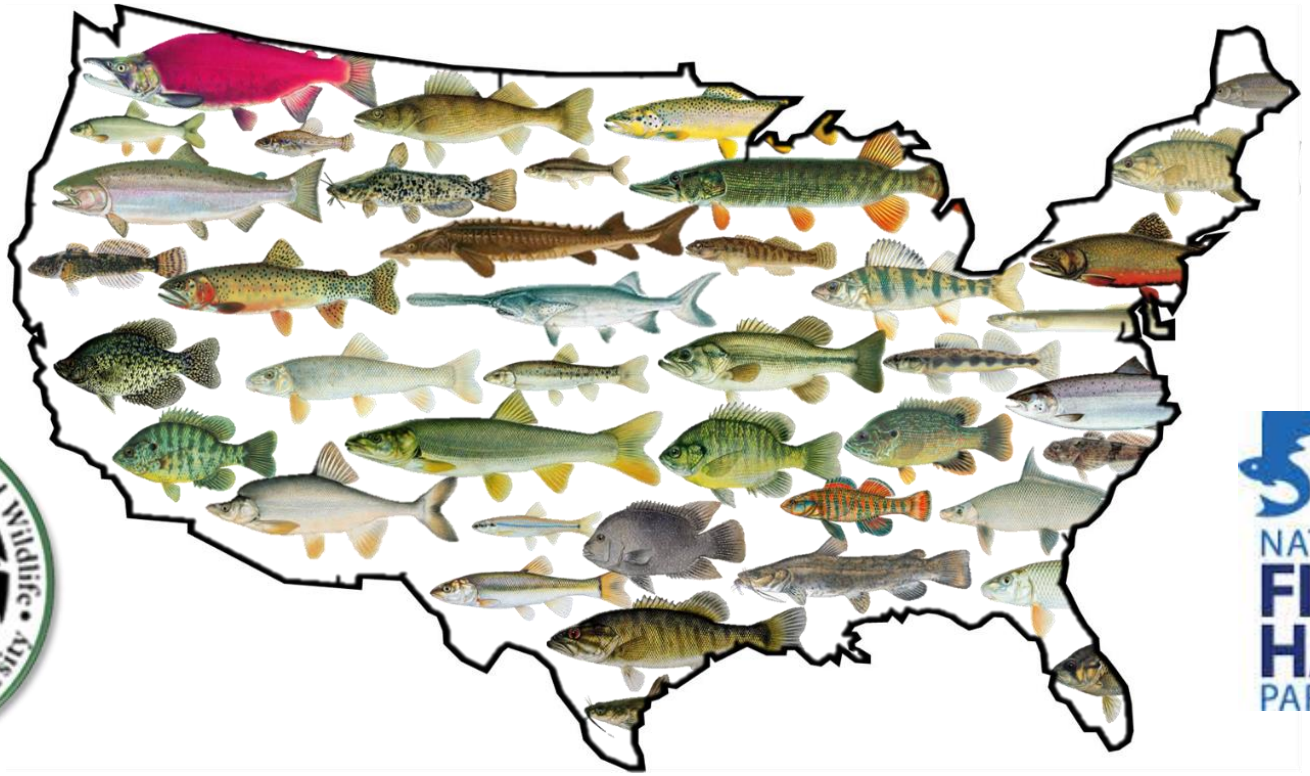
2015 Inland Assessment for the National Fish Habitat Partnership: National results and highlights for Chesapeake Bay



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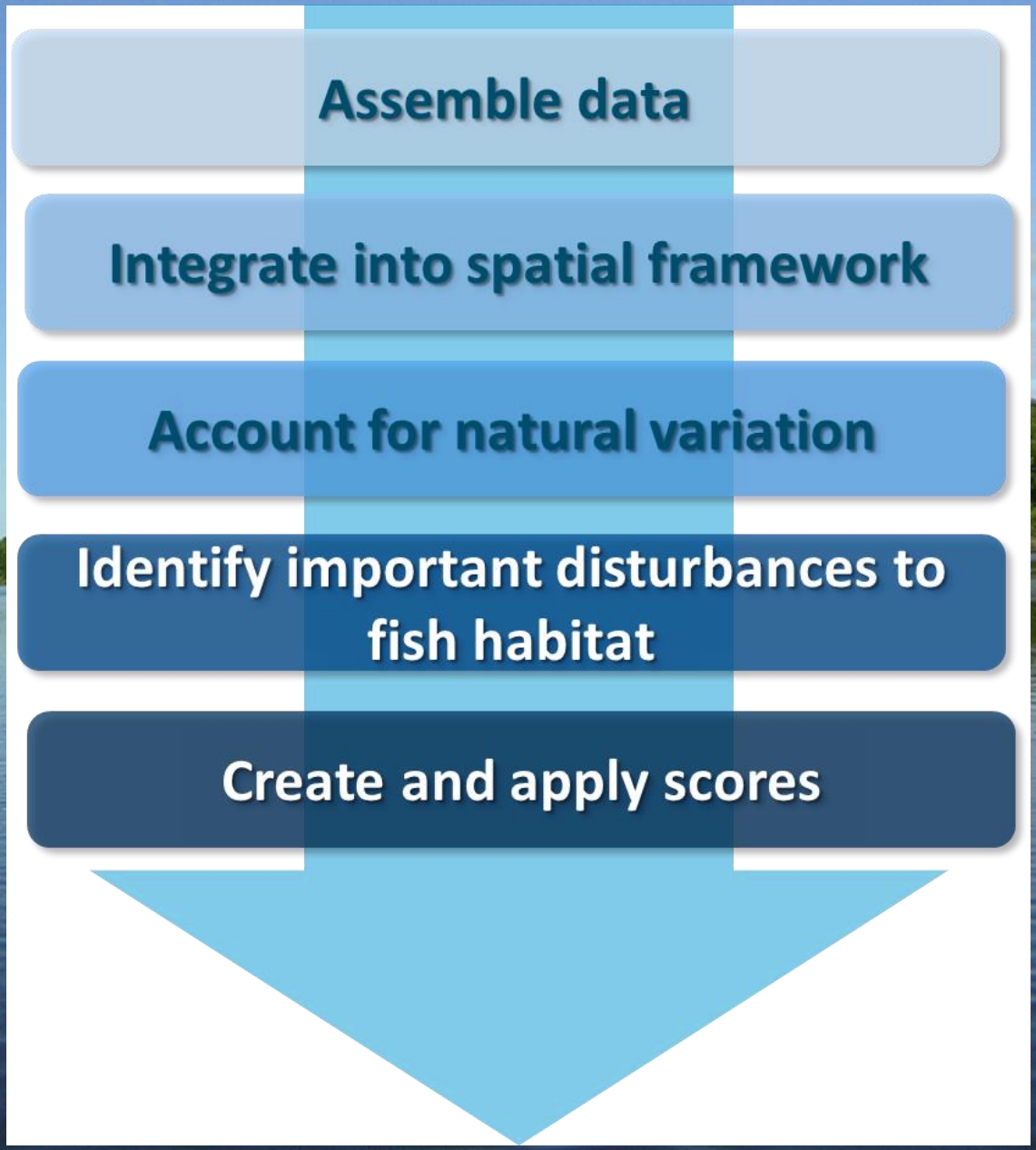
Michigan State University
East Lansing, Michigan

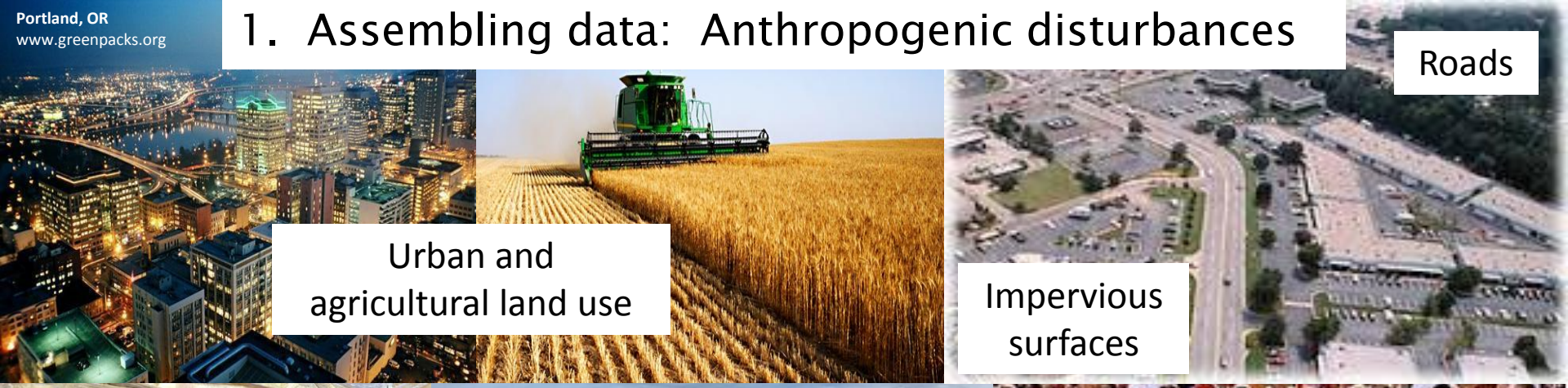
Outline for today

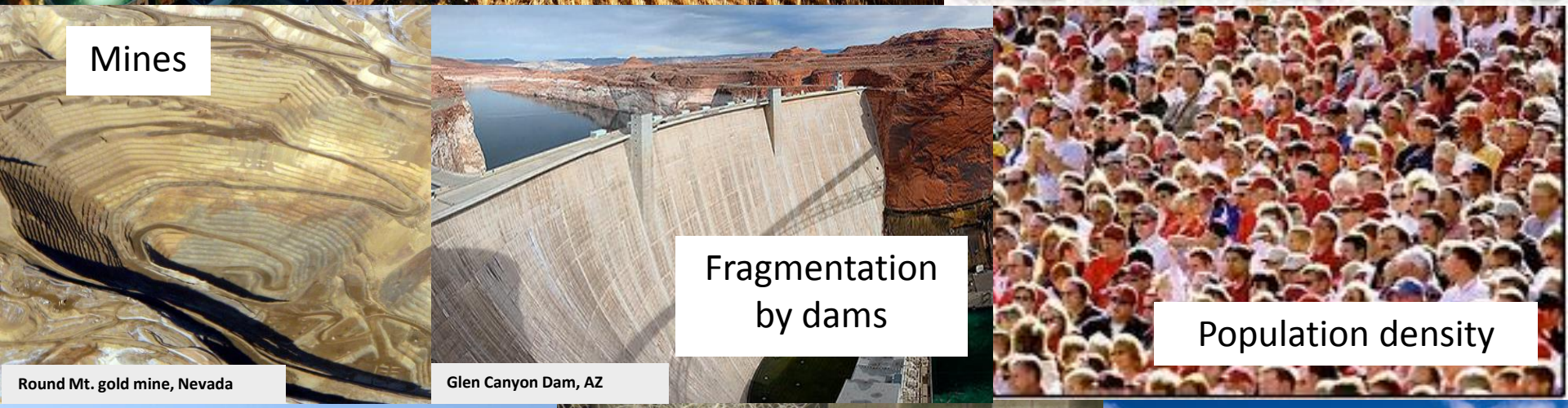
- Highlight methods and results for 2015 national inland assessment
- Highlight results for Chesapeake Bay region
- Describe opportunities to use scores and other data to enhance conservation actions

Methodological approach



1. Assembling data: Anthropogenic disturbances



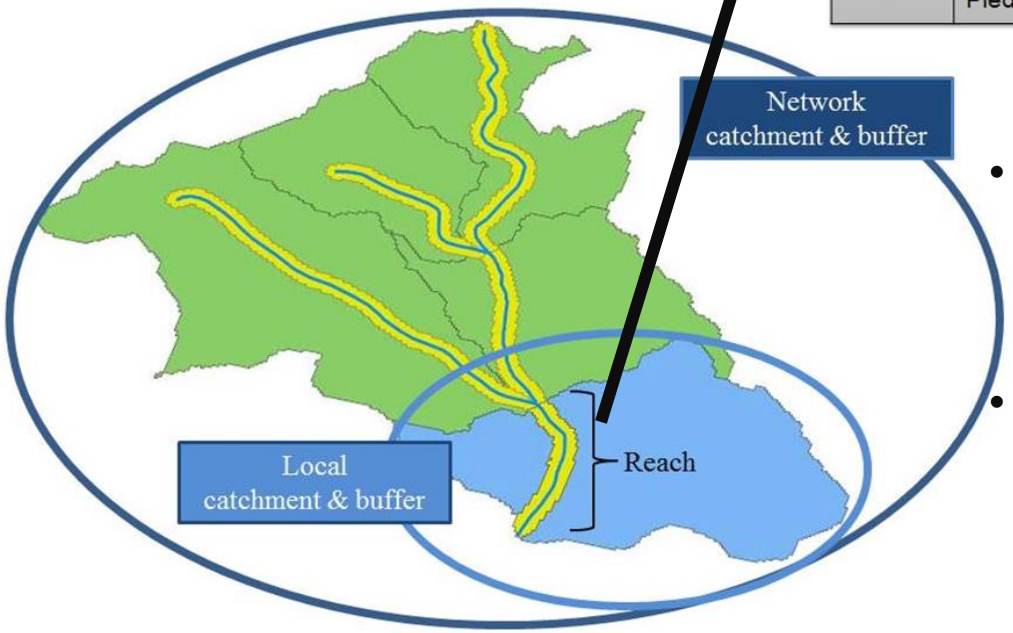


2. Attributing data to our spatial framework

- Spatial framework developed from stream reaches, catchments of National Hydrography Dataset Version 1; we created 90 m buffers for 2015 assessment

- Anthropogenic disturbances attributed to local and network catchments and buffers (in most cases)

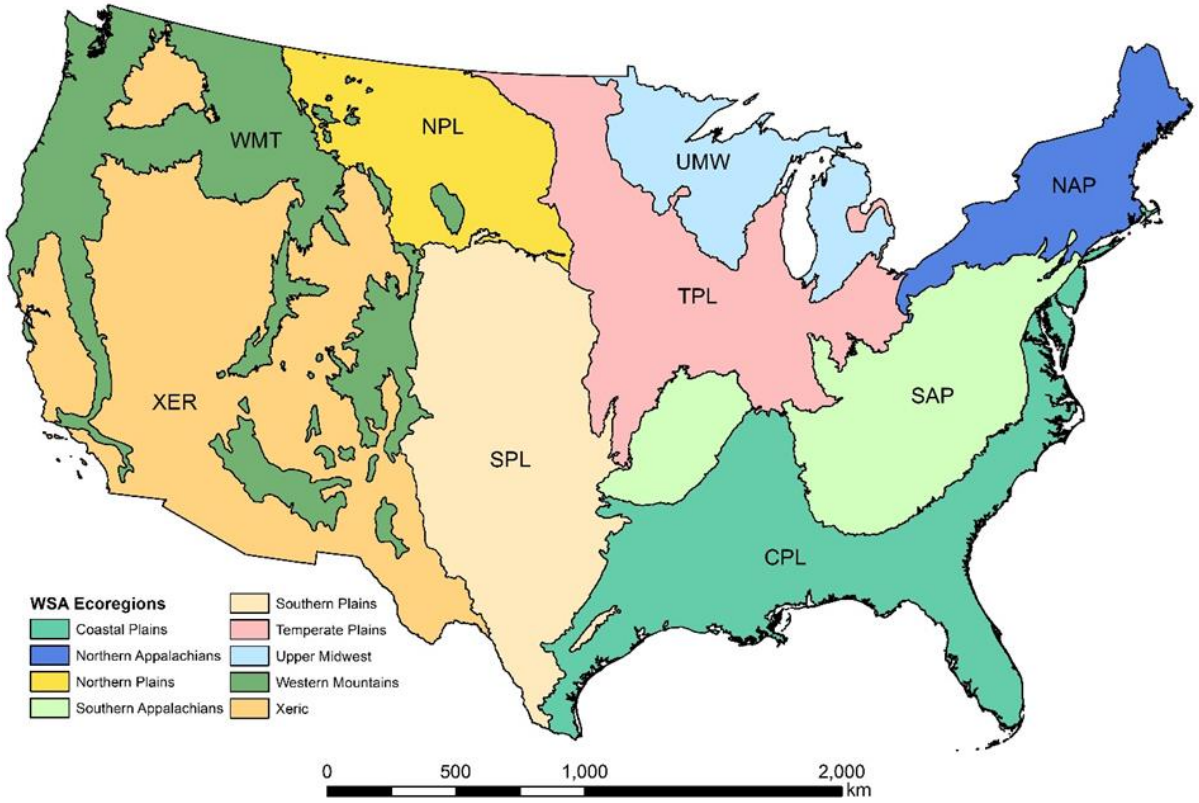
COMID	ECOREG	EDU	AGR_LOC	AGR_NET	DAMS_LOC
1054	Middle Missouri	North Platte	0.0	3.2	0
1055	Middle Missouri	North Platte	9.6	4.4	0
1056	Middle Missouri	Kansas/Republican	3.5	4.0	0
1057	Middle Missouri	Kansas/Republican	0.4	7.4	0
1058	Upper Missouri	Bighorn River	0.0	0.3	1
1059	Lower Rio Grande	Laguna Madre	5.1	14.0	0
1060	Lower Rio Grande	Laguna Madre	8.4	7.7	1
1061	Pecos	Middle Rio Grande	7.7	6.3	0
1062	Pecos	Lower Pecos River	3.4	14.1	0
1063	Appalachian Piedmont	Cape Fear River	5.0	7.6	0



- Natural landscape factors (i.e., slope, air temperature, precipitation, etc.) also attributed to spatial framework

- Stream fish samples (provided by state and federal programs) attributed to reaches

Relationships between disturbances and fishes tested in ecoregions…



3. Accounting for natural variation

…and in stream size classes

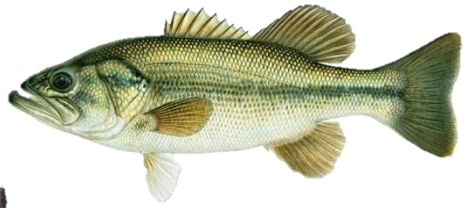
4. Identifying important disturbances

Metrics identified regionally, by size strata following Stoddard et al. 2008

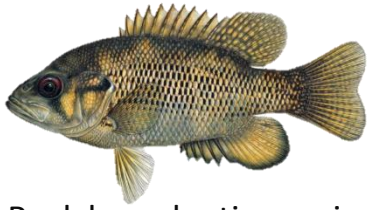
Stream size	Ecoregion	Fish metric
	CPL	
Creek		% regional intolerant individuals
		% native piscivore individuals
		% native invertivore taxa*
		% EPA tolerant taxa
		% lentic taxa
		% native taxa associated with soft sediments
River		% regional intolerant individuals
		% native invertivore taxa*
		% EPA tolerant taxa
		% lentic taxa
		% native lithophilic spawner taxa
		% taxa associated with sand substrate
		% native individuals associated with woody debris
	NAP	
Creek		% guarder taxa
		% native lithophilic spawner taxa*
		% native piscivore-invertivore individuals
		% individuals associated with sand substrate
		% regional intolerant individuals*
River		% large river taxa
		% native lithophilic spawner taxa*
		% native piscivore-invertivore individuals
		% lentic taxa
		% regional intolerant individuals*
	SAP	
Creek		% native lithophilic spawner taxa
		% piscivore individuals*
		% Percina taxa
		% regional intolerant individuals*
		% native lentic individuals.
		% native rheophilic taxa*
River		% regional intolerant individuals*
		% piscivore individuals*
		% detritivore taxa
		% native rheophilic taxa *
		% native piscivore-invertivore taxa
		% native taxa associated with soft sediments

*= same metric was used in 2010 assessment

Brook trout, lithophilic spawner

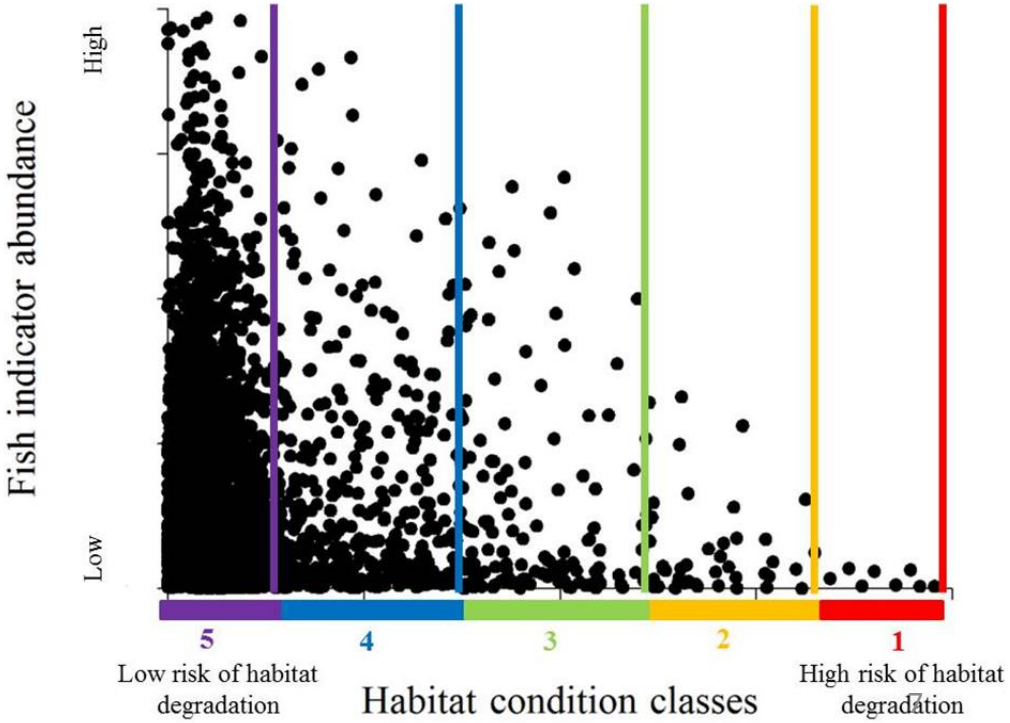


Largemouth bass, piscivore

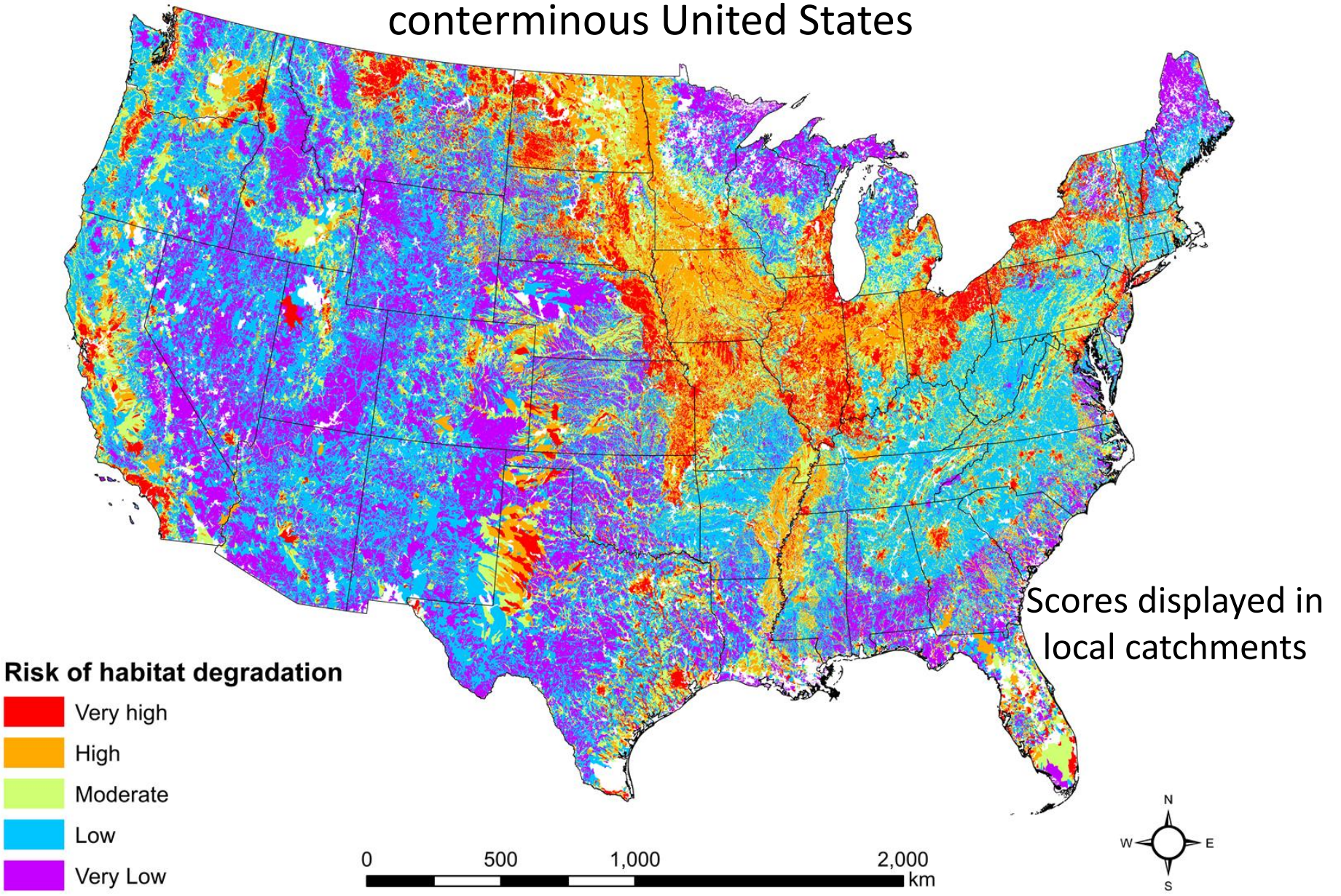


Rock bass, lentic species

- Tested for associates between metrics and disturbances
- Results used to create scores…



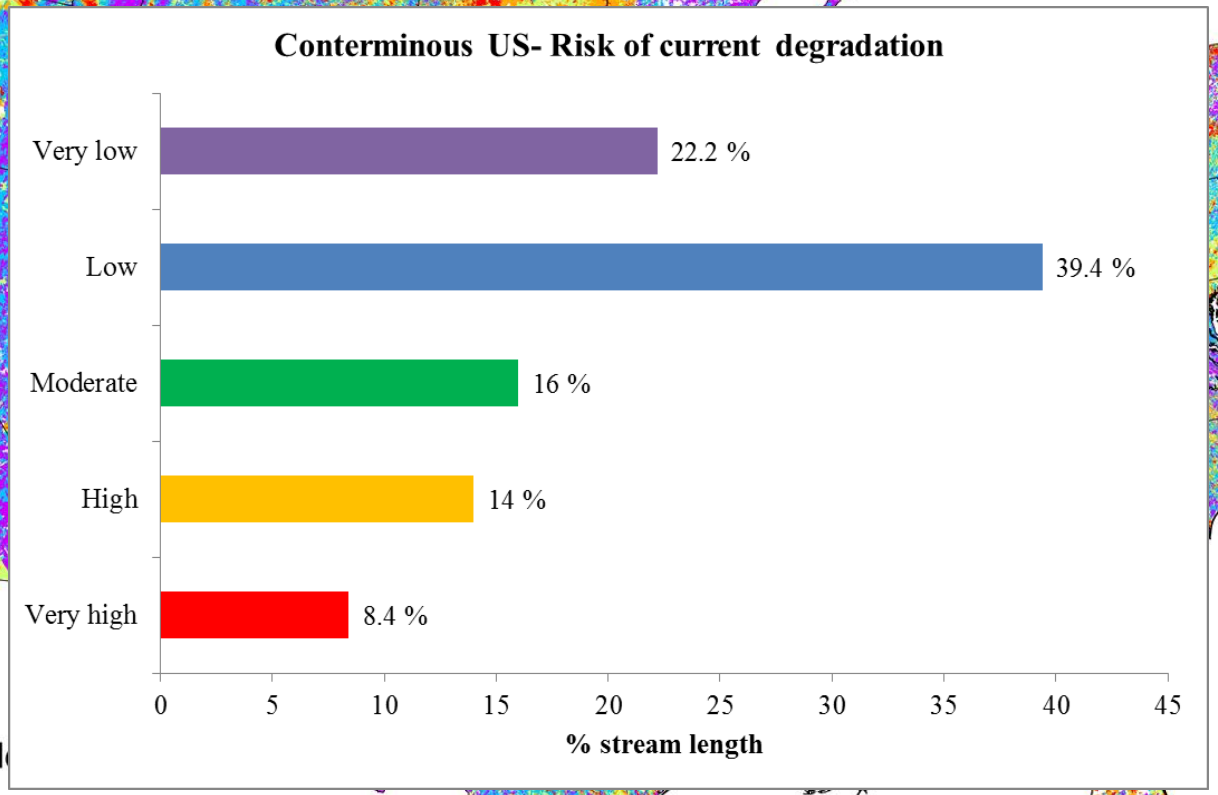
2015 relative condition of fish habitat in streams of the conterminous United States



Scores displayed in local catchments

To reference this figure: Crawford, S., Whelan, G., Infante, D.M., Blackhart, K., Daniel, W.M., Fuller, P.L., Birdsong, T., Ruhl, P., Wieferich, D.J., McClees-Funinan, R., and Stedman, S.M. In Review. Through a Fish's Eye: The Status of Fish Habitats in the United States 2015. Online report in development by the U. S. Geological Survey.

2015 relative condition of fish habitat in streams of the conterminous United States



Risk of habitat d

- Very high
- High
- Moderate
- Low
- Very Low

0 500 1,000 2,000 km

N W E S

To reference this figure: Crawford, S., Whelan, G., Infante, D.M., Blackhart, K., Daniel, W.M., Fuller, P.L., Birdsong, T., Ruhl, P., Wieferich, D.J., McClees-Funinan, R., and Stedman, S.M. In Review. Through a Fish's Eye: The Status of Fish Habitats in the United States 2015. Online report in development by the U. S. Geological Survey.

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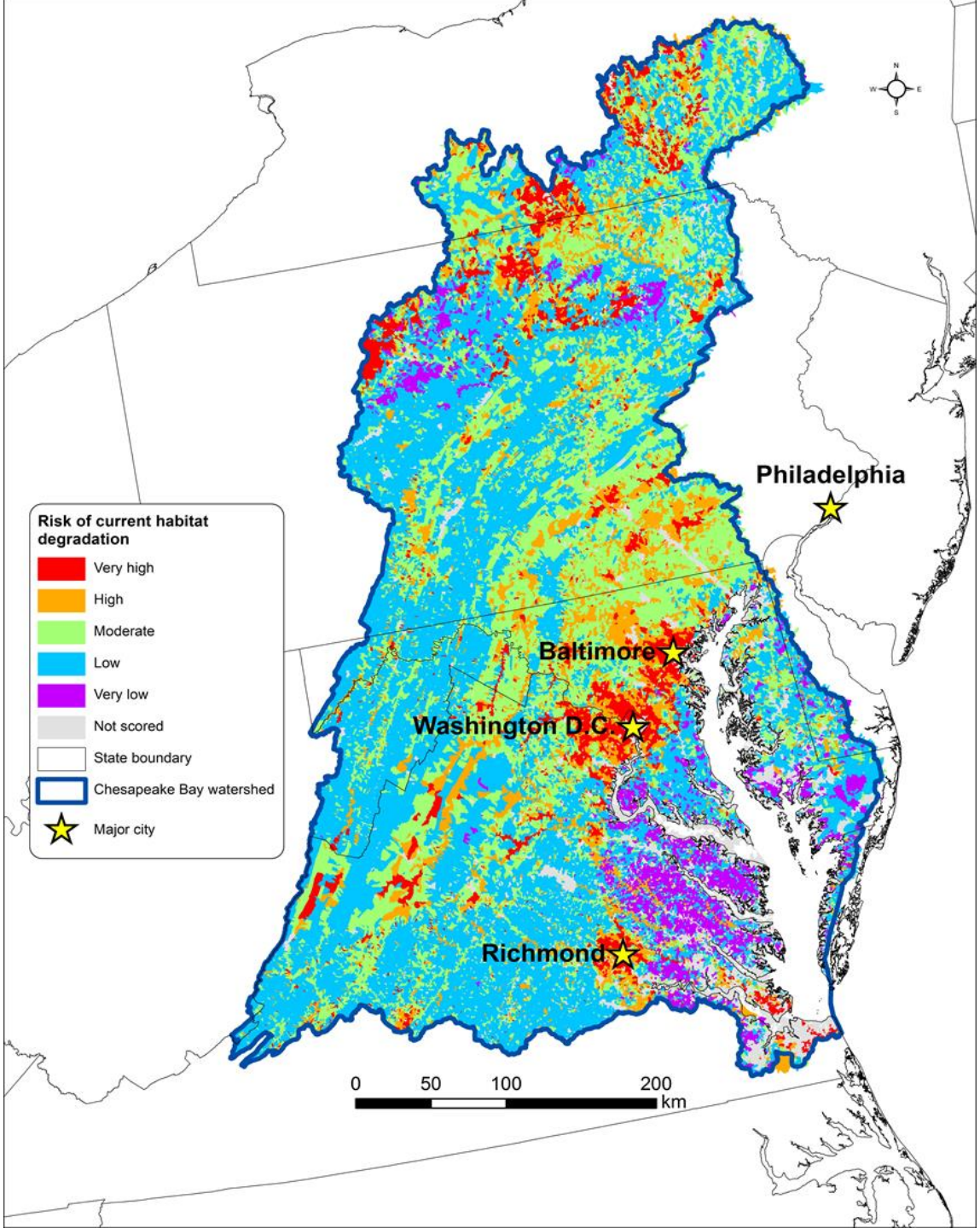
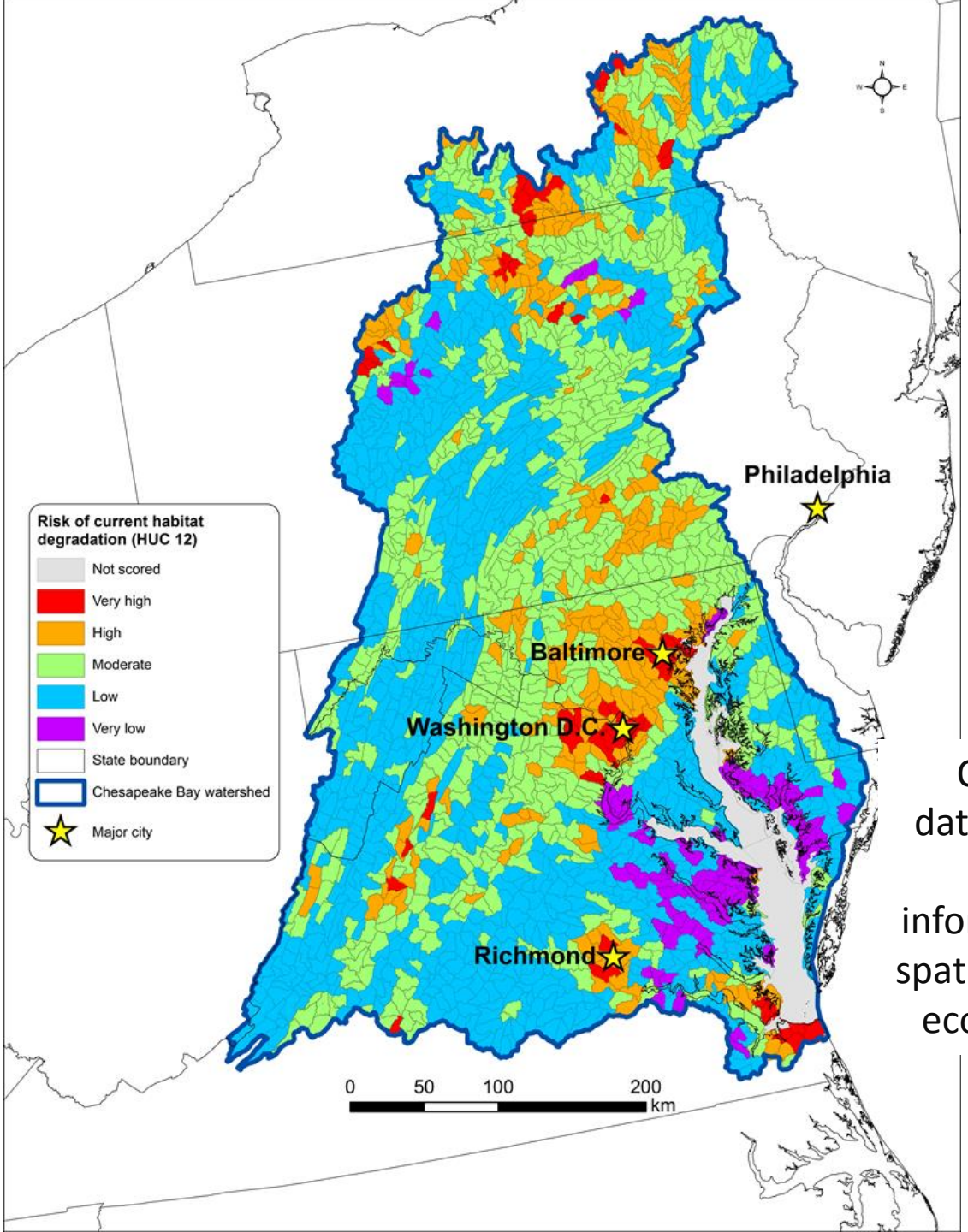


Chesapeake Bay basin fish habitat scores displayed in local catchments

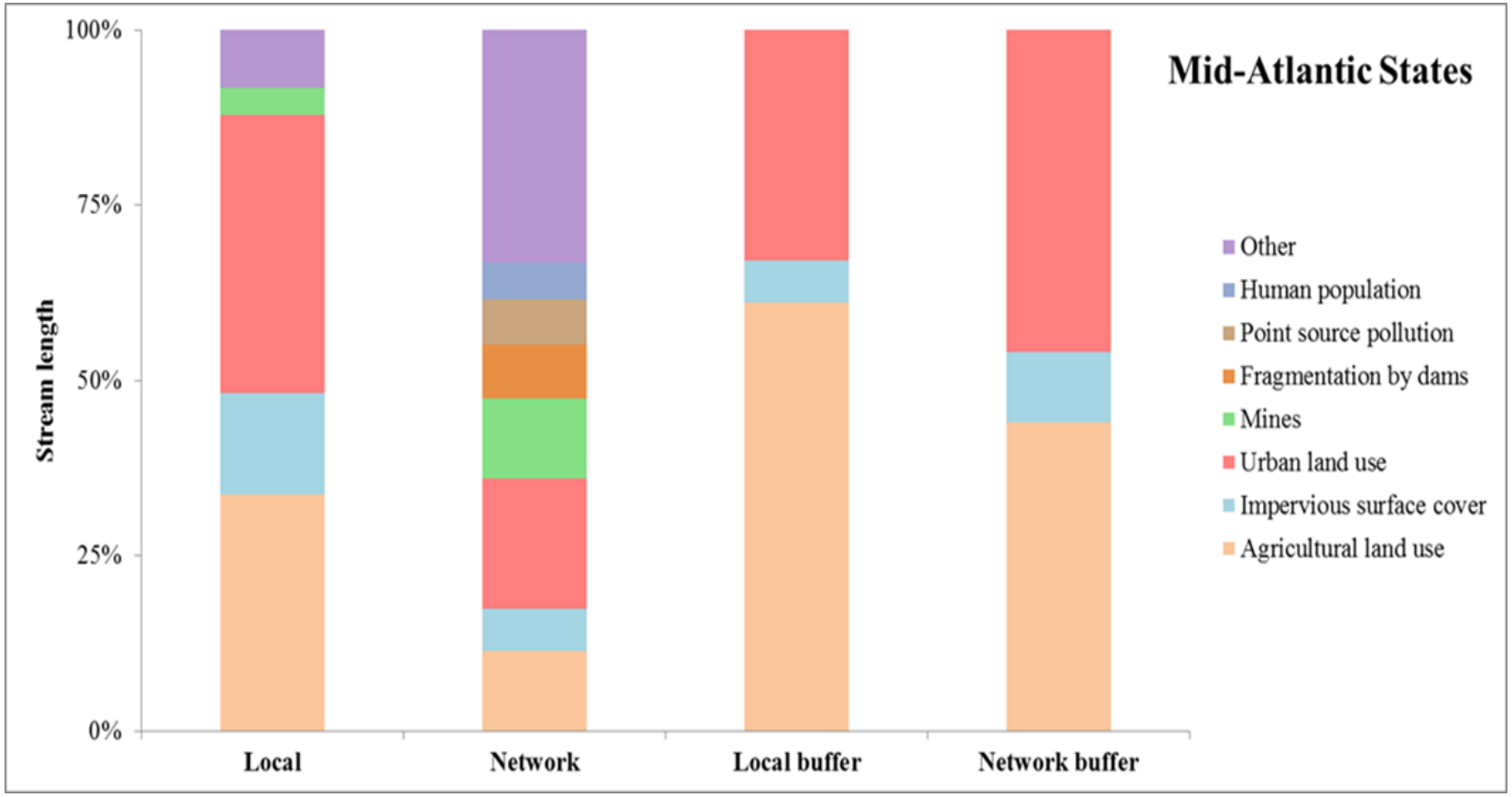
Chesapeake Bay basin fish habitat scores displayed in HUC12 watersheds



Organization of our database allows for easy summarization of information in a variety of spatial units (i.e., counties, ecoregions, states, etc.)

Most limiting disturbances to stream habitats in Mid-Atlantic state grouping:

Virginia, Maryland, West Virginia, Pennsylvania, Delaware, New Jersey

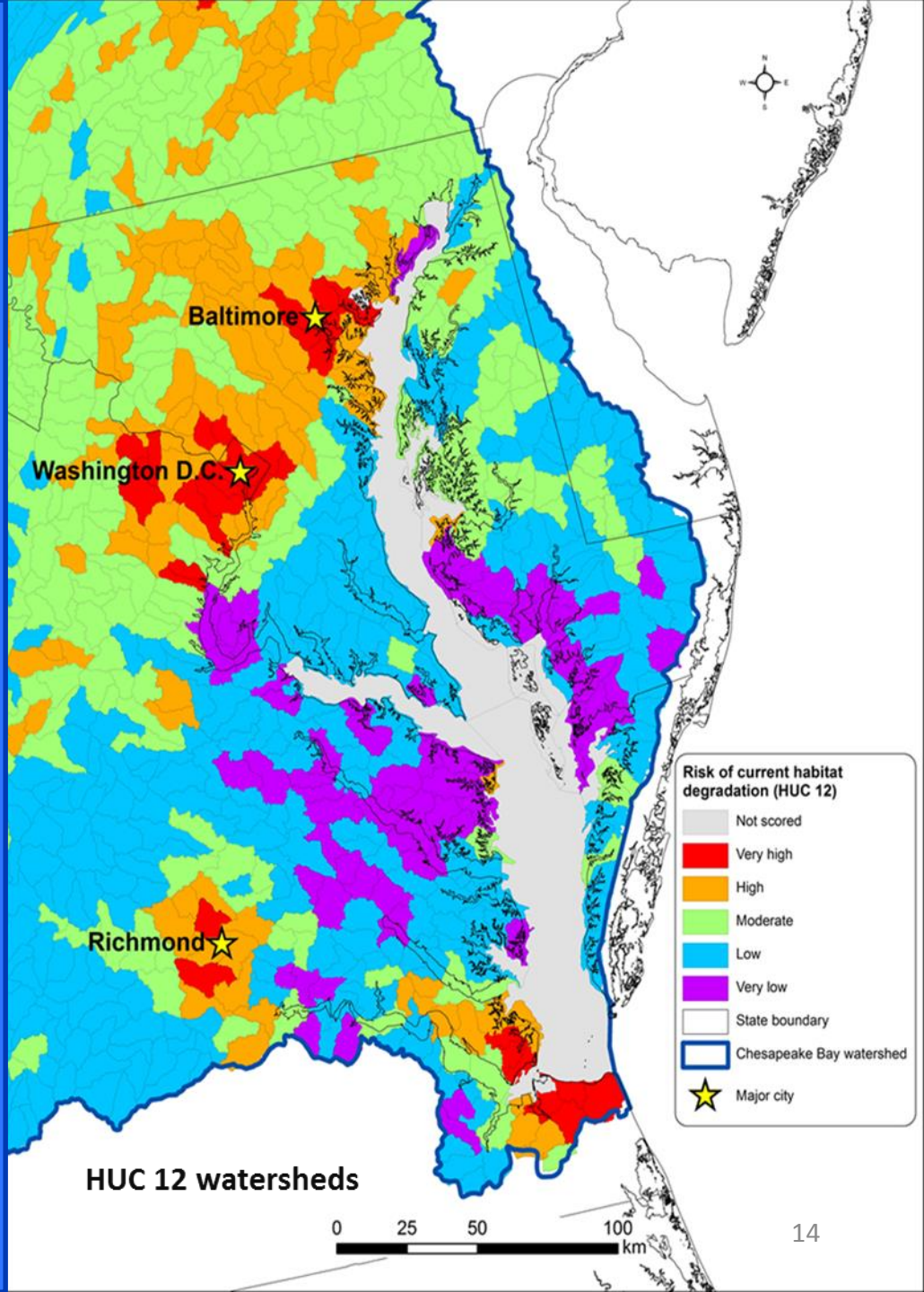


While multiple disturbances contribute to overall habitat condition scores, management efforts targeting most limiting disturbances in different spatial extents may be most effective for improving overall habitat condition

What are limiting disturbances in the Chesapeake Bay basin?

- Agriculture (pasture/hay)
- Urbanization
- Mining (coal and mineral)
- Nutrients (N and P)

- Results vary regionally, by spatial extent



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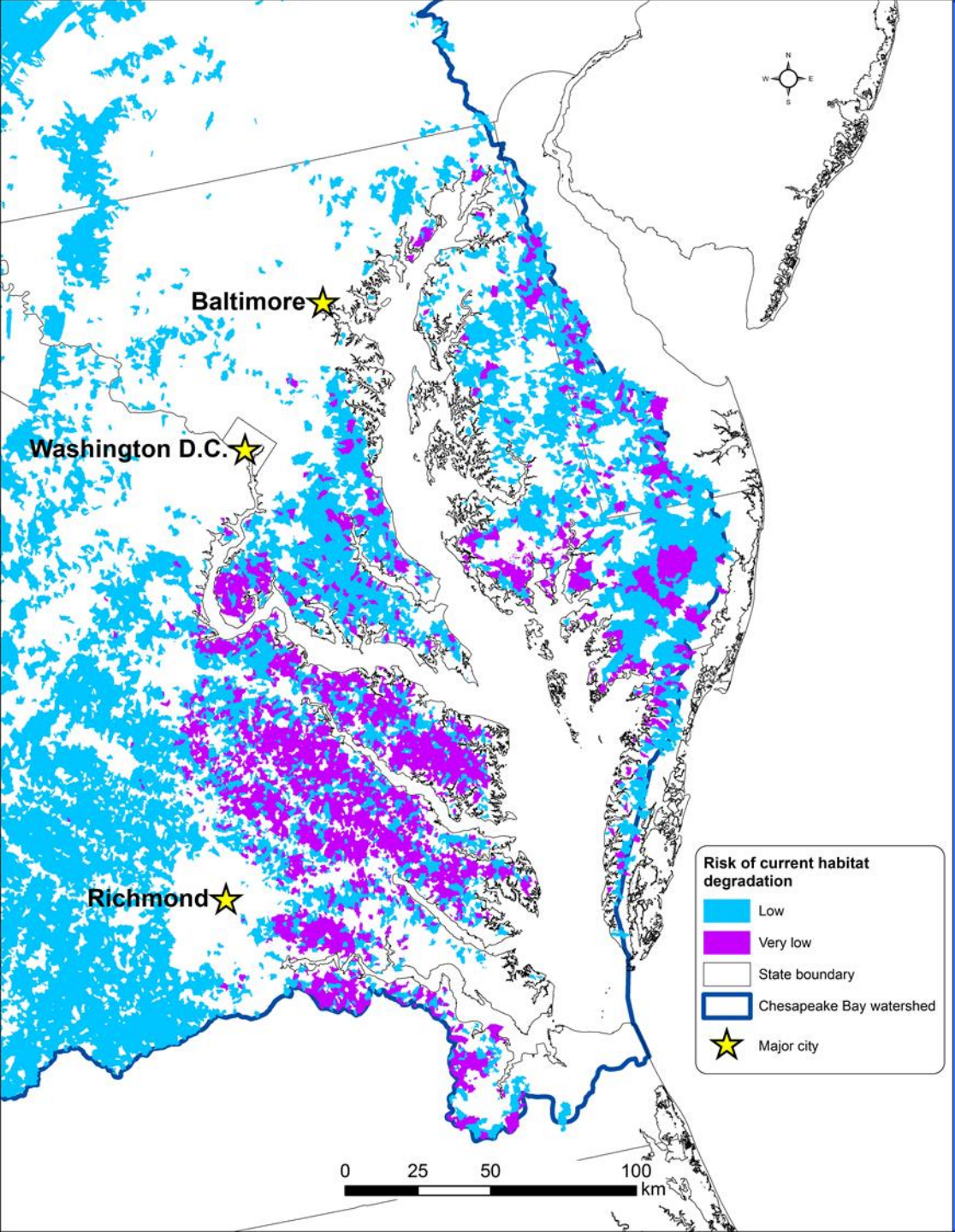
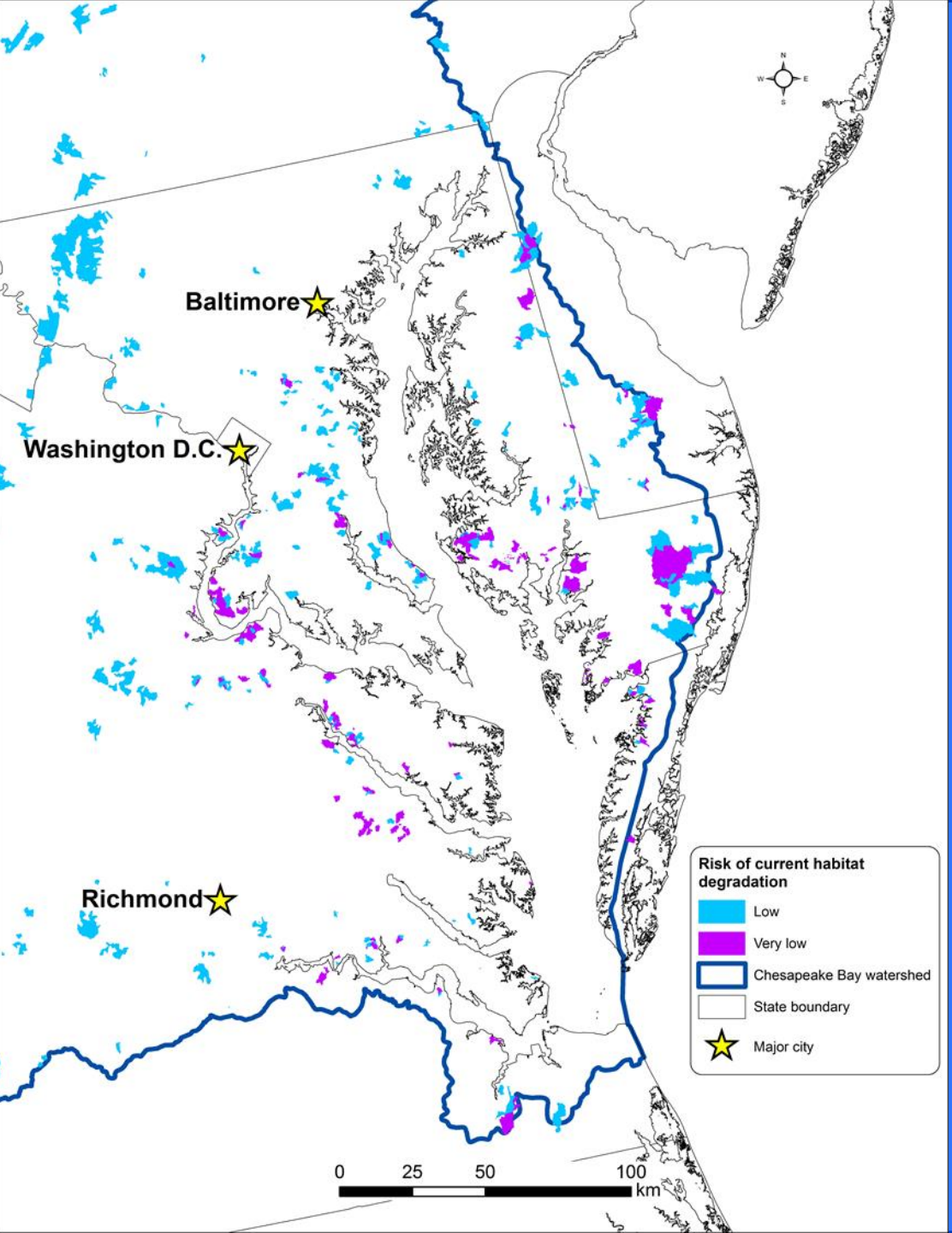
Where is the best stream fish habitat in the Chesapeake Bay basin?



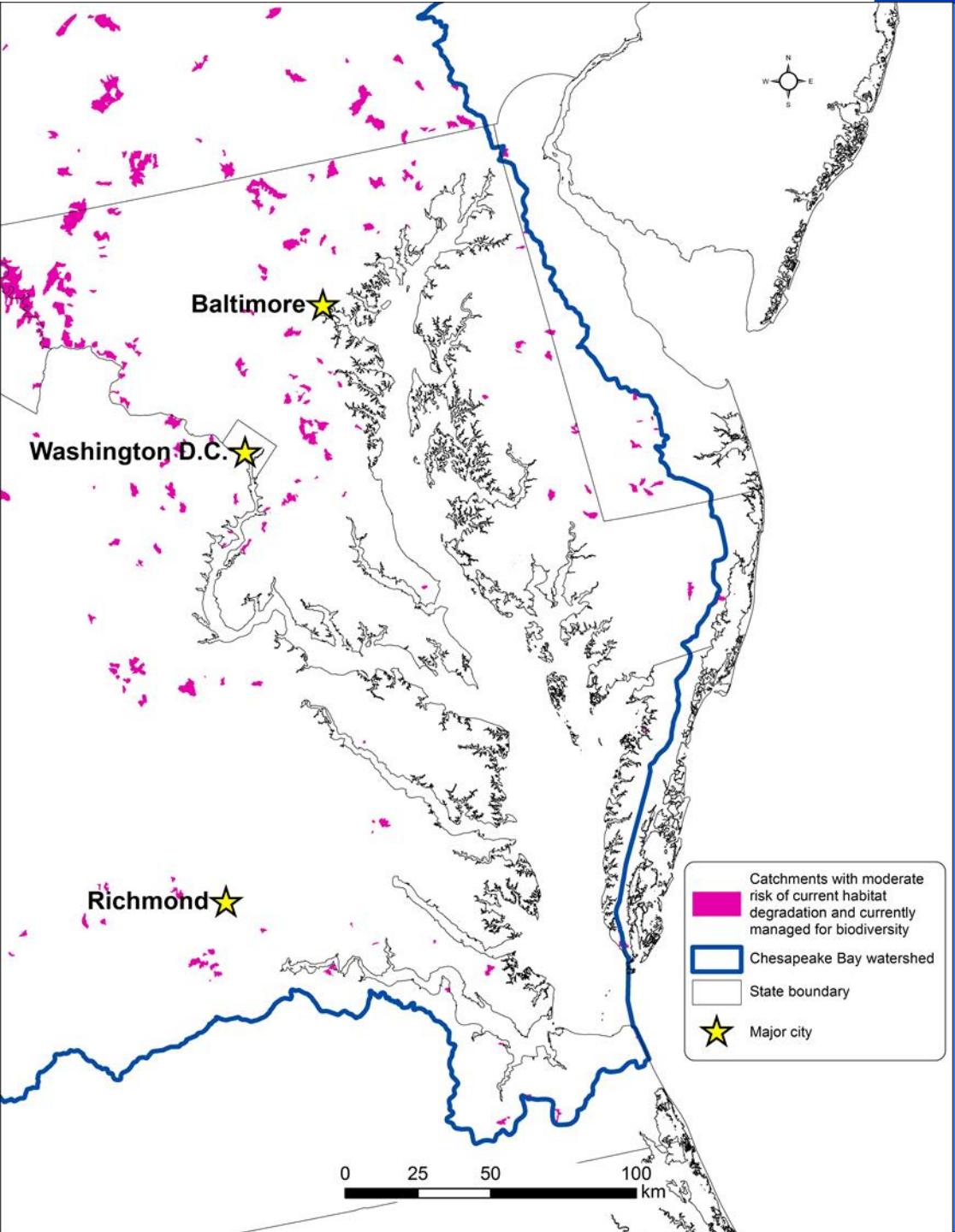
- Results were identified via stream fish associations with disturbances
- We acknowledge that regionally prominent disturbances may be missing



Where is the best fish habitat in the Chesapeake Bay basin being protected?

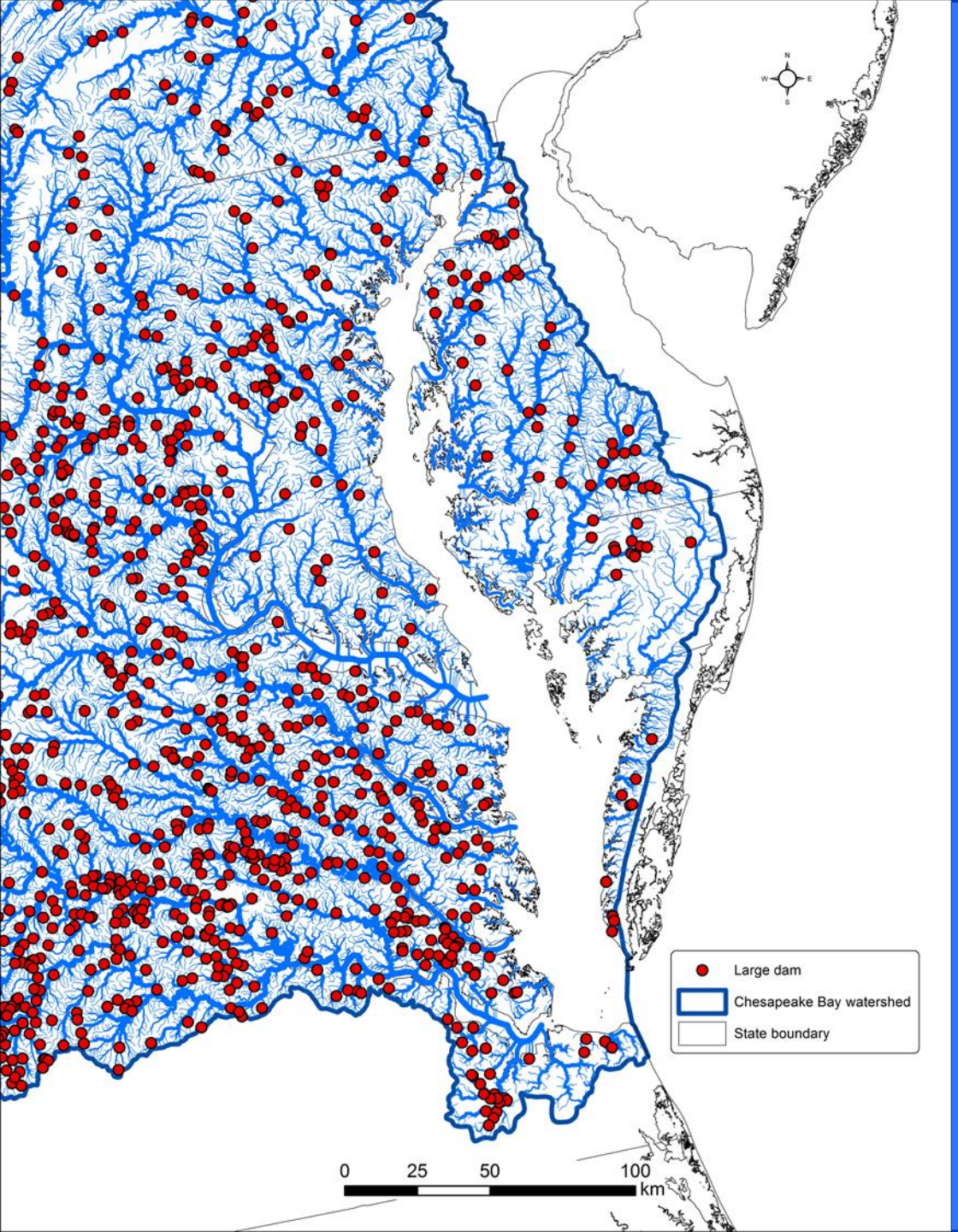
- Data from USGS Protected Areas Database (PAD 2015)
- Local catchments in landscapes with Category 1 or 2 protection status

Where are moderately degraded habitats being protected?



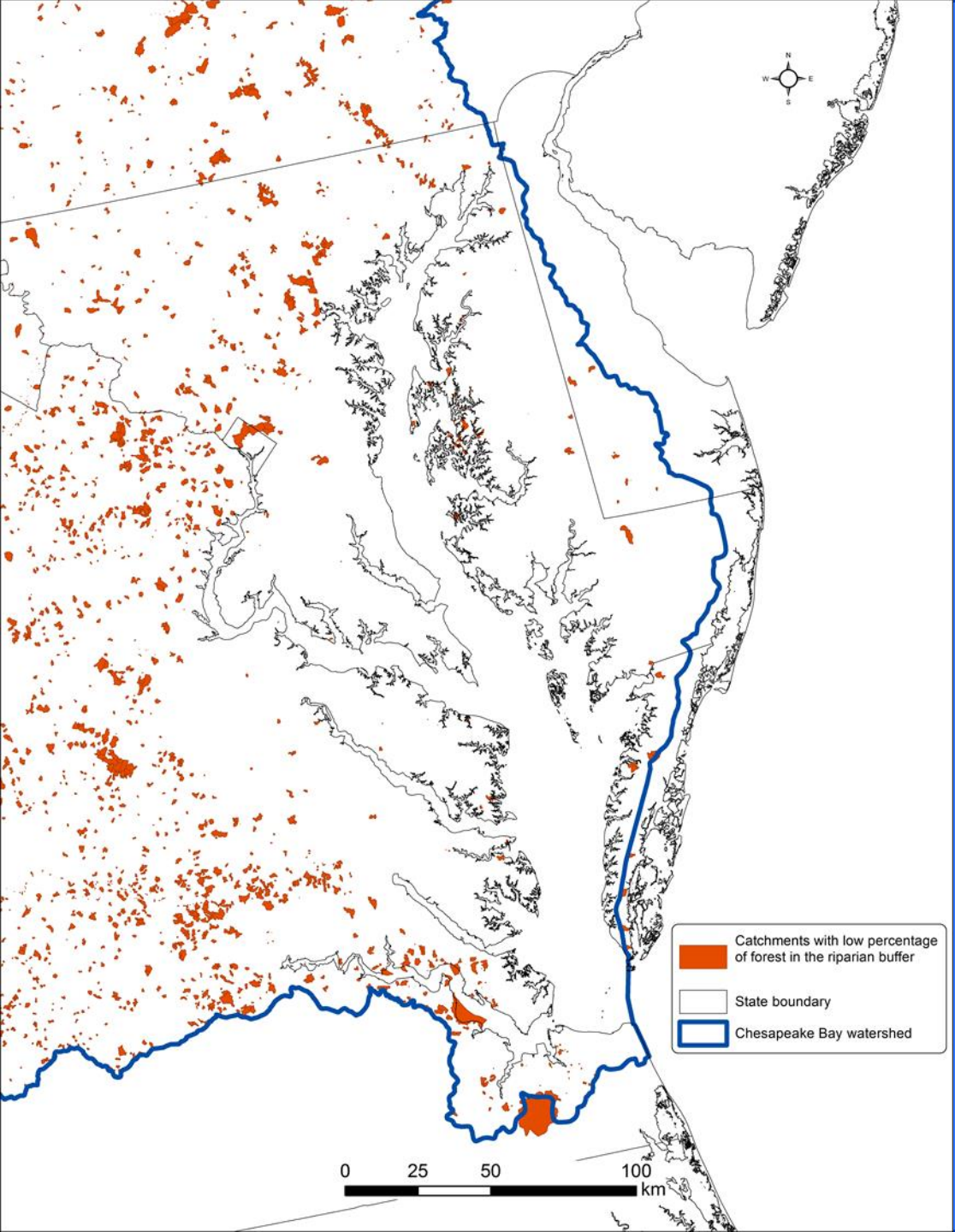
- Data from USGS Protected Areas Database (PAD 2015)
- Local catchments within landscapes with Category 1 or 2 protection status identified
- May be useful to consider in a network context…

Which river networks are fragmented by large dams?

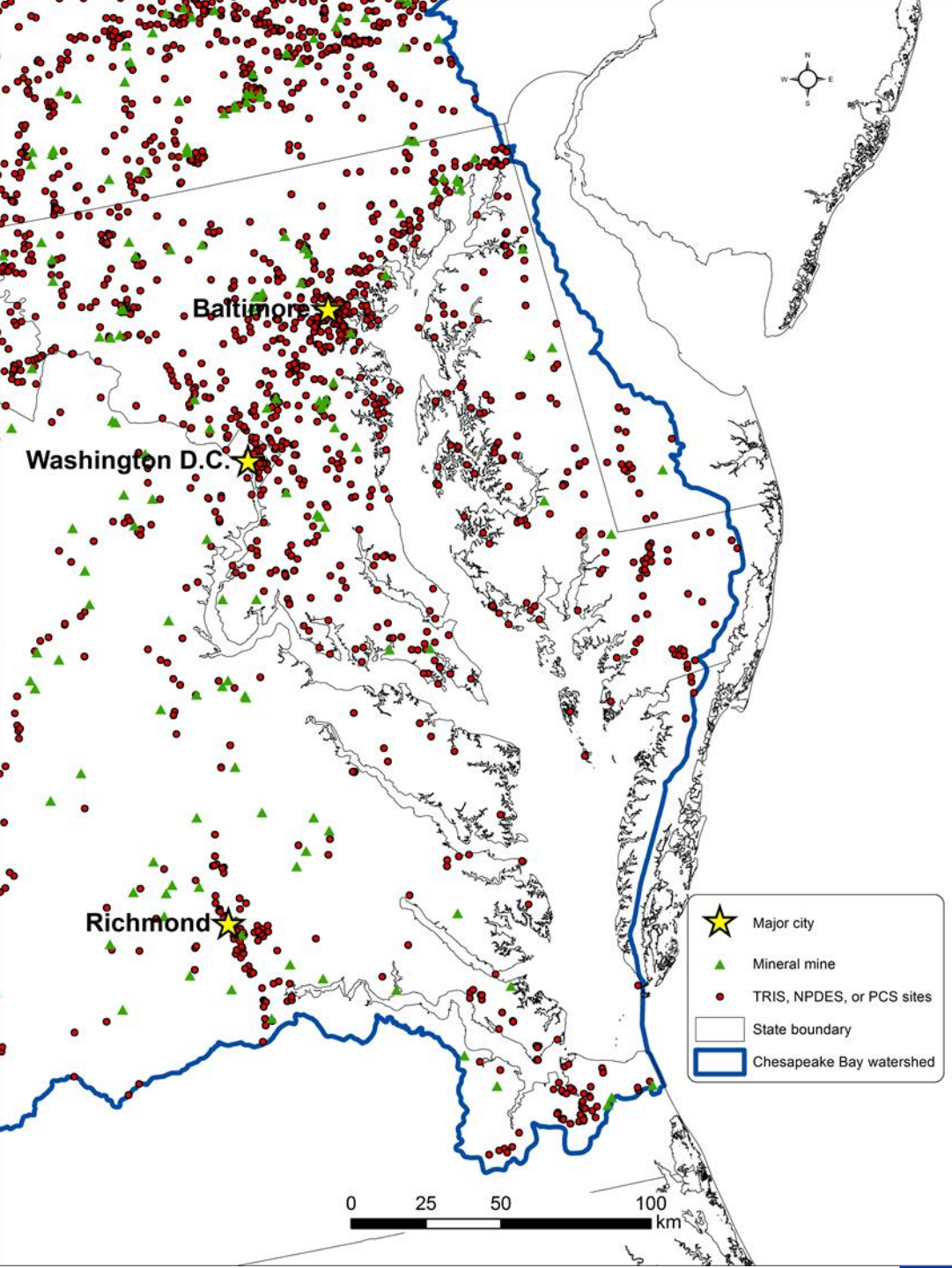


- 1,816 large dams in the Chesapeake Bay basin (946 in the map)
- Data are from the National Anthropogenic Barrier Dataset
- Multiple river fragmentation metrics for networks developed by Cooper et al. In Review

Where might the lack of forested riparian buffers potentially degrade fish habitat?

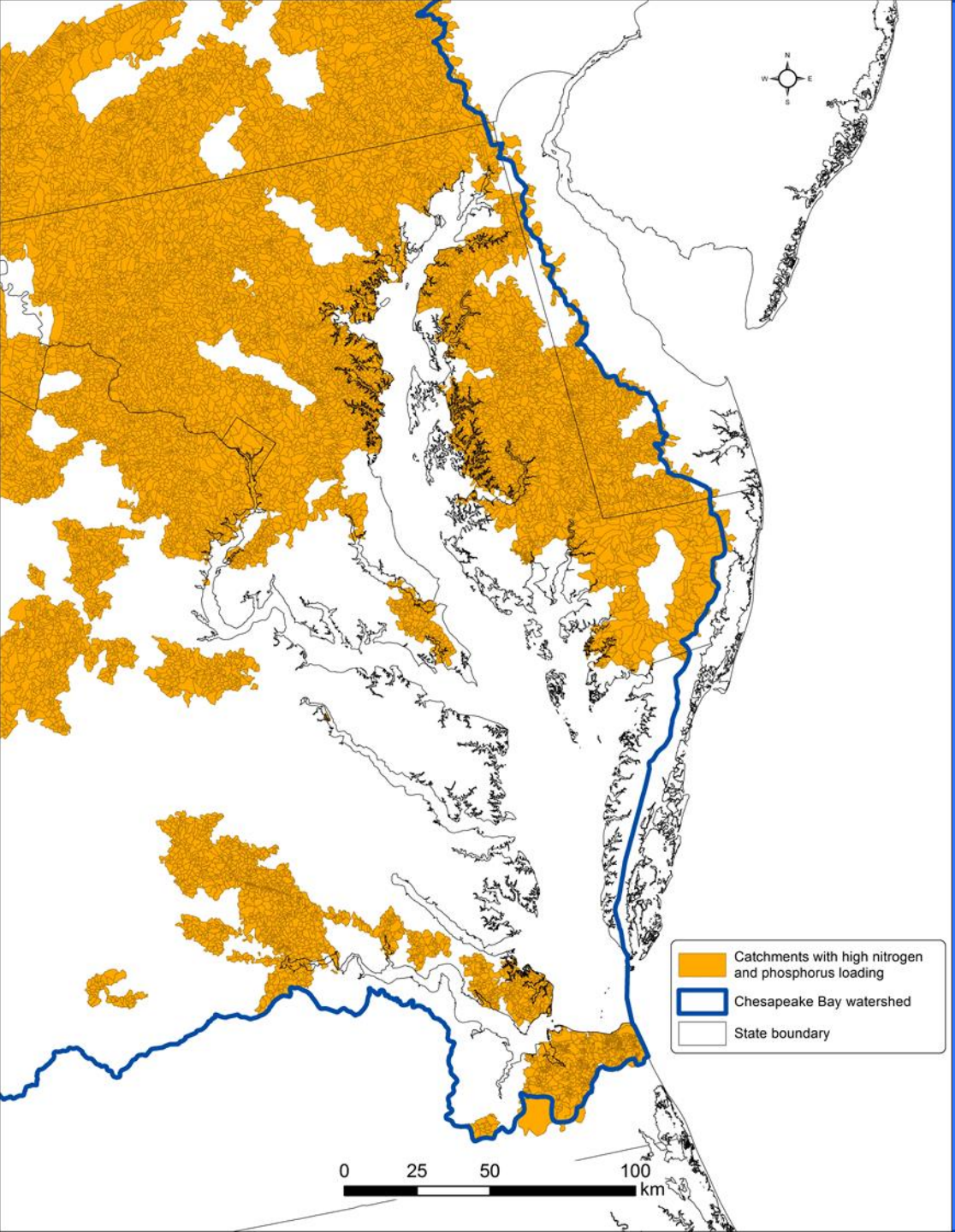


- Figure shows local catchments with buffers assessed as having a high risk of habitat degradation due to intensive urban or agricultural land uses
- Data are from National Land Cover Database (NLCD 2006)



Where are locations of point source pollution?

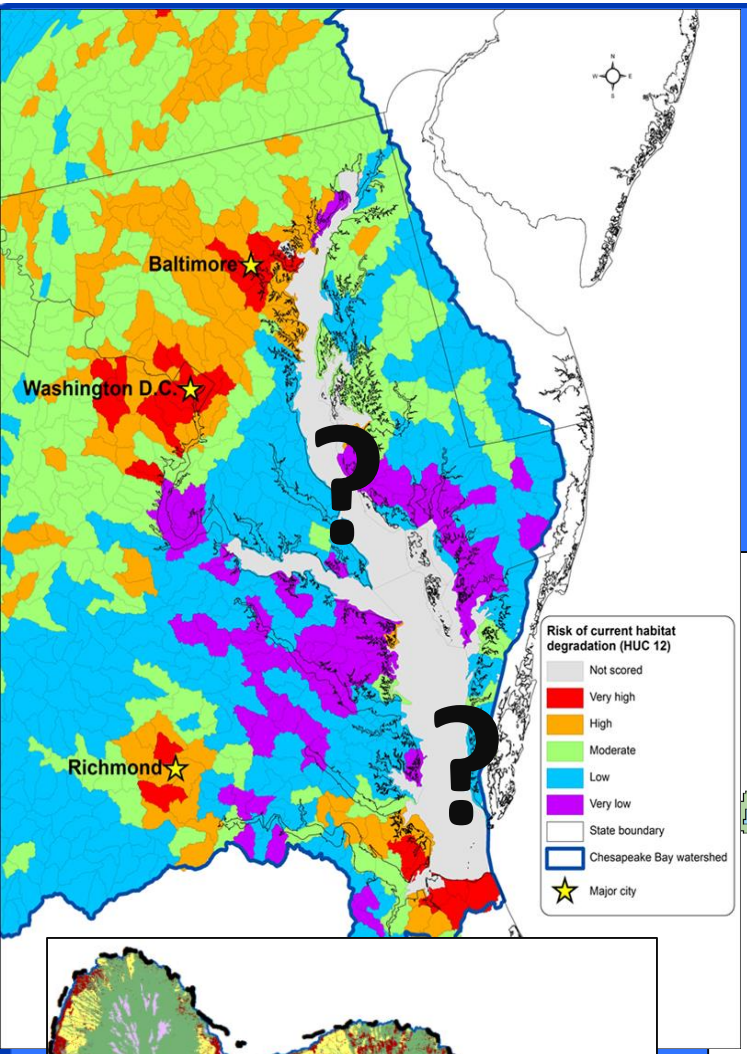
- 3,561 EPA point source sites
  -Toxic Release Inventory (TRI 2007)
  -National Pollutant Discharge Elimination System (NPDES 2007)
  -Permit Compliance System (PCS 2007)
- 331 mineral mines
  -USGS Mineral Resources Program (MRP 2003)
  -Daniel et al. 2015 describes associations between fishes and mines in Eastern US



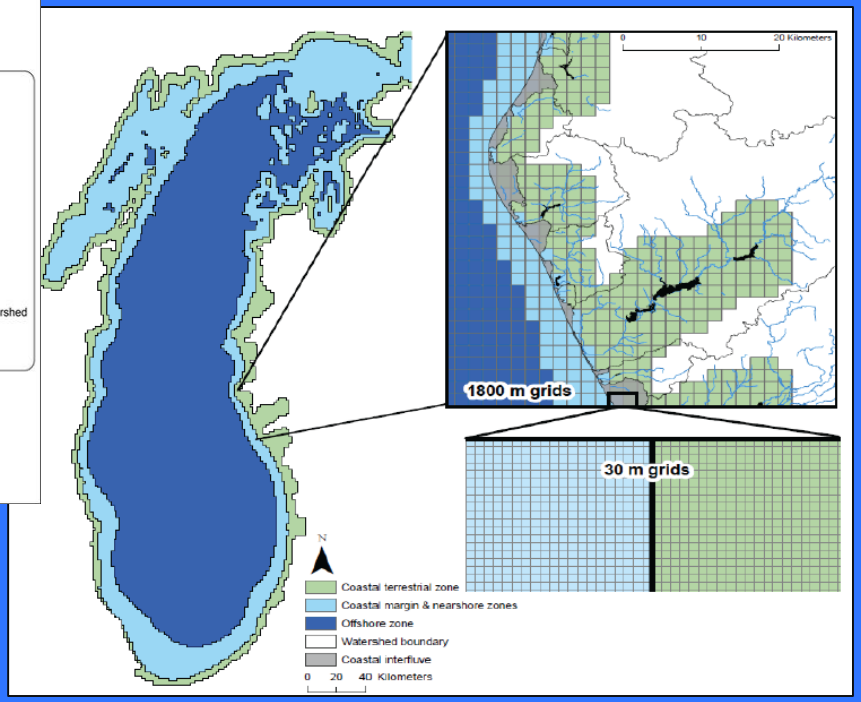
Which watersheds have the highest nutrient loadings in the Chesapeake Bay basin?

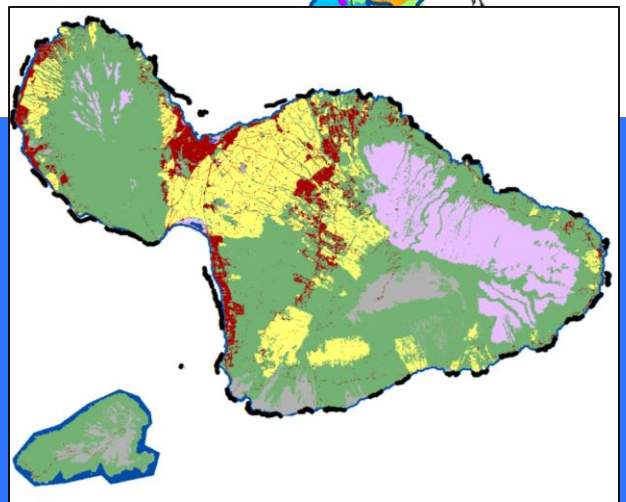
- Highlighted local catchments have both nitrogen and phosphorus loadings above identified threshold points that associated with negative fish responses
- Data are from USGS SPARROW 1992

Extending inland condition scores into coastal environments



Wang et al. 2015. A spatial classification and database for management, research, and policy making: The Great Lakes Aquatic Habitat Framework. Journal of Great Lakes Research 41:584-596.





Hsiao, J. In Progress MS Thesis. Characterizing landscape influences on nearshore coastal habitats to understand spatial linkages between terrestrial and coastal systems.

Strengths/limitations of 2015 assessment

- Limitations
  - Landscape scale assessment
    - Instream habitat variables (substrate, flow characteristics, temperature) lacking across the conterminous US
  - Missing known disturbances (grazing, channel modifications)
- Strengths
  - Conservative estimate of habitat condition
    - Results determined based on highly significant associations between declines in fish metrics and landscape factors
    - Assessment was conducted using two analytical approaches, thresholds needed to be in agreement
  - Comparable across the US
    - Made possible by use of continuous landscape disturbance variables
  - Every stream has been scored
    - 2.3 million stream reaches
  - Data, as well as scores, can be shared with partners: http://ecosystems.usgs.gov/fishhabitat/

Enhancing decision making and conservation actions

- Results identify most limiting disturbances to stream reaches at multiple spatial scales (including buffers)
- Ability to combine assessment results with other information to inform management
  - Future disturbances (i.e., climate change, land use change)
  - Socio-economic variables
- Ability to identify priority locations for conservation and restoration

Acknowledgments

- U.S. Fish and Wildlife Service and the U.S. Geological Survey (USGS) Aquatic Gap Program for funding
- NFHP's Science and Data Committee; chairs Gary Whelan (Michigan Department Natural Resources) and Pete Ruhl (USGS) formerly by Andrea Ostroff (USGS) and Doug Beard (USGS)
- Inland assessment team: Kyle Herreman, Arthur Cooper, Yin-Phan Tsang, William W. Taylor, Ralph W. Tingley III, Jared Ross, Daniel Wieferich
- Finally, we wish to acknowledge the following groups for special assistance: Hawai'i FHP, Eastern Brook Trout Joint Venture, Mat-Su SHP, Southwest AK SHP, Kenai Peninsula FHP, Southeast AK FHP and SARP

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Stream fish data providers for 2015 national assessment of stream fish habitats	Idaho Department of Environmental Quality	Maryland Department of Natural Resources	New Mexico Game and Fish	Texas Parks and Wildlife Department
	Idaho Department of Fish and Game	Massachusetts Department of Fisheries and Wildlife	New York State Department of Environmental Conservation	Texas Water Development Board
	Illinois Department of Natural Resources	Michigan Department of Natural Resources	North Carolina Division of Water Quality	Troy University
	Indiana Department of Environmental Management	Michigan State University, Department of Fisheries and Wildlife	Ohio Environmental Protection Agency	U.S. Forest Service
Alabama Department of Conservation and Natural Resources	Indiana Department of Natural Resources	Minnesota Pollution Control Agency	Oklahoma Conservation Commission	University of Central Arkansas, Department of Biology
Alabama Department of Environmental Management	Iowa Department of Natural Resources	Mississippi Natural Heritage Museum	Pennsylvania Fish and Boat Commission	University of Southern Mississippi, Department of Biological Sciences
Alaska Department of Fish and Game	Kansas Department of Natural Resources	Missouri Department of Conservation	Rushing Rivers Institute	University of Wyoming, Department of Zoology and Physiology
Arizona Game and Fish Department	Kansas Department of Wildlife and Parks	Missouri Resource Assessment Partnership	South Atlantic Landscape Conservation Cooperative	U.S. Environmental Protection Agency, National Rivers and Streams Assessment
Arkansas Department of Environmental Quality	Kentucky Department for Environmental Protection	Multistate Aquatic Resources Information System	South Carolina Department of Natural Resources	U.S. Geological Survey, Arkansas Water Science Center
Clemson University, Campbell Museum of Natural History	Kentucky Department for Fish and Wildlife	Museum of Southwestern Biology	South Dakota Game, Fish and Parks	U.S. Geological Survey, BioData
Colorado Division of Parks and Wildlife	Kentucky Division of Water	Natural History Museum of Los Angeles County	Southeast Aquatic Resources Partnership	U.S. Geological Survey, National Water-Quality Assessment Program
Connecticut Department of Environmental Protection	Lake Superior State University	Nebraska Department of Environmental Quality	State of Hawaii, Division of Aquatic Resources	Vermont Fish and Wildlife Department
Delaware Department of Natural Resources and Environmental Control, Division of Water	Louisiana Department of Environmental Quality	Nebraska Regional Environmental Monitoring and Assessment Program	Tarleton State University, Department of Biological Sciences	Virginia Department of Environmental Quality
Florida Fish and Wildlife Conservation Commission	Louisiana Department of Wildlife and Fisheries	Nevada Department of Wildlife	Tennessee Water Resources Authority	Washington Department Ecology
Geological Survey of Alabama	Louisiana State University, Department of Renewable Natural Resources	New Hampshire Fish and Game Department	Tennessee Wildlife Resources Agency	West Virginia Department of Environmental Protection
Georgia Department of Natural Resources, Wildlife Resources Division	Maine Department of Environmental Protection	New Jersey Division of Fish and Wildlife	Texas Commission on Environmental Quality	Wisconsin Department of Natural Resources