# Open Water non-attainment and scoping runs

Gary Shenk

CBPO

Presentation to MWG 1/7/20

# Main Bay Open Water non-attainment

| | | PT 1995 | PT 2025 | PT 2035 | PT 2045 | PT 2055 |
|---|---|---|---|---|---|---|
| CB1TF | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB2OH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB3MH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB4MH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB5MH_MI | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB5MH_VA | VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB6PH | VA | 0.13% | 0.49% | 0.81% | 1.09% | 1.39% |
| CB7PH | VA | 0.64% | 1.74% | 2.43% | 3.34% | 4.51% |
| CB8PH | VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |

# Main Bay open water non-attainment increase

| | PT 2025 | PT 2035 | PT 2045 | PT 2055 |
|---|---|---|---|---|
| CB1TF | 0.00% | 0.00% | 0.00% | 0.00% |
| CB2OH | 0.00% | 0.00% | 0.00% | 0.00% |
| CB3MH | 0.00% | 0.00% | 0.00% | 0.00% |
| CB4MH | 0.00% | 0.00% | 0.00% | 0.00% |
| CB5MH_M | 0.00% | 0.00% | 0.00% | 0.00% |
| CB5MH_V | 0.00% | 0.00% | 0.00% | 0.00% |
| CB6PH | 0.36% | 0.68% | 0.96% | 1.26% |
| CB7PH | 1.10% | 1.79% | 2.70% | 3.87% |
| CB8PH | 0.00% | 0.00% | 0.00% | 0.00% |

# Scoping Runs from 2017

| Nitrogen | 243 | 234 | 224 | 214 | 205 | 195 | 185 | 174 | 164 | 154 | 144 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Phosphorus | 15.6 | 15.3 | 14.8 | 14.4 | 14 | 13.7 | 12.8 | 11.9 | 11.1 | 10.3 | 9.5 |
| Cbseg | | | | | | | | | | | |
| CB1TF | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB2OH | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB3MH | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB4MH | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB5MH_MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB5MH_VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB6PH | 0.43% | 0.29% | 0.20% | 0.14% | 0.07% | 0.02% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CB7PH | 1.78% | 1.42% | 1.05% | 0.71% | 0.45% | 0.28% | 0.19% | 0.15% | 0.12% | 0.08% | 0.05% |
| CB8PH | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |

**30 Mlbs TN and 1.2 Mlbs TP will get a 1% change in CB7PH and a 0.29% change in CB6PN**

# Can calculate an increase per million lbs N

| Nitrogen | 243 | 234 | 224 | 214 | 205 | 195 |
|---|---|---|---|---|---|---|
| CB7PH | 1.78% | 1.42% | 1.05% | 0.71% | 0.45% | 0.28% |
| | | | | | | |
| N reduction | | 9 | 19 | 29 | 38 | 48 |
| DO increase | | 0.36% | 0.73% | 1.07% | 1.33% | 1.50% |
| Increase per million lbs | | 0.04% | 0.04% | 0.04% | 0.03% | 0.03% |

| | |
|---|---|
| CB5MH_V | 0.00% |
| CB6PH | 0.36% |
| CB7PH | 1.10% |
| CB8PH | 0.00% |

1.1% / (0.04% / million lbs) = **27 million lbs N**

# Tidal fresh non-attainment

Very large jumps in non-attainment

| | | PT 1995 | PT 2025 | PT 2035 | PT 2045 | PT 2055 |
|---|---|---|---|---|---|---|
| PAXTF | MD | 2.81% | 11.93% | 11.95% | 12.37% | 13.35% |
| WBRTF | MD | 0.00% | 32.27% | 32.27% | 39.65% | 54.64% |
| PISTF | MD | 4.63% | 4.65% | 4.65% | 4.65% | 4.65% |
| MATTF | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| RPPTF | VA | 0.00% | 0.00% | 0.00% | 0.00% | 1.65% |
| MPNTF | VA | 1.31% | 27.03% | 36.88% | 41.21% | 35.67% |
| PMKTF | VA | 6.90% | 71.26% | 81.54% | 74.44% | 69.83% |
| JMSTFL | VA | 0.00% | 0.00% | 0.38% | 0.96% | 1.02% |
| JMSTFU | VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| APPTF | VA | 4.59% | 0.00% | 0.00% | 0.00% | 4.59% |
| NORTF | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CHSTF | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CHOTF | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| NANTF_MD | MD | 0.00% | 0.73% | 4.70% | 0.73% | 0.00% |
| POCTF | MD | 0.00% | 69.83% | 77.48% | 77.48% | 77.48% |

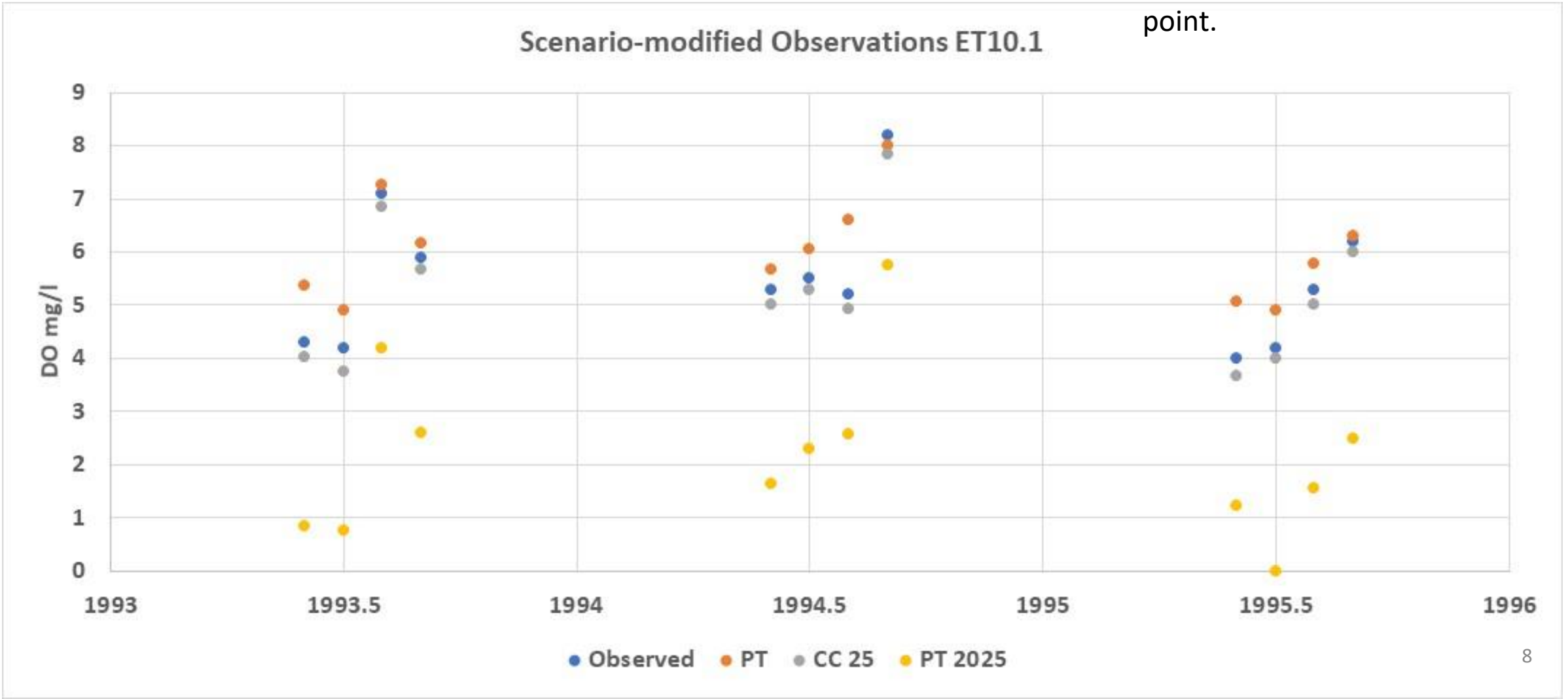
# Tidal Fresh Non-attainment Increase

Very large reductions in nitrogen!

| | PT 2025 | PT 2035 | PT 2045 | PT 2055 | | increase per million lbs best case | Mlbs N reduction |
|---|---|---|---|---|---|---|---|
| PAXTF | 9.11% | 9.13% | 9.56% | 10.54% | | 0.072% | 127 |
| WBRTF | 32.27% | 32.27% | 39.65% | 54.64% | | 0.242% | 134 |
| PISTF | 0.02% | 0.02% | 0.02% | 0.02% | | 0.088% | 0 |
| MATTF | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| RPPTF | 0.00% | 0.00% | 0.00% | 1.65% | | 0.000% | |
| MPNTF | 25.72% | 35.57% | 39.90% | 34.36% | | 0.173% | 149 |
| PMKTF | 64.36% | 74.64% | 67.53% | 62.93% | | 0.085% | 758 |
| JMSTFL | 0.00% | 0.38% | 0.96% | 1.02% | | 0.000% | |
| JMSTFU | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| APPTF | -4.59% | -4.59% | -4.59% | 0.00% | | 0.000% | |
| NORTF | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| CHSTF | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| CHOTF | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| NANTF_M | 0.73% | 4.70% | 0.73% | 0.00% | | 0.000% | |
| POCTF | 69.83% | 77.48% | 77.48% | 77.48% | | 0.102% | 687 |

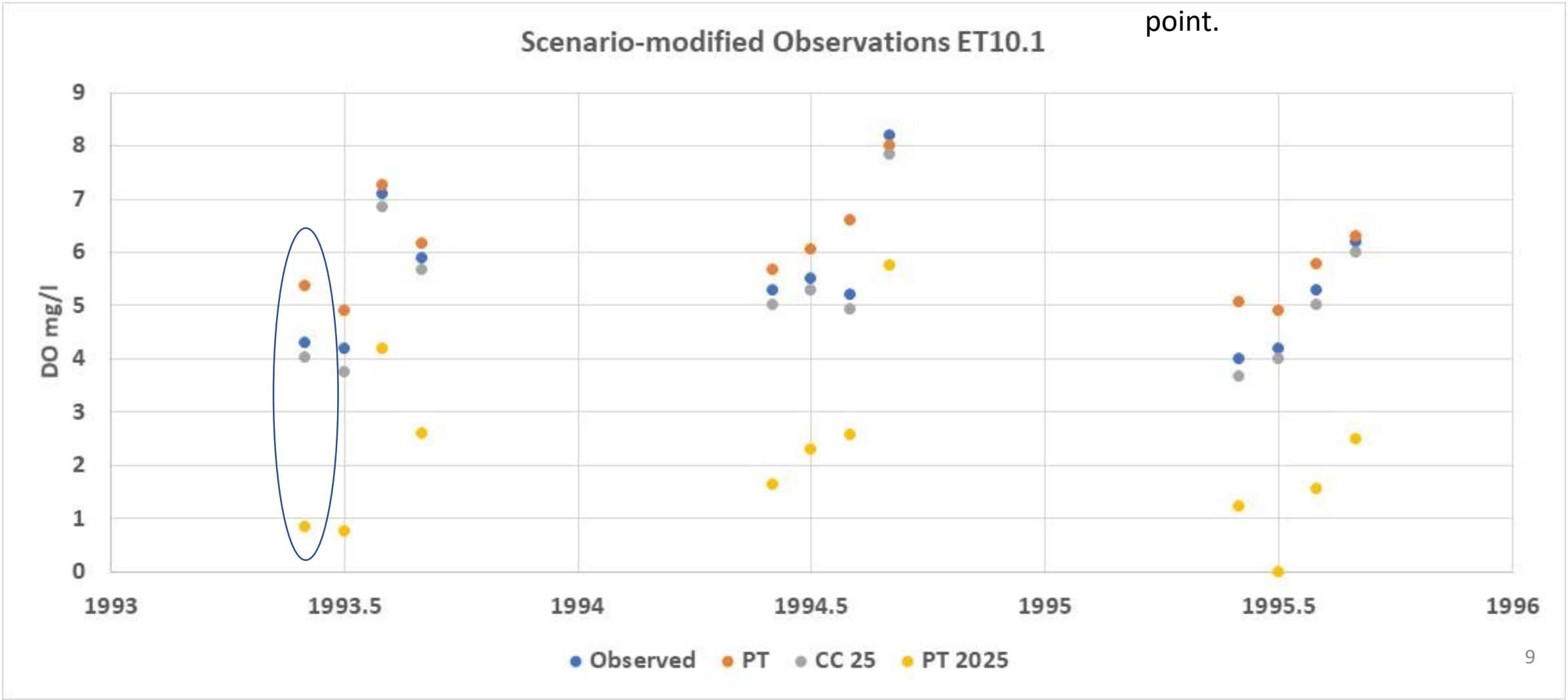
# Single station in the Pocomoke

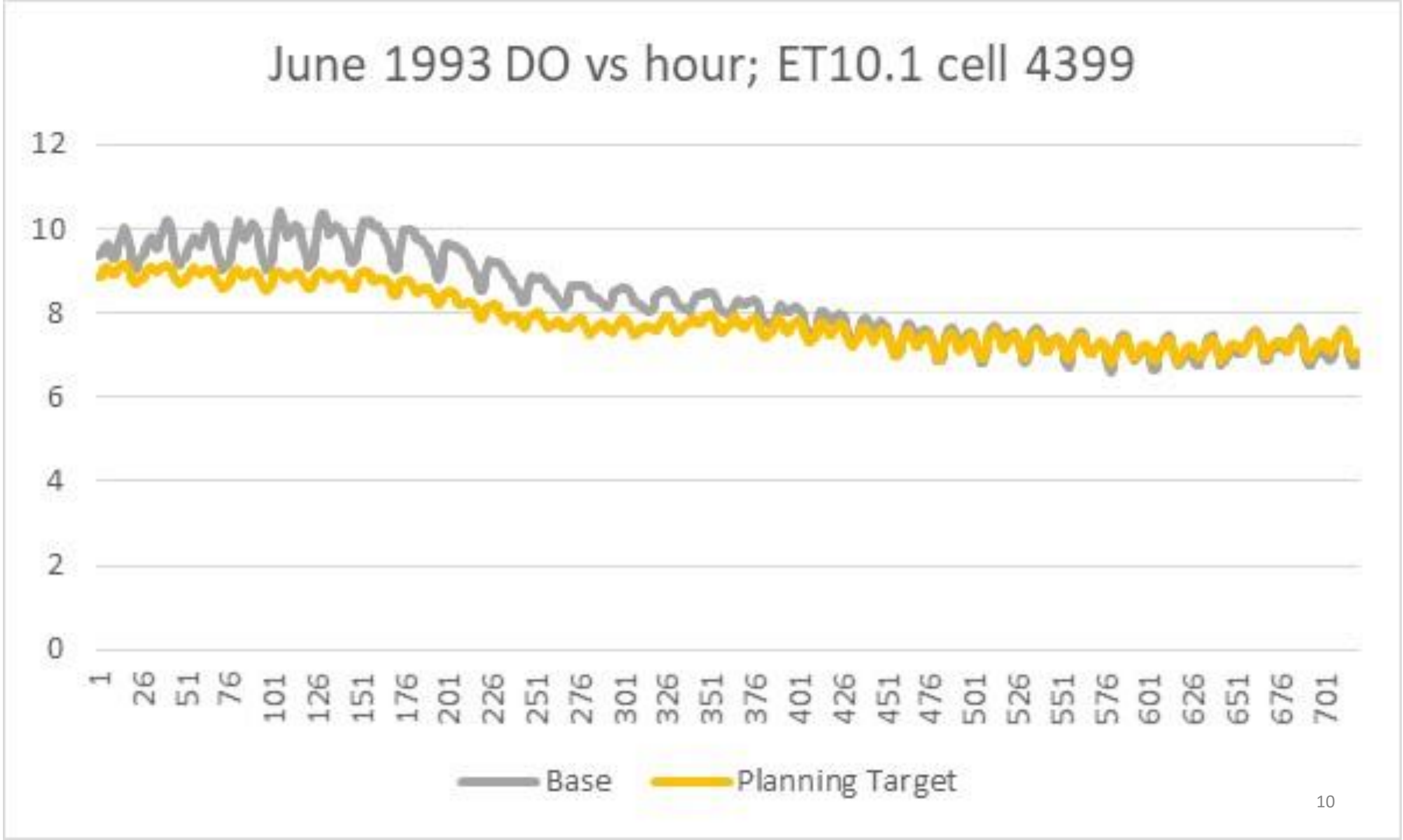
Climate change and planning target scenario not resolving well at this point.

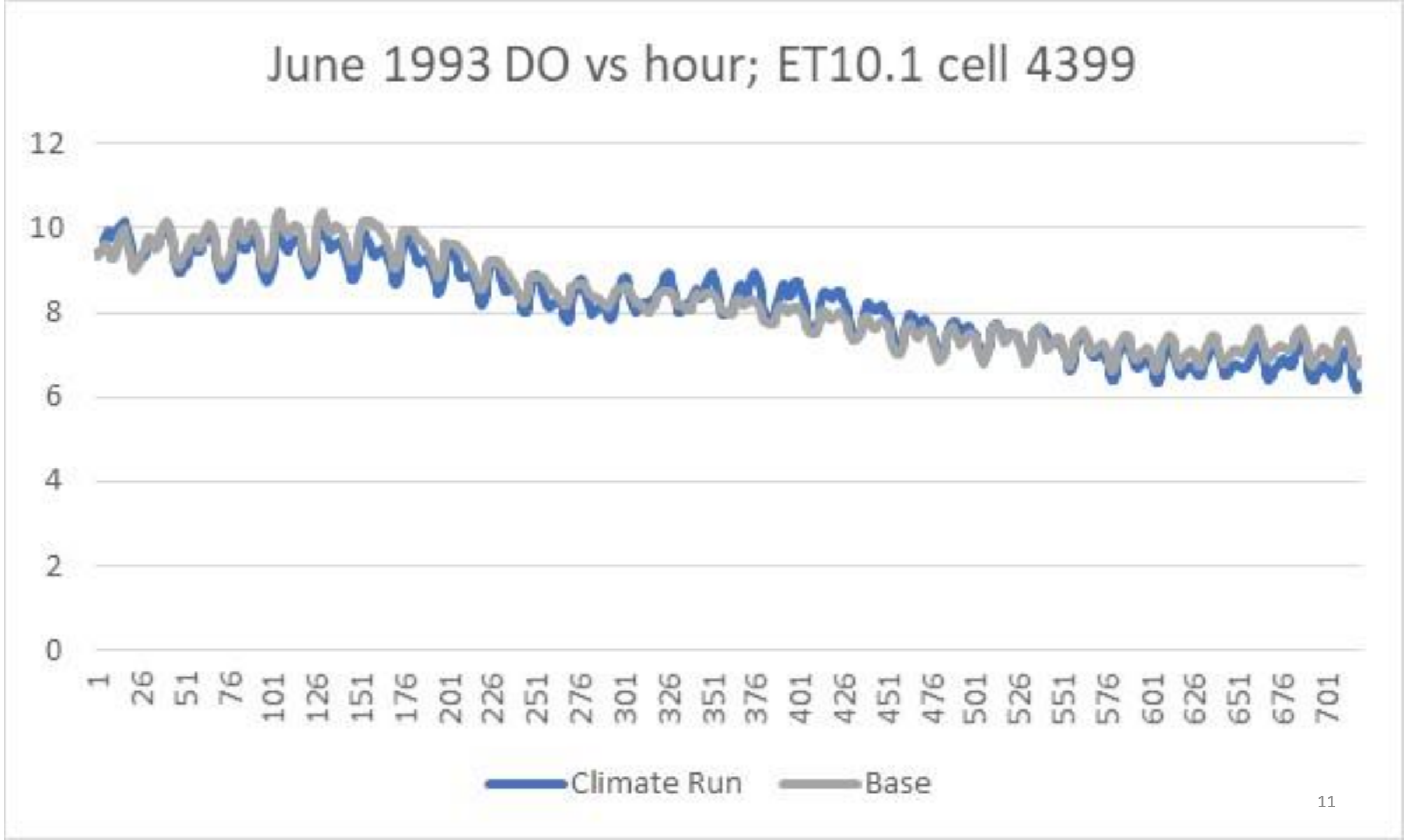


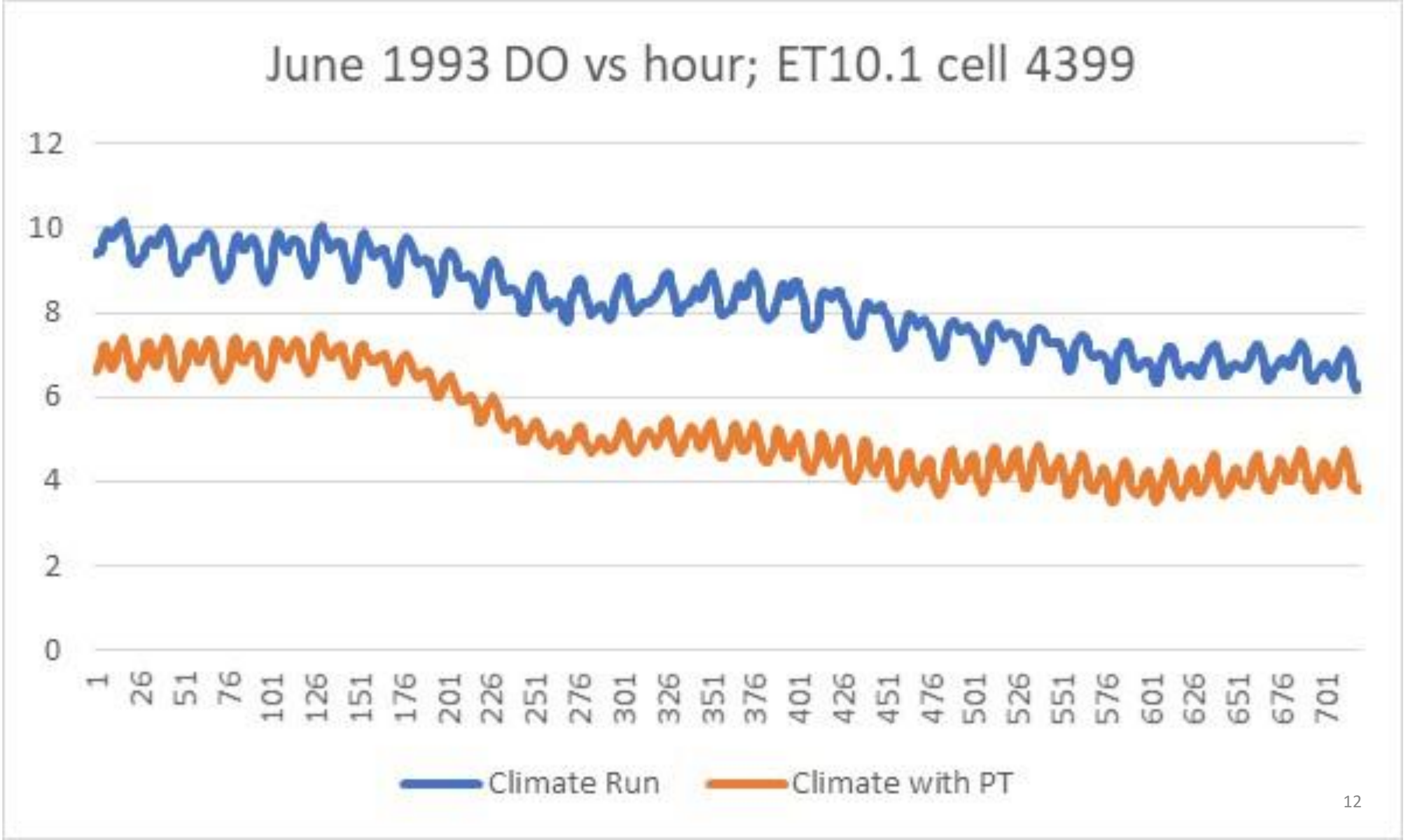
# Single station in the Pocomoke

Climate change and planning target scenario not resolving well at this point.




June 1993 DO vs hour; ET10.1 cell 4399
12
10
8
6
4
2
0
1
26
51
76
101
126
151
176
201
226
251
276
301
326
351
376
401
426
451
476
501
526
551
576
601
626
651
676
701
Base
Planning Target


June 1993 DO vs hour; ET10.1 cell 4399
12
10
8
6
4
2
0
1
26
51
76
101
126
151
176
201
226
251
276
301
326
351
376
401
426
451
476
501
526
551
576
601
626
651
676
701
Climate Run
Base


June 1993 DO vs hour; ET10.1 cell 4399
12
10
8
6
4
2
0
1
26
51
76
101
126
151
176
201
226
251
276
301
326
351
376
401
426
451
476
501
526
551
576
601
626
651
676
701
Climate Run
Climate with PT

# Oligohaline non-attainment

Very large jumps in non-attainment

| | | PT 1995 | PT 2025 | PT 2035 | PT 2045 | PT 2055 |
|---|---|---|---|---|---|---|
| BSHOH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| GUNOH | MD | 4.59% | 4.59% | 4.59% | 4.59% | 4.59% |
| MIDOH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| BACOH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| PAXOH | MD | 0.65% | 6.21% | 8.86% | 10.51% | 12.33% |
| POTOH1_MD | MD | 0.00% | 0.07% | 0.23% | 0.47% | 0.77% |
| RPPOH | VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| MPNOH | VA | 0.00% | 2.07% | 0.28% | 0.00% | 0.00% |
| PMKOH | VA | 0.36% | 11.03% | 10.22% | 3.71% | 2.27% |
| JMSOH | VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CHKOH | VA | 0.00% | 13.40% | 22.40% | 27.35% | 29.38% |
| BOHOH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| ELKOH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| SASOH | MD | 0.56% | 0.59% | 0.59% | 0.59% | 0.59% |
| CHSOH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CHOTF | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CHOOH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| NANOH | MD | 0.00% | 0.42% | 1.67% | 0.00% | 0.00% |
| POCOH_MD | MD | 0.00% | 69.83% | 77.48% | 77.48% | 77.48% |

# Oligohaline non-attainment increase

Very large decreases in nitrogen necessary

| | PT 2025 | PT 2035 | PT 2045 | PT 2055 | | increase per million lbs best case | Mlbs N reduction |
|---|---|---|---|---|---|---|---|
| BSHOH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| GUNOH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.058% | |
| MIDOH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| BACOH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| PAXOH | 5.56% | 8.21% | 9.85% | 11.68% | | 0.283% | 20 |
| POTOH1_M | 0.07% | 0.22% | 0.46% | 0.77% | | 0.007% | 11 |
| RPPOH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| MPNOH | 2.07% | 0.28% | 0.00% | 0.00% | | 0.000% | |
| PMKOH | 10.67% | 9.86% | 3.35% | 1.91% | | 0.014% | 760 |
| JMSOH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| CHKOH | 13.40% | 22.40% | 27.35% | 29.38% | | 0.000% | |
| BOHOH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| ELKOH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| SASOH | 0.03% | 0.03% | 0.03% | 0.03% | | 0.010% | 3 |
| CHSOH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| CHOTF | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| CHOOH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| NANOH | 0.42% | 1.67% | 0.00% | 0.00% | | 0.000% | |
| POCOH_M | 69.83% | 77.48% | 77.48% | 77.48% | | 0.034% | 2036 |

# Small-river mesohaline non-attainment

Slightly more reasonable results

| | | PT 1995 | PT 2025 | PT 2035 | PT 2045 | PT 2055 |
|---|---|---|---|---|---|---|
| PATMH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| MAGMH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| SEVMH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| SOUMH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| RHDMH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| WSTMH | MD | 0.01% | 0.01% | 0.01% | 0.01% | 0.01% |
| CRRMH | VA | 6.00% | 15.81% | 17.30% | 17.30% | 19.80% |
| PIAMH | VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| WBEMH | VA | 7.80% | 8.13% | 8.13% | 8.13% | 8.13% |
| SBEMH | VA | 23.56% | 34.57% | 42.53% | 50.90% | 54.36% |
| EBEMH | VA | 15.46% | 18.62% | 21.63% | 21.63% | 21.63% |
| LCHMH | MD | 0.00% | 0.00% | 0.00% | 0.08% | 0.08% |
| FSBMH | MD | 0.00% | 58.29% | 14.33% | 0.00% | 0.00% |
| WICMH | MD | 11.22% | 22.74% | 22.97% | 32.74% | 39.43% |
| MANMH | MD | 0.63% | 4.73% | 5.07% | 4.59% | 0.63% |
| BIGMH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |

# Small-river mesohaline non-attainment increase

Slightly more reasonable results

| | PT 2025 | PT 2035 | PT 2045 | PT 2055 | | increase per million lbs best case | Mlbs N reduction |
|---|---|---|---|---|---|---|---|
| PATMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| MAGMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| SEVMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| SOUMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| RHDMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| WSTMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| CRRMH | 9.81% | 11.30% | 11.30% | 13.80% | | 0.392% | 25 |
| PIAMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| WBEMH | 0.33% | 0.33% | 0.33% | 0.33% | | 0.000% | |
| SBEMH | 11.01% | 18.97% | 27.34% | 30.80% | | 0.223% | 49 |
| EBEMH | 3.16% | 6.16% | 6.16% | 6.16% | | 0.333% | 9 |
| LCHMH | 0.00% | 0.00% | 0.08% | 0.08% | | 0.000% | 38 |
| FSBMH | 58.29% | 14.33% | 0.00% | 0.00% | | 0.000% | |
| WICMH | 11.53% | 11.75% | 21.53% | 28.21% | | 0.633% | 18 |
| MANMH | 4.10% | 4.44% | 3.96% | 0.00% | | 0.000% | |
| BIGMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |

# Big-river mesohaline non-attainment

Reasonable results

| | | PT 1995 | PT 2025 | PT 2035 | PT 2045 | PT 2055 |
|---|---|---|---|---|---|---|
| PAXMH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.03% |
| POTMH_MD | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| RPPMH | VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| YRKMH | VA | 1.29% | 2.19% | 1.51% | 2.31% | 4.08% |
| JMSMH | VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CHSMH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| EASMH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CHOMH2 | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| CHOMH1 | MD | 0.06% | 0.08% | 0.10% | 0.20% | 0.32% |
| NANMH | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| POCMH_MD | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| POCMH_VA | VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| TANMH_MD | MD | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| TANMH_VA | VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.03% |

# Big-river mesohaline non-attainment increase

Reasonable results

| | PT 2025 | PT 2035 | PT 2045 | PT 2055 | | increase per million lbs best case | Mlbs N reduction |
|---|---|---|---|---|---|---|---|
| PAXMH | 0.00% | 0.00% | 0.00% | 0.03% | | 0.000% | |
| POTMH_M | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| RPPMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| YRKMH | 0.89% | 0.22% | 1.02% | 2.79% | | 0.178% | 5 |
| JMSMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| CHSMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| EASMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| CHOMH2 | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| CHOMH1 | 0.02% | 0.05% | 0.14% | 0.26% | | 0.001% | 13 |
| NANMH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| POCMH_M | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| POCMH_V | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| TANMH_M | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| TANMH_V | 0.00% | 0.00% | 0.00% | 0.03% | | 0.000% | |

# Polyhaline non-attainment

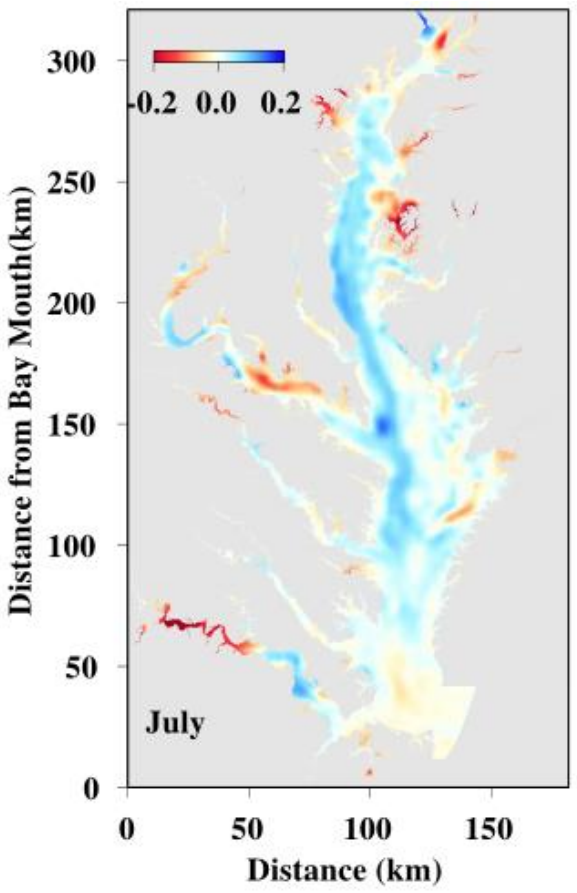
| | | PT 1995 | PT 2025 | PT 2035 | PT 2045 | PT 2055 |
|---|---|---|---|---|---|---|
| CB6PH | VA | 0.13% | 0.49% | 0.81% | 1.09% | 1.39% |
| YRKPH | VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| MOBPH | VA | 0.00% | 0.00% | 0.01% | 0.11% | 0.16% |
| JMSPH | VA | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |

increase

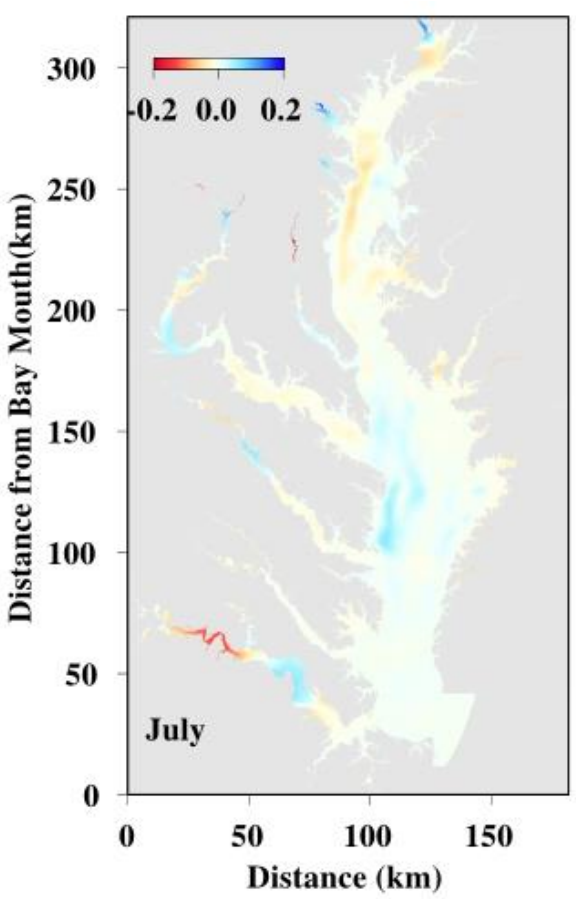
| | PT 2025 | PT 2035 | PT 2045 | PT 2055 | | increase per million lbs best case | Mlbs N reduction |
|---|---|---|---|---|---|---|---|
| CB6PH | 0.36% | 0.68% | 0.96% | 1.26% | | 0.015% | 24 |
| YRKPH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |
| MOBPH | 0.00% | 0.01% | 0.11% | 0.16% | | 0.000% | |
| JMSPH | 0.00% | 0.00% | 0.00% | 0.00% | | 0.000% | |

# Bottom DO change by 2025

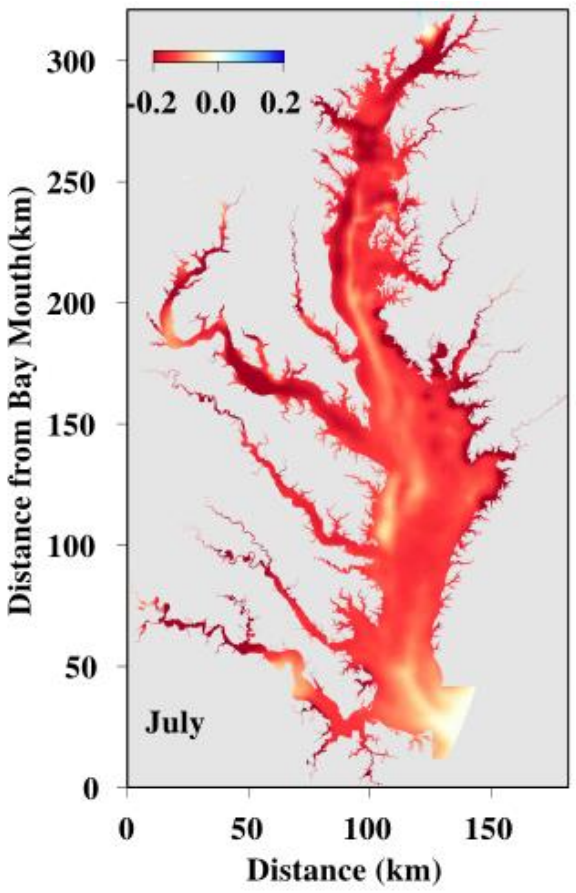
**SLR**



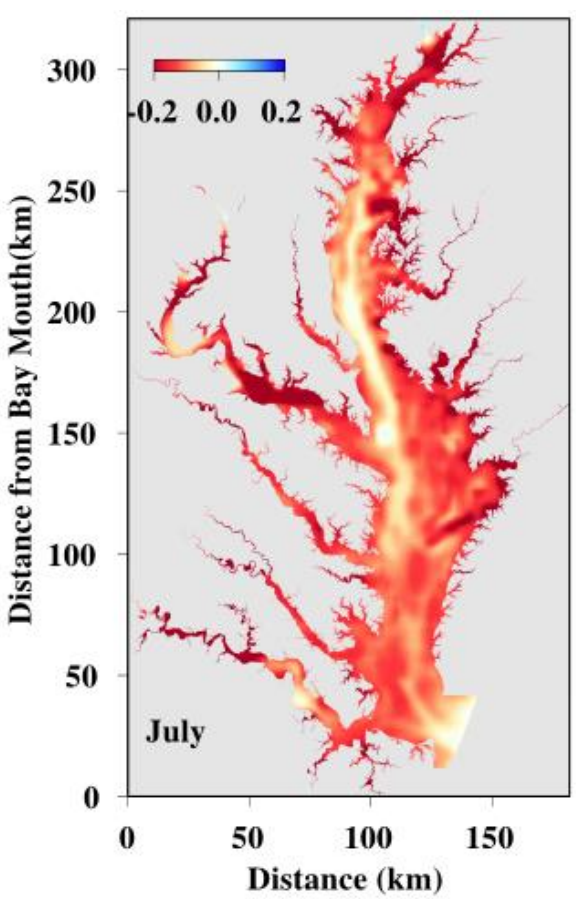

**Flow**




**Heat**




**All factors**



# Thoughts on the WQSTM

- Reasonable that OW would respond more to temperature increases

- TF, OH, and small-river MH need more analysis
- Main Bay and large-river results seem reasonable.

- May need a better shallow water model for climate assessment beyond 2025