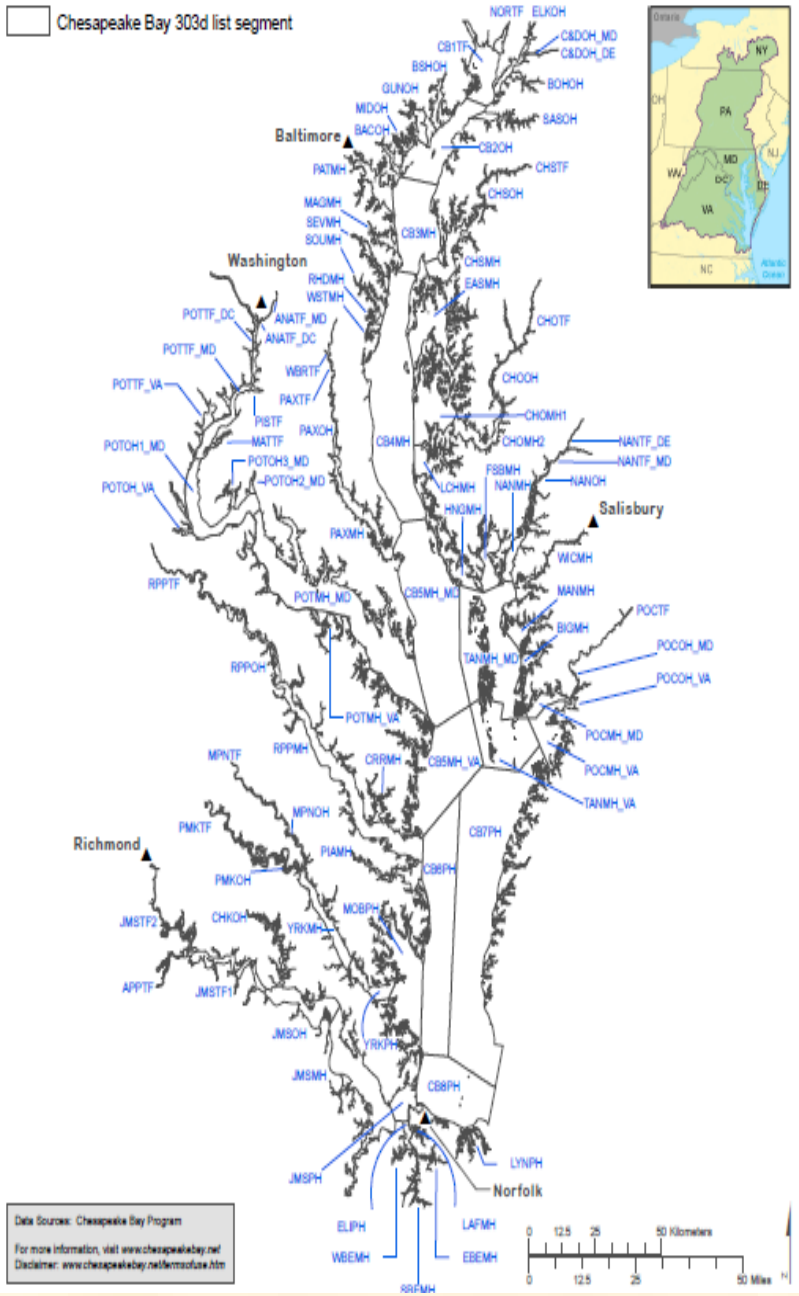
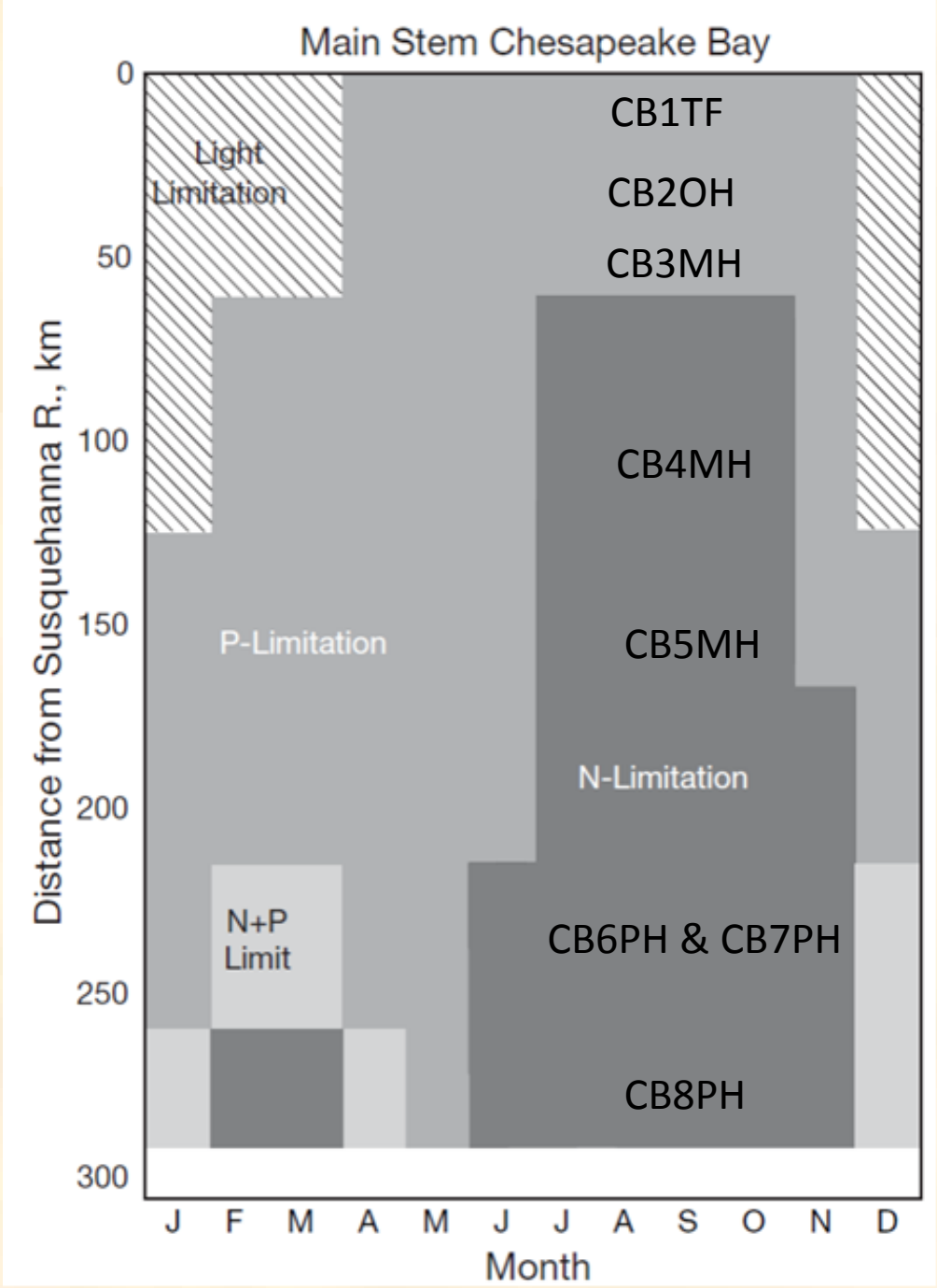
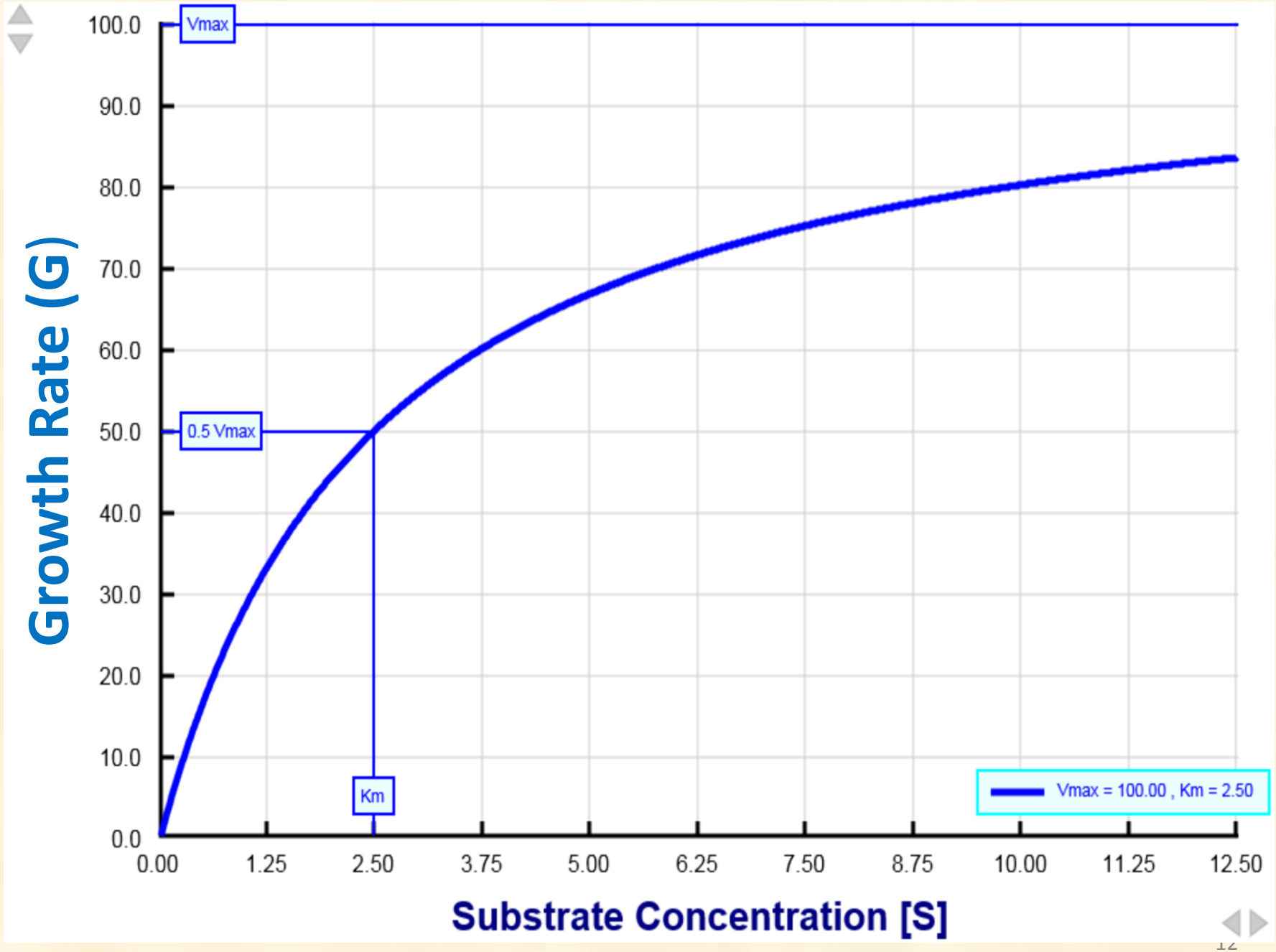
Station CB2.2




Chesapeake Bay 303d list segment
Baltimore
Washington
Salisbury
Richmond
Norfolk
NORTF_ELKOH
C&DOH_MD
C&DOH_DE
CB1TF
BSHOH
GUNOH
BOHOH
MIDOH
BACOH
SASOH
CB2OH
PATMH
CHSTF
CHSOH
MAGMH
SEVMH
SOUMH
CB3MH
CHSMH
RHDMH
WSTMH
EASMH
POTTF_DC
ANATF_MD
ANATF_DC
CHOTF
POTTF_MD
WBRTF
CHOOH
POTTF_VA
PAXTF
CHOMH1
PISTF
PAXOH
CB4MH
CHOMH2
NANTF_DE
POTOH1_MD
MATTF
NANTF_MD
POTOH3_MD
POTOH2_MD
FSBMH
NANMH
NANOH
POTOH_VA
LCHMH
HNGMH
PAXMH
WICMH
RPPTF
POTMH_MD
CB5MH_MD
MANMH
POCTF
BIGMH
TANMH_MD
POCOH_MD
RPPOH
POCOH_VA
POTMH_VA
POCMH_MD
RPPMH
CB5MH_VA
POCMH_VA
MPNTF
CRRMH
TANMH_VA
MPNOH
PMKTF
CB7PH
PIAMH
CB6PH
PMKOH
MOBPH
JMSTF2
CHKOH
YRKMH
APPTF
JMSTF1
JMSOH
YRKPH
JMSMH
CB8PH
LYNPH
JMSPH
ELIPH
LAFMH
WBEMH
EBEMH
RSKMH
Data Sources: Chesapeake Bay Program
For more information, visit www.chesapeakebay.net
Disclaimer: www.chesapeakebay.net/termsofuse.htm
0 12.5 25 50 Kilometers
0 12.5 25 50 Miles
NY
PA
MD
NJ
WV
DC
DE
VA
NC
Atlantic Ocean

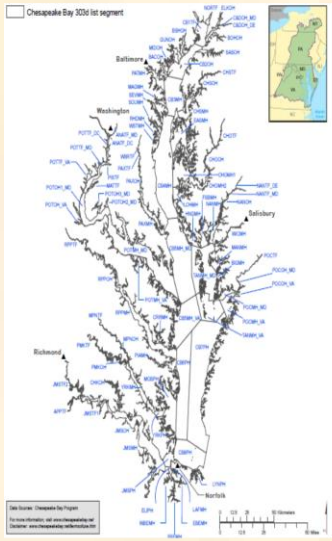

Main Stem Chesapeake Bay
Distance from Susquehanna R., km
0
50
100
150
200
250
300
Light Limitation
P-Limitation
N+P Limit
N-Limitation
CB1TF
CB2OH
CB3MH
CB4MH
CB5MH
CB6PH & CB7PH
CB8PH
J F M A M J J A S O N D
Month

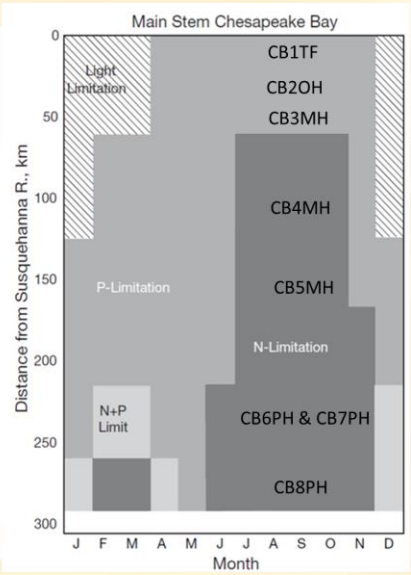

Vmax
0.5 Vmax
Km
Vmax = 100.00 , Km = 2.50
Growth Rate (G)
Substrate Concentration [S]
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.00
1.25
2.50
3.75
5.00
6.25
7.50
8.75
10.00
11.25
12.50

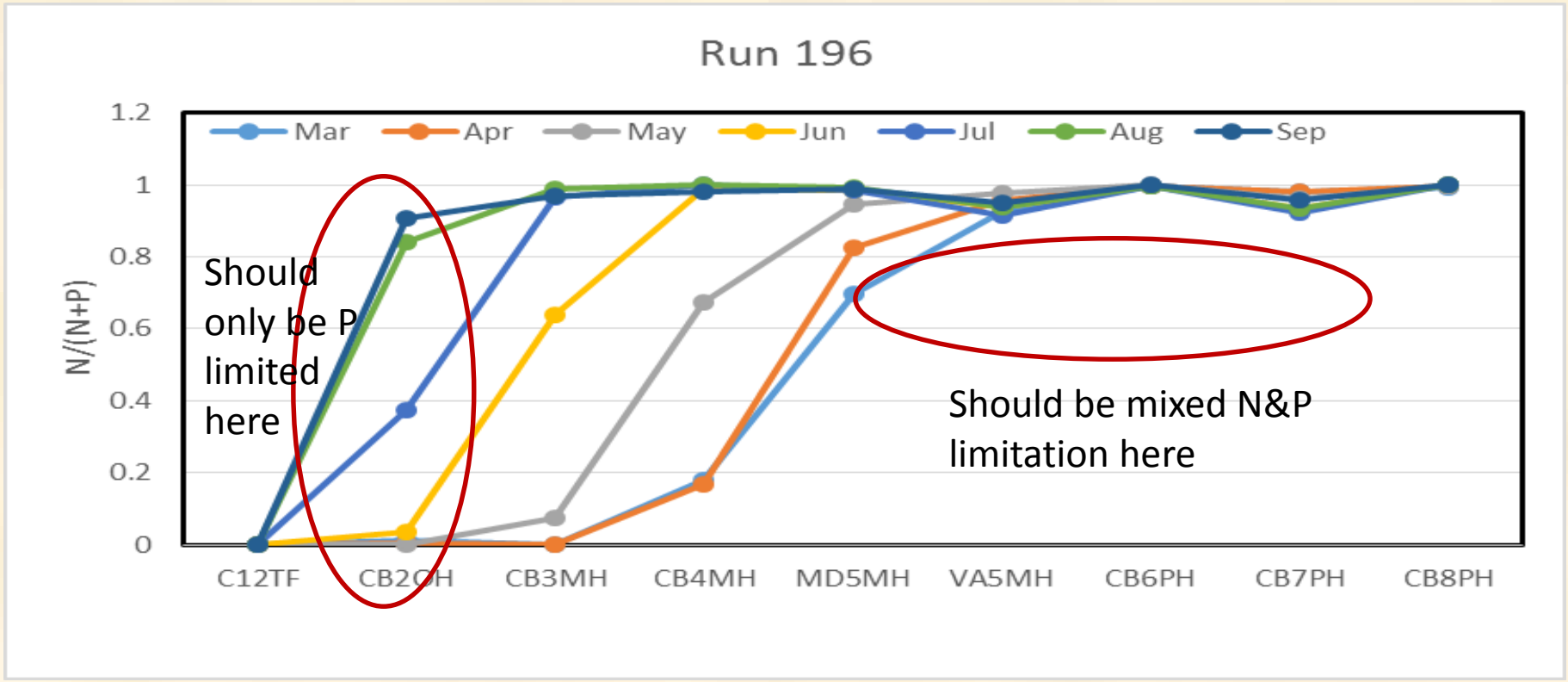
Run 196

Insufficient P limitation throughout.

Failed



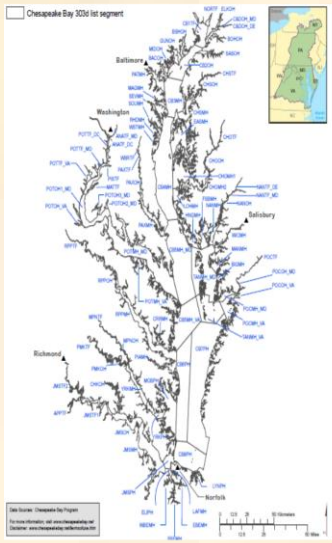


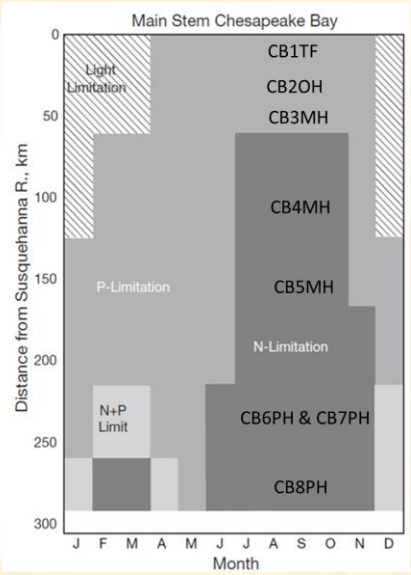


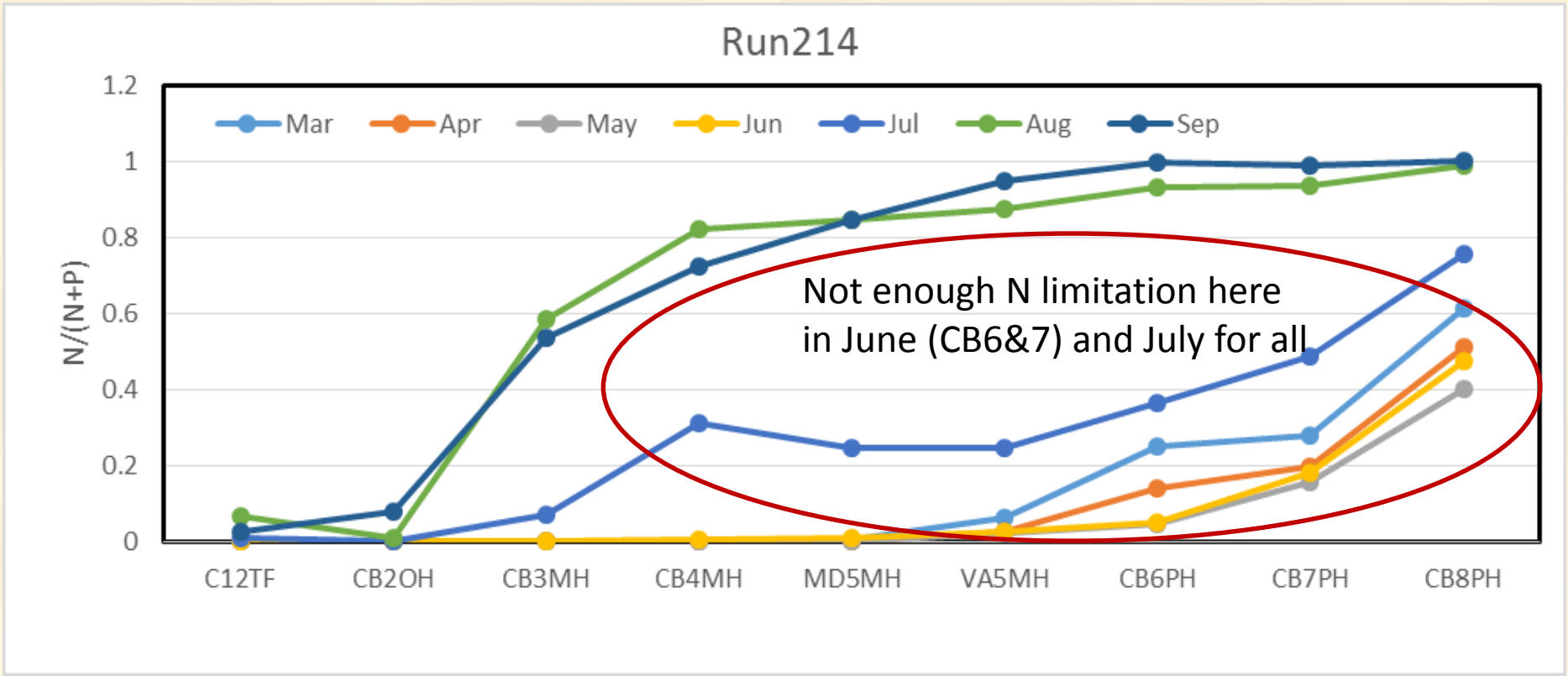
Run 214

Not enough N limitation in CB4, CB5, CB6, CB7, and CB8.

Failed

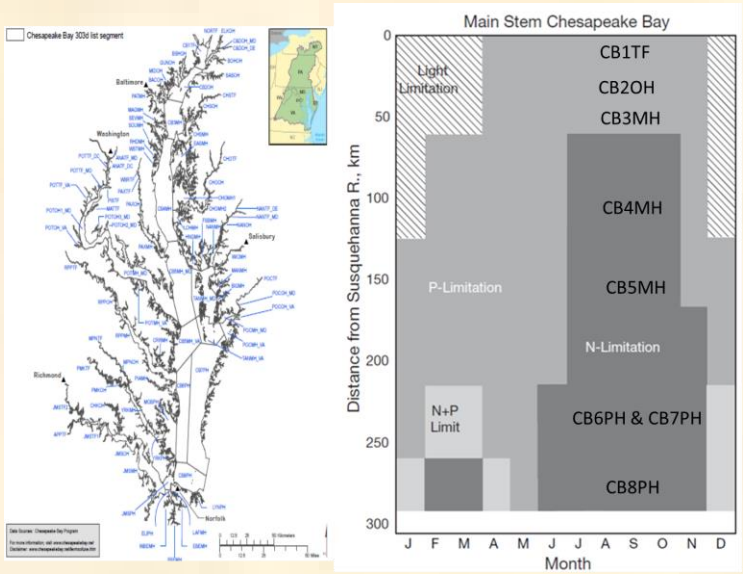


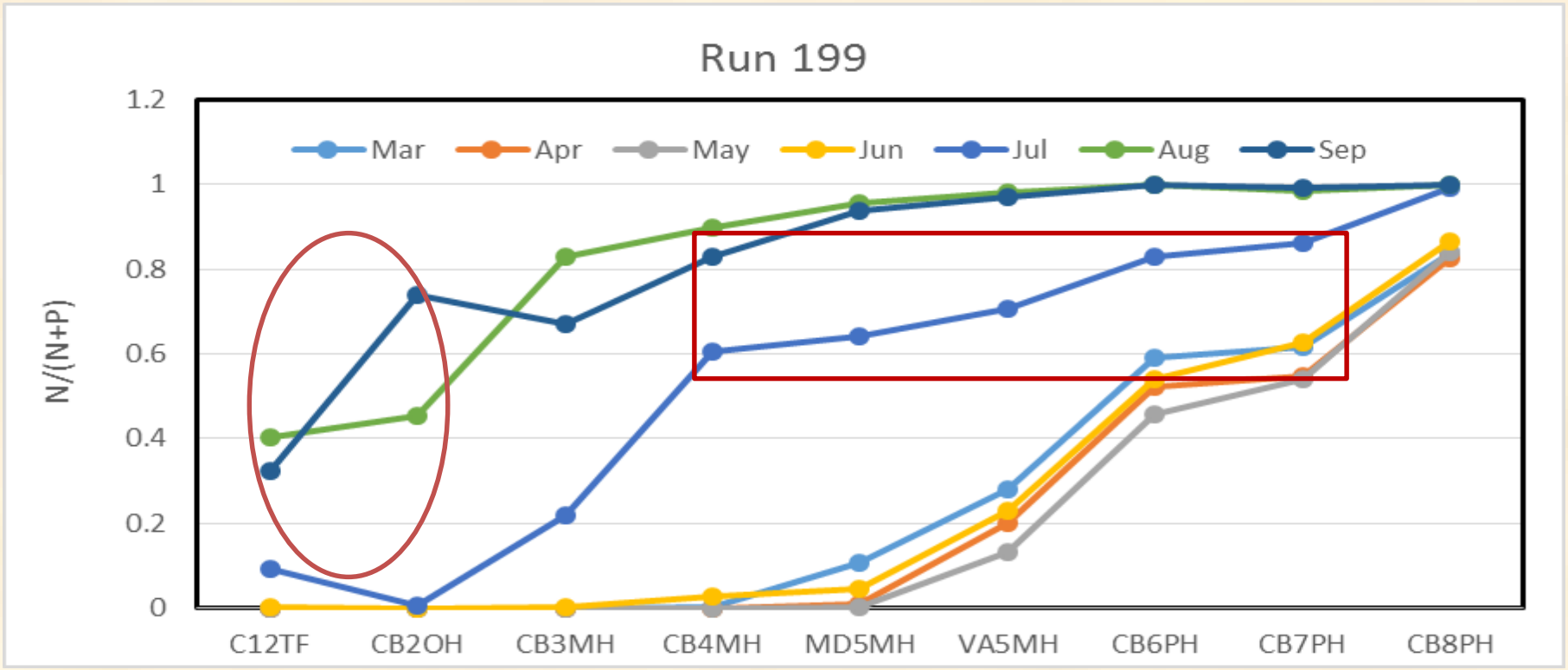




Run 199

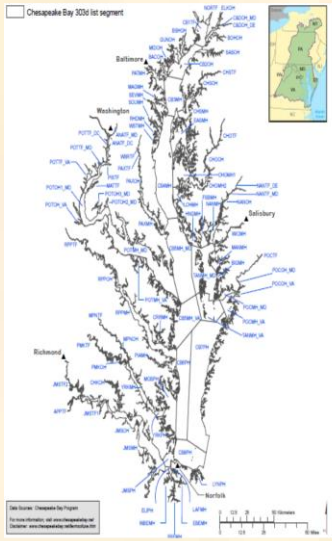
- Insufficient P limitation in CB1 & CB2 (should be P limited at all times).
- Insufficient N limitation in CB4, CB5, CB6, and CB7 in July (Should be entirely N limited in July).

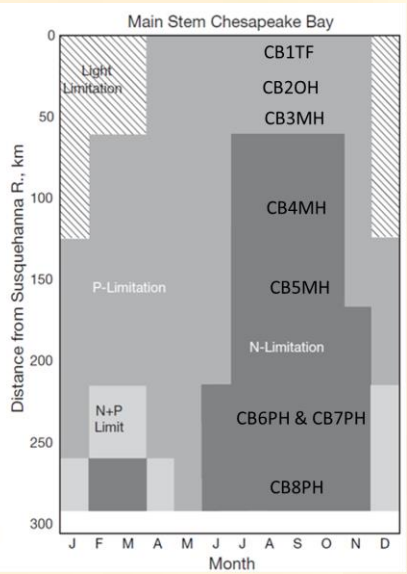


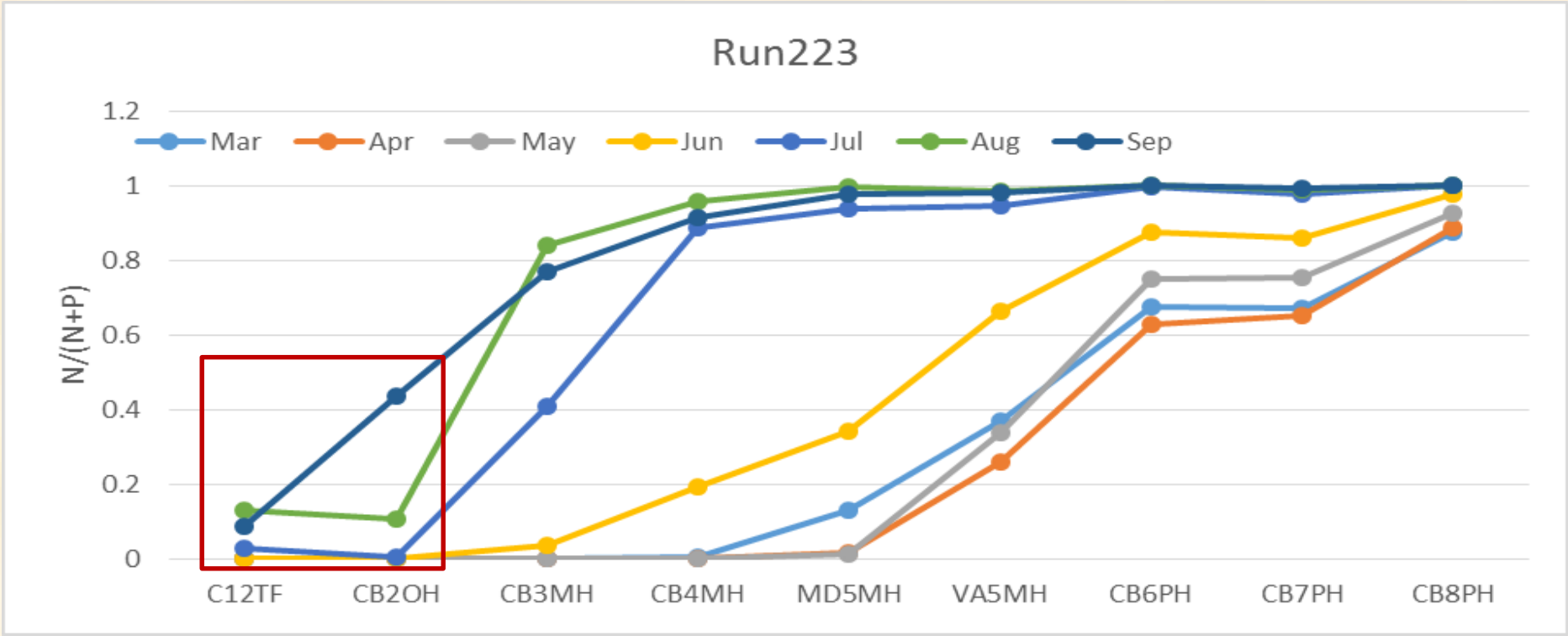


Run 223

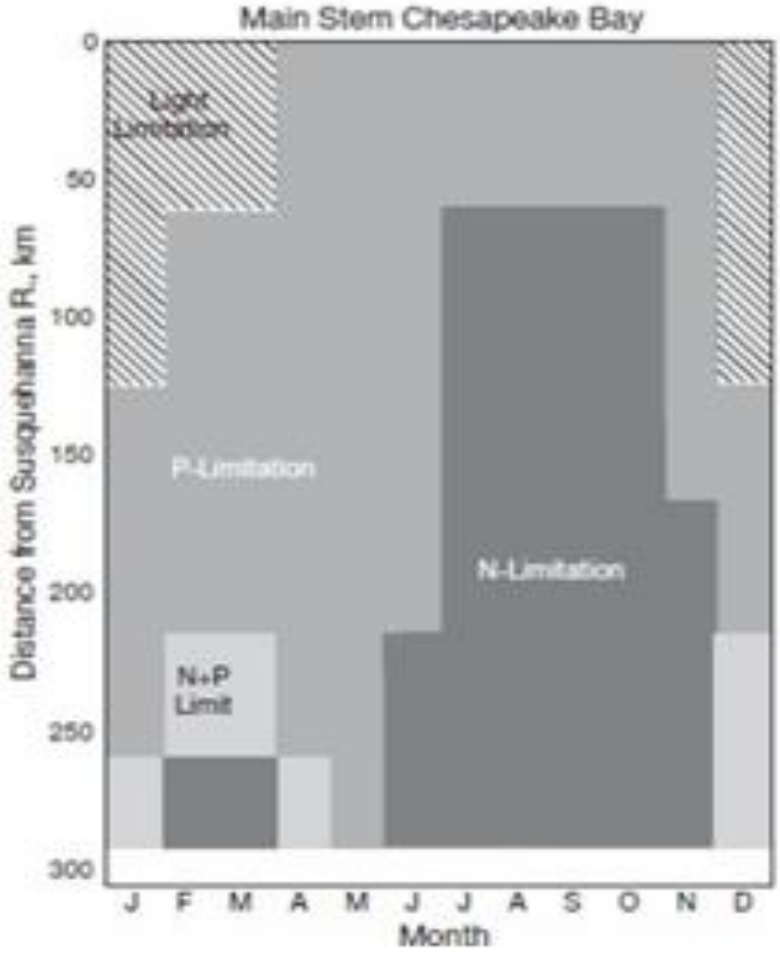
- Improved representation of P limitation in CB1 & CB2 (should be P limited at all times).
- Appropriate N limitation in CB4, CB5, CB6 & CB7 in July (Should be N limited in July).



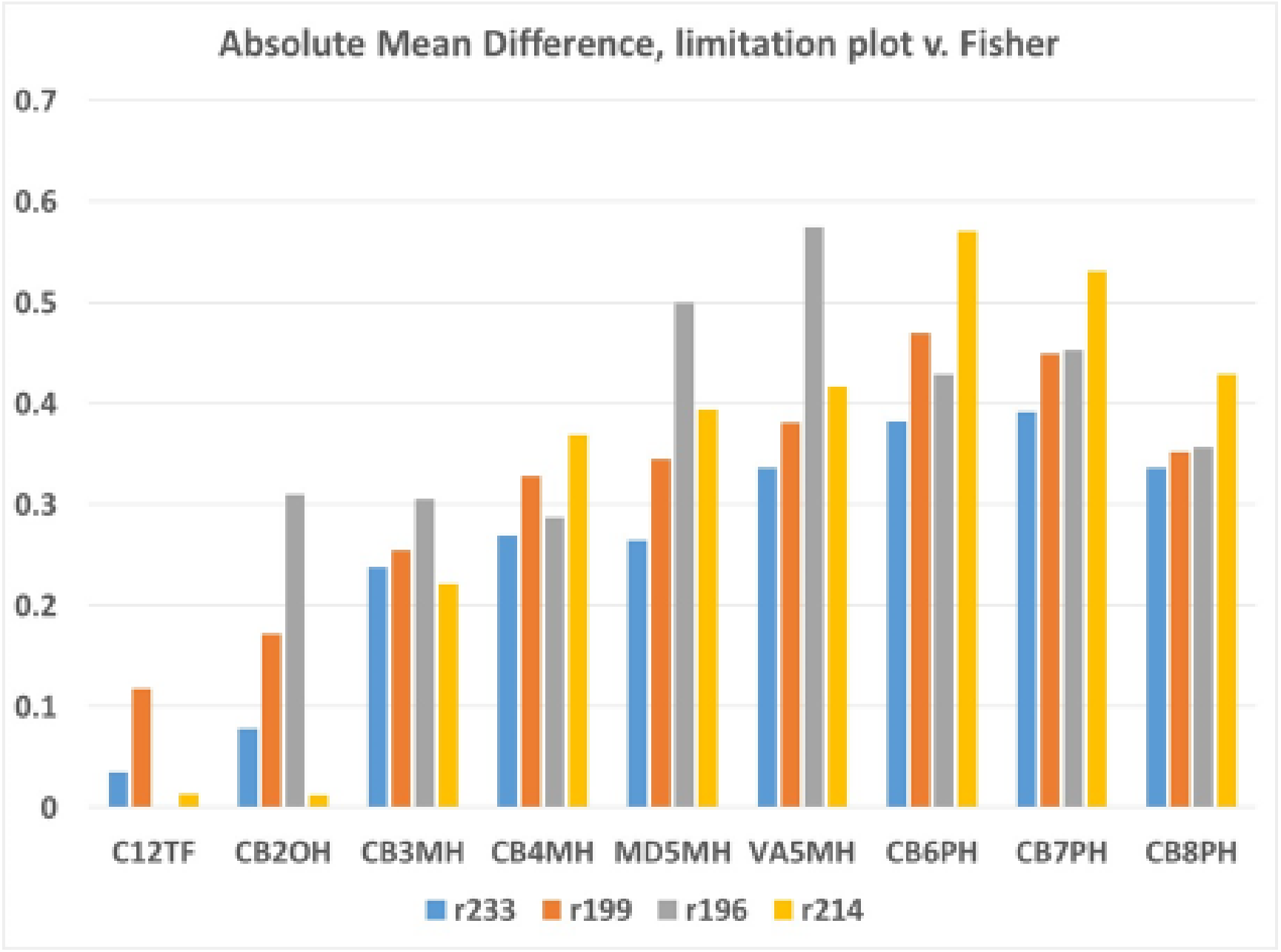


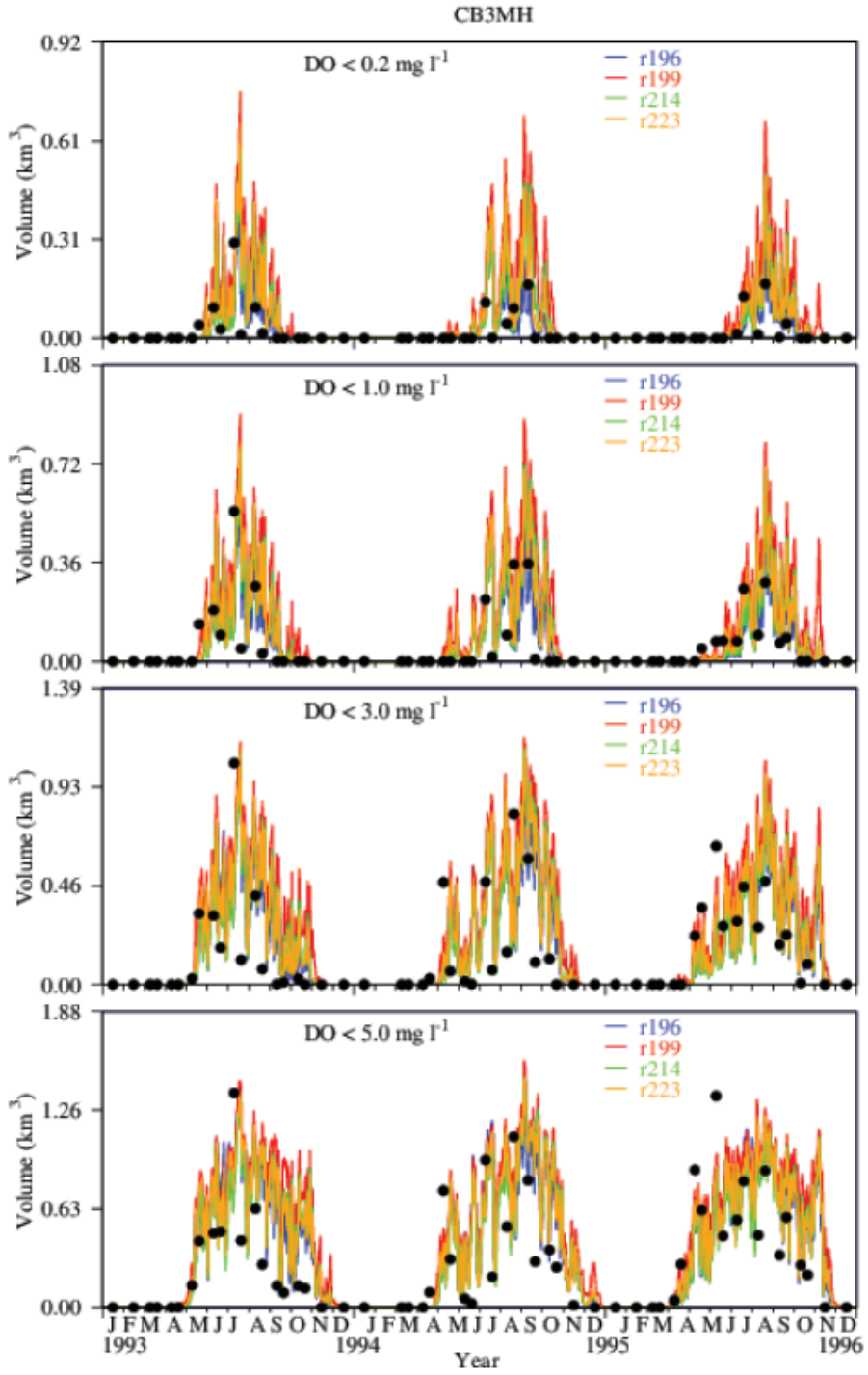


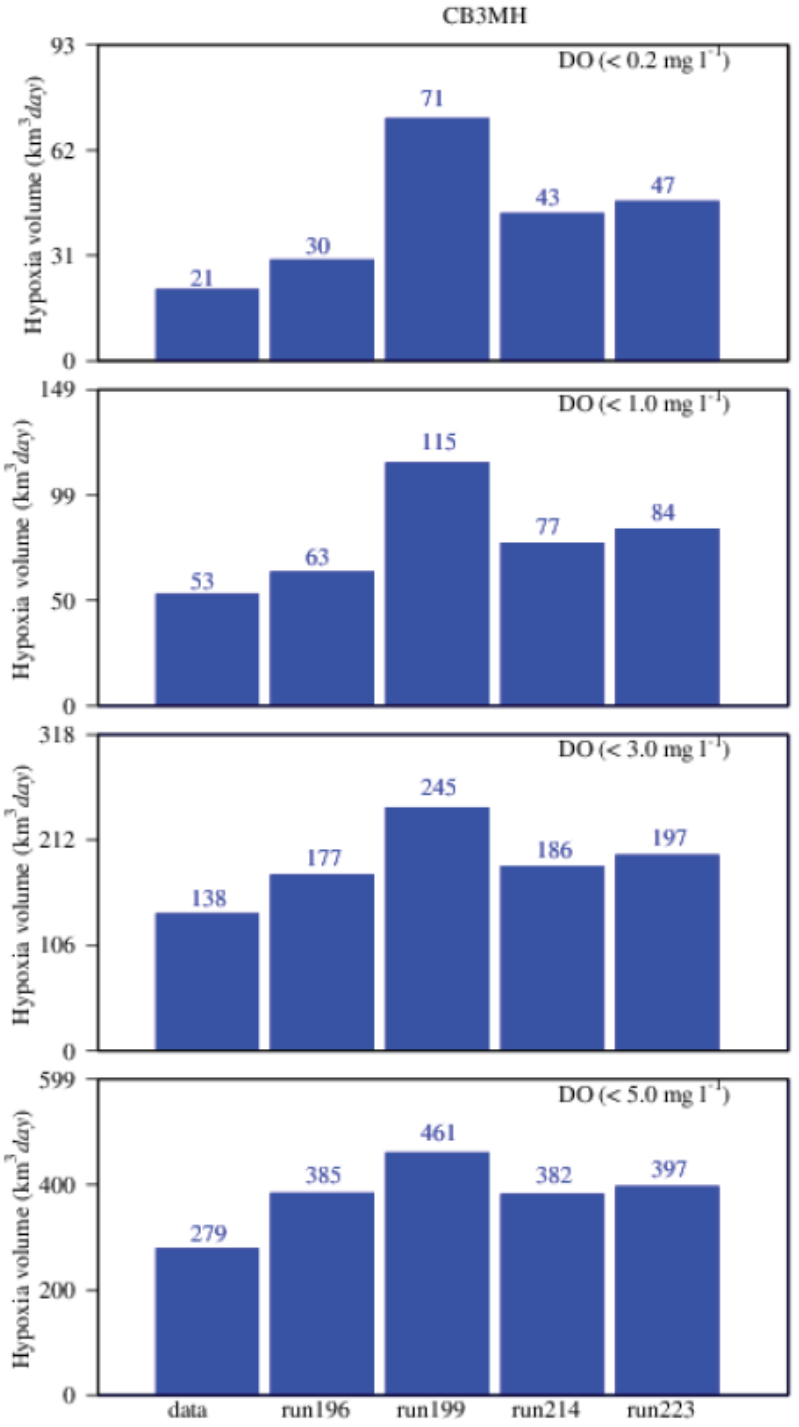
Fisher plot ... ...converted to table

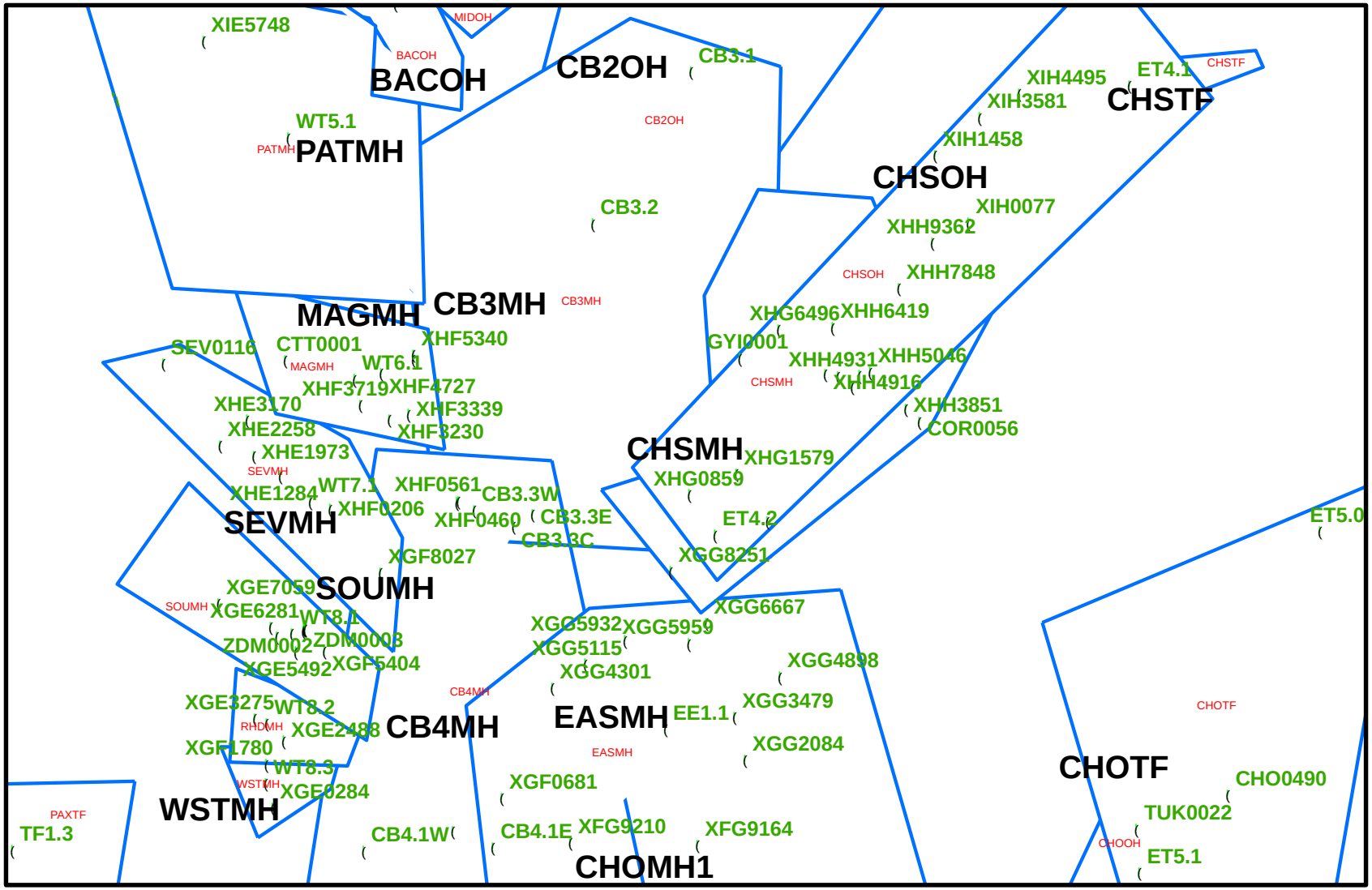


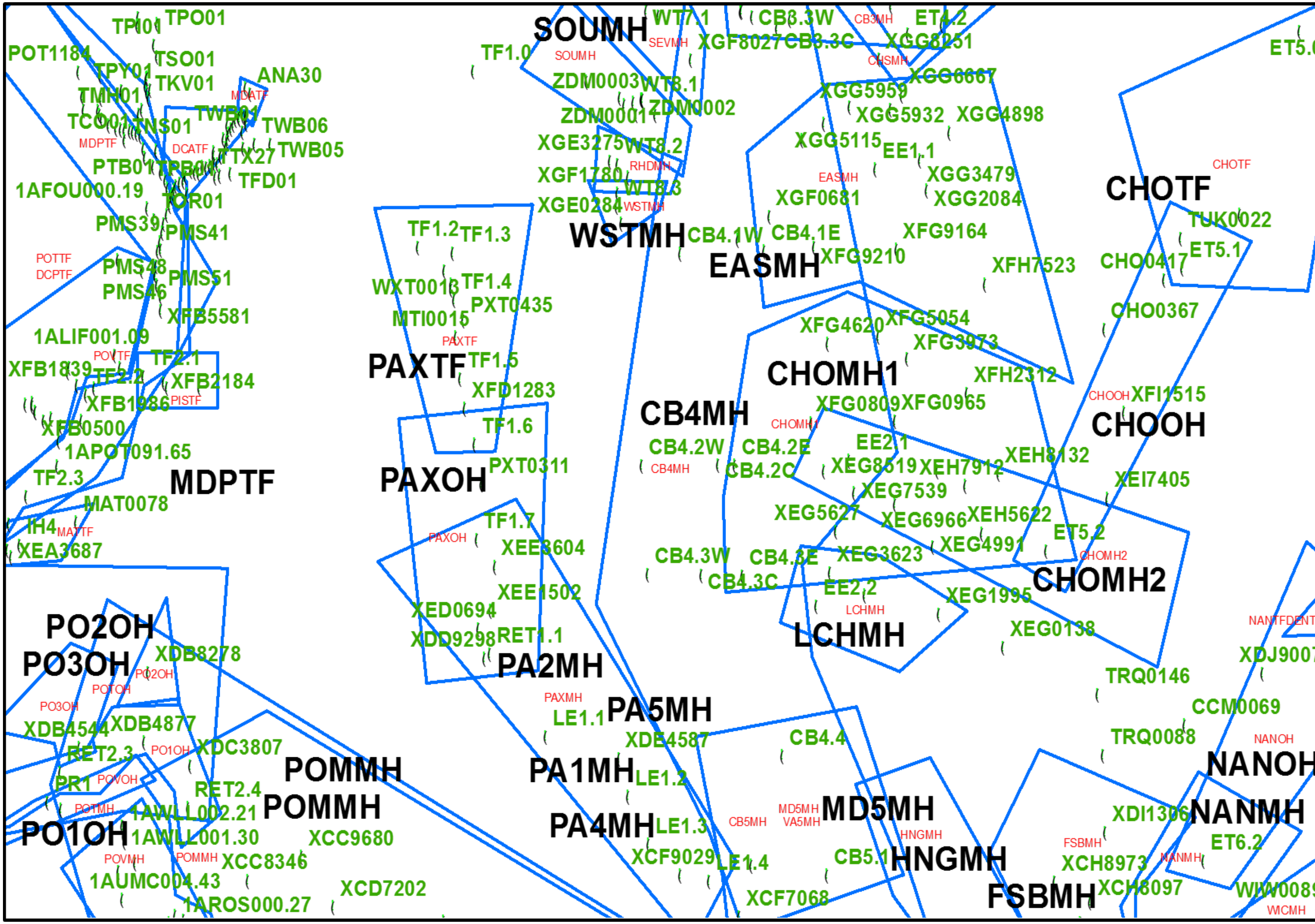
N	CB1TF	CB2OH	CB4MH	MDSMH	VASMH	CB6MH	CB8PH
Month	0	50	100	150	200	250	300
1					0	0	0	0.5
2				0	0	0	0.5	1
3				0	0	0	0.5	1
4	0	0	0	0	0	0	0	0.5
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	1	1
7	0	0	1	1	1	1	1	1
8	0	0	1	1	1	1	1	1
9	0	0	1	1	1	1	1	1
10	0	0	1	1	1	1	1	1
11	0	0	0	0	1	1	1	1
12					0	0	0.5	0.5


Absolute Mean Difference, limitation plot v. Fisher
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
C12TF
CB2OH
CB3MH
CB4MH
MD5MH
VA5MH
CB6PH
CB7PH
CB8PH
r233
r199
r196
r214

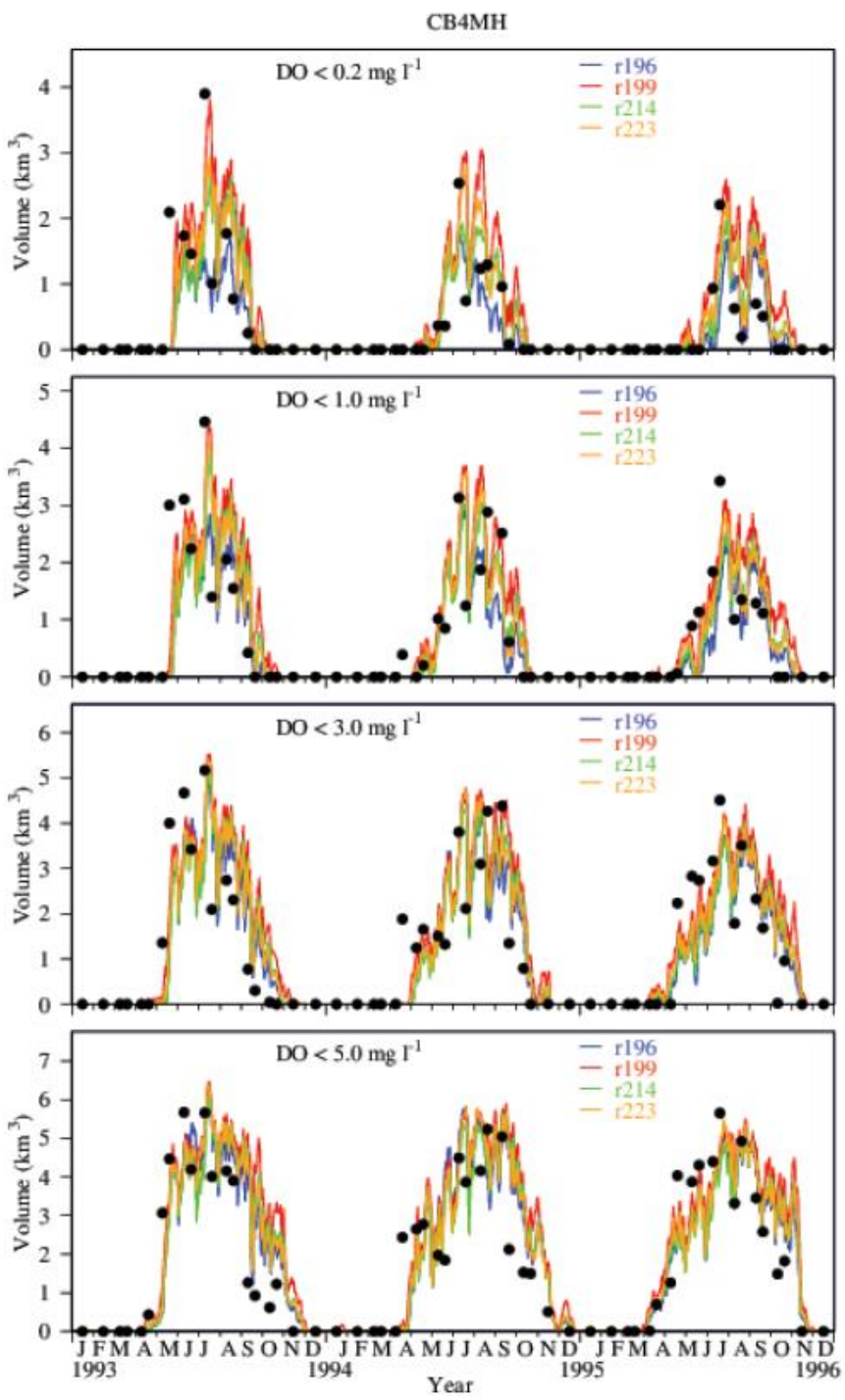

CB3MH
DO < 0.2 mg l-1
DO < 1.0 mg l-1
DO < 3.0 mg l-1
DO < 5.0 mg l-1
r196
r199
r214
r223
Volume (km3)
0.92
0.61
0.31
0.00
1.08
0.72
0.36
1.39
0.93
0.46
1.88
1.26
0.63
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1993
1994
1995
1996
Year

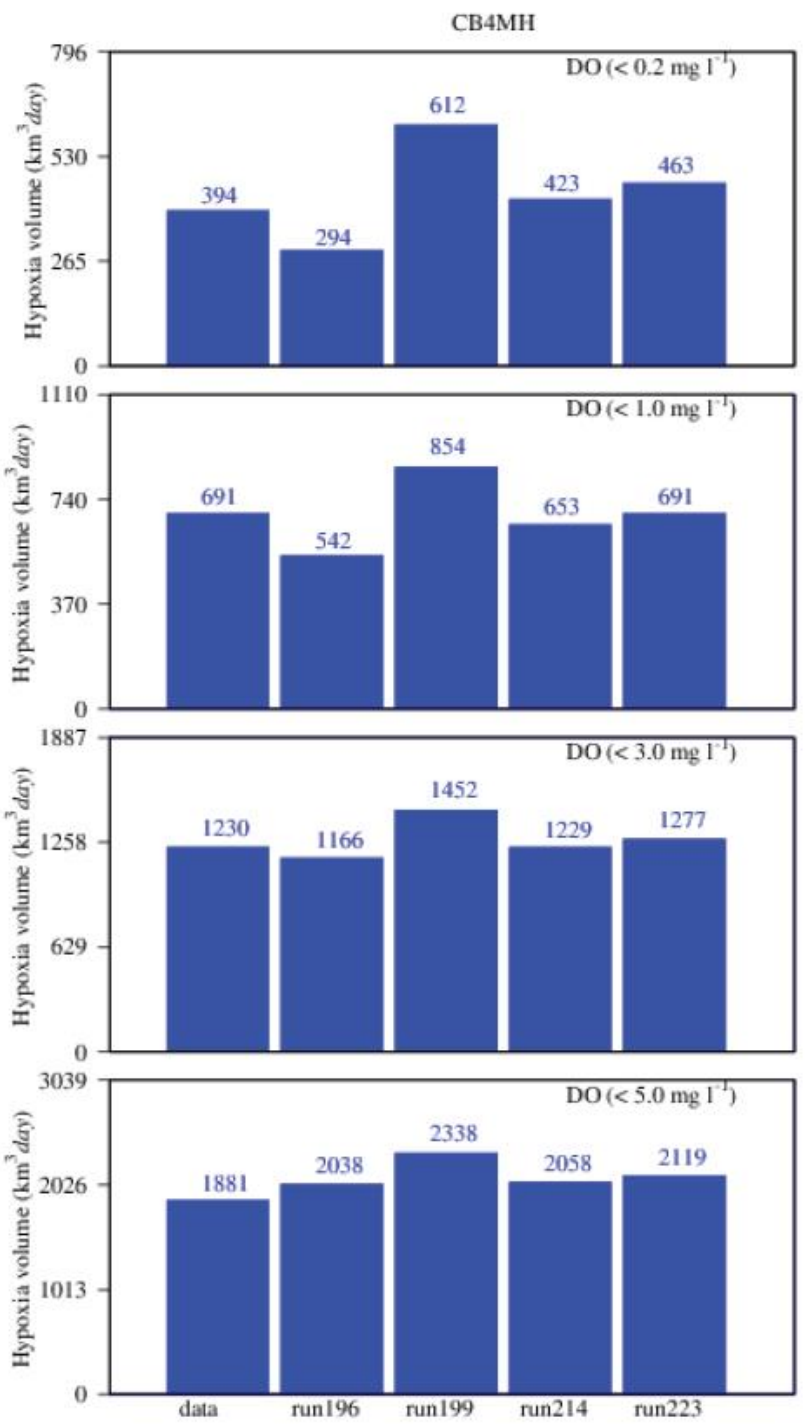

CB3MH
DO (< 0.2 mg l-1)
DO (< 1.0 mg l-1)
DO (< 3.0 mg l-1)
DO (< 5.0 mg l-1)
Hypoxia volume (km3 day)
93
62
31
0
21
30
71
43
47
149
99
50
53
63
115
77
84
318
212
106
138
177
245
186
197
599
400
200
279
385
461
382
397
data
run196
run199
run214
run223

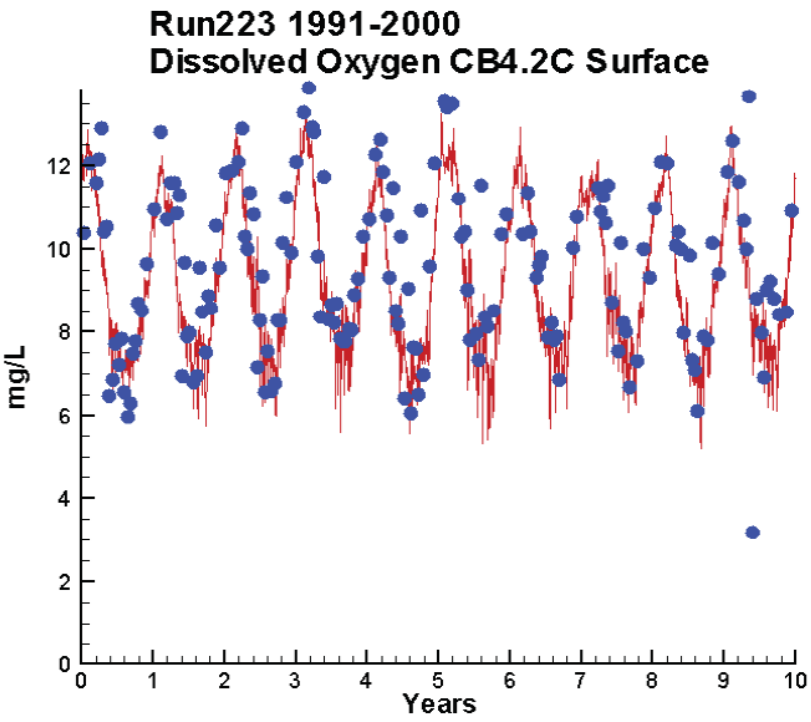

XIE5748
MIDOH
BACOH
BACOH
CB2OH
CB3.1
XIH4495
ET4.1
CHSTF
CHSTF
XIH3581
WT5.1
PATMH
PATMH
CB2OH
XIH1458
CHSOH
CB3.2
XIH0077
XHH9362
CHSOH
XHH7848
CB3MH
MAGMH
CB3MH
XHG6496
XHH6419
SEV0116
CTT0001
XHF5340
GYI0001
MAGMH
WT6.1
XHH4931
XHH5046
CHSMH
XHH4916
XHF3719
XHF4727
XHE3170
XHF3339
XHH3851
XHE2258
XHF3230
COR0056
CHSMH
XHE1973
XHG1579
SEVMH
XHG0859
XHE1284
WT7.1
XHF0561
CB3.3W
ET5.0
SEVMH
XHF0206
XHF0460
CB3.3E
ET4.2
CB3.3C
XGF8027
XGG8251
XGE7059
SOUMH
SOUMH
XGG6667
XGE6281
WT8.1
XGG5932
XGG5959
ZDM0002
ZDM0003
XGG5115
XGE5492
XGF5404
XGG4301
XGG4898
CB4MH
XGE3275
WT8.2
XGG3479
EASMH
EE1.1
CHOTF
RHDMH
XGE2488
CB4MH
XGF1780
XGG2084
EASMH
WT8.3
CHOTF
CHO0490
WSTMH
XGE0284
XGF0681
WSTMH
TUK0022
PAXTF
TF1.3
CB4.1W
CB4.1E
XFG9210
XFG9164
CHOOH
ET5.1
CHOMH1

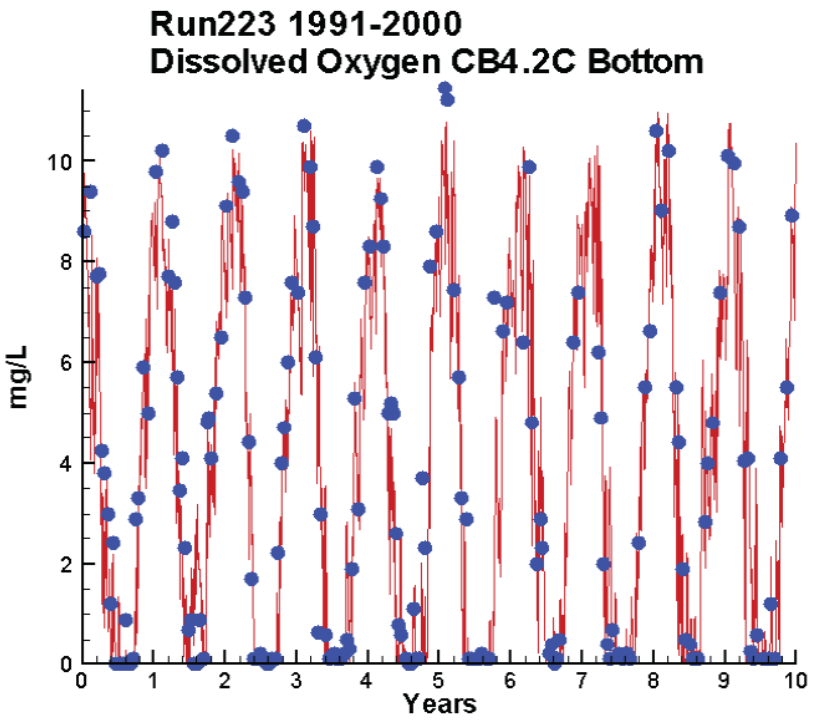


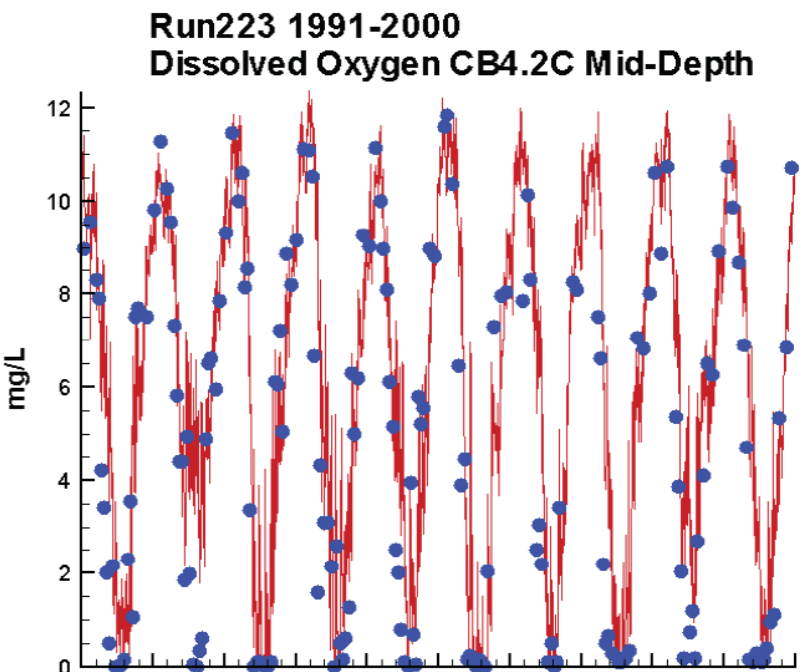
SOUMH
WSTMH
EASMH
CHOTF
PAXTF
CHOMH1
CB4MH
CHOOH
MDPTF
PAXOH
CHOMH2
LCHMH
PO2OH
PO3OH
PA2MH
PA5MH
POMMH
PA1MH
POMMH
NANOH
MD5MH
NANMH
PO1OH
PA4MH
HNGMH
FSBMH
TPO01
TPI01
POT1184
TSO01
TPY01
TKV01
ANA30
TMH01
TWB01
TCO01
TNS01
TWB06
TWB05
TTX27
PTB01
TPB01
TFD01
1AFOU000.19
TOR01
PMS39
PMS41
PMS48
PMS51
PMS46
XFB5581
1ALIF001.09
XFB1839
TF2.1
TF2.2
XFB2184
XFB1986
XFB0500
1APOT091.65
TF2.3
MAT0078
XEA3687
TF1.0
TF1.2
TF1.3
WXT0018
TF1.4
PXT0435
MTI0015
TF1.5
XFD1283
TF1.6
PXT0311
TF1.7
XEE3604
XEE1502
XED0694
XDD9298
RET1.1
WT7.1
CB3.3W
ET4.2
XGF8027
CB3.3C
XGG8251
ET5.0
ZDM0003
WT8.1
XGG6667
ZDM0002
ZDM0001
XGG5959
XGG5932
XGG4898
XGE3275
WT8.2
XGG5115
EE1.1
XGF1780
XGG3479
WT8.3
XGF0681
XGG2084
XGE0284
TUK0022
CB4.1W
CB4.1E
XFG9164
ET5.1
XFG9210
XFH7523
CHO0417
CHO0367
XFG4620
XFG5054
XFG3973
XFH2312
XFI1515
XFG0809
XFG0965
CB4.2W
CB4.2E
EE2.1
XEH8132
CB4.2C
XEG8519
XEH7912
XEI7405
XEG7539
XEG5627
XEG6966
XEH5622
ET5.2
CB4.3W
CB4.3E
XEG3623
XEG4991
CB4.3C
EE2.2
XEG1995
XEG0138
XDJ9007
XDB8278
TRQ0146
CCM0069
XDB4544
XDB4877
LE1.1
XDE4587
CB4.4
TRQ0088
RET2.3
XDC3807
PR1
RET2.4
LE1.2
1AWLL002.21
XDI1306
1AWLL001.30
XCC9680
LE1.3
ET6.2
XCC8346
XCF9029
LE1.4
CB5.1
XCH8973
1AUMC004.43
XCD7202
XCH8097
WIW0089
1AROS000.27
XCF7068
SEVMH
CB3MH
SOUMH
CHSMH
MDATF
MDPTF
DCATF
RHDMH
CHOTF
EASMH
WSTMH
POTTF
DCPTF
PAXTF
POTTF
PISTF
CHOOH
CHOMH1
CB4MH
MATTF
PAXOH
CHOMH2
LCHMH
NANTF
DENTF
PO2OH
POTOH
PO3OH
PAXMH
NANOH
PO1OH
POVOH
POTMH
MD5MH
VA5MH
CB5MH
HNGMH
FSBMH
NANMH
POVMH
POMMH
WICMH


CB4MH
DO < 0.2 mg l-1
DO < 1.0 mg l-1
DO < 3.0 mg l-1
DO < 5.0 mg l-1
r196
r199
r214
r223
Volume (km 3)
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1993
1994
1995
1996
Year

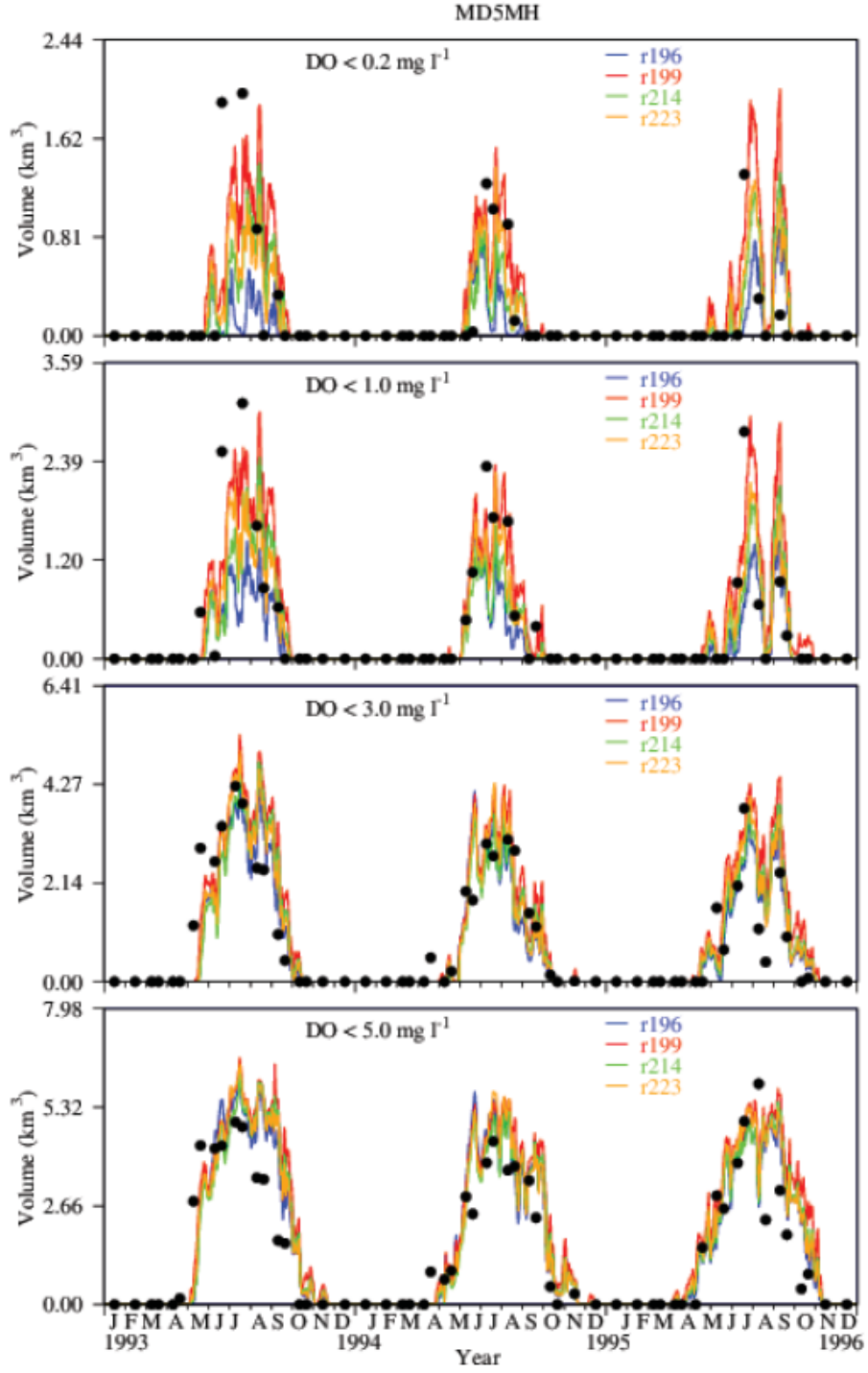

CB4MH
DO (< 0.2 mg l-1)
DO (< 1.0 mg l-1)
DO (< 3.0 mg l-1)
DO (< 5.0 mg l-1)
Hypoxia volume (km3 day)
796
530
265
0
394
294
612
423
463
1110
740
370
691
542
854
653
691
1887
1258
629
1230
1166
1452
1229
1277
3039
2026
1013
1881
2038
2338
2058
2119
data
run196
run199
run214
run223

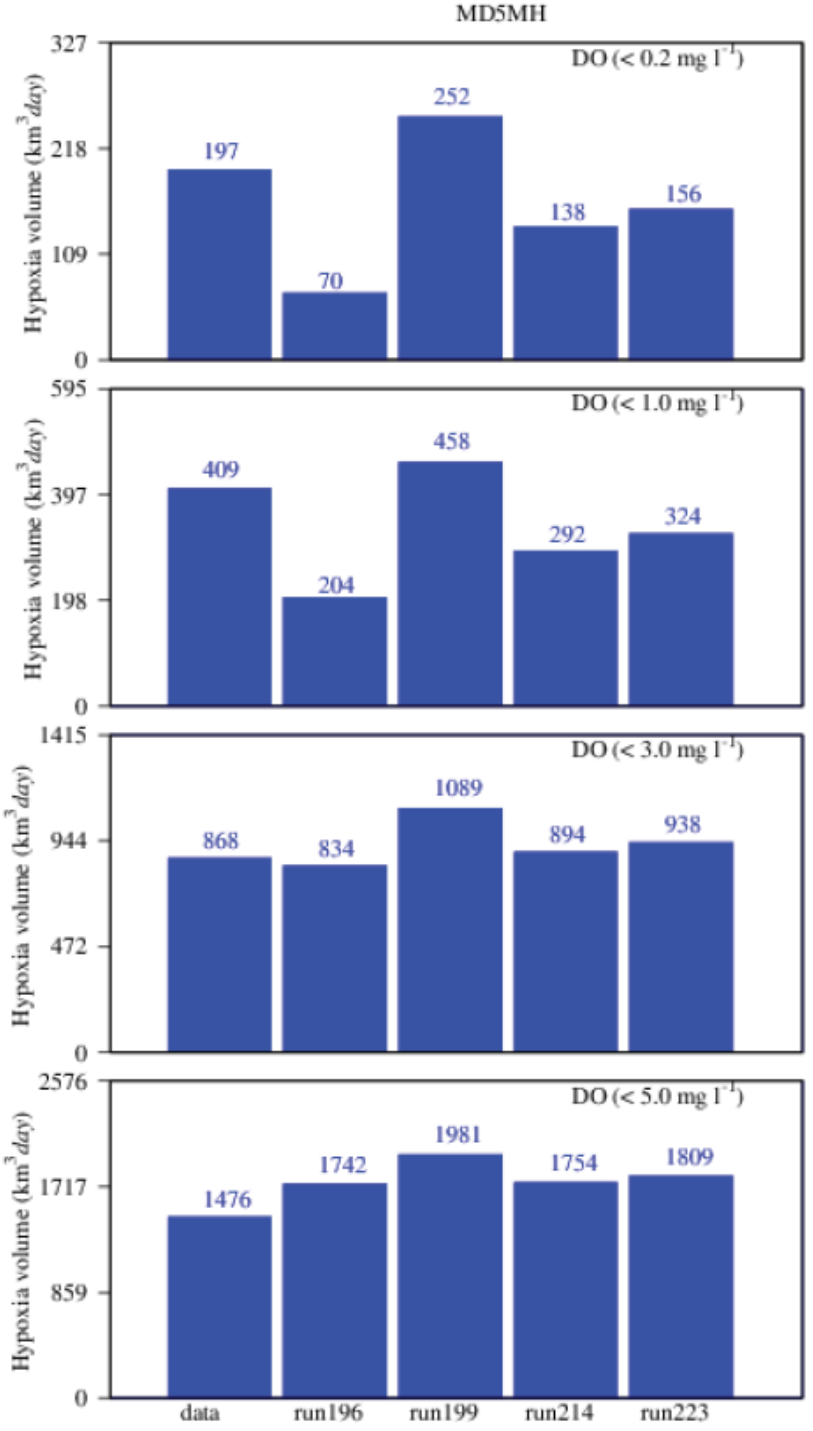


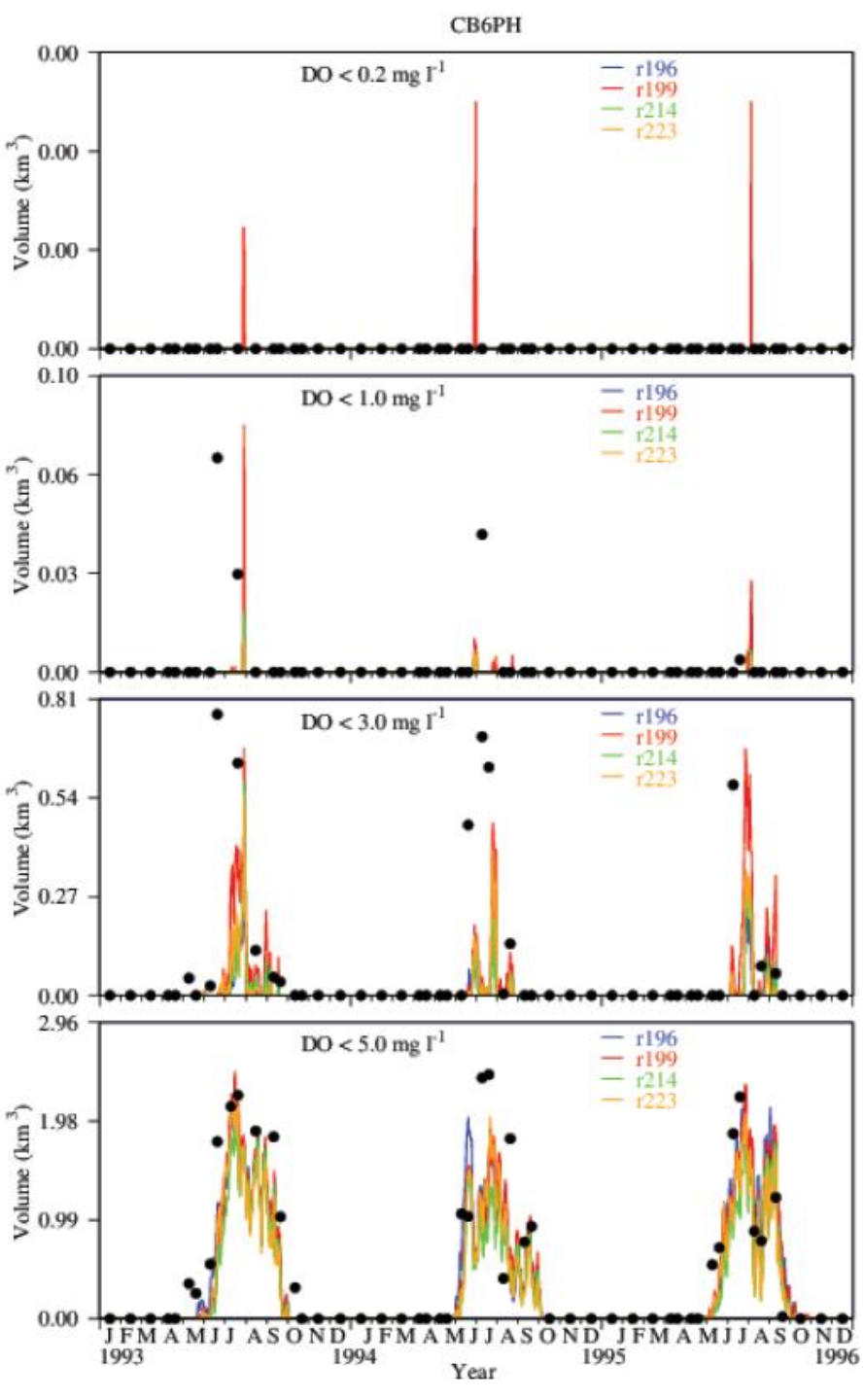


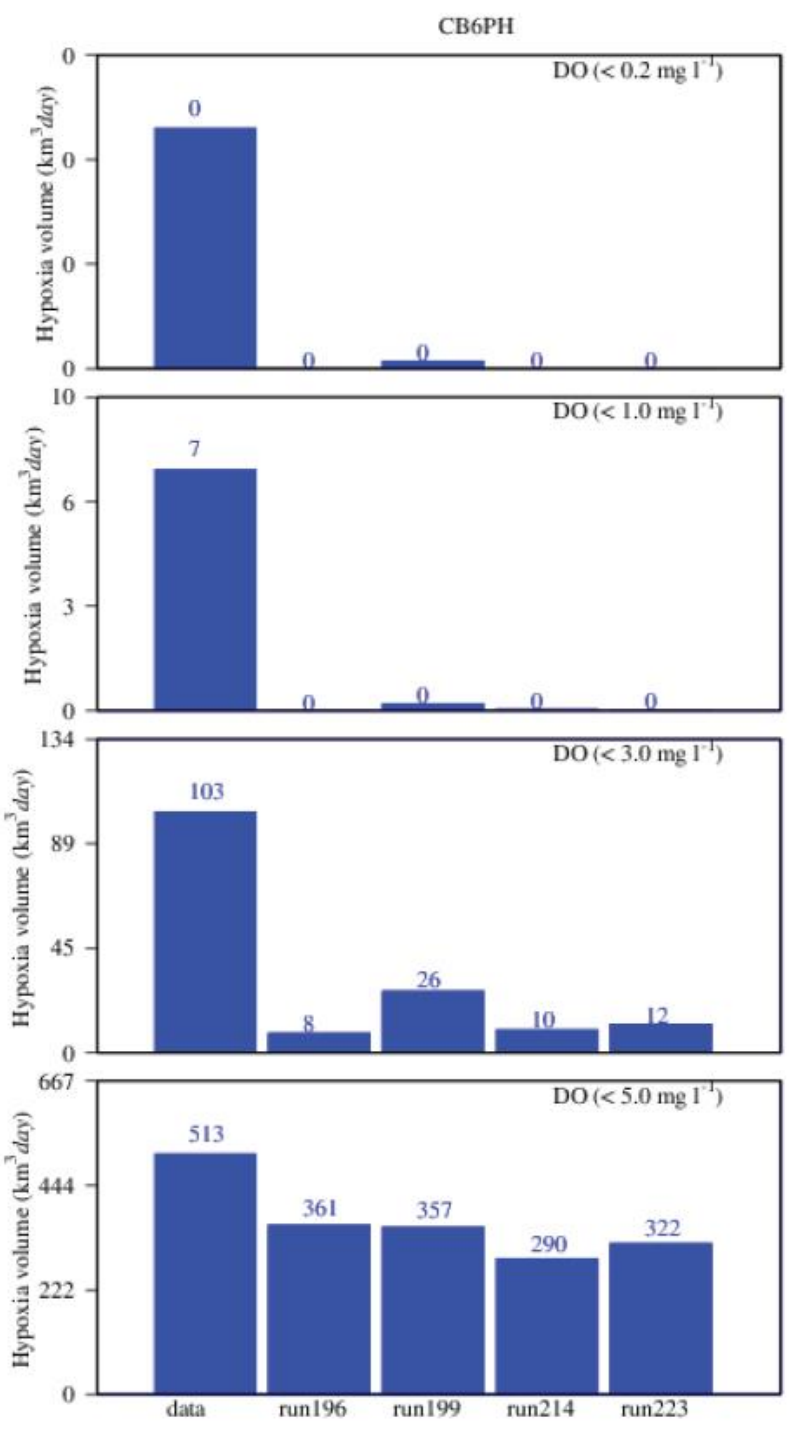


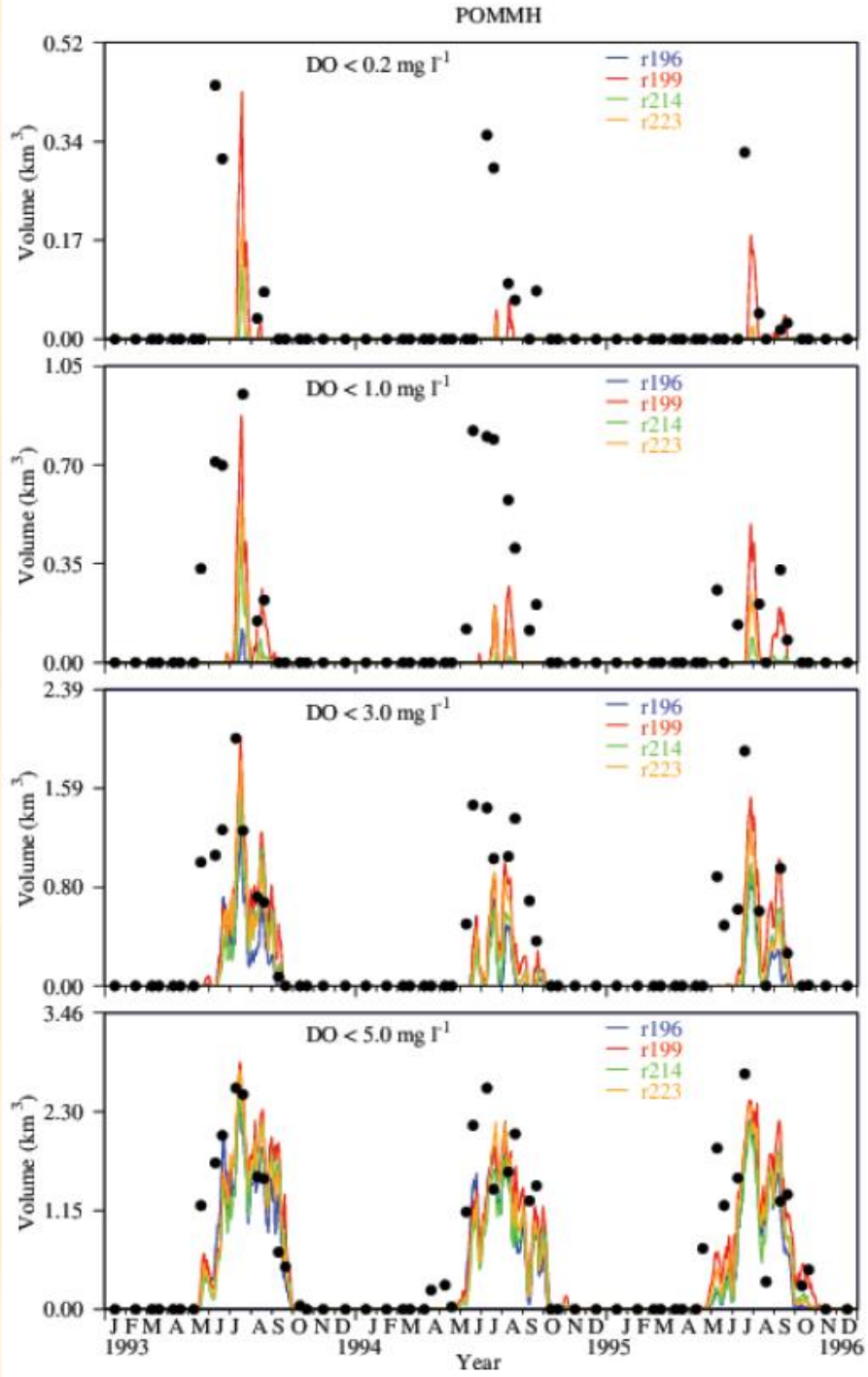
	Mean Difference	Absolute Mean Differen
Top DO	-0.5205	0.9002
Mid DO	1.0038	1.4866
Bot DO	-0.4165	0.9393

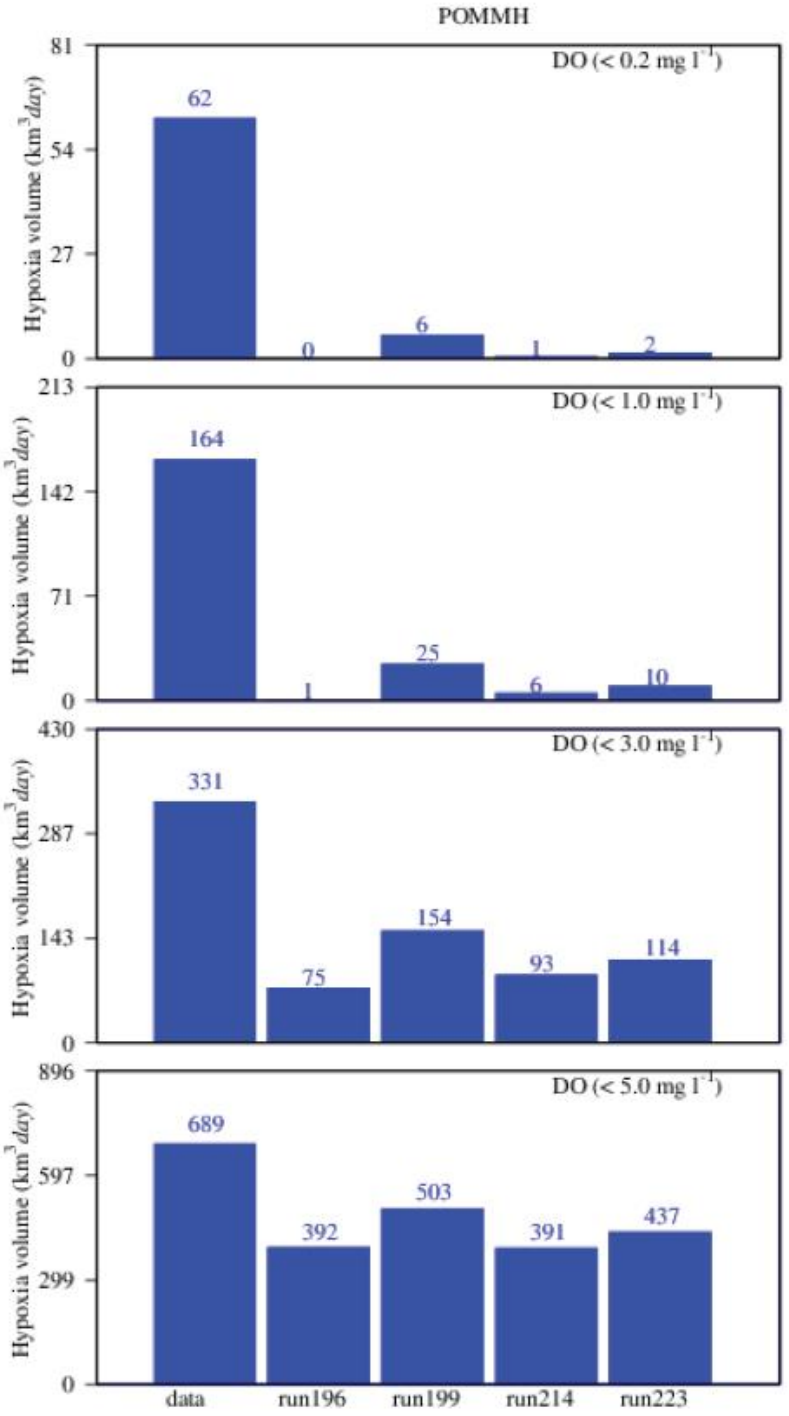

MD5MH
DO < 0.2 mg l-1
DO < 1.0 mg l-1
DO < 3.0 mg l-1
DO < 5.0 mg l-1
r196
r199
r214
r223
Volume (km3)
2.44
1.62
0.81
0.00
3.59
2.39
1.20
6.41
4.27
2.14
7.98
5.32
2.66
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1993
1994
1995
1996
Year

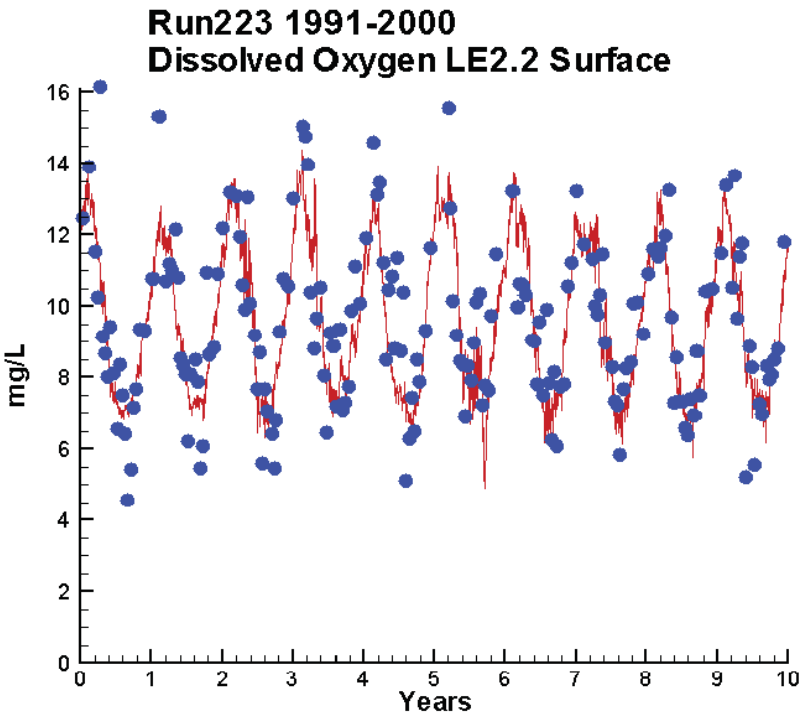

MD5MH
DO (< 0.2 mg l-1)
DO (< 1.0 mg l-1)
DO (< 3.0 mg l-1)
DO (< 5.0 mg l-1)
Hypoxia volume (km3 day)
327
218
109
0
197
70
252
138
156
595
397
198
409
204
458
292
324
1415
944
472
868
834
1089
894
938
2576
1717
859
1476
1742
1981
1754
1809
data
run196
run199
run214
run223

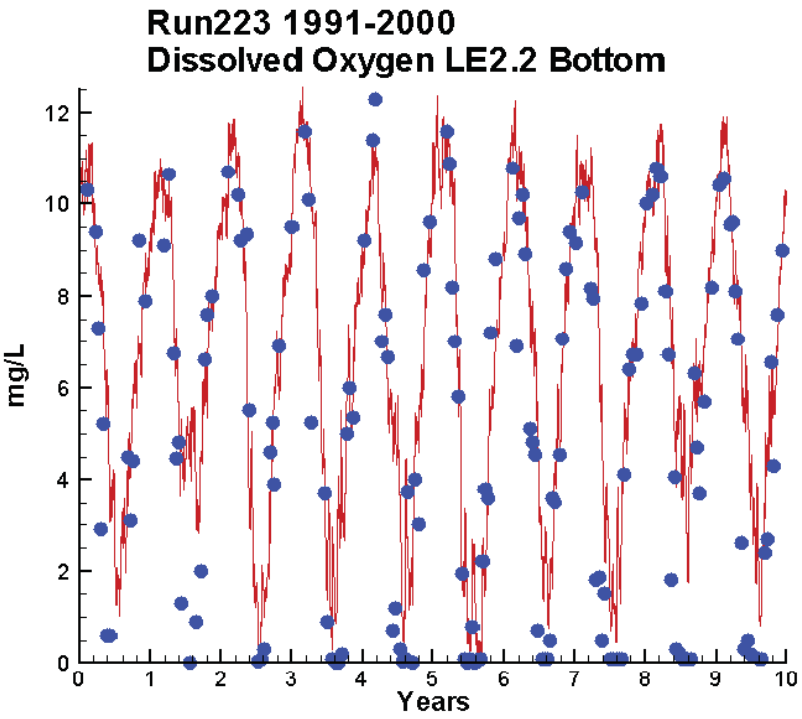

CB6PH
DO < 0.2 mg l-1
DO < 1.0 mg l-1
DO < 3.0 mg l-1
DO < 5.0 mg l-1
r196
r199
r214
r223
Volume (km3)
0.00
0.00
0.00
0.00
0.10
0.06
0.03
0.00
0.81
0.54
0.27
0.00
2.96
1.98
0.99
0.00
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1993
1994
1995
1996
Year

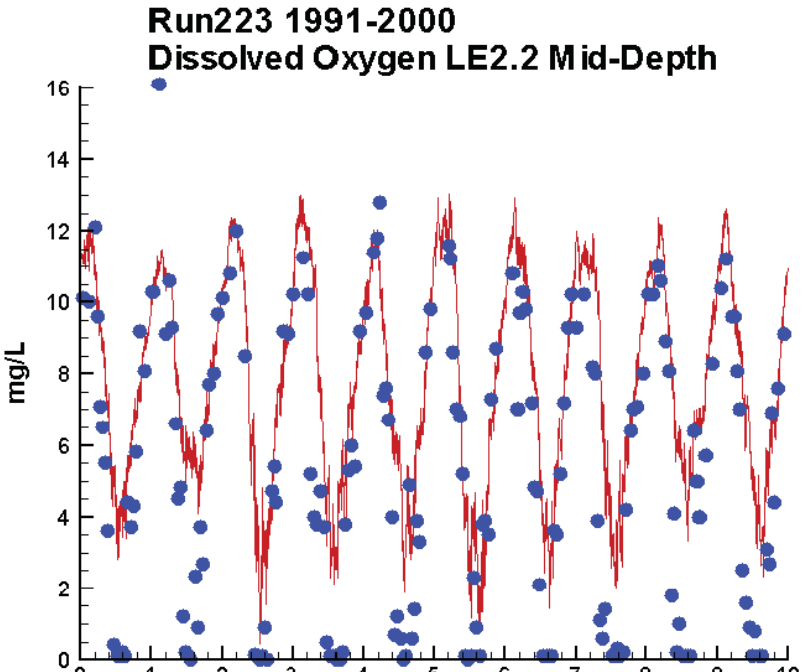

CB6PH
DO (< 0.2 mg l-1)
DO (< 1.0 mg l-1)
DO (< 3.0 mg l-1)
DO (< 5.0 mg l-1)
Hypoxia volume (km3day)
0
0
0
0
0
0
10
7
6
3
0
0
134
103
89
45
0
8
26
10
12
667
513
444
361
357
290
322
222
0
data
run196
run199
run214
run223


POMMH
DO < 0.2 mg l-1
DO < 1.0 mg l-1
DO < 3.0 mg l-1
DO < 5.0 mg l-1
r196
r199
r214
r223
Volume (km3)
0.52
0.34
0.17
0.00
1.05
0.70
0.35
2.39
1.59
0.80
3.46
2.30
1.15
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1993
1994
1995
1996
Year

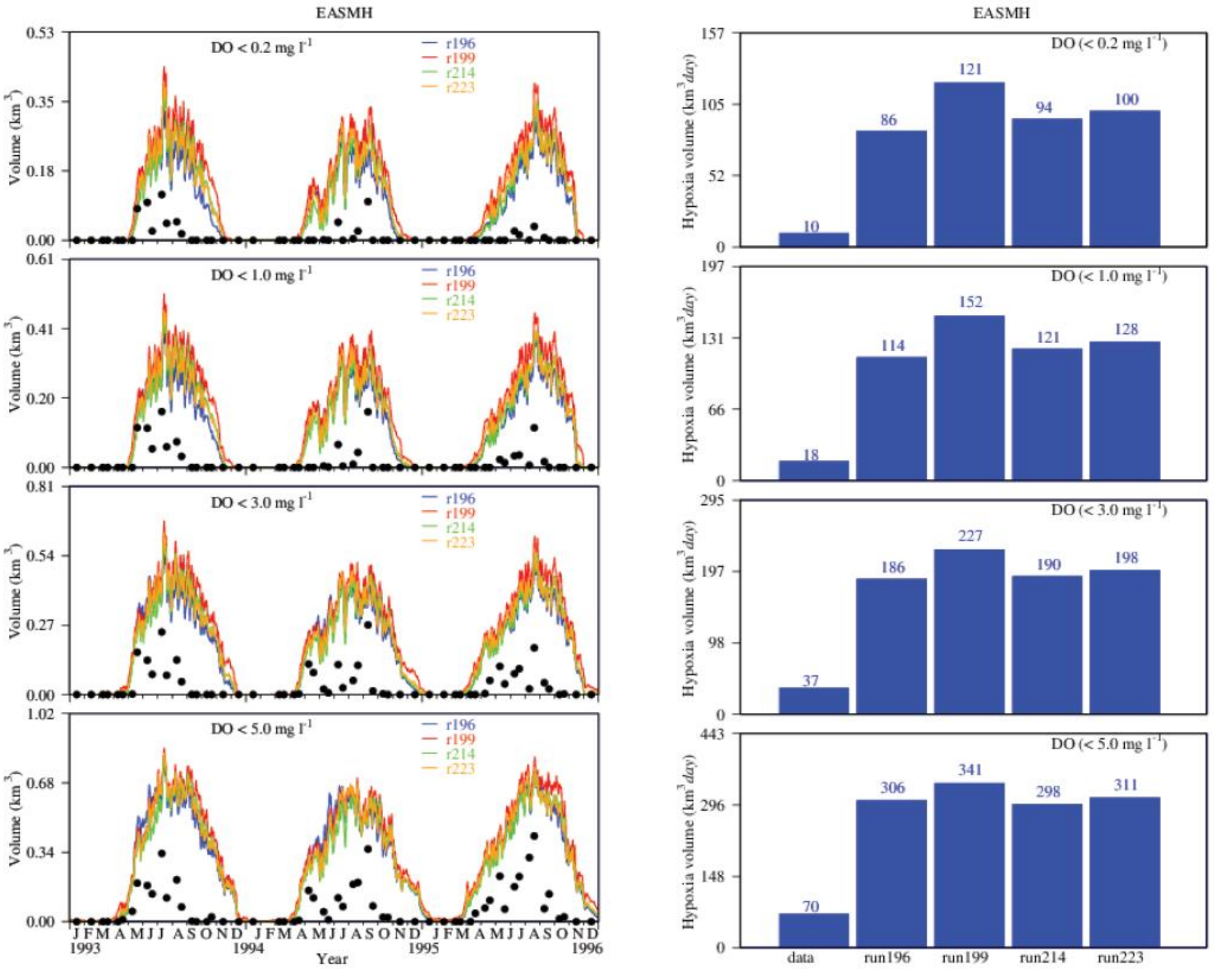

POMMH
DO (< 0.2 mg l-1)
DO (< 1.0 mg l-1)
DO (< 3.0 mg l-1)
DO (< 5.0 mg l-1)
Hypoxia volume (km3 day)
81
54
27
0
62
0
6
1
2
213
142
71
164
1
25
6
10
430
287
143
331
75
154
93
114
896
597
299
689
392
503
391
437
data
run196
run199
run214
run223

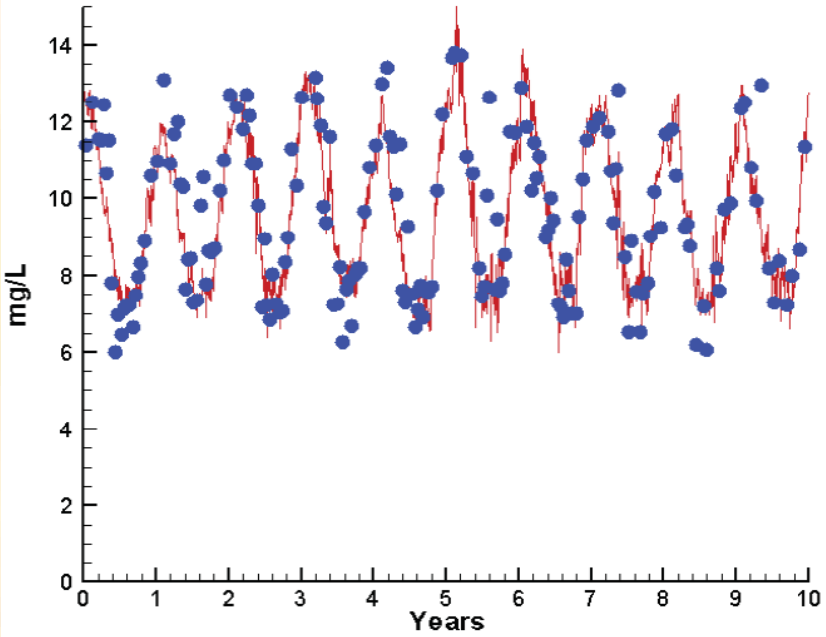


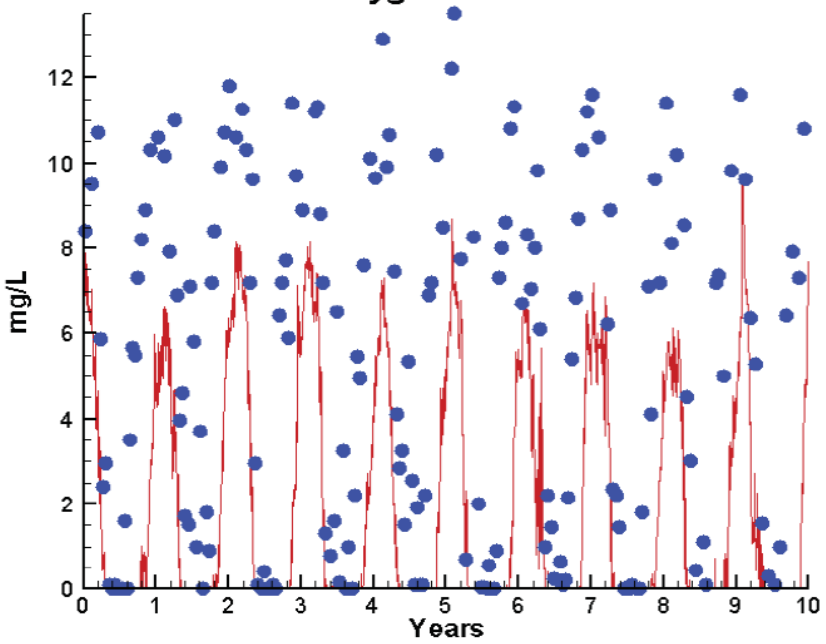


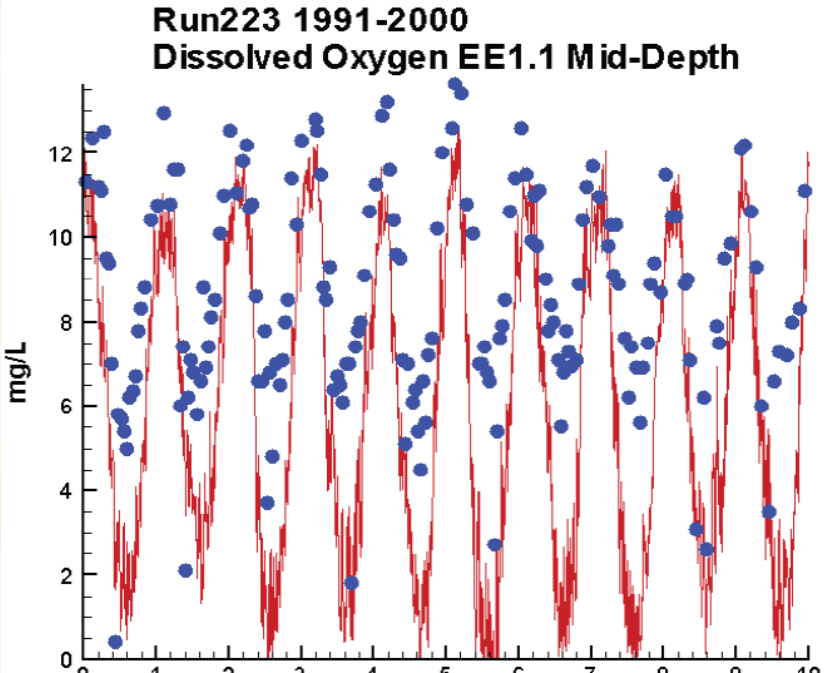


	Mean Difference	Absolute Mean Differen
Top DO	-0.1304	1.0621
Mid DO	2.1693	2.3757
Bot DO	1.2367	1.6722

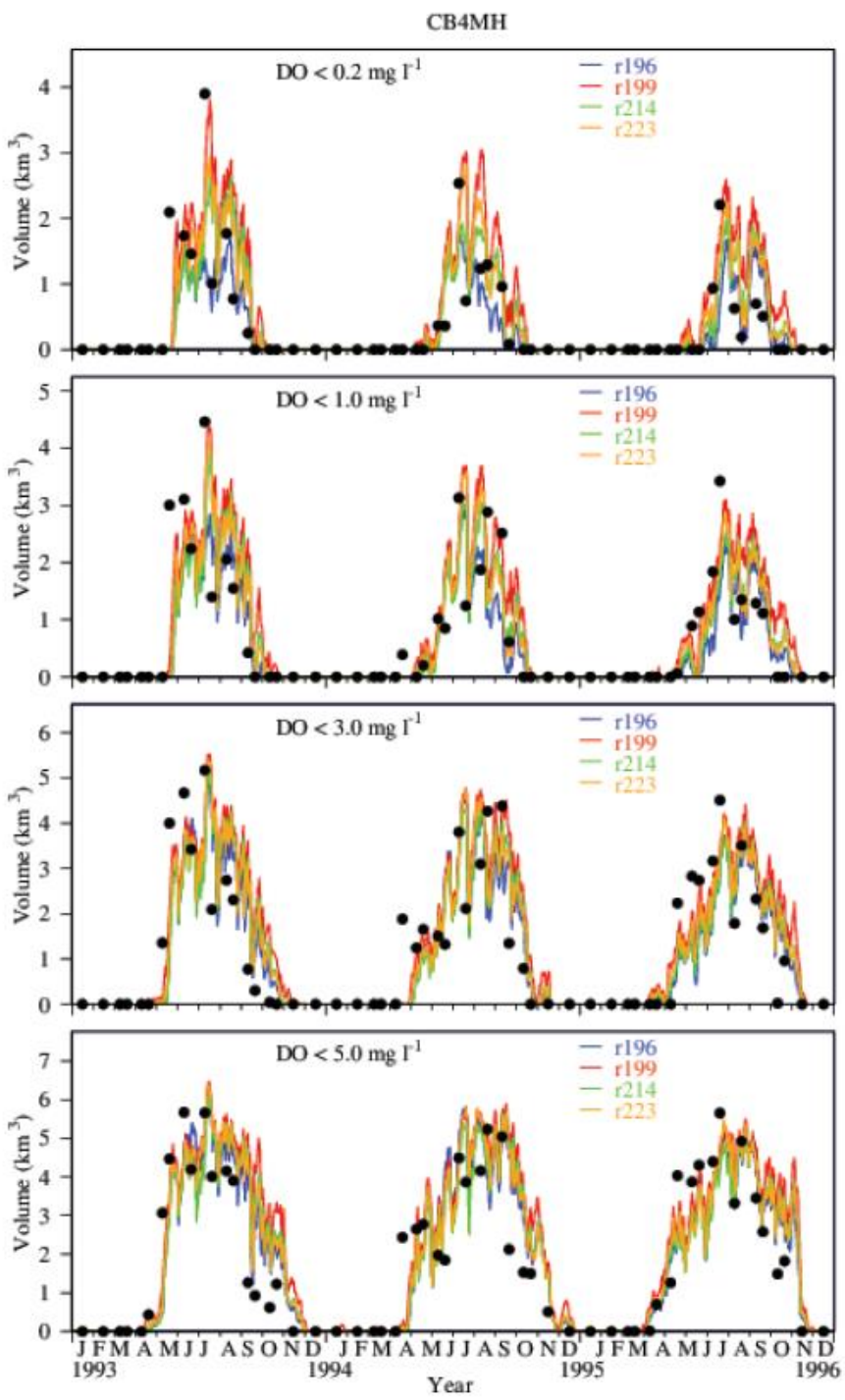

EASMH
DO < 0.2 mg l-1
DO < 1.0 mg l-1
DO < 3.0 mg l-1
DO < 5.0 mg l-1
r196
r199
r214
r223
Volume (km3)
0.53
0.35
0.18
0.00
0.61
0.41
0.20
0.81
0.54
0.27
1.02
0.68
0.34
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1993
1994
1995
1996
Year
EASMH
DO (< 0.2 mg l-1)
DO (< 1.0 mg l-1)
DO (< 3.0 mg l-1)
DO (< 5.0 mg l-1)
Hypoxia volume (km3day)
157
105
52
0
10
86
121
94
100
197
131
66
18
114
152
121
128
295
197
98
37
186
227
190
198
443
296
148
70
306
341
298
311
data
run196
run199
run214
run223

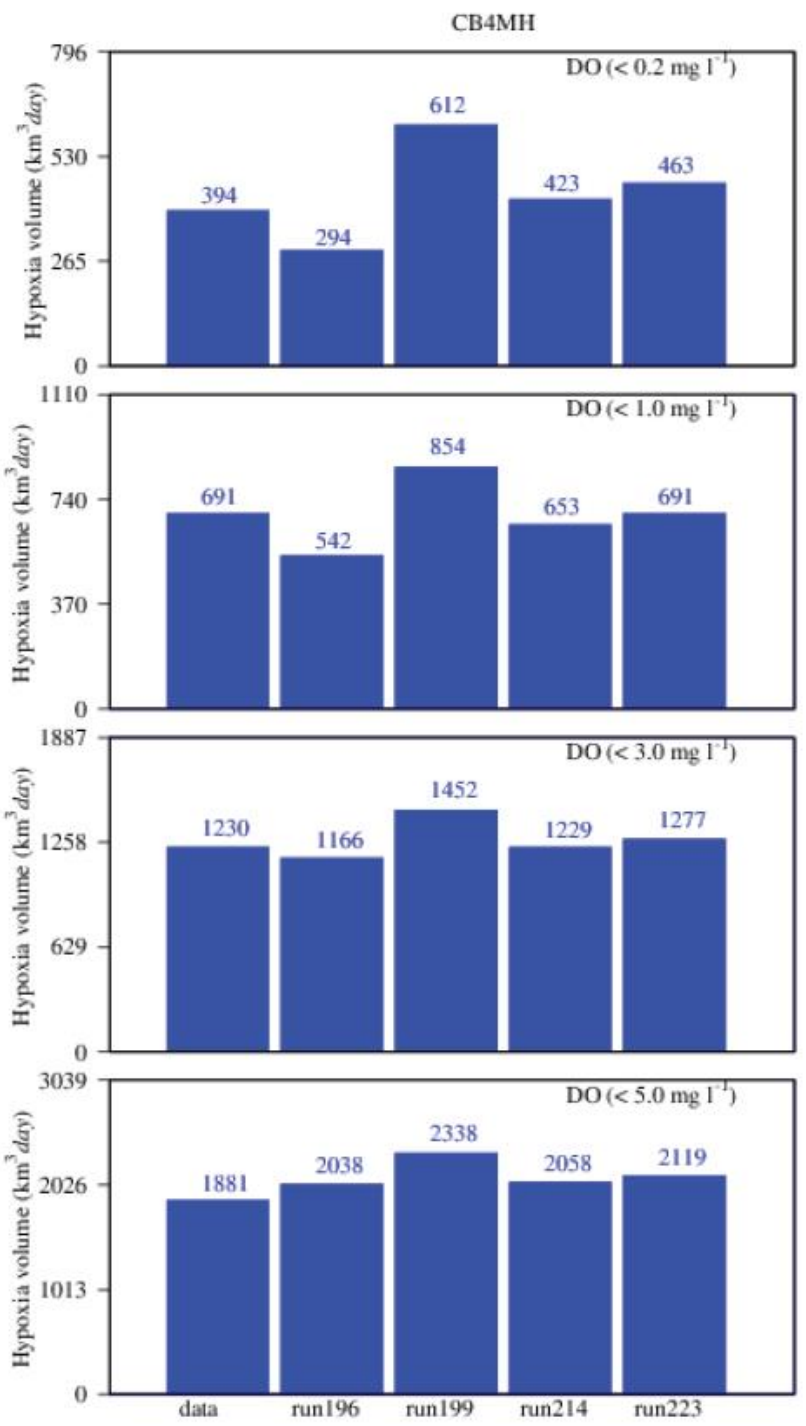


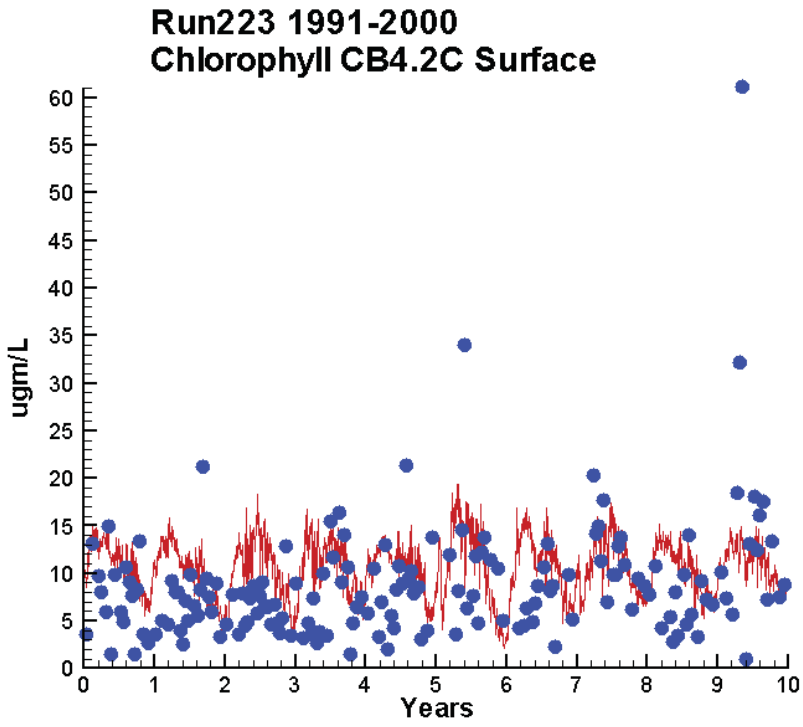


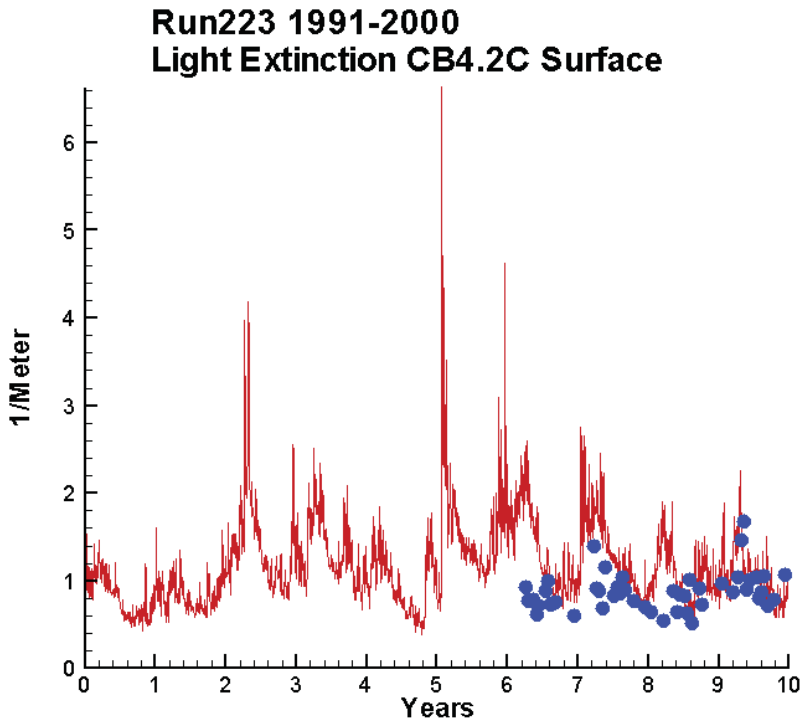


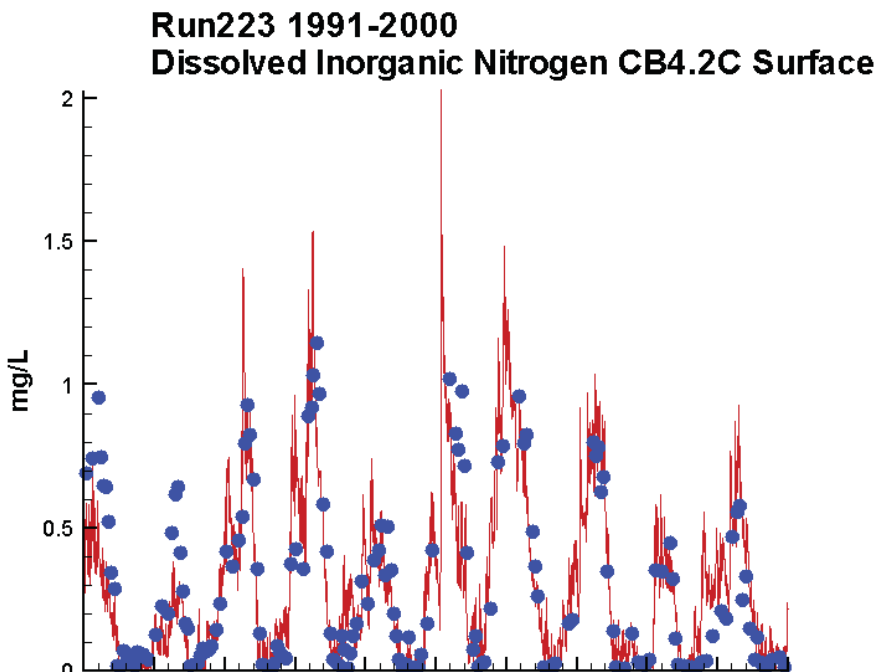
	Mean Difference	Absolute Mean Differen
Top DO	-0.1637	0.7896
Mid DO	-3.2056	3.2775
Bot DO	-3.6903	3.7084

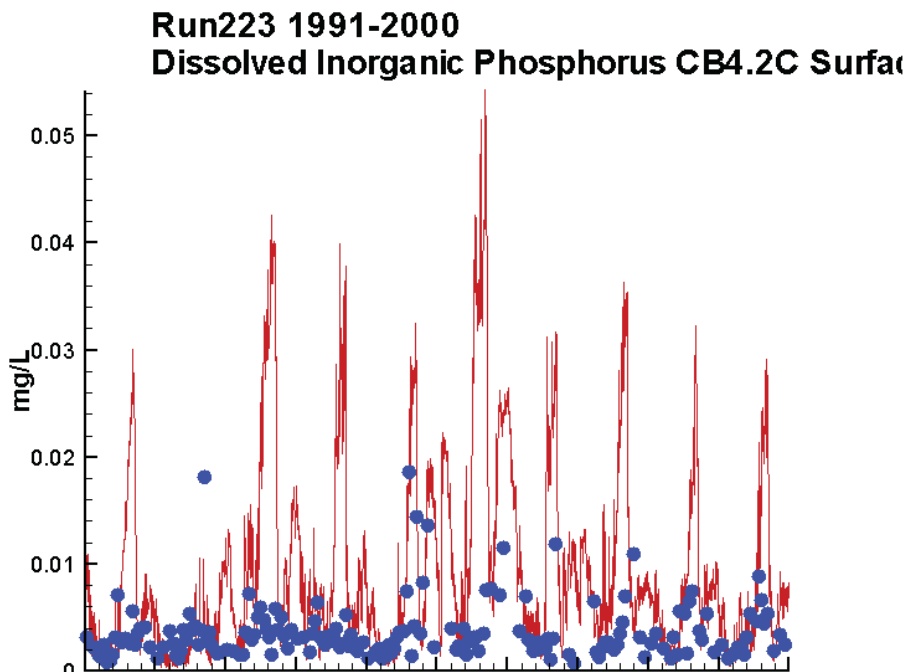

CB4MH
DO < 0.2 mg l-1
DO < 1.0 mg l-1
DO < 3.0 mg l-1
DO < 5.0 mg l-1
r196
r199
r214
r223
Volume (km 3)
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1993
1994
1995
1996
Year

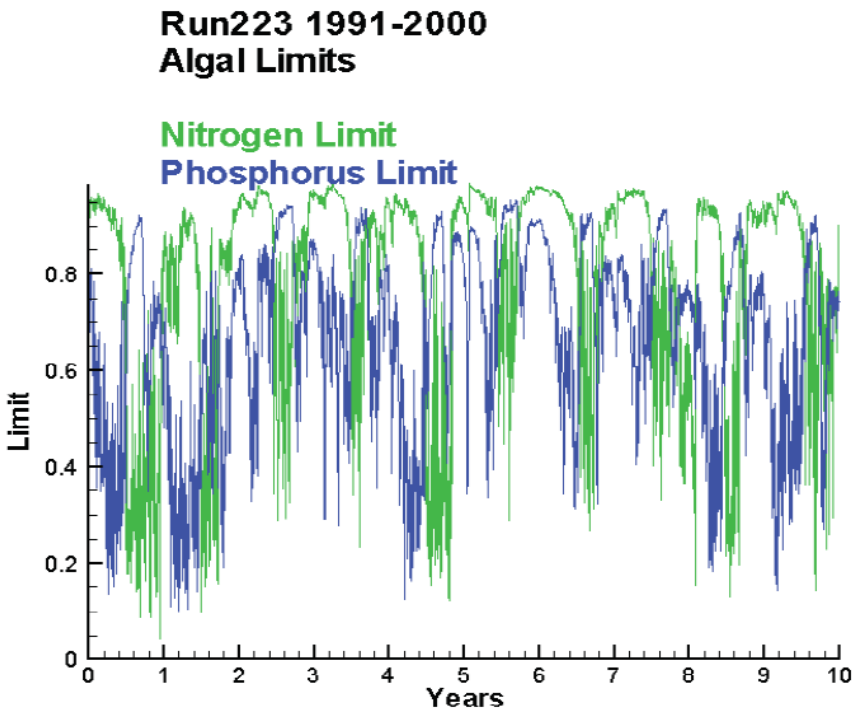

CB4MH
DO (< 0.2 mg l-1)
DO (< 1.0 mg l-1)
DO (< 3.0 mg l-1)
DO (< 5.0 mg l-1)
Hypoxia volume (km3 day)
796
530
265
0
394
294
612
423
463
1110
740
370
691
542
854
653
691
1887
1258
629
1230
1166
1452
1229
1277
3039
2026
1013
1881
2038
2338
2058
2119
data
run196
run199
run214
run223

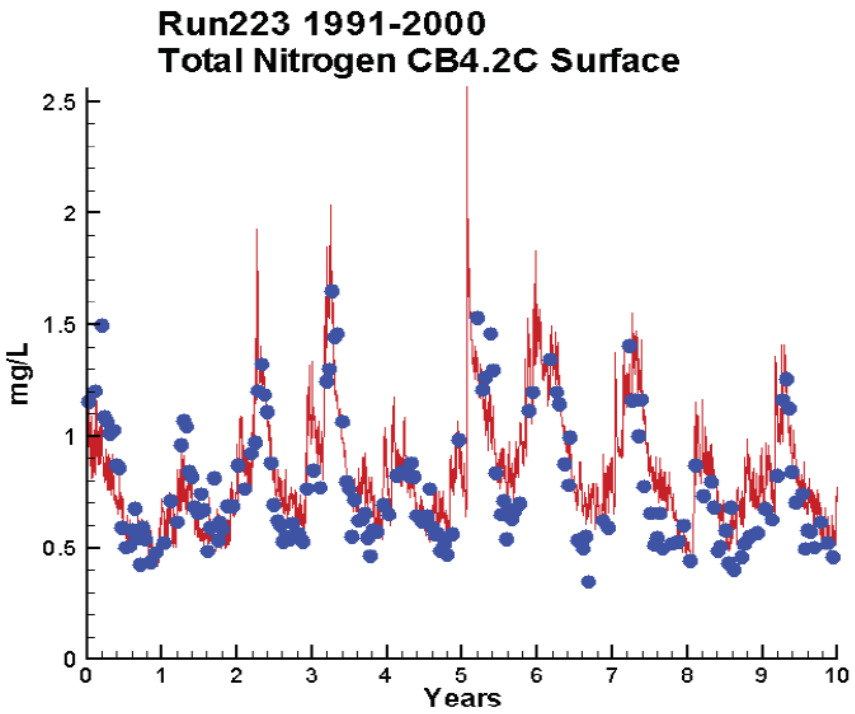

Run223 1991-2000
Chlorophyll CB4.2C Surface
ugm/L
Years

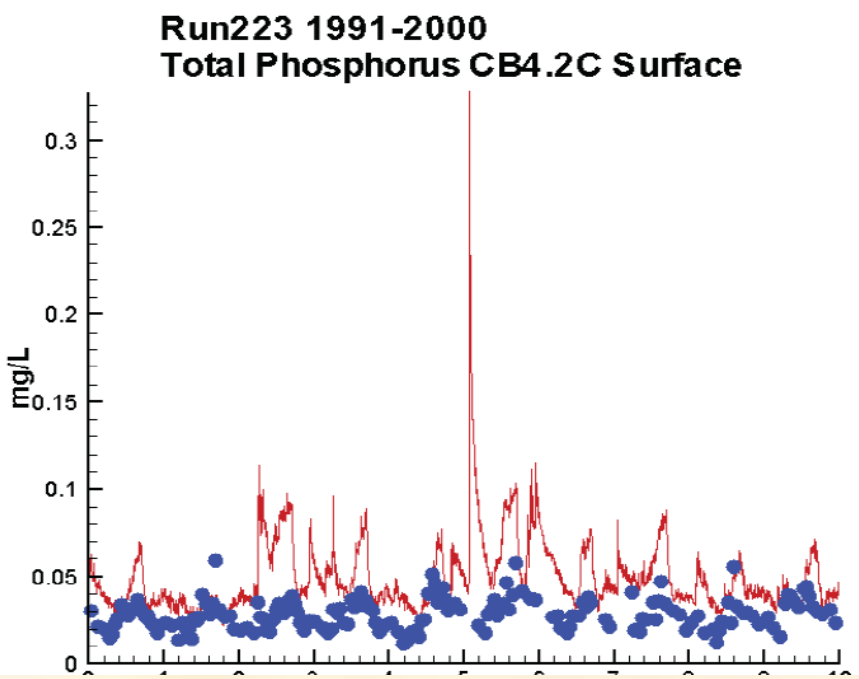

Run223 1991-2000
Light Extinction CB4.2C Surface
1/Meter
Years


Run223 1991-2000
Dissolved Inorganic Nitrogen CB4.2C Surface
mg/L

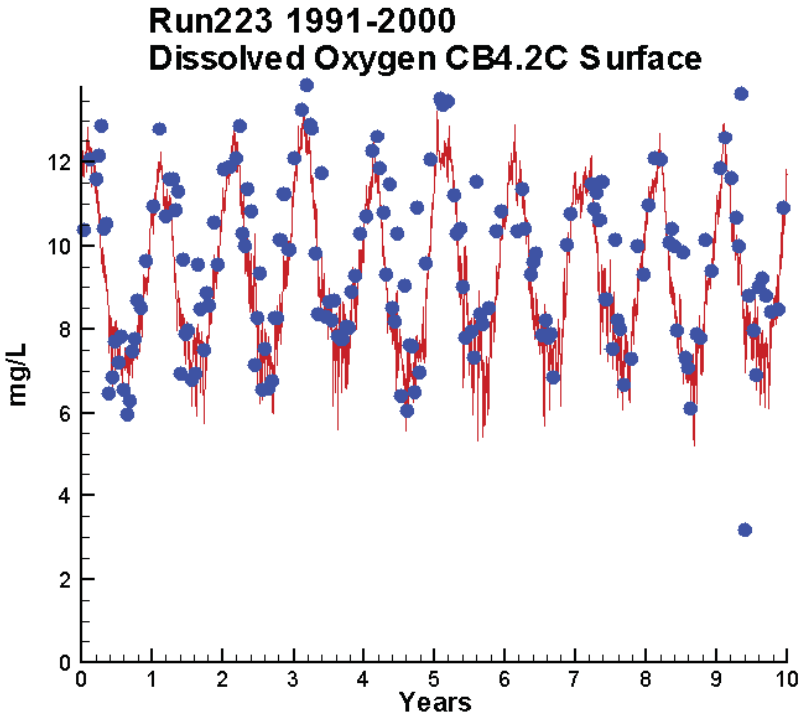

Run223 1991-2000
Dissolved Inorganic Phosphorus CB4.2C Surfac
mg/L

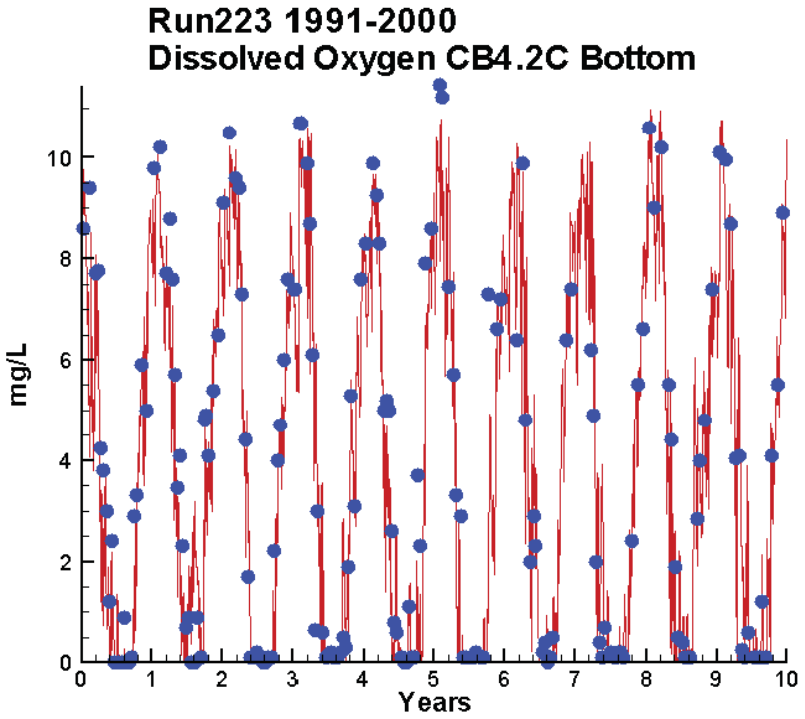


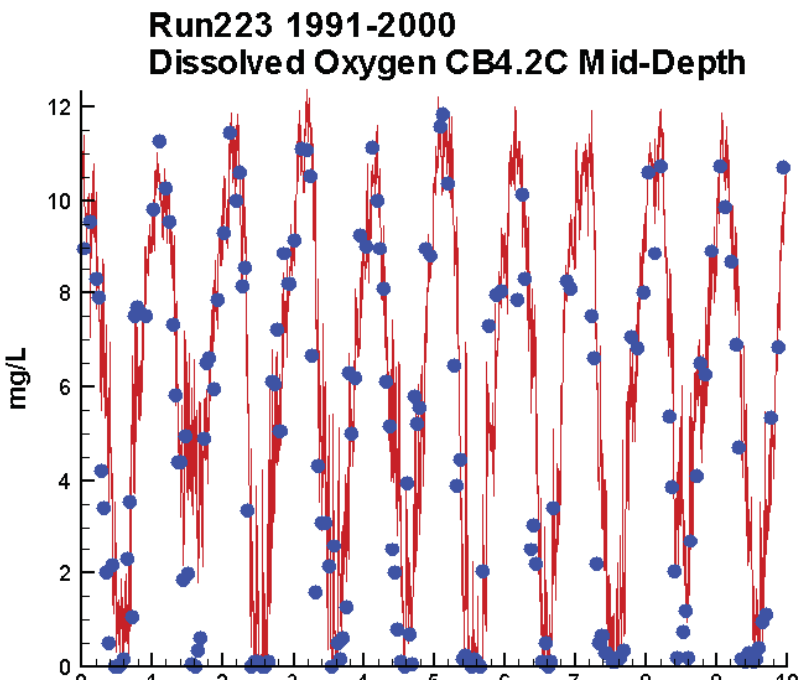




	Mean Difference	Absolute Mean Diffe
Chl	2.4157	5.0535
DIN	-0.0053	0.1028
KE	0.3059	0.3607
DIP	0.0062	0.0071
TP	0.0207	0.0214
TN	0.0625	0.1384

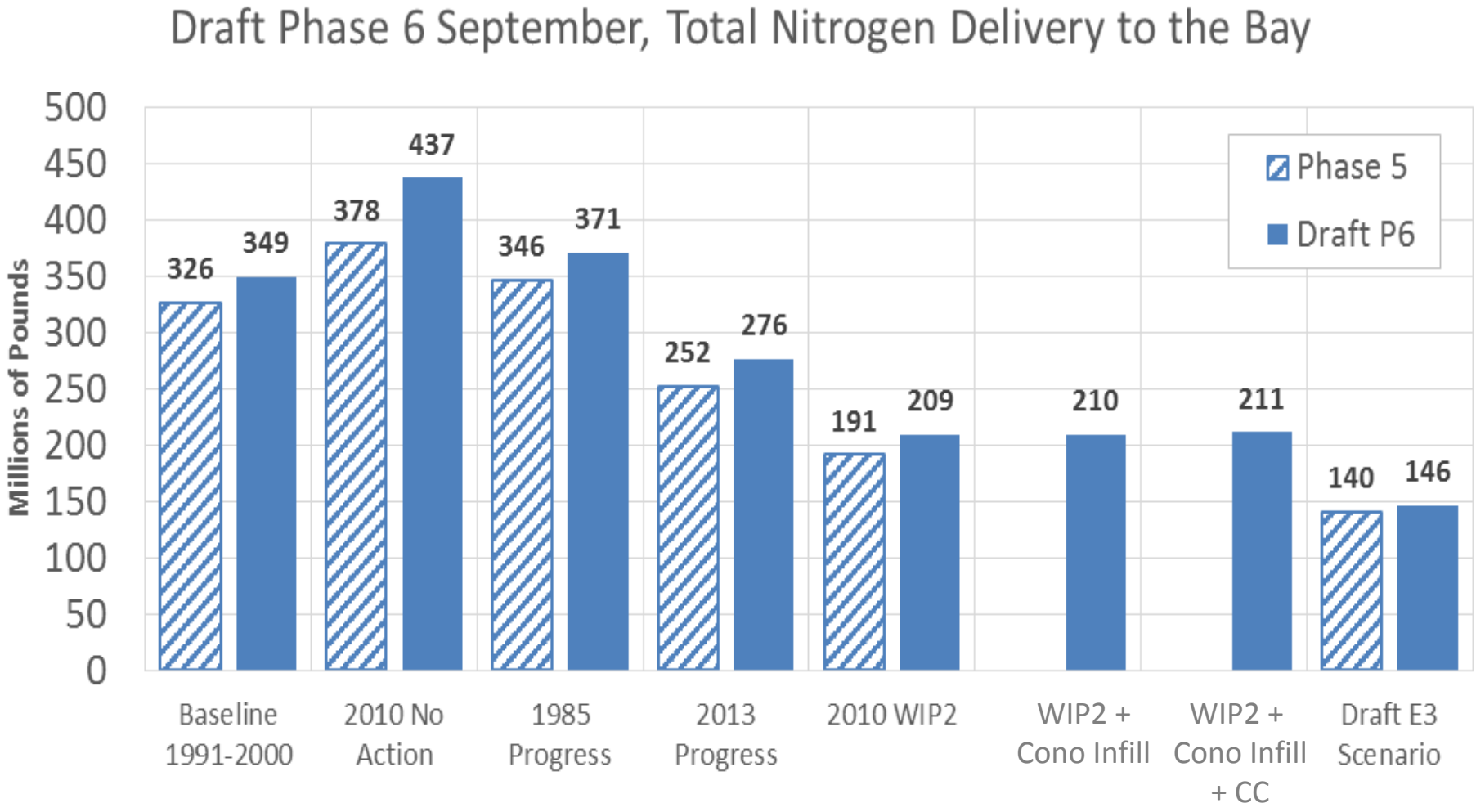






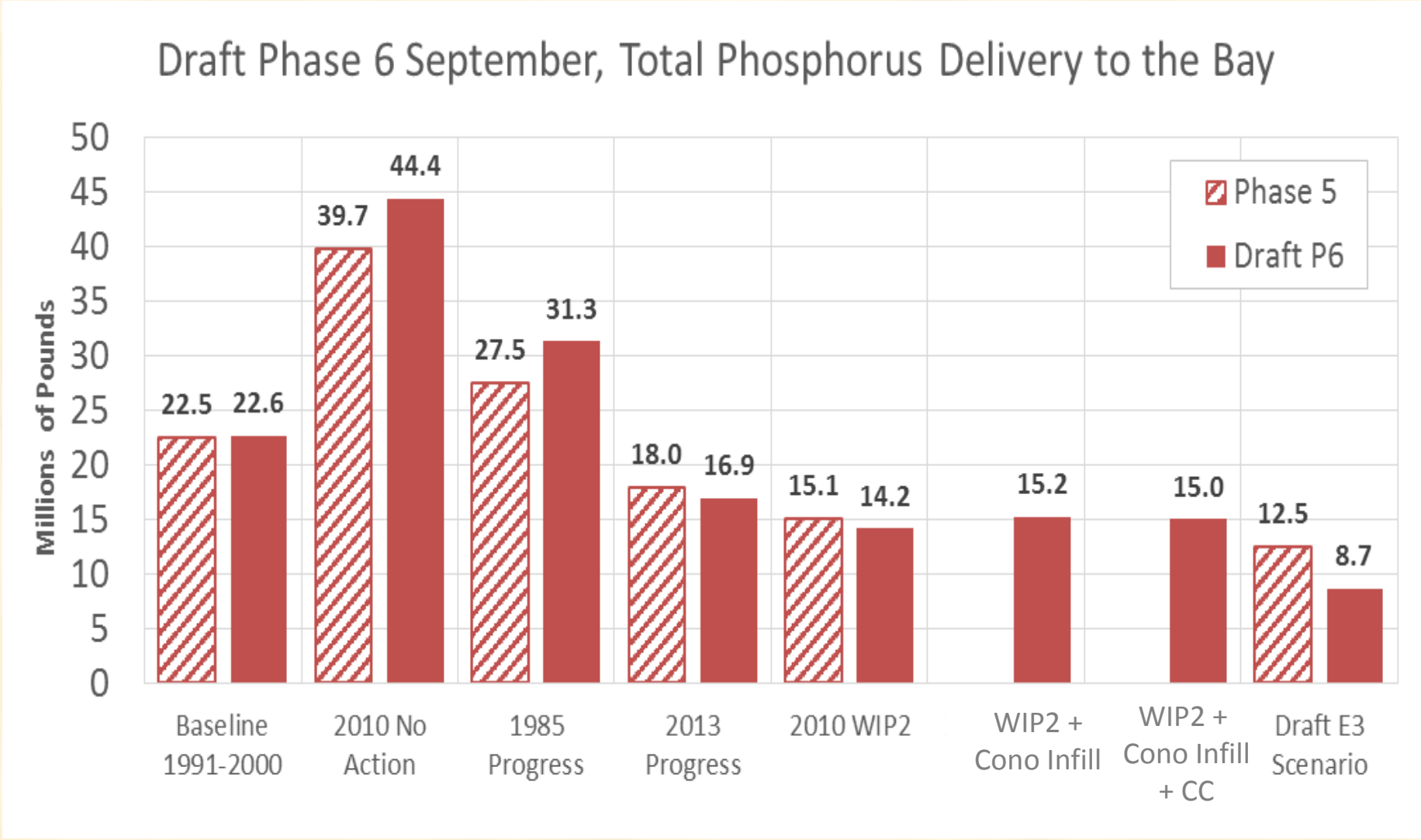
	Mean Difference	Absolute Mean Differen
Top DO	-0.5205	0.9002
Mid DO	1.0038	1.4866
Bot DO	-0.4165	0.9393

Phase 6 Nitrogen Loads



2017 September Draft Phase 6 in solid blue bars. Phase 5.3.2 in stippled bars. Units in millions of pounds.

Phase 6 Phosphorus Loads



2017 September Draft Phase 6 in solid blue bars. Phase 5.3.2 in stippled bars. Units in millions of pounds.

Early Indications/Insights Preview of Key Scenarios:

- Here using September version of Phase 6 Watershed Model – Final P6 Watershed Model available early November.
- Here using wrong WQSTM. Showing Run 214 - **but** should be Run 223 (my fault). Results of key scenarios from Run 223 will be available later this week.

The Phase 6 Assessment of Deep Channel DO Standard Achievement - Run 214

Run 214 10/17/2017		Base 349TN 22.6TP 1993-1995 Deep Channel	No Action 437TN 44.4TP 1993-1995 Deep Channel	1985 Progress 371TN 31.3TP 1993-1995 Deep Channel	1993 Progress 279TN 17.9TP 1993-1995 Deep Channel	2013 Progress 276TN 16.9TP 1993-1995 Deep Channel	WIP2 209TN 14.2TP 1993-1995 Deep Channel	WIP2 + Cono Infill 210TN 15.2TP 1993-1995 Deep Channel	WIP2 + Cono + CC 211TN 15.0TP 1993-1995 Deep Channel	E3 146TN 8.7TP 1993-1995 Deep Channel	All Forest 40TN 2.1TP 1993-1995 Deep Channel
Cbseg	State										
CB3MH	MD	16%	16%	11%	8%	1%	0%	0%	0%	0%	0%
CB4MH	MD	46%	58%	52%	48%	27%	11%	14%	15%	0%	0%
CB5MH	MD/VA	14%	24%	20%	16%	2%	0%	0%	0%	0%	0%
CHSMH	MD	37%	33%	23%	18%	6%	2%	2%	8%	0%	0%
POTMH	MD/VA	20%	25%	21%	18%	0%	0%	0%	0%	0%	0%
POMMH	MD	20%	25%	21%	18%	0%	0%	0%	0%	0%	0%
RPPMH	VA	19%	30%	22%	20%	0%	0%	0%	0%	0%	0%
EASMH	MD	25%	40%	26%	19%	11%	7%	9%	10%	0%	0%
MD5MH	MD	22%	32%	26%	23%	5%	0%	0%	0%	0%	0%
VA5MH	VA	4%	13%	10%	7%	0%	0%	0%	0%	0%	0%
PATMH	MD	25%	44%	39%	29%	1%	0%	0%	0%	0%	0%

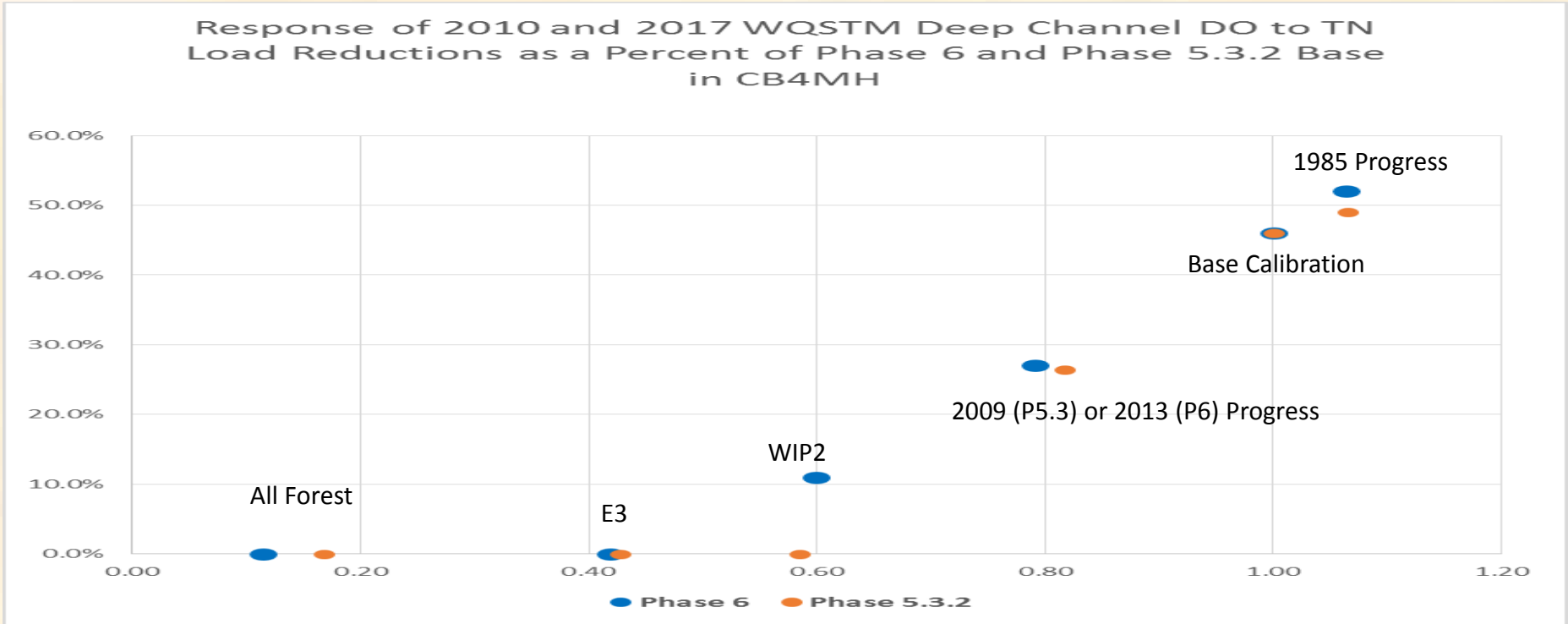
Phase 5.3.2		Base 323TN 20.6TP 1993-1995 Deep Channel	No Action 376TN 37.9TP 1993-1995 Deep Channel	1985 Progress 344TN 25.7TP 1993-1995 Deep Channel	2009 Progress 264TN 18.3TP 1993-1995 Deep Channel	WIP2 189TN 13.2TP 1993-1995 Deep Channel	E3 138TN 10.6TP 1993-1995 Deep Channel	All Forest 54TN 2.6TP 1993-1995 Deep Channel
Cbseg	State							
CB3MH	MD	16.0%	22.0%	19.2%	7.3%	0.2%	0.0%	0.0%
CB4MH	MD	46.0%	52.8%	49.1%	26.4%	2.9%	0.0%	0.0%
CB5MH	MD/VA	14.2%	20.0%	37.4%	0.6%	0.0%	2.3%	0.0%
CHSMH	MD	37.4%	41.5%	22.7%	35.6%	16.6%	0.6%	0.0%
POTMH	MD/VA	20.2%	27.4%	22.7%	0.0%	0.0%	0.0%	0.0%
POMMH	MD	20.4%	27.6%	22.8%	0.0%	0.0%	0.0%	0.0%
RPPMH	VA	19.0%	28.1%	25.1%	0.0%	0.0%	0.0%	0.0%
EASMH	MD	25.4%	35.6%	27.5%	14.0%	1.6%	1.1%	0.0%
MD5MH	MD	21.7%	27.2%	23.8%	3.9%	0.0%	0.0%	0.0%
VA5MH	VA	4.5%	10.7%	7.4%	0.0%	0.0%	0.0%	0.0%
PATMH	MD	24.8%	49.1%	38.2%	11.5%	0.0%	0.0%	0.0%

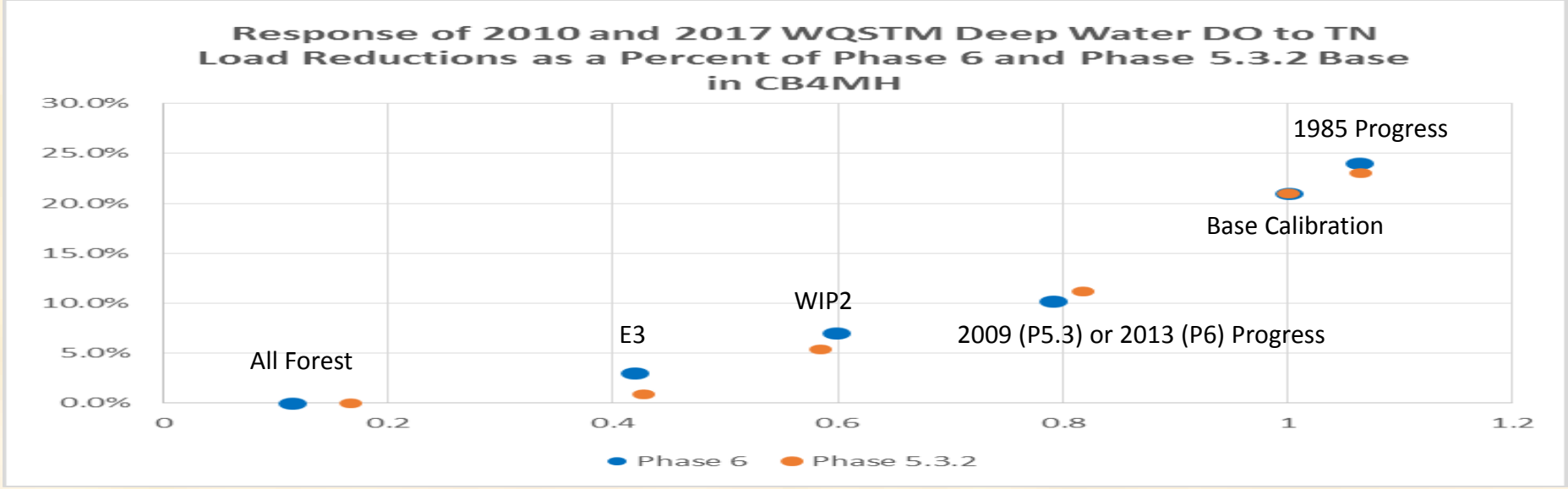
The Phase 6 Assessment of Deep Channel DO Standard Achievement - Run 199

		Base	No Action	1985 Progress	1993 Progress	2013 Progress	WIP2	WIP2 + Cono Infill	WIP2 + Cono + CC	E3	All Forest
Phase 6		349TN	437TN	371TN	279TN	276TN	209TN	210TN	211TN	146TN	40TN
9/25/17		22.6TP	44.4TP	31.3TP	17.9TP	16.9TP	14.2TP	15.2TP	15.0TP	8.7TP	2.1TP
		1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995
Cbseg	State	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel
CB3MH	MD	16.0%	14.9%	10.6%	8.1%	1.6%	0.0%	0.6%	0.7%	0.0%	0.0%
CB4MH	MD	46.0%	56.1%	50.6%	47.2%	31.1%	16.8%	18.9%	19.4%	0.0%	0.0%
CB5MH	MD/VA	14.2%	21.8%	17.4%	15.6%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%
CHSMH	MD	37.4%	25.5%	19.8%	17.9%	9.3%	8.8%	11.5%	13.2%	0.6%	0.0%
POTMH	MD/VA	20.2%	23.9%	19.4%	17.6%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
POMMH	MD	20.4%	24.0%	19.5%	17.7%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
RPPMH	VA	19.0%	27.9%	18.3%	17.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EASMH	MD	25.4%	34.4%	23.1%	19.5%	13.4%	9.8%	14.5%	14.6%	1.1%	0.0%
MD5MH	MD	21.7%	29.2%	24.4%	22.4%	6.8%	0.0%	0.0%	0.1%	0.0%	0.0%
VA5MH	VA	4.5%	11.9%	7.9%	6.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
PATMH	MD	24.8%	44.2%	41.2%	28.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

		Base	No Action	1985 Progress	2009 Progress	WIP2	E3	All Forest
Phase 5.3.2		323TN	376TN	344TN	264TN	189TN	138TN	54TN
		20.6TP	37.9TP	25.7TP	18.3TP	13.2TP	10.6TP	2.6TP
		1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995
Cbseg	State	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel
CB3MH	MD	16.0%	22.0%	19.2%	7.3%	0.2%	0.0%	0.0%
CB4MH	MD	46.0%	52.8%	49.1%	26.4%	2.9%	0.0%	0.0%
CB5MH	MD/VA	14.2%	20.0%	37.4%	0.6%	0.0%	2.3%	0.0%
CHSMH	MD	37.4%	41.5%	22.7%	35.6%	16.6%	0.6%	0.0%
POTMH	MD/VA	20.2%	27.4%	22.7%	0.0%	0.0%	0.0%	0.0%
POMMH	MD	20.4%	27.6%	22.8%	0.0%	0.0%	0.0%	0.0%
RPPMH	VA	19.0%	28.1%	25.1%	0.0%	0.0%	0.0%	0.0%
EASMH	MD	25.4%	35.6%	27.5%	14.0%	1.6%	1.1%	0.0%
MD5MH	MD	21.7%	27.2%	23.8%	3.9%	0.0%	0.0%	0.0%
VA5MH	VA	4.5%	10.7%	7.4%	0.0%	0.0%	0.0%	0.0%
PATMH	MD	24.8%	49.1%	38.2%	11.5%	0.0%	0.0%	0.0%

The Degree of Water Quality Attainment In Deep Channel & Deep Water DO - Run 214





The Phase 6 Assessment of Deep Water DO Standard Achievement - Run 214

Run 214 10/17/17		Base 349TN 22.6TP	No Action 437TN 44.4TP	1985 Progress 371TN 31.3TP	1993 Progress 279TN 17.9TP	2013 Progress 276TN 16.9TP	WIP2 209TN 14.2TP	WIP2 + Cono Infill 210TN 15.2TP	WIP2 + Cono + CC 211TN 15.0TP	E3 146TN 8.7TP	All Forest 40TN 2.1TP
		1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-
Cbseg	State	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water	Water
CB3MH	MD	2%	4%	2%	2%	0%	0%	0%	0%	0%	0%
CB4MH	MD	21%	31%	24%	21%	10%	7%	8%	9%	3%	0%
CB5MH	MD/VA	4%	6%	4%	3%	2%	1%	1%	1%	0%	0%
CB6PH	VA	0%	2%	1%	0%	0%	0%	0%	0%	0%	0%
CB7PH	VA	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%
CHSMH	MD	26%	21%	9%	8%	0%	0%	0%	0%	0%	0%
EASMH	MD	6%	36%	19%	5%	0%	1%	1%	0%	0%	0%
PAXMH	MD	6%	29%	19%	11%	0%	0%	0%	0%	0%	0%
POTMH	MD/VA	4%	13%	6%	5%	1%	0%	0%	0%	0%	0%
POMMH	MD	4%	13%	6%	5%	1%	0%	0%	0%	0%	0%
RPPMH	VA	6%	15%	10%	7%	2%	0%	0%	0%	0%	0%
SBEMH	VA	0%	5%	3%	0%	0%	0%	0%	0%	0%	0%
YRKPH	VA	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
MD5MH	MD	8%	12%	8%	7%	3%	2%	2%	2%	0%	0%
VA5MH	VA	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%
PATMH	MD	12%	18%	11%	8%	0%	0%	0%	0%	0%	0%
MAGMH	MD	51%	57%	57%	51%	27%	17%	27%	5%	3%	3%
SOUMH	MD	19%	37%	31%	19%	8%	8%	8%	3%	0%	0%
SEVMH	MD	6%	27%	13%	6%	0%	0%	0%	0%	0%	0%

Phase 5.3.2		Base 323TN 20.6TP	All Forest 53.6TN 2.6TP	No Action 376TN 37.9TP	1985 Progress 344TN 25.7P	2009 Progress 264TN 18.3TP	WIP2 189TN 13.2TP	E3 138TN 10.6TP
		1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995
Cbseg	State	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water
CB3MH	MD	2.1%	0.0%	3.4%	2.3%	0.7%	0.1%	0.0%
CB4MH	MD	21.0%	0.0%	27.0%	23.0%	11.2%	5.4%	0.9%
CB5MH	MD/VA	4.2%	0.0%	5.9%	4.9%	1.8%	0.4%	0.0%
CB6PH	VA	0.0%	0.0%	0.8%	0.3%	0.0%	0.0%	0.0%
CB7PH	VA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CHSMH	MD	25.7%	0.0%	35.8%	31.1%	12.6%	2.9%	0.0%
EASMH	MD	5.9%	0.0%	31.1%	13.9%	2.0%	0.8%	0.0%
PAXMH	MD	6.3%	0.0%	21.5%	11.6%	0.6%	0.0%	0.0%
POTMH	MD/VA	4.1%	0.0%	9.0%	5.1%	0.4%	0.0%	0.0%
POMMH	MD	4.1%	0.0%	9.1%	5.1%	0.4%	0.0%	0.0%
RPPMH	VA	5.9%	0.0%	11.3%	8.3%	0.1%	0.0%	0.0%
SBEMH	VA	0.0%	0.0%	5.0%	3.4%	0.0%	0.0%	0.0%
YRKPH	VA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MD5MH	MD	8.5%	0.0%	11.3%	9.5%	4.1%	1.3%	0.0%
VA5MH	VA	0.5%	0.0%	0.8%	0.7%	0.0%	0.0%	0.0%
PATMH	MD	12.4%	0.0%	31.9%	19.0%	3.6%	0.0%	0.0%
MAGMH	MD	51.0%	0.0%	57.1%	51.0%	51.0%	9.5%	7.1%
SOUMH	MD	18.6%	0.0%	35.5%	22.8%	0.0%	0.0%	0.0%
SEVMH	MD	6.1%	0.0%	30.2%	6.1%	0.7%	0.0%	0.0%

Conclusions:

- New methods and techniques were developed to take a deep look at the quality of the calibration, particularly for nutrient limitation and anoxic volume days (AVDs).
- Based on all available information Run 223 is the representation of the Chesapeake that has the highest fidelity to the observed data.
- Key scenarios are now being run on the final WQSTM calibration (Run 223) based on the September version of the Phase 6 WSM. The final key scenarios will be run early November on the final Phase 6 WSM & WQSTM.
- Geographic Isolation Scenarios are now being completed with the final WQSTM calibration.