Umbrella Criteria Workshop

Purpose

March 16 – 17, 2011

- **Under what conditions does the "Umbrella Criteria" assumption appears to be accurate?**

- **Under what conditions does this assumption appear to be violated?**

- **For what conditions does currently available data NOT allow us to test this assumption**

- **What are the data needed to test this assumption for all conditions?**

Umbrella Criteria Workshop
Products

A SET OF CONCLUSIONS/RECOMMENDATIONS REGARDING THE FOLLOWING:

- **REGIONS, CONDITIONS, TIME PERIODS (inter-annual; close to compliance) UNDER WHICH "UMBRELLA CRITERIA" IS ACCEPTABLE**

- **ARE THE ANALYSES/TECHNIQUES UTILIZED SUFFICIENT TO REACH SOLID CONCLUSIONS REGARDING USE IN BAY-WIDE CRITERIA ASSESSMENT (weight of evidence via many approaches)**

- **FOR GAPS IN ASSESSMENT, WHAT DATA SETS ARE MOST NEEDED AND WHAT'S THE STRATEGY FOR OBTAINING THOSE DATA SETS**

- **IS THE SPECTRAL CASTING METHOD READY FOR PRIME-TIME USE…IF NOT, WHAT ELSE NEEDS TO BE DONE?**

- **HOW DO THE STATES IMPLEMENT THE NEW ANALYTICAL METHODS FOR ASSESSING THE SHORT TERM CRITERIA?**

- **OTHER ITEMS GENERATED FROM THIS WORKSHOP…ISSUES OF SPECIAL CONCERN**

Umbrella Criteria Assessment Workshop
March 16-17, 2011
Agenda

DAY 1 (16 March 2011)

9:00	**Light Refreshments**	
9:30	**Introductions, Purpose, & Desired Products**	Boynton
9:45	**Details of DO Criteria**	Tango
10:15	**Umbrella Criteria Concept**	Keisman
10:45	**Coffee Break**	
11:00	**Presentations**: Evaluating the protectiveness of the criteria	
	Open Water – shallow water component	
11:00	Potomac ConMon data analysis (30 day vs 7 day mean criteria)	Buchanan
11:20	Additional ConMon data analysis (30 day mean vs instantaneous criteria)	Boynton
11:40	Probability analysis for criteria assessment (30 day vs 7 day means)	Perry
12:00-1:00	**LUNCH**	

12:00-1:00 **LUNCH**

Open Water - offshore component

1:00	Initial offshore and deep water analyses	Olsen
1:20	Open and deep water analyses: York River profiler and acrobat	Tango
1:40	Additional York River analyses	Jasinski

2:00	**Open Water – CFD Analysis**	
2:00	Spectral Casting Methods	Perry
2:30	Application of spectral casting: 12 segments VA	Robertson and Lane
2:50	Application of Spectral casting: segments in MD and comments on deep water analysis	Hall

3:10-3:30 **BREAK**

3:30	**Discussion**: Summary table comments and debate.	Tango
4:45	**Summary of the Day**	Boynton

5:00 **Adjourn** for day (potential for informal discussions over dinner)

DAY 2 (17 March)

8:00 **Light Refreshments**

8:30 **Purpose and Goals** of second day sessions — Boynton

8:45 **Discussion: Results & Conclusions** — Tango

- Criteria Assessment Methodology
- Science
- Monitoring

12:15-12:45 **LUNCH: Bring back to seat**

12:45 – 2:00 **Working Lunch: Conclusions & Recommendations**

- The **Initial goals** of the workshop (develop summary statements)

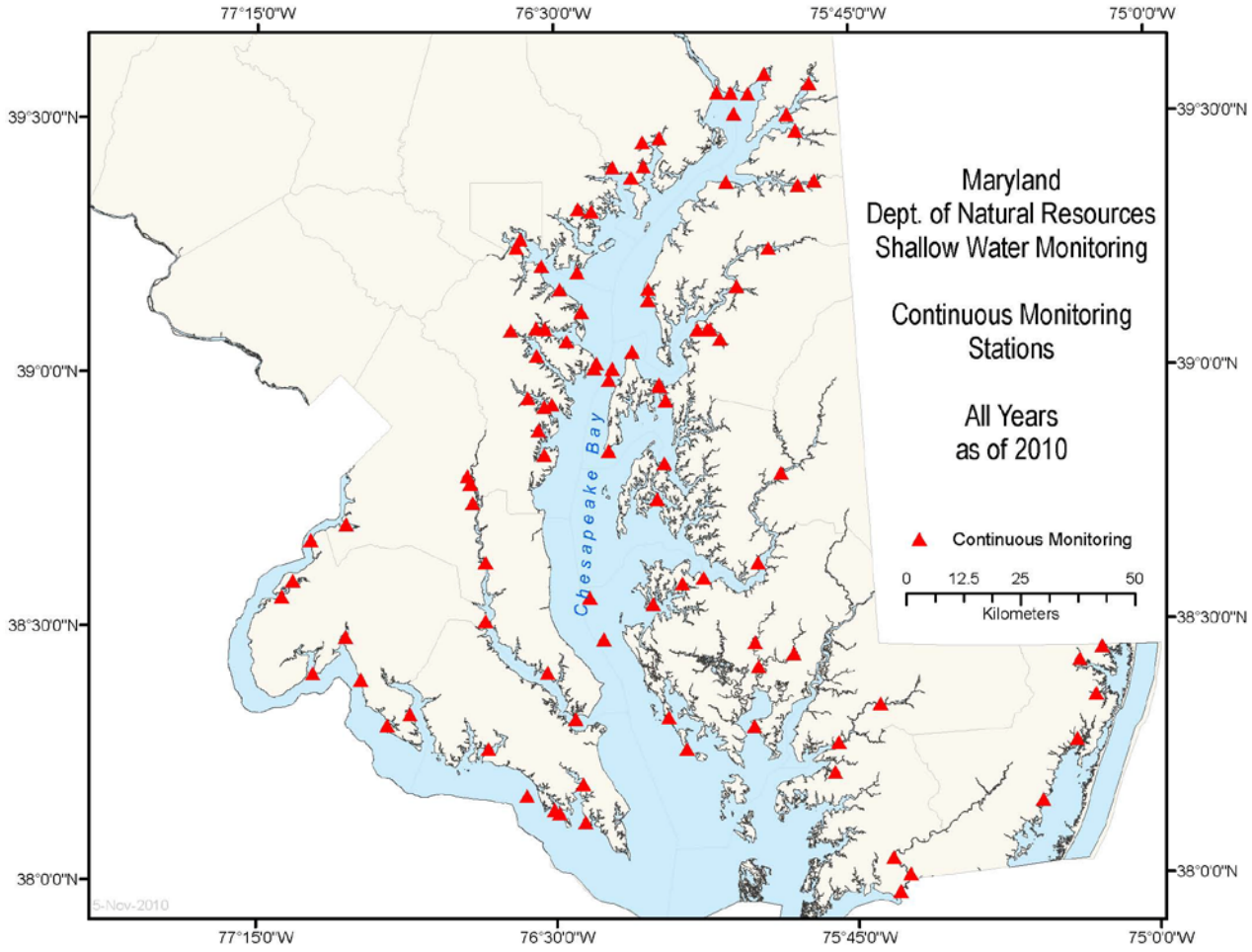
    1. Under what conditions does the Umbrella Criteria Hold?
    2. Under what conditions are the Umbrella Criteria Violated?
    3. What are the major Gaps in Testing the Umbrella Criteria?
    4. What would we need to test those gaps

- **Final considerations and suggestions**

2:00 **ADJOURN**

ConMon Data Analysis
(Shallow Water Analysis continued)

- The ConMon System of sites
- Diel hypoxia…Obese and healthy systems
- Historical patterns of DO
- Instantaneous vs 30 and 7-day criteria failure
- Issues of low DO duration
- DO and SAV

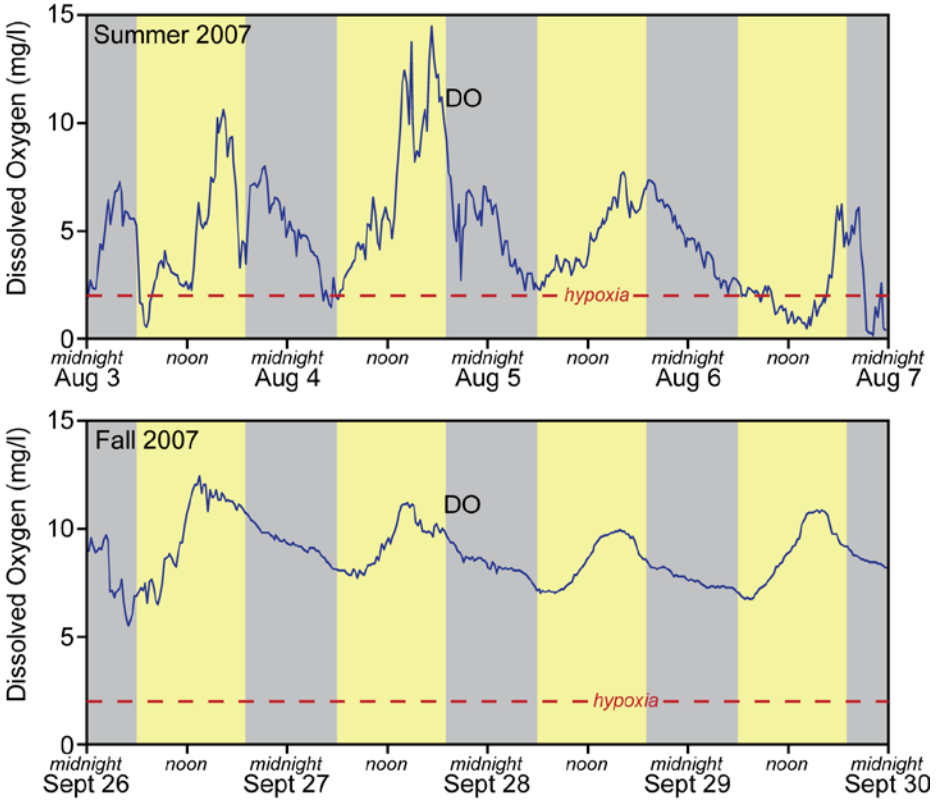


Shallow Water Data

- Many sites now available
- 3 – 9 year records
- Coverage especially good in tributaries
- Large range in water quality conditions
- More sites in Virginia
- A huge data set!

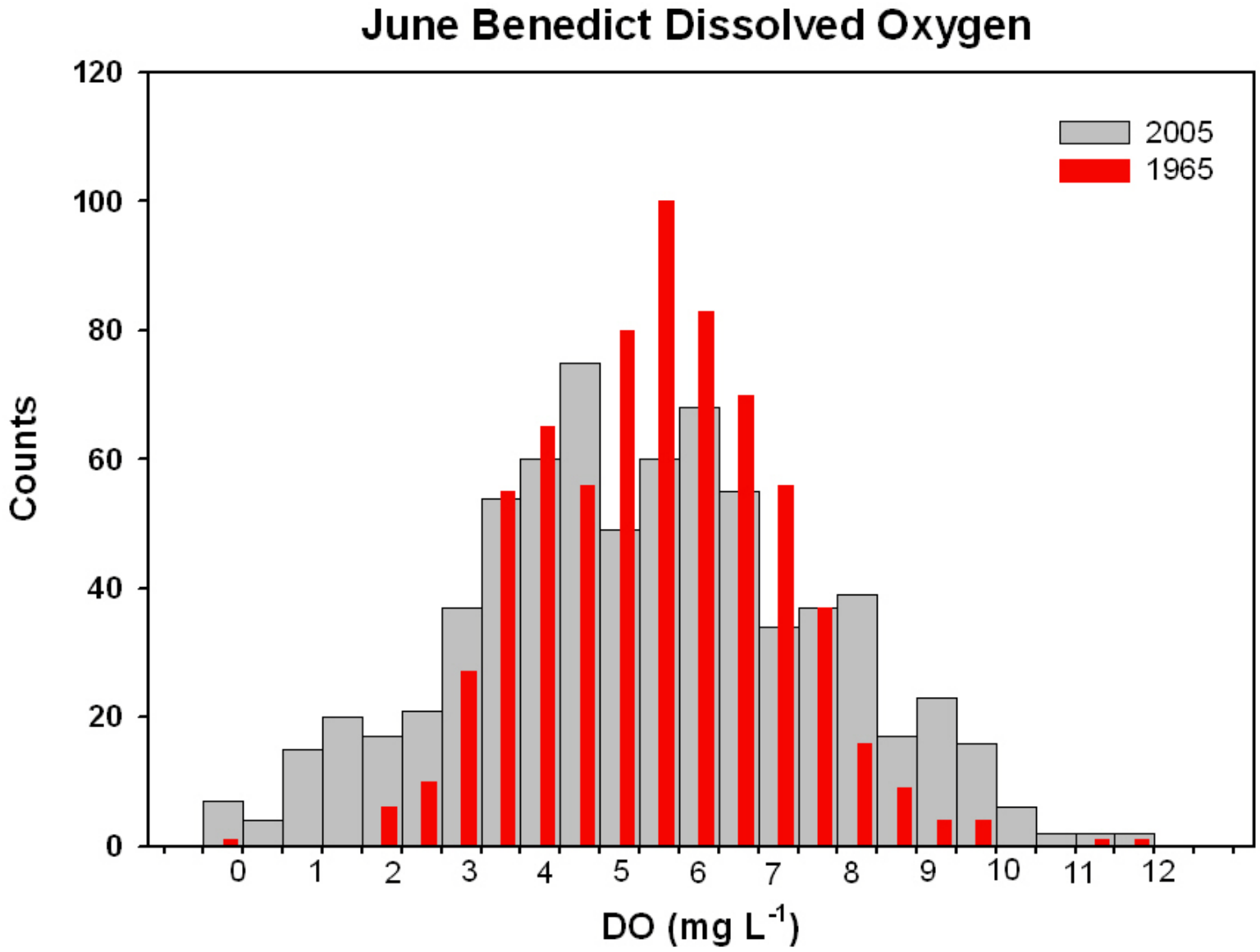
Dissolved O_2 Conditions Vary Seasonally and Daily

(DIEL-SCALE HYPOXIA)



NOTES

- Larger swings in summer than fall (or spring and winter)
- Low DO can extend for multi-day periods (cloudy days)



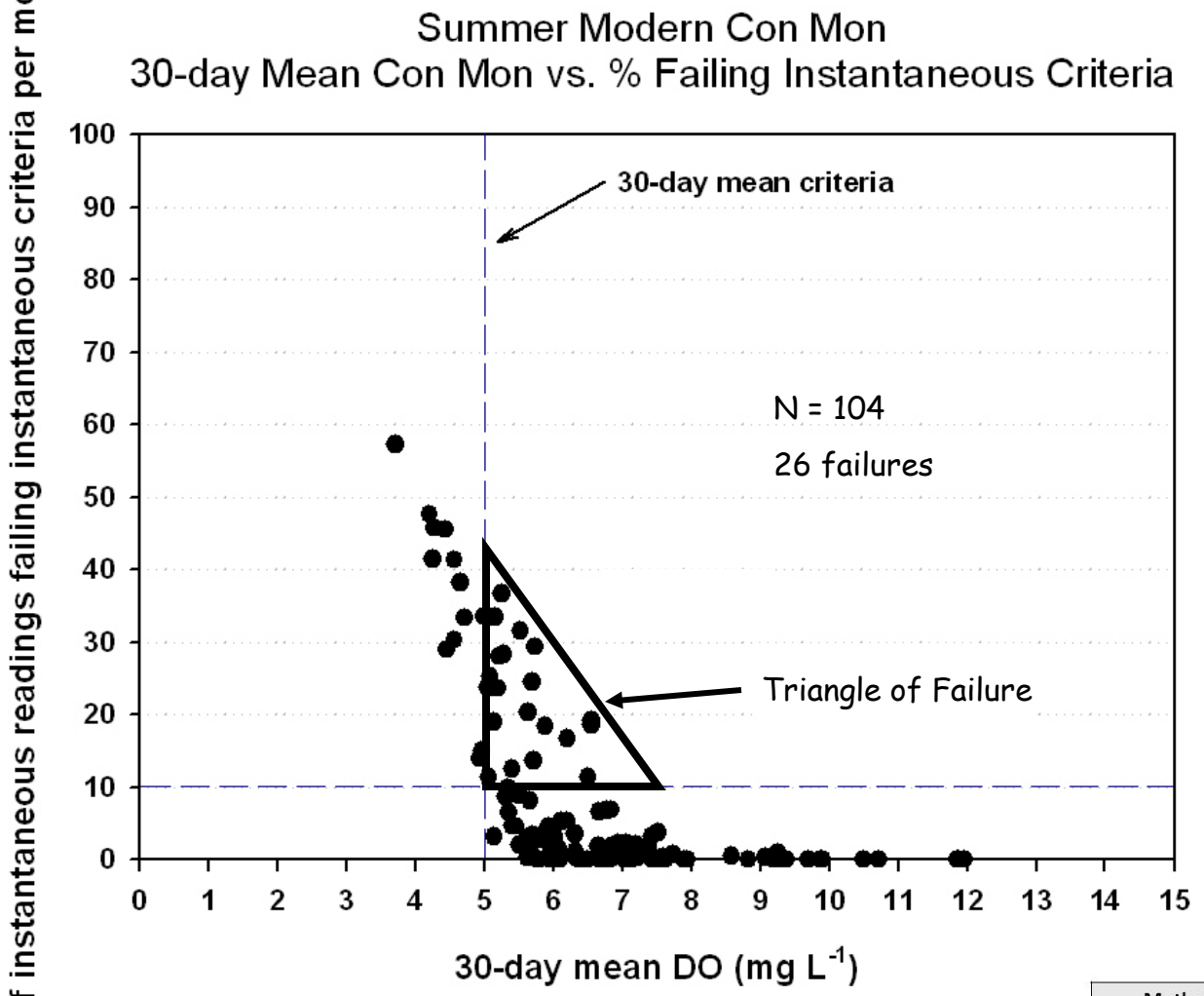
Histograms of June ConMon surface water dissolved oxygen from Benedict, MD. Data from Cory (1965) and MDDNR. 24 observations per day.

PATUXENT RIVER MESOHALINE @ Benedict, MD
July Dissolved Oxygen Criteria
% Non Attainment

(< 4 mg L^{-1})

Cory Historical Data Set (Avg = 8.2%)						**Modern Continuous Monitoring Data Set (Avg = 30.0%)**		
1964	1965	1966	1967	1968	1969	2003	2004	2005
7.4	0	13.5	3.1	23.2	2.0	28.3	15.6	46.2

Percent non-attainment calculated as the number of observations less than 4 mg/l divided by the total number of observations during the month of July (times 100).

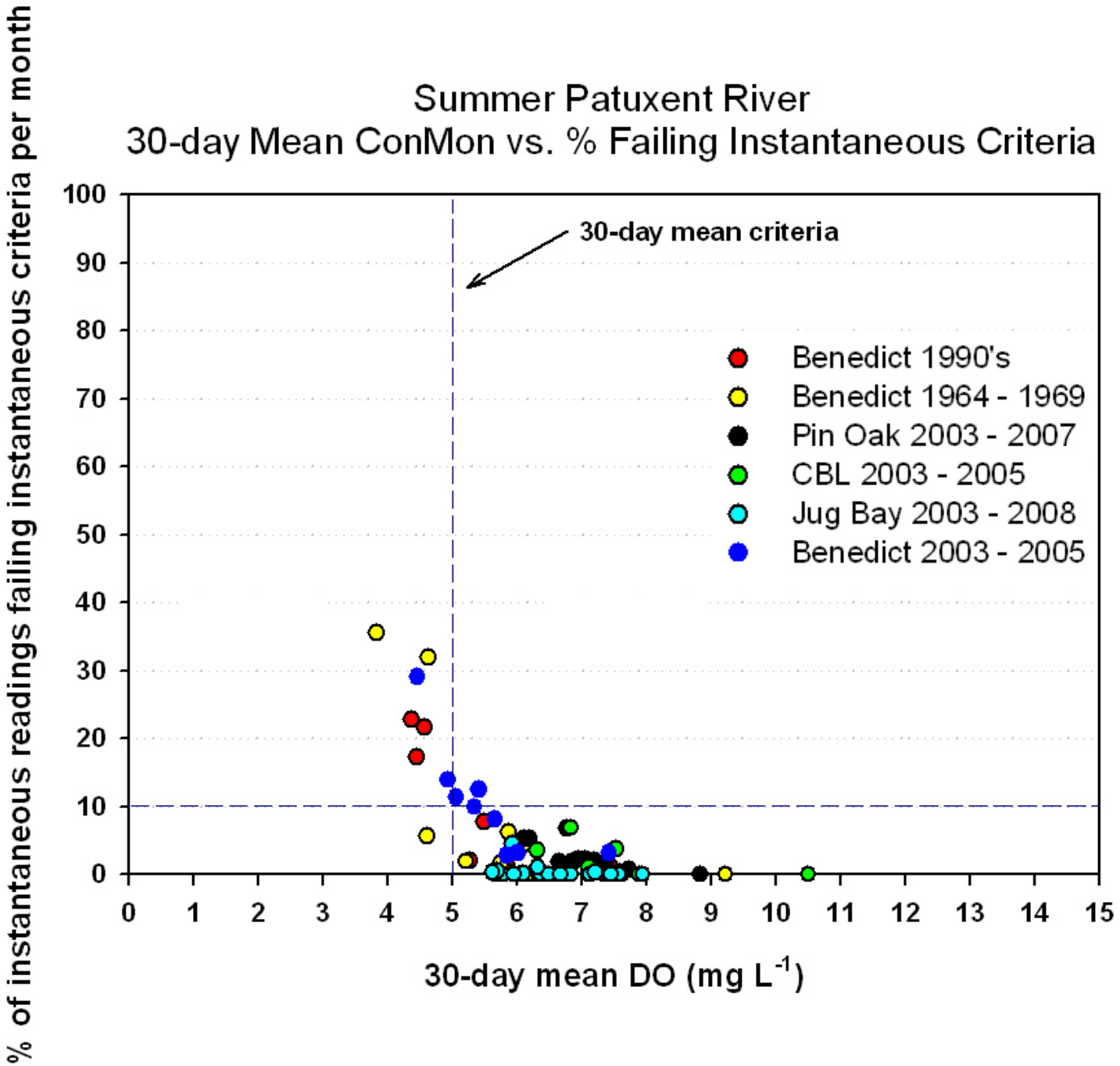


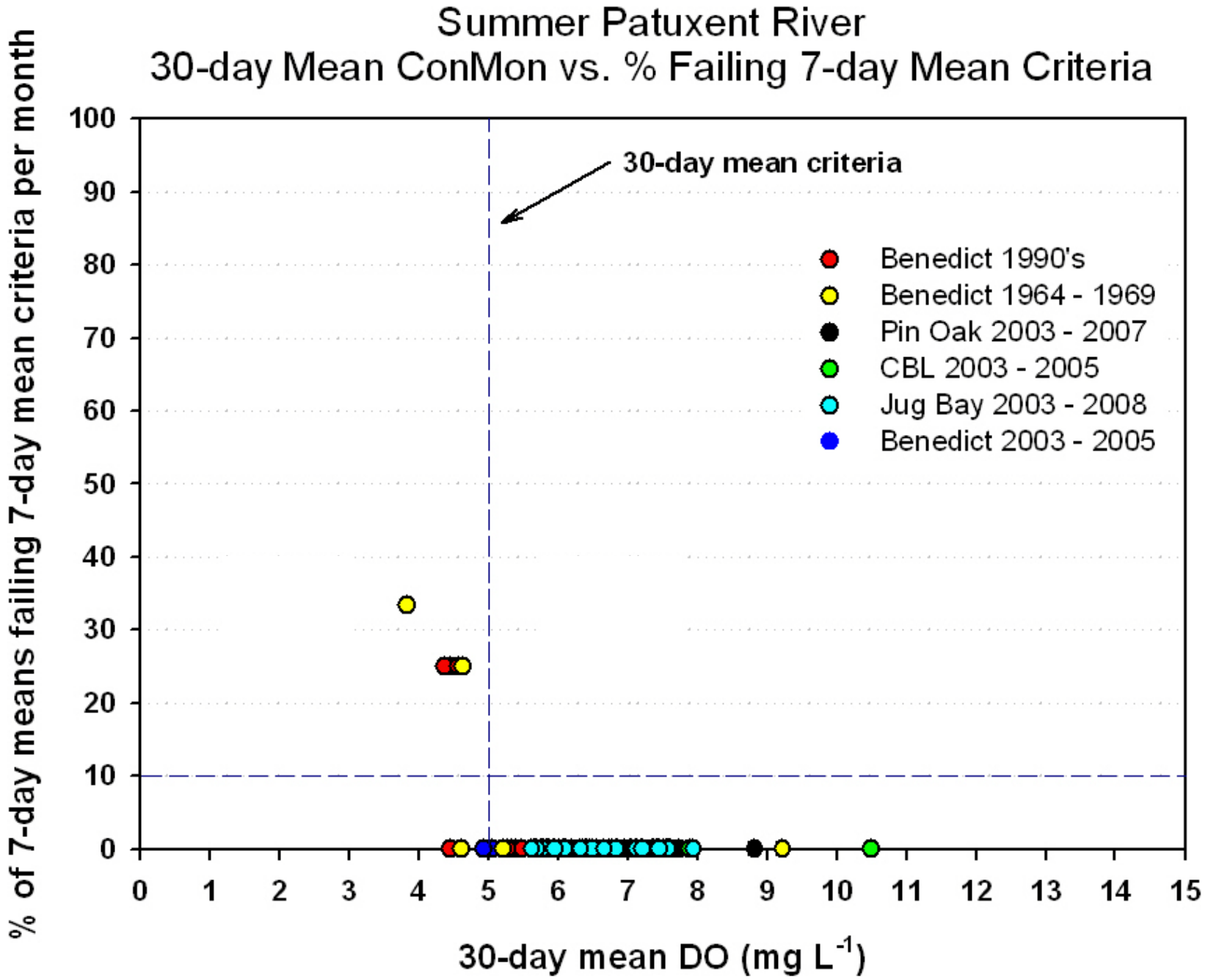
Modern Con Mon:

Benedict
St. George's Island
Sycamore Point
Public Landing
Bishopville Prong
Fenwick
Pin Oak
CBL
Jug Bay

Method	Use	DO Criteria
30 Day Mean	Open Water	≥ 5.0 mg L^{-1}
7 Day Mean	Open Water	≥ 4.0 mg L^{-1}
Instantaneous	Open Water	≥ 3.2 mg L^{-1}

A scatter plot of 30 day mean DO versus the rate of instantaneous DO criteria failures for a selection of ConMon sites. The dashed horizontal line represents the !0% failure rate.


Summer Patuxent River
30-day Mean ConMon vs. % Failing Instantaneous Criteria
% of instantaneous readings failing instantaneous criteria per month
30-day mean criteria
Benedict 1990's
Benedict 1964 - 1969
Pin Oak 2003 - 2007
CBL 2003 - 2005
Jug Bay 2003 - 2008
Benedict 2003 - 2005
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
30-day mean DO (mg L-1)


Summer Patuxent River
30-day Mean ConMon vs. % Failing 7-day Mean Criteria
% of 7-day means failing 7-day mean criteria per month
30-day mean DO (mg L-1)
30-day mean criteria
Benedict 1990's
Benedict 1964 - 1969
Pin Oak 2003 - 2007
CBL 2003 - 2005
Jug Bay 2003 - 2008
Benedict 2003 - 2005
0
10
20
30
40
50
60
70
80
90
100
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

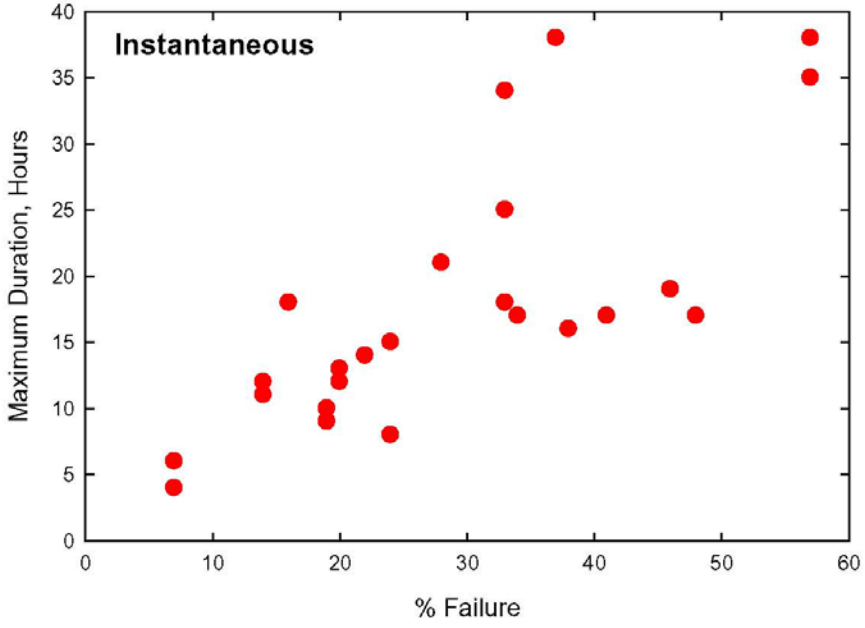
Dissolved Oxygen Criteria

Location	Station	Year	Date Range	Total Hours	Criteria < 3.2 mg L^{-1}			Criteria < 5.0 mg L^{-1}		
					Hours Below Criteria	% Failure	Maximum Single Duration Below Criteria (Hours)	Hours Below Criteria	% Failure	Maximum Single Duration Below Criteria (Hours)
Bishopville Prong	XDM4486	2003	4/16 to 12/22	5839	1761	30	60	2589	44	121
	XDM4486	2004	3/11 to 12/21	6806	1012	15	38	1943	29	75
	XDM4486	2005	3/2 to 12/20	6929	1121	16	34	1989	29	68
	XDM4486	2006	3/15 to 12/12	4591	484	11	16	1191	26	24
	XDM4486	2007	3/15 to 12/17	4156	496	12	18	1100	26	21
	XDM4486	2008	3/19 to 12/10	5961	491	8	15	1286	22	35
St. George Island	XBF7904	2006	4/25 to 10/31	4536	59	1	11	600	13	36
	XBF7904	2007	4/3 to 10/30	4536	69	2	4	623	14	38
	XBF7904	2008	3/27 to 10/21	4885	223	5	15	1001	20	22

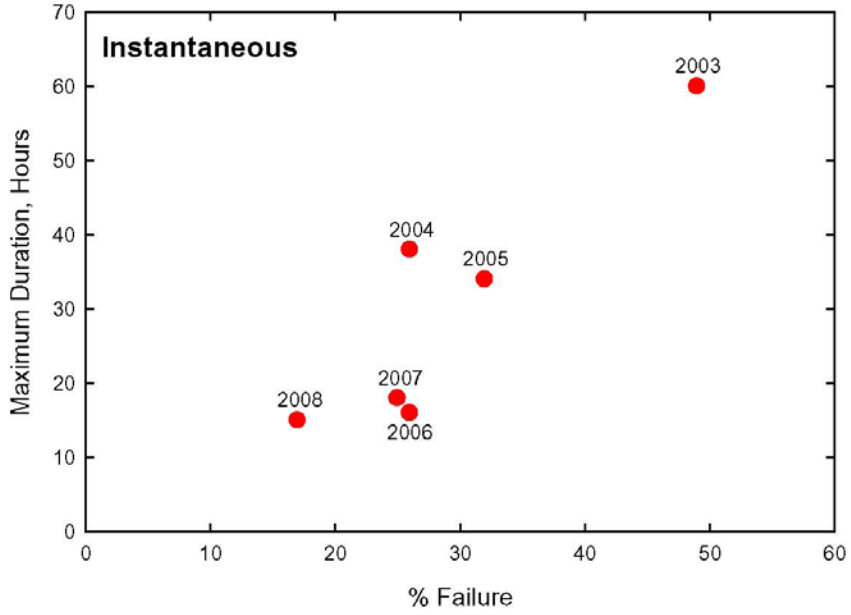
Dissolved Oxygen Criteria

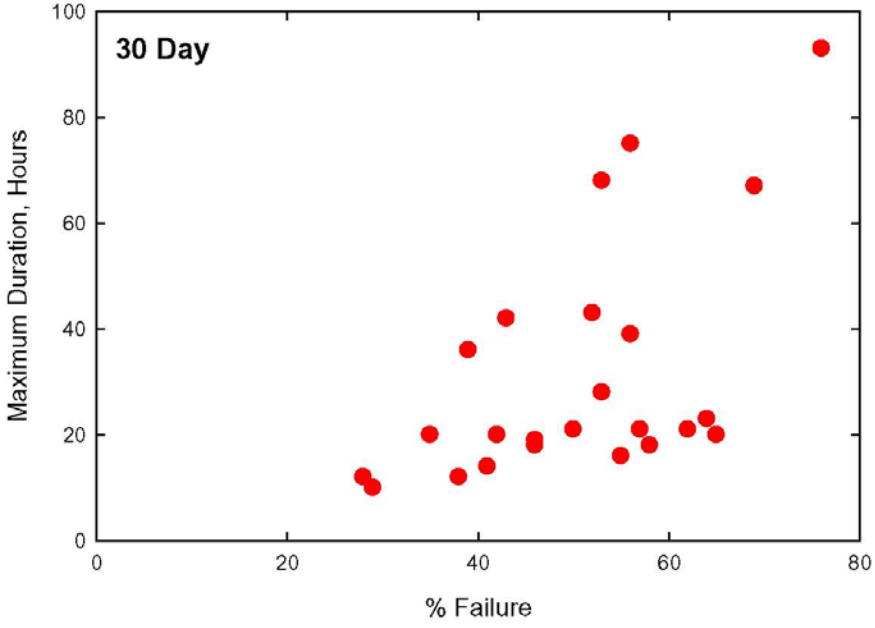
Location	Station	Year	Date Range	Total Hours	Criteria < 3.2 mg L^{-1}			Criteria < 5.0 mg L^{-1}		
					Hours Below Criteria	% Failure	Maximum Single Duration Below Criteria (Hours)	Hours Below Criteria	% Failure	Maximum Single Duration Below Criteria (Hours)
Jug Bay	PXT0455	2003	4/4 to 12/31	6130	0	0	0	153	3	20
	PXT0455	2004	1/1 to 12/31	8000	5	0	2	590	7	35
	PXT0455	2005	1/1 to 12/4	8678	35	0	11	586	7	67
	PXT0455	2006	1/1 to 12/31	8464	2	0	2	498	6	43
	PXT0455	2007	1/1 to 12/31	7717	0	0	0	297	4	18
	PXT0455	2008	1/1 to 12/31	8779	13	0	4	584	7	22
Pin Oak	XDE4587	2003	6/26 to 11/10	2804	43	2	9	292	10	43
	XDE4587	2004	3/3 to 11/29	6382	20	0	8	142	2	43
	XDE4587	2005	4/6 to 10/29	4077	69	2	15	306	8	30
	XDE4587	2006	6/26 to 11/10	3335	24	1	11	110	3	13
	XDE4587	2007	3/22 to 10/31	4058	31	1	7	245	6	17

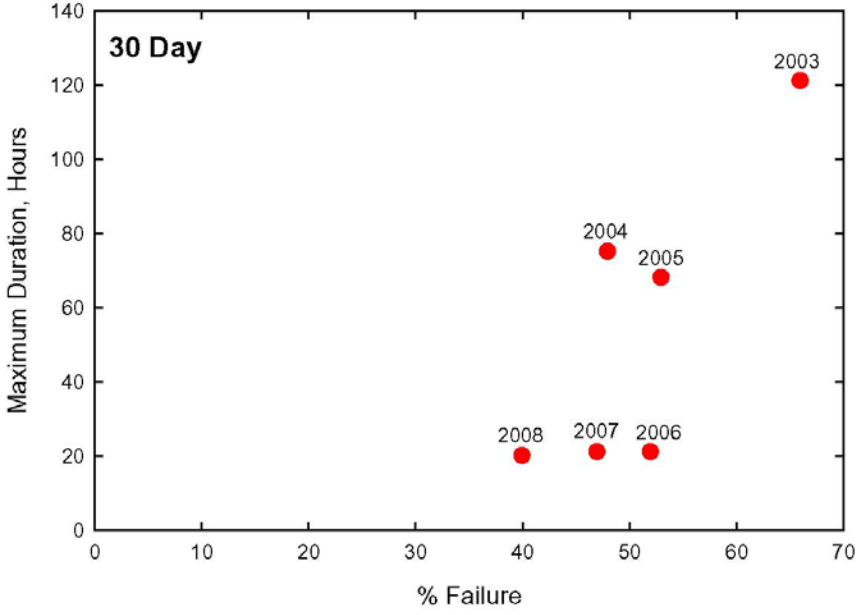
Monthly Bishopville Prong, Coastal Bays 2003-2008



Annual Bishopville Prong, Coastal Bays 2003-2008

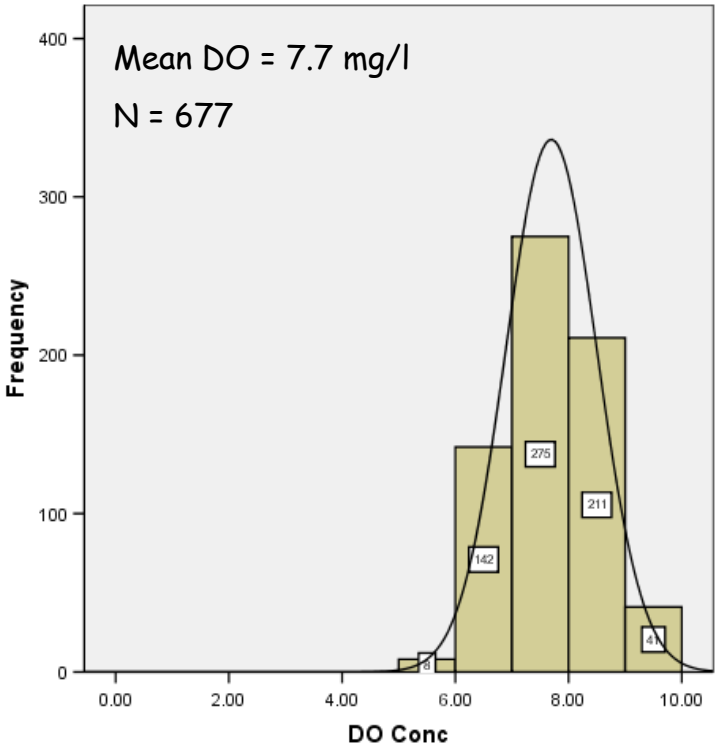




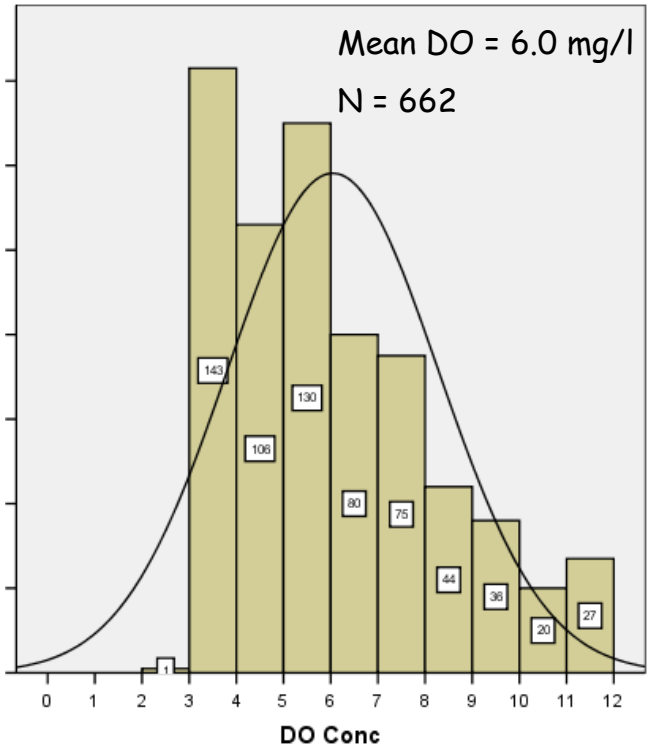


Choptank SAV Bed

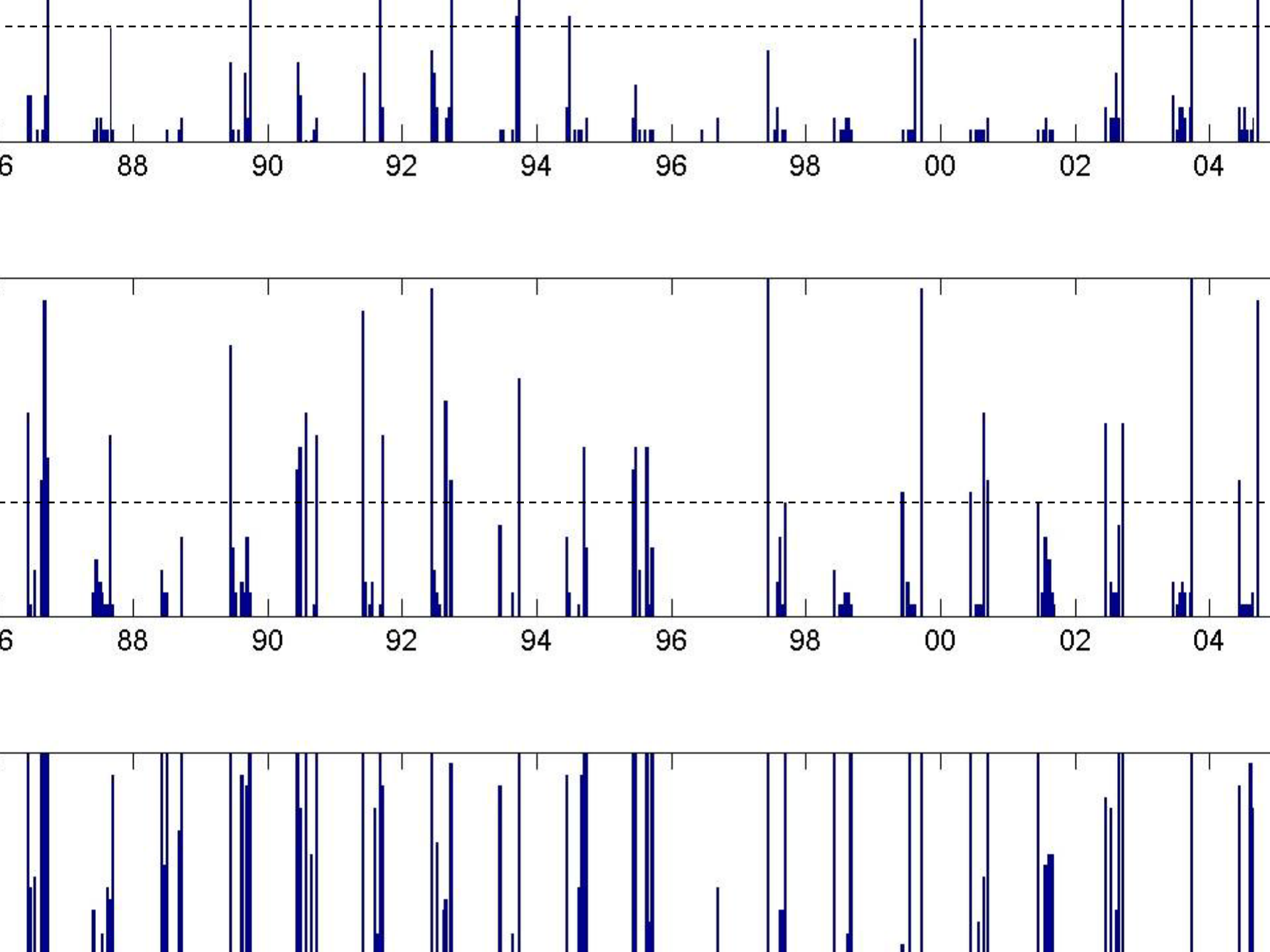
BARE SEDIMENTS



WITHIN SAV BED



Additional Materials


6
88
90
92
94
96
98
00
02
04
6
88
90
92
94
96
98
00
02
04

As another measure of diel signal, the average range is computed for each week. To compute the average range, for each day, the maximum DO for daylight hours and the minimum DO for night hours (including time before sunrise of the following day) are determined. A daily range is computed as this maximum minus the minimum. The daily range values are averaged over the week.

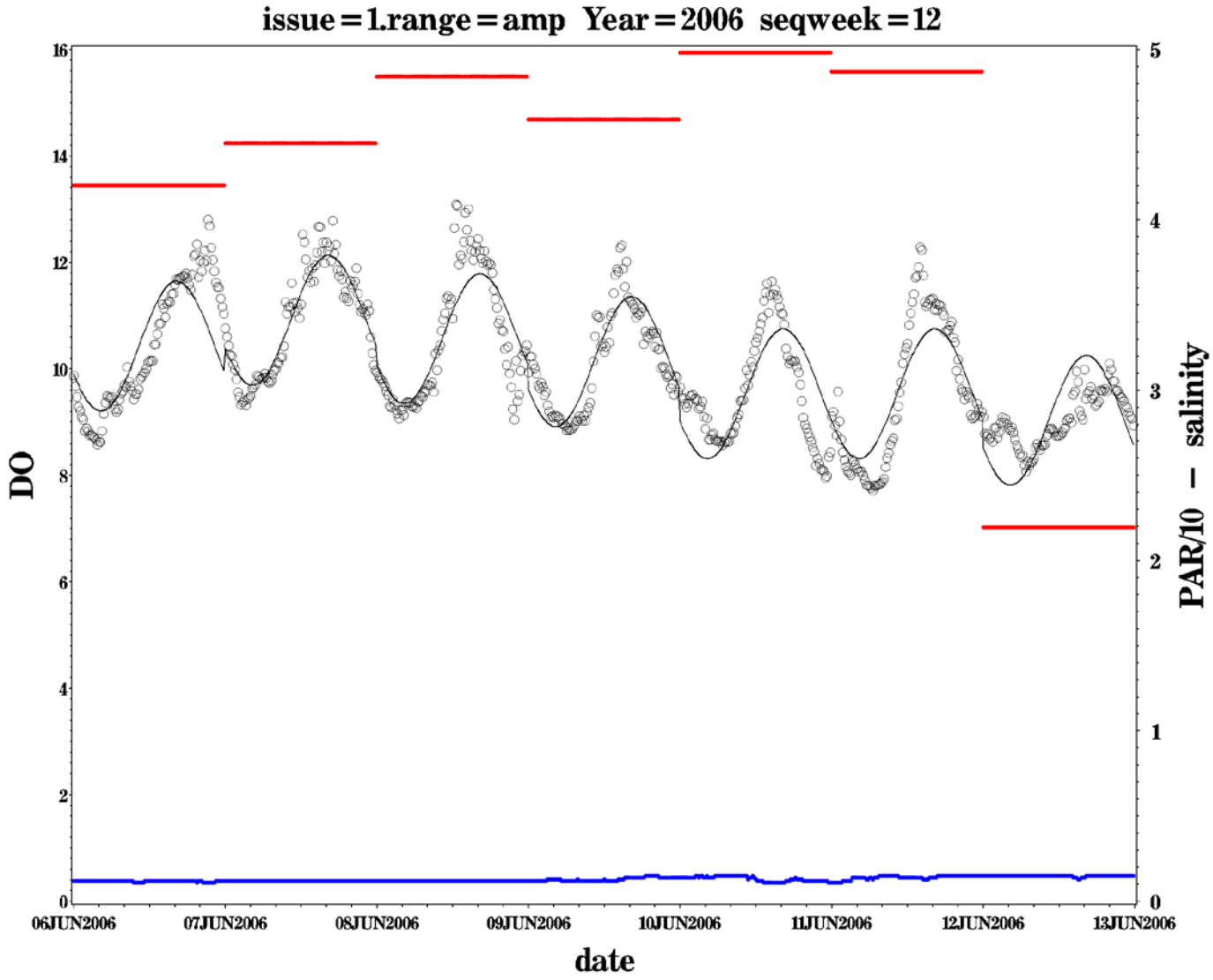
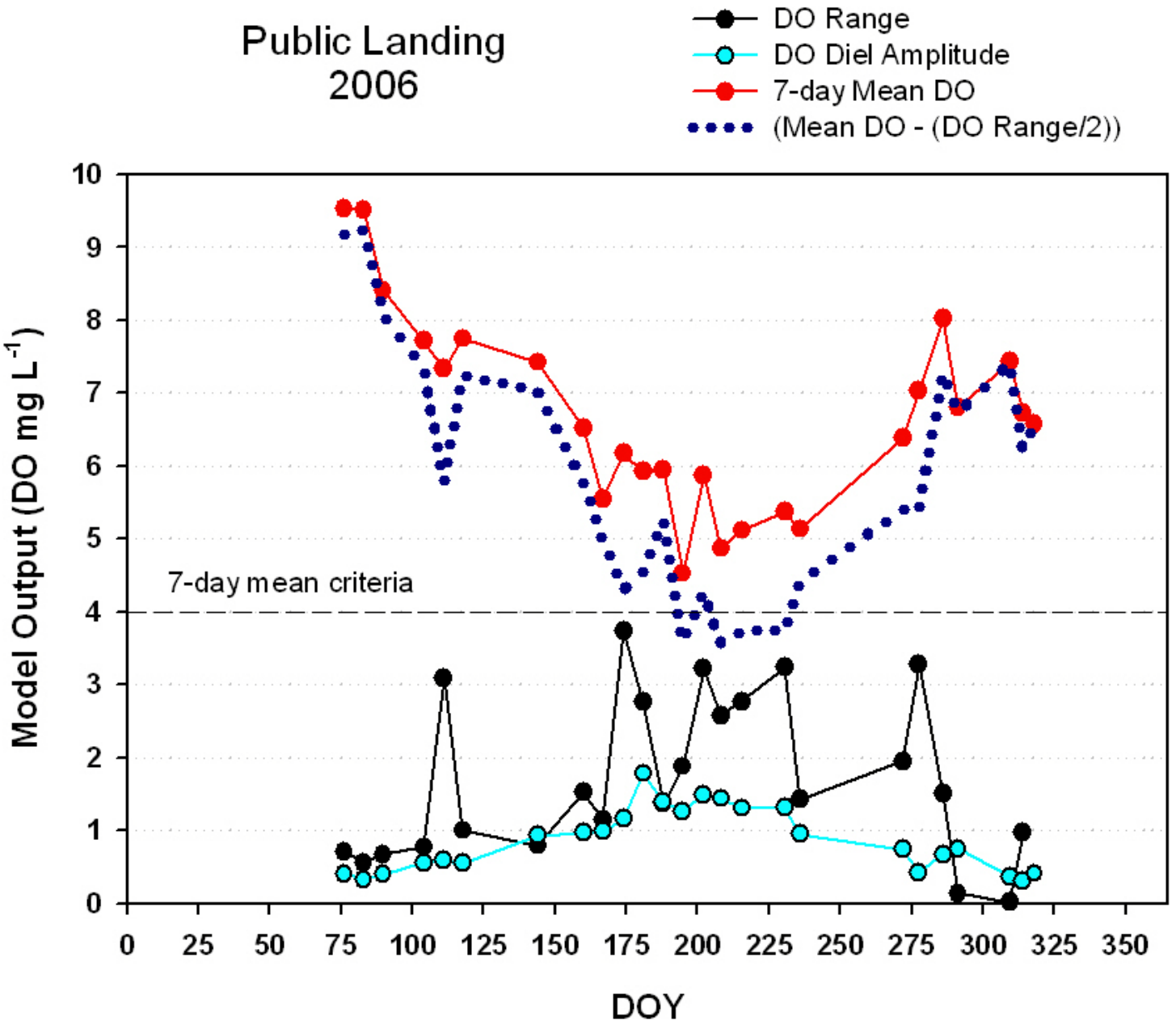
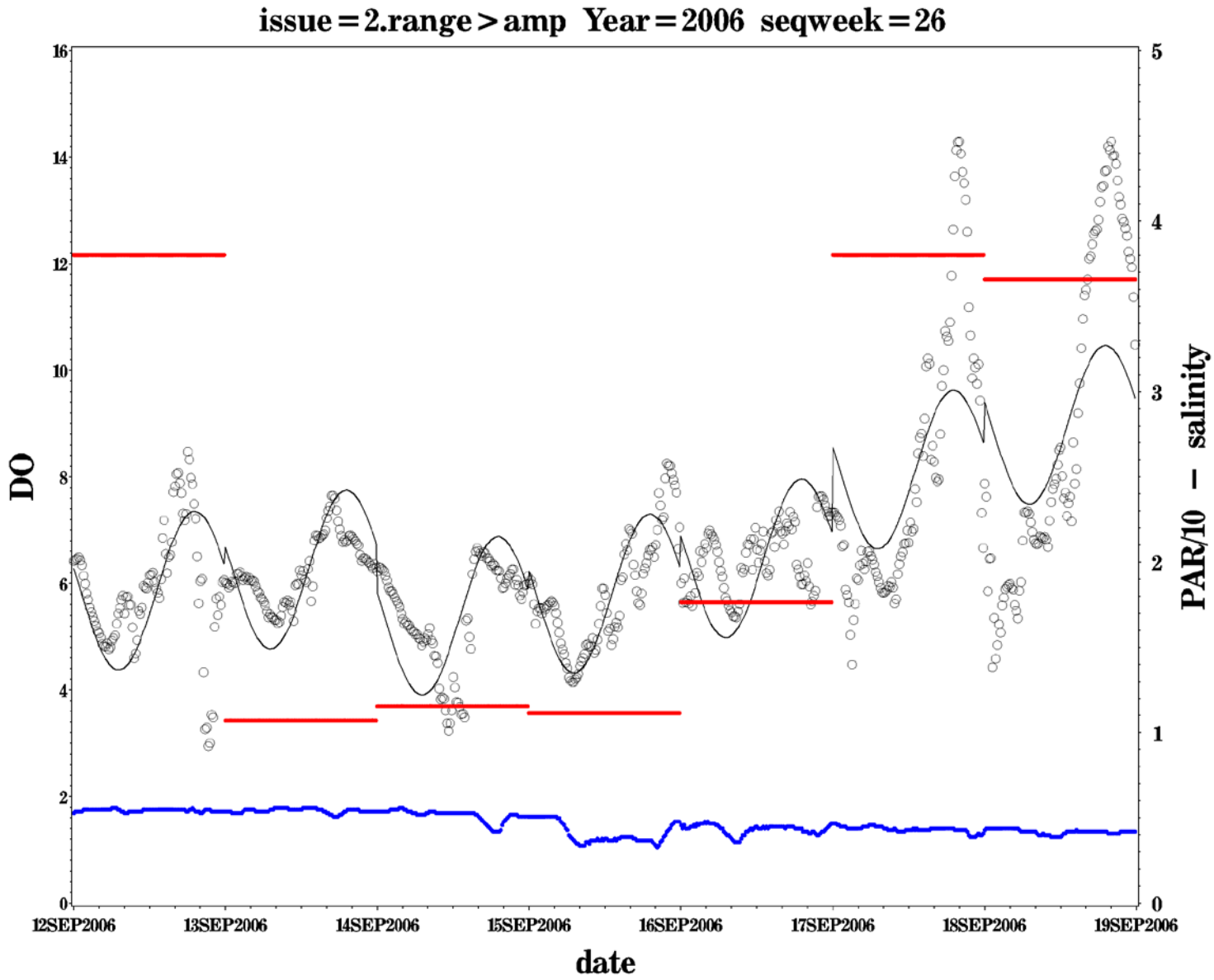
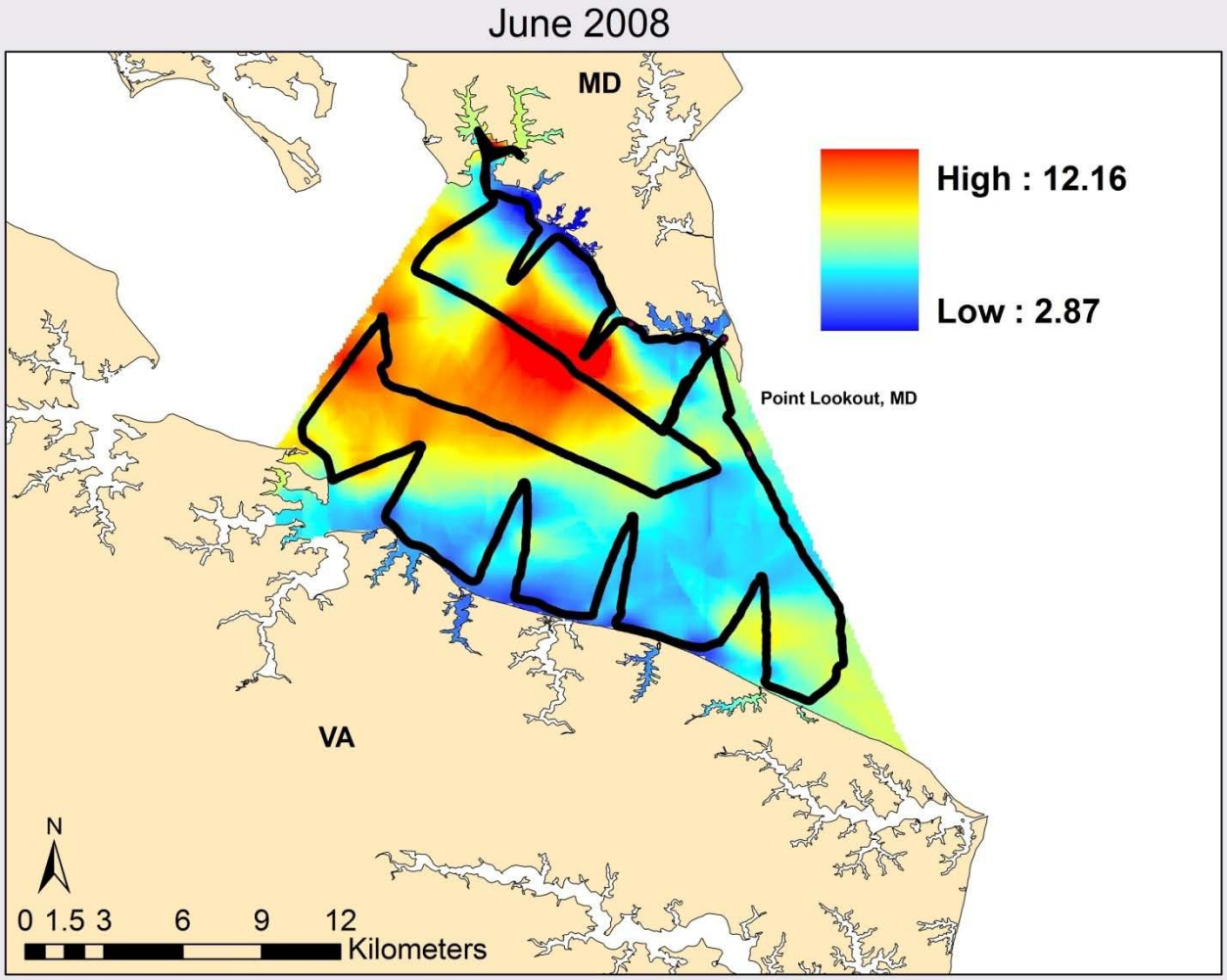


Illustration of diel cycle model applied to one week of dissolved oxygen data.

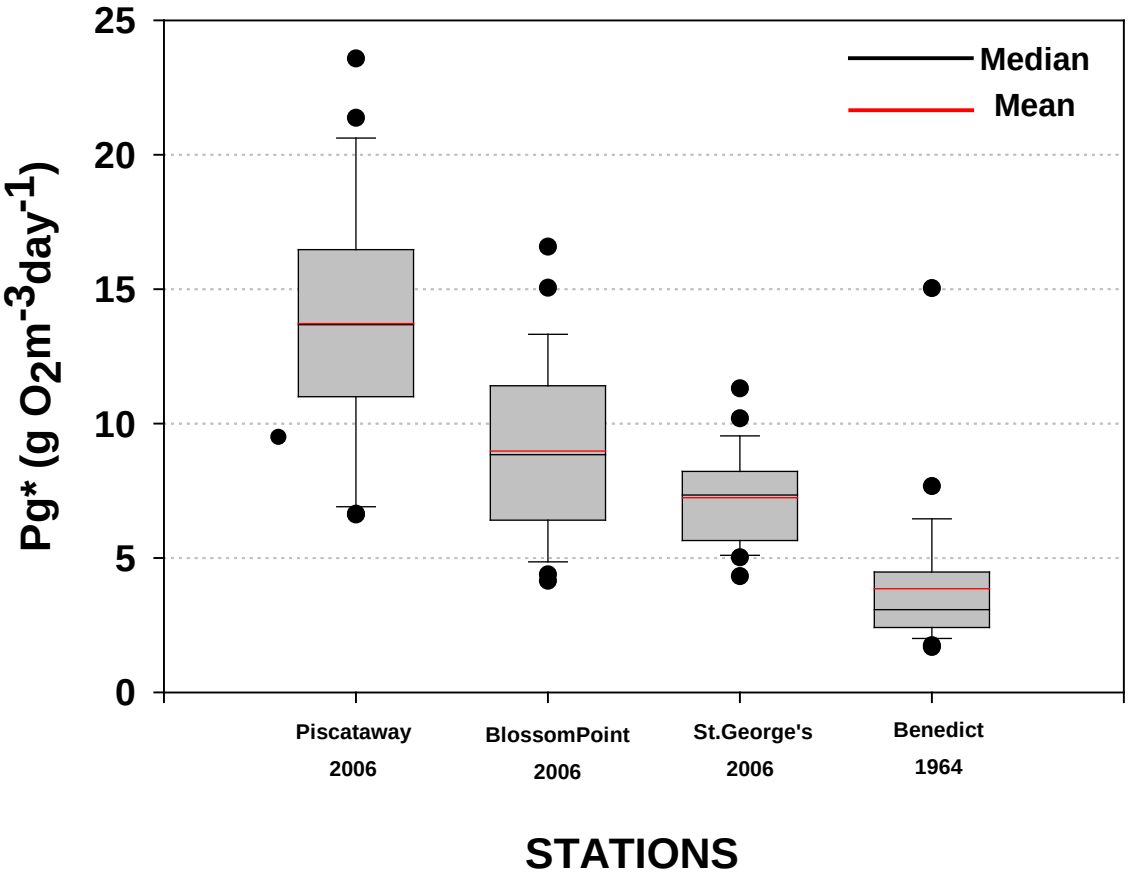

Public Landing
2006
DO Range
DO Diel Amplitude
7-day Mean DO
(Mean DO - (DO Range/2))
Model Output (DO mg L-1)
7-day mean criteria
DOY
0
1
2
3
4
5
6
7
8
9
10
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350


issue = 2.range > amp Year = 2006 seqweek = 26
DO
PAR/10 – salinity
date
0
2
4
6
8
10
12
14
16
0
1
2
3
4
5
12SEP2006
13SEP2006
14SEP2006
15SEP2006
16SEP2006
17SEP2006
18SEP2006
19SEP2006

Potomac River June 2008
Chlorophyll a Krige with cruise track



Nutrient Based Metabolic Gradient For July



Box and whisker plots of Pg* for upper, middle, and lower sections of the Potomac River. The boundary of the box closest to zero Indicates the 25th percentile, the black line within the box is the median, the red line within the box is mean and the boundary of the box farthest from zero indicates the 75th percentile. Whiskers above and below the box indicate the 90th and 10th percentiles and black dots indicate the 95th and 5th percentiles.

Photos from:
http://mddnr.chesapeakebay.net/newmontech/contmon/instruments.cfm

Benedict
July Dissolved Oxygen Criteria
% Non Attainment (all measurements)

(< 4 mg L^{-1})

Cory Historical Data Set						**Modern Continuous Monitoring Data Set**		
1964	1965	1966	1967	1968	1969	2003	2004	2005
7.4	0	13.5	3.1	23.2	2.0	28.3	15.6	46.2

DO Criteria Assessment Details			
Criteria	**Description of CBP CAP Calculations**	**Boynton Modification**	**Criteria**
Instantaneous	evaluate on each hour	evaluate using all available data (every 15 minutes)	≥ 3.2 mg L-1
1-day	average for each 24 hour period	do not use (only for below pycnocline in summer)	≥ 2.3 mg L-1
7-day	begin on day 1 of each month, evaluate first 4 weeks, ignore trailing days	divide all available data for calendar month into 4 equal bins, use 4 "weekly" averages	≥ 4.0 mg L-1
30-day	begin on day 1 of calendar month, ignore trailing day	use all available data for calendar month	≥ 5.0 mg L-1

Umbrella Criteria Graphs (similar to Buchcannan) for Summer Data (June, July & August Data only)	
Item	**Calculation**
% Failing Instantaneous	((total observations in calendar month below 3.2 mg L^{-1})/ total observations)) x 100
% Failing 7-day mean*	((Total of 4 “weekly” means in calendar month below 4 mg L^{-1}) / 4) x 100
30 day mean	Same as above (mean DO using all available data for calendar month)
	* This percentage will either be 0% (no failures), 25%, 50%, 75% or 100% since it is a percentage taken from the 4 “weekly” means.

Table 1. Definitions of DO criteria assessment details and an explanation of the umbrella criteria graphic analyses.