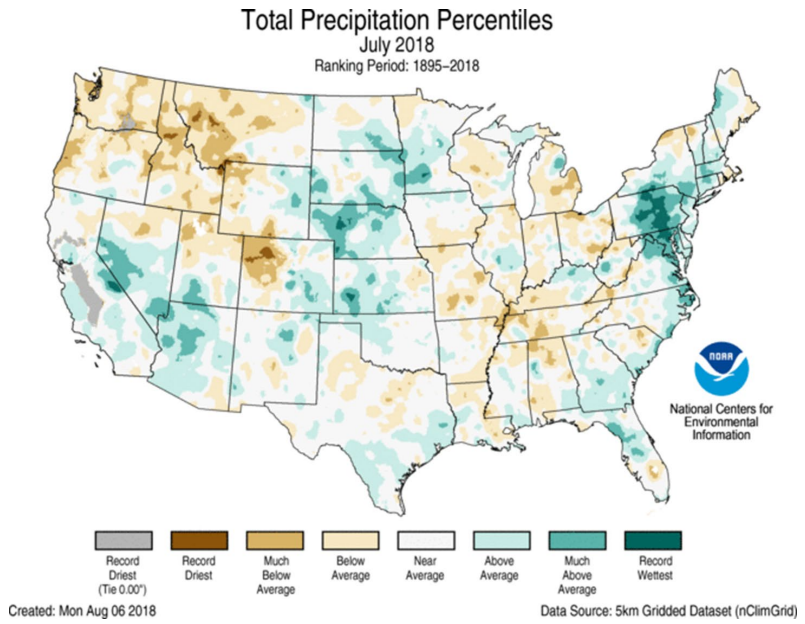
Summer Storms 2018: Chesapeake Bay watershed conditions and early monitoring results



Data Integrity WG

October 23, 2018

Peter Tango and Scott Phillips, USGS

on behalf of STAR

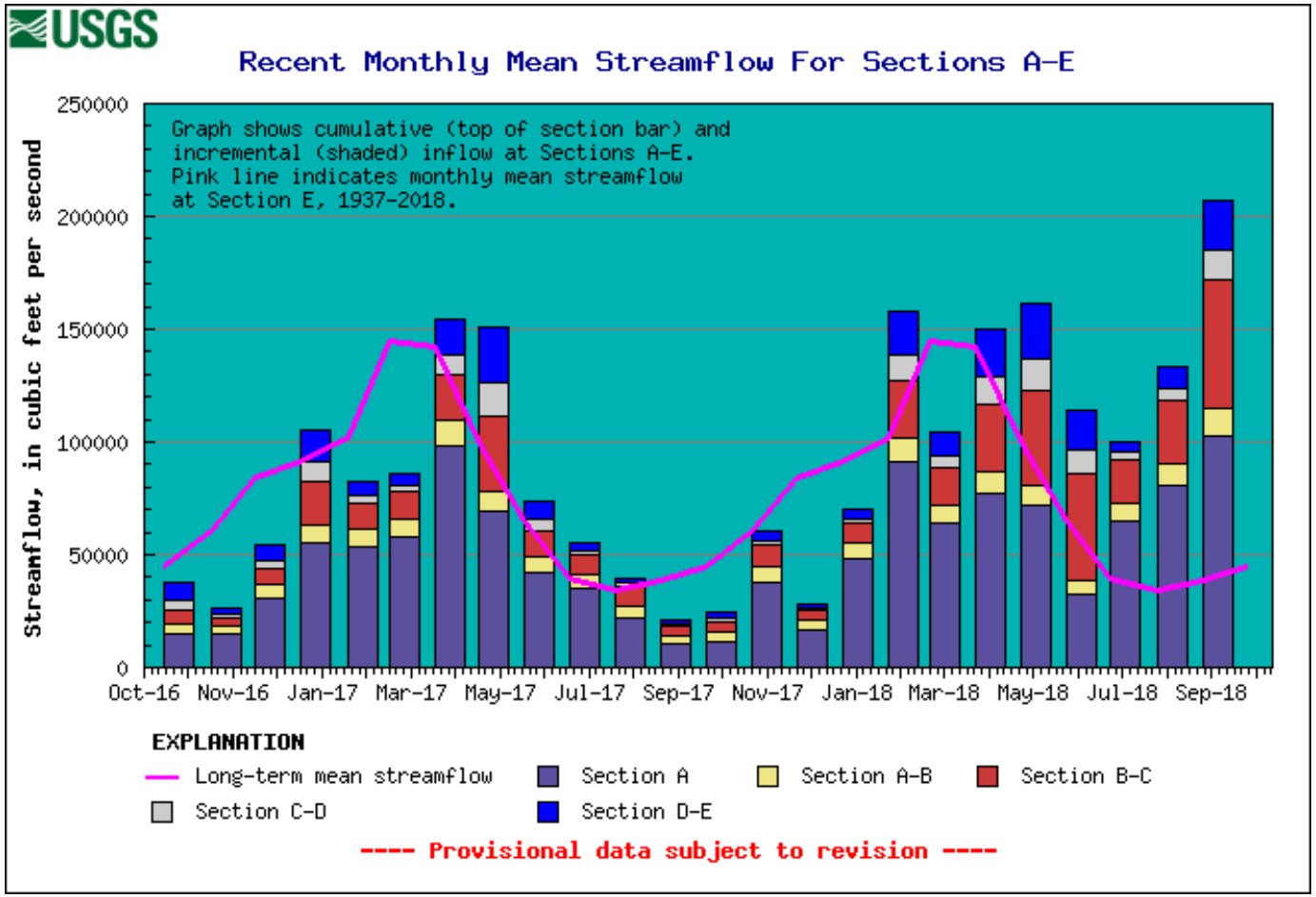
Chesapeake Bay Program
Science. Restoration. Partnership.

Outline

- River flow into the Bay during 2018
- Initial monitoring results of Bay conditions
- Potential impacts compared to other high-flow years
- Implications for nutrient and sediment management

2018 River Flow: A Very Unusual Summer

- Above normal since May
- Monthly records: Aug and Sept
- Multiple storms
- WY: Oct-Sept

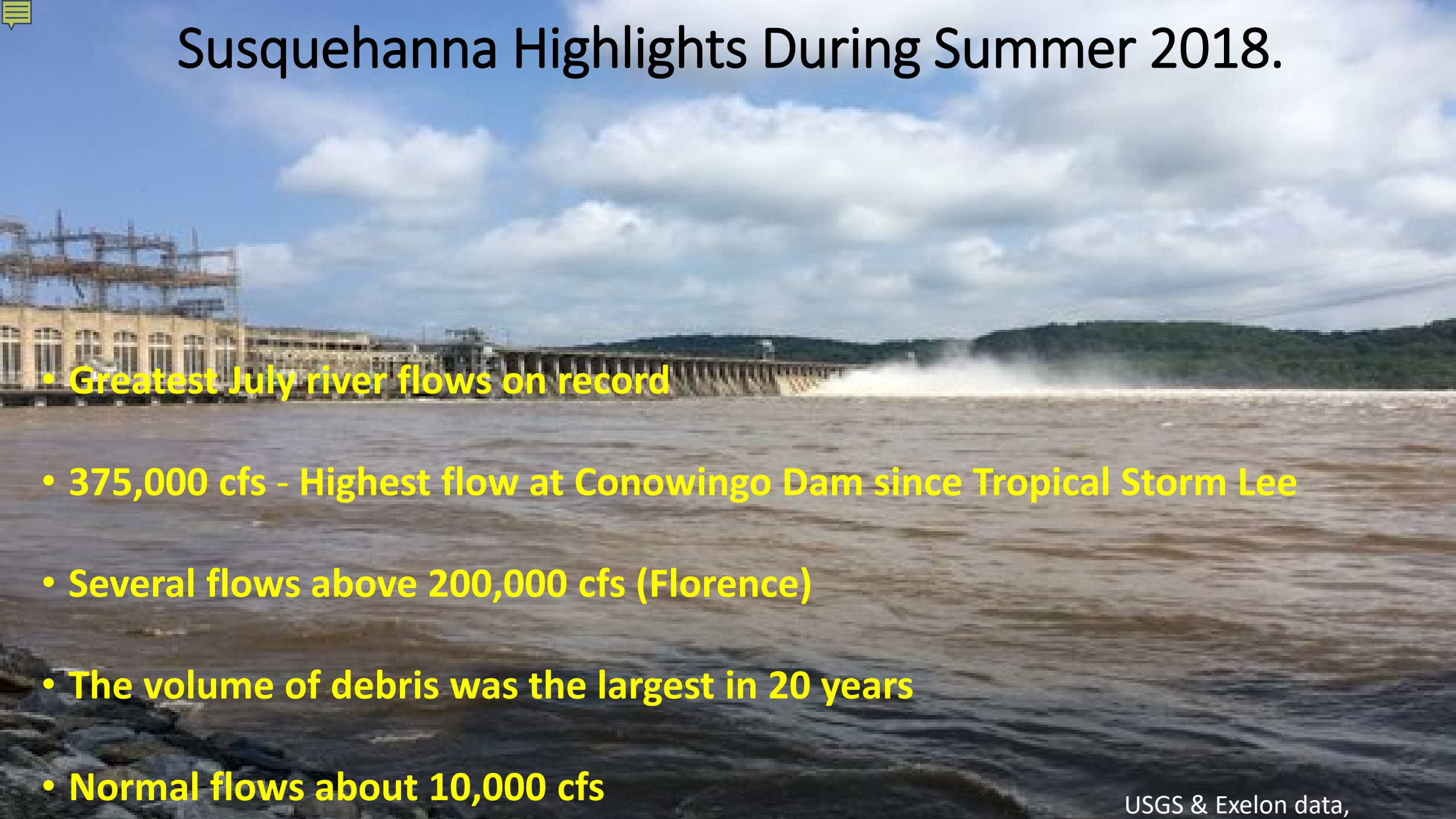


Chesapeake Bay Program
Science. Restoration. Partnership.

https://md.water.usgs.gov/waterdata/chesinflow/

USGS
science for a changing world

Susquehanna Highlights During Summer 2018.

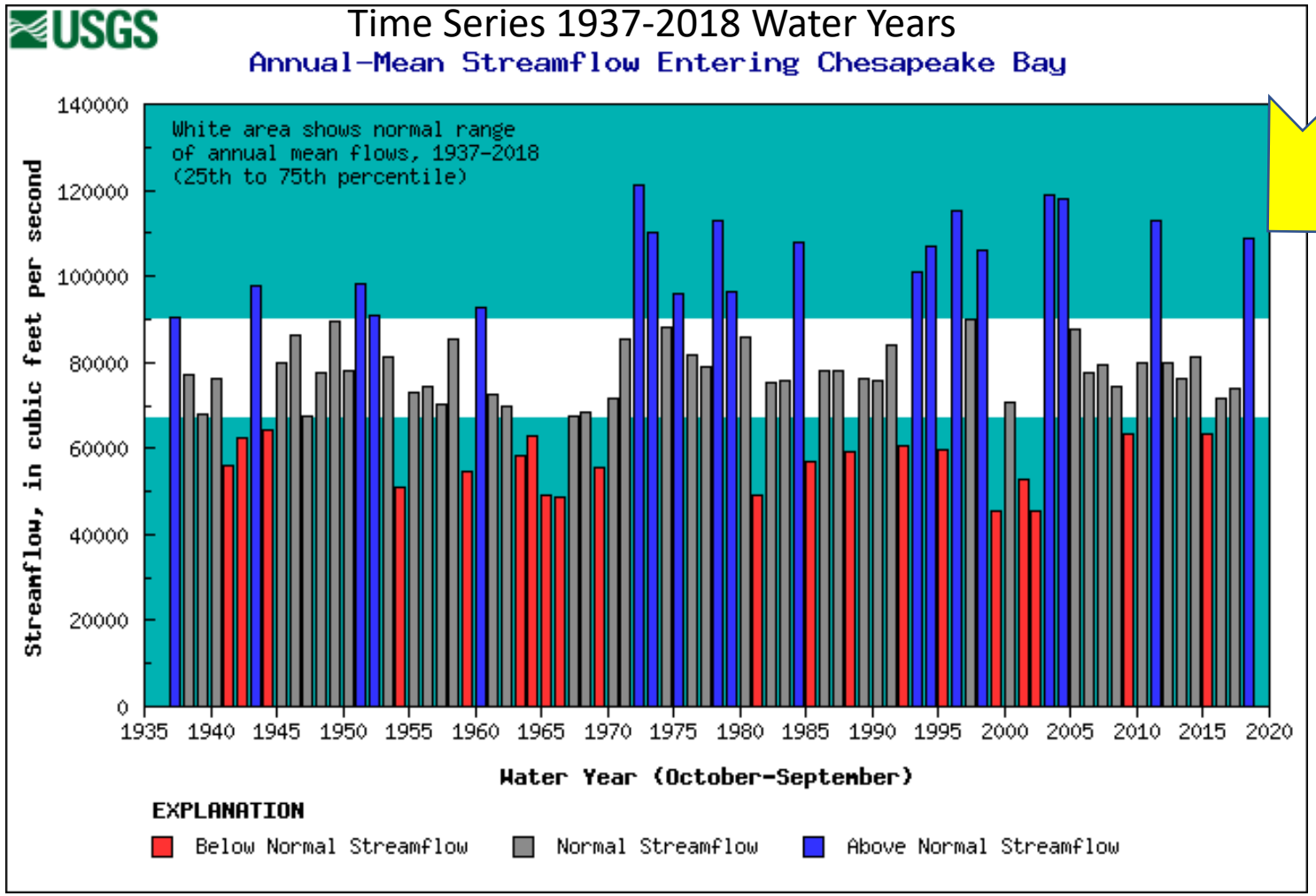


- Greatest July river flows on record
- 375,000 cfs - Highest flow at Conowingo Dam since Tropical Storm Lee
- Several flows above 200,000 cfs (Florence)
- The volume of debris was the largest in 20 years
- Normal flows about 10,000 cfs

USGS & Exelon data,

2018: Above normal for the Water Year.

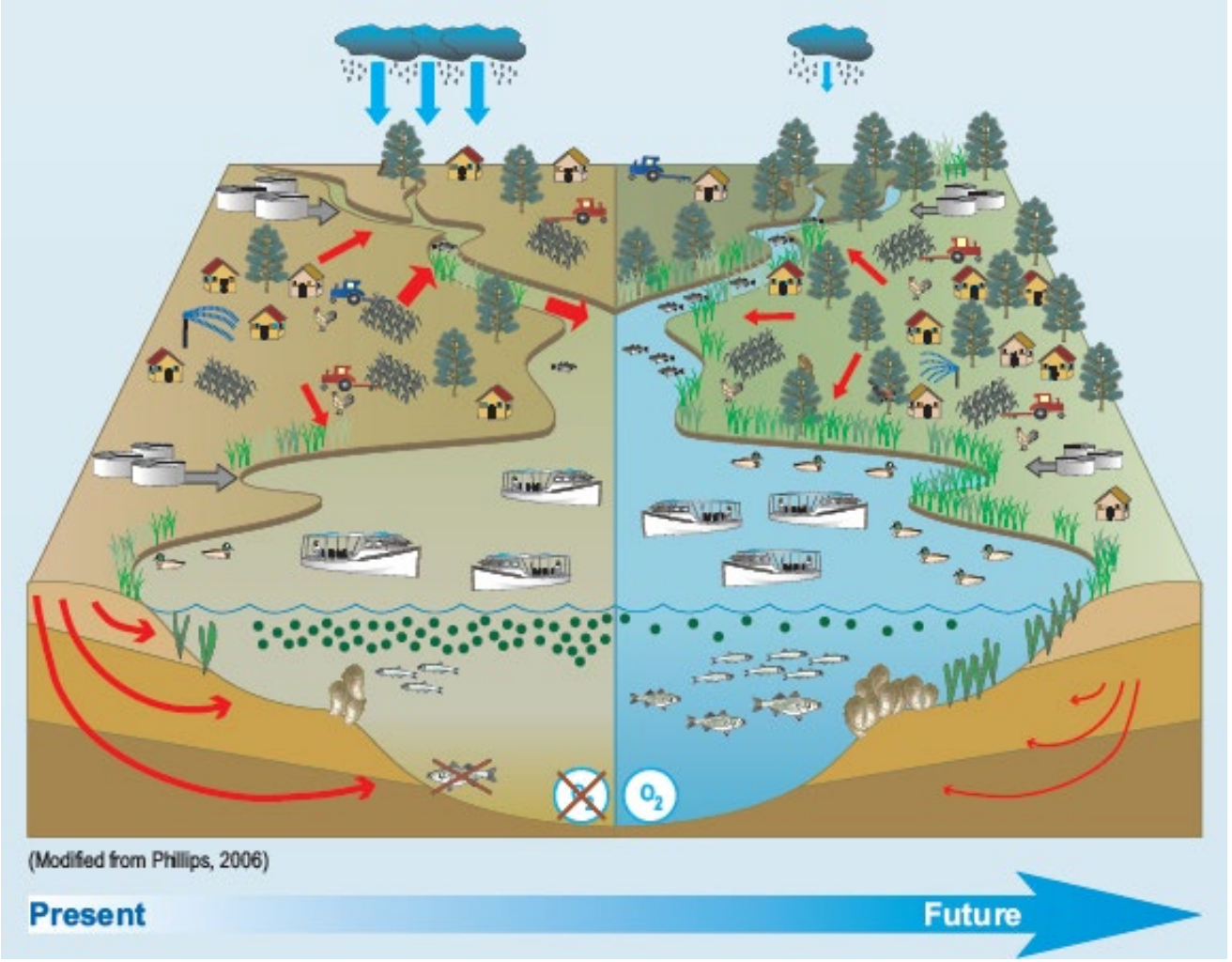
- Only 2nd year above normal in over a decade
- Last was 2011
- Negative impacts on Bay



10/16/2018 https://md.water.usgs.gov/waterdata/chesinflow/

Potential Bay Impacts

- Greater pollutant loads:
  - Poorer water clarity
  - Loss of SAV
  - Lower dissolved oxygen
- High amounts of fresh water
  - Oyster morality
  - Migration of crabs and fin fish
- Monitoring providing early results



Chesapeake Bay Program
Science. Restoration. Partnership.

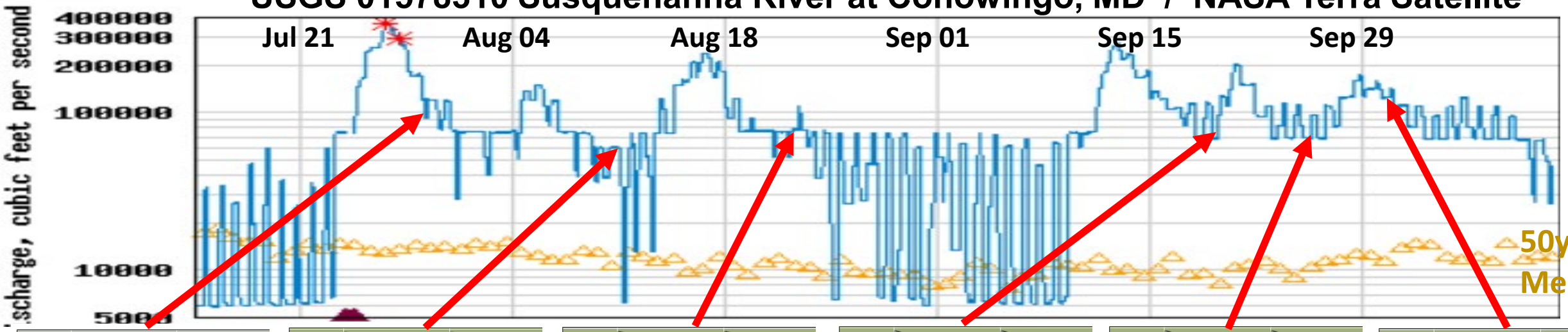
Outline

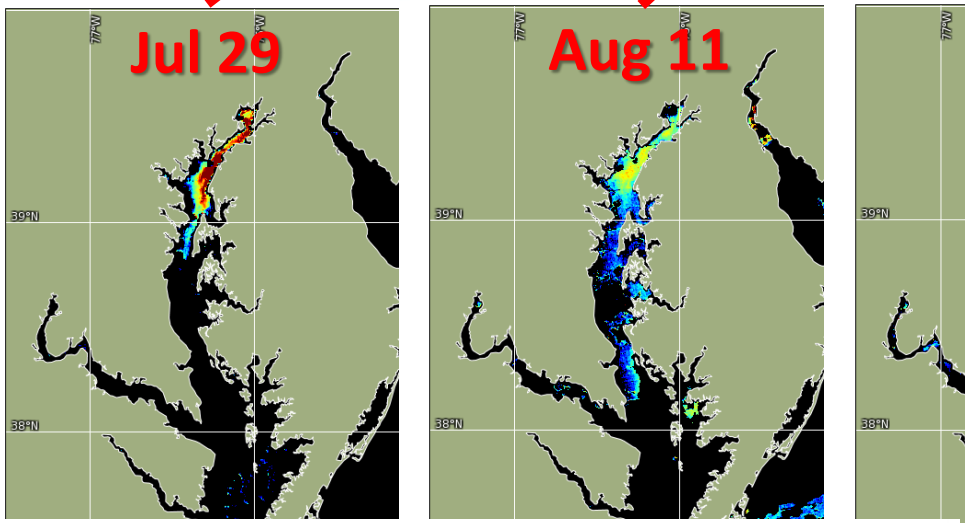
- River flow into the Bay during 2018
- Initial monitoring results of Bay conditions
  - STAR: Multiple-agency monitoring effort
    - Clarity
    - SAV
    - Hypoxia
    - Fresh water and fisheries
- Potential impacts compared to other high-flow years
- Summary and implications

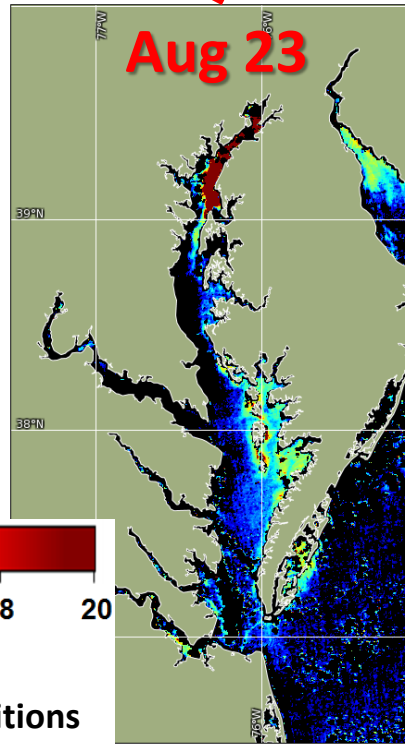
2018 Sediment plumes per peak discharge event

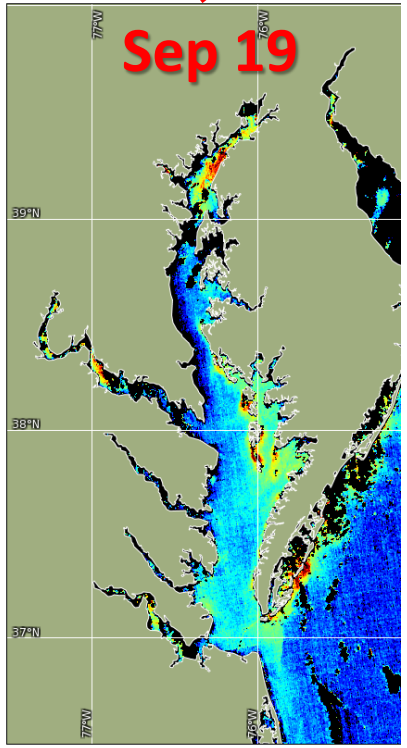
– as seen by satellite

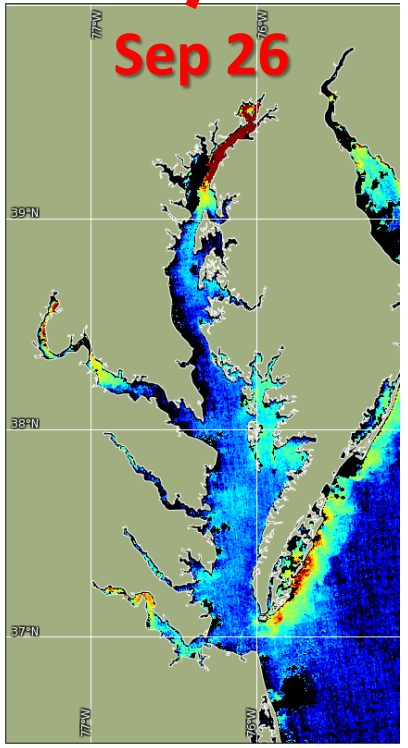
USGS 01578310 Susquehanna River at Conowingo, MD / NASA Terra Satellite

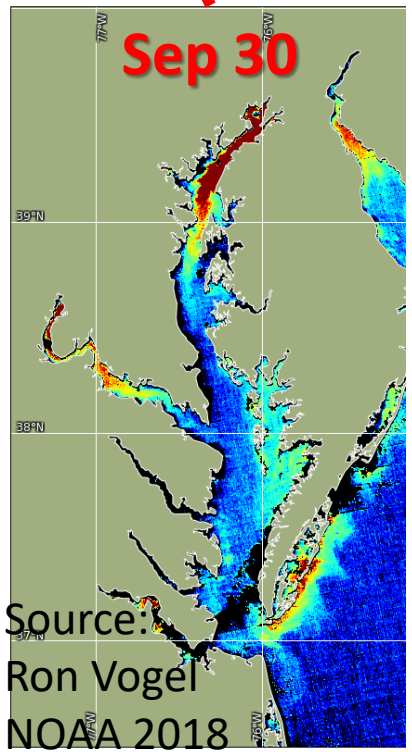


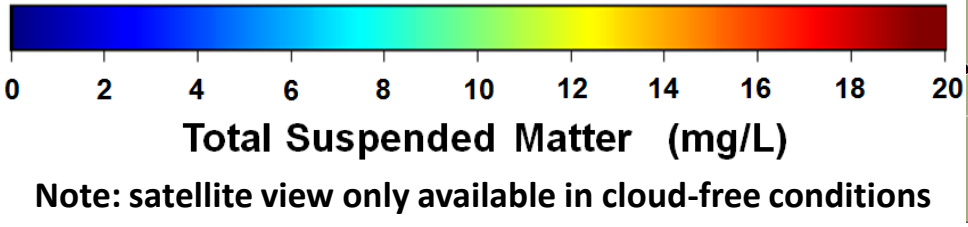










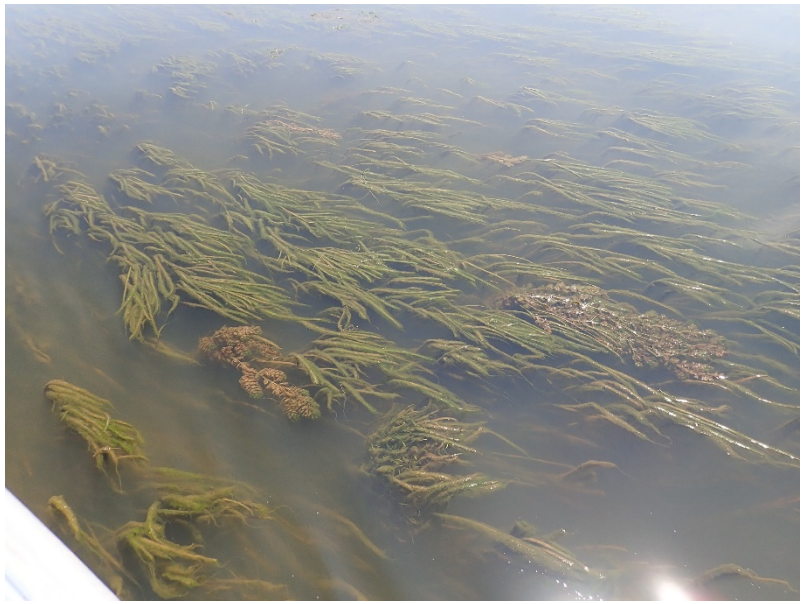


Note: satellite view only available in cloud-free conditions

Source:
Ron Vogel
NOAA 2018

SAV: Poor Water Clarity in Upper Bay but Grasses Still Present in the Susquehanna Flats

Turbidity 8-10-2018
out in the channel



Bay Grass 8-10-2018
Perimeter of beds with epiphytes

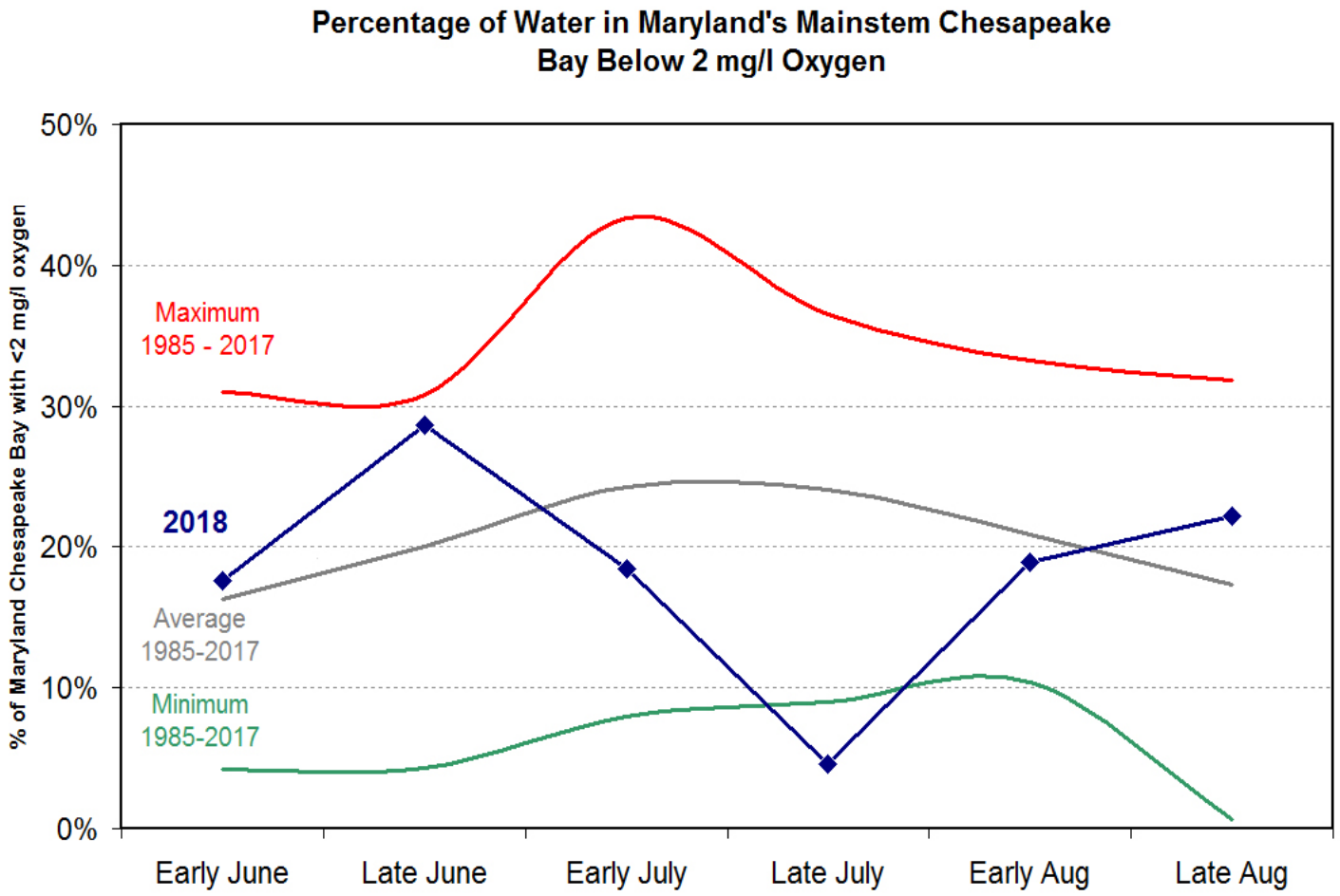
Bay Grass 8-10-2018
Clear water in the beds

Chesapeake Bay Program
Science. Restoration. Partnership.

Photos by Brooke Landry, MD DNR

Summer MD Hypoxia: Variable Conditions

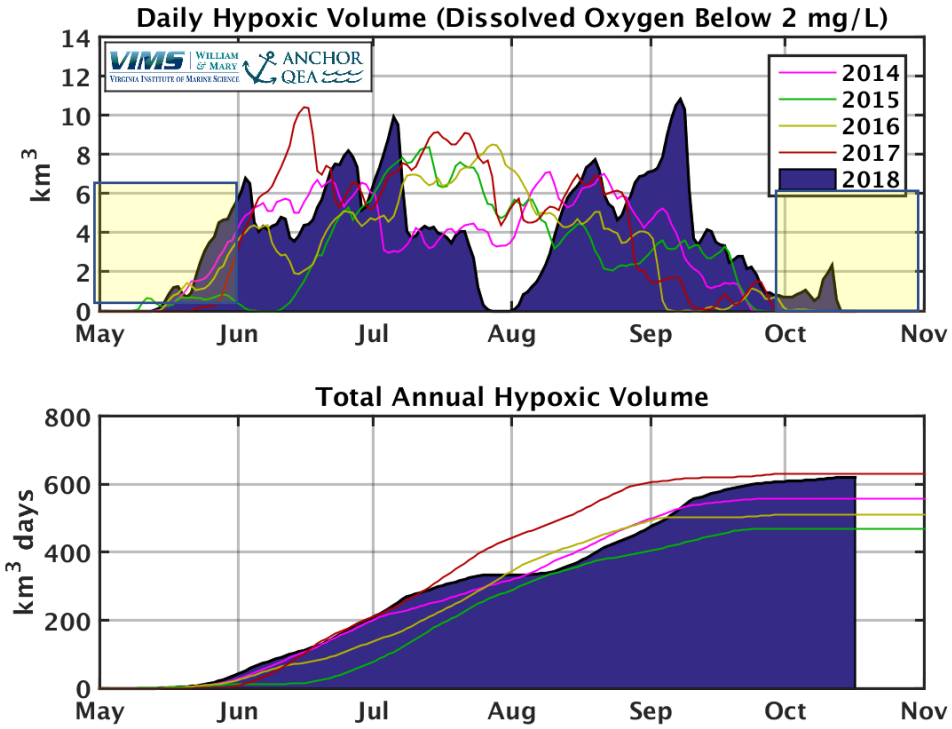
- June: above average
- July: Below average
  - Due to winds
- August: near average



M. Trice. MD DNR

Chesapeake Bay Program
Science. Restoration. Partnership.

2018 Hypoxia – May to October (VIMS)



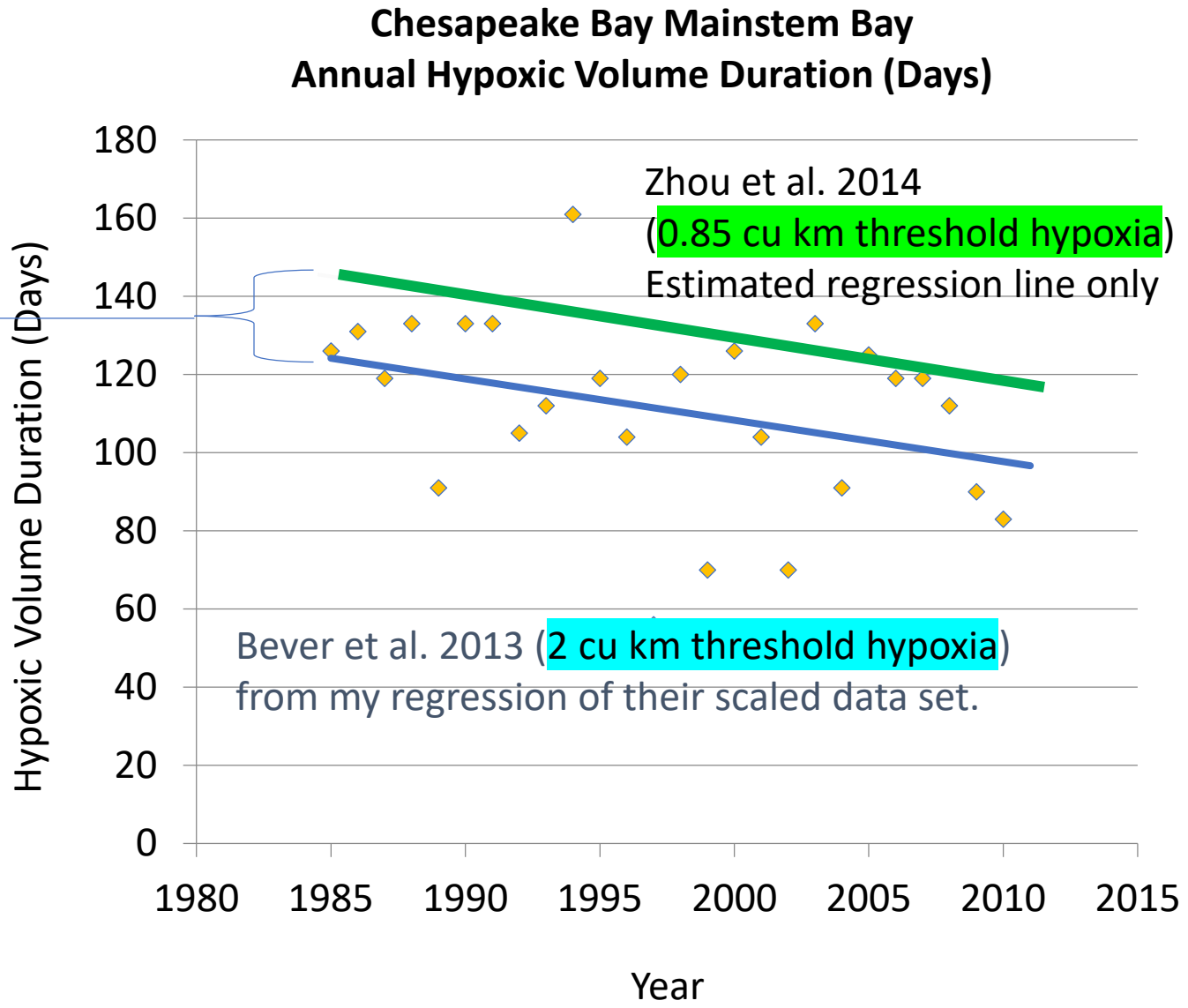
Hypoxic Volume (HV) Metrics for Recent Years for Comparison to 2018 Forecast

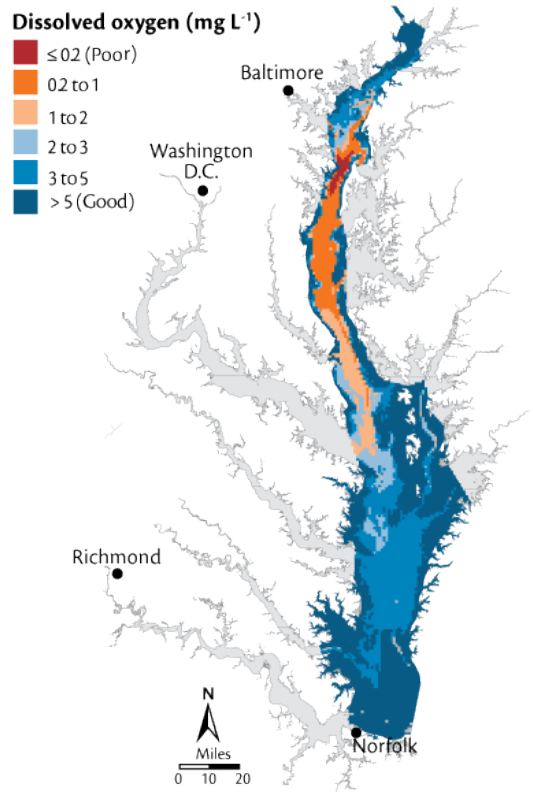
Year	Maximum Daily HV [km³]	Total Annual HV [km³ days]	Duration [days]	Summer Average [km³]
2014	7.1	557	107	4.4
2015	8.4	468	94	3.7
2016	8.5	511	98	4.0
2017	10.4	630	92	5.1

http://www.vims.edu/research/topics/dead_zones/forecasts/cbay/hypoxic-volume/index.php

Duration: It depends on your threshold volume definition for when hypoxia exists in the bay

About a 20 day difference





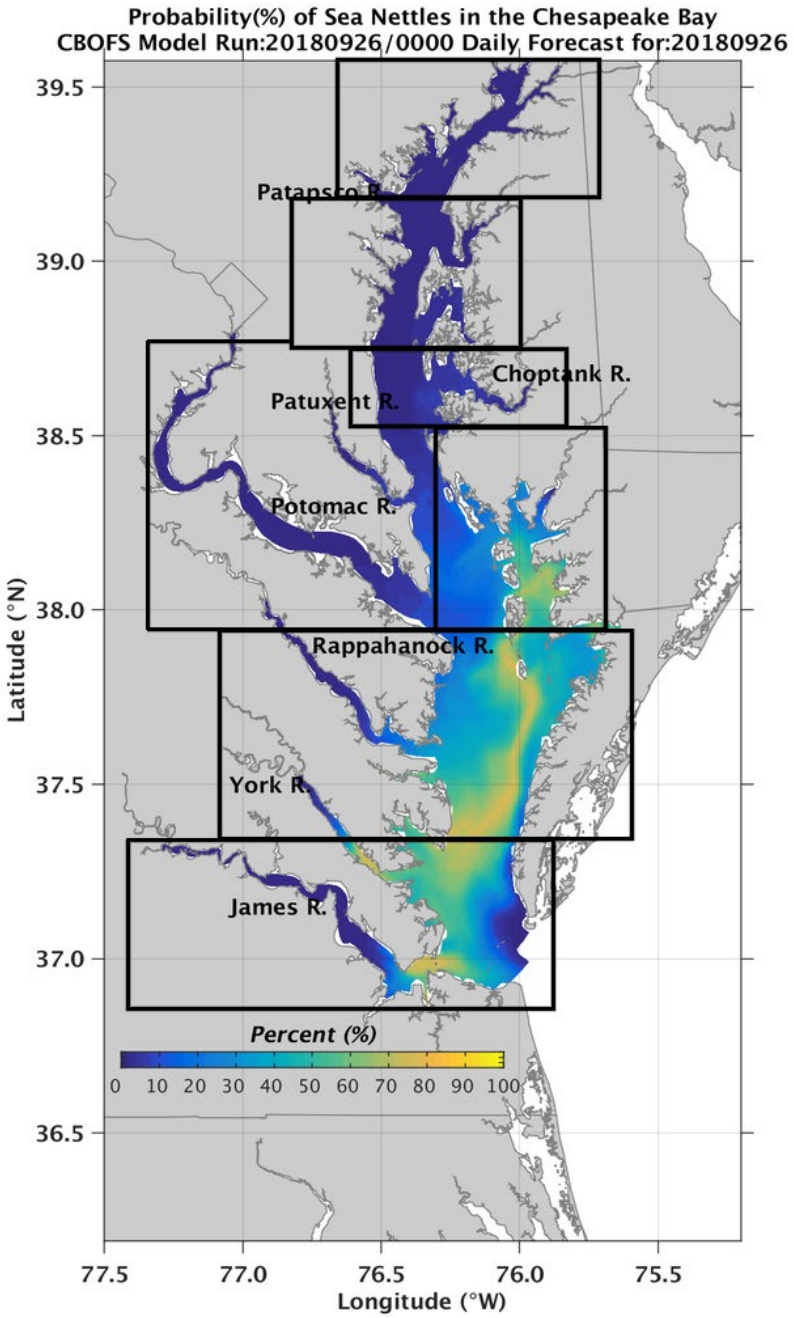
Chesapeake Bay Hypoxia Summer 2012

USGS science for a changing world

Chesapeake Bay Program
A Watershed Partnership

Freshwater flow impacts

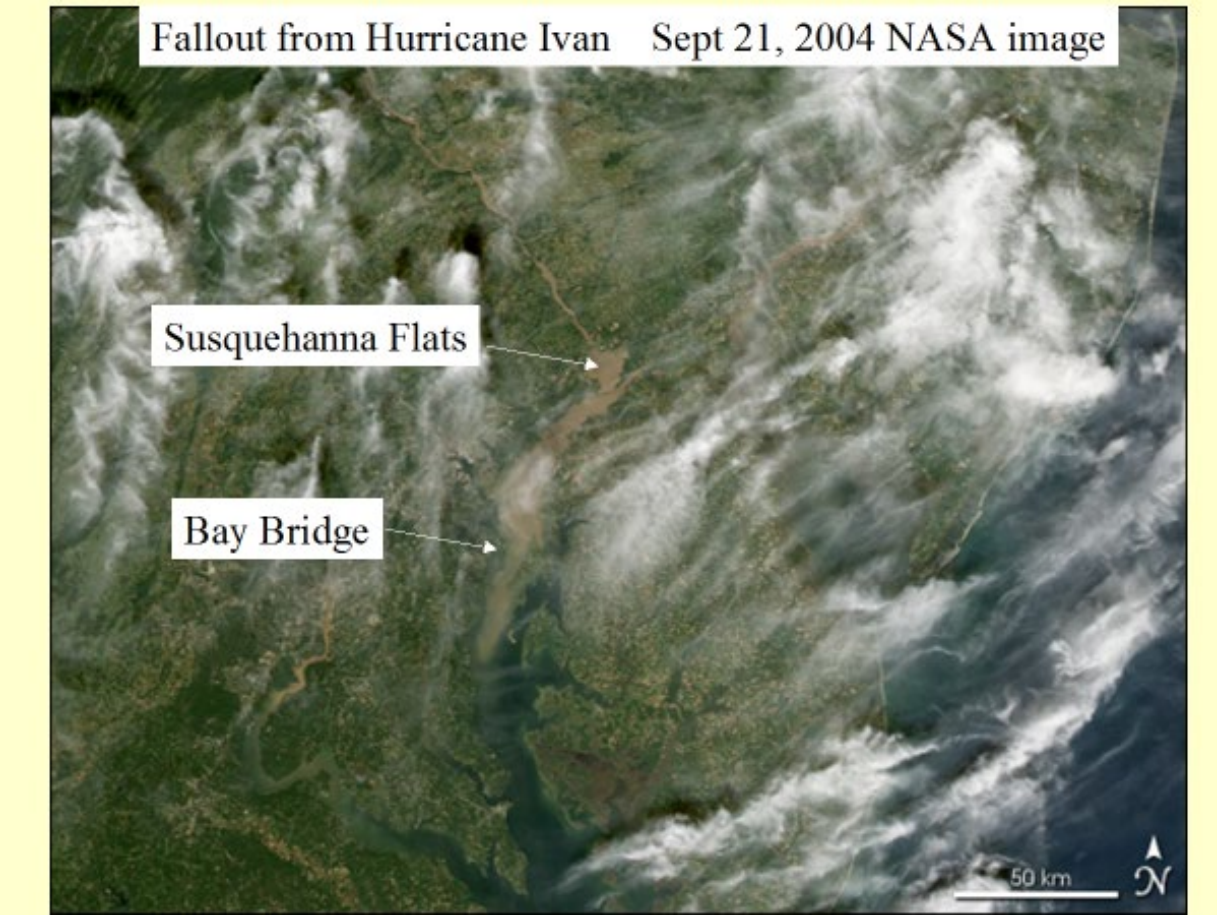
- Mortality of some oysters (-)
  - Less disease down bay (+)?
- Crabs migrating south
- Fin fish moving to stay in salinity ranges
- Fewer jellyfish in the northern bay



https://www.opc.ncep.noaa.gov/Loops/SeaNettles/prob/SeaNettles.shtml

Chesapeake Bay Program
Science. Restoration. Partnership.

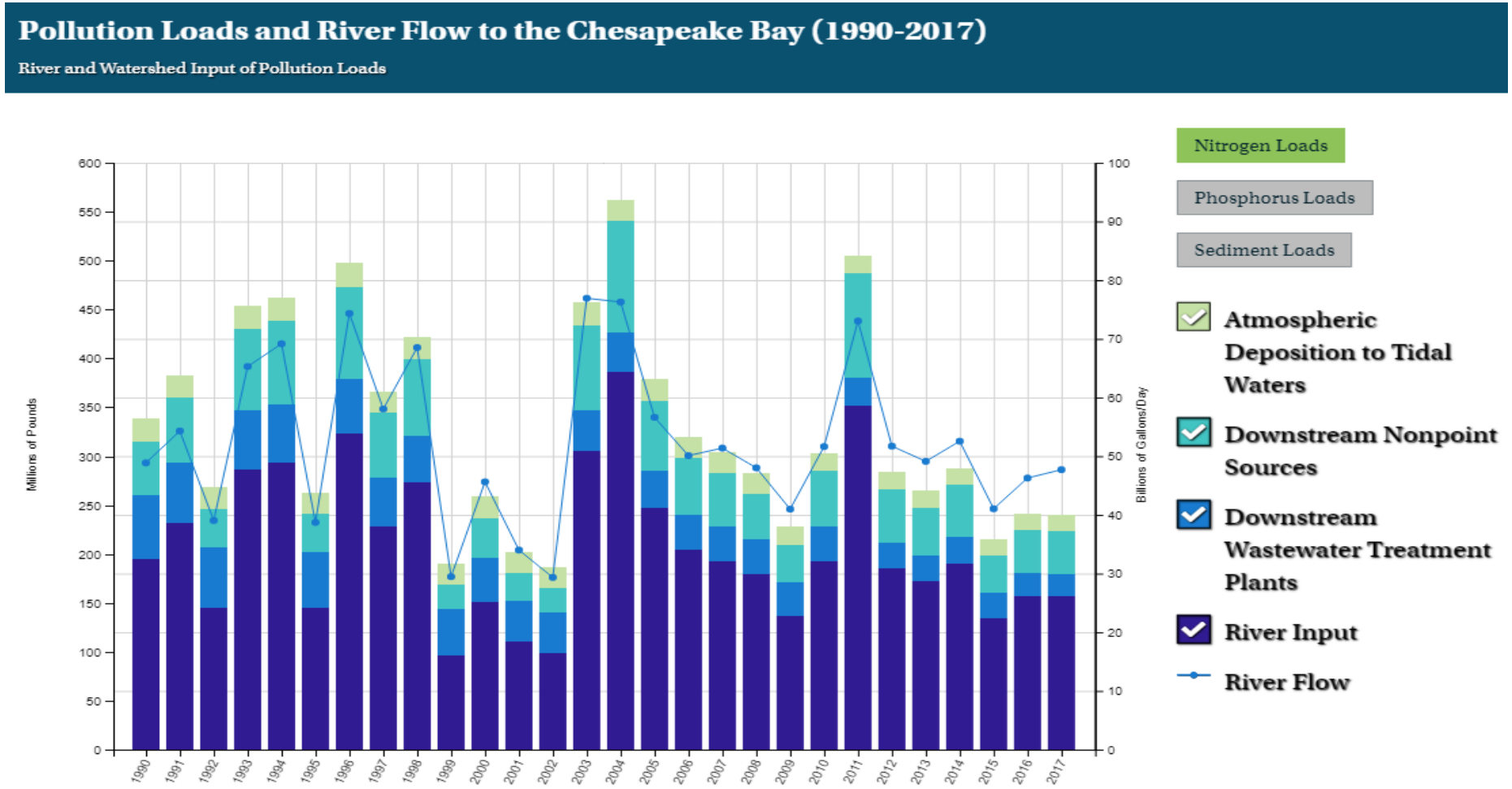
Outline



- River flow into the Bay during 2018
- Initial monitoring results of Bay conditions
- Potential impacts compared to other high-flow years
  - Loads
  - SAV
  - Oysters (+ and -)
- Summary and implications

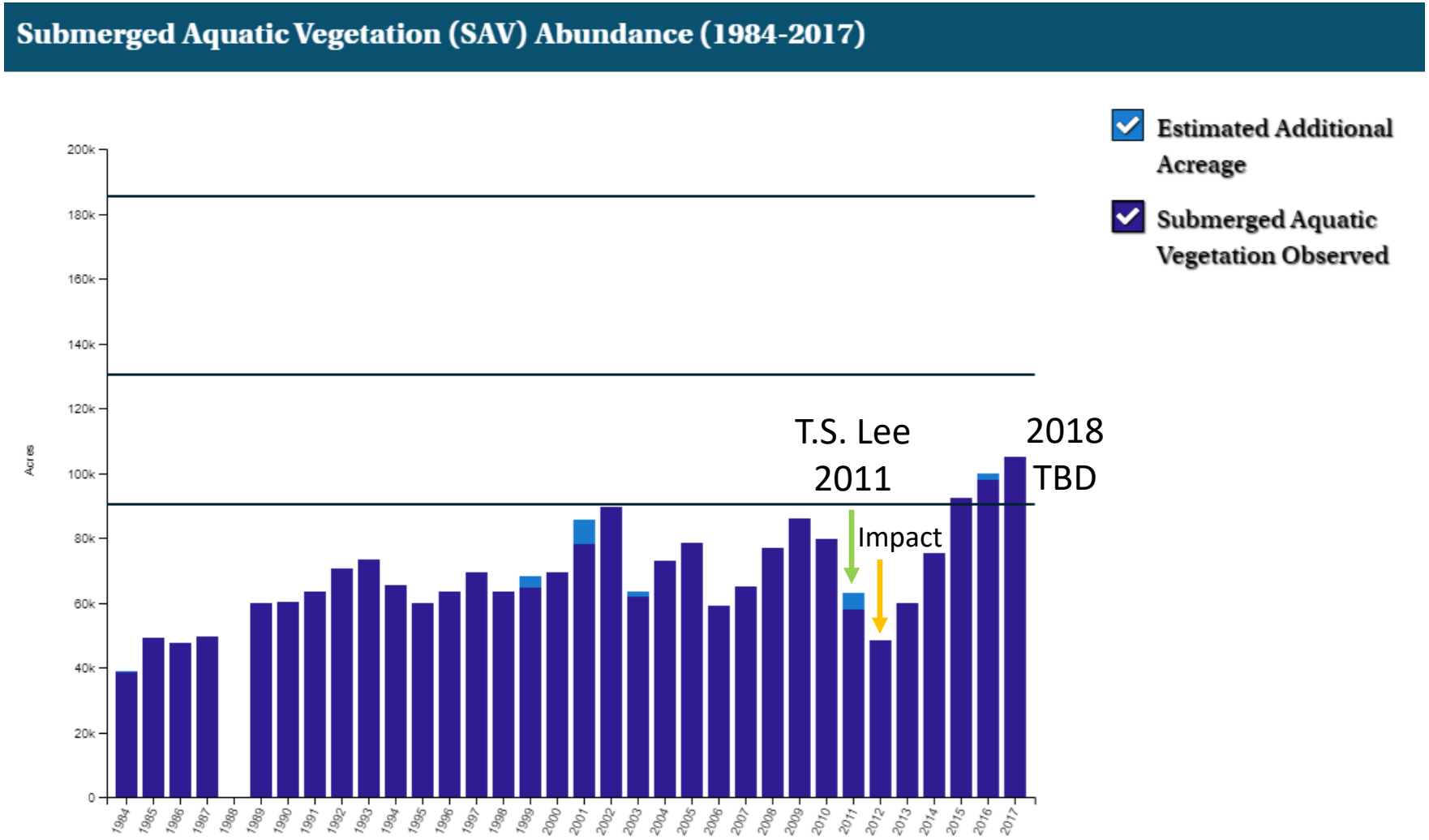
High Flows Deliver More Nutrients and Sediment

- High Flow years: 2011; 2003 & 2004
- Greater nutrient and sediment loads
- Usually lower DO
- May be near average in 2018
  - July wind events
  - More BMPs in place



Potential Loss of SAV

- 2011 High Flows
- Declines in SAV for two years
- SAV beds larger so may be more resilient
- More BMPs in place
- Less overall loss?

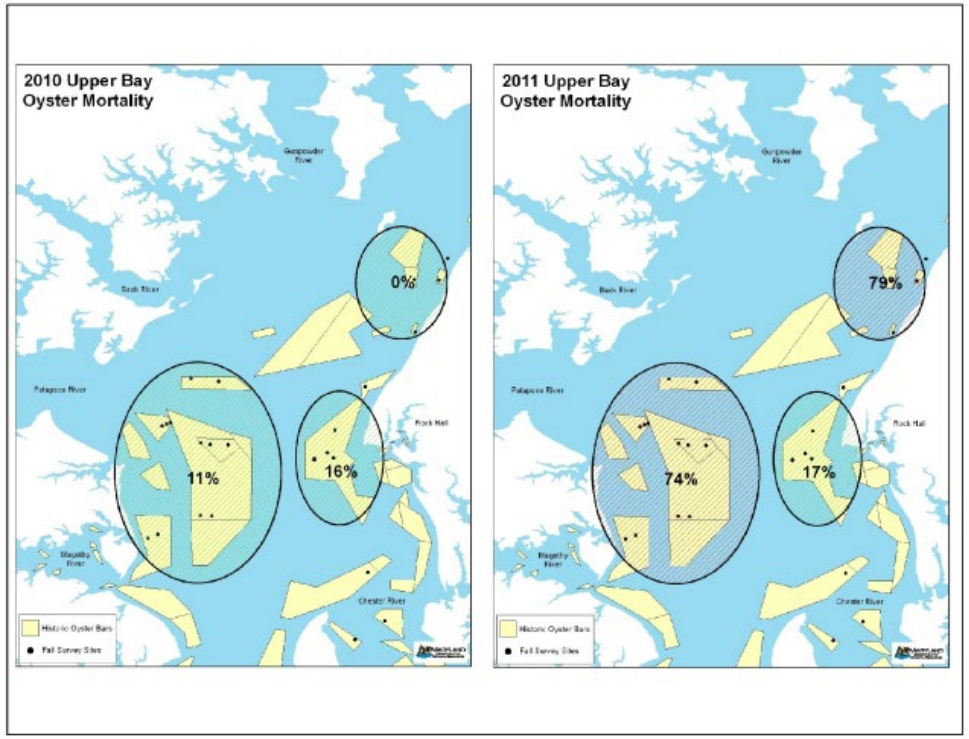


Living Resource Effects in High Flows: Historical inference for oysters and benthos

- Oysters 2011:
  - High mortality in the upper Bay
  - Excellent baywide survival

- Baywide benthos 2011
  - Showed little impact from the storms.

  (R. Llanso VERSAR Inc.)

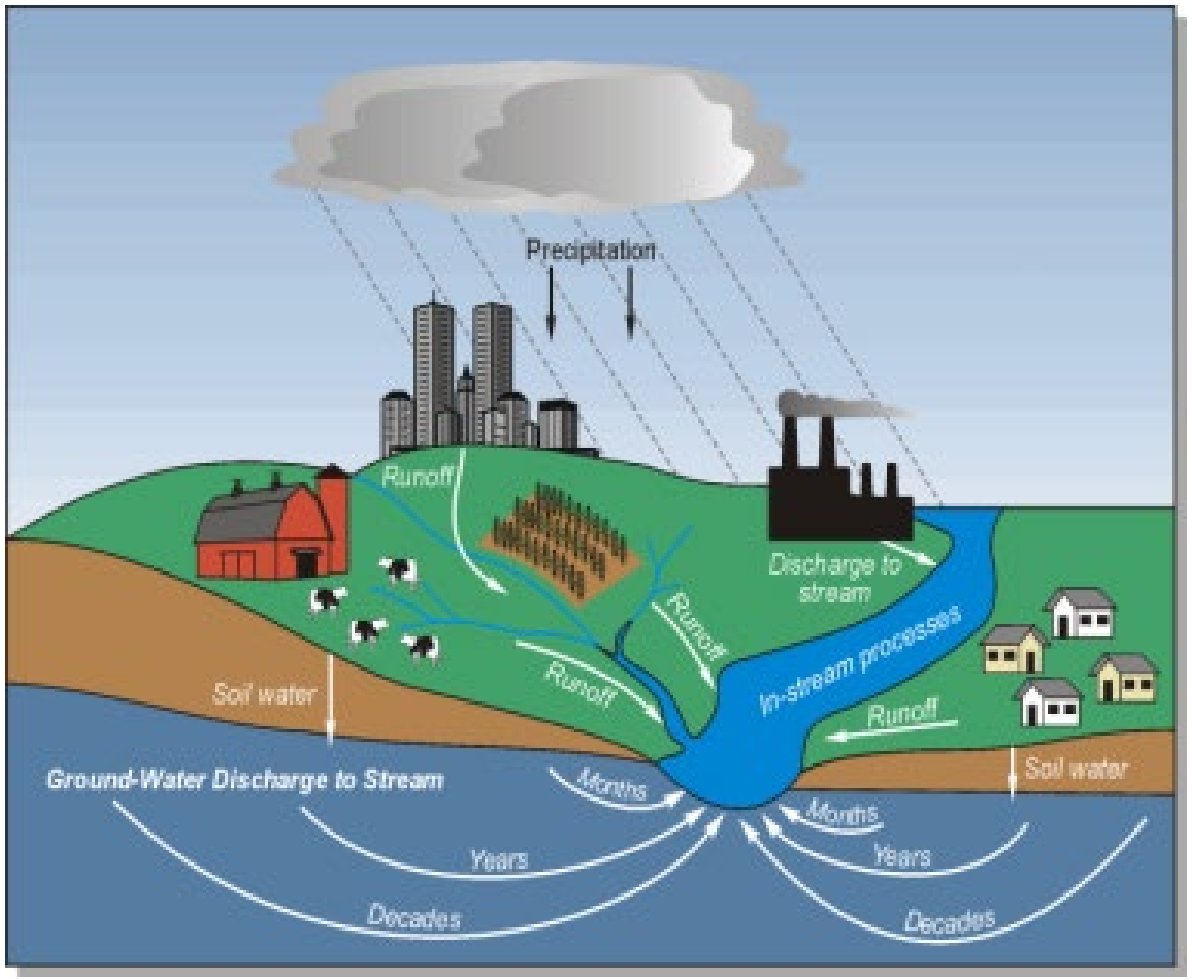


Flow impact to Oysters

- Highest overall oyster survival rate since 1985 (92%)
- More than double the survival rate of 2002
- 44% increase in oyster biomass in one year
- Dermo and MSX at all-time lows

(M. Naylor MD DNR 2011 results)

Summary and Implications



- More climate and flow variability
  - N, P and S loads from storms need to be mitigated
- More emphasis on water-quality practices to address storm events
  - Urban storm water
  - Runoff from ag lands
- Monitoring to explain watershed and estuary response
  - Assess changes from high flows vs. management practices
  - Resilience of SAV and living resources
- Many thanks to field and lab teams for the long hours and storm chasing!