Exposure Levels of Chlorinated Compounds and Metals in Urban Anglers

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Overview

- The Lower Hudson River, Newark Bay Complex and surrounding waters is a complex urban, highly industrialized, river system.
- Despite heavy commercial and industrial use, it is also used by recreational anglers.
- Commercial fishing has been closed in the areas for many years due to sediment contamination from legal and illegal industrial discharge.
- Fish advisories have been in place for about the past 20 years.

Background
Fish consumption from the Lower Hudson

- Methods
  - 160 people angling at six locations along Manhattan waterfront (May-Nov. 1999)
  - Mostly Latino (64.9%) and Black (27.3%)
  - Male (97%)
  - Mean age 46
  - Annual income < $25,000 (48%)
- Results
  - 70% reported Hudson River was a safe fishing location.
  - No posted fish advisory signs observed
  - Averaged fishing 3 times/wk; 6 months/yr
  - Catch 7 fish per outing
  - 75% report take fish home
  - 65.5% eat more than one fish meal per month

Ramos AM, Crain EF. Potential health risks of recreational fishing in New York City. Ambulatory Pediatrics 2001;1:252-255.

Background
Fish consumption from the Lower Hudson

- Methods
  - 267 people angling at several locations in New Jersey (May-September 1999)
  - 43% White; 23% Black; 21% Latino; 13% Asian
- Results
  - No ethnic differences in fishing or crabbing
  - People who both fished and crabbed (12%), ate their local catch over 6 times per month.
  - 30% did not eat catch
  - Very few reported angling to obtain food

Burger J. Consumption patterns and why people fish. Environmental Research 2002;90:125-135.

Background
Fish consumption from the East River

- Methods
  - 200 people angling at several locations along the East River (Aug-September 2000)
  - Mostly Latino and Black
  - All male
  - 16-60 years of age
- Results
  - Catch between 40-75 fish per week (~9.5 fish per week per family member)
  - Blue crab, American eel, blue fish and striped bass most frequently consumed
  - Toxicological tests on fish: cadmium, mercury, chlordane, DDT, dioxins, PCBs, arsenic and lead.

Corburn J. Combining community-based research and local knowledge to confront asthma and subsistence- fishing hazards in Greenpoint/Williamsburg, Brooklyn, New York. Environmental Health Perspectives 2002;110:241-248.

Background
Perception and knowledge of risk from local fish consumption

- Methods
  - 300 anglers along the Newark Bay (July-Oct. 1995)
  - Mostly White (55%); Latino (20%) and Black (17%)
  - Male (91%)
  - mean age 46
- Results
  - 47% reported fish from local waters were safe to eat; 34% reported not safe to eat.
  - Response for 'Safe to eat'
    - "If the water were polluted there would be no fish"
    - "I have been eating them all of my life and never gotten sick"
  - 60% aware of fish advisories
  - Only 15% correctly understood the advisories

Pflug KK, Lurig L, Von Hagen LA, Von Hagen S, Burger J. Urban Anglers' perceptions of risk from contaminated fish. The Science of the Total Environment 1999;228:203-218.

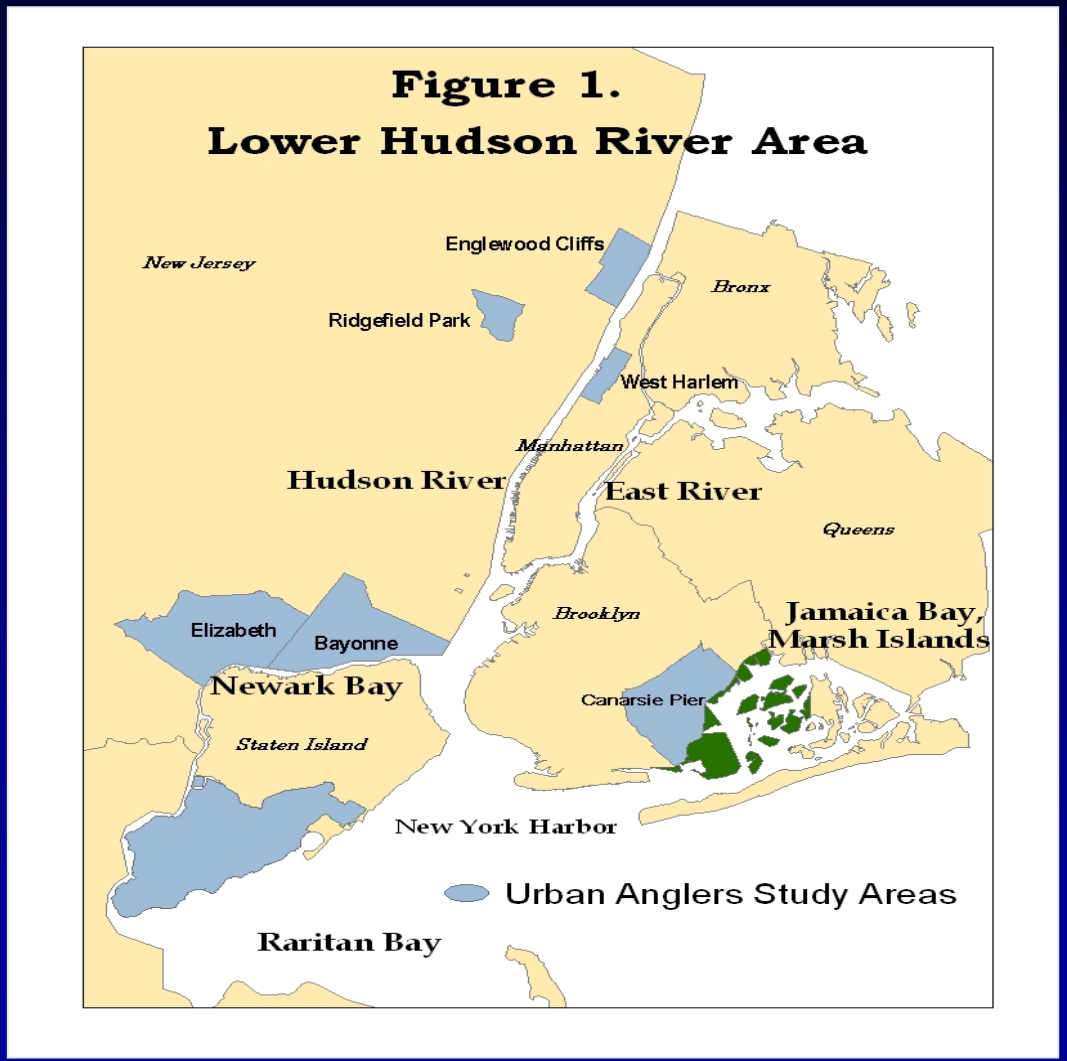
Goals and Objectives of the Urban Anglers Study

To determine current body burdens of persistent, bioaccumulative environmental pollutants, including PCBs, organochlorine pesticide residues and mercury through a serological survey of persons who consume fish and crabs from the estuarine waters of the lower Hudson River

To quantitatively examine associations between self reported consumption of fish and crabs taken from the lower Hudson River watershed and body burdens of persistent pollutants

To determine whether patterns of exposure to persistent pollutants differ among persons who consume fish and crabs from various regions of the lower Hudson River watershed with different known sources and patterns of contaminants

Locations of Recruitments for the Urban Anglers Study



Study Description

- Enrolled 191 anglers during fishing seasons 2001 – 2004.
- Anglers were recruited from fishing piers and fishing clubs from the following locations: **Harlem, NY; Canarsie Pier in Brooklyn, NY; Staten Island, NY; Ridgefield, NJ; Englewood NJ; Bayonne, NJ; Elizabeth, NJ**

Data Collection: Questionnaires

- Questionnaires
  - Local fish intake (species specific; frequency; amount)
  - Fish preparation and cooking practices;
  - Knowledge of local fish advisories;
  - Share fish;
  - Demographic information

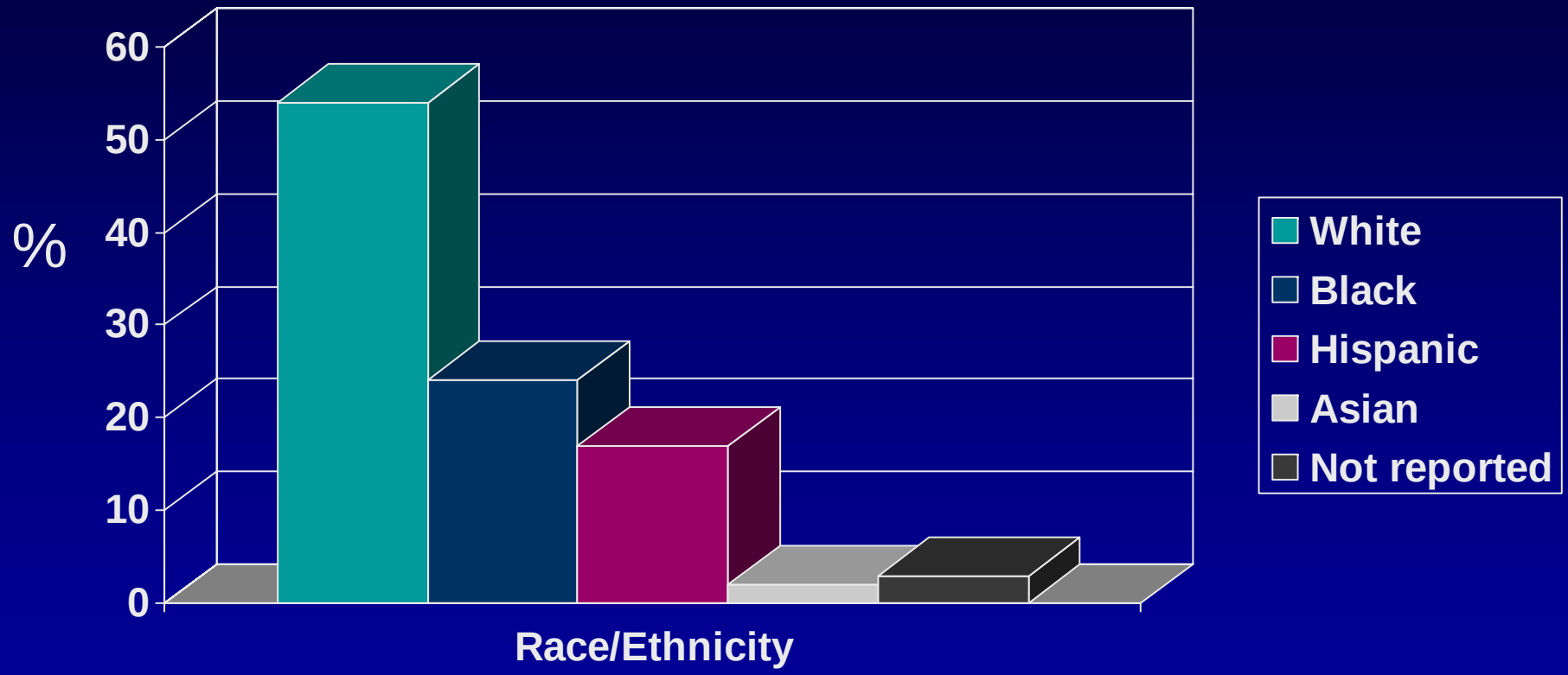
Data Collection: Blood Samples

- Venipuncture blood samples collected and centrifuged on site
- 68% response rate for blood collection
- Three Vacutaner tubes collected for analysis of:
  Polychlorinated biphenlys, mercury, chlordane, DDT/DDE and polybrominated diphenyl ethers

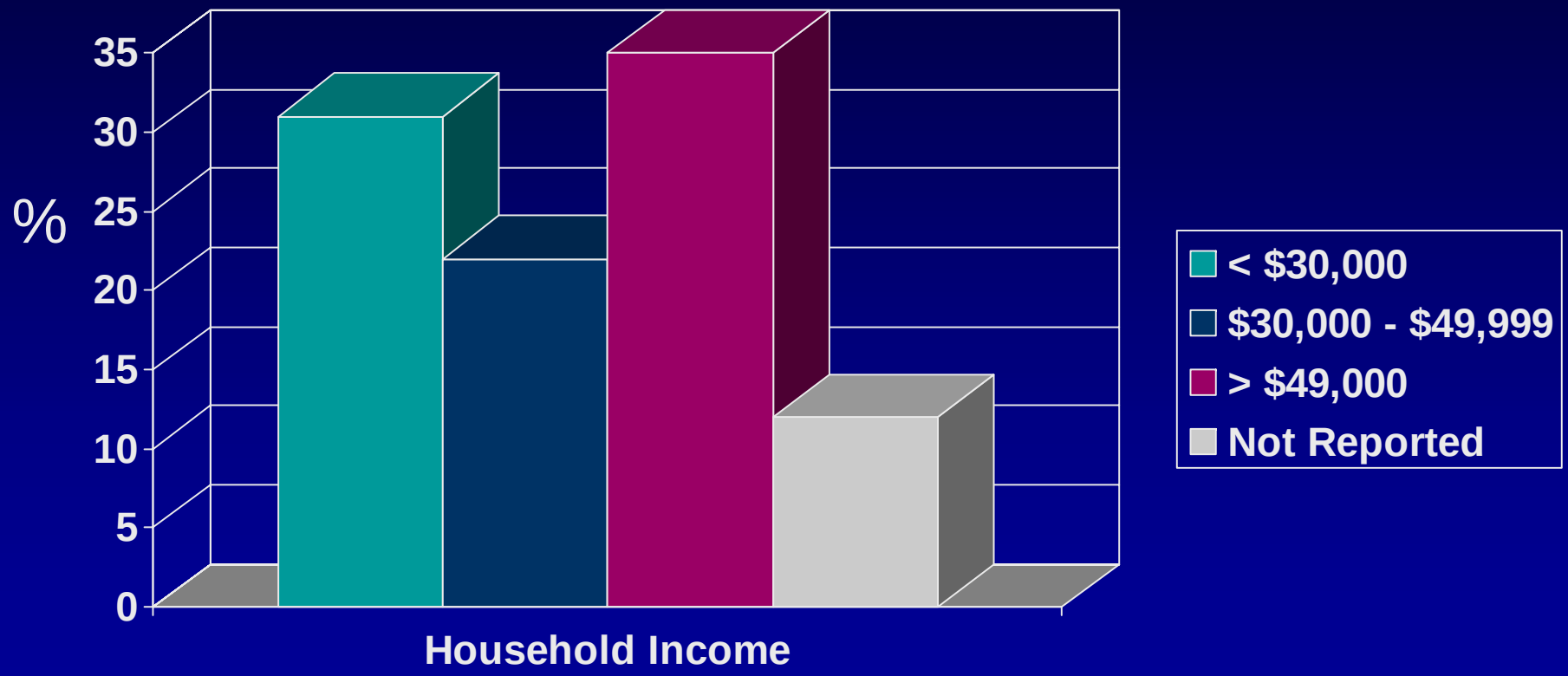
Description of Urban Angler Study Population (N=191)

- Male 84%
- Mean age in yrs 52 (15)
- Mean BMI 30 (5.5)
- Share Catch 63%
- Education
  - High School 55%
  - > High School 44%

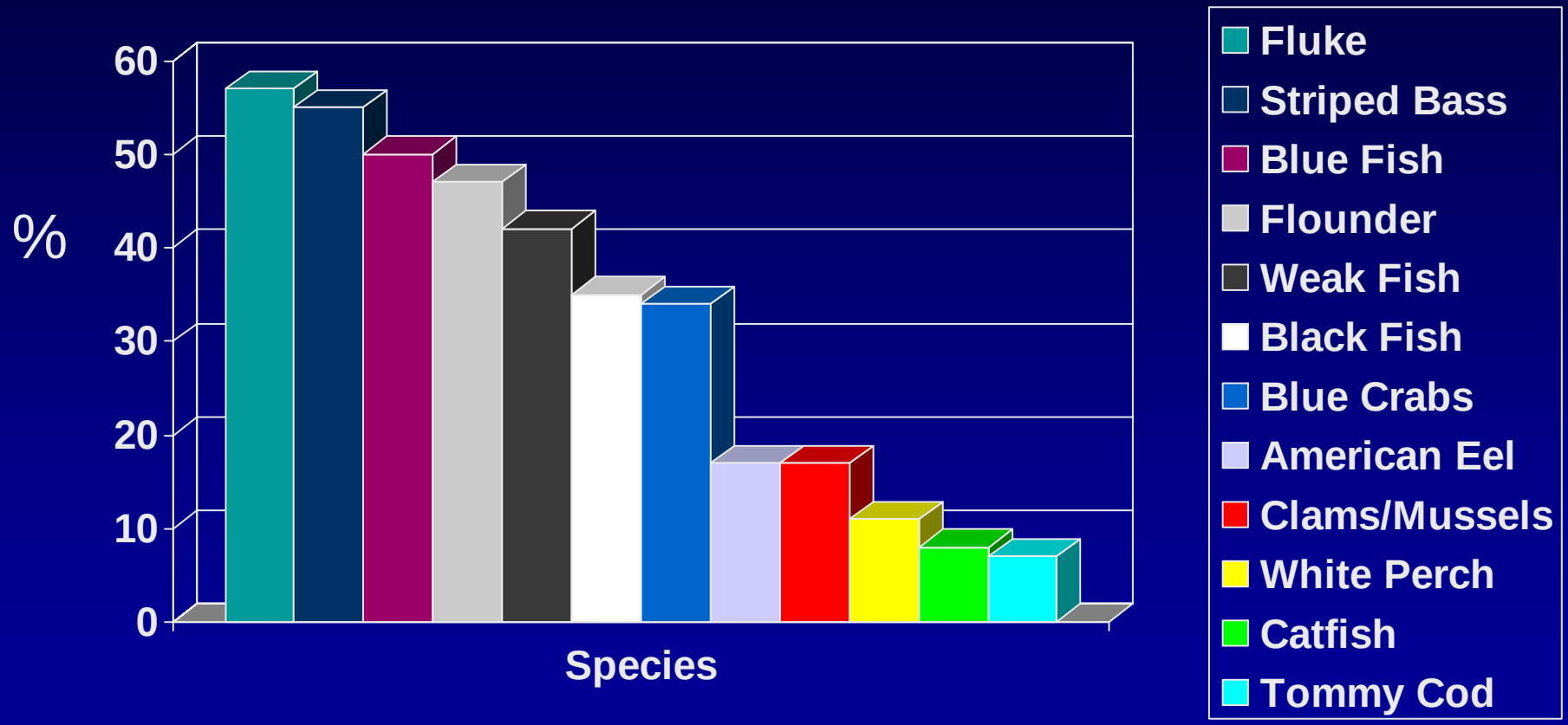
Race/Ethnicity of Urban Angler Study Population



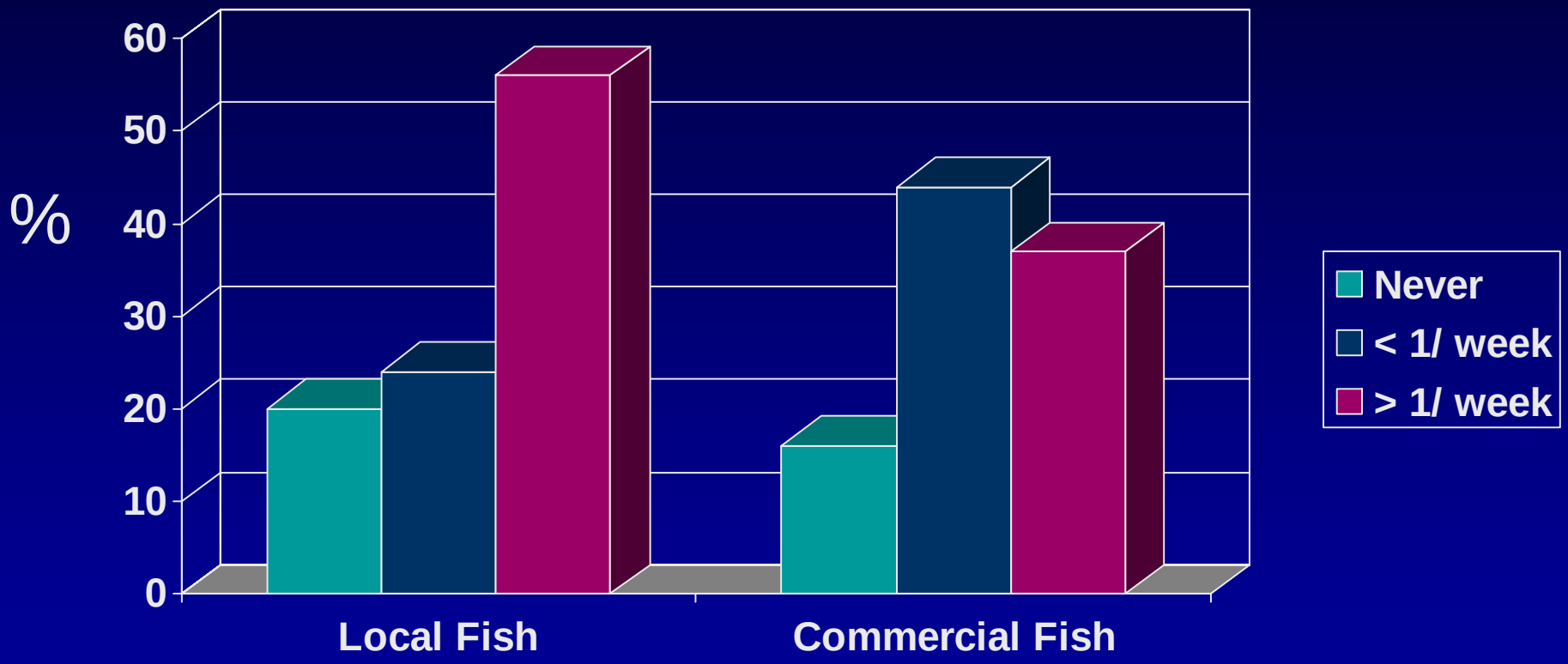
Household Income of Urban Angler Study Population



Angler Consumption of Specific Species of Fish



Proportion Report Eating Locally Caught & Commercial Fish



Methods for Mercury Analysis

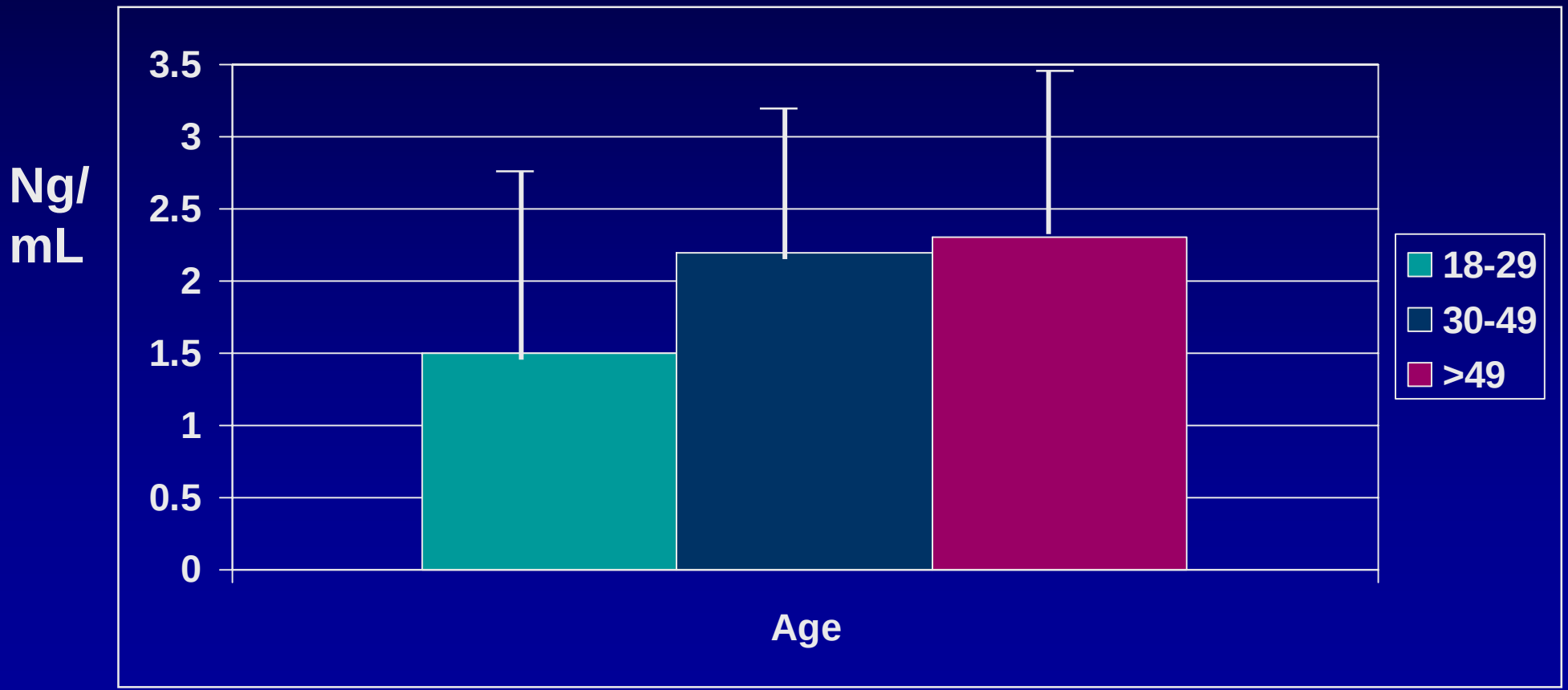
- Whole blood samples (10mL) were stored at –20 degrees Celsius and analyzed for total mercury content using a UV-absorptiometer at the Clarkson Lab at the University of Rochester.
- LOD was 0.75 and samples with concentrations below the LOD were coded with LOD/SQRT of 2.
- Total Mercury was positively skewed, therefore log transformed geometric means were calculated.
- Frequency of locally caught fish was calculated based on summed weighted frequencies across species of fish.

Gobeille A, Morland K, Bopp R, Godbold J, Landrigan P. Body Burden of Mercury in Hudson River Area Anglers, Environmental Research, (in press).

Geometric Mean Concentrations of Mercury (ng/mL) by Demographic Characteristics (N=124)

		Mean[a] (SE)[b]	P-value
Total		2.2 (0.2)	
Race/ Ethnicity			
	Non-Hispanic White	2.4 (1.1)	*ref.*
	Black	1.6 (1.2)	*0.063*
	Hispanic	2.0 (1.3)	*0.490*
	Other	3.5 (1.6)	*0.392*
Gender			
	Men	2.3 (1.3)	*0.180*
	Women	1.7 (1.2)	*ref.*
Yearly Household Income			
	< $30,000	1.8 (1.2)	*0.157*
	$30,000 - $49,999	2.0 (1.3)	*0.393*
	> $50,000	2.4 (1.1)	*ref.*
	Not Reported	3.0 (1.3)	*0.408*
Completed Years of Education			
	≤ 12	1.9 (1.1)	*0.046*
	> 12	2.6 (1.2)	*ref.*

Geometric Mean Concentration of Mercury by Age



Geometric Mean Concentration of Mercury by BMI

Mercury Concentration (ng/mL) by Reported Fish Consumption

		Unadjusted		Adjusted	
	n[a]	Mean[b] (SE)[c]	P value	Mean[b] (SE)[c]	P value
Never versus Any Local Fish Intake					
Never	20	1.3 (1.2)	*ref.*	0.2 (2.1)	*ref.*
Any Fish Intake	104	2.4 (1.2)	0.009	0.4 (1.2)	0.002
Average Frequency per Week[e]					
Never	20	1.3 (1.2)	*ref.*	0.2 (2.1)	*ref.*
Any fish ≤ once per week	31	2.0 (1.3)	0.142	0.4 (1.3)	0.031
Any fish > once per week	73	2.6 (1.3)	0.004	0.5 (1.3)	0.001

[a]n is the number of participants ; [b]Mean is log transformed (geometric mean); [c]SD is log transformed (geometric standard error); [d]Model adjusted for race, gender, income, education age and BMI; [e]p values presented against reference dose (never eats local fish)

Methods for PBDE Analysis

- 93 samples were selected from the 2002-2003 data collection to be analyzed for PBDEs at the National Center for Environmental Health at the CDC in Atlanta.
- Concentrations below the limit of detection (LOD) were coded with LOD.
- PBDE concentrations were positively skewed, therefore log transformed geometric means were calculated.
- Frequency of locally caught fish was calculated based on summed weighted frequencies across species of fish.

Morland KB, et al. Body burdens of polybrominated diphenyl ethers among urban anglers. Enviromental Health Perspectives 2005;113:1689-1692.

Mean concentratation of polybrominated diphenyl ethers (PBDEs) in human serum

		Unadjusted (pg/g fresh weight)		Lipid adjusted (ng/g lipid weight)	
PBDE Congener	N‡	Mean§	STD†	Mean§	STD†
47	93	91.4	3.8	13.3	3.6
85	92	7.3	3.5	1.0	3.6
99	93	21.5	3.6	3.2	3.4
100	93	18.6	3.4	2.7	3.2
153	93	21.8	3.2	3.2	3.1
154	89	4.4	2.3	0.6	2.3
183	93	3.6	1.7	0.5	1.7

‡ Number of participants

§ Geometric mean

† Geometric standard deviation

Mean concentration of polybrominated diphenyl ethers (PBDEs) by local fish intake (ng/g lipid weight)

	No local fish intake			Any local fish intake			
PBDE Congener	N‡	Mean§	STD†	N‡	Mean§	STD†	p-value
47	14	12.61	5.42	79	13.41	3.30	0.87
85	14	0.70	3.56	78	1.11	3.54	0.21
99	14	2.83	4.69	79	3.30	3.24	0.67
100	14	2.32	4.66	79	2.77	2.94	0.59
153	14	2.02	4.13	79	3.43	2.88	0.10
154	12	0.56	3.74	77	0.64	2.09	0.57
183	14	0.38	1.99	79	0.56	1.65	0.01

‡ Number of participants

§ Geometric mean

† Geometric standard deviation

Mean concentratation of polybrominated diphenyl ethers (PBDEs) by frequency of reported local fish intake (ng/g lipid weight)

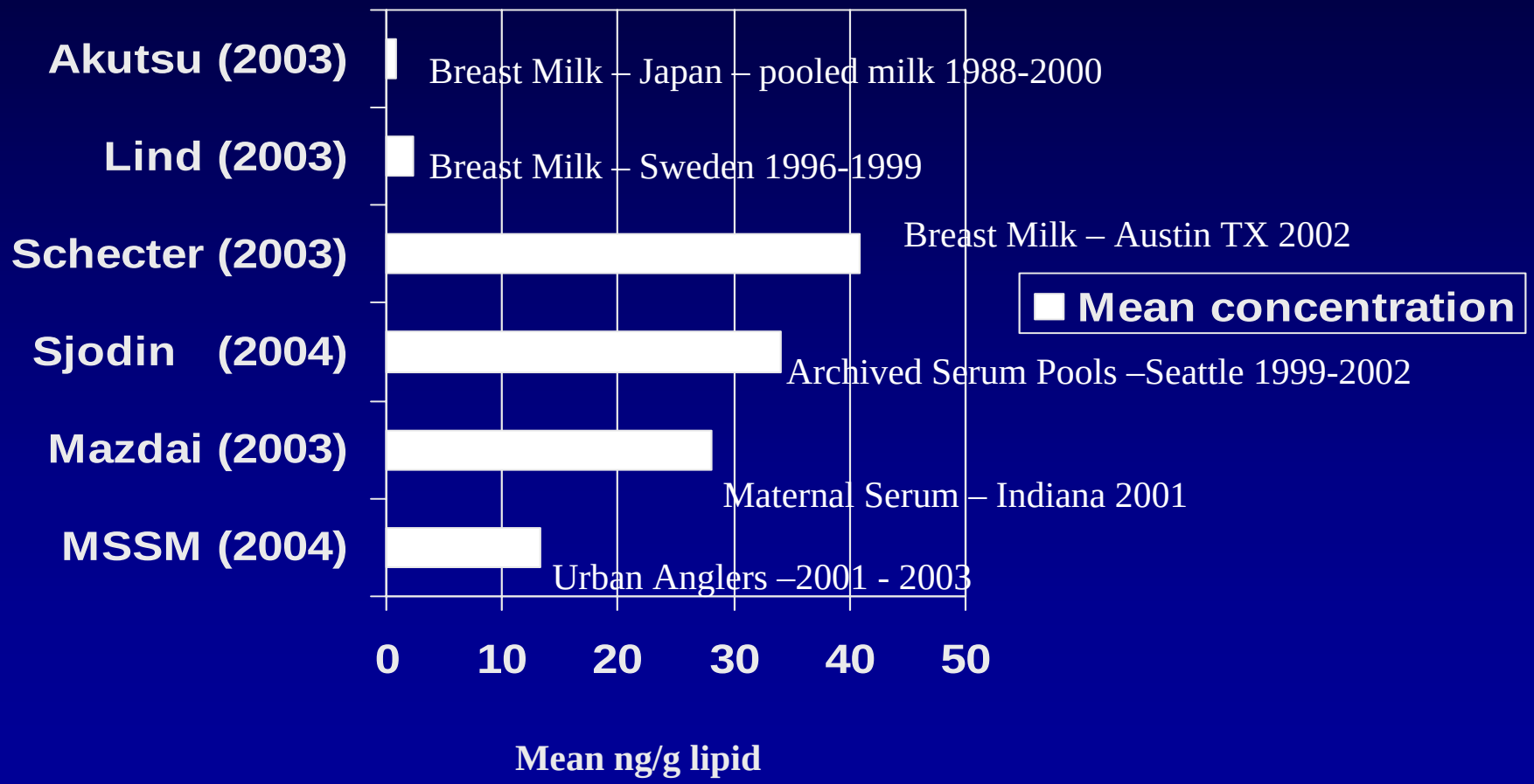
	No local fish intake			Fish Intake <= 1 wk			Fish Intake > 1 wk		
PBDE Congener	N‡	Mean§	STD†	N‡	Mean§	STD†	N‡	Mean§	STD†
47	14	12.61	5.42	25	11.55	3.07	54	14.37	3.41
85	14	0.70	3.56	25	0.89	3.28	53	1.23	3.65
99	14	2.83	4.69	25	2.68	2.92	54	3.63	3.38
100	14	2.32	4.66	25	2.34	2.63	54	3.00	3.08
153	14	2.02	4.13	25	2.58	3.06	54	3.91	2.76
154	12	0.56	3.74	23	0.51	1.91	54	0.71	2.13
183	14	0.38	1.99	25	0.49	1.70	54	0.59	1.62

‡ Number of participants

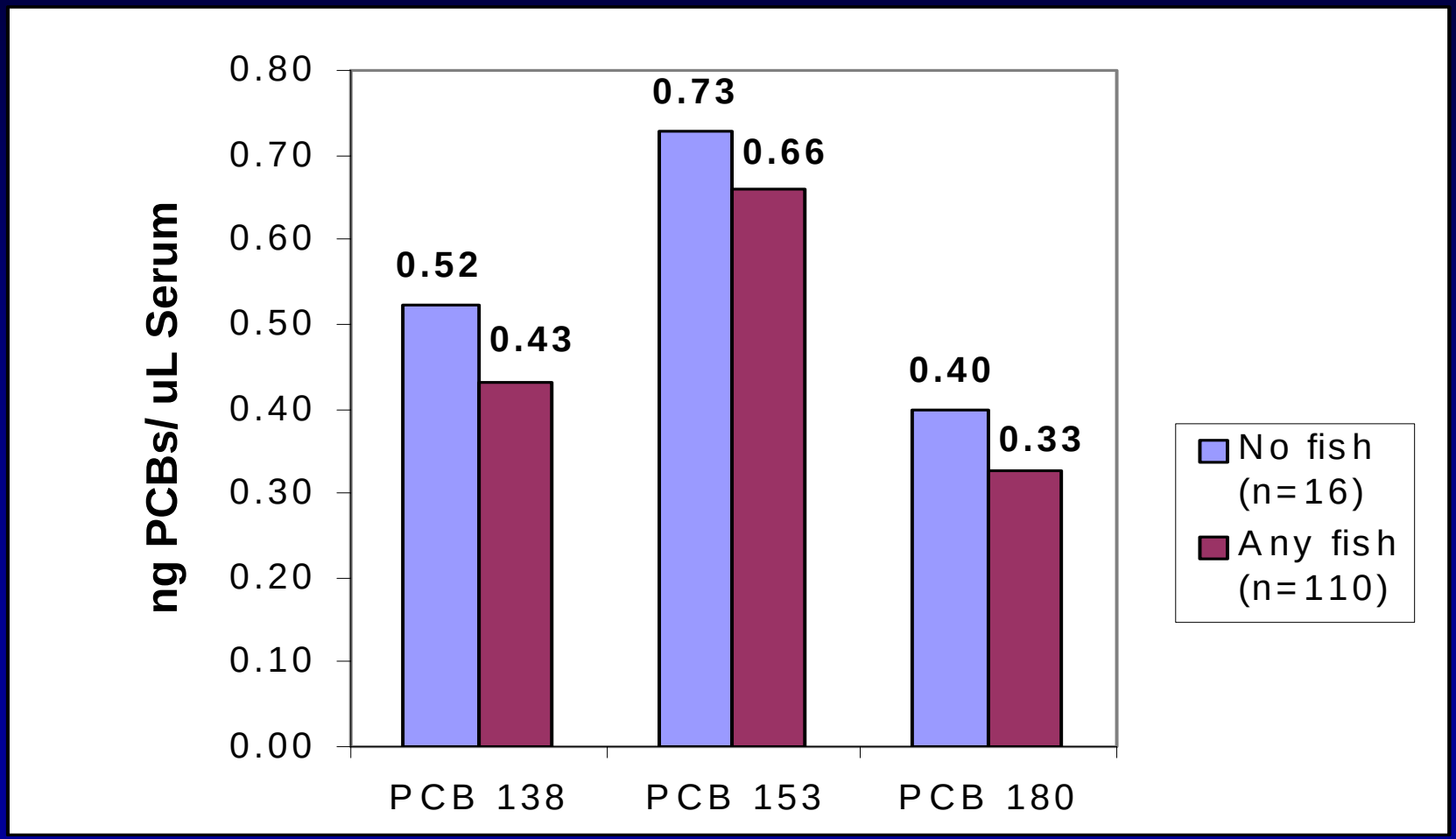
§ Geometric mean

† Geometric standard deviation

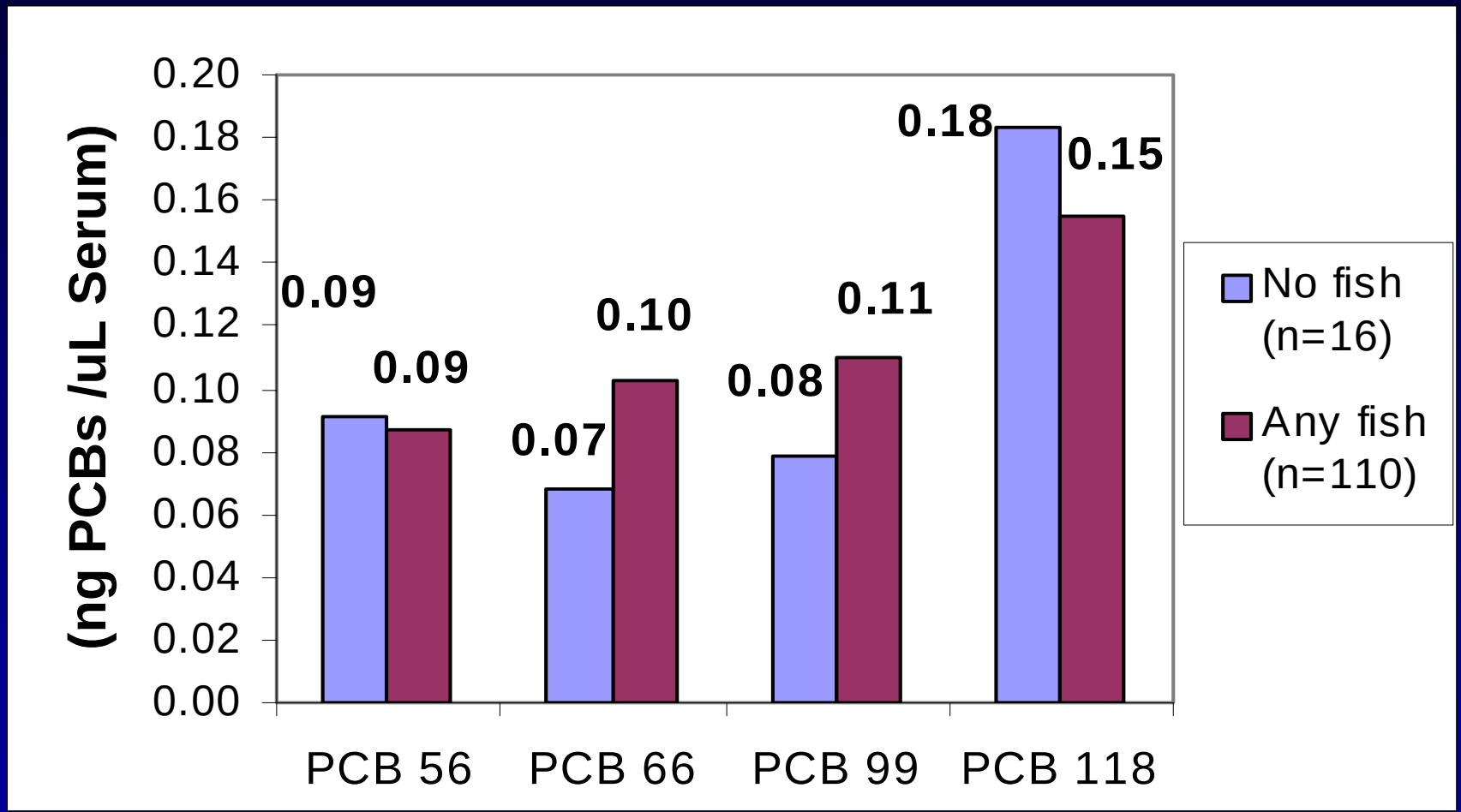
Comparison of mean concentrations (BDE-47)



Geometric Mean Concentration of Major PCBs by Local Fish Intake



Geometric Mean Concentration of Tetra & Penta Chlorinated PCBs by Fish Intake



Summary

- Observed higher levels of total mercury among urban anglers reporting eating locally caught fish
- Levels of mercury higher than other US populations (ex. NHANES)
- Significant differences in PBDE levels were not observed between anglers reporting eating locally caught fish and those that do not.
- Observed concentrations lower than other US populations but higher than non-US populations.
- Differences in levels of PCBs were not observed by fish consumption.

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