PSC Review Update and Discussion

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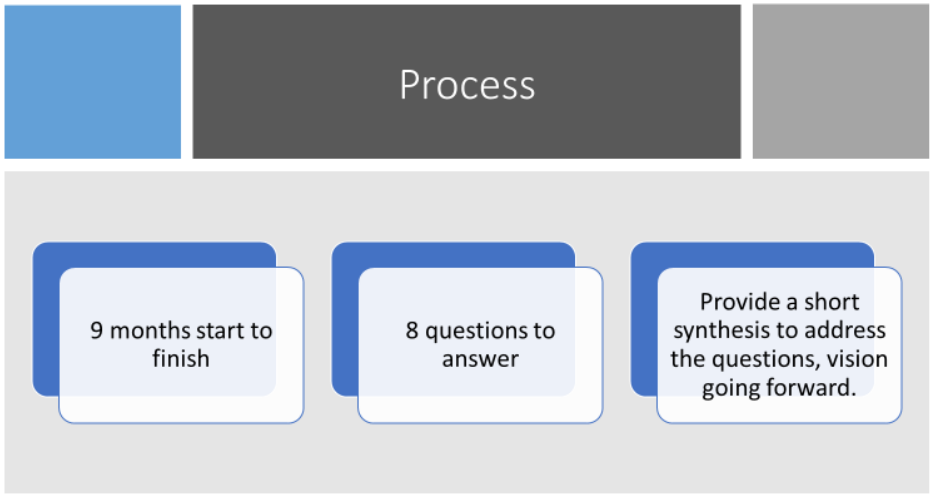
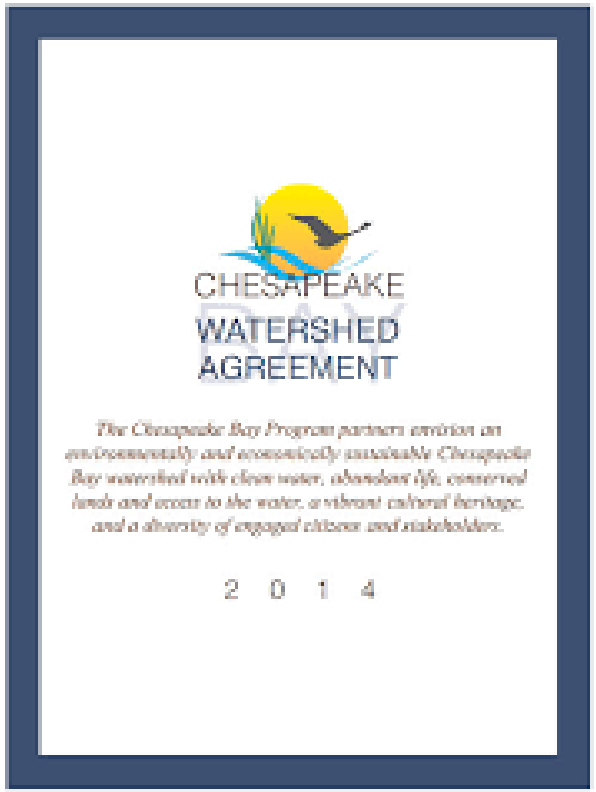
USGS
CBP STAR
1/26/2022





PSC Report Outline

- **Section 1** of the report provides **a summary of the monitoring recommendations** needed to address the improvement of the CBP monitoring networks.
  - High level funding recommendations.

- **Section 2** of the report provides **network portfolios of existing CBP monitoring networks** to highlight the status, vulnerabilities, monitoring gaps, enhancements, and available cost estimates to support resource need.
  - More detailed funding recommendations dissecting the high level funding numbers

- **Section 3** of the report **emphasizes the monitoring needs for all the outcomes in the *Chesapeake Bay Watershed Agreement***.
- **Section 4** of the report offers potential **opportunities to support and fund** the growing need of enhancing the networks **through a multi-partner strategy**.

- **Appendix. Answers to the original 8 questions** the community has addressed on the networks.

3 themes addressed in the review

1. Unassessed water quality criteria and standards
2. Explaining change in response to management actions
3. Accountability to the 2014 Watershed Agreement 31 outcomes
4. Opportunities for a partnership approach to enhance monitoring

Activity	Primary Themes in Monitoring		
	Unassessed Tidal Bay Water Quality Criteria	Explaining response to management actions	2014 Bay Agreement Goals and Outcomes
How we work	*Long term WQ Monitoring *SAV annual survey *Benthic annual survey *Community Science	Nontidal Network Land Use/Cover	Chemical, physical, biological, social change monitoring programs
What we do	Assess dissolved oxygen, water clarity, chlorophyll criteria and benthic macroinvertebrates for WQ standards attainment	Evaluate spatial status and trends in land, air, and water conditions Create understanding of management influence and targeting for restoration	Assess progress towards 10 goals and 31 outcomes
What we invest in monitoring	**"$TBD Million annually	**$TBD Million annually	***No specific synthesis available
What we need	• Sustaining existing foundations of monitoring programming • Strategic growth addressing gaps in space and time for monitoring needs • Address costs and cost effectiveness of programming		

	Unassessed Tidal Bay Water Quality Criteria	Explaining response to management actions	2014 Bay Agreement Goals and Outcomes
DRAFT **Investment to address needs**	+200,000 building to 600,000 annually in next 5 years: Maintain long term monitoring program +600,000 one-time cost: new hypoxia network 11 sensor arrays for short duration DO criteria +250,000 annually – operate and maintain hypoxia network +200,000 annually for 3 years: SAV satellite monitoring design and algorithm development +230,000 Nutrient limitation evaluation +90,000 annually next 4 years: develop, test, and maintain new 4D	+288,000 annually: Maintain long term network (243K PA, 45K station loss support) +520,000 one-time cost: improve River Input Monitoring network with continuous sensors +240,000 annually operate and maintain new RIM network "+TBD" annually for watershed-wide imagery tracking land use/cover	$276,000 Toxics YR 1 with 5% COLA in outyears Other outcomes developing designs, indicators and funding needs

DRAFT

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1. Jamboard activity will help identify next steps to reach this investment assessment and how the PSC can currently support your needs.
2. Peter will provide an example of the process going from need idea to monitoring assessment.

Overview of Outcomes' Monitoring Needs

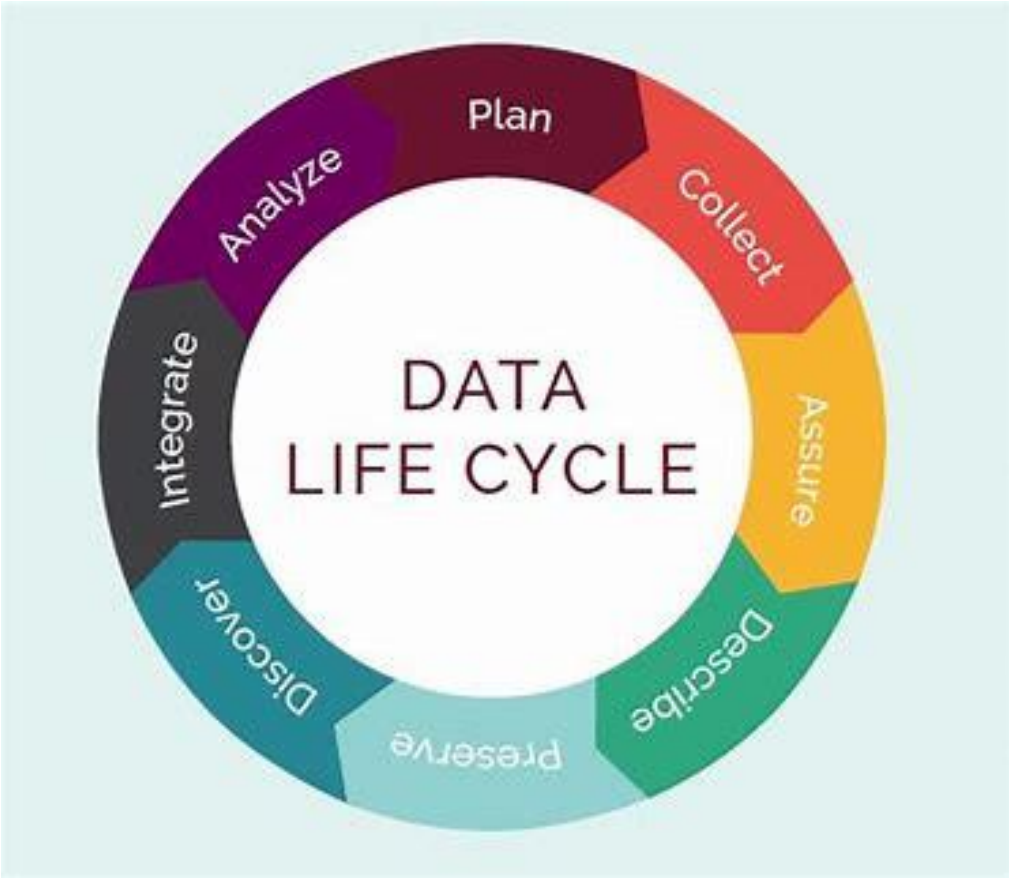
- Discussion:
  - Do the missing outcomes want to contribute monitoring needs?
  - Do any outcomes want to change their content?
  - Feedback from STAR

Style	Total	Outcome
Summary w/ cost estimates	1	Toxic Contaminant Research
Paragraph w/ management implications	8	Forage Fish, Stream Health, Brook Trout, Healthy Watersheds, Climate Monitoring & Assessment, Environmental Literacy Planning, Sustainable Schools, Student, Microplastics*
Science Needs database	5	Forest Buffers, Tree Canopy, WIP, Diversity, Public Access Site Development
No new monitoring needs	6	Fish Passage, Toxic Policy and Prevention, Protected Lands, Land Use Options Evaluation, Citizen Stewardship, Local Leadership, Climate Adaptation
Missing	5	Blue Crab Abundance Oysters Fish Habitat Wetlands Black Duck

Note - SAV, Land Use Methods and Metrics, and WQSAM monitoring needs are included in the earlier sections

I need monitoring.

Going from concept to funding recommendations



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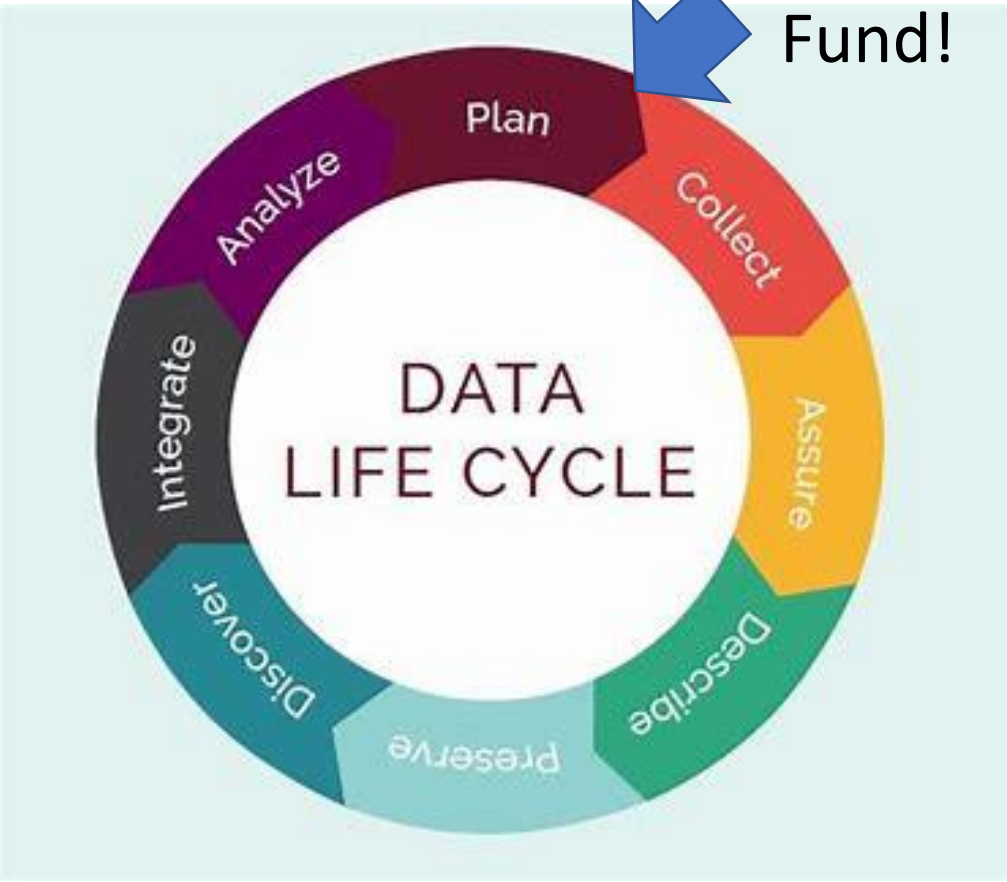
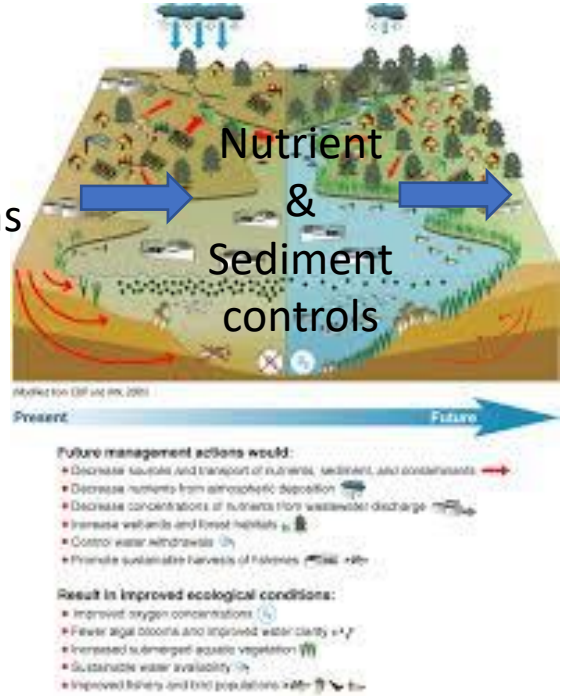
Going from concept to funding recommendations



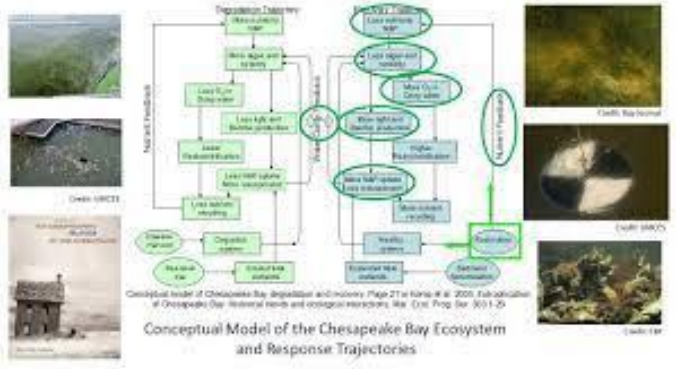
Example in our PSC Report: Why are we interested in nutrient limitation?

- We have a conceptual model about how the bay works.
- This is key to justifying investment in any measure for a monitoring program.
    - Nutrient limitation is a measure of availability of nutrients to algae so we understand our state of control on algae growth.
- Nutrient limitation of algae is a key to our understanding about eutrophication in Chesapeake Bay.

Degraded Habitat:
Dead zones
Algal blooms
Poor clarity
Little SAV

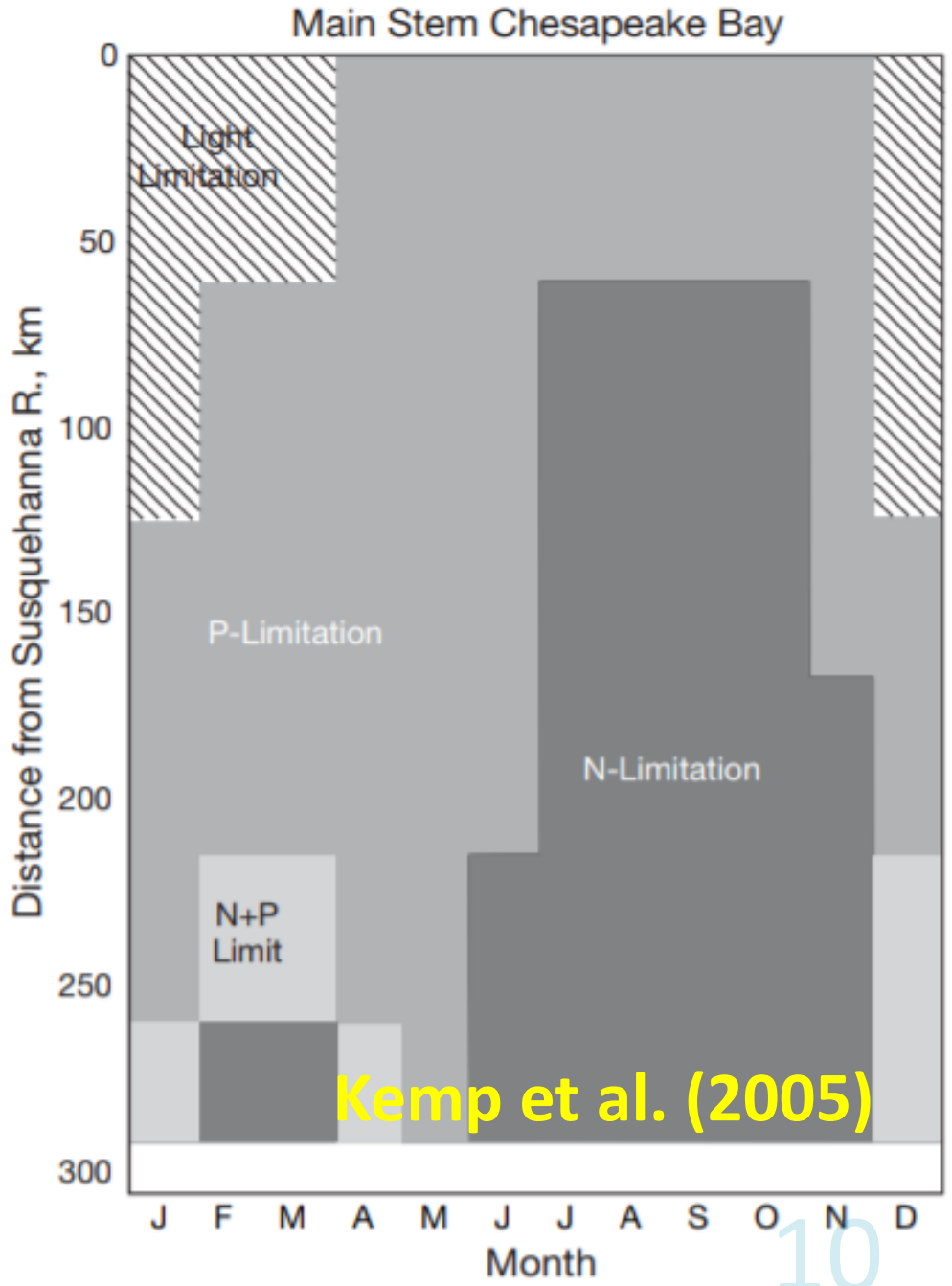


Healthy Habitat:
Healthy oxygen
Healthy algae
Good clarity
Good SAV



Background

- Eutrophication and hypoxia are recurring issues in the Bay.
- Large-scale dual nutrient reduction goals have been in place across the watershed for decades.
- Chesapeake Bay has well-documented seasonal and spatial variations in nutrient limitation to algal growth (e.g., Fisher et al. 1999, Kemp et al., 2005).



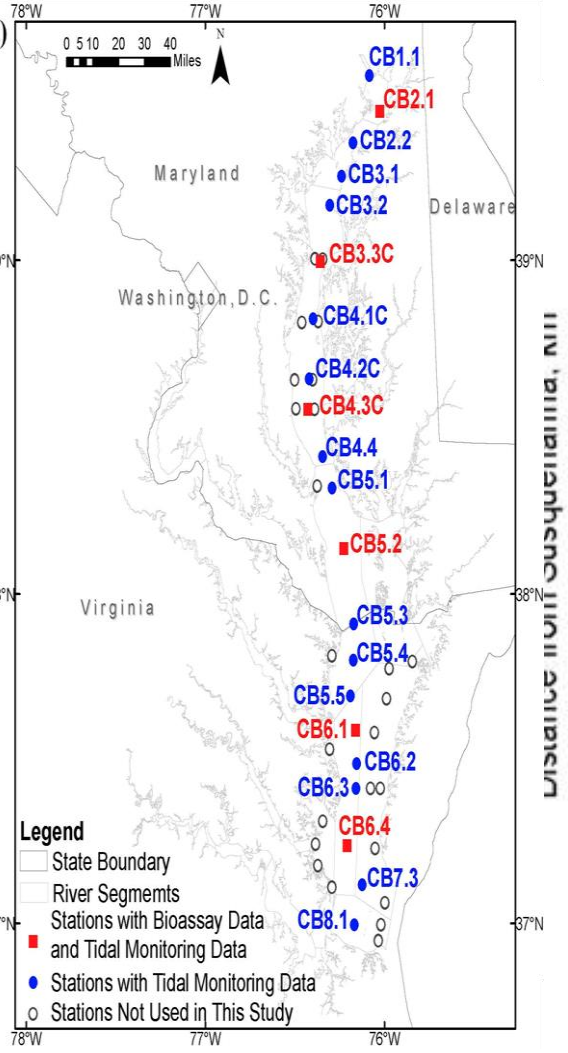
Hypothesis

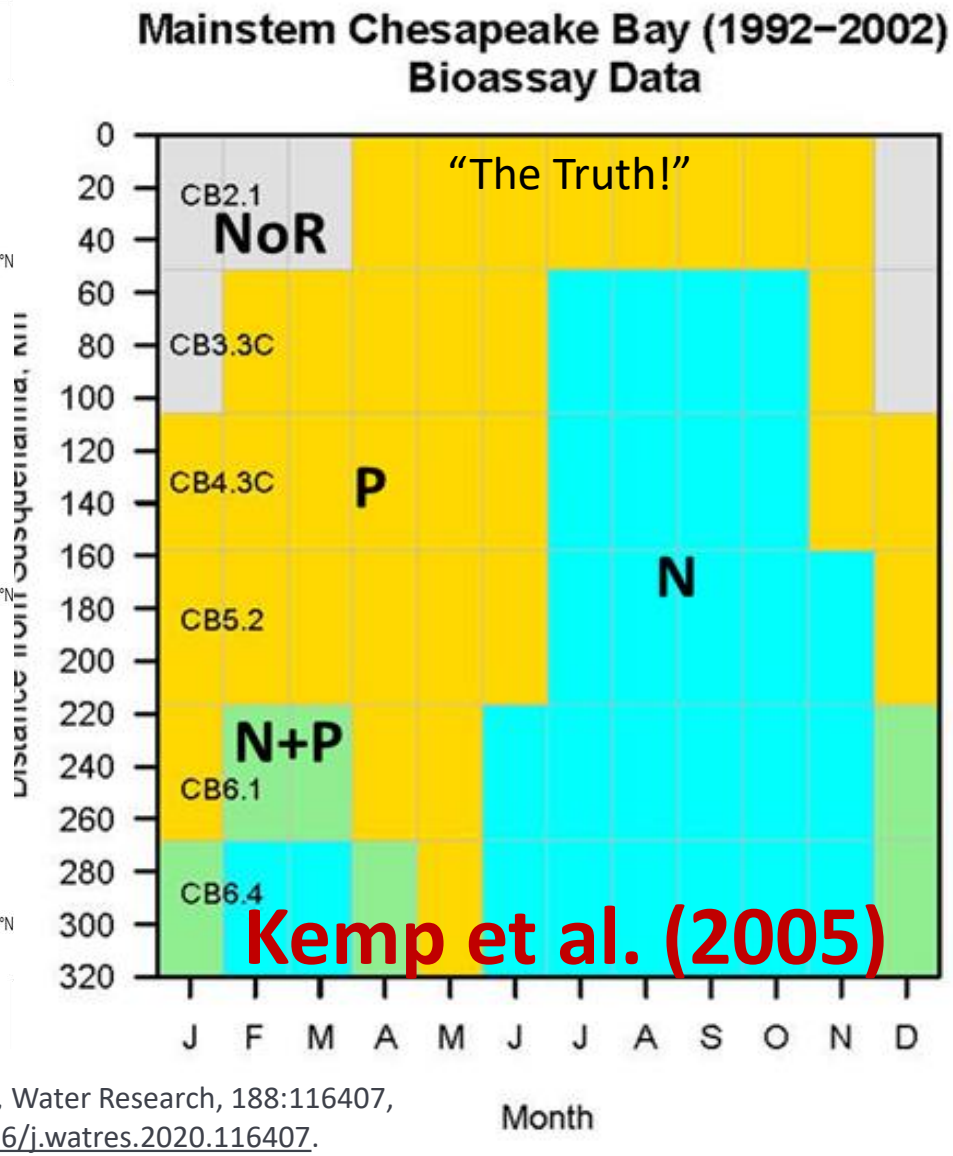
Given the long-term efforts to reduce nutrients to the Bay and different trends in N and P loads, nutrient limitation patterns in the mainstem Bay may have changed temporally and spatially over time.

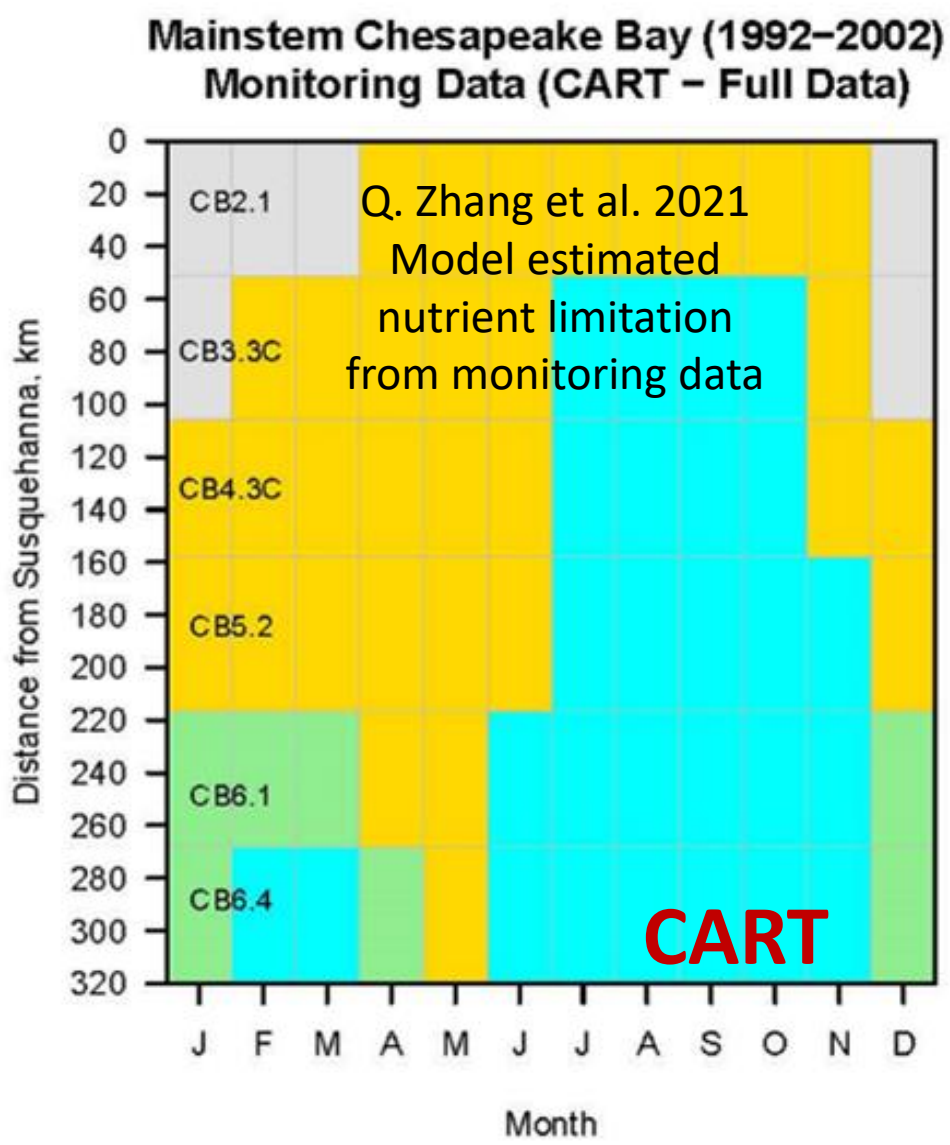
Objectives – We have not had bioassay monitoring for many years, so, what can we do in the interim?

1. To develop empirical approaches (i.e., statistical models) to relate annual monitoring data (something we have a lot of) to the bioassay-based nutrient limitation results ("the truth") in the concurrent period of 1992-2002 ("Goal 1")
2. To apply the developed statistical modeling approach that estimates nutrient limitation from annual water quality data to predict nutrient limitation and explore potential changes in limitation in response to altered nutrient loading from the decades of management actions ("Goal 2").

Step 1. Show that our model can recreate historical knowledge of bioassays in space and time.



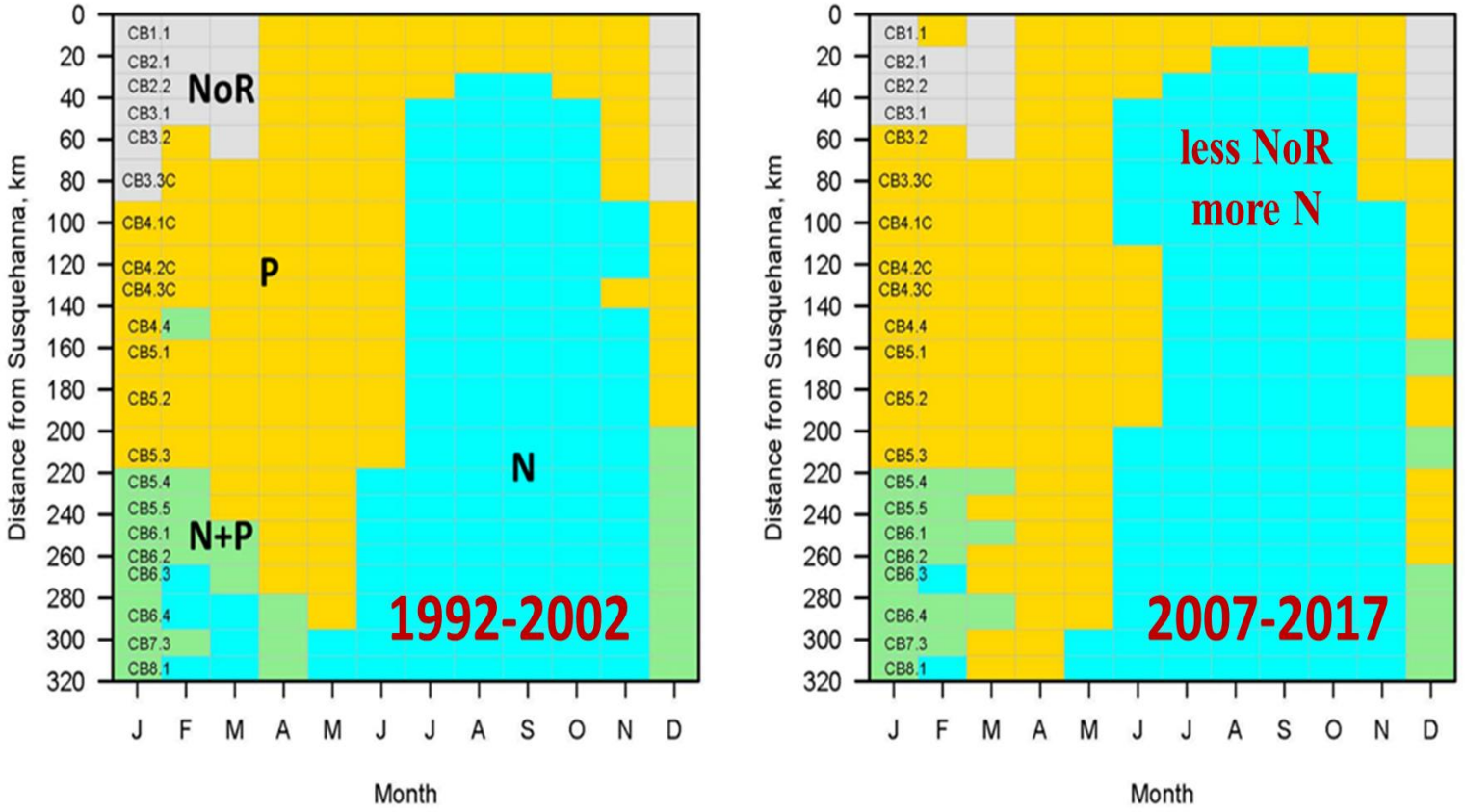




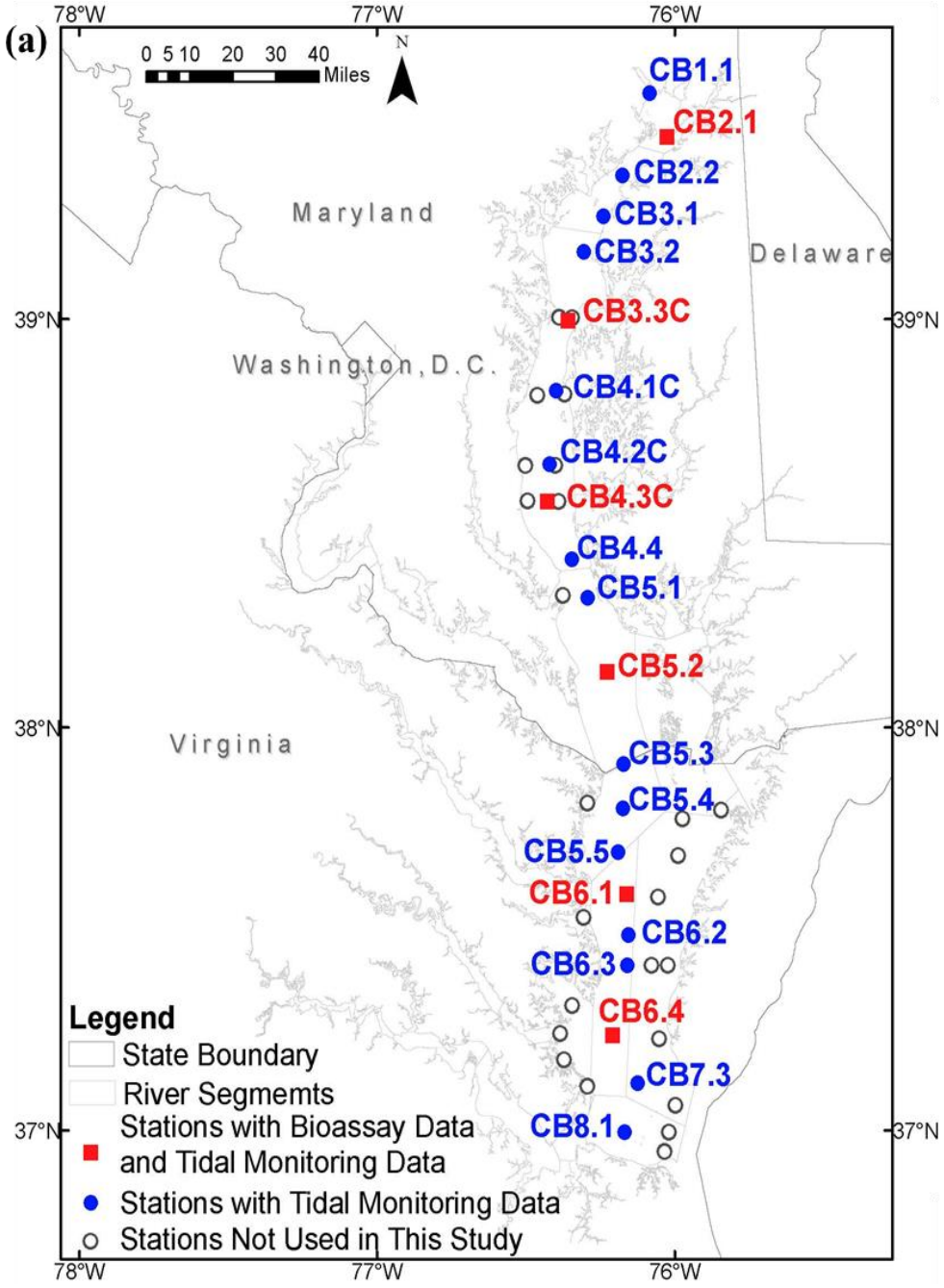
* Zhang, Fisher, et al. (2021), Water Research, 188:116407, https://doi.org/10.1016/j.watres.2020.116407.

STEP 2: APPLY MODEL. ESTIMATE BAY RESPONSE TO NUTRIENT MANAGEMENT AFTER 20 YEARS

- Long-term reductions in N load appear to have led to expanded areas with N-limitation, suggesting long-term improvement in water quality.



Zhang, Fisher, et al. (2021)



I. STEP 3. Use historical monitoring design to guide investment in new bioassays to confirm bay condition and model estimation

* Zhang, Fisher, et al. (2021), Water Research, 188:116407, https://doi.org/10.1016/j.watres.2020.116407.

Step 4. With sampling design in hand, develop costs for staff, samples, monitoring and assessment

- Frequency of sampling needed
- How many locations
- How many people are needed
- What skill level is needed
- How much travel is needed
- What equipment is needed
- What is the cost of analyzing any samples collected
- Who will manage the data
- Communications – what are you expecting for sharing the results

2020 Budget for Monitoring Bioassays-Chesapeake Bay Program (1 Year)	
	annual
A. Salaries and wages	
1. Senior Personnel	
a. PI (2 months, data analysis, report & manuscript writing)	23333
2. others	
a. Co-PI (12 months: oversight, sample pickup, bioassays, data management)	75431
b. Graduate Student	0
3. total salaries and wages	98764
B. Fringe - Co-PI: 38 % of salaries and wages, PI: 10% of S&W	30997
total A + B	129761
C. Permanent equipment	0
D. Expendibles	
1.filters, vials, reagents, glass, plasticware, carboys, cubetainers, incubators, etc.	5000
2. Licor Sensor and logger	2300
E. Travel	
vehicle charges for sample pickup (72 trips/y, $100/trip)	7200
vehicle charges for meetings & seminars (2 trips/y, $100/trip)	200
presentation of results at scientific meeting	0
F. Other costs	
1. Projected Analytical Services Lab (nutrients) - 144 samples @ $16.20	2333
2. Projected Analytical Services Lab (CHN) - 144 samples @ $12.80	0
3. Projected IT Services	2231
4. Communication costs (phone, xerox)	100
G. Total direct costs (A3 + B + C + D + E + F)	149125
H. Indirect costs, 54% of G	80527
I. Total project costs (G+H)	229652

Jamboard Discussion

- What partners are currently supporting a monitoring need?
- What next steps would help GITs mature their monitoring needs to include information such as design considerations, sample location(s), frequency, equipment, and cost estimates?
- What funding opportunities are available to complete these and future next steps?