



**Polychlorinated Biphenyls (PCBs) in Fish
Tissue from U.S. Fresh Waters:
Results from Major Rivers, the Great Lakes
and other U.S. Lakes**

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Authors



John Wathen, presenting author & Leanne Stahl
U.S. Environmental Protection Agency
Office of Water/Office of Science and Technology
Washington, DC

Anthony Olsen and Thomas Kincaid
U.S. Environmental Protection Agency
Office of Research and Development
National Ecological Exposure Research Laboratory,
Western Ecology Division, Corvallis, OR

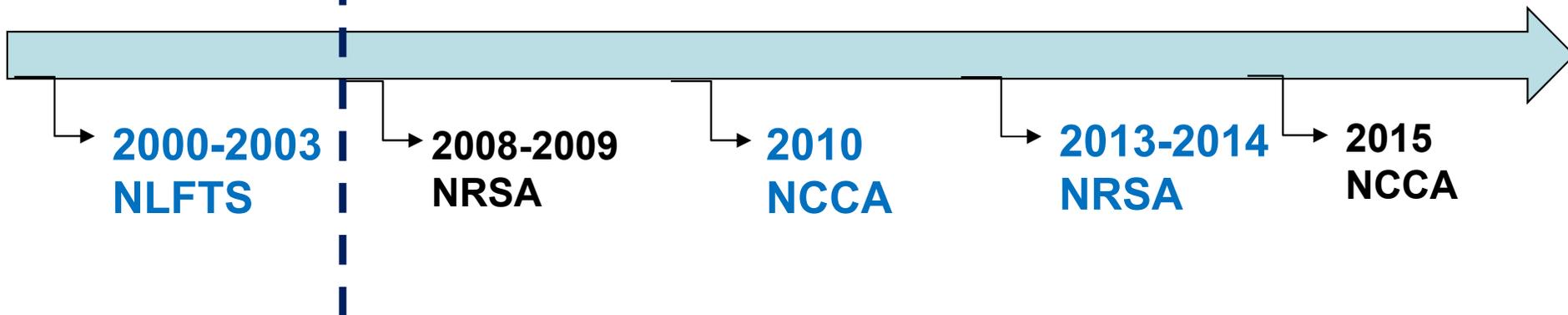
Blaine Snyder
Tetra Tech, Inc.
Owings Mills, MD

Harry McCarty
CSGov, LLC, a CSRA Company
Alexandria, VA

The views expressed in this presentation are those of the authors and do not necessarily reflect the views or policies of the U.S. EPA or those of the U.S. Government



National Aquatic Resource Surveys Operating on a 5-year cycle



NLFTS - National Lake Fish Tissue Study



- At the time of report completion (2007), Hg was IDed as the prevalent lake fish contaminant
- Mercury concentrations in fillet tissue from 48.9 % of the sampled population of lakes exceeded EPA's 300 ug/kg fish tissue-based WQ criterion
- Only 16.8% of the sampled population exceeded EPA's 12 ug/kg cancer-based screening value (SV) concentration for PCBs (209 congeners)



Great Lakes Human Health Fish Tissue Study

- PCB fish tissue concentration results were elevated relative to other waters
- There was not a comparable Great Lakes data set (w/statistical sampling) with which to compare across U.S. waters
- SVs applied to the data were expanded to include EPA non cancer SV (47ug/kg) and two SVs developed by the Great Lakes Sport Fish Advisory Task Force (60 ug/kg- 1 meal/week and 210 ug/kg- 1 meal/month advisory levels)



Three water body types, one analyte group: Polychlorinated Biphenyls- 209 Congeners



- National Lake Fish Tissue Study: 486 predator samples analyzed for PCBs
- 2010 NCCA Great Lakes Human Health Fish Tissue Study: 157 Sampling locations (All analyzed for PCBs)
- 2013-14 National Rivers and Streams Assessment: 361 Sampling locations (224 samples analyzed for PCBs)

National Lake Fish Tissue Study



- Random selection of lakes and reservoirs in 4 national annual statistical subsets
- 500 lakes and reservoirs in the lower 48 states sampled over 4 years (2000-2003)
- Lake criteria:
 - Permanent water body with permanent fish population
 - Minimum surface area of one hectare (~2.5 acres)
 - 1000 square meters of open, unvegetated water
 - Depth of at least one meter



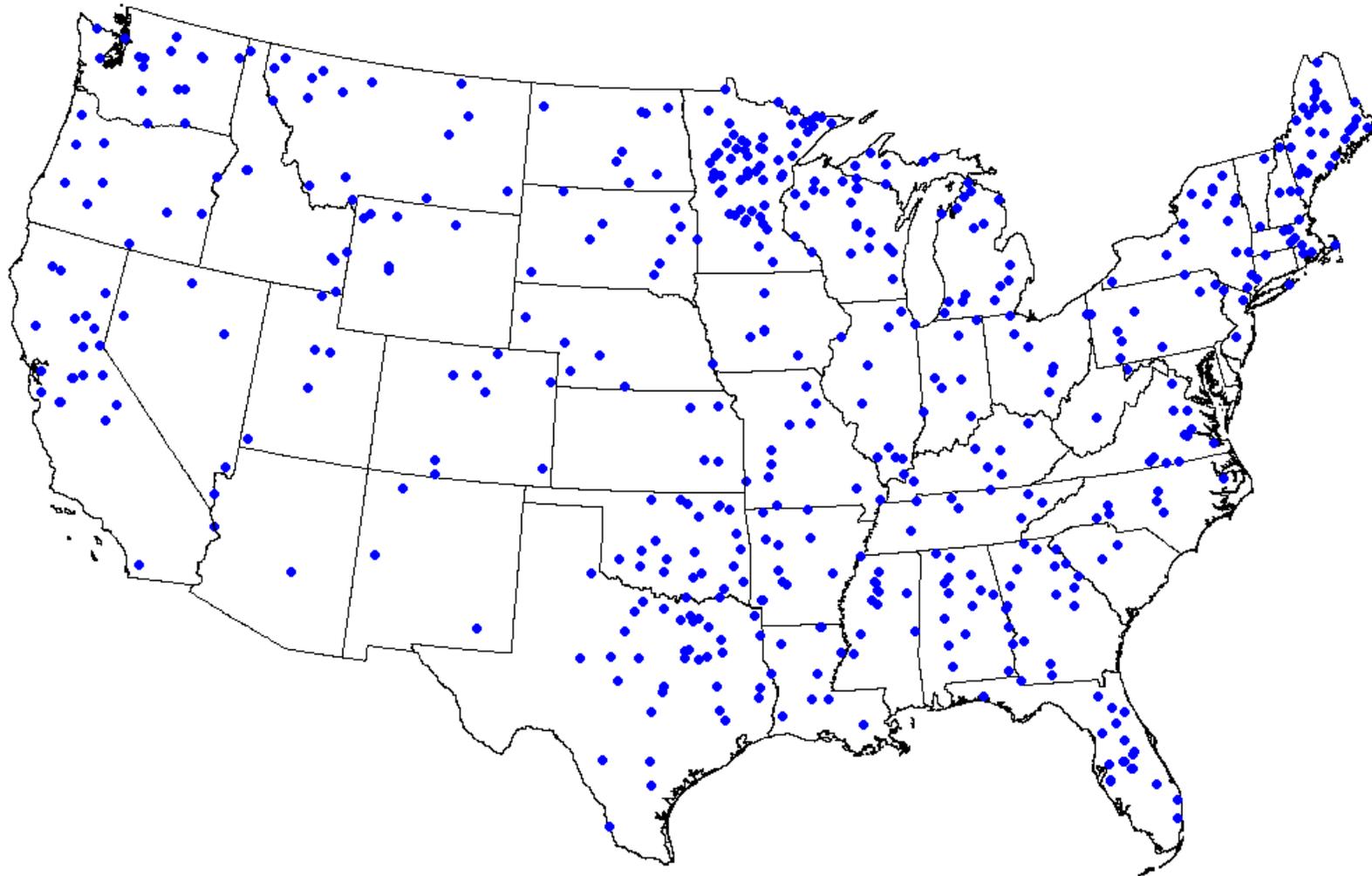


- Was the first national-scale statistically representative freshwater fish contamination study conducted in the U.S.
- Other analytes included PBDEs, Hg, As, dioxins and furans, organochlorine pesticides, organo-phosphate pesticides, SVOCs, not reported here.

NLFTS Sampling Locations



Fish Fillet Tissue Sampling Locations $n = 486$



2013-14 National Rivers and Streams Assessment



- Out of 1,808 sites on rivers and streams within the conterminous United States- 361 sites sampled on rivers 5th order or greater in size
- Fillet tissue samples were analyzed for PCBs from fish samples collected at 224 of the sites, which represents a sampled population of 25,574 river miles.

Other analyses not reported here:

- Mercury
- Perfluorinated compounds (PFCs)

2013-14 National Rivers and Streams Assessment



- Randomized site selection process yields nationally and regionally representative weighted results based on the study's unequal probability design
- Ecoregions:
 - Eastern Highlands (EHIGH)
 - Plains and Lowlands (PLNLOW)
 - Western Mountains (WMTS)

Also nationally representative by urban and non-urban census tract.

2013-14 National Rivers and Streams Assessment

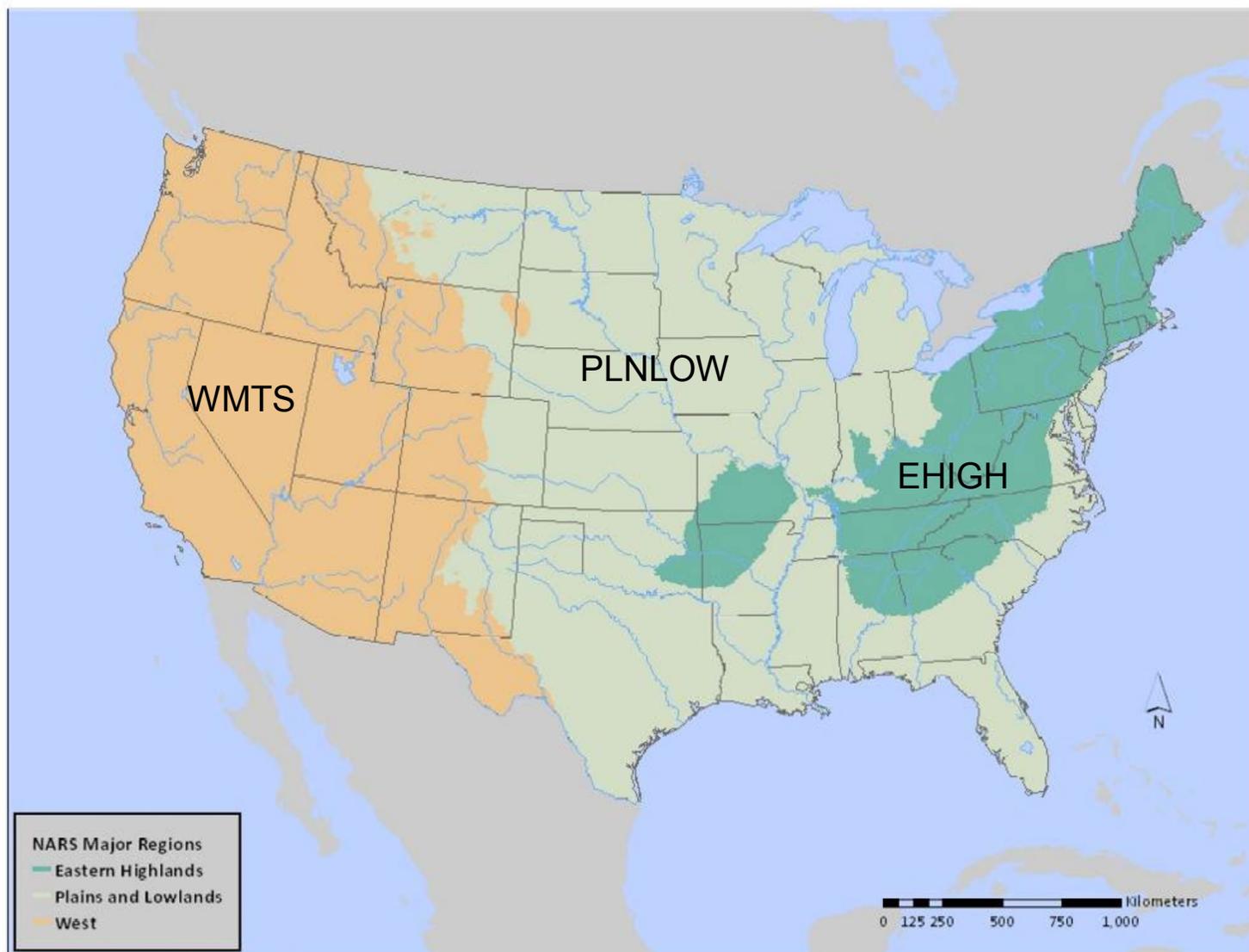


Fish Fillet Tissue Sampling Locations $n = 361$





NARS Major Ecoregions



2010 Great Lakes Human Health Fish Tissue Study Sampling



Sampling Locations

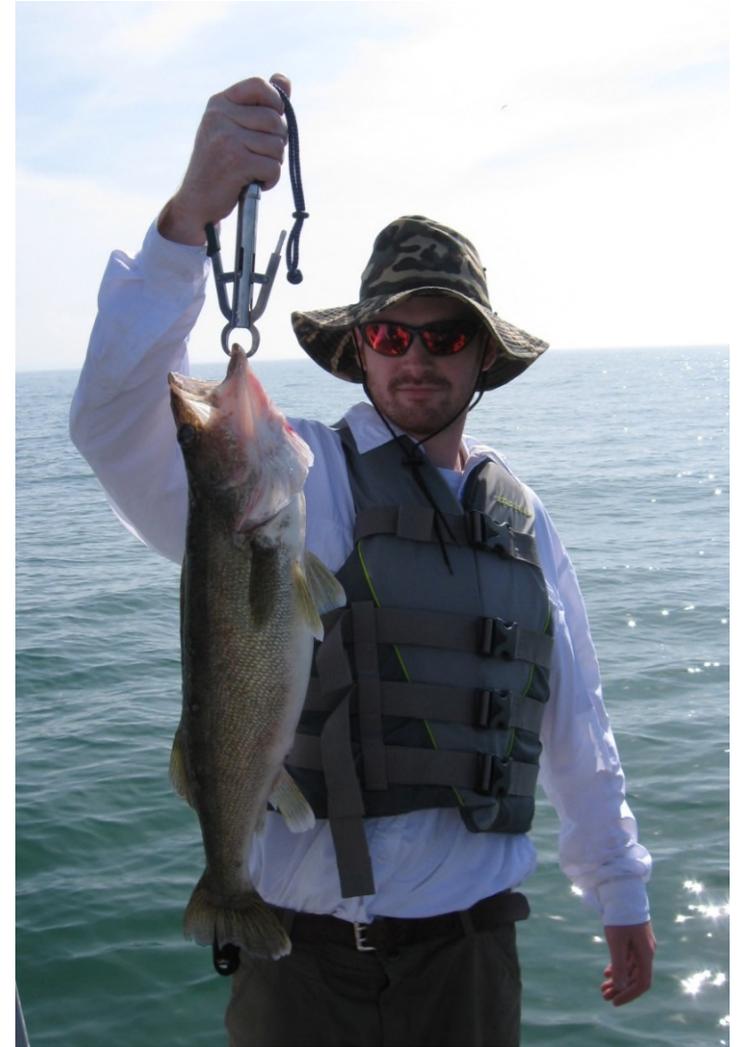
Sampled 157 randomly selected sites (about 30 per lake) in the nearshore region (depths up to 30 m or distance up to 5 km from shore) during 2010

Sample Collection

Collected one fish composite sample from each site (optimally, 5 similarly sized adult fish of the same species that are consumed by humans)

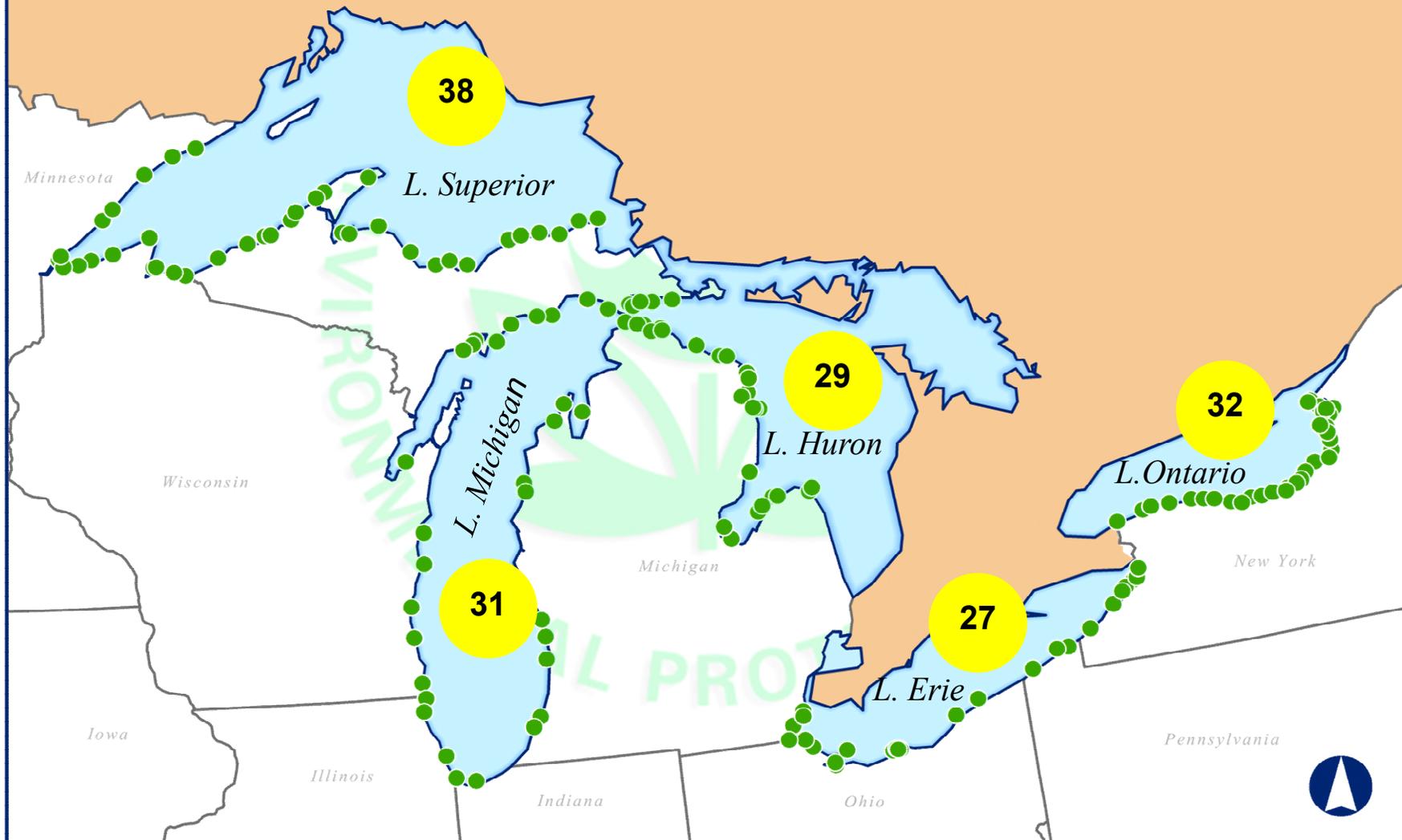
Representation

Results can be extrapolated to a Great Lakes nearshore surface area of an estimated 11,086 km² (4,280 mi²)



2010 GLHHFTS Sampling Locations

157 randomly selected nearshore sites (<5 km from shore or <30 m depth)



PCB Analytical Methods



- **The same sampling protocols for all three studies**
- **Current EPA GC-MS Methods for all studies**
- **Yields 160 Separate Results including co-eluting congeners and total PCBs**
- **Summable results (Total PCBs) for all detected congeners- Non detects for congeners set equal to 0**

NLFTS

EPA Method 1668A

2010 GLHHFTS

EPA Method 1668C

2013-2014 NRSA

EPA Method 1668C

PCB Statistics-all studies



| Fish Study and Statistical Subgroups | Number of Samples | Sampled Population | 50th %ile µg/kg* | 95th %ile µg/kg* | Maximum Concentration µg/kg* |
|---|--------------------------|---------------------------|--|--|---|
| NLFTS | 486 | 76,559 lakes | 2.2 | 33.2 | 705 |
| 2010 GLHHFTS (NCCA) | 157 | 4,282 lake square miles | 178.7 | 1,045 | 2,380 |
| 2013-14 NRSA All sites | 224 | 25,574 river miles | 11.3 | 244 | 4,617 |
| 2013-14 NRSA Non-urban sites | 154 | 20,077 river miles | 9.2 | 171.5 | 957 |
| 2013-14 NRSA Urban sites | 70 | 5,497 river miles | 38.5 | 526 | 4,617 |
| 2013-14 NRSA Eastern Highland sites | 83 | 8,422 river miles | 25.4 | 520.8 | 4,617 |

*All PCB results are reported as wet-weight concentrations.

Show me the pictures



Thresholds in the pictures:

- $210 \mu\text{g}/\text{kg} = 1 \text{ meal/month GL}^* \text{ threshold}$

- $60 \mu\text{g}/\text{kg} = 1 \text{ meal/week GL}^* \text{ threshold}$

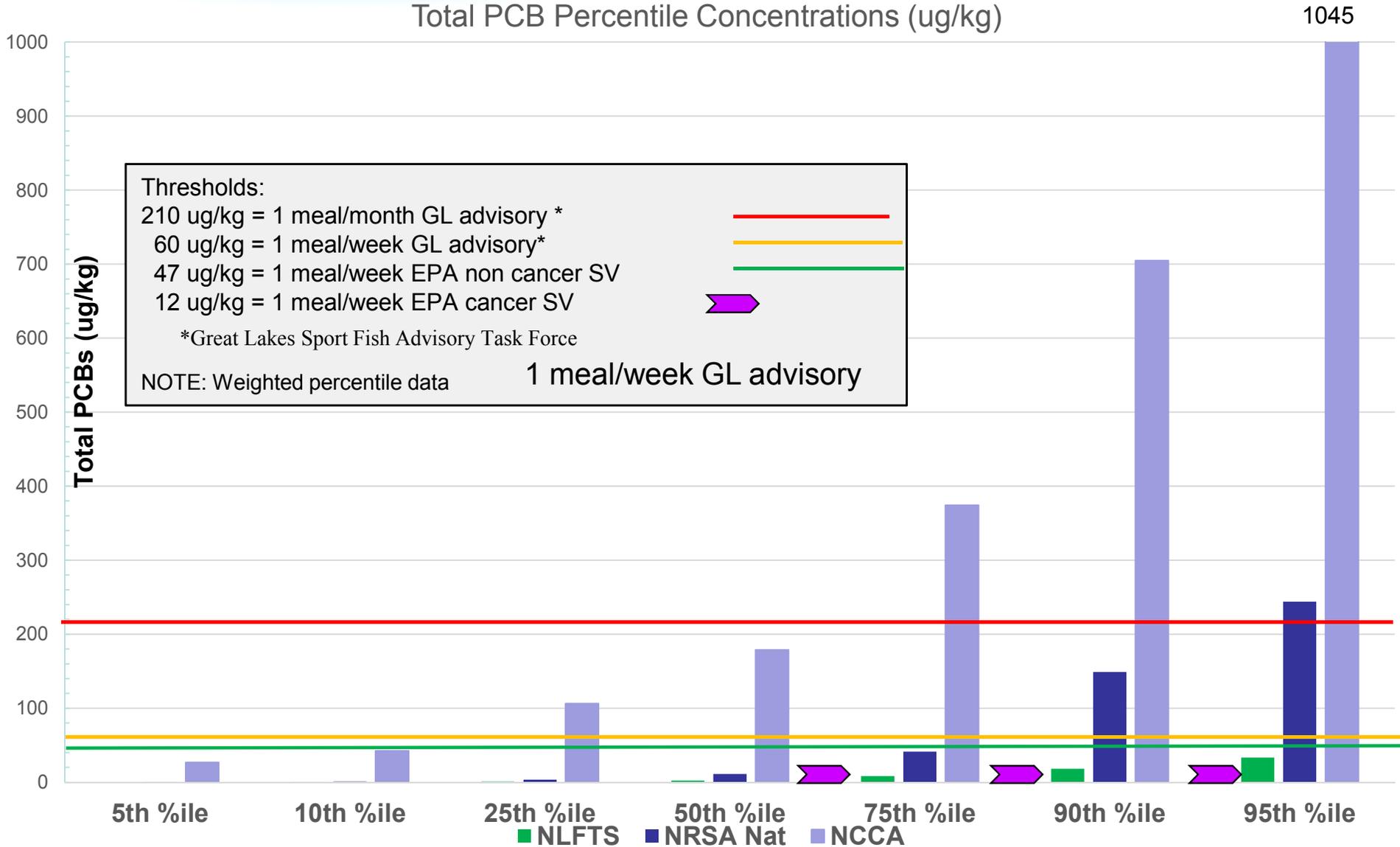
- $47 \mu\text{g}/\text{kg} = 1 \text{ meal/week EPA non cancer SV}$

- $12 \mu\text{g}/\text{kg} = 1 \text{ meal/week EPA cancer SV}$

Total PCB Percentile Concentrations



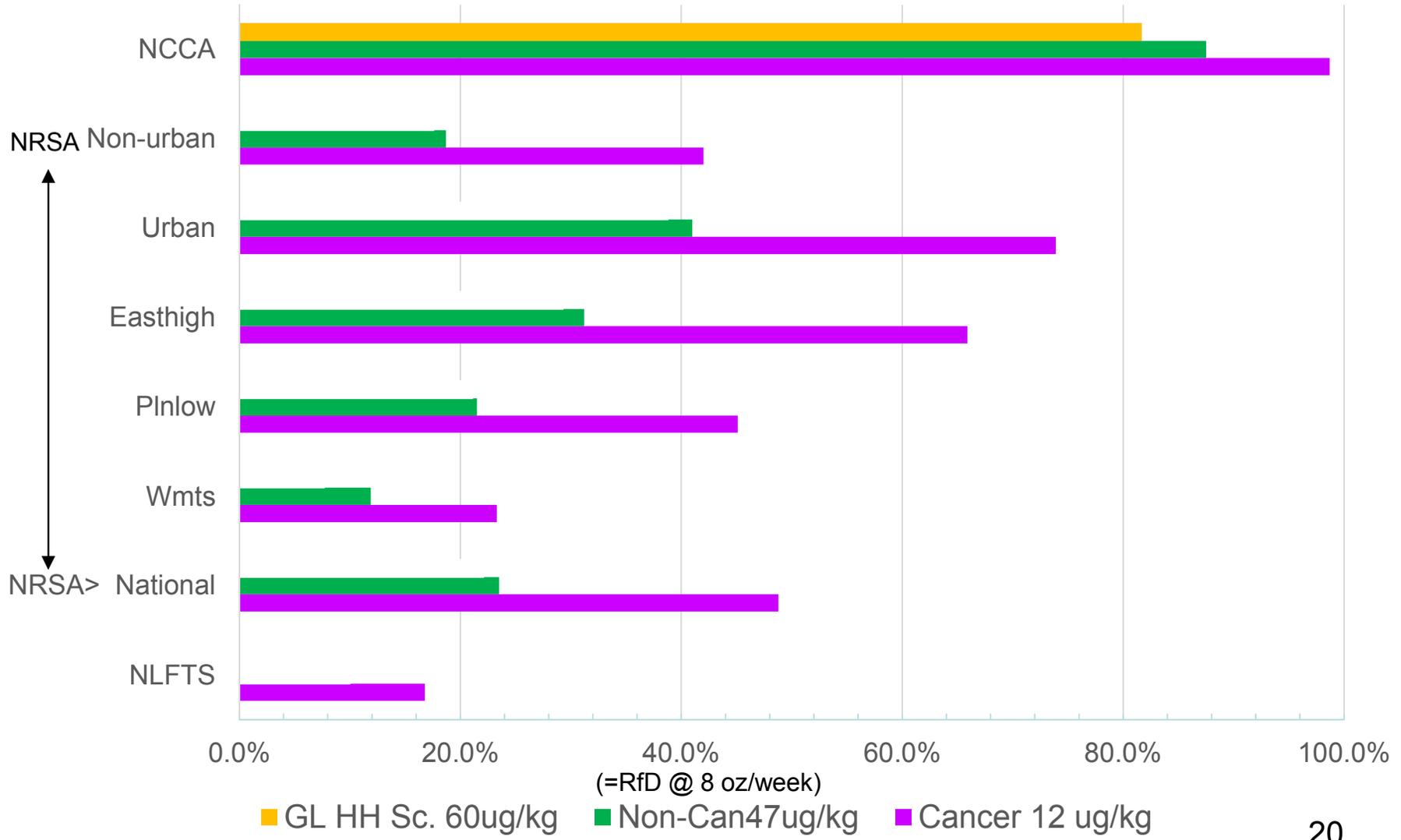
Total PCB Percentile Concentrations (ug/kg)



Total PCB Screen exceedances (Weighted Pcts)



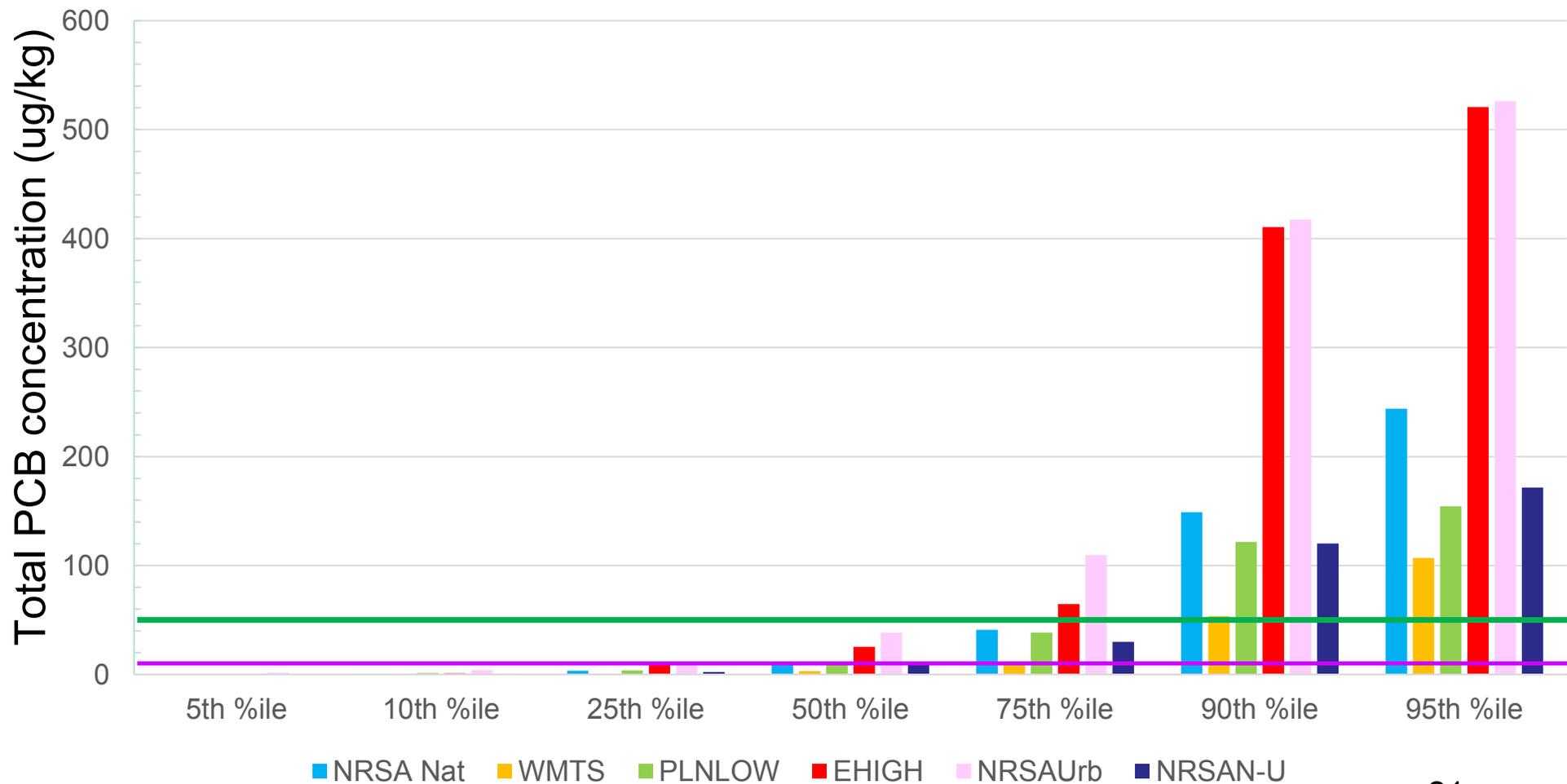
Percentages of total HH PCB SV Exceedances



2013-14 National Rivers and Streams Assessment



NRSA Subgroup Percentile Total PCB Fish Tissue Fillet Concentrations



47 ug/kg = 1 meal/week non cancer SV

12 ug/kg = 1 meal/week cancer-based SV



Summary

- PCB concentrations in fish fillet tissue vary markedly across types of U.S. waters:

Lakes and reservoirs < major rivers < Great Lakes

- PCBs in fish tissue from major rivers vary by ecoregion and between urban/non-urban sites
- Application of additional human health screening values is useful for interpreting Great Lakes PCB fish tissue data and comparing concentrations among waters.

That's about it.
Thanks for your attention

