Expanding our hypoxia monitoring network: Locating new arrays - Sampling design considerations

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HYPOXIA COLLABORATIVE MEETING

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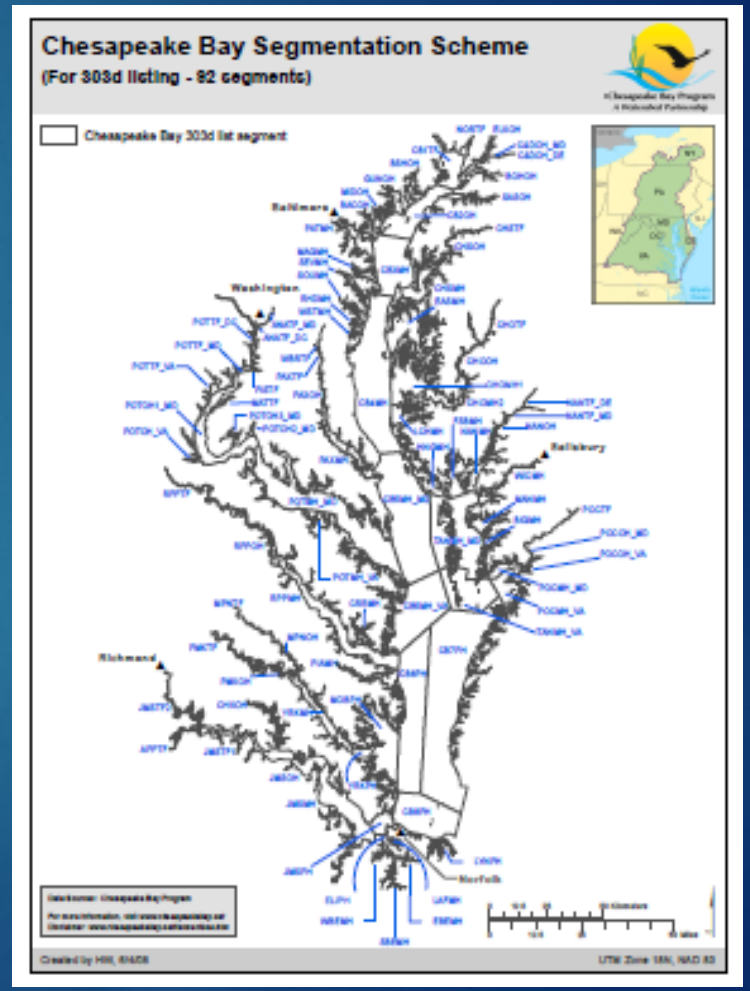
Acknowledgements

- Leadership team includes
  - Bruce Vogt
  - Jay Lazar
  - Kevin Schabow
  - Justin Shapiro
  - Sean Corson
  - Breck Sullivan
  - Amy Goldfischer

The 2021-22 Principal Staff Committee (PSC) Monitoring Review

- ***On March 2, 2021***, the PSC heard from EPA that the water quality monitoring program was characterized as **"Fair"** for addressing water quality criteria attainment assessments.
  - The PSC wanted a review and feedback on what is needed to move the CBP water quality monitoring program from "Fair" to "Good".

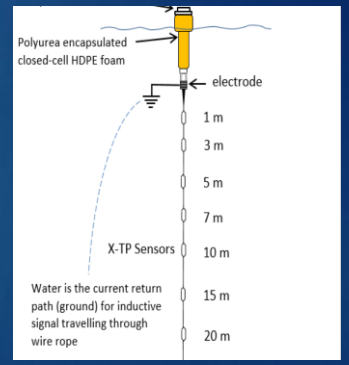
- **Action on recommendations – investments are in progress! ☺**



Issues of interest in growing out the sampling design for the array network

Needed information as we discussed design considerations

- Desirable locations/regions
  - (e.g., poorly monitored/high uncertainty areas)
- All year or seasonal
  - (duration of deployment for operations and maintenance planning)
- Vertical resolution at locations
  - (sensor density using a fixed array system)



Recommendations on sampling design for the next phase of hypoxia monitoring network development

- Mainstem bay (3)
  -
- Lower tributaries: Potomac and Rappahannock. (4)
  - 2 Potomac arrays
  - 2 Rappahannock arrays
- Mobile, targeted study arrays (4)
  - 3 new as a suite for evaluating scales of variability
  - 1 existing with MD DNR and their Fishing Bay study area

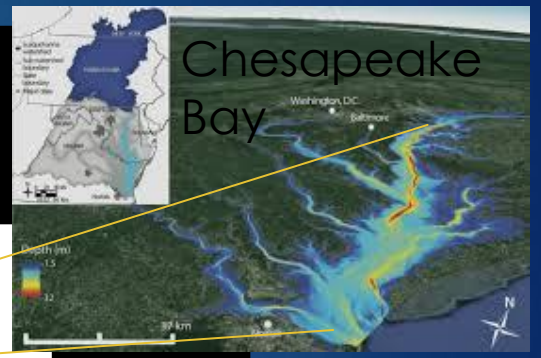
n=11+ arrays.

- Growing the water quality network from "Fair" to "good", addressing high frequency water quality habitat conditions with this level of investment and build out of the program.

Asking for your thoughts and insights on location details

Concept has been expressed, we just need to go from 3-D to 4-D expression and shorten the time interval to hourly

Frequency of hypoxia expressed as "% years of 25 yrs" as a function of depth along the mainstem of



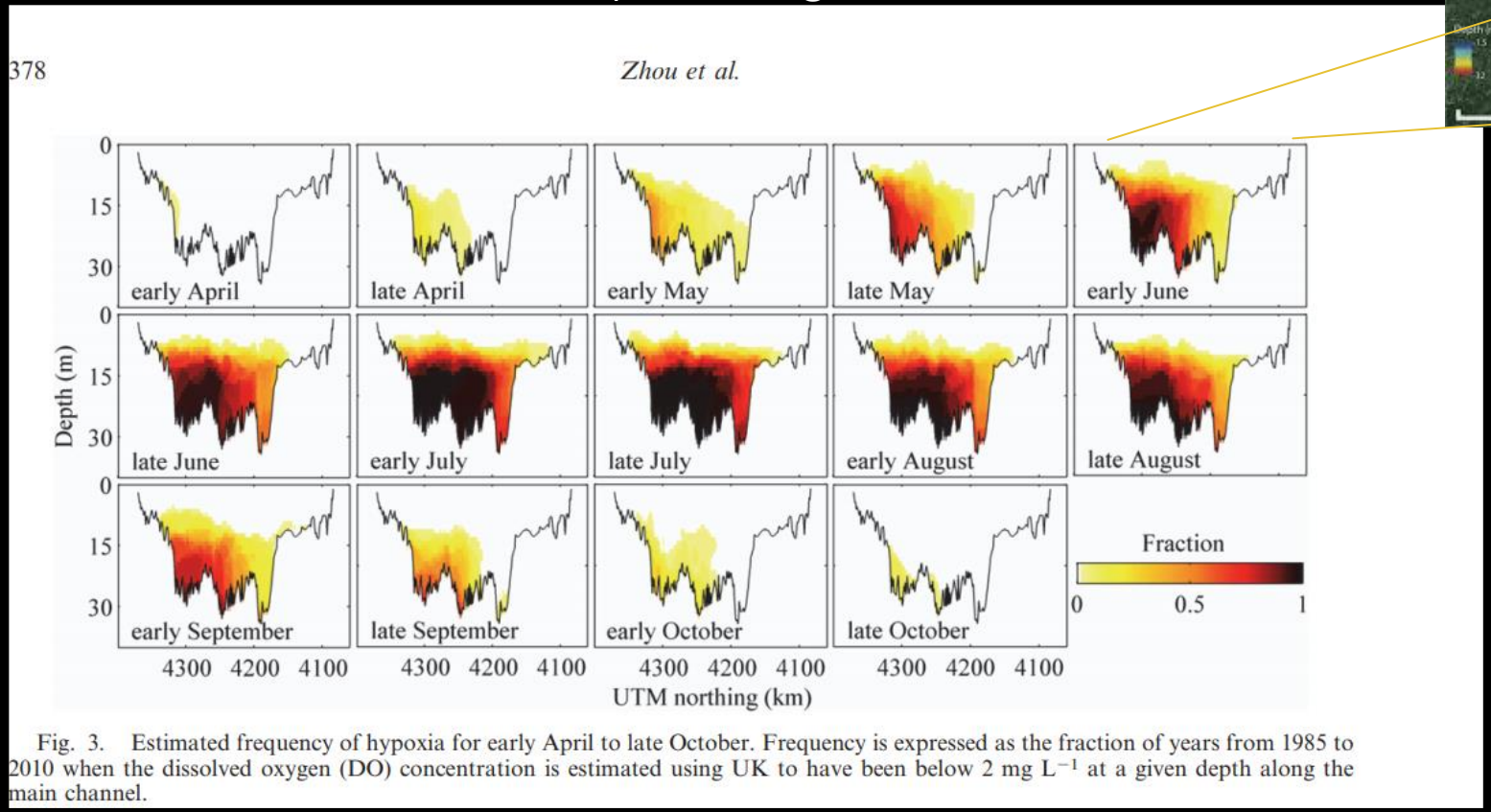


Fig. 3. Estimated frequency of hypoxia for early April to late October. Frequency is expressed as the fraction of years from 1985 to 2010 when the dissolved oxygen (DO) concentration is estimated using UK to have been below 2 mg L^{-1} at a given depth along the main channel.

Zhou et al. 2014. Nutrient loading and meteorological conditions explain interannual variability of hypoxia in Chesapeake Bay. Limnol Oceanogr 59(2):373-384.

Hypoxia phenomenon

Mainstem

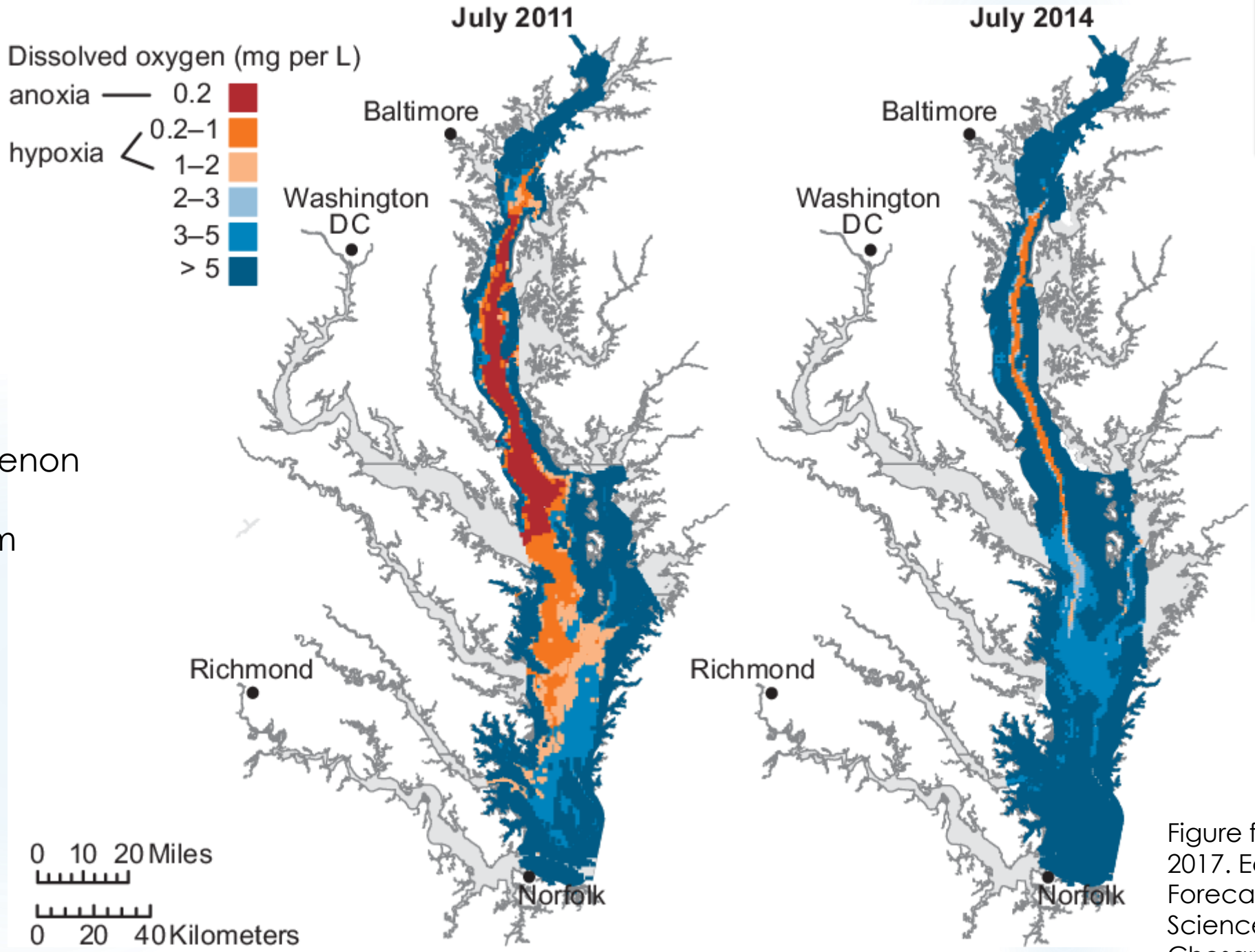
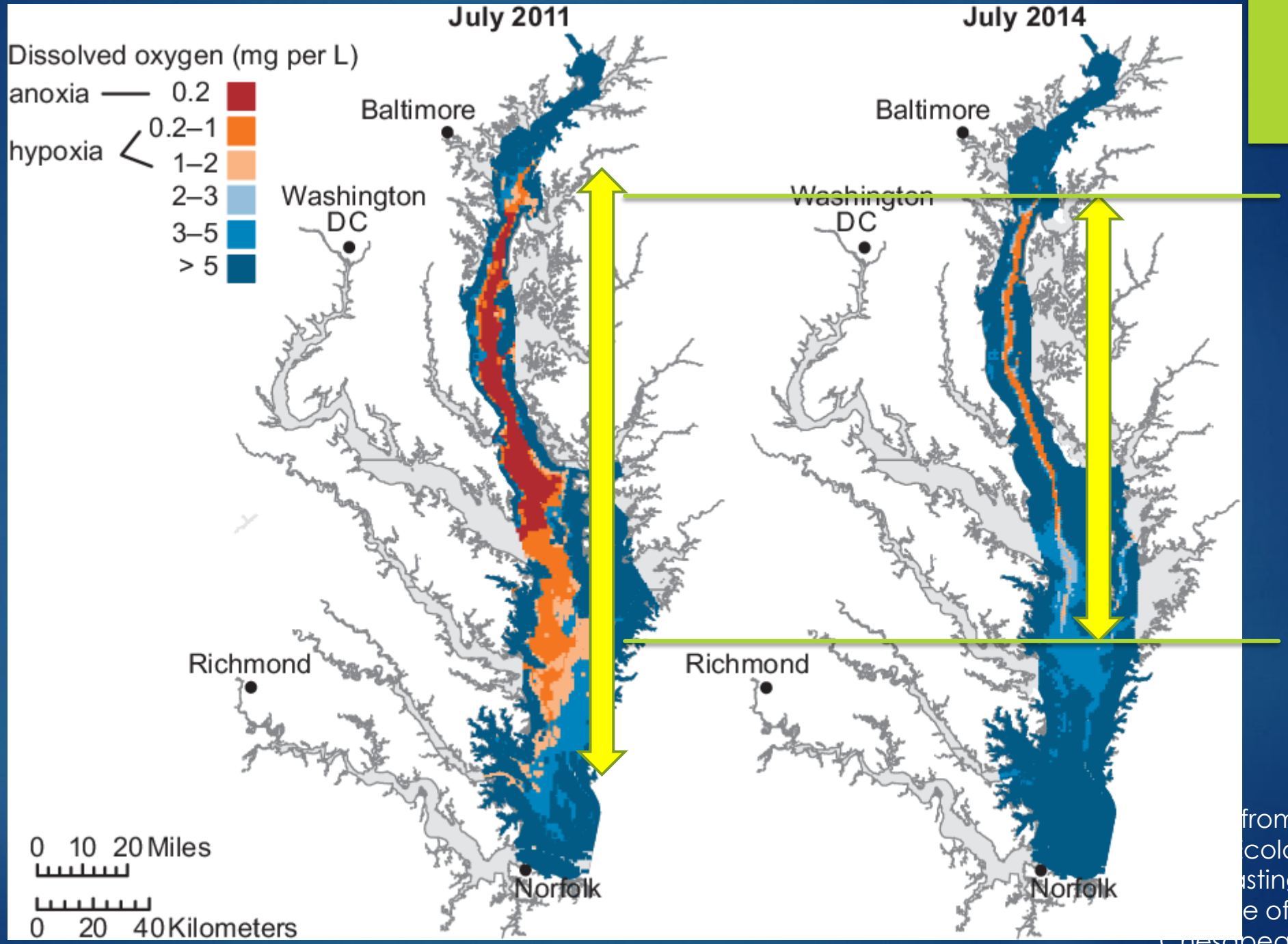


Figure from Testa et al. 2017. Ecological Forecasting and the Science of Hypoxia in Chesapeake Bay.



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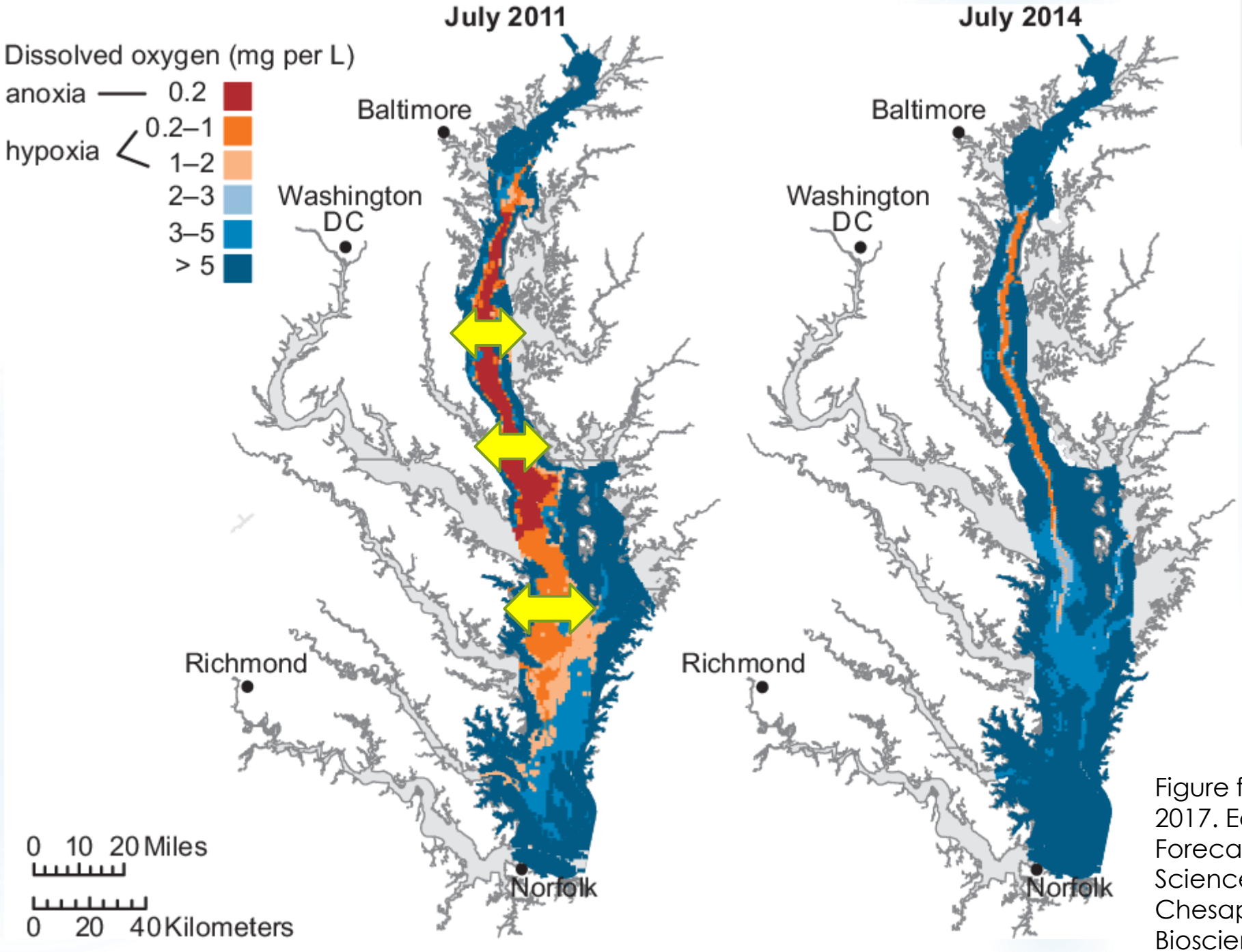
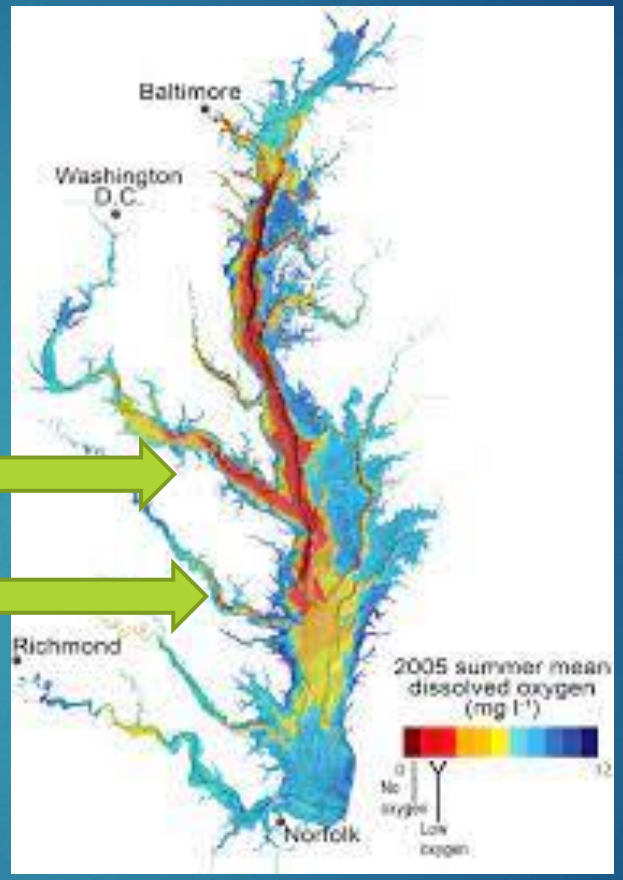
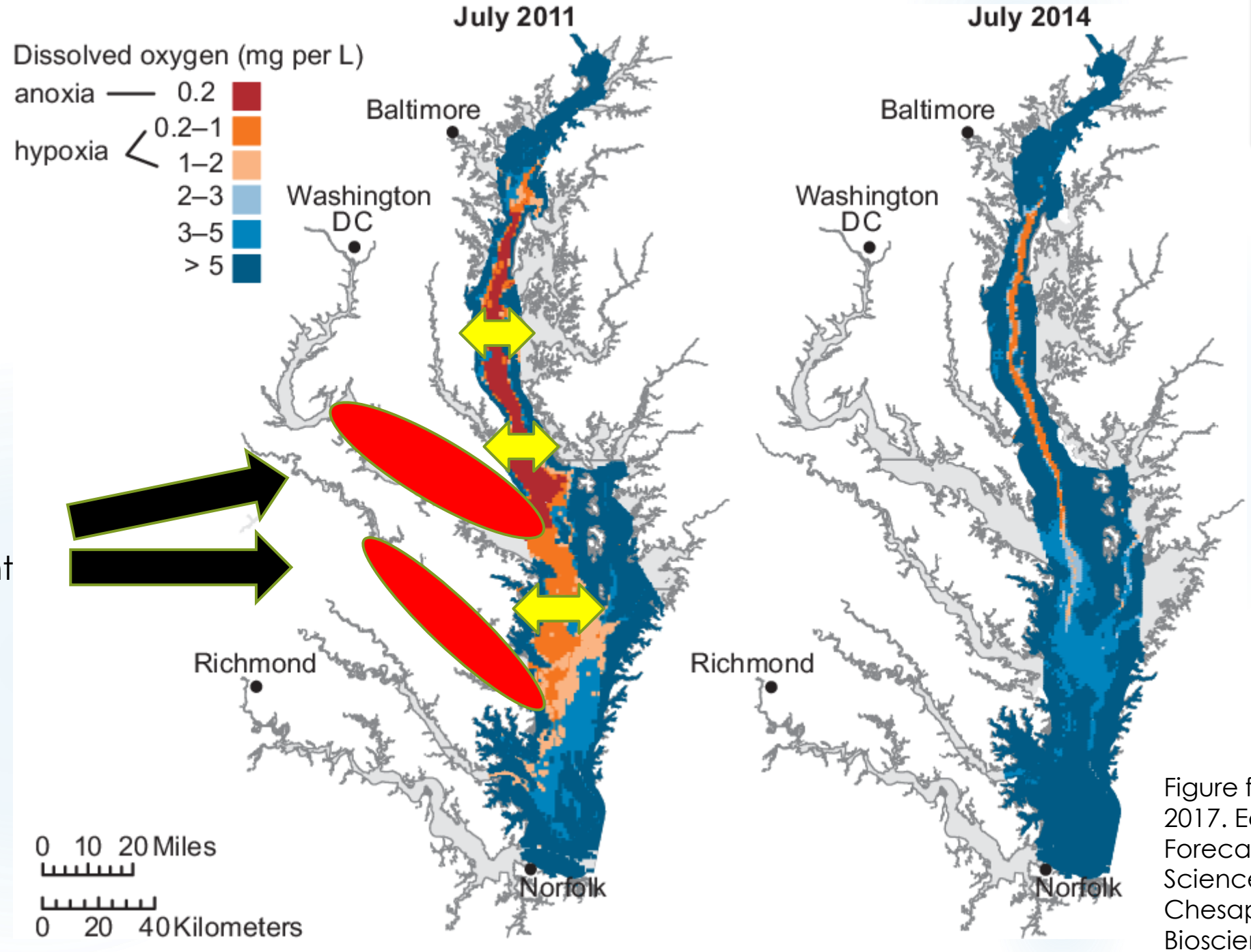


Figure from Testa et al. 2017. Ecological Forecasting and the Science of Hypoxia in Chesapeake Bay. Bioscience.

But remember, lower trib hypoxia/anoxia is important for us too



Also important



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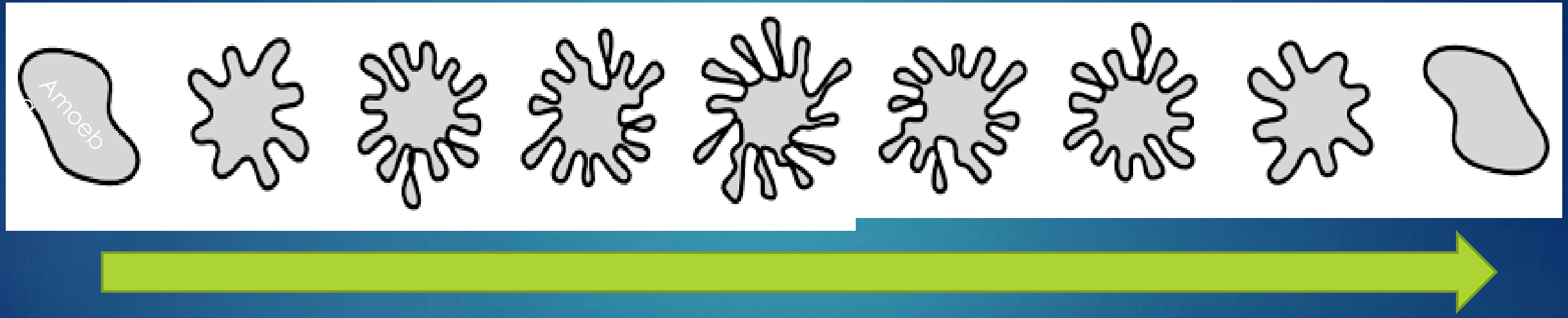
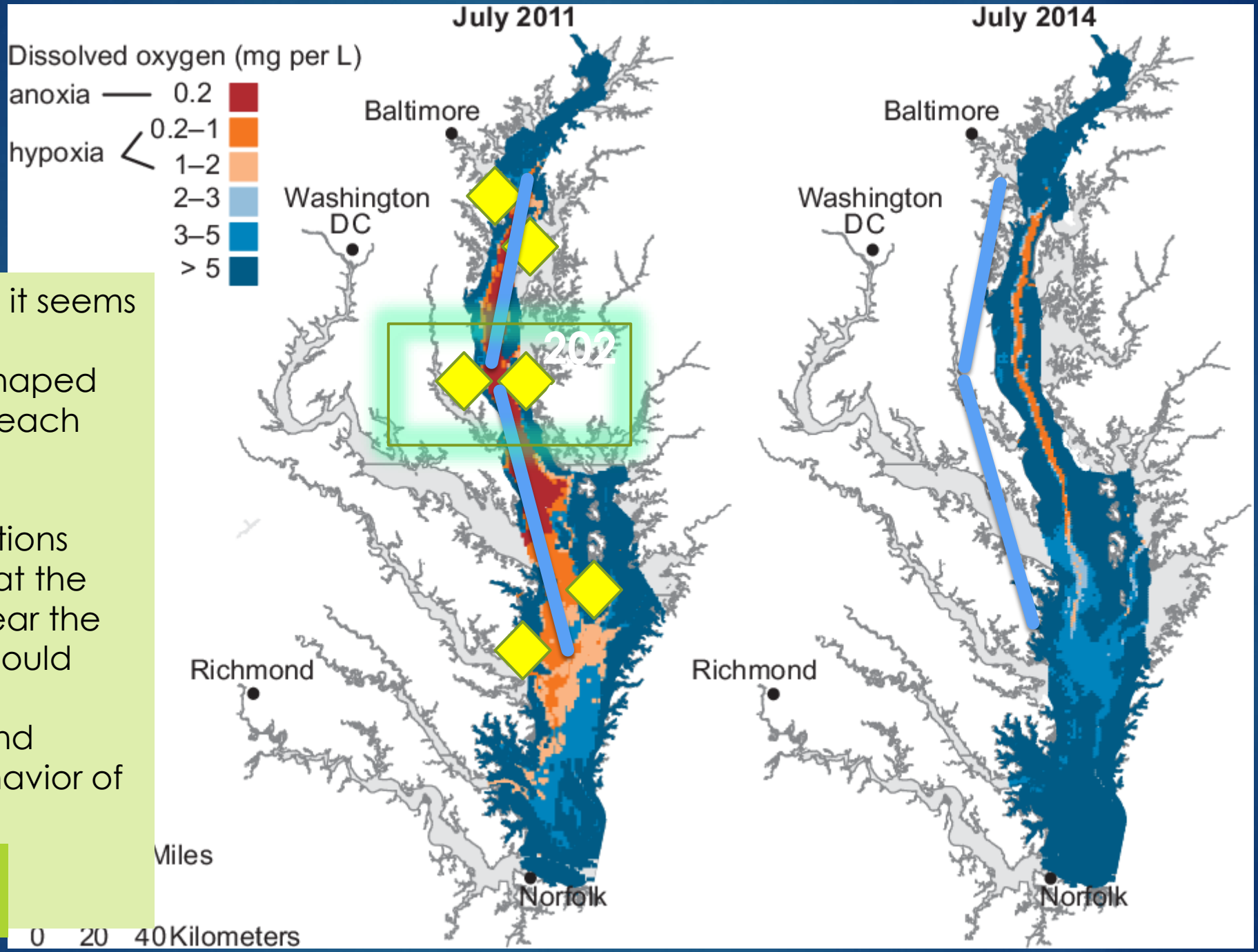
What monitoring do we need to track hypoxic zone shape change through time at hourly time scales?

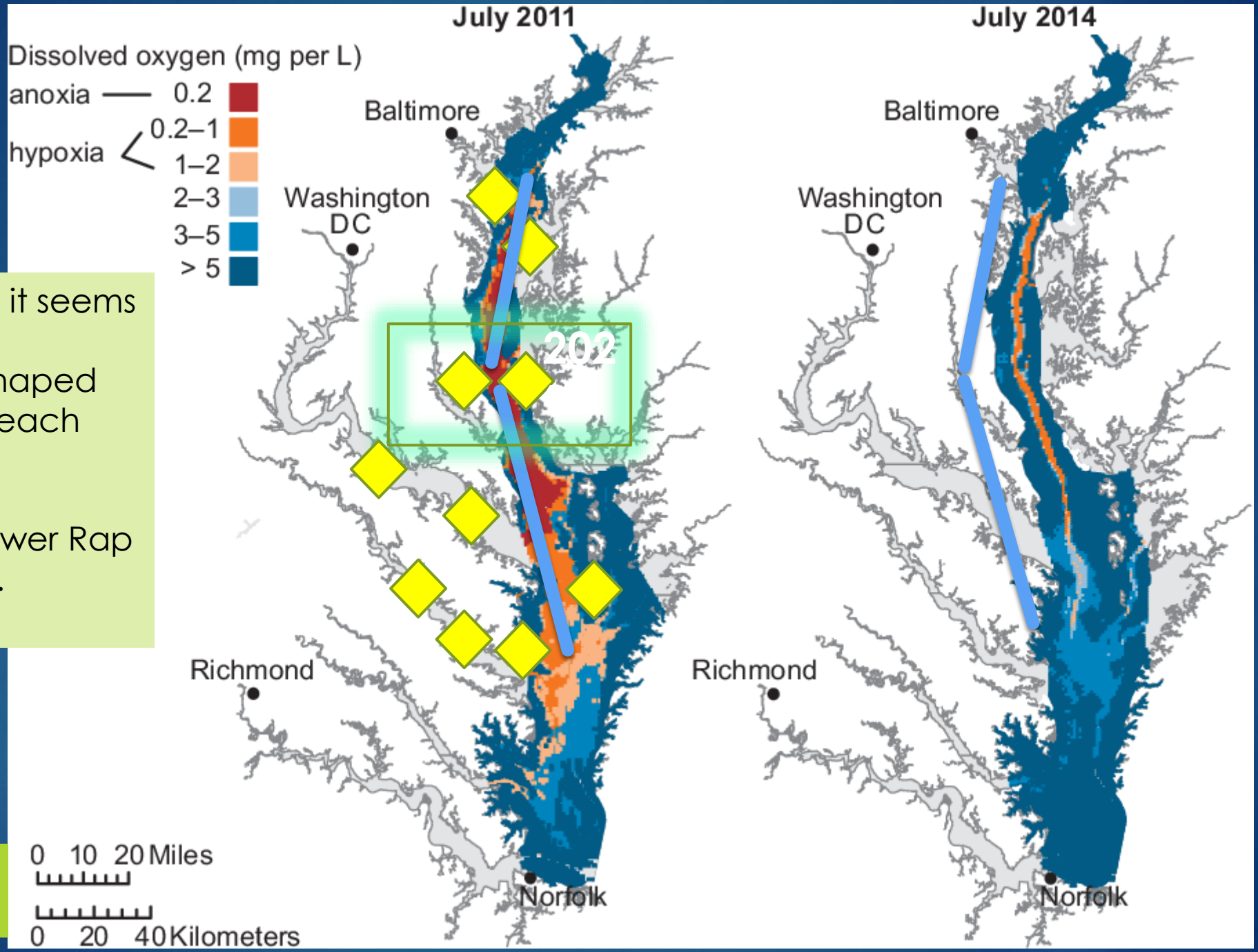




Conceptually, it seems we
Have an "L" shaped hypoxia zone each year.

If we have stations near the top, at the elbow, and near the bottom, we should capture the longitudinal and latitudinal behavior of hypoxia in the

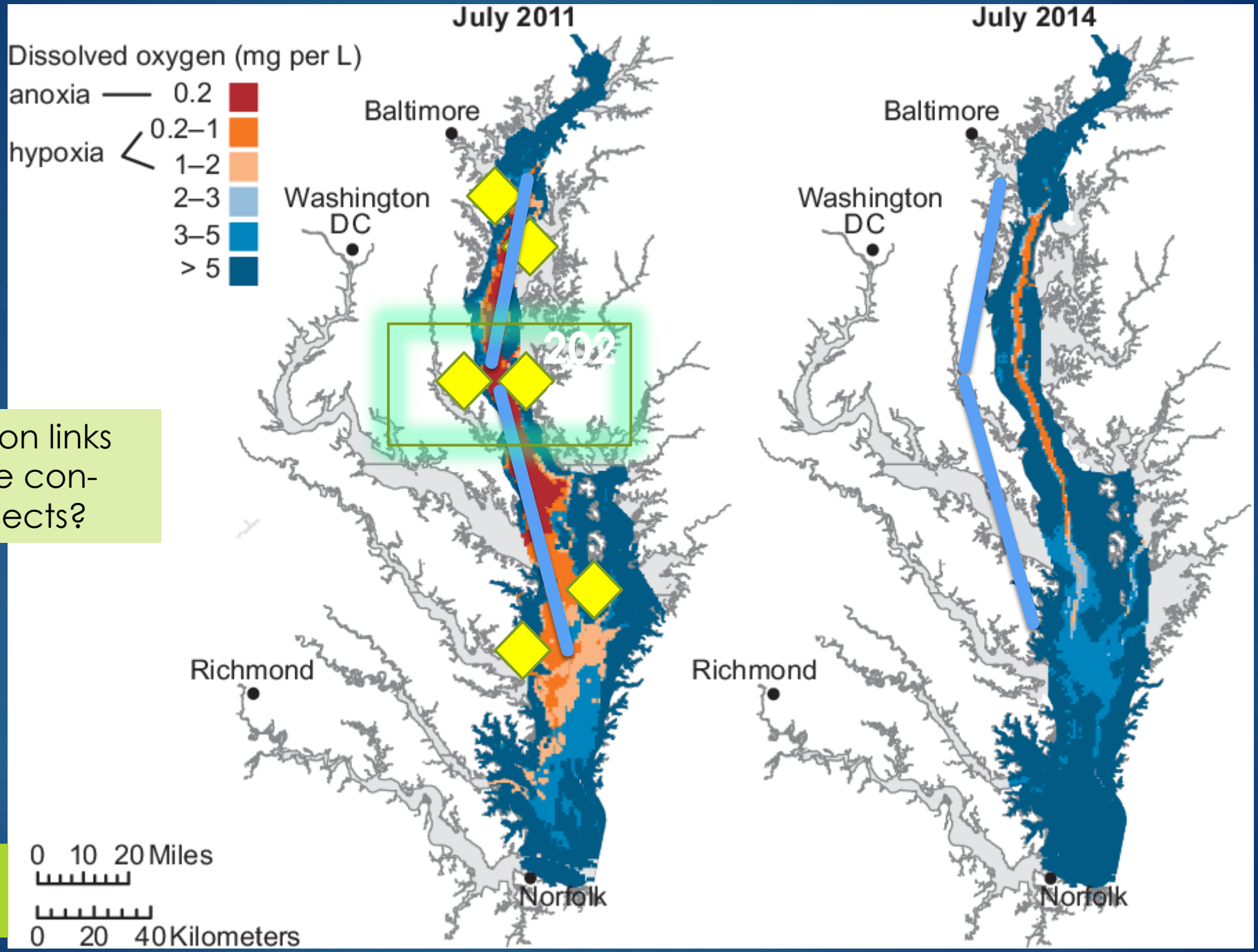
Hypothetical stations



Conceptually, it seems we
Have an "L" shaped hypoxia zone each year.

And we get lower Rap and Potomac.

Hypothetical stations



Can we plan on links with nearshore con-mons for transects?

Hypothetical stations

Recommendations on sampling design for the next phase of hypoxia monitoring network development: General locations

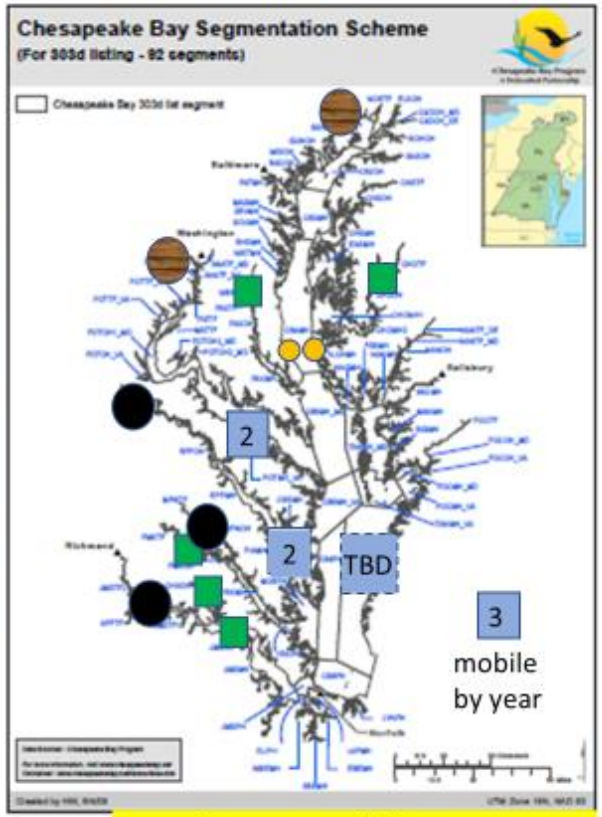
Expanding monitoring and assessment capacity 2021+: High frequency monitoring network

Existing

- NOAA supports 2 vertical sensor arrays
- 3 fully funded river input water quality continuous monitors (VADEQ/USGS)
- 2 river input water quality continuous monitoring sites with support ending, need funding (MD/USGS)

New – proposed and considered for investment

- 2021-22 PSC Monitoring Review proposal for capacity to support unassessed criteria assessment, improved fish habitat assessment, modeling calibration and verification:
  - 8 new tidal water vertical array sites
  - 5 new river input con-mons at tidal/nontidal boundary
  - New 4-D water quality interpolator tool development



Network vision: D.O., Temp, Salinity

- 11 vertical arrays operating in main bay and tidal tributaries
- 10 boundary condition river input continuous monitoring stations
- Sustain existing long-term and targeted shallow water monitoring

Today

- Diving into details please

In closing

- Justification for the present stage of the sampling design reflects
  - fisheries habitat information needs
  - modeling needs
  - research interests, and
  - water quality criteria assessment requirements

- Setting up the network will allow other partners to align data collection and QA with the network efforts to leverage resources

Issues of interest in growing out the sampling design

Needed information

- Locations/regions
- Vertical resolution at locations
- All year or seasonal (duration of deployment)

Future

- Aligning nearshore con-mons and bottom con-mons with vertical arrays in transects to improve our interpolations and assessments?

- Suggestions

- 8 new arrays
- Hypoxia Meeting recommendation
- Hypoxia Meeting recommendation