Water Quality Attainment Indicator

Melinda (Mindy) Ehrich

UMCES
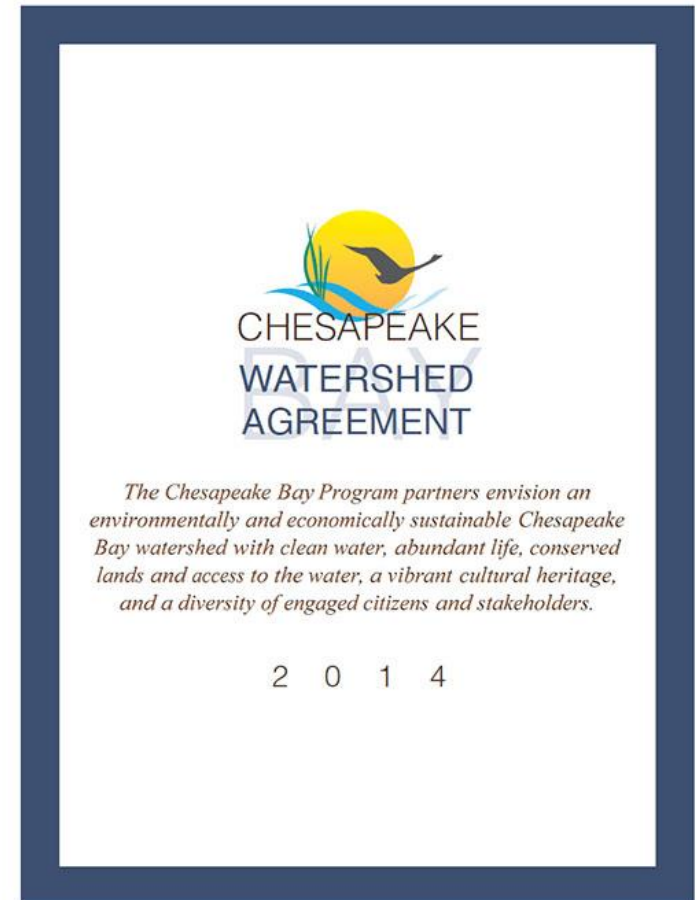
Chesapeake Bay Program

STAR Monitoring Team

Chesapeake Bay Program
Science. Restoration. Partnership.

Role at the Bay Program

- Assist with expansion of the monitoring program
  - Identify needs and gaps of the Goal Teams
  - Incorporate citizen science

- Ensure each outcome has a monitoring plan

- Trends and visualization of our indicators and metrics

CHESAPEAKE
WATERSHED
AGREEMENT

The Chesapeake Bay Program partners envision an environmentally and economically sustainable Chesapeake Bay watershed with clean water, abundant life, conserved lands and access to the water, a vibrant cultural heritage, and a diversity of engaged citizens and stakeholders.

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Incremental WQ Progress:
Draft Plan for Analyzing Water Quality Criteria Attainment Patterns

Bay Managers Call

July 28, 2015

Mindy Ehrich, Jeni Keisman, and Rebecca Murphy

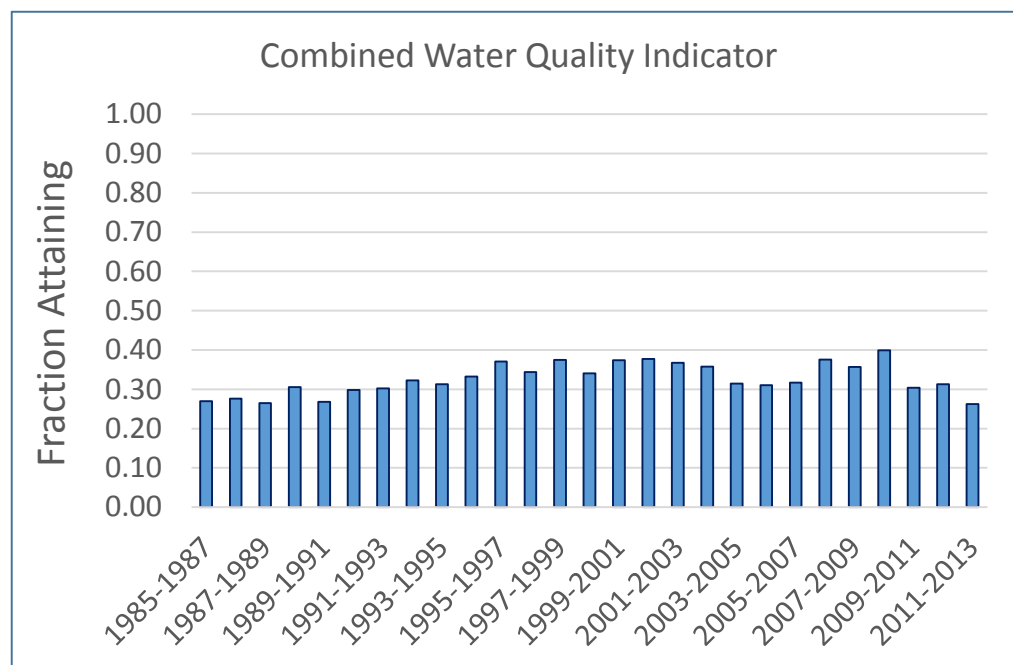Planning effort including: Rich Batiuk, Peter Tango, Richard Tian, and team

Chesapeake Bay Program
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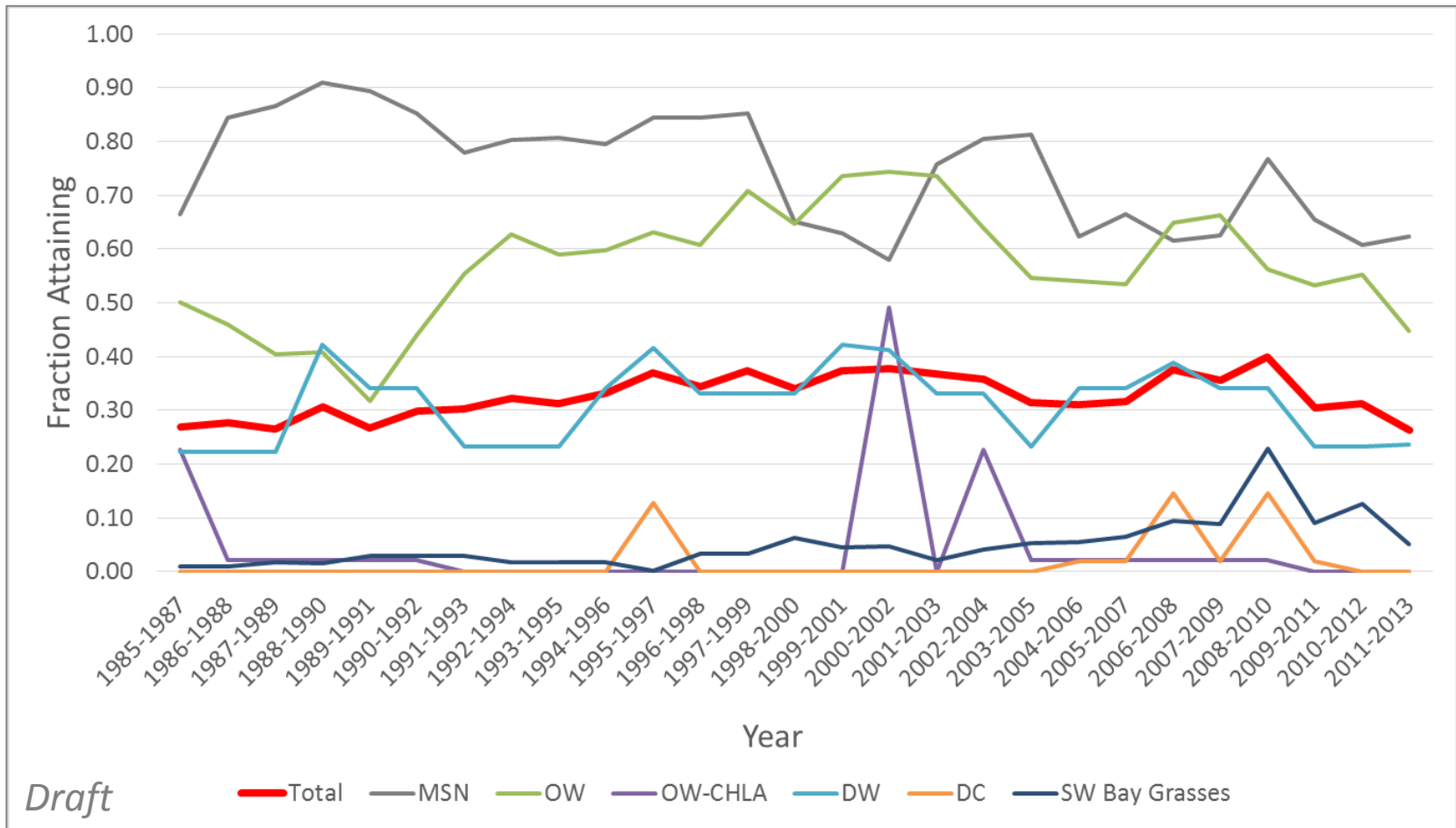
Current Water Quality Standards Indicator

Combined indicator: A Bay-wide fractional attainment indicator computed on a surface-area basis for all designated uses
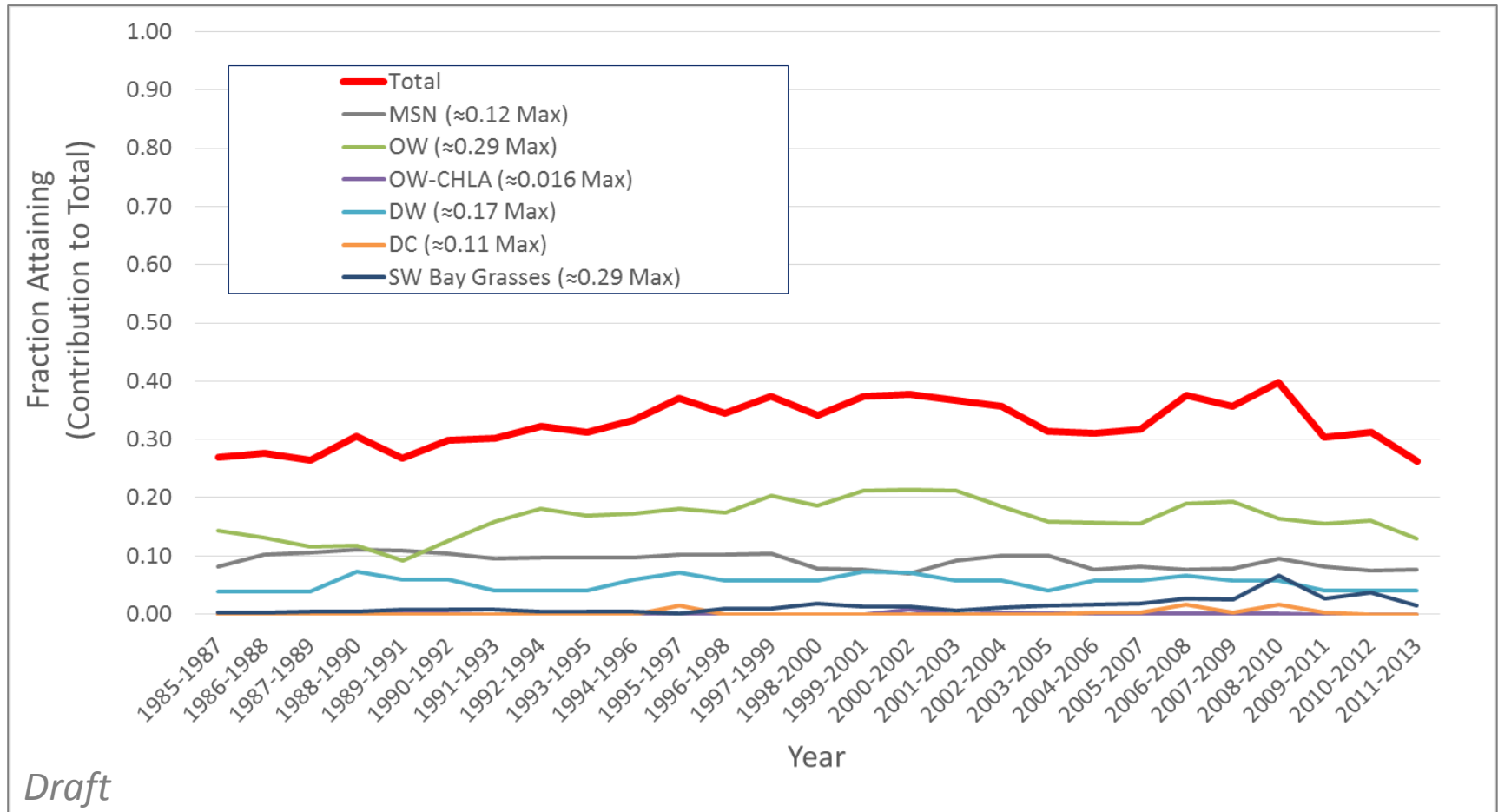
All individual criteria
- DO designated uses
  - Deep Channel (11 segments)
  - Deep water (25 segments)
  - Open water (91 segments)
  - Migratory fish spawning and nursery ground (73 segments)
- Chlorophyll (Spring 5 segments, Summer 7 segments)
- SAV and clarity (98 segments)

Combined Water Quality Indicator

Fraction Attaining

1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00

1985-1987, 1987-1989, 1989-1991, 1991-1993, 1993-1995, 1995-1997, 1997-1999, 1999-2001, 2001-2003, 2003-2005, 2005-2007, 2007-2009, 2009-2011, 2011-2013

Standards Attainment By Designated Use
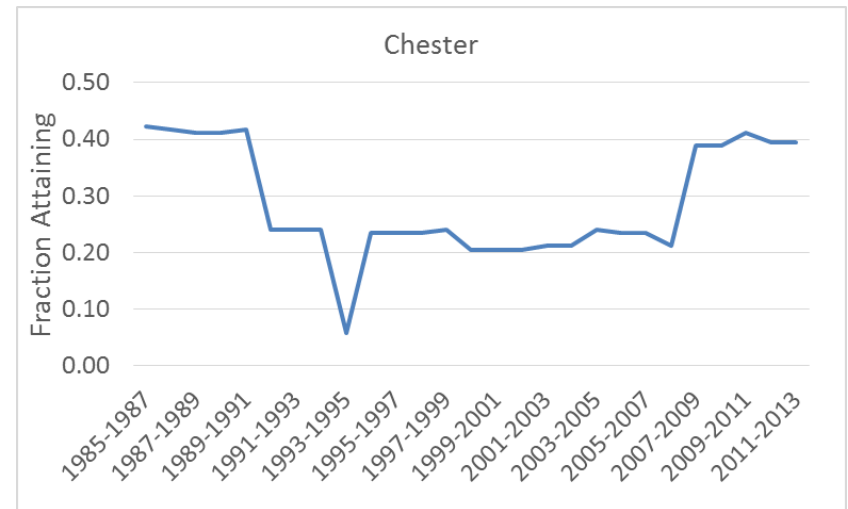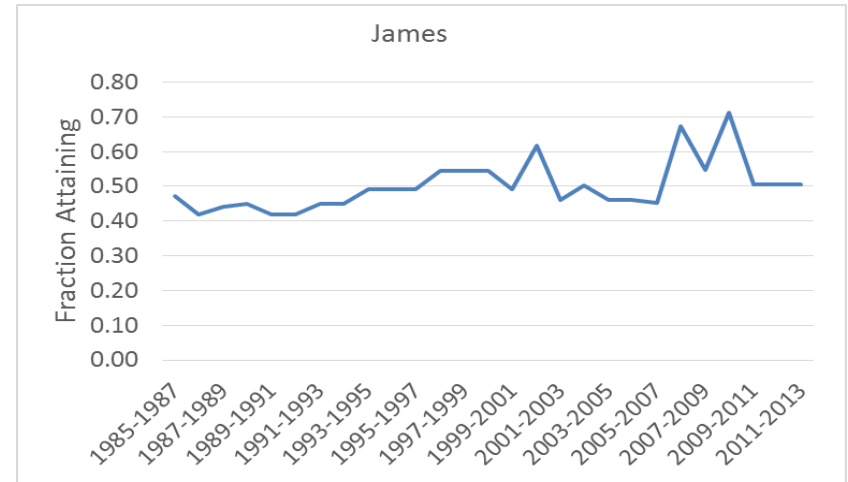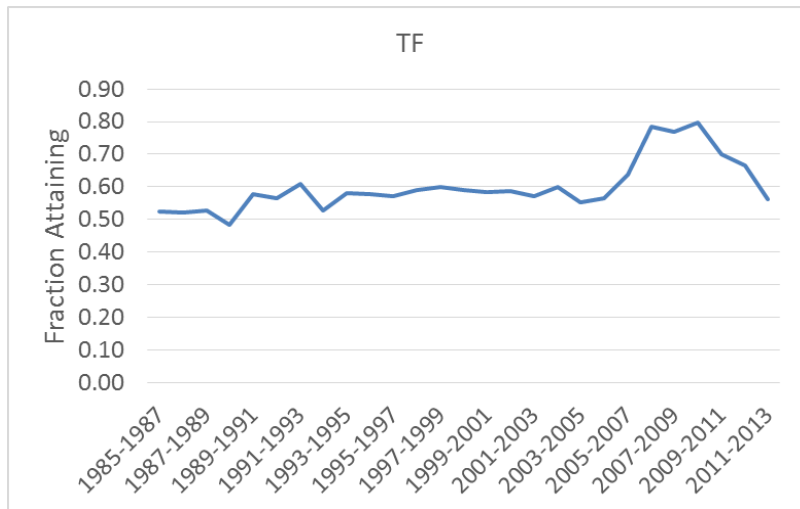

Draft

Contribution to Overall Attainment by Designated Use

Attainment Fraction Within Groupings

Examine surface-area weighted attainment records by:

- Salinity Zones
- Main vs. Tributaries
- Individual Tributaries
- Others?

Draft

Segment Level Analysis:
If not at attainment, is it getting closer?

- Previous graphs are based on whether or not each segment/DU is in attainment or not (i.e., yes/no)

- Other, more incremental, information is available from the attainment computations, specifically a fraction indicating "how close" the segment is to attaining
  - These are computed from the CFD curves
  - If the value is less than 1, the segment is out of attainment,
  - But if these fractions are increasing over time, this could be a useful information
  - We're calling it "Percent to Attainment"

Draft
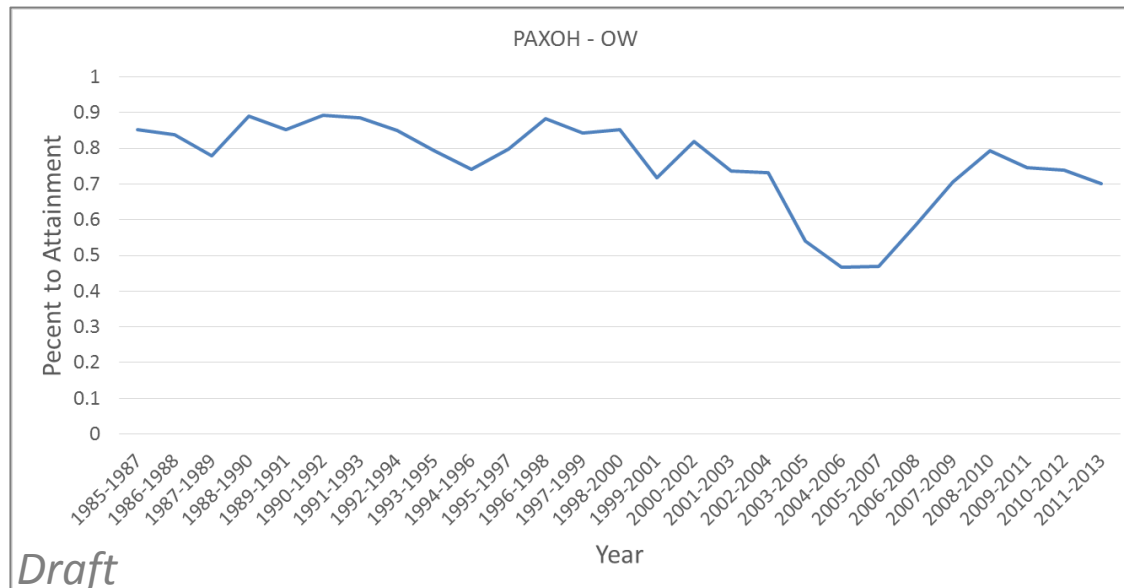
Segment Level Analysis
Percent to attainment: Trends over time

Shallow Water Trends from 1985 to 2012

Legend

cbseg_104

☐ Segments with no SW

Description

- Always and Mostly Attaining
- Sig +, Reaches 100%
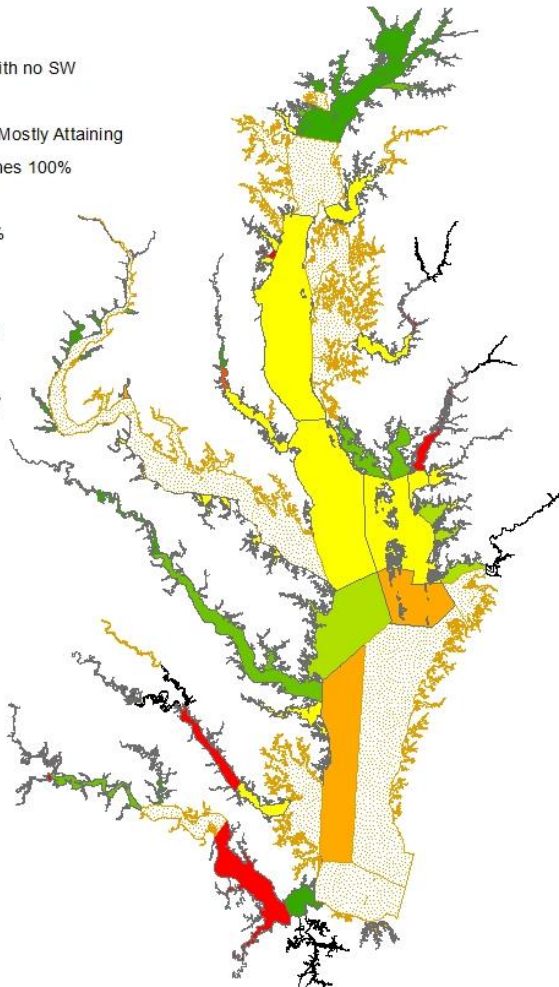- Sig +
- Sig +, Low %
- Low %
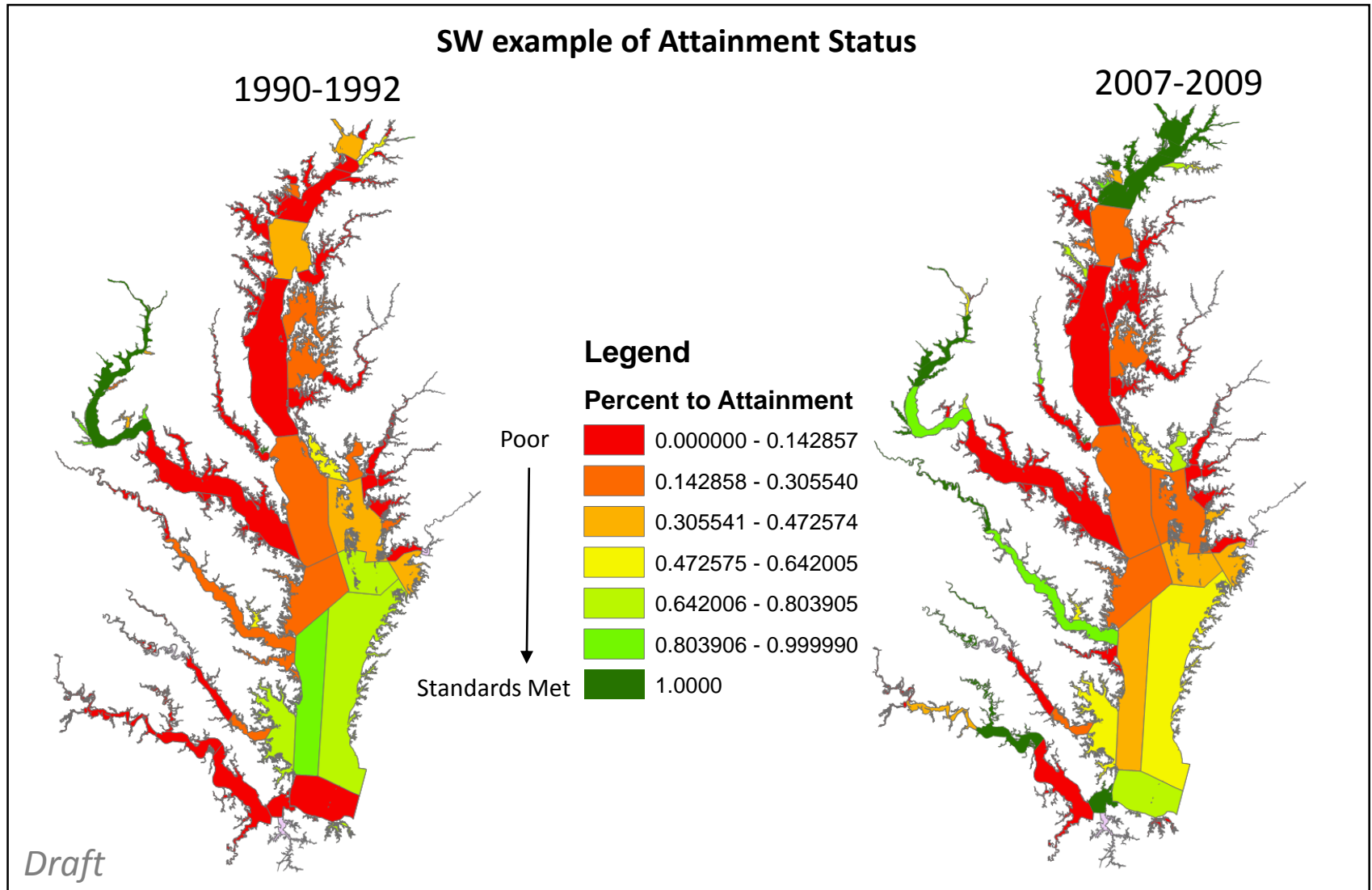- Sig -
- Sig -, Low %
- 0%
- No Category

- Trends computed by individual segments and DU (map is SW example)

- Describing Patterns in Percent-to-attainment
  - Comprehensive Table of Segment and DU and patterns found
  - Graphs of Each Segment
  - Maps
    - Segment Status
    - Trends

Category	Count	Category	Count
Always and Mostly Attaining	6	Low %	16
Sig +, Reaches 100%	20	Sig -	5
Sig +	8	Sig -, Low %	1
Sig +, Low %	4	0%	9

Draft

9
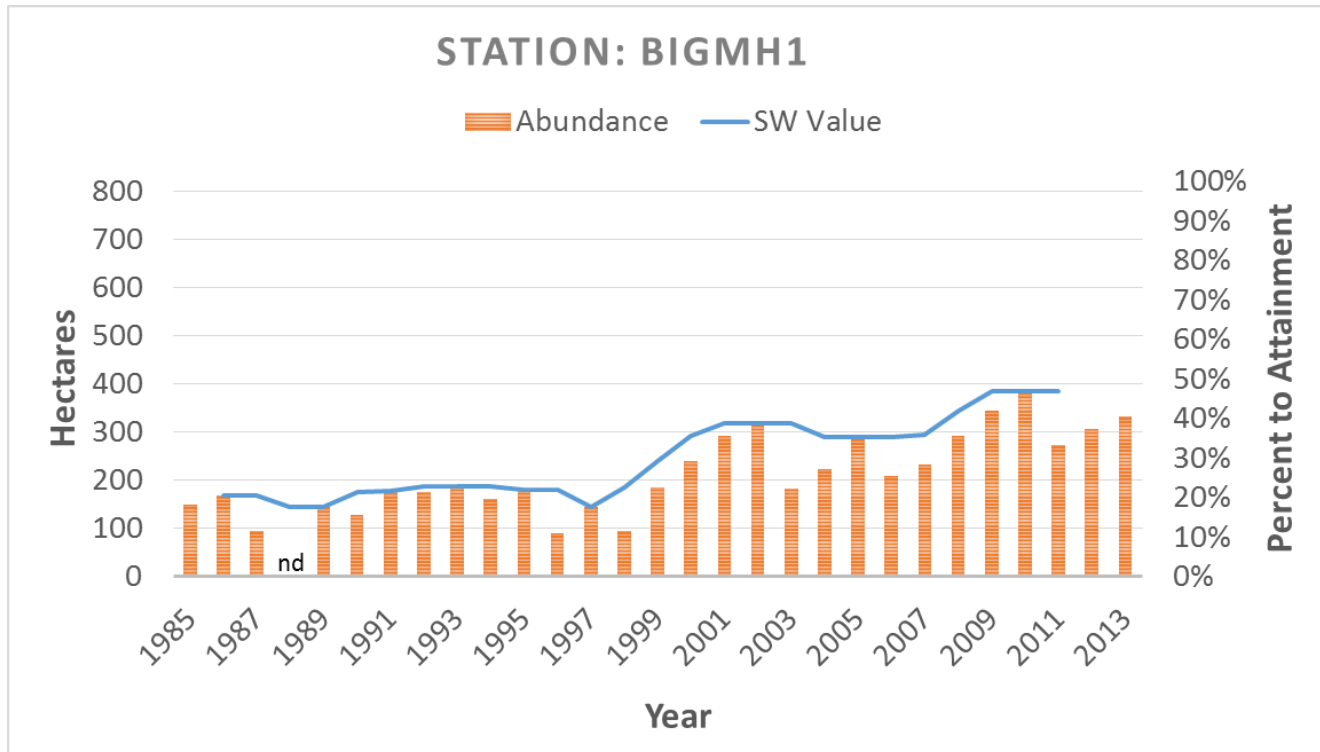
Segment Level Analysis
Percent to Attainment: for Segment Status

SW example of Attainment Status

1990-1992

2007-2009

Legend

Percent to Attainment

Poor

![red]	0.000000 - 0.142857
![orange]	0.142858 - 0.305540
![orange2]	0.305541 - 0.472574
![yellow]	0.472575 - 0.642005
![lightgreen]	0.642006 - 0.803905
![green]	0.803906 - 0.999990
![darkgreen]	1.0000

Standards Met

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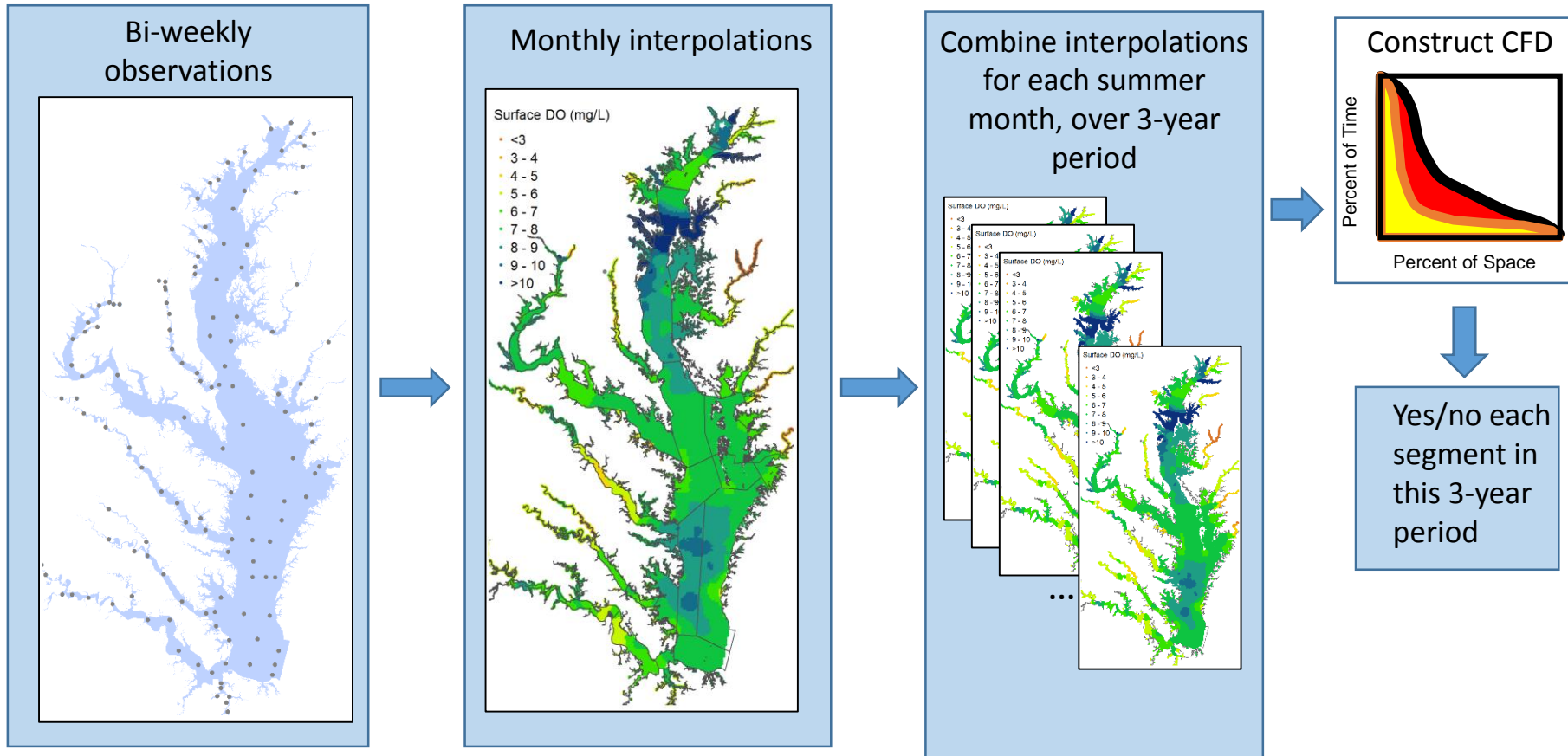
Does the monitoring data tell the same story as the attainment values?

Linking To Monitoring Data
DO and Incremental Computations

Bi-weekly observations

Monthly interpolations

Surface DO (mg/L)
- <3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9
- 9 - 10
- >10

Combine interpolations for each summer month, over 3-year period

Construct CFD

Percent of Time

Percent of Space

Yes/no each segment in this 3-year period

- Aggregation makes trend analysis on the attainment end-product difficult
- But intermediary interpolation output can be analyzed to identify where/when changes are happening → *probably a more sensitive indicator of water quality change*

Question/Ideas?

- Examine overall attainment patterns
    - Understand the combined attainment indicator
    - Compute attainment long-term patterns by Designated Uses and other groupings
- Evaluate incremental attainment metrics
    - Examine "percent-to-attainment" records
        - Pattern identification/maps by segment
        - Statistical trend analysis
    - Identify more sensitive indicators of change (that are components of attainment calculations)
        - SAV abundance
        - Interpolated DO concentrations by segment/DU by season
        - Link to findings from trend analysis of station-based data (e.g., GAMs)
- Test watershed factors influencing the changes
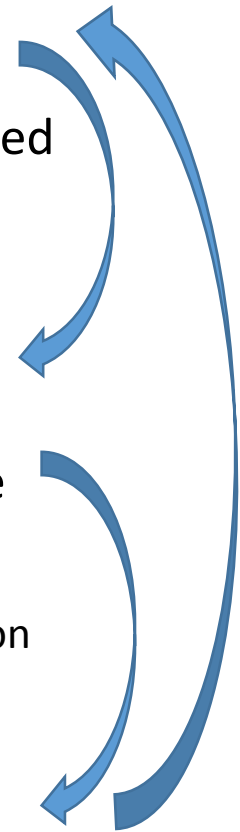
Continuously link each level of information to explain whole story

Extra: Segment map

Chesapeake Bay Segmentation Scheme
(For 303d listing - 92 segments)