Umbrella Criteria Assessment Workshop

Offshore Component –
Initial open- and deep water analyses
1992, 2004

Marcia Olson

Assessing Achievement of the DO Restoration Goal - 1992

- DO >= 1 mg/L at all times, everywhere;
- 1.0 mg/L < DO <=3 mg/L for no longer than 12 hrs everywhere;
- Monthly mean do >= 5 mg/L at all times in above pycnocline waters
- DO >=5 mg/L all times above pycnocline in spawning and nursery areas

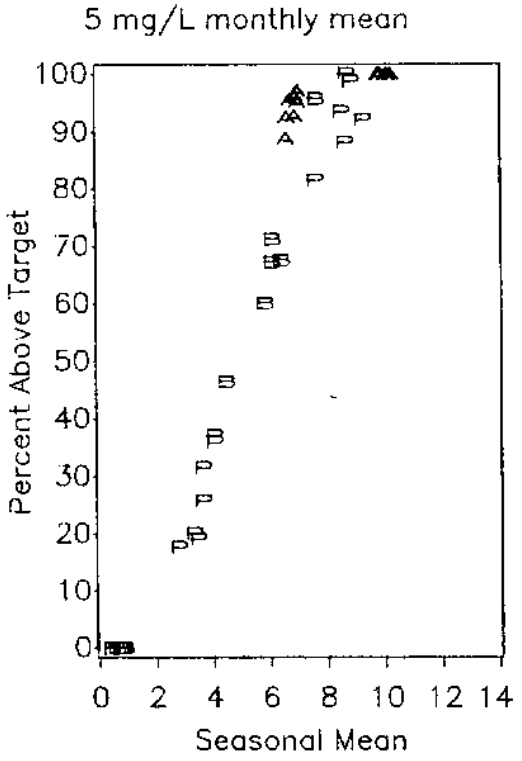
Assessing Achievement of the DO Restoration Goal - 1992

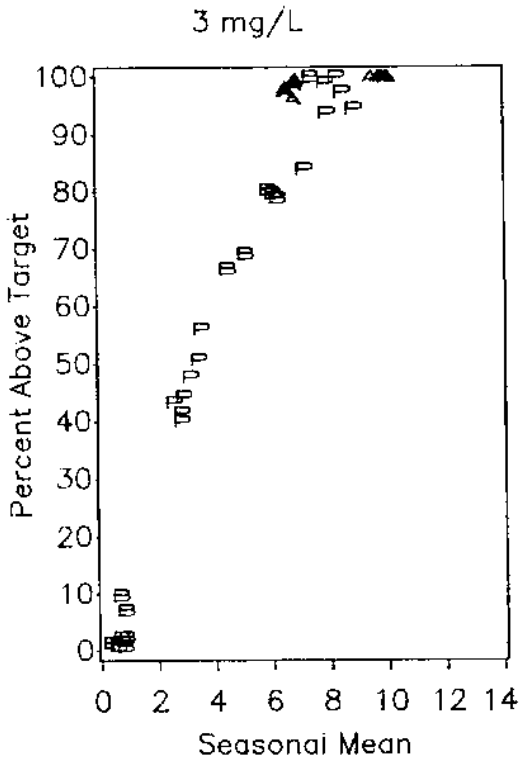
- Long-term (low-frequency Monitoring Program data (1984-90) grouped by
  - year
  - season (spring, summer)
  - segment (model and CBP analytical segments, separately)
  - depth layer (above pyc, in the region of the pyc, below pyc),

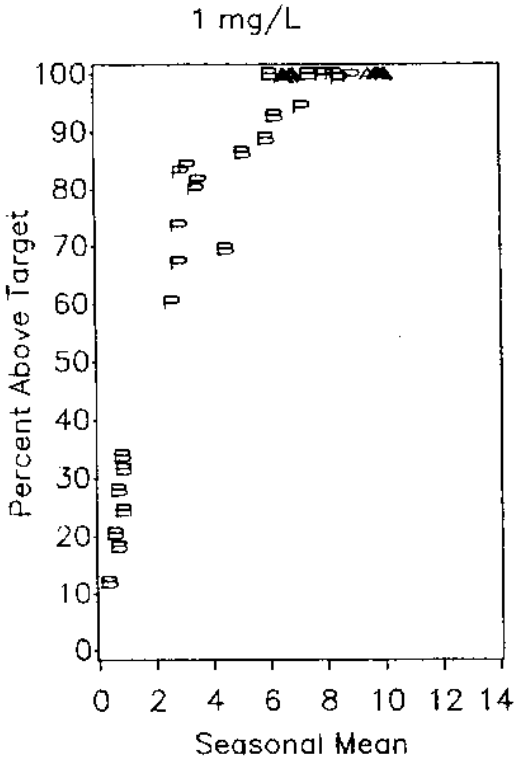
- The seasonal mean and % obs above target determined for each group

Assessing Achievement of the DO Restoration Goal – 1992

Plots of % obs above target conc vs seasonal mean DO for example segment CB4 (now CB$MH)







Assessing Achievement of the DO Restoration Goal - 1992

- Regression analysis was used to obtain the equation that would describe the relationship between % above target and the seasonal mean DO.

- arcsine (sqrt of r)=A*(seasonal mn)^2 +

  B*(seasonal mn) + C

where r=ratio of #obs above target / total #obs

Assessing Achievement of the DO Restoration Goal - 1992

- The regression model results could predict the percent of observations achieving or failing the target concentration for each segment.

- Using the regression models, one could also estimate the mean seasonal DO concentration required to achieve any or ALL of the restoration goal target concentrations.

Assessing Achievement of the DO Restoration Goal – 1992

DO concentrations required to meet goals

	Target Concentration			
CBP segment	1 mg/L[a]	3 mg/L[b]	5 mg/L[c]	5 mg/L[d]
CB1	5.3	5.3	7.0	6.6
CB2	5.3	5.3	7.0	6.6
CB3	6.3	8.1	9.2	8.9
CB4	6.7	8.4	-	9.1
CB5	6.5	8.1	-	9.0
CB6	3.3[e]	5.8	-	7.6
CB7	4.4[e]	6.2	-	7.2
CB8	5.6[e]	6.0	-	6.7
EE3	4.9[e]	6.2	-	6.9

Assessing Achievement of the DO Restoration Goal – 1992

DO concentrations required to meet goals based on 'controlling' target concentrations

CBP Segment	Below Pycnocline	Above Pycnocline
CB1	5.3[a]	7.0[b]
CB2	5.3[a]	7.0[b]
CB3	6.3[a]	9.2[b]
CB4	6.7[a]	9.1[c]
CB5	6.5[a]	9.0[c]
CB6	3.3[a,d]	7.6[c]
CB7	4.4[a,d]	7.2[c]
CB8	5.6[a,d]	6.7[c]
EE3	4.9[a,d]	6.9[c]

[a] Controlling target concentration is 1 mg/L
[b] Controlling target concentration is 5 mg/L
[c] Controlling target concentration is 5 mg/L monthly mean
[d] Dissolved oxygen never, or rarely, went below the target concentration in this segment. The seasonal mean shown is the lowest seasonal mean recorded in any depth category with 100% of the observations above the target concentration.

Assessing Achievement of DO Criteria - 2004-2005

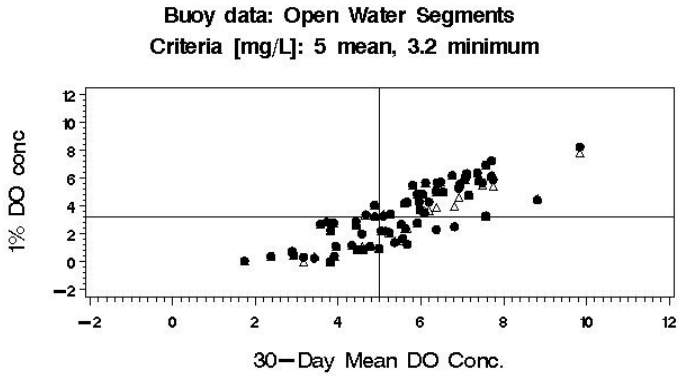
- Issue: how to determine attainment of the instantaneous and 1- and 7-day average DO criteria given lack of data at these time scales
  - Assembled a variety of ‘buoy’ data sets: high frequency data using sensors located at various fixed depths in the water column, usually ~ 1 m off the bottom, with water mass passing back and forth with tide and current.
  - Anecdotal to our purpose—sites were sometimes random, some chosen to answer particular questions, some short- some longer-term deployments.

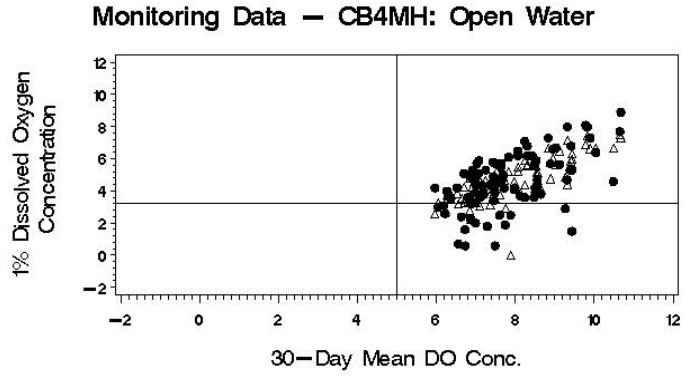
Assessing Achievement of DO Criteria - 2004-2005

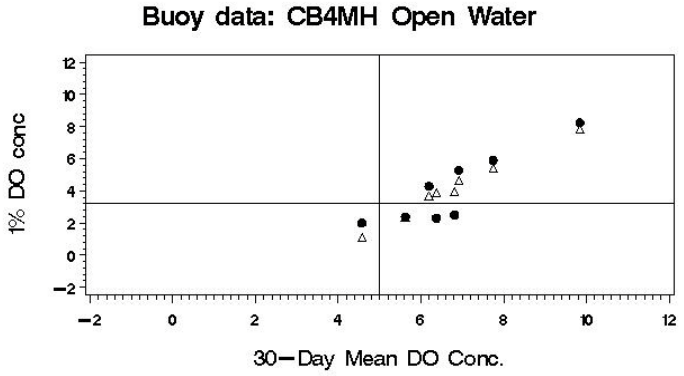
Characterized the buoy data sets:

- Determined deployment dates and duration of record (established season)
- Assigned CBP segment
- Determined depth of site and depth of sensor
- Assigned designated use (DU) by comparing sensor depth to avg depth of pycnocline in segment that month
- Assigned relevant criteria for season/segment/DU
- Calculated the min and max DO concentrations, 1 and 10th percentile and 30-day median and mean concentrations and determined achievement of the relevant criteria.

Assessing Achievement of DO Criteria - 2004-2005

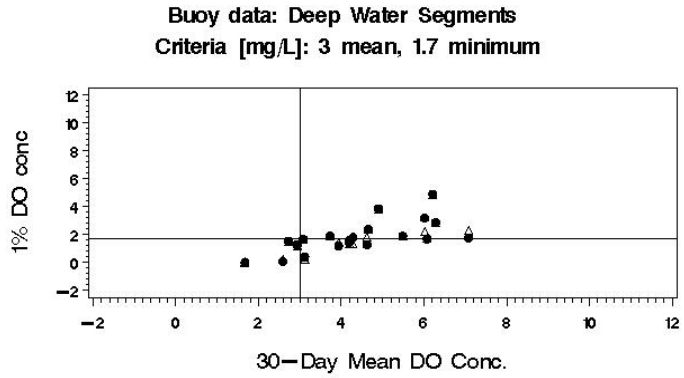


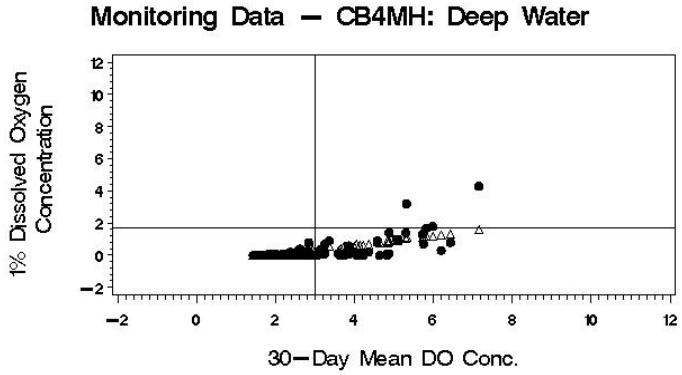


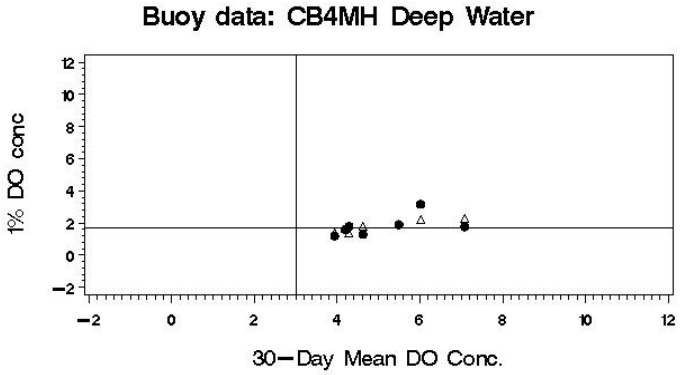


Open water summer season: Plots of 30-day mean dissolved oxygen concentration (mg liter-1) versus the 1 percentile dissolved oxygen concentration as measured by sensors on individual buoys. Plot on top shows buoy data pooled across Chesapeake Bay. Plot below on left is from monitoring data in segment CB4MH. Plot on right is from buoy data in CB4MH. Circles are observed concentrations; triangles are 1% concentrations predicted as a function of the monthly mean and coefficient of variation.

Assessing Achievement of DO Criteria - 2004-2005







Deep water summer season: Plots of 30-day mean dissolved oxygen concentration (mg liter-1) versus the 1 percentile dissolved oxygen concentration as measured by sensors on individual buoys. Plot on top shows buoy data pooled across Chesapeake Bay. Plot below left is from monitoring data in segment CB4MH. Plot on right is from buoy data in CB4MH. Circles are observed concentrations; triangles are 1% concentrations predicted as a function of the monthly mean and coefficient of variation.

Assessing Achievement of DO Criteria 2004-2005

Table V-8 fragment. Characterization of the Chesapeake Bay Program segments based on occupied quadrants in a plot of the 1 percent dissolved oxygen concentration vs observed 30-day mean dissolved oxygen concentration.

	Number of Data Points By Quadrant by Designated Use											
CBP	Open-Water				Deep-Water				Deep-Channel			
Segment	1	2	3	4	1	2	3	4	1	2	3	4
CB1TF*	39	0	0	0								
CB2OH	12	19	8	0								
CB3MH	38	2	0	0	2	34	4	0	3	17	18	0
CB4MH	35	5	0	0	1	8	31	0	2	2	36	0
CB5MH	36	4	0	0	6	29	5	0	11	20	9	0
CB6PH	31	9	0	0	32	8	0	0				
CB7PH	36	4	0	0	33	5	2	0				
CB8PH*	39	1	0	0								
BSHOH*	37	0	0	1								
GUNOH**	38	0	1	1								
MIDOH*	40	0	0	0								
BACOH**	36	0	0	4								
PATMH	40	0	0	0	0	7	33	0	1	1	7	0
MAGMH	8	16	16	0								
SEVMH	7	9	19	4								
SOUMH**	3	2	31	3								
RHDMH**	37	0	1	1								
WSTMH**	28	3	5	3								