Water Quality Monitoring Program 2021-2022 for Tidal Creeks in Calvert County, Maryland

University of Maryland
Center for Environmental Science
Chesapeake Biological Laboratory

Pictured: Hall Creek

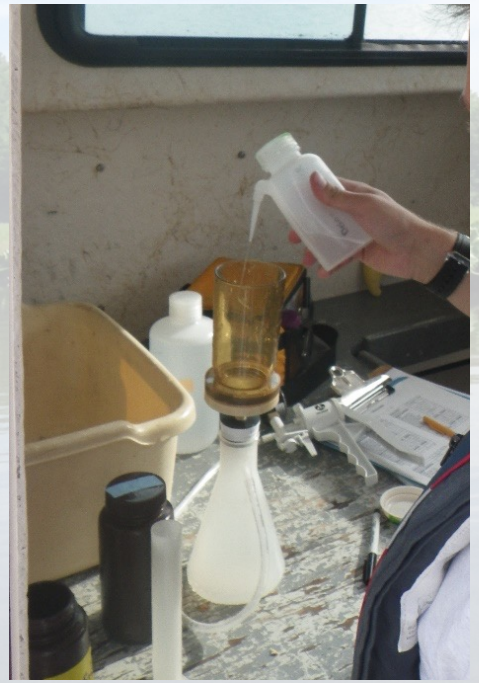
Tidal Water Quality Sampling Program in Calvert County

Solomons Harbor since 1987

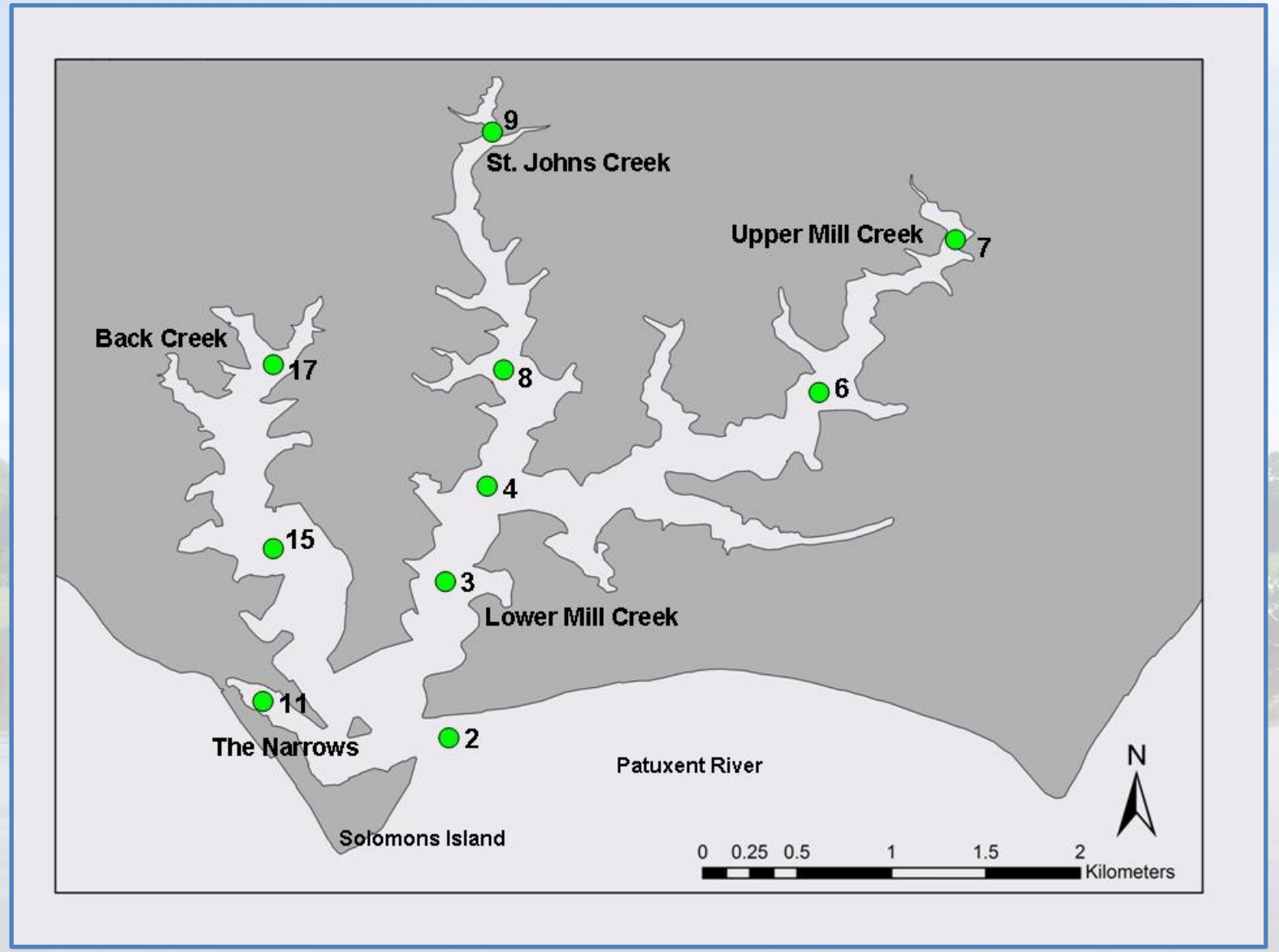
A larger collection of smaller Calvert County tidal creeks beginning 2009

Parameters Measured:

dissolved oxygen, temperature, salinity, chlorophyll-a, secchi depth



Solomons Harbor Stations



2021, 2022 in The Context of Previous Years

Oxygen:

Best 2012>2012>1991>1997>2002>1992>1994>2001>2010>2009>1998>2014>2013>2016>1996>2000>2006>1999>2015>1995>1990>**2021**>2011>1987>2019>2005>**2022**>1993>2007>2004>2008>2018>2017>2020>2003 **Worst**

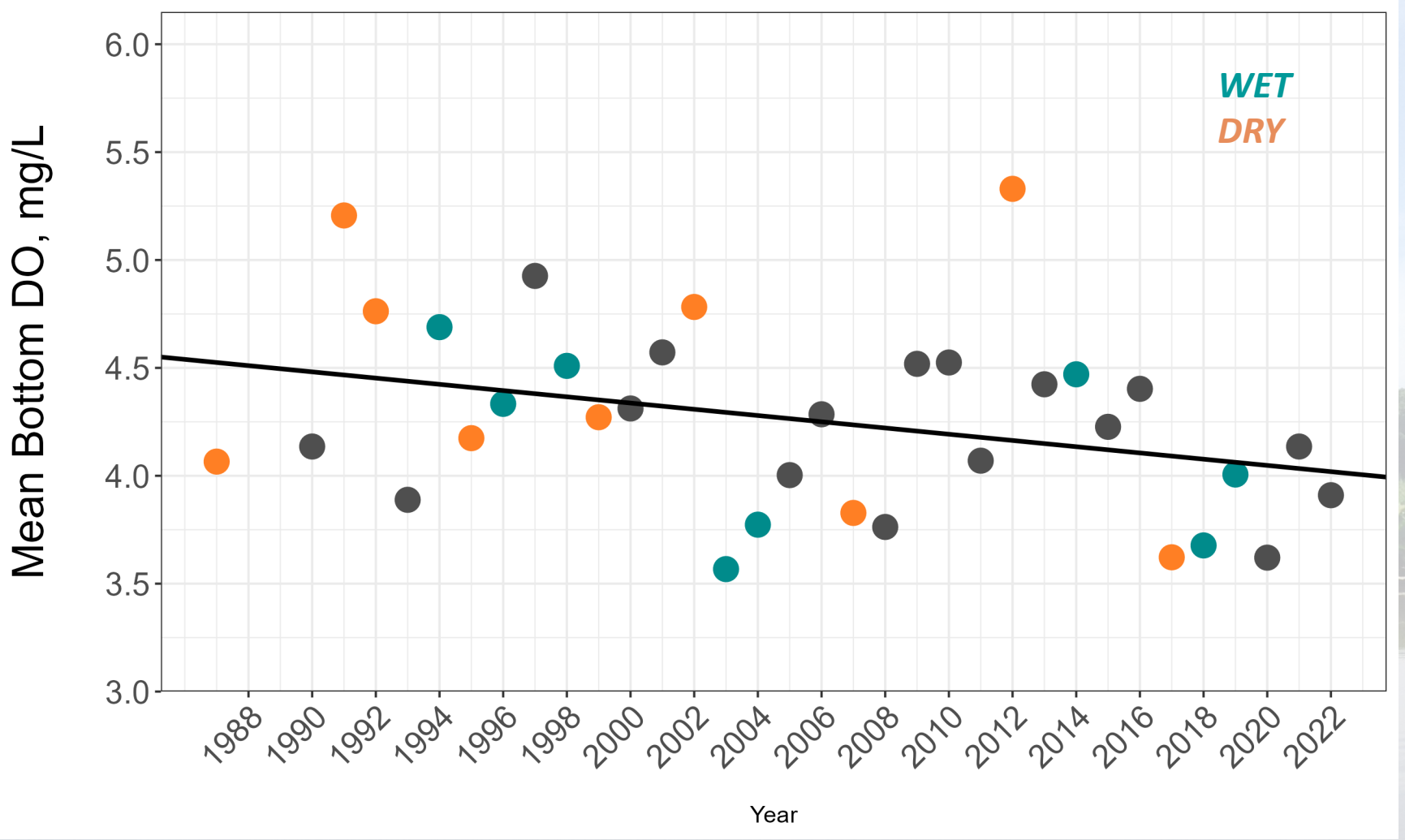
Algae:

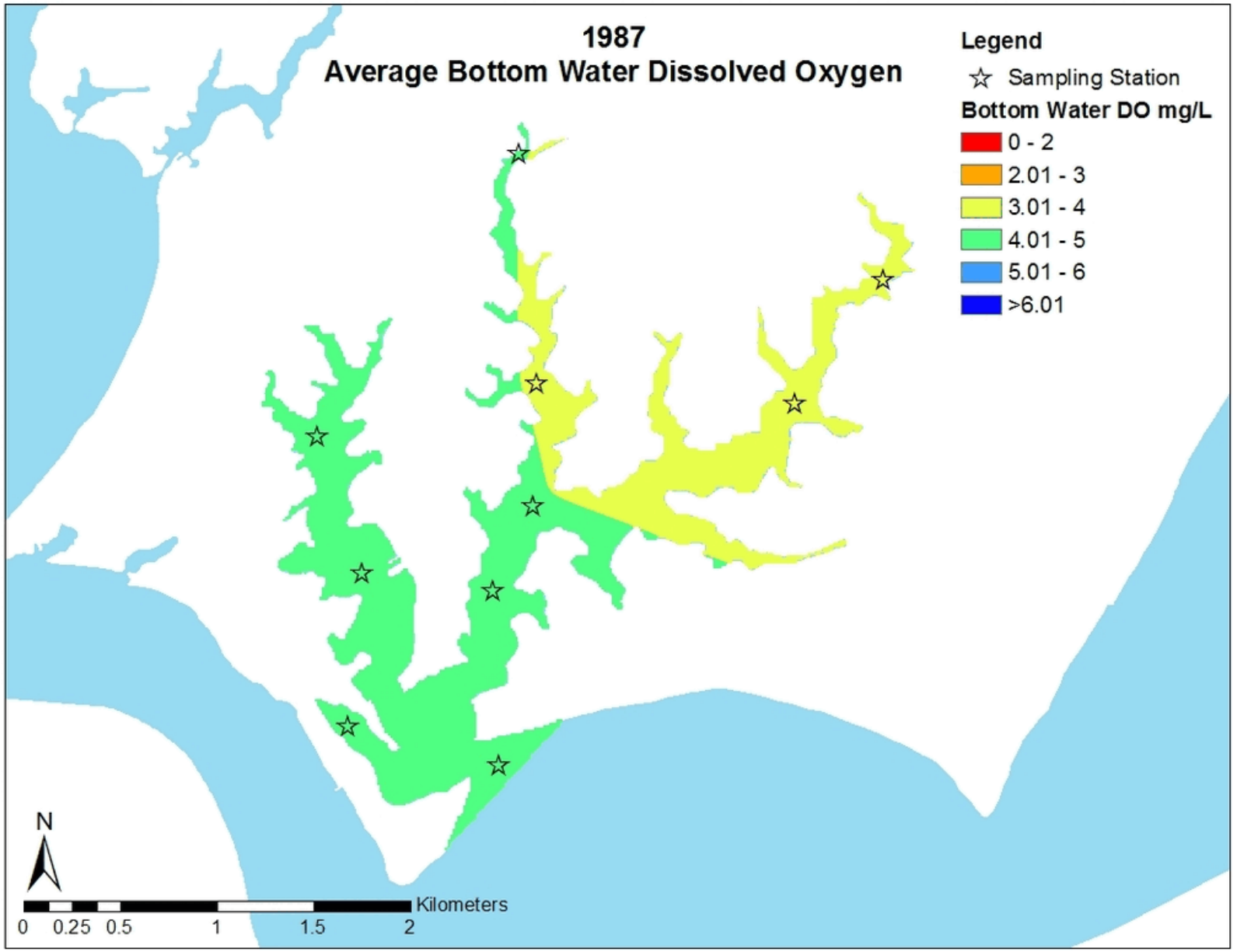
1991<1992<1995<1999<2002<2000<1997<1993<1987<**2022**<2012<2016<2001<1994<2006<2015<2005<**2021**<2013<1990<2009<2008<2017<1996<2014<2018<2004<2010<2007<2020<1998<2019<2011<2003

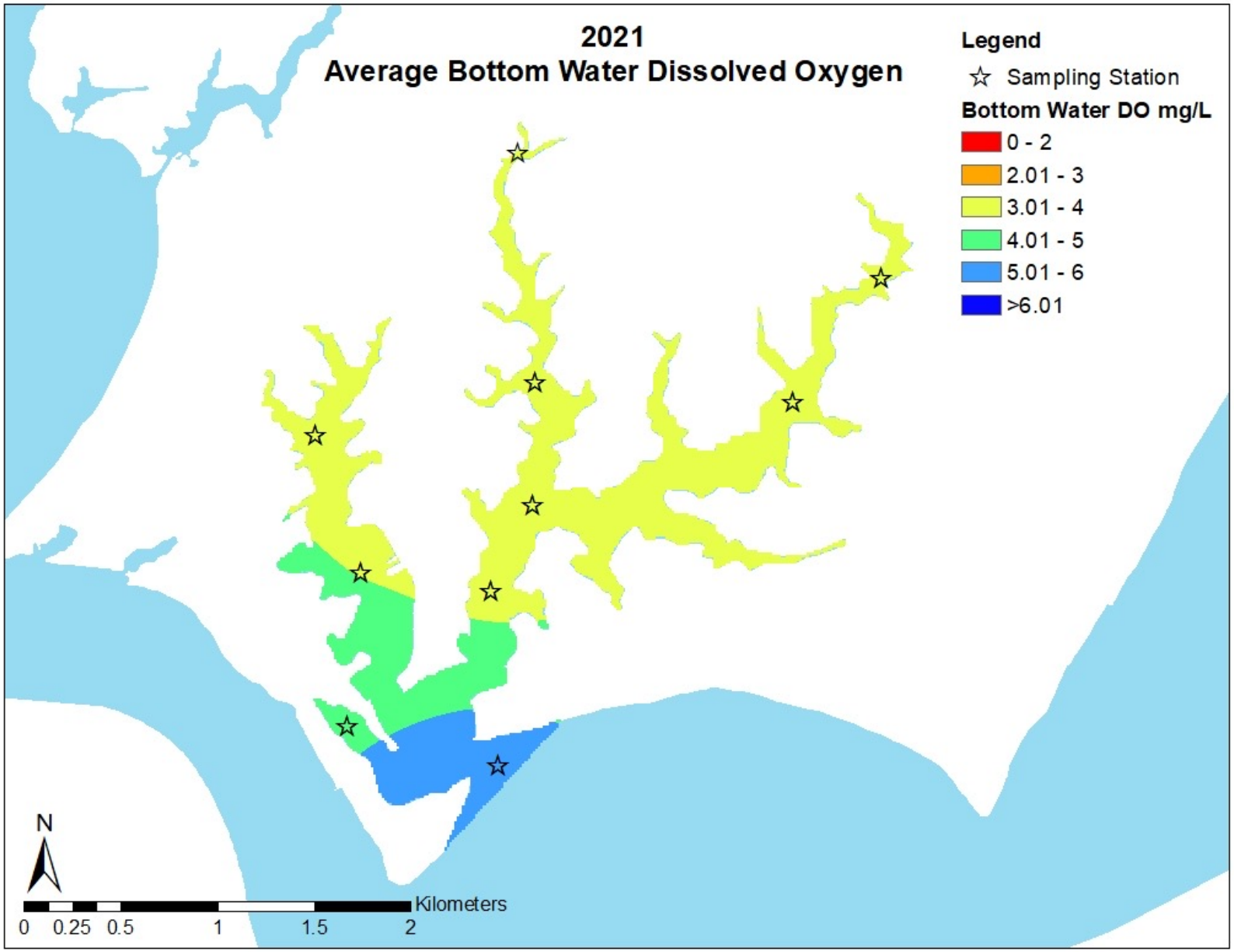
Blooms:

1999<1995<2002<1991=1992<2005<2012<1993=1997=2000<1987=1990=2013<2006=**2021**<2009<**2022**<1994=2001=2015=2016<1996=2008=2014=2017=2020<2004=2010<2018<2019<1998<2007<2011<2003

Oxygen at 5 Long-term Sites




1987
Average Bottom Water Dissolved Oxygen
Legend
Sampling Station
Bottom Water DO mg/L
0 - 2
2.01 - 3
3.01 - 4
4.01 - 5
5.01 - 6
>6.01
N
Kilometers
0 0.25 0.5 1 1.5 2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Average Bottom Water Dissolved Oxygen
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Sampling Station
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3.01 - 4
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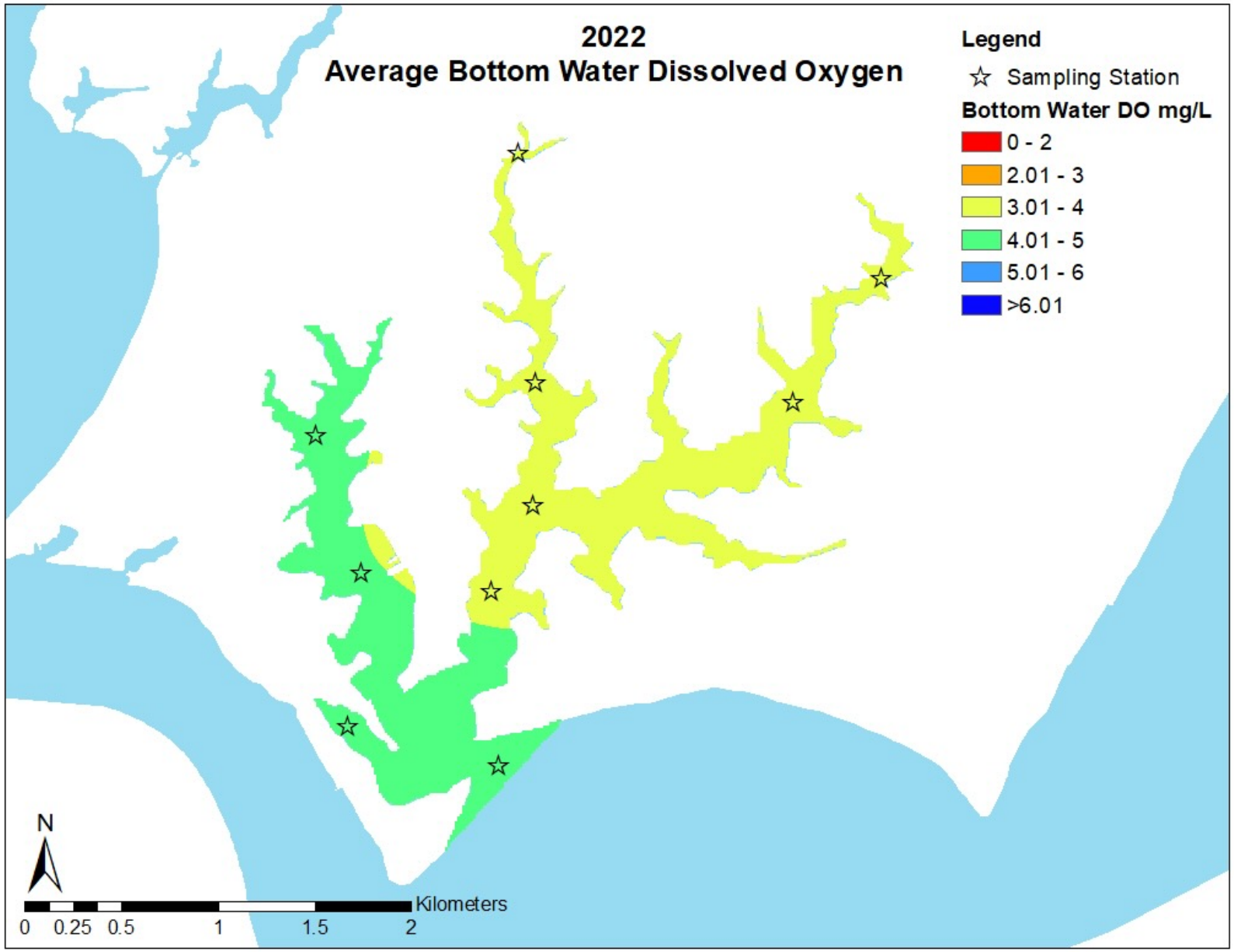
2022
Average Bottom Water Dissolved Oxygen
Legend
Sampling Station
Bottom Water DO mg/L
0 - 2
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4.01 - 5
5.01 - 6
>6.01
N
Kilometers
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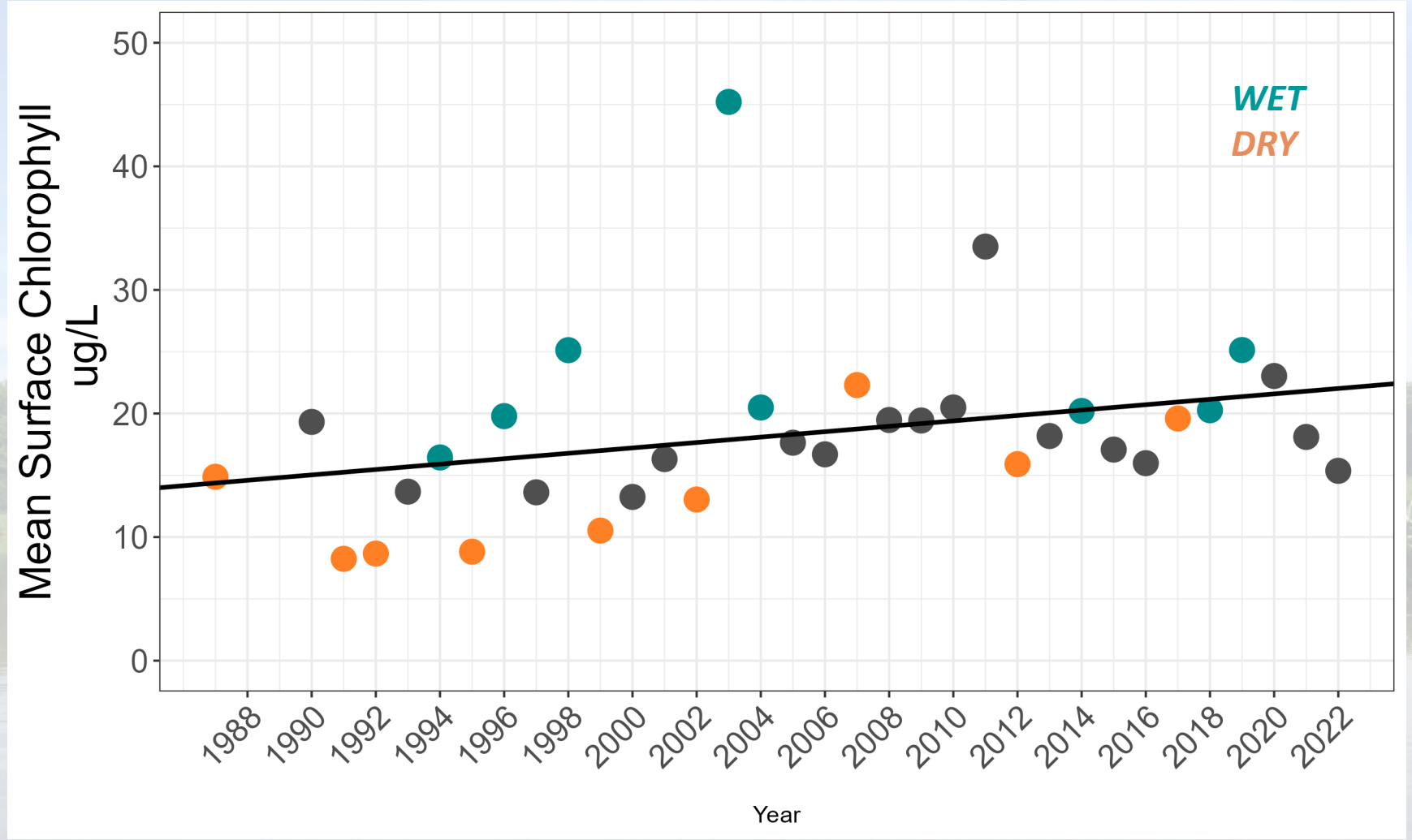
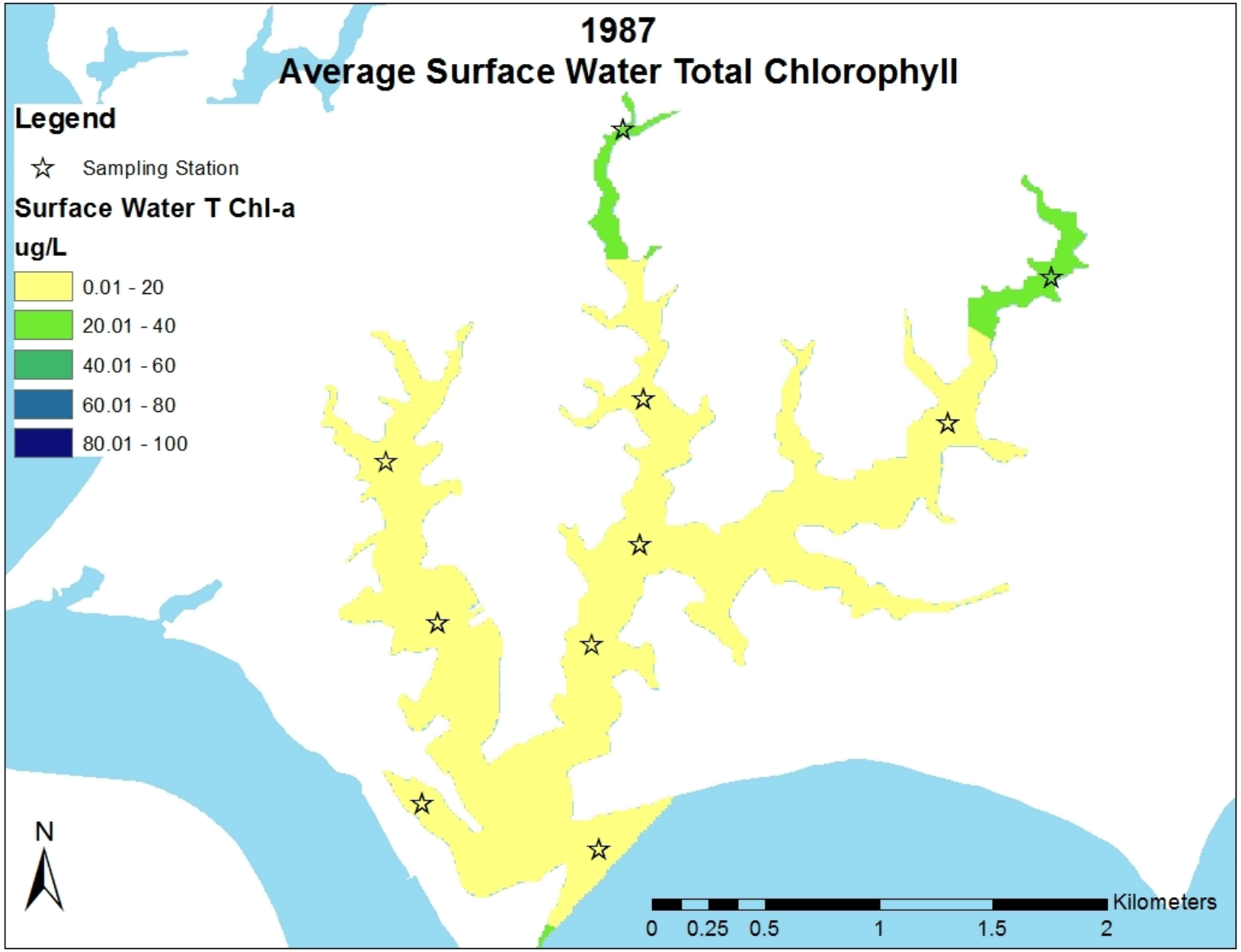
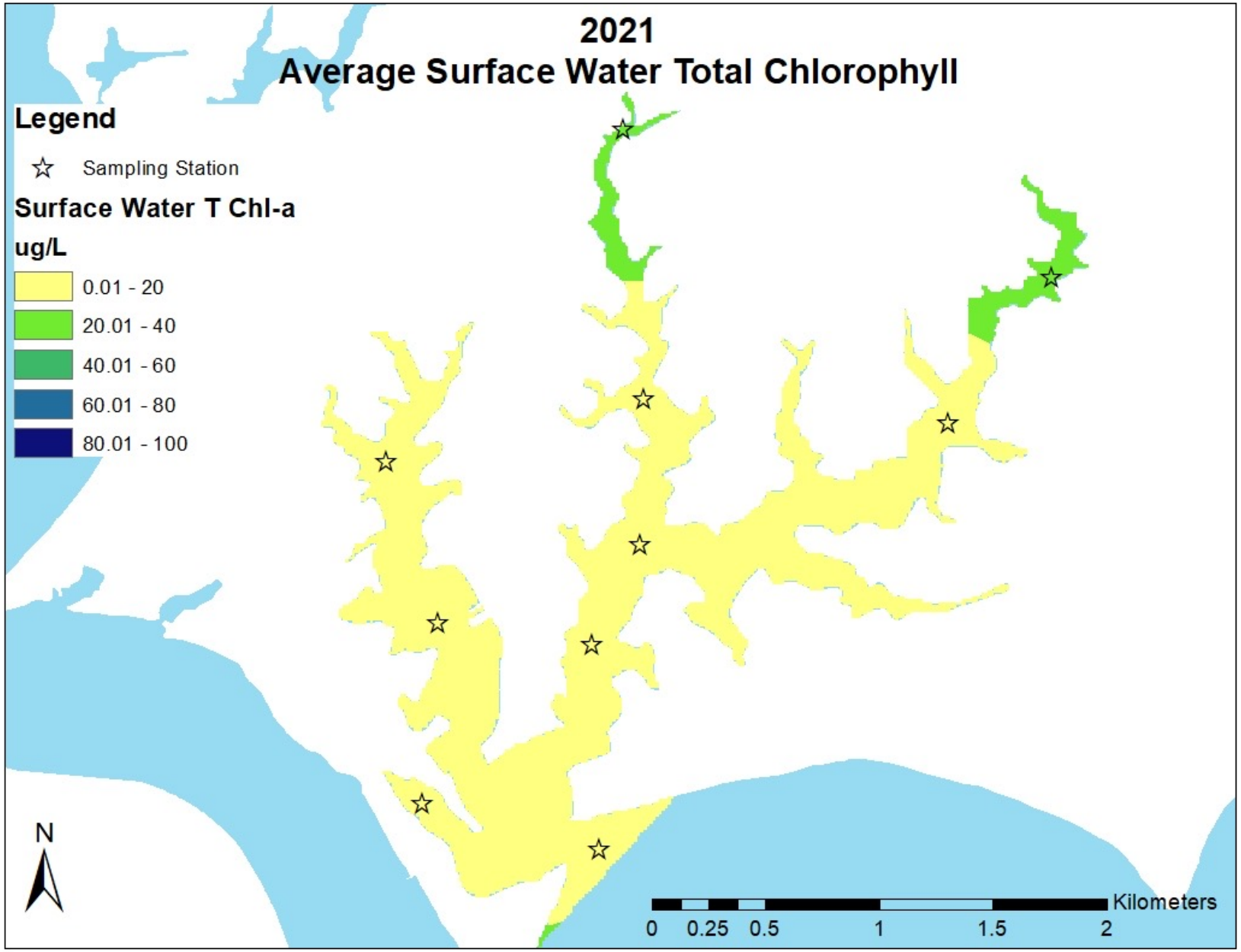
Algae at 5 Long-term Sites




1987
Average Surface Water Total Chlorophyll
Legend
Sampling Station
Surface Water T Chl-a
ug/L
0.01 - 20
20.01 - 40
40.01 - 60
60.01 - 80
80.01 - 100
N
0 0.25 0.5 1 1.5 2
Kilometers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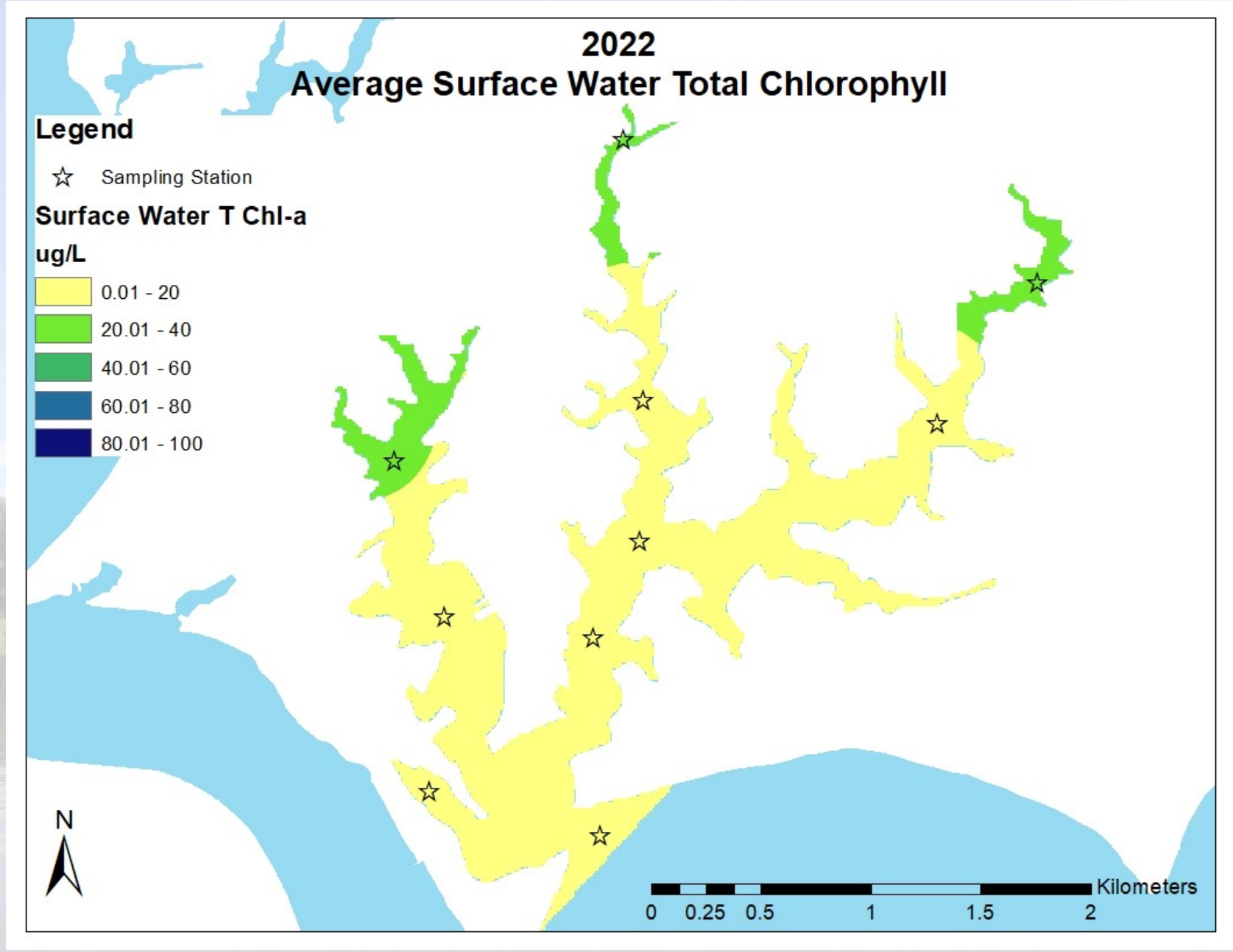
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Surface Water T Chl-a
ug/L
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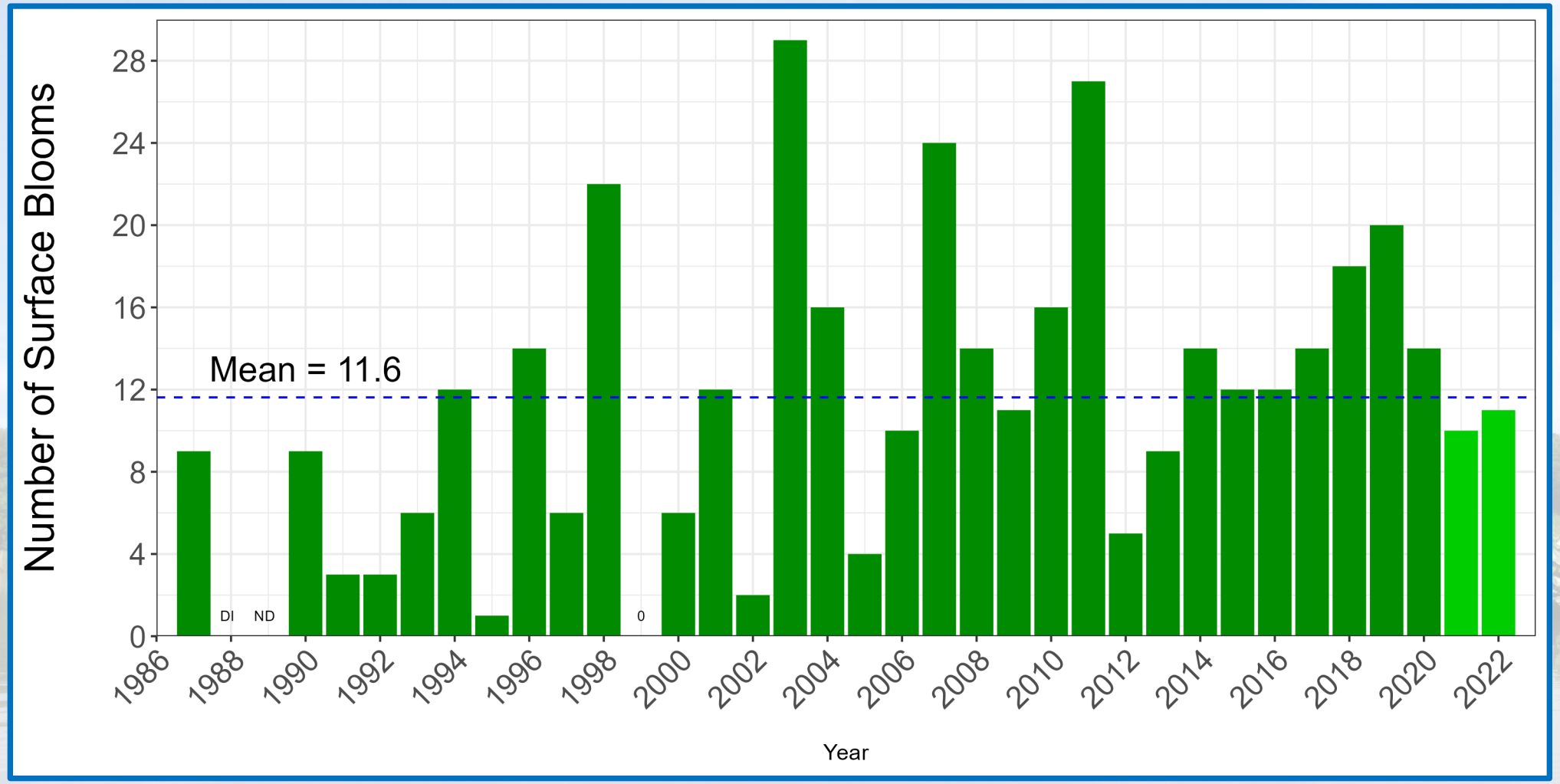
20.01 - 40
40.01 - 60
60.01 - 80
80.01 - 100
N
0 0.25 0.5 1 1.5 2
Kilometers

Algal Bloom Frequency



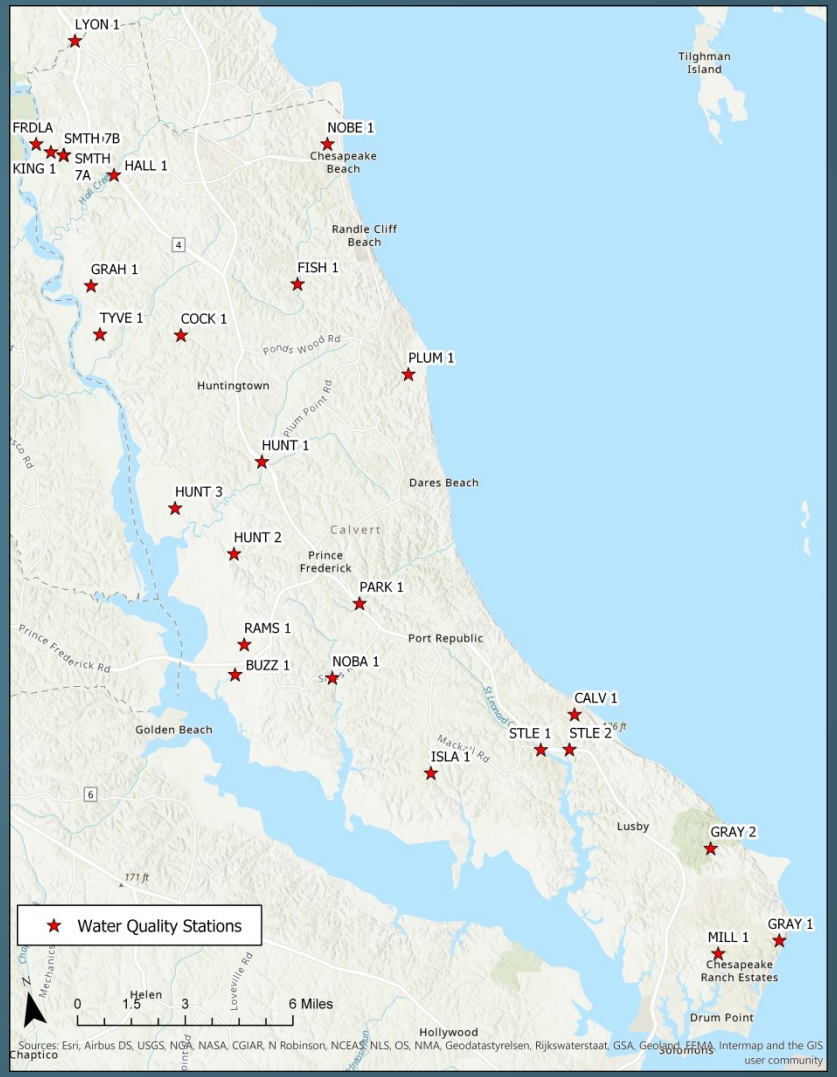
DI= incomplete data set
ND= no study that year

It has been said that streams are the gutters down which flow the ruins of continents

L. B. Leopold et al. 1964

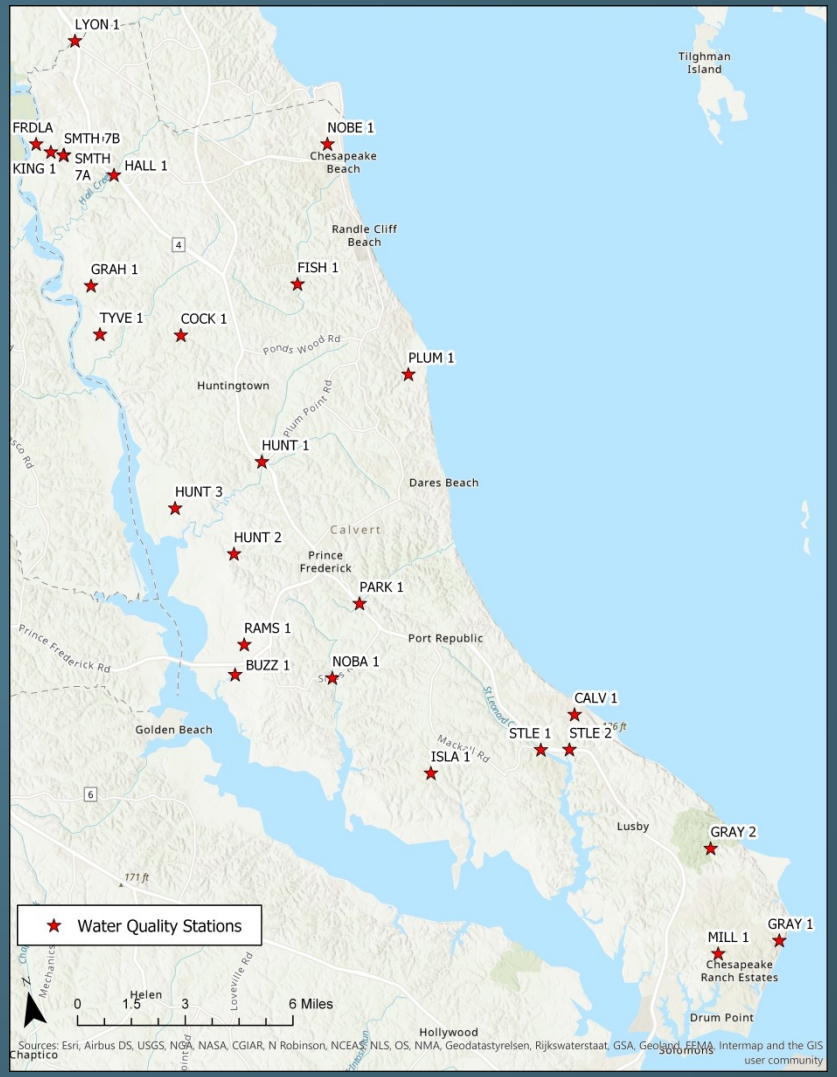
Nontidal (stream) Water Quality Sampling Program in Calvert County

- Calvert County has monitoring data for ~26 nontidal stream sampling sites
- Phosphorus, nitrogen, total suspended solids, stream discharge and more
- We cleaned up the data and worked on analyses



Nontidal (stream) Water Quality Sampling Program in Calvert County

- We looked at data over time
- We compared stations with one another
- We used a version of the Chesapeake Bay Program's watershed model to predict loads



Ranking Sites by Pollutant Yield

- *There are no all green stations.*
- *Fishing Creek (NOBE) is all dark red for all pollutants*
- *HELEN and GRAH1 are also all red*
- *Several of the stations with high pollutants are in the Hall Creek watershed (SMTH, KING, LYON)*
- *Many other red/yellow mixed stations*
- *Perhaps better stations are: FISH1, GRAY1, PLUM1, STLE2*

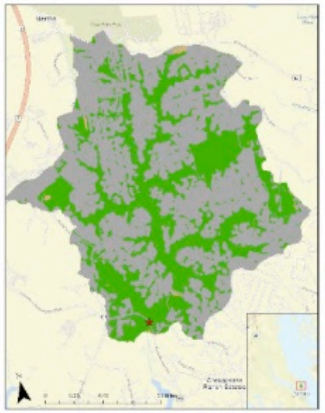
very low	low	near median	high	very high

Median Station Yields				
Station	*NH_4 mg N/acre/day*	*NO_{23} mg N/acre/day*	*PO_4 mg P/acre/day*	*TSS mg/acre/day*
CALV 1	221	5399	25	25333
COCK 1	295	2164	72	39021
FISH 1	23	35	24	14746
FRLDA	447	1437	41	38038
GRAH 1	304	3273	91	44255
GRAY 1	65	1537	2	6457
GRAY 2	101	924	5	35801
HALL 1	394	1753	101	51070
HELEN	289	5025	134	124584
HUNT 1	118	347	31	31119
HUNT 2	165	521	35	26050
HUNT 3	210	6400	85	34164
ISLA 1	204	1788	68	46187
KING 1	171	7112	41	12882
LYON 1	245	2156	126	40832
MILL 1	516	2006	7	28677
NOBA 1	68	673	23	19516
NOBE 1	797	8756	188	88555
PARK 1	152	103	26	23445
PLUM 1	23	202	38	14212
RAMS 1	337	1596	45	71128
SMTH 7A	16	8379	11	7332
SMTH 7B	90	27005	65	24305
STLE 1	154	1347	34	25731
STLE 2	37	63	12	27675
TYVE 1	38	250	8	72753

Station by Station Summary Sheets

Station MILL 1: Mill Creek

MILL 1 is close to the median for NO_{23}, higher for NH_4 and discharge, lower for PO_4 and TSS, while yields are higher for nitrogen compared to the median for all stations. More than half of the station basin is developed (63.3%).

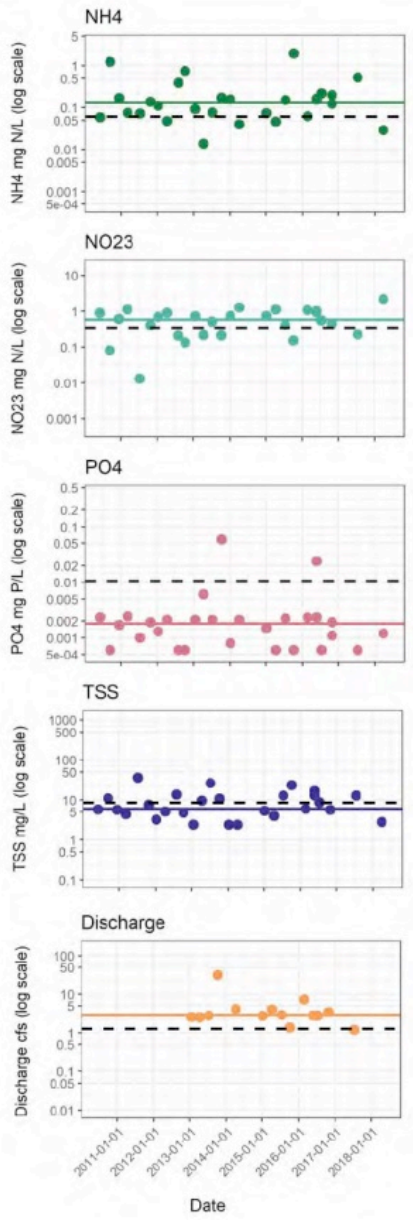


Watershed Land Use

- Station
- Watershed
- Agriculture (Ag)
- Developed (Dev)
- Natural (Nat)

Station Nutrients & Discharge

- Median for All Stations
- Median for Station



Size, Land Use (%), & Septic (#) Comparison

	Acres	Ag	Dev	Nat	Septic
Station Basin	2086	0.4	63.3	36.3	2396
L-R Basin	6276	1.3	56.2	42.5	-

L-R (Land-River) Segment N24009XL0_4954_0000

CAST Watershed Loads (lbs/year) by Land Use

	Ag	Dev	Nat	Septic	Total
Nitrogen	136	11,997	2059	25,540	39,732
Phosphorus	7	938	204	NA	1148

Downscaled from CAST modeled loads for L-R Segment

Station Concentrations & Discharge Summary

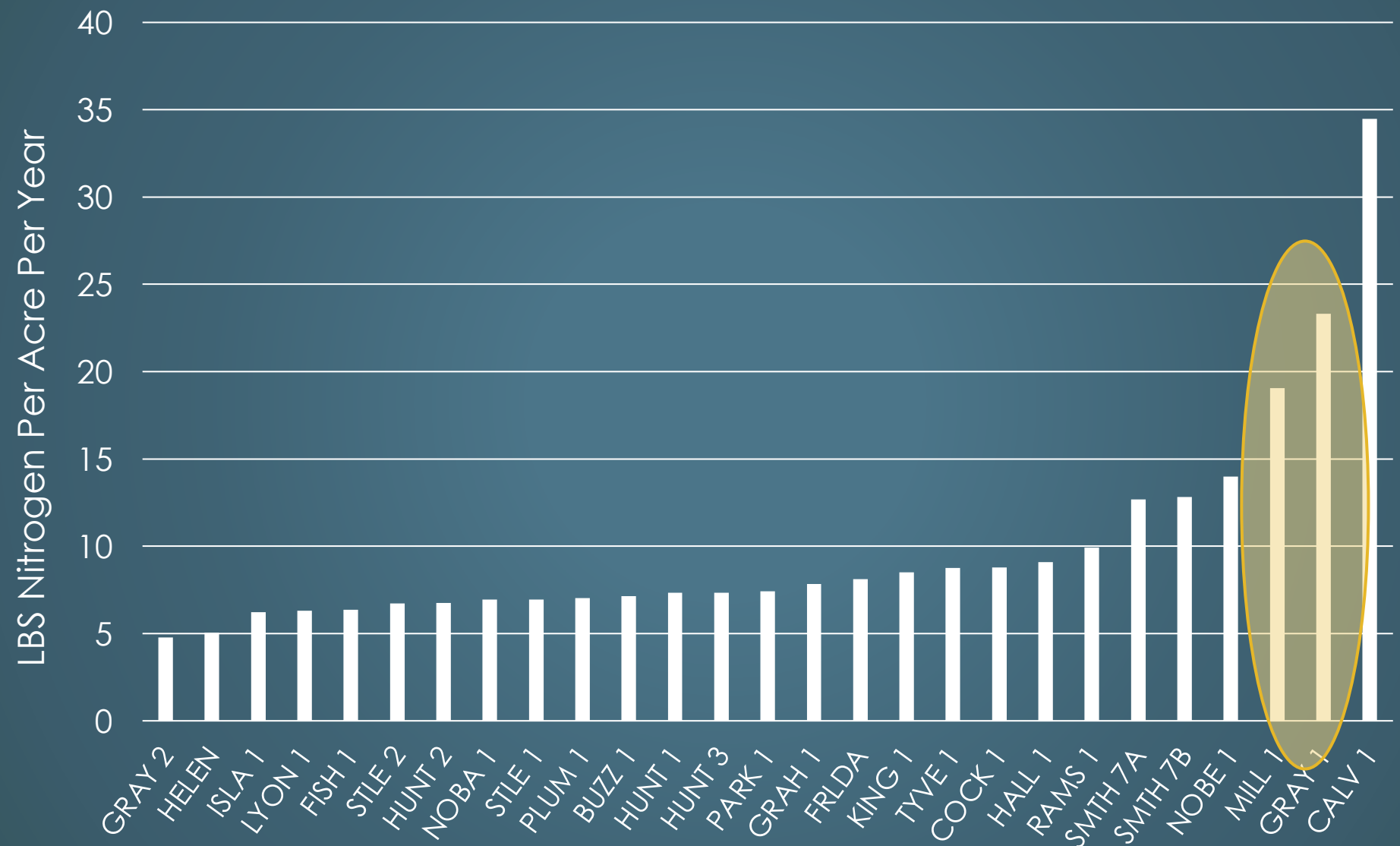
	Median	*Min*	*Max*
***TSS**, mg/L*	6.0	2.4	36.0
***NH_4**, mg N/L*	0.131	0.014	1.950
***NO_{23}**, mg N/L*	0.575	0.013	2.190
***PO_4**, mg P/L*	0.0018	0.0006	0.0588
***Discharge**, cfs*	2.82	1.21	31.29

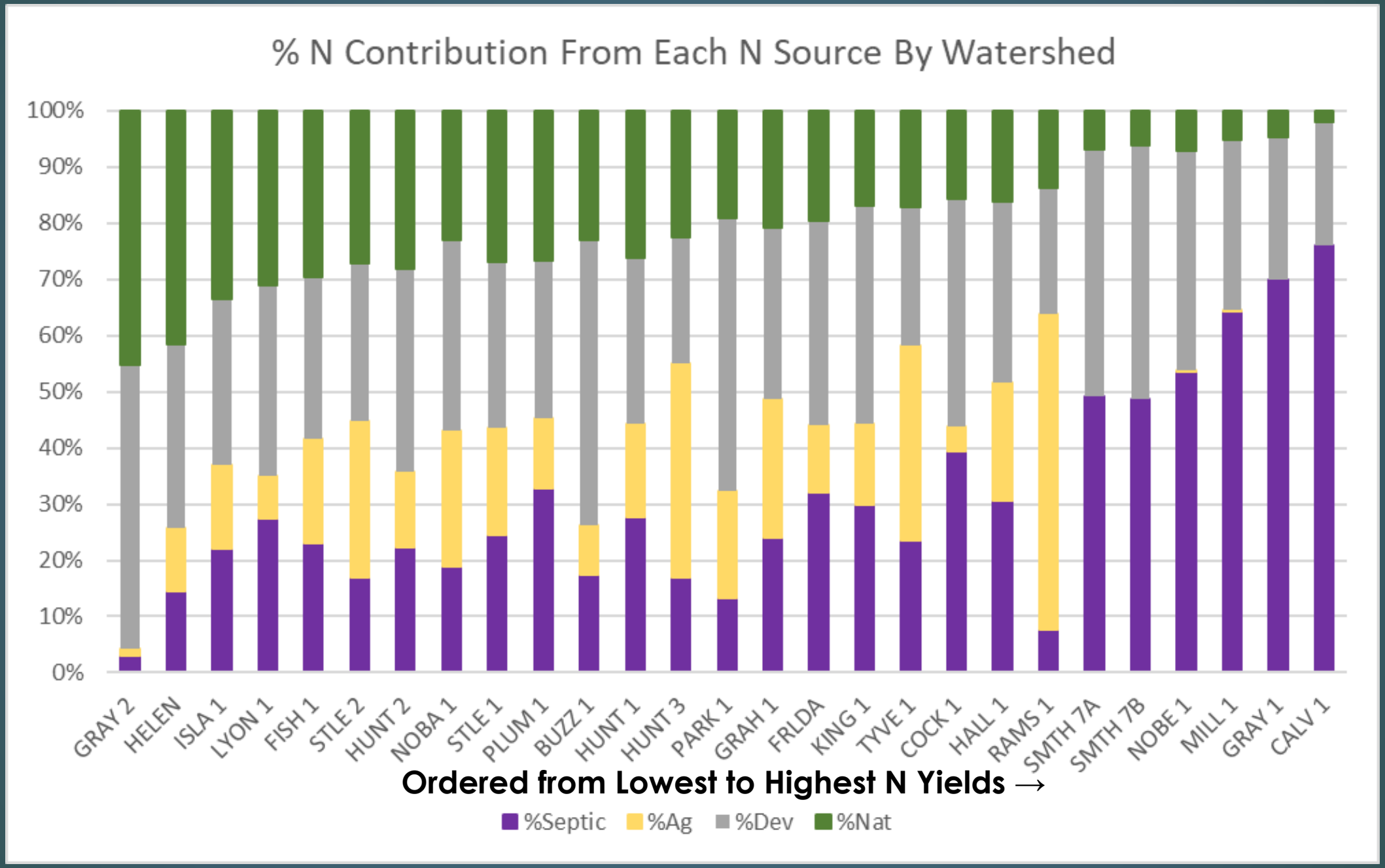
Watershed Nutrient & Sediment Yields Summary

	Median	*Min*	*Max*	*Median for All*
***TSS**, mg/acre/day*	28,677	7320	396,404	28,677
***NH_4**, mg N/acre/day*	516	42	6350	165
***NO_{23}**, mg N/acre/day*	2006	244	9112	1,596
***PO_4**, mg P/acre/day*	7	1	2158	35

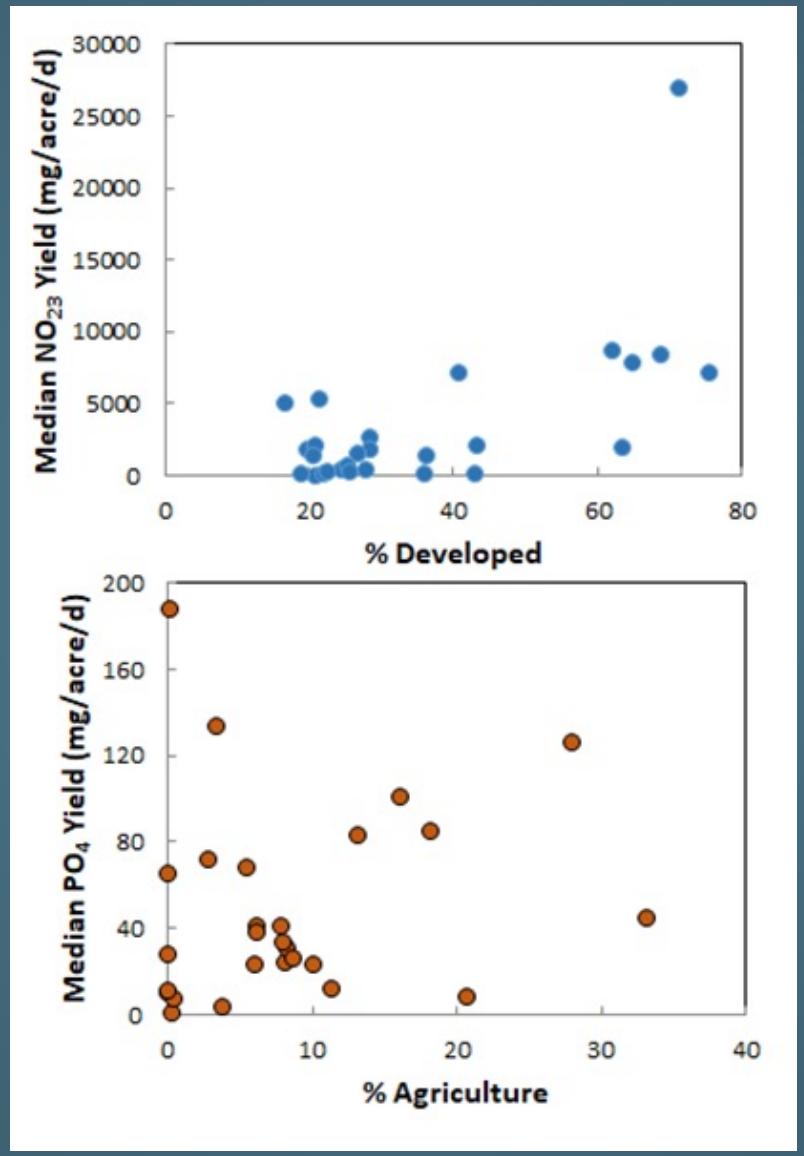
Calculated using instantaneous flow. Further scale up not recommended.

CAST Modeled Nitrogen Yields




% N Contribution From Each N Source By Watershed
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
GRAY 2
HELEN
ISLA 1
LYON 1
FISH 1
STLE 2
HUNT 2
NOBA 1
STLE 1
PLUM 1
BUZZ 1
HUNT 1
HUNT 3
PARK 1
GRAH 1
FRLDA
KING 1
TYVE 1
COCK 1
HALL 1
RAMS 1
SMTH 7A
SMTH 7B
NOBE 1
MILL 1
GRAY 1
CALV 1
Ordered from Lowest to Highest N Yields →
%Septic
%Ag
%Dev
%Nat

Impact of Land Use



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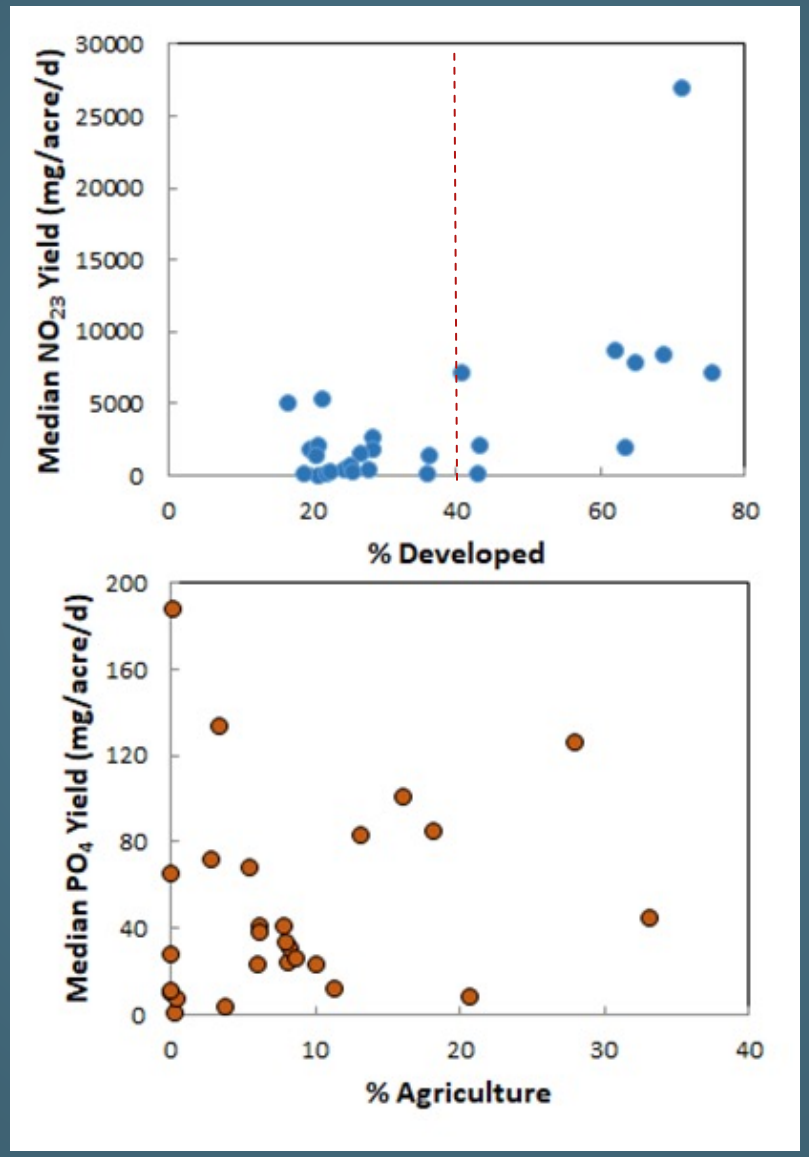

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CHESAPEAKE BIOLOGICAL LABORATORY

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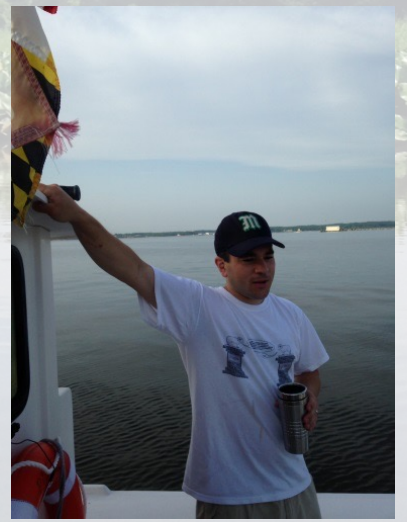
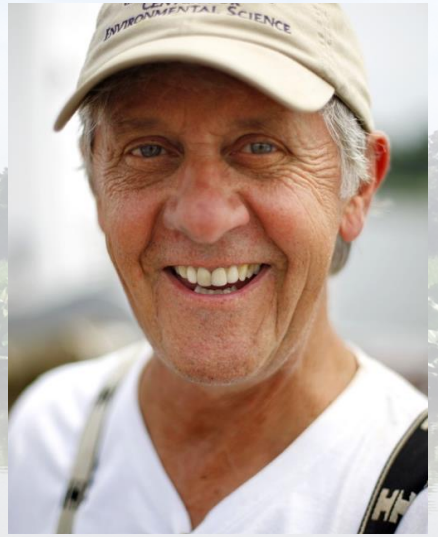
Dr. Jeremy Testa – jtesta@umces.edu
Dr. Walter Boynton

Research Assistants:
Cynthia Ross
Janet Barnes
Casey Hodgkins

Thanks to
Calvert County