Science of mercury behind 5 popular headlines: Fiction, misunderstanding & reality? You decide!

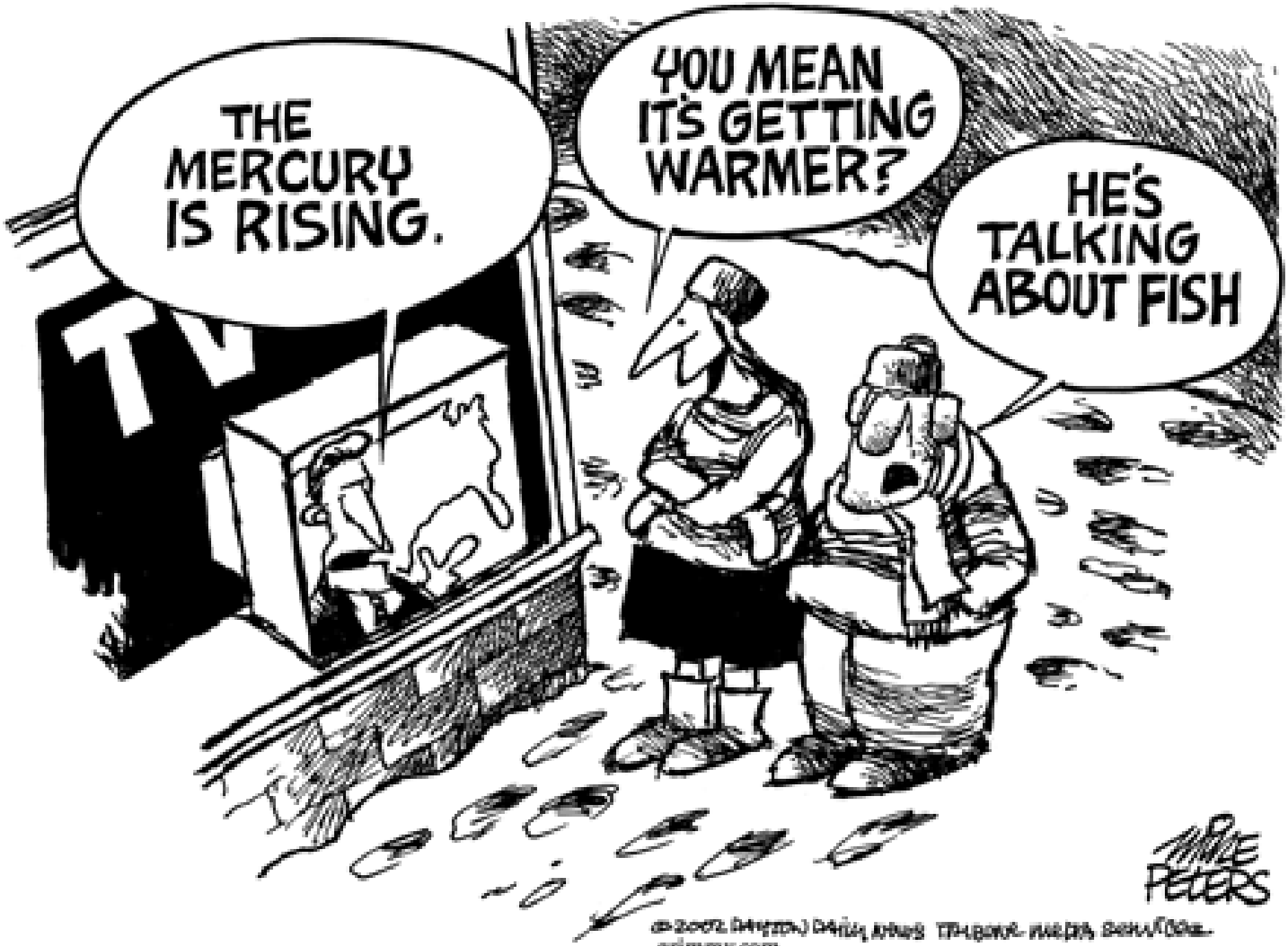
Headline # 1: "The Bush administration's ploy would allow coal-fired power plants to put more mercury into the air, where it rains down on lakes and oceans, is swallowed by fish, and could wind up on your plate." (NRDC and MoveOn.Org)

Headline # 2: "America learned this week that tuna, and many other fish, can contain harmful levels of toxic mercury." (NRDC and MoveOn.Org)

Headline # 3: "The National Academy of Sciences had stated that mercury in contaminated fish consumed by pregnant women will interfere with brain development in their babies." (FOE)

Headline # 4: "Already, five millions American women of childbearing age have dangerous levels of mercury in their bodies, according to the Centers for Disease Control." (Sierra Club) "Millions of women in America currently have levels of mercury in their blood considered unsafe by the Environmental Protection Agency" (PSR)

Headline # 5: "The facts are undisputed: power plant mercury is poisoning America's children. 630,000 babies are born each year with dangerous levels of mercury in their blood." (FOE)

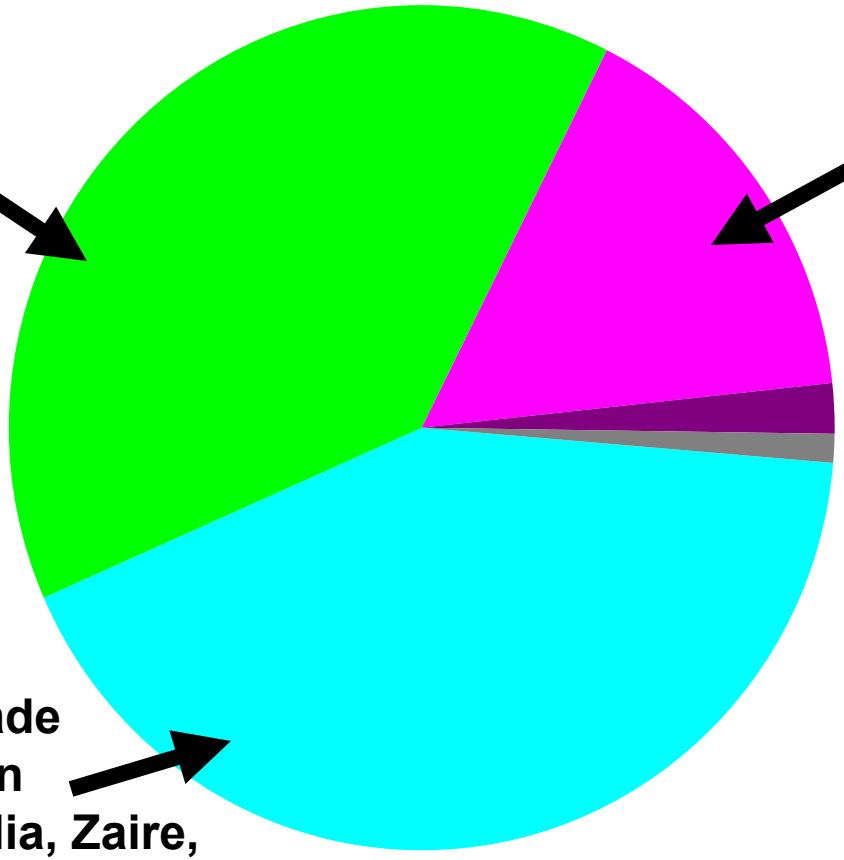

THE MERCURY IS RISING.
YOU MEAN IT'S GETTING WARMER?
HE'S TALKING ABOUT FISH
JIMMIE PEEERS
grimmy.com

Science of mercury behind 5 popular headlines: Fiction, misunderstanding & reality? You decide!

Headline # 1:

"The Bush administration's ploy would allow coal-fired power plants to put more mercury into the air, where it rains down on lakes and oceans, is swallowed by fish, and could wind up on your plate." (NRDC and MoveOn.Org)

Mercury Emission from U.S. Power Plants: Only 1% of the world total emission



39% Natural

(Oceans and volcanoes)

16% Natural

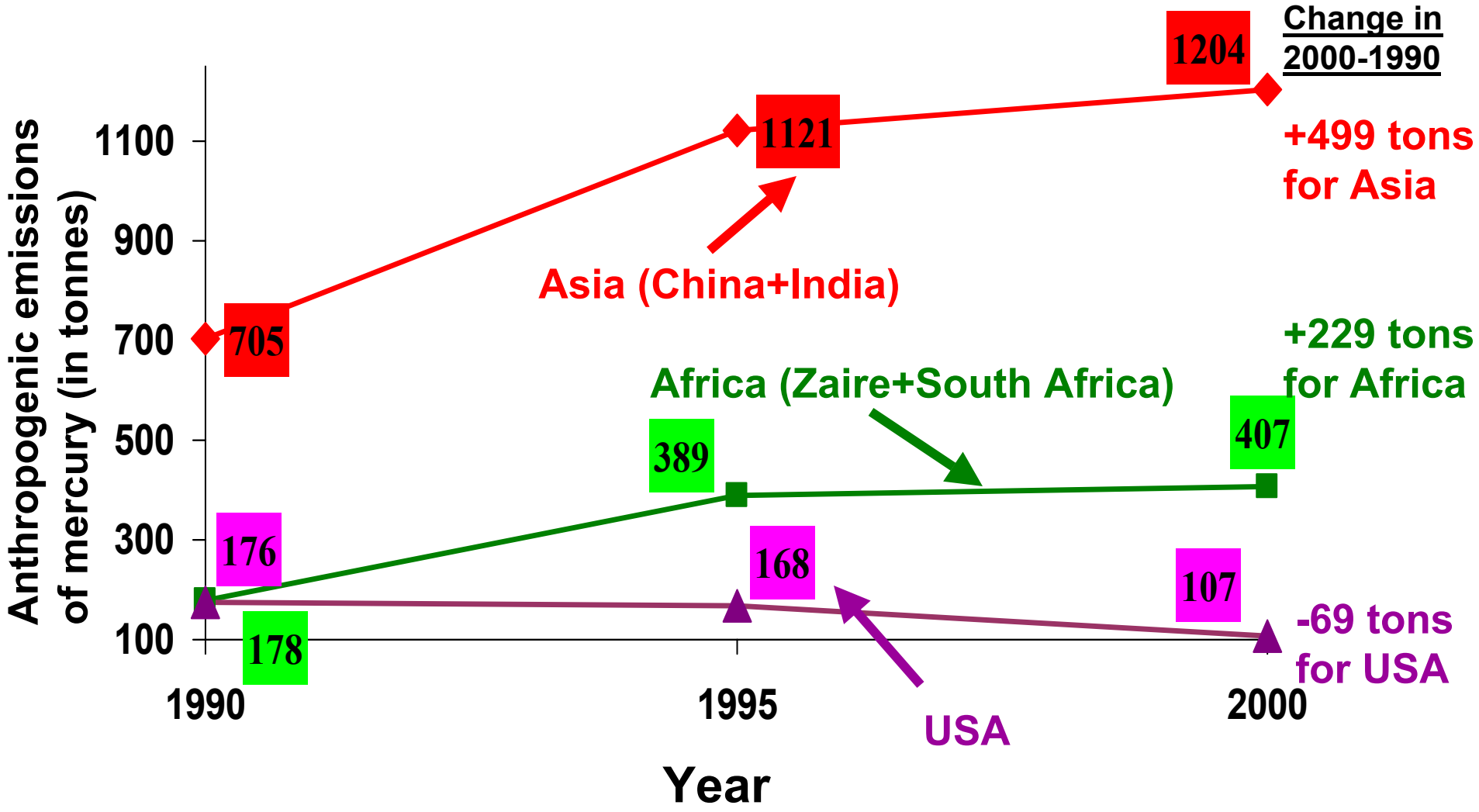
(Biomass burning)

42 % Non-U.S. man-made (China, Top-7 European Emitters, India, Australia, Zaire, etc.)

U.S. Man-made
3 % total
1 % power plants

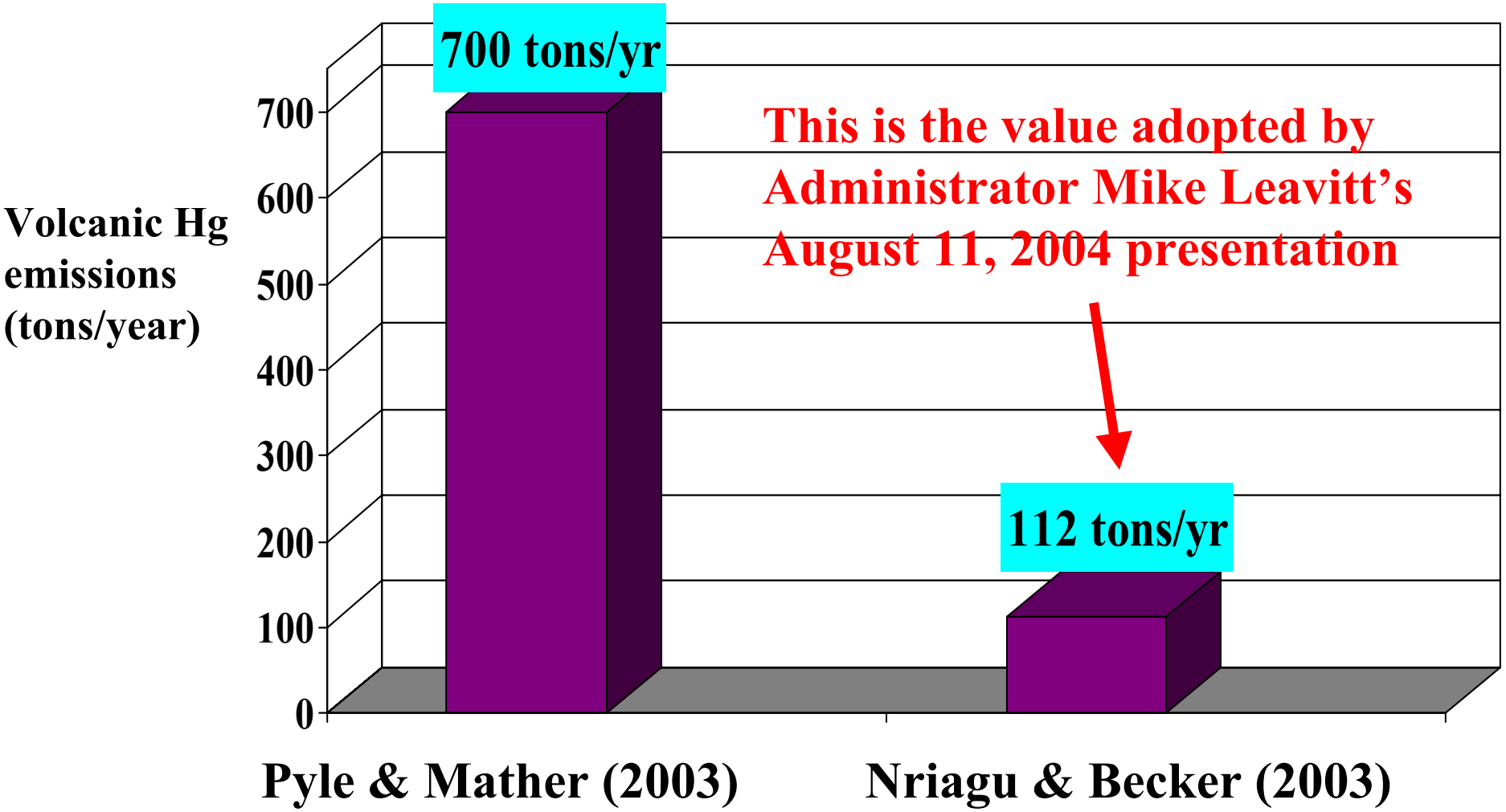
Pacyna et al. 2003, Freidli et al. 2003

US (and North America) mercury emissions: Small and have been decreasing over time



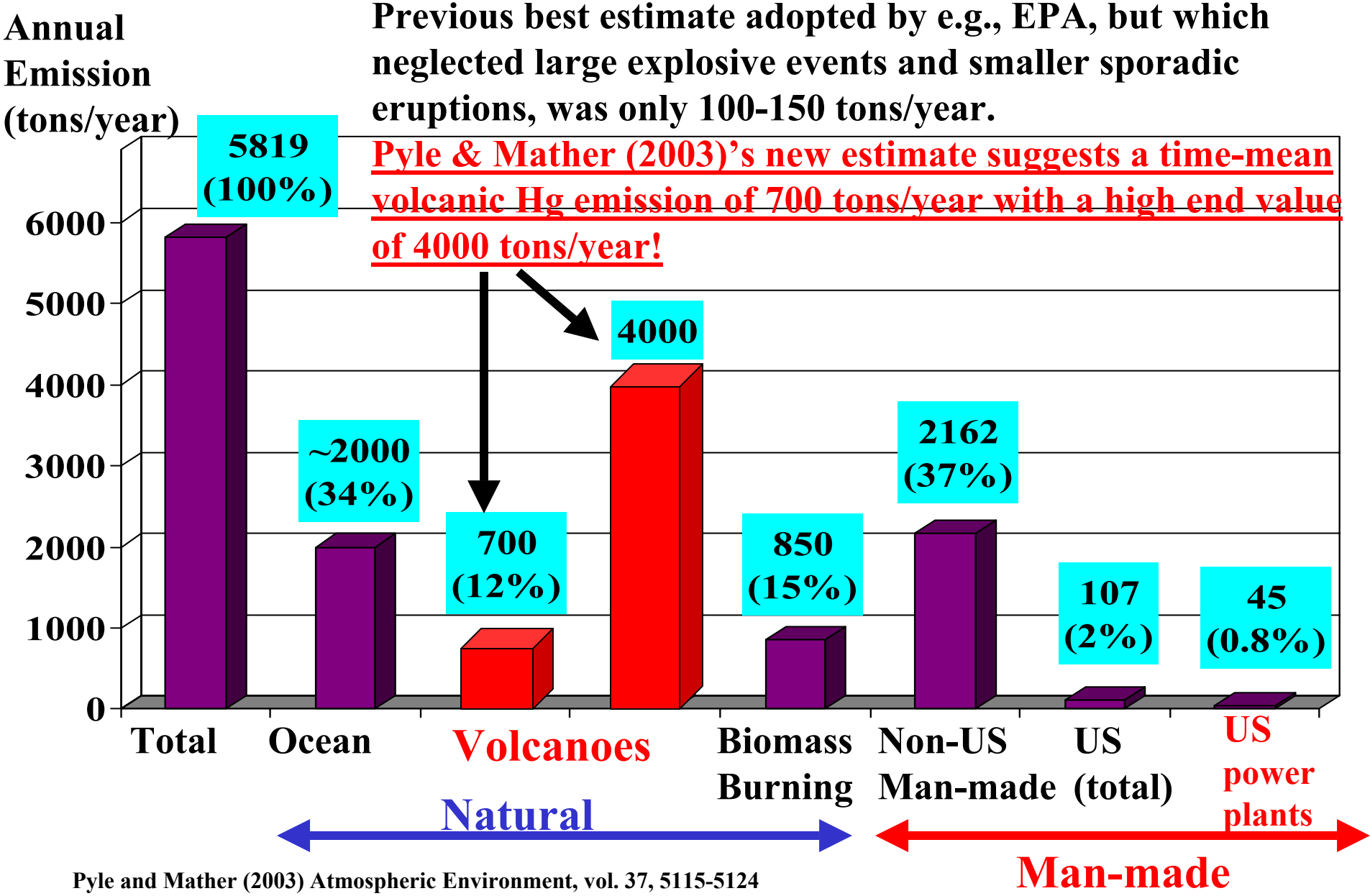
Adapted from presentation by Jozef Pacyna of the Norwegian Institute of Air Research (private communication March 4, 2004 + help from Simon Wilson of AMAP on April 3, 2004)

Previous estimates of Hg from volcanic activities may have been underestimated: Pyle and Mather (2003) give a range of 80 to 4000 tons/year with time-averaged value of 700 tons/year



Pyle and Mather (2003) Atmospheric Environment, vol. 37, 5115-5124;
Nriagu and Becker (2003), Science of the Total Environment, vol. 304, 3-12

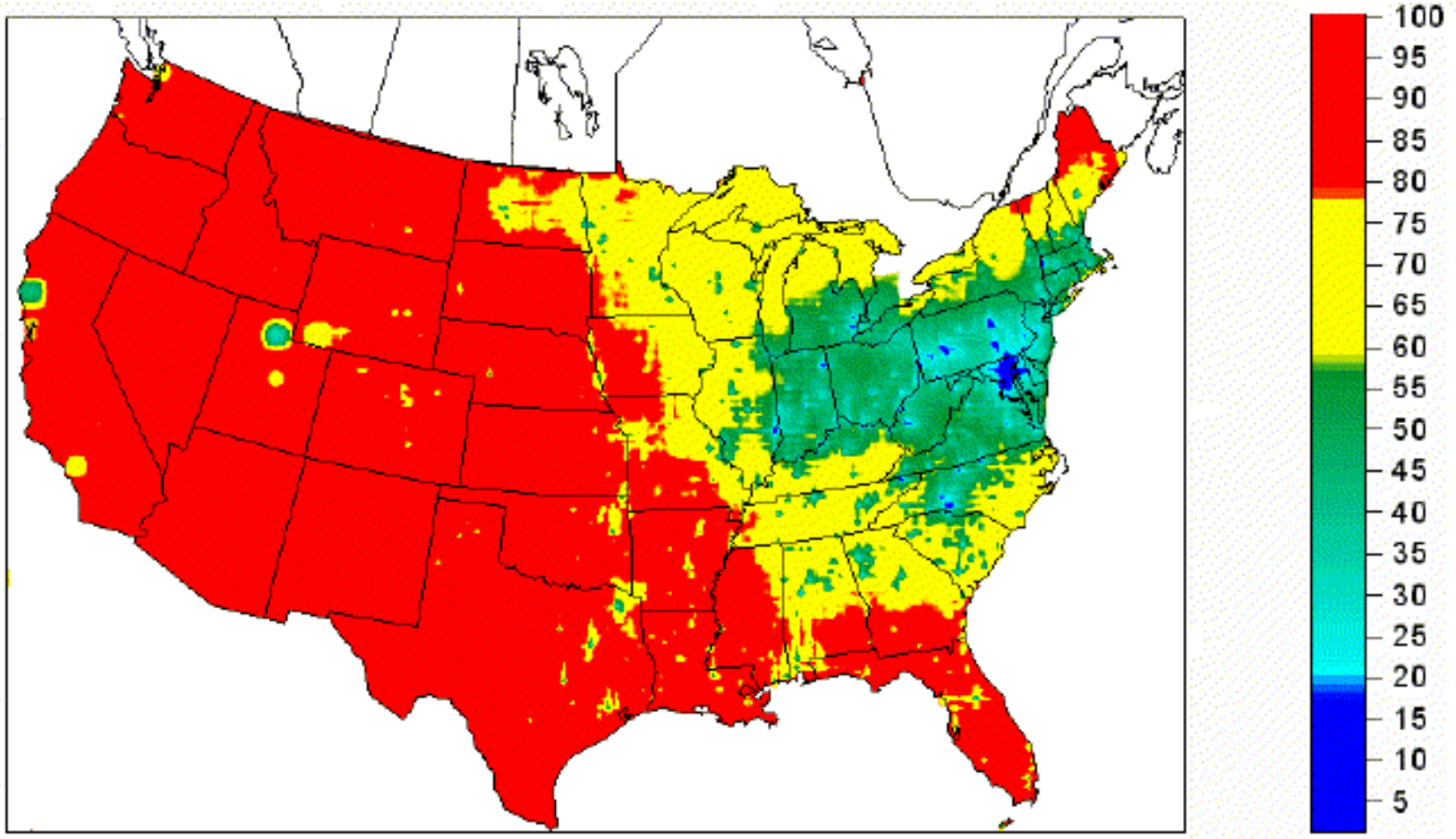
New view on world mercury emission budget: A serious underestimation of volcanic Hg sources?



Pyle and Mather (2003) Atmospheric Environment, vol. 37, 5115-5124

U.S. Mercury Deposition from Non-U.S. Sources

% contribution by non-U.S. sources, 2004



EPRI

From Michael Miller, EPRI, June 15, 2004's presentation at the Resources for the Future

"Man-made Hg" from atmospheric deposition is a VERY SMALL contributor to the huge amount of natural Hg in Illinois and US soils

"The hypothesis that most Hg in Illinois and the USA soils is of anthropogenic origin is rejected."

(1) It has been estimated that "anthropogenic activities could have increased world soil Hg content by [only] 0.02 percent."

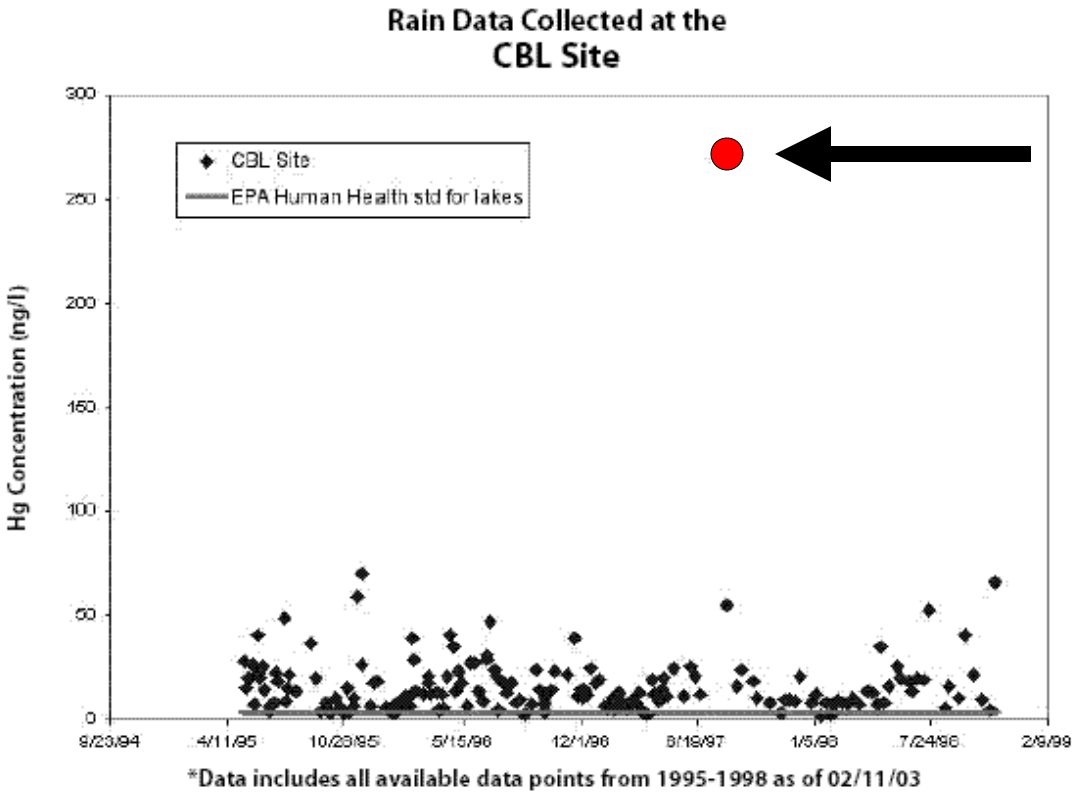
(2) From the measured high Hg content in Illinois soils, it would take 9000 years at the currently measured atmospheric deposition rate to dump all the Hg to the top 380-cm of Illinois soils.

(3) If assuming the average Hg in the top 140-cm of US soils to be about 10 ppb, it would take 14,000 years at the current atmospheric deposition rate to do it.

Krug and Winstanley, 2004, Hydrology & Earth System Sciences, vol. 8, 98-102

Use of extreme data outliers by NWF's *Cycle of Harm* Report: Maryland Data

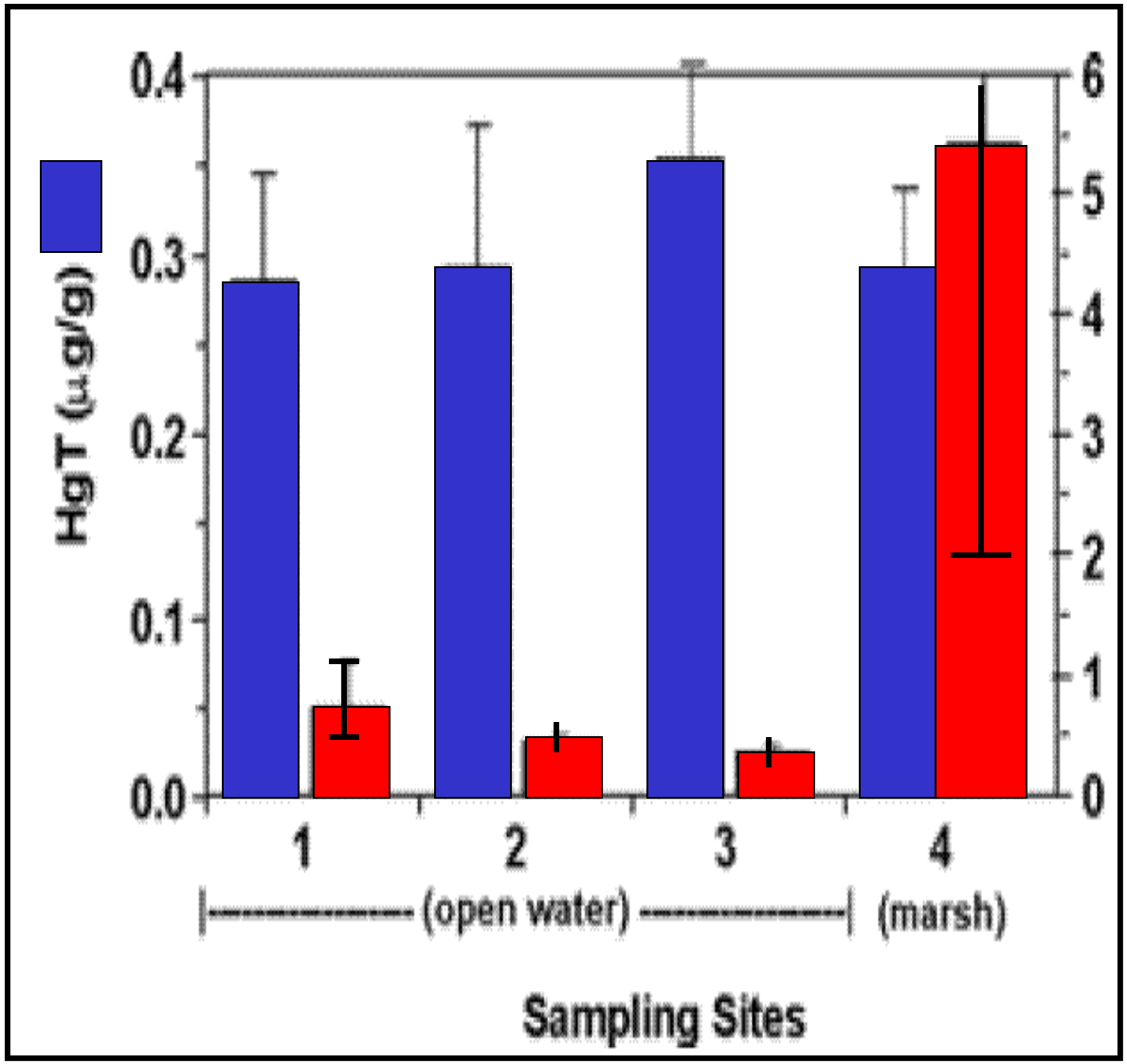
Precipitation Data (Continued)

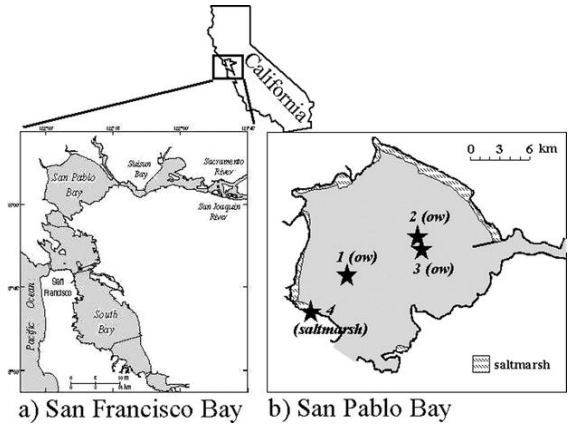


Data outlier used by NWF to claim that Hg in MD's rain exceeds EPA human health standard by as much as 77.2 times

Methylmercury (MeHg) production DOES NOT depend on the amount of elemental mercury (including those from power plants) available:

Mircobial MeHg production in marsh wetlands are 25-50 times more than in open-water locations around San Pablo Bay area



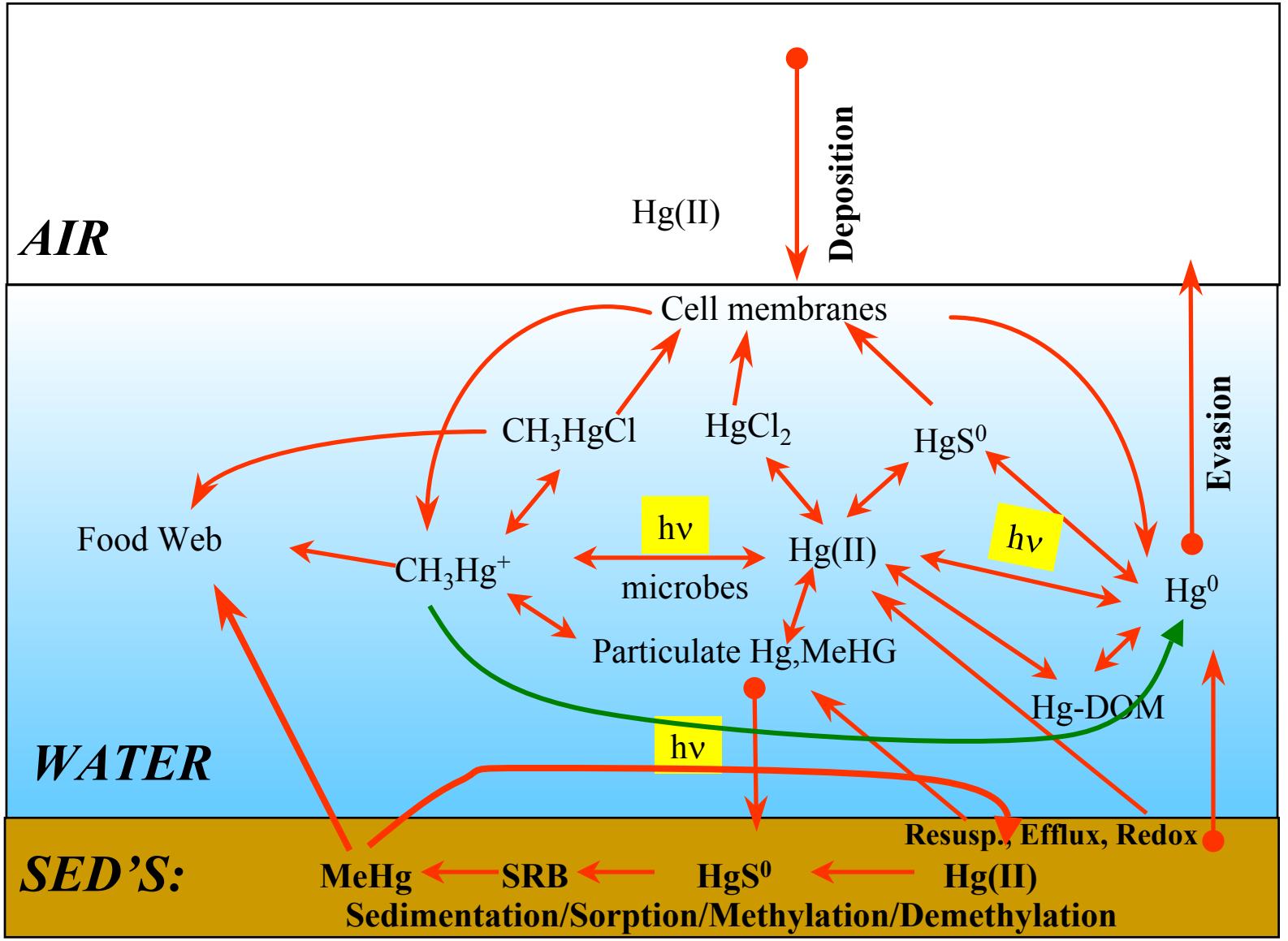


a) San Francisco Bay b) San Pablo Bay

Marvin-DiPasquale et al. (2003) concluded that "Microbial MeHg production ... in 0-4 [cm] surface sediments was also the highest in the marsh [3.1 ng/g/day] and below detection limit [< 0.06 ng/g/day] in open-water locations. The marsh exhibited a methylation/demthylation ratio more than 25X than of all open-water locations. ... These preliminary data indicate that wetlands surrounding San Pablo Bay represent important zones of MeHg production, more so than similarly Hg-contaminated adjacent open-water areas." (p. 260)

Reference: Marvin-DiPasquale et al. (2003) Environmental Geology, vol. 43, 260-267

The Aquatic Mercury Cycle Conceptual Model



Adapted from (USGS) David Krabbenhoft's ppt presentation

The actual scientific evidence/understanding for Hg-MeHg conversion and MeHg accumulation simply do not support any direct or clear link of a reduction in (U.S. power plants) Hg emission to a reduction of MeHg in fish

Related factors/papers:

(i) levels of MeHg are independent of raw Hg levels (Marvin-DiPasquale et al. 2003; Paller et al. 2004; Bonzongo & Lyons 2004)

(ii) pH and sulfate (Bonzongo & Lyons 2004) + water depth, wetland catchment area, potassium levels, Chlorophyll a, fish displacement by anglers, food web structure, sediment biogechemistry, iron oxides in sediments (Warner, Bonzongo et al. 2005)

(iii) leaf litter inputs and microbial growth (Balogh et al. 2003)

(iv) roles of visible light (Seller et al. 1996), UVA (Lalonde et al. 2004), diurnal MeHg and solar radiation (Siciliano et al. 2005)

(v) experimental treatments with sulfate (Harmon et al. 2004)

(vi) sulfate, organic matter, and bacterial activity (Mason et al. 2005)

(vii) water temperature and fish body weight (Trudel and Rasmussen 1997)

(viii) algal bloom-induced biodilution of MeHg in zooplankton Daphnia (Pickhardt et al. 2002)

(ix) dependence of MeHg on species of zooplankton (Masson & Tremblay 2003)

(x) "MeHg accumulation paradox" (Schaefer et al. 2004)

(xi) seasonal cycle of MeHg before and after control flooding (St. Louis et al. 2004)

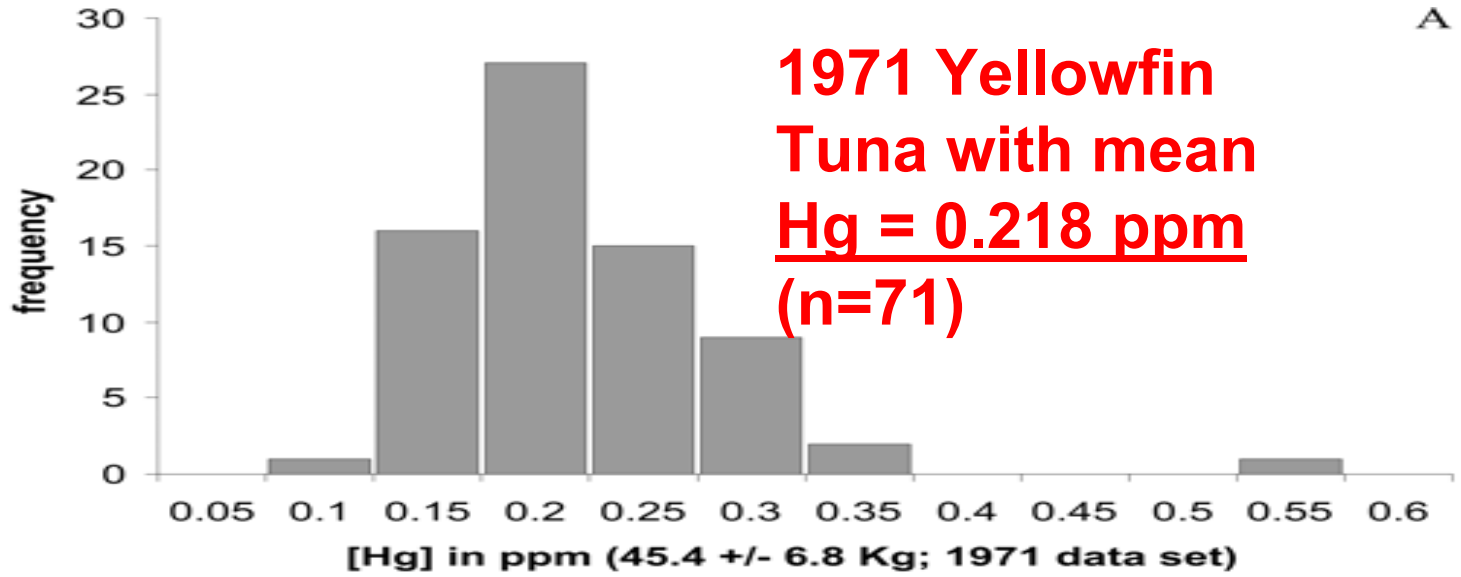
(xii) mercury levels in perch and 48 environmental variables including land use, various catchment area and lake characteristics, lake water chemistry, and fish stocks (Soneston 2003)

Science of mercury behind 5 popular headlines:
Fiction, misunderstanding & reality? You decide!

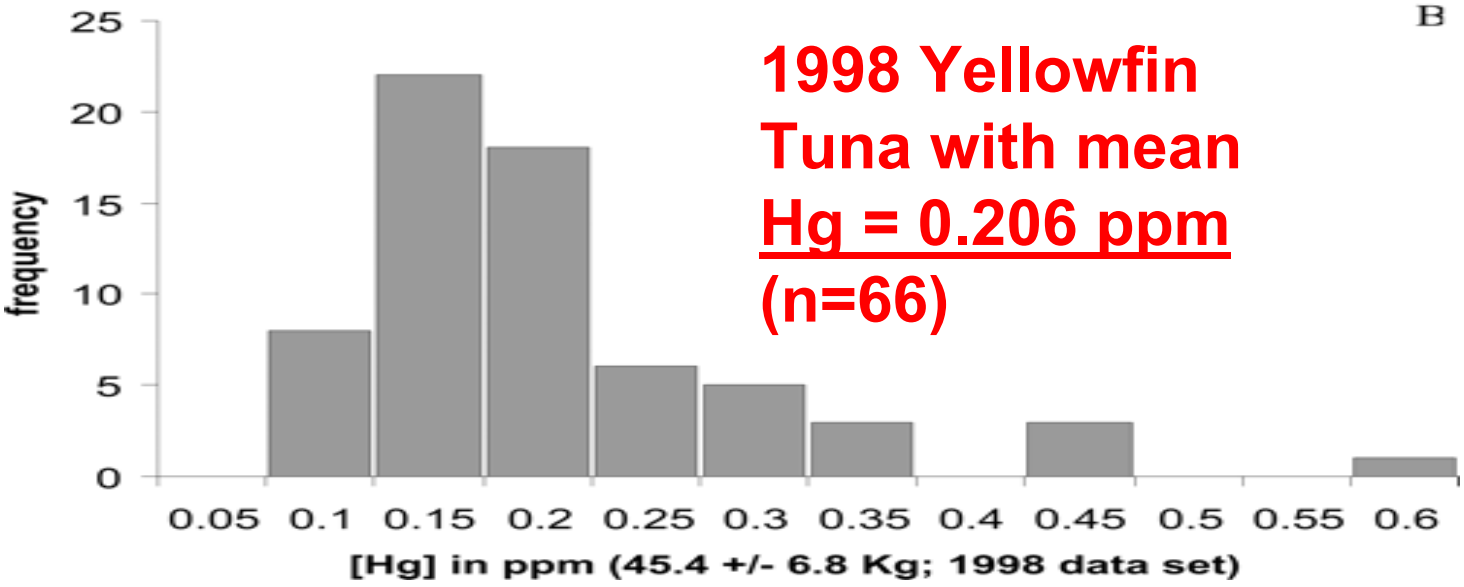
Headline # 2:

"America learned this week that tuna, and many other fish, can contain harmful levels of toxic mercury." (NRDC and MoveOn.Org)

No increase in mercury levels for Yellowfin tuna caught in 1998 relative to a similar sample caught in 1971



1971 Yellowfin Tuna with mean Hg = 0.218 ppm (n=71)



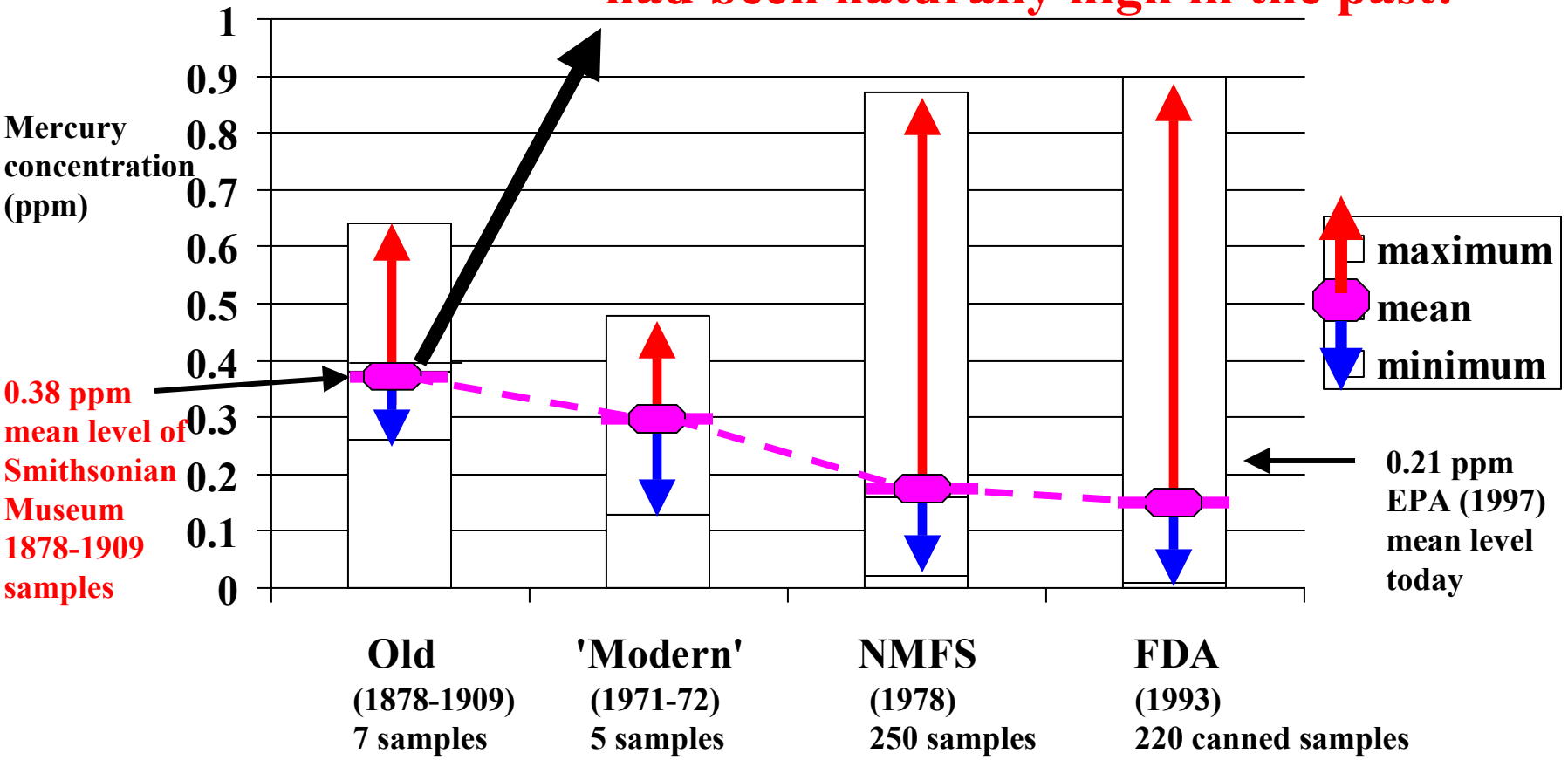
1998 Yellowfin Tuna with mean Hg = 0.206 ppm (n=66)

Expected increase of 9 to 26% in mercury levels between 1971 and 1998 but none was observed

Kraepiel et al., 2003, *Environmental Science & Technology*, vol. 37, 5551-5558

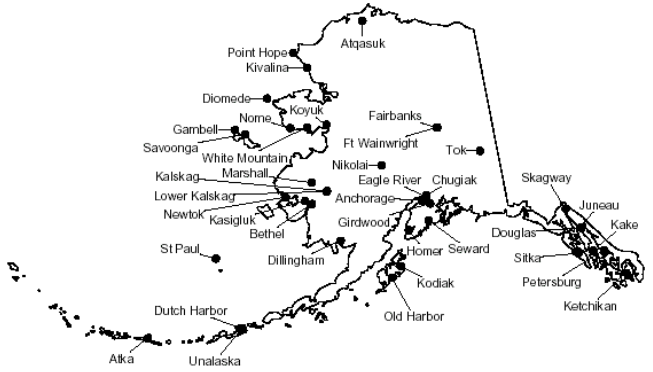
Mercury levels in tuna: Old (museum) versus New specimens

Hg levels in tuna (marine fish) had been naturally high in the past!



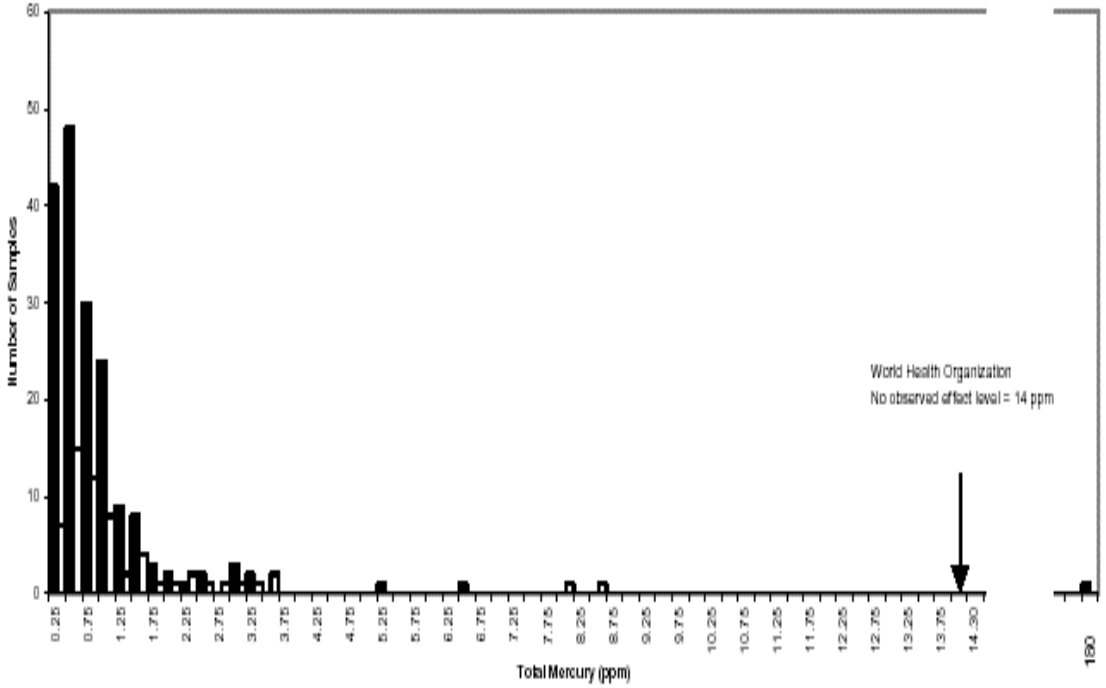
Data Sources: Miller et al. (1972), *Science*, vol. 175, 1121-1122; Carrington et al. (1997), *Water, Air and Soil Pollution*, vol. 97, 273-283

Exposure to MeHg in Alaska: Today versus 550 years ago



Today's distribution of pregnant women (n=177) in Alaska with a mean of 0.7 ppm (or median value of 0.47 ppm)

Figure 20. The Frequency Distribution of the Total Mercury Concentrations Detected in the Hair of Pregnant Women (n = 177; black bars; median = 0.47 ppm) Statewide and Nonpregnant Women of Childbearing Age (n = 60; white bars; median = 0.63 ppm) Participating in the Statewide Maternal Hair Mercury Biomonitoring Program.



Compare this 0.7 ppm to the mean level of MeHg in 550-year old Aleutian mummies:

1.2 ppm (mean of 4 adults)

1.44 ppm (mean of 4 infants)

with one mummy with MeHg as high as 4.6 ppm!

State of Alaska Epidemiology Bulletin No. 11 (December 2, 2004)

Science of mercury behind 5 popular headlines:
Fiction, misunderstanding & reality? You decide!

Headline # 3:

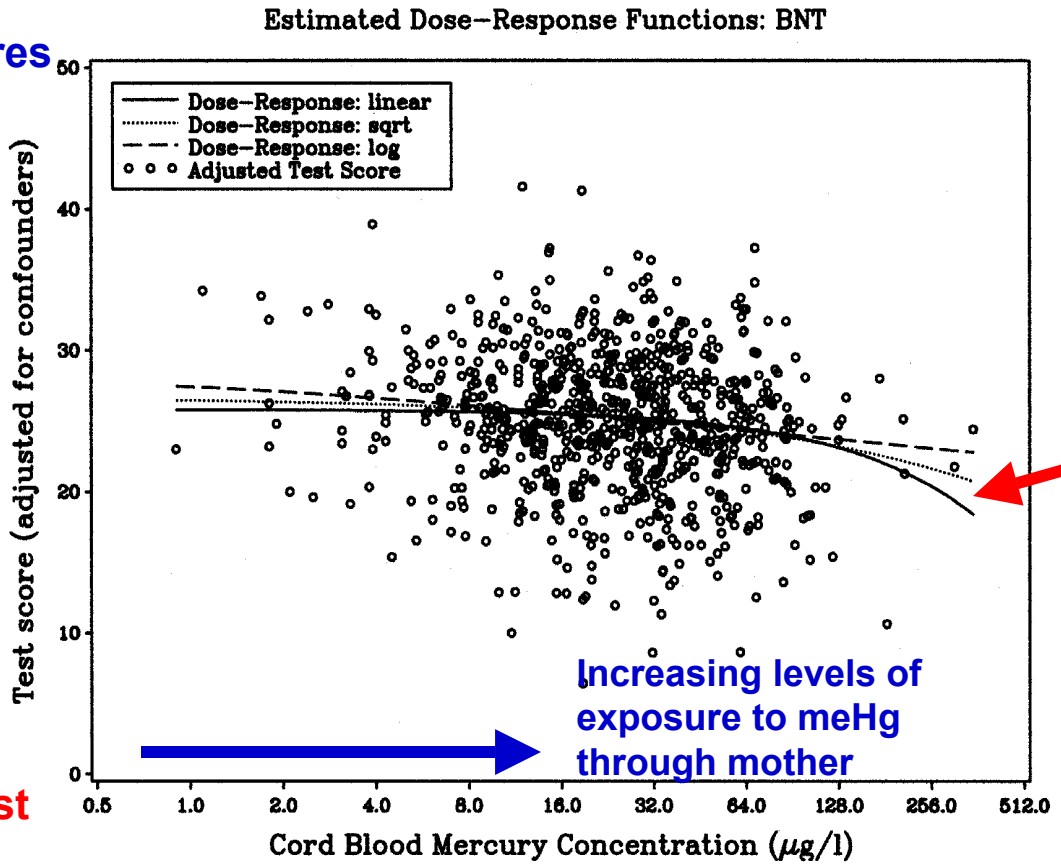
"The National Academy of Sciences had stated that mercury in contaminated fish consumed by pregnant women will interfere with brain development in their babies." (FOE)

Evidence for neuropsychological problems in the Faroe islands children study is not strong

better test scores

Cued Boston Naming Test

worsening test scores



These tendencies for curving downward are what were referred to as adverse neuro-developemental problems in children from the Faroe Island study in popular media

Figure 1: Partial residual plot of the relation between prenatal mercury exposure and the scores on the cued Boston Naming Test.

Budtz-Jorgensen et al. (2003) *Environmetrics*, vol. 14, 105-120

Crucial Admission by Faroe Island Children Study's Chief Physician, Dr. Pal Weihe: The Faroese children are exposed to mercury by consumption of pilot whale meat, not fish. In contrast, the fish consumption most likely is beneficial to their health.

OPEN LETTER by Dr. Pal Weihe, Chief Physician of

Department of Occupational and Public Health, The Faroese Hospital System

09 February 2004

To whom it may concern:

Faroe Islands women do not eat mercury-tainted fish and fish consumption does not harm Faroese children

In the Boston Herald, Friday, February 6, 2004, p. 20 the following was stated about a mercury study in the Faroe Islands conducted in the cooperation with the Harvard University: "A fish industry spokesman said that the Harvard study was flawed because Faroe Islands women typically eat far more mercury-tainted fish than do Americans"

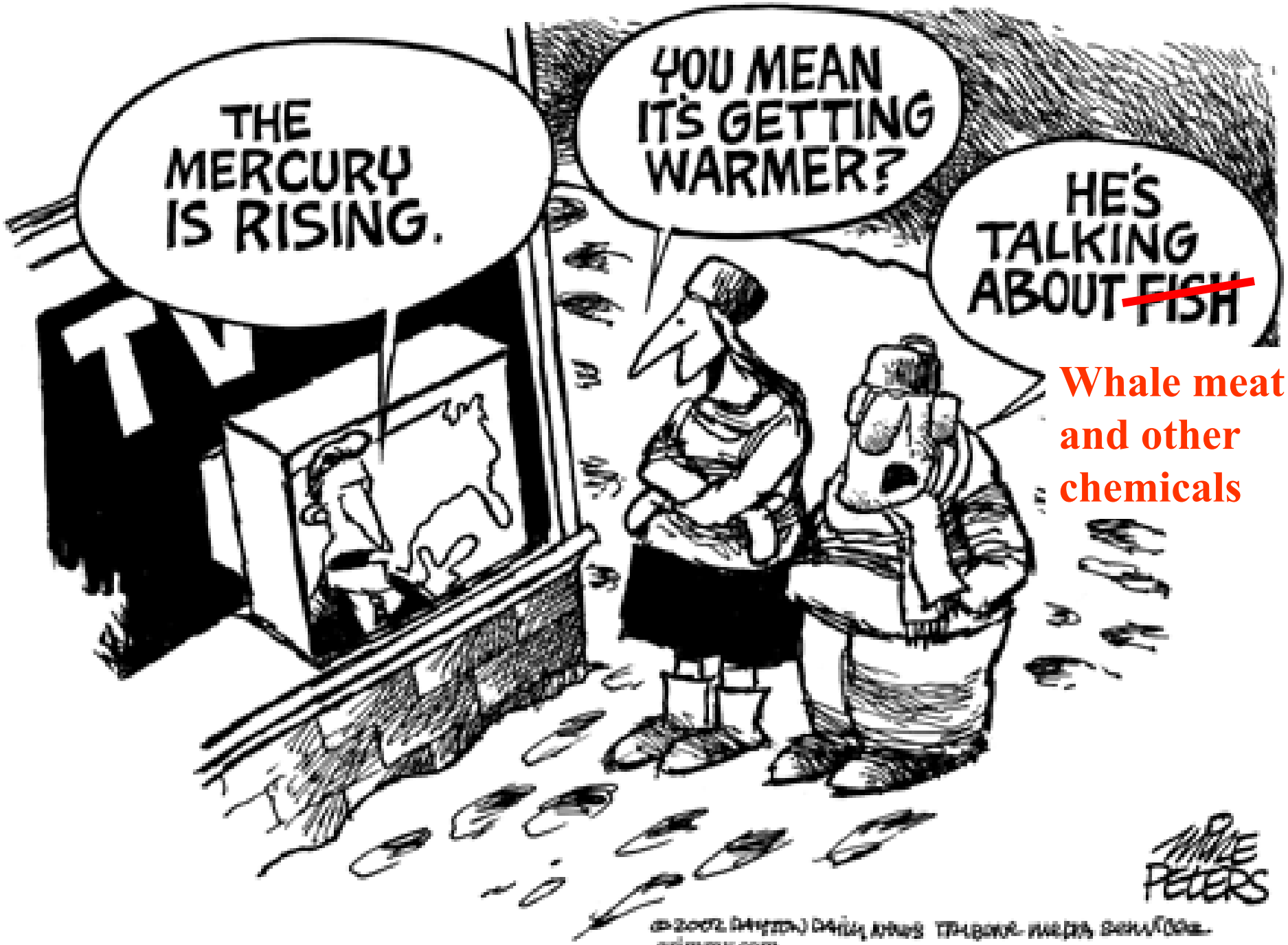
As the researcher in charge of the mercury studies on children in the Faroe Islands since 1985 I want to correct this statement.

The Faroese children are not exposed to methylmercury by eating fish. They are exposed to mercury by the traditional consumption of pilot whale meat. Fish normally consumed in the Faroes, e.g. Cod and haddock, are low in mercury and do not, to my opinion constitute any threat to the health of the Faroese children. In the contrary the fish consumption most likely is beneficial to their health.

The Faroese authorities in 1998 recommended women who plan to become pregnant within months, pregnant women, and nursing women to abstain from eating pilot whale meat. The mercury concentration in the blood of pregnant women has declined dramatically since and are now below the US-EPA limit.

Yours sincerely,

Pal Weihe, Chief Physician


THE MERCURY IS RISING.
YOU MEAN IT'S GETTING WARMER?
HE'S TALKING ABOUT FISH
Whale meat and other chemicals
JIMMIE PEERS
grimmy.com

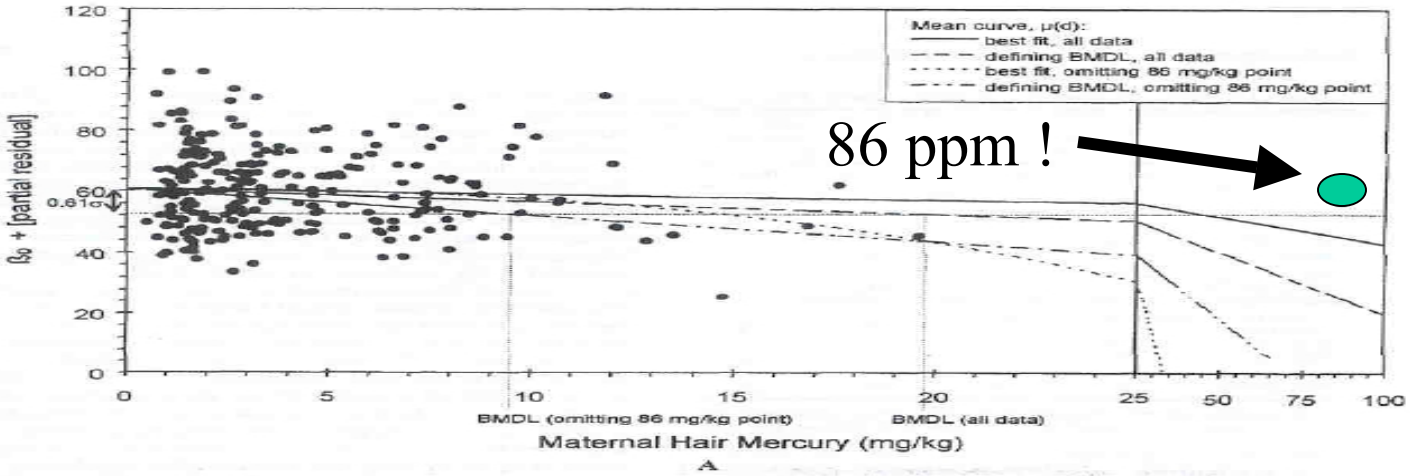
Confusion of Faroe Island children results by PCBs: Admission by Grandjean et al. (2001) after NRC (2000)

"Prenatal exposure to PCBs was examined by analysis of cord tissue from 435 children from a Faroese birth cohort... The association between cord PCB and cord-blood mercury (r=0.42) suggested possible confounding. While no PCB effects were apparent in children with low mercury exposure, PCB-associated deficits within the highest tertile of mercury exposure indicated a possible interaction between the two neurotoxicants. The limited PCB-related neurotoxicity in this cohort appears to be affected by concomitant methylmercury exposure." (p. 305)

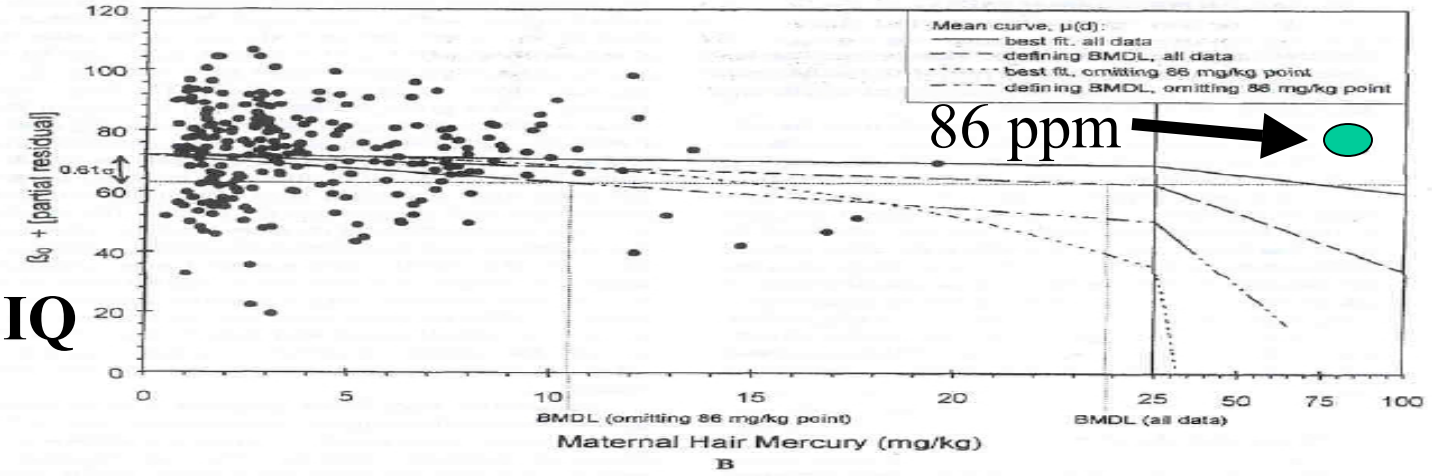
Grandjean et al. (2001) Neurotoxicology & Teratology, vol. 23, 305-317

Data from Neuropsychological Tests: New Zealand Children Study

Language Development



Performance IQ



Crump et al. (1998, Risk Analysis)

No Detectable Risk on Neurodevelopment of Children from MeHg in Fish: Seychelles Study Update

(Myers et al., *Lancet*, vol. 361, 1686-1692, May 17, 2003)

- **A group of 643 children, tracked from before birth to 9 years of age, shows no sign of any detectable risk from the low-level of MeHg exposure through fish consumption by their mothers (and themselves).**

- **One test shows beneficial effect from higher MeHg exposure: Children of women with higher MeHg is less likely to be hyperactive!**

An unscientific bias against negative results by the Seychelles Child Development Study

"The committee concludes that there do not appear to be any serious flaws in the design and conduct of the Seychelles, Faroe Islands, and New Zealand studies that would preclude their use in a risk assessment. However, because there is a large body of scientific evidence showing adverse neurodevelopmental effects [unfortunately, the NRC did not provide any precise citation for such evidence], ... the committee concludes that an RfD should not be derived from a study, such as the Seychelles study, that did not observe an association with MeHg." — (p. 6 of NRC 2000 report, *Toxicological Effects of Methylmercury*)

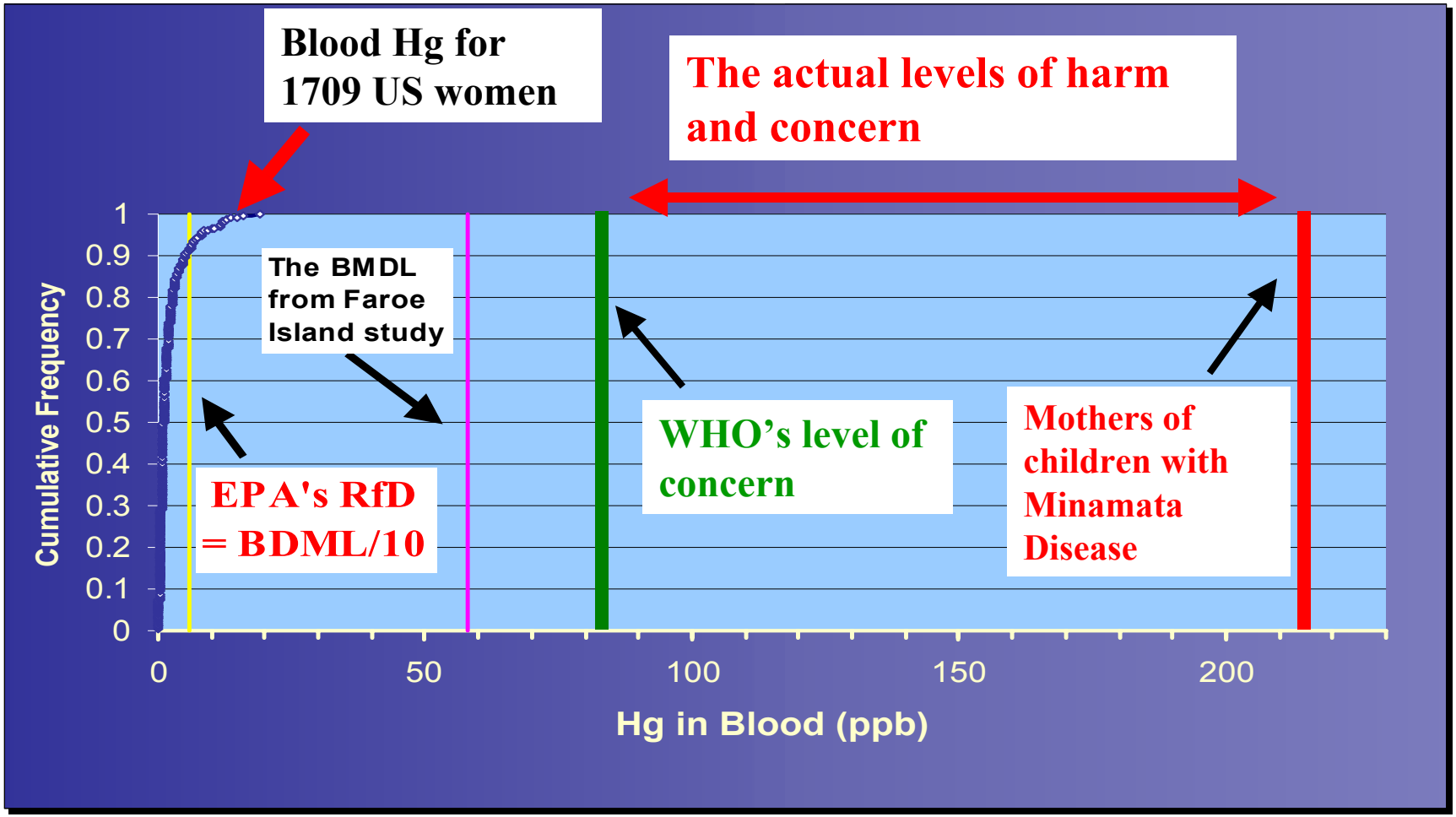
Science of mercury behind 5 popular headlines:
Fiction, misunderstanding & reality? You decide!

Headline # 4:

"Already, five millions American women of childbearing age have dangerous levels of mercury in their bodies, according to the Centers for Disease Control." (Sierra Club)

"Millions of women in America currently have levels of mercury in their blood considered unsafe by the Environmental Protection Agency" (PSR)

No woman in the NHANES survey has blood mercury higher than EPA's chosen Benchmark Dose Lower Limit (BMDL) value and the actual level for triggering an actual health concern or harm is much higher than EPA's RfD level of 5.8 ppb



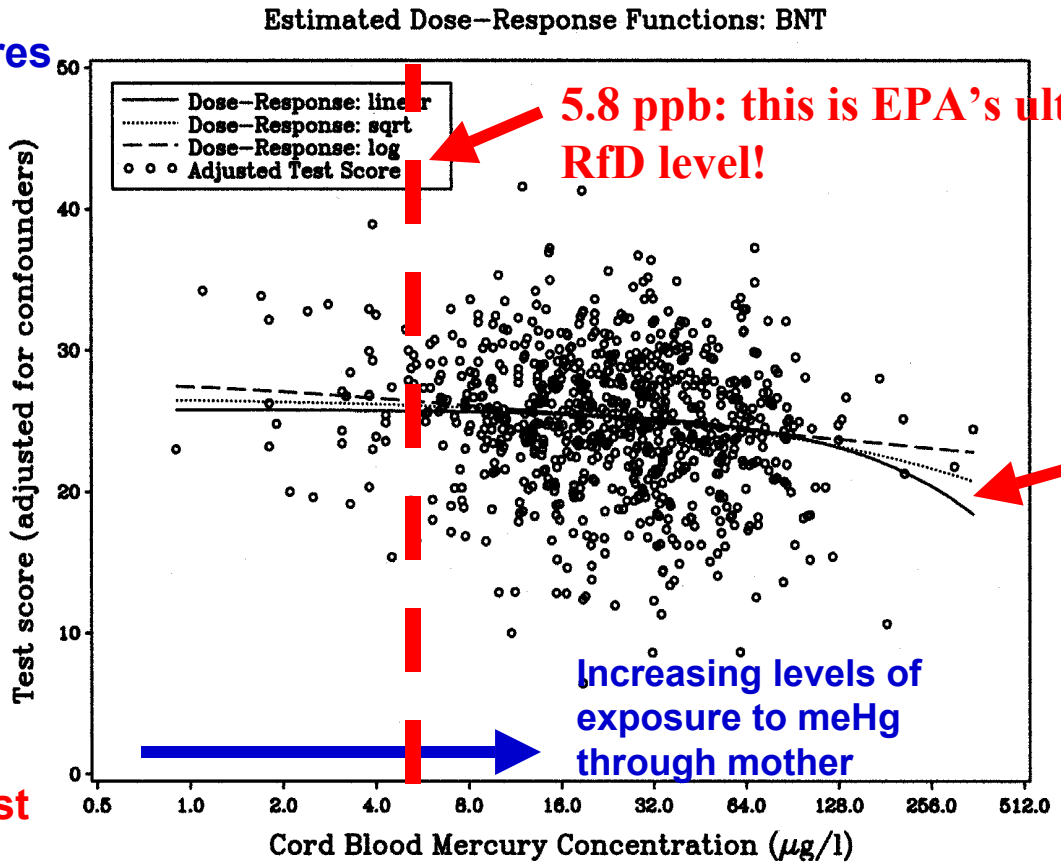
Adapted from chart shown in the July 2003 EPA/FDA stakeholder meeting

Evidence for neuropsychological problems in the Faroe islands children study is not strong

better test scores

Cued Boston Naming Test

worsening test scores



5.8 ppb: this is EPA's ultra-conservative RfD level!

Increasing levels of exposure to meHg through mother

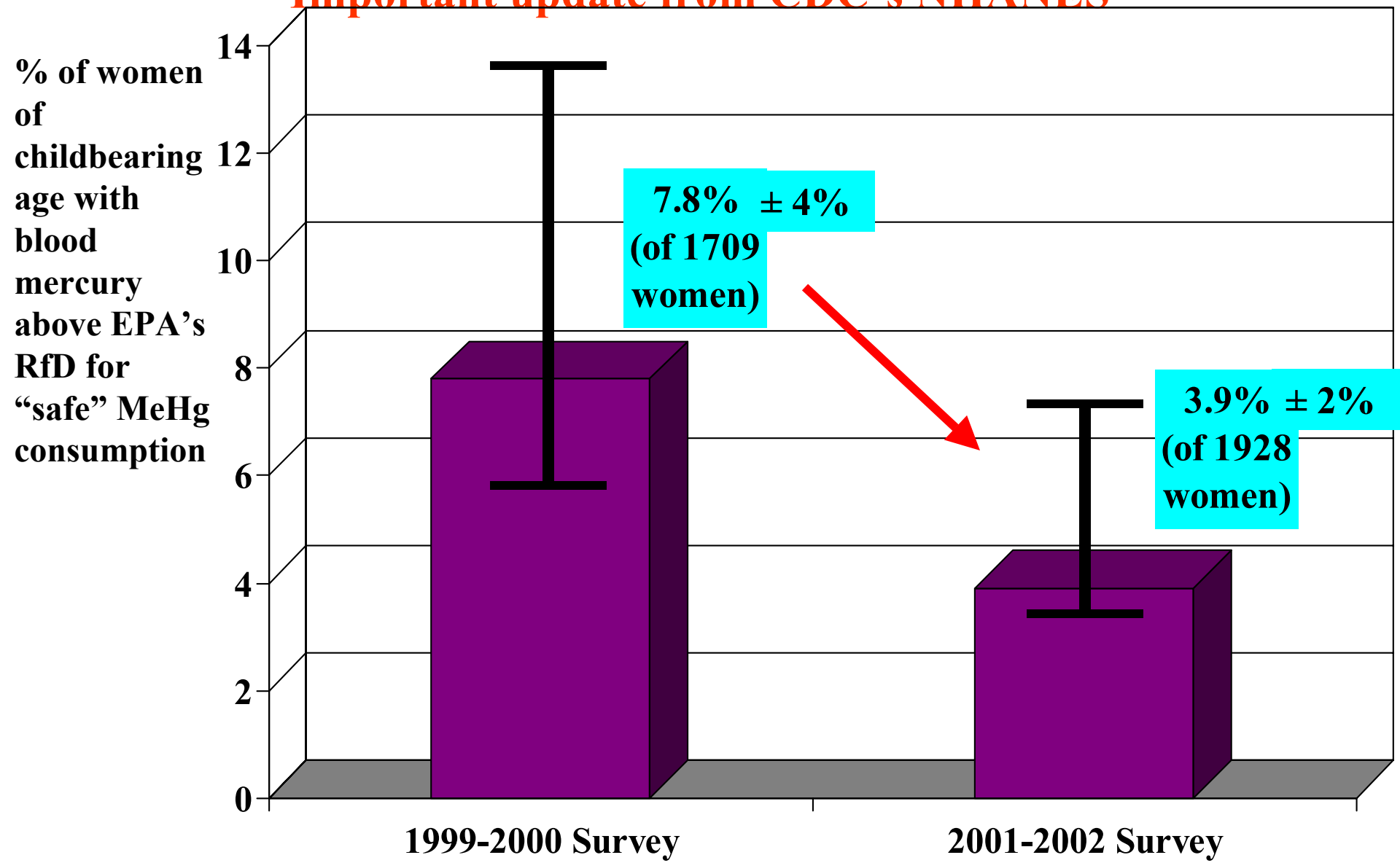
These tendencies for curving downward are what were referred to as adverse neuro-developemental problems in children from the Faroe Island study in popular media

Figure 1: Partial residual plot of the relation between prenatal mercury exposure and the scores on the cued Boston Naming Test.

Budtz-Jorgensen et al. (2003) *Environmetrics*, vol. 14, 105-120

Surprising evidence for a lowering of percentage of U.S. women with mercury blood levels above EPA's MeHg RfD:

Important update from CDC's NHANES



From the important CDC's update on November 5, 2004 at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5343a5.htm

Another Proof of Extremity in EPA's MeHg RfD

The latest results from the Japanese hair mercury measurements for 8665 individuals collected in 10 different locations over 1999 to 2002 by Yasutake et al. (2004) suggest that overwhelming majority of this population, 87%, has hair mercury levels exceeding the mercury "safety" level set by EPA's Reference Dose.

Yasutake et al., 2004, Journal of Health Science, vol. 50 (2), 120-125

Evidence for Extremism in EPA's RfD for MeHg (about 1.5 ppm for hair and 5.8 ppb for blood mercury)

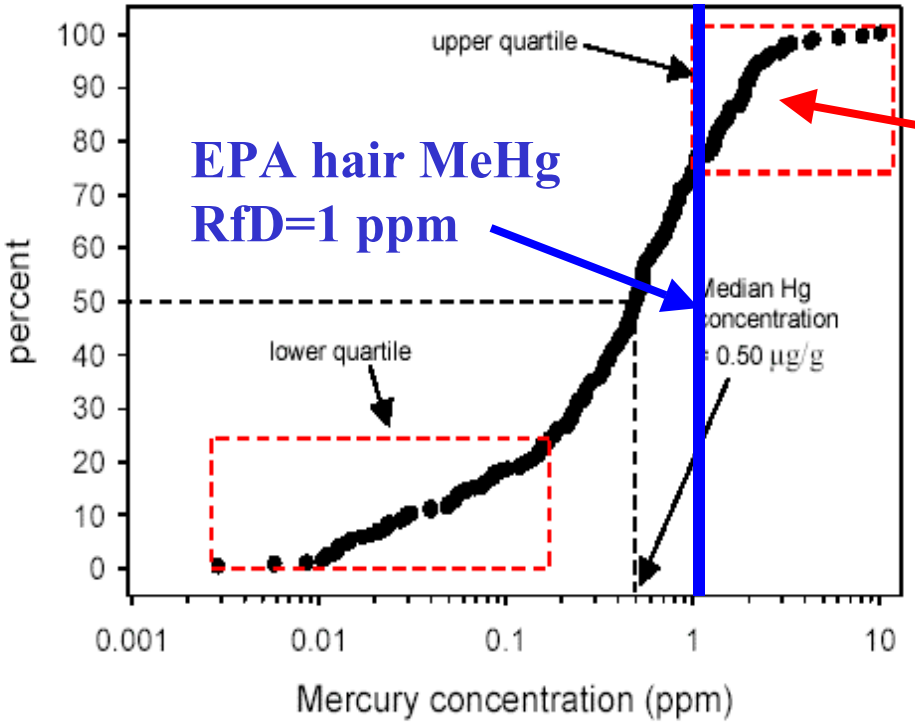
KEY FACT: The Institutional Review Board of the National Center for Health Statistics of the CDC that approves the NHANES study adopts the following ethical guidelines:

Cautions are issued to NHANES participant if the total hair mercury levels are above 15 ppm or total blood mercury are above 200 ppb

Puzzle on EPA's RfD: Is there something special EPA knows about the danger of MeHg that CDC does not know?

McDowell et al., 2004, Environmental Health Perspectives, in press (available online May 27, 2004)

Another proof of extremity in EPA's MeHg RfD: How about hair mercury levels from 260 members of the Society of Environmental Journalists (SEJ) + the coordinator (Spengler) of this SEJ study?



Bottomline: 27% or about 70 out of the 260 SEJ members have hair Hg levels above EPA's recommended "safe exposure level" of 1 ppm yet one could hardly consider those environmental journalists to be neurologically abnormal or unusual.

Also this SEJ study coordinator, Professor John Spengler of the Harvard School of Public Health, found his own hair mercury level to be 3.4 ppm (which is more than 3 times the EPA limit) where he commentedthat "But I'm not going [to be] apoplectic about it because I know if I just watch my consumption, I can moderate that over time ... and there's that safety margin [i.e., a factor of 10] ... that I suspect I'd have to be much higher for much longer to really have symptoms."

Senn, Lincoln & Spengler (2005) *SEJ Mercury Biomarker Study Report* [available at http://www.hsph.harvard.edu/water/SEJHgStudy.pdf] (a project funded by the Heinz Endowment)

On what the EPA's MeHg Reference Dose (RfD) and its (ultra-)precautionary "safety" level means

"It doesn't tell us there's a hazard [if one has blood mercury level above the EPA's RfD]"
– Tom Sinks, CDC's Epidemiologist

"The whole idea of a safety factor is to protect people. You can't turn it around to use as an indication of who's at risk. If you are just above it, you aren't necessarily in trouble." **– Tom Clarkson, Distinguished Professor of Environmental Medicine, University of Rochester**

Both quotes were taken from March 2005 article "Our Preferred Poison" of the Discover Magazine

The HUGE difference in precaution-based SAFETY level and ACTUAL level of harm

Consider this analogy:

(1) To be protective against potential harm from guns, strict gun control's laws are set to prevent criminals or bad elements from accessing guns unlawfully.

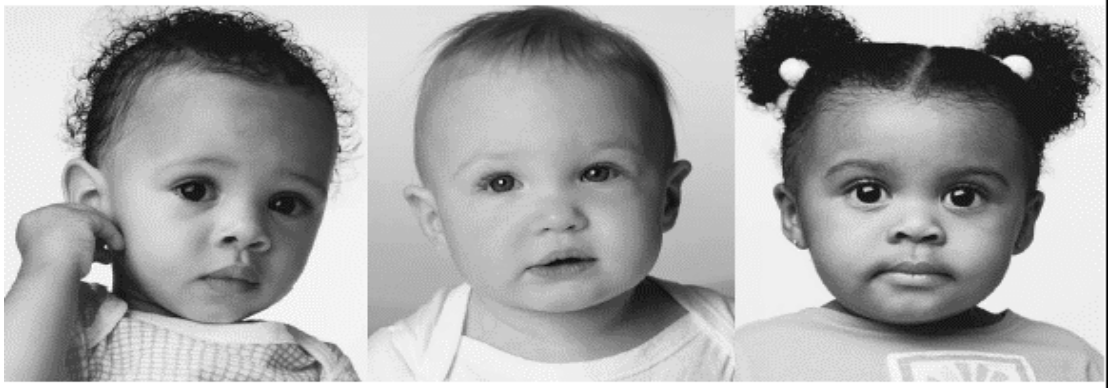
(2) But when gun control laws are found to be broken by certain % of abusers, it does not mean certain % of us will have gun shot wounds or be dead from them!

Science of mercury behind 5 popular headlines:
Fiction, misunderstanding & reality? You decide!

Headline # 5:

"The facts are undisputed: power plant mercury is poisoning America's children. 630,000 babies are born each year with dangerous levels of mercury in their blood." (FOE)

They're being poisoned.



Your kids are being poisoned by deadly mercury from power plants.

Every year American power plants spew out nearly 50 tons of mercury, a deadly poison that causes brain damage in young children and developing fetuses. But when the Environmental Protection Agency considered requiring power companies to cut mercury emissions by 90 percent in four years, the Bush administration stopped them.

It so happens these same power companies have given George Bush millions in campaign contributions, and they want to reduce mercury emissions as cheaply and slowly as possible. The administration's new proposal left the power companies smiling: reduce emissions by only 70 percent in 14 years.

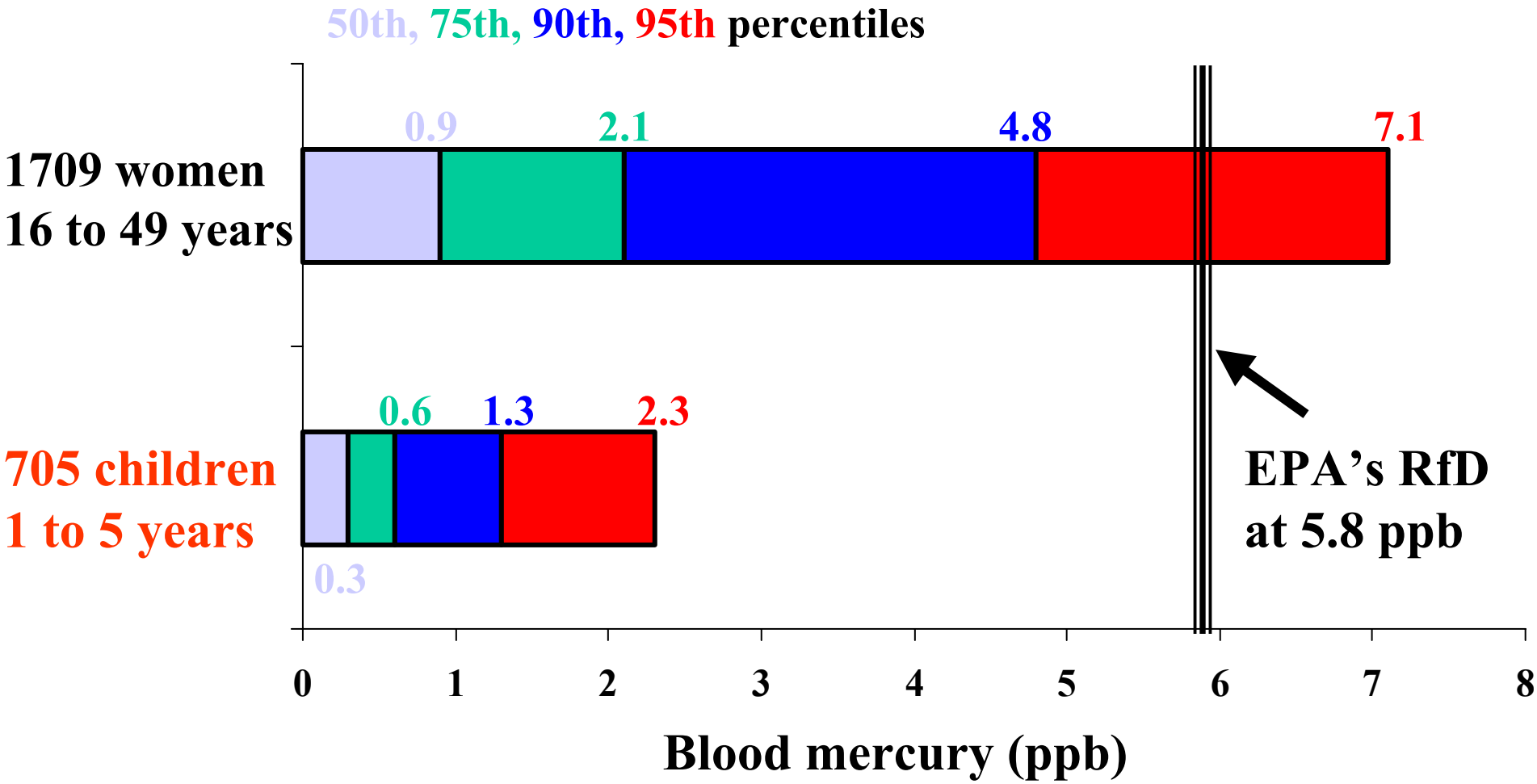
The Bush administration wants to allow more mercury pollution even though:

- The National Academy of Sciences has stated that mercury in contaminated fish consumed by pregnant women will interfere with brain development in their babies.
- One in six American women of childbearing age has absorbed enough mercury to endanger a developing fetus.
- 630,000 babies are born each year with dangerous levels of mercury in their blood.
- Forty-four states have strict warnings against eating fish from rivers, streams and lakes due to mercury contamination.

The facts are undisputed: power plant mercury is poisoning America's children. Yet the Bush administration has sided with the power company polluters. Shouldn't your kids come first?

President Bush: Protect America's Children, Not Power Company Profits!

US children ARE NOT "being poisoned by deadly mercury from power plants"



Data Source: Schober et al., 2003, JAMA, vol. 289, 1667-1674

Explanations of what is meant by risk above EPA's RfD value by chair-person of NRC (2000) committee

"The term 'at risk' refers to children born each year from mothers with a level of methylmercury that is above the current RfD. ... The offspring of those mothers are exposed to mercury levels that are not considered safe, and, therefore, the committee considered them to be 'at risk'. The calculation presents an estimate of the number of children at risk because of high exposure (maternal dose exceeding current RfD) [i.e., note hypothetical pregnancy]. The number should not be interpreted as an estimate of the annual number of cases of adverse neuro-developmental effects. The committee does not believe it is possible to estimate a meaningful number of children that might be affected within the 'at risk' population. ... We hope this clarifies the derivation and meaning of the 60,000 children at risk. "

— Robert Goyer, Chair of NRC (2000) Committee on the Toxicological Effects of Mercury, in his December 1, 2000 letter to Joseph Levitt, Director of CFSAN of FDA

5 Popular Headlines Debunked: Fiction, Misunderstanding, and Reality

Headline # 1: Atmospheric deposition of mercury (Hg) from power plant emissions is a totally negligible source to the HUGE pool of natural Hg available in the world's oceans, land and soils. The production and destruction of methylmercury (MeHg) are controlled by environmental and ecosystem factors that are largely *independent* of power plant emissions.

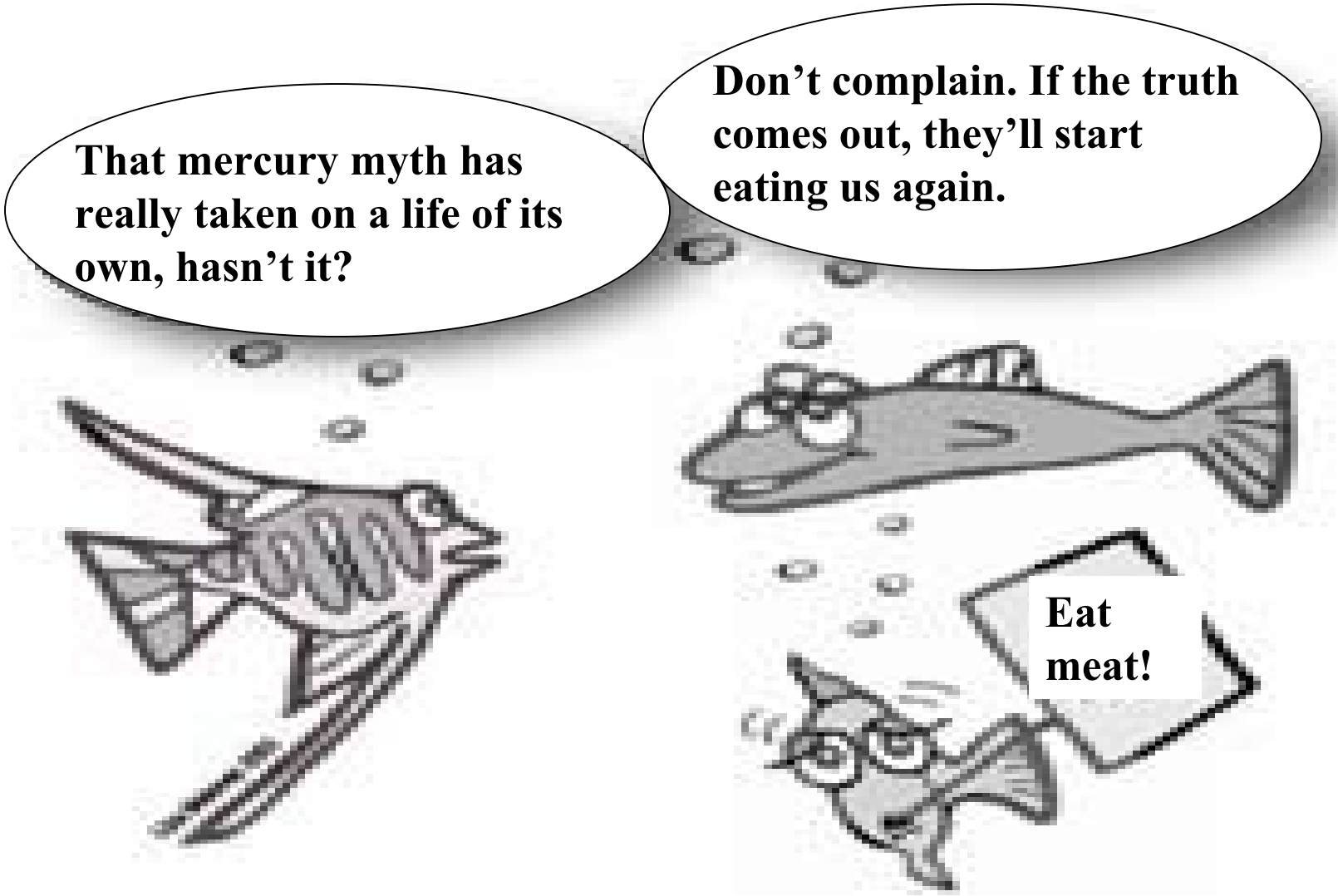
Headline # 2: Mercury concentration in tuna are not increasingly rapidly (in fact possibly even declining slightly!). Methylmercury (MeHg) content in ocean fish is naturally high in the past and has no relation to any power plants emission of elemental mercury (Hg).

Headline # 3: The NAS (2000) report is scientifically biased and inappropriately promoted the Faroe Island children study that is known to be confounded by a cocktail of toxic chemicals including PCBs, DDT from whale blubber in addition to MeHg from whale meat.

Headline # 4: The EPA's Reference Dose is subjective and not supported by scientific evidence or logical reasoning. Not a single US woman in the CDC NHANES survey has blood mercury that is above the levels for actual health concern (WHO) or harm (Minamata).

Headline # 5: No babies are "being poisoned by deadly mercury from power plants." Fish is nutritious and has been found to benefit mental development of children in contrast to questionable results from the Faroe Island children study. Fish oil has also been shown to reduce risks to pre-term delivery and low birth weights.

A fishy tale on mercury cycling, mercury emission control and health hazard?



From New England's Environment Magazine: www.environews.com (2003)

Happy anglers: President Eisenhower and his four brothers fishing for muskies and northern pike at Pine Lake, Wisconsin in 1946

Image from Wisconsin Department of Natural Resources web page for the *2005 Wisconsin Fishing Report*

Science of mercury behind 5 popular headlines:
Fiction, misunderstanding & reality? You decide!

What is the big deal or so harmful for being a little more cautious and to insist on "zero" mercury in the environment?

Bottomline:

(1) You can't!

(2) A huge potential for a public health crisis in US may result from extreme precautions. Here are the reasons ...

“The message of fish being good has been lost and people are learning more about the hypothetical scare of a contaminant than they are of the well-documented benefits of coronary disease reduction. The danger of the tuna fish is not well documented compared to the potential dangers for a 50-year-old male or female who are at a much higher risk of coronary health.” —Eric Rimm, Professor of Epidemiology and Nutrition at Harvard School of Public Health (in the April 10, 2004, NY Times article by Jennifer Lee)

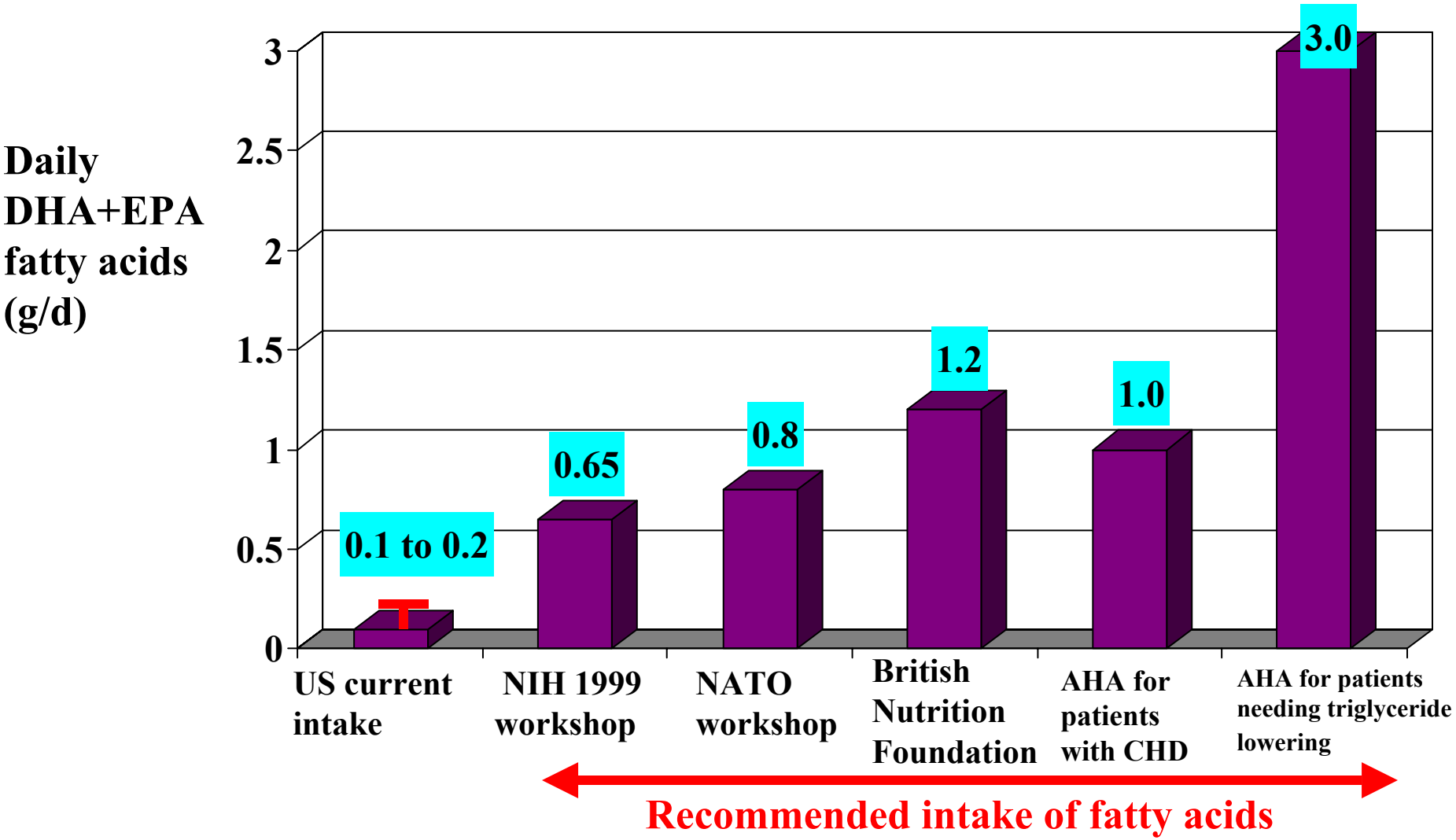
American Heart Association's findings and recommendations on omega-3 fatty acids

How omega-3 fatty acids from fish can help you?

- **"decrease risk for arrhythmias, which can lead to sudden cardiac arrest.**
- **decrease risk for thrombosis, which can lead to heart attack and stroke.**
- **decrease triglyceride and remnant lipoprotein levels.**
- **improve endothelial function.**
- **(slightly) lower blood pressure.**
- **reduce inflammatory responses." (p. 151)**

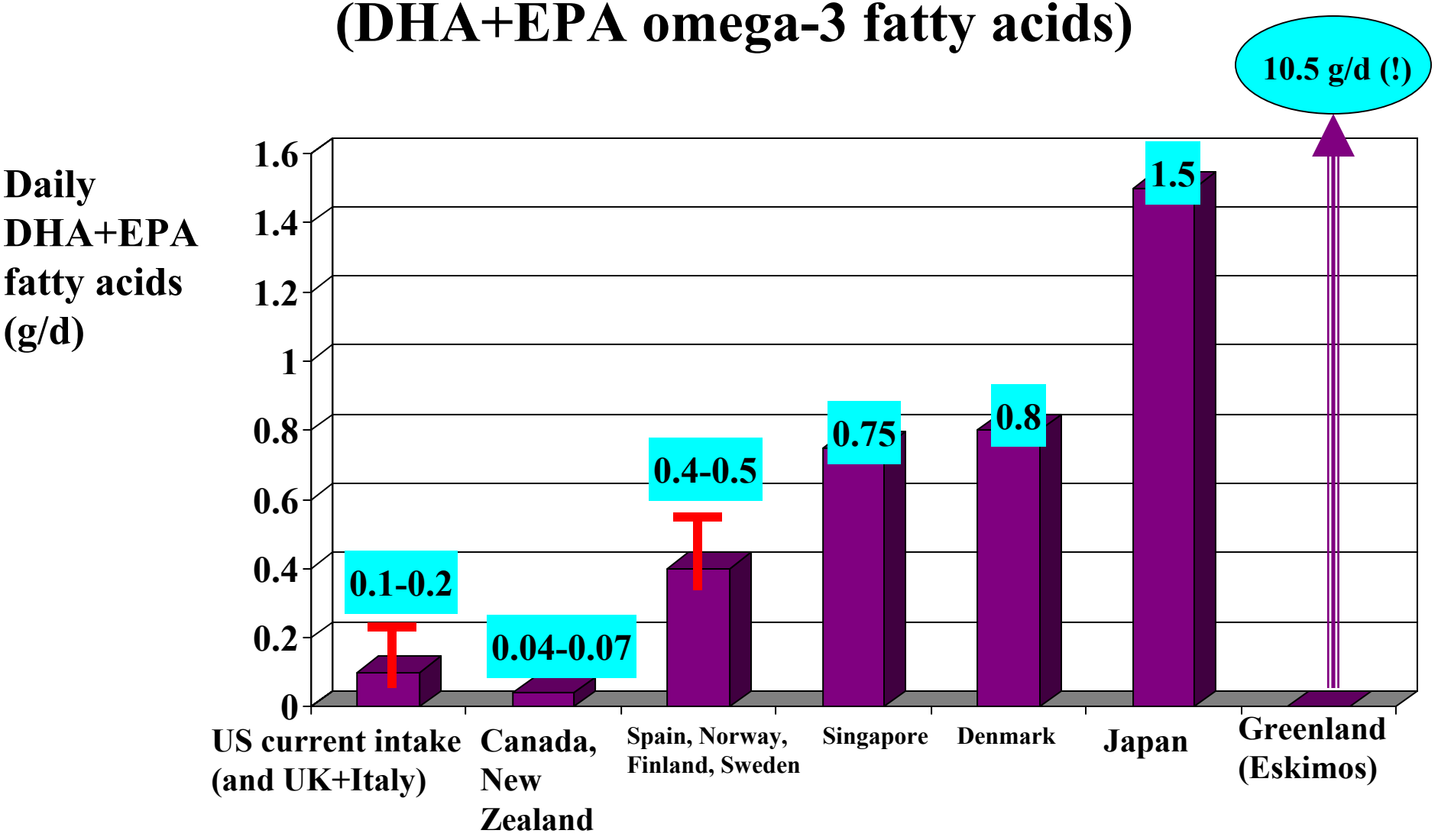
Kris-Etherton et al. (2003, Arterioscler. Thromb. and Vasc. Biol., vol. 23, 151-152)

Average American needs more fish oils (DHA+EPA omega-3 fatty acids)



Sources: Kris-Etherton et al. (2000, Am. J. Clin. Nutr., vol. 71, 179-188); Kris-Etherton et al. (2003, Arterioscler. Thromb. and Vasc. Biol., vol. 23, e20-e30); Din et al. (2004, Brit. Med. J., vol. 328, 30-35)

Average American needs more fish oils (DHA+EPA omega-3 fatty acids)



Sources: Kris-Etherton et al. (2000, Am. J. Clin. Nutr., vol. 71, 179-188); Iso et al. (2001, JAMA, vol. 285, 304-312); Terry et al. (2003, Am. J. Clin. Nutr., vol. 77, 532-543); Gago-Dominguez et al. (2003, Brit. J. Cancer, vol. 89, 1686-1692)

The real cost and danger of restricting fish intake (or omega-3 polyunsaturated fatty acid) ...

Fish consumption may help reduce risks to:

(a) pre-term delivery and low birth weights and mental development of infants and children

(b) postpartum depression, major depression, bipolar disorders, schizophrenia, and suicidal ideation

(c) cardiovascular disease + coronary heart disease (CHD) + sudden deaths

(d) breast cancer

(e) prostate cancer

(f) endometrial (inner lining of uterus) cancer

(g) kidney disorders

(h) Alzheimer disease

(i) rheumatoid arthritis

(j) type 2 diabetes in women and CHD in type 2 diabetic women

(detailed references are available upon request to CSPP)

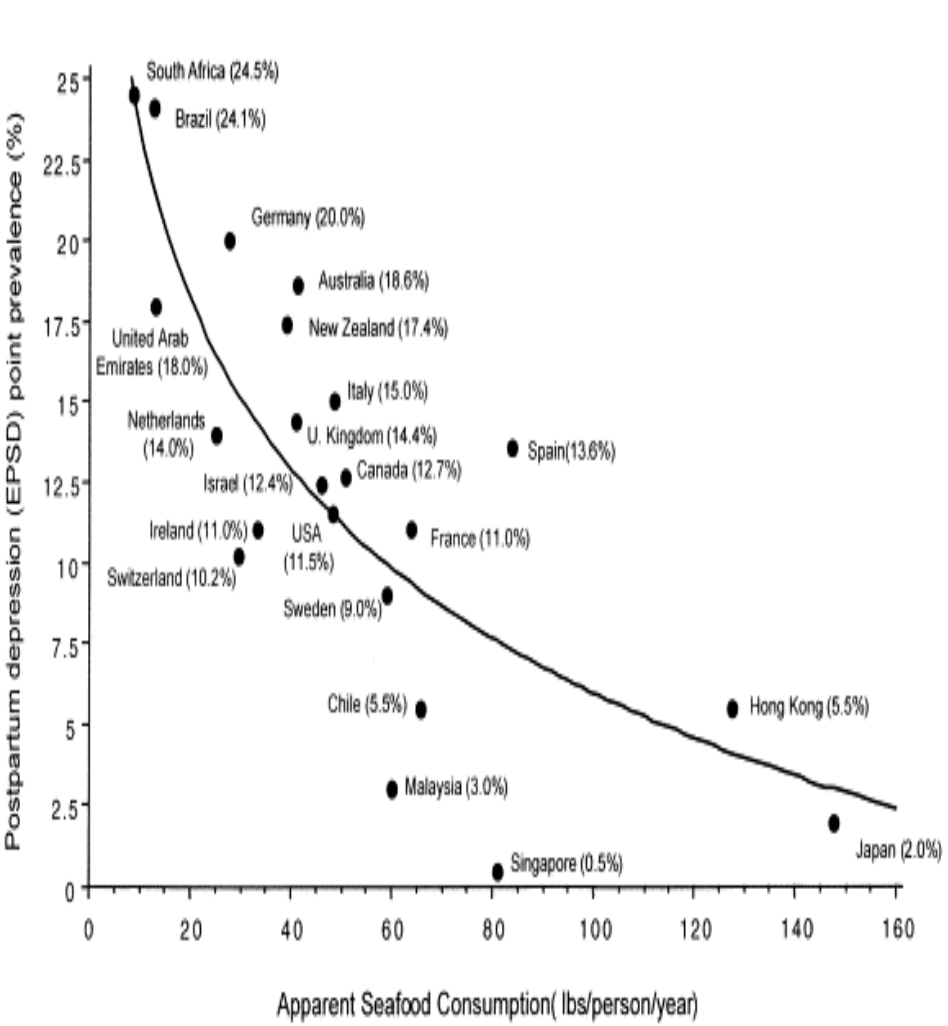
Dr. Charles Lockwood, now chairman of Obstetrics and Gynecology at the Yale School of Medicine, in his previous capacity as the chairman of the 46,000-member American College of Obstetricians and Gynecologists' panel on obstetric practice, commented:

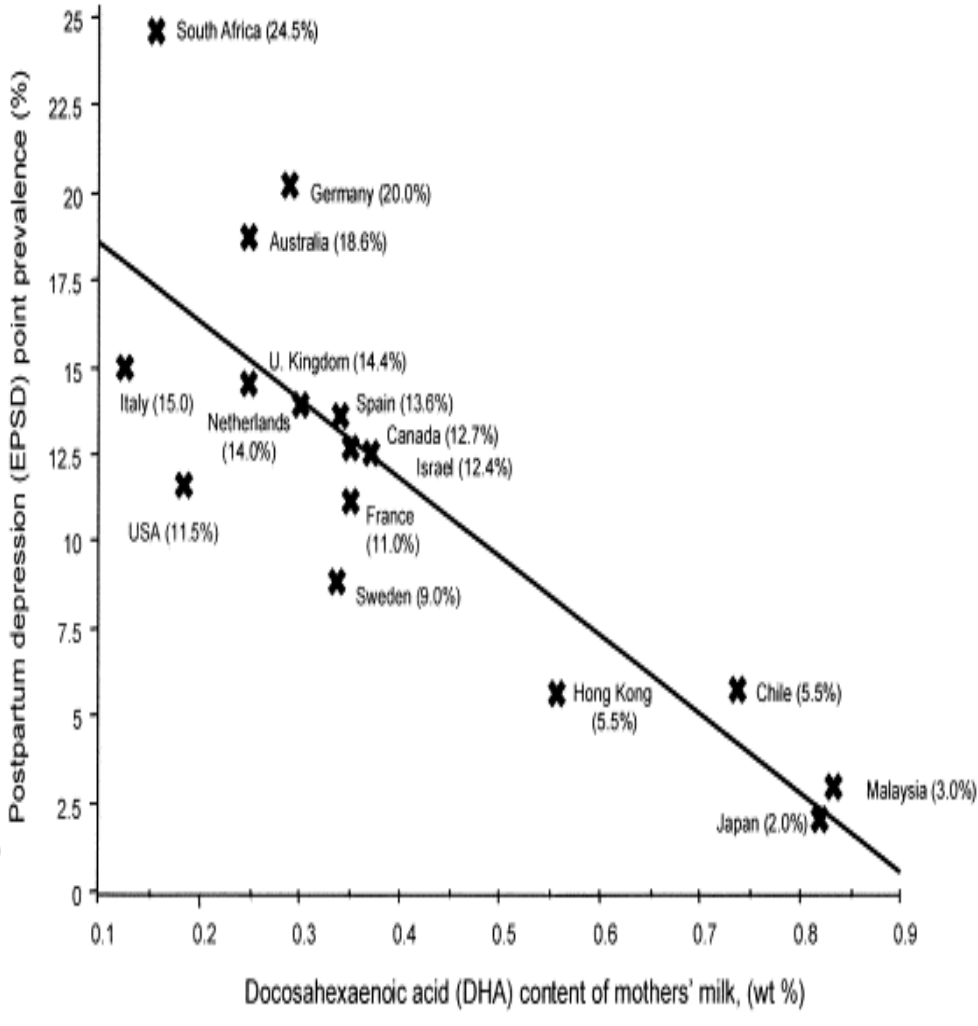
"We would like to urge the NIH [National Institutes of Health] and other federal agencies to support research to establish in a much more rigorous way what mercury does to the developing infant's brain. ...
I suppose at this point, if we are left with increasingly concerning information about the lack of a lower limit of mercury exposure, pregnant women will stop eating fish, but there are a lot of health benefits of eating fish and it is a relatively cheap source of protein. There may be some additional benefits of reducing oxidative stresses that might induce pre-eclamsia or pre-term delivery; may affect fetal growth restriction by impairing placentation. So, there are lots of reasons to think that fish might be useful for pregnant women to take in ..." [Emphasis added]

(From the July 24, 2002s FDA food advisory committee on methylmercury, transcript available at http://www.fda.gov/OHRMS/DOCKETS/ac/02/transcripts/3872t2.htm)

Higher Prevalence Rates of Postpartum Depression With Low Seafood Consumption and DHA Content in Mother's Milk

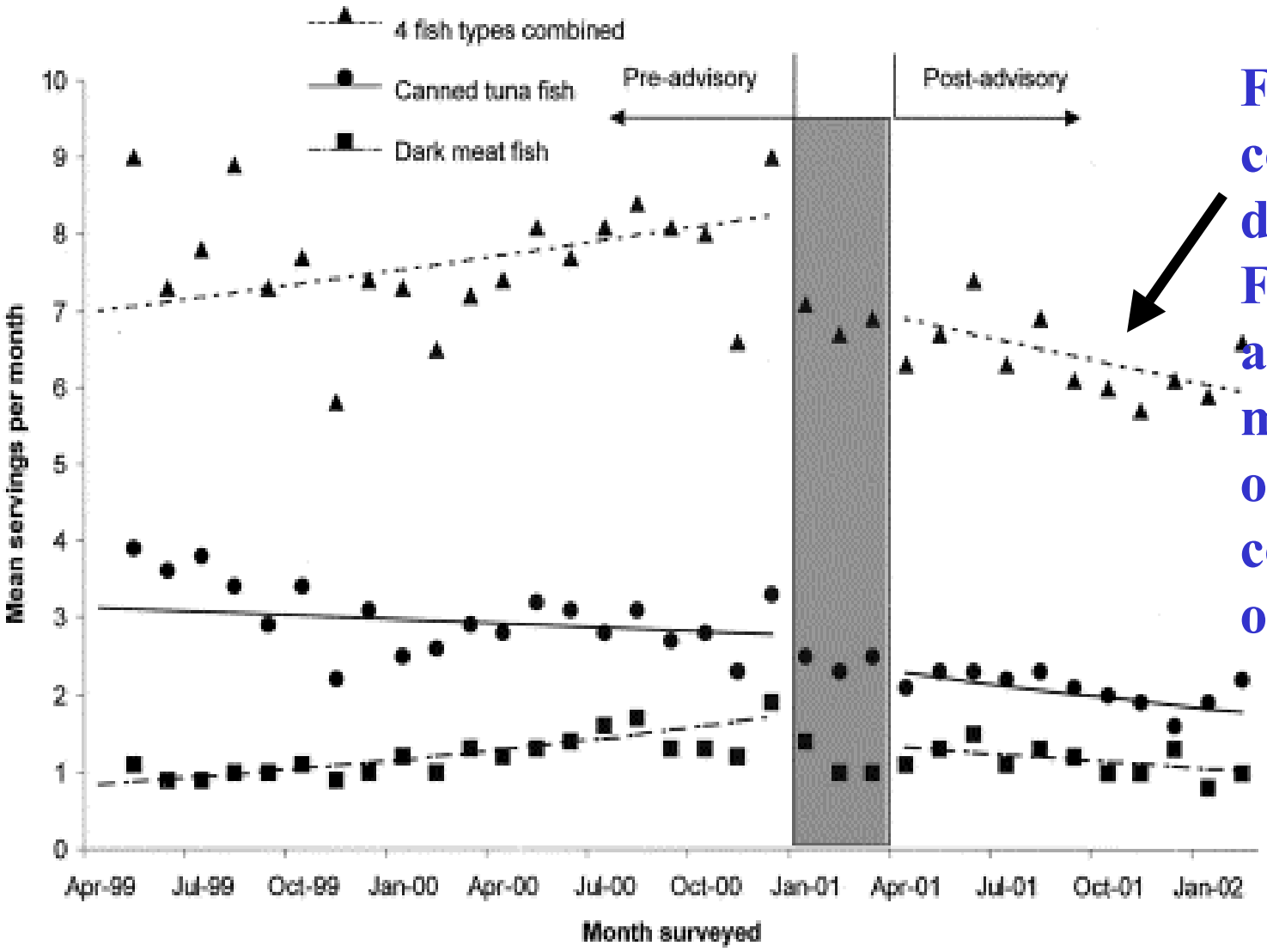
"Both lower DHA content in mother's milk and lower seafood consumption were associated with higher rates of postpartum depression. Interventional studies are needed to determine if omega-3 fatty acids can reduce major postpartum depressive symptoms."





Hibbeln (2002) Journal of Affective Disorders, vol. 69, 16-29

Pregnant women are responding to FDA's fish advisory: But at what price to their + their babies' health by restricting fish (omega-3 fatty acids) intake?



Fish consumption is declining after FDA's advisory and numerous media reports on "mercury contamination of fish"

Oken et al., (2003), Obstetrics & Gynecology, vol. 102, 346-351

Concentrations of mercury, lead and persistent organic pollutants in umbilical cord blood of Inuit infants born in Nunavik, Quebec have been decreasing from 1994 to 2001

"A significant reduction of lead and mercury concentrations was found, but there was no clear linear or exponential trend. The decreases observed could be explained by a decrease in food contamination, by changes in dietary habits, or, most likely by a combination of both. Although questions remains as to the exact causes of decline, it is encouraging to observe such an improvement in prenatal exposure for this highly exposed population."

POPs

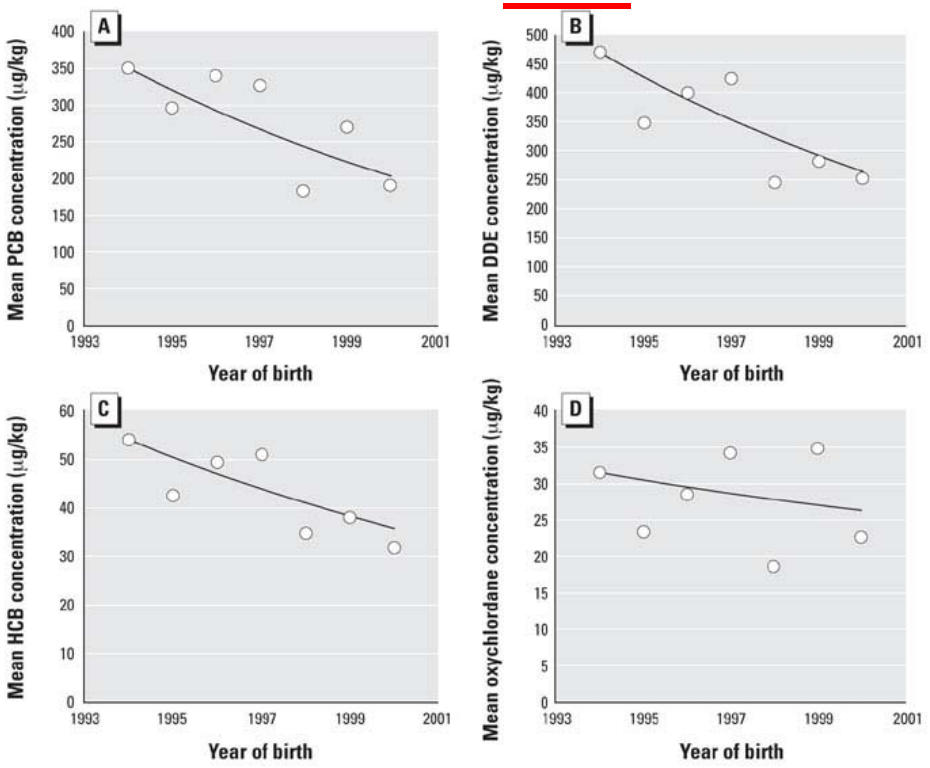


Figure 2. Adjusted mean OC concentrations according to the year of birth: (*A*) PCBs; (*B*) DDE; (*C*) HCB; (*D*) oxychlordane. The lines represent the slope estimates presented in Table 2.

Lead and Mercury

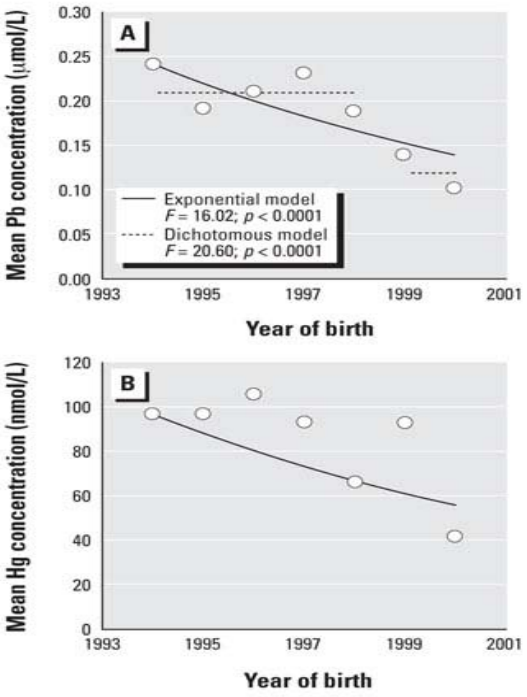


Figure 3. Adjusted mean heavy metal concentrations according to the year of birth for (*A*) lead and (*B*) mercury. The solid lines represent the slope estimates presented in Table 2. The dotted lines represent the adjusted mean lead concentrations before and after January 1999.

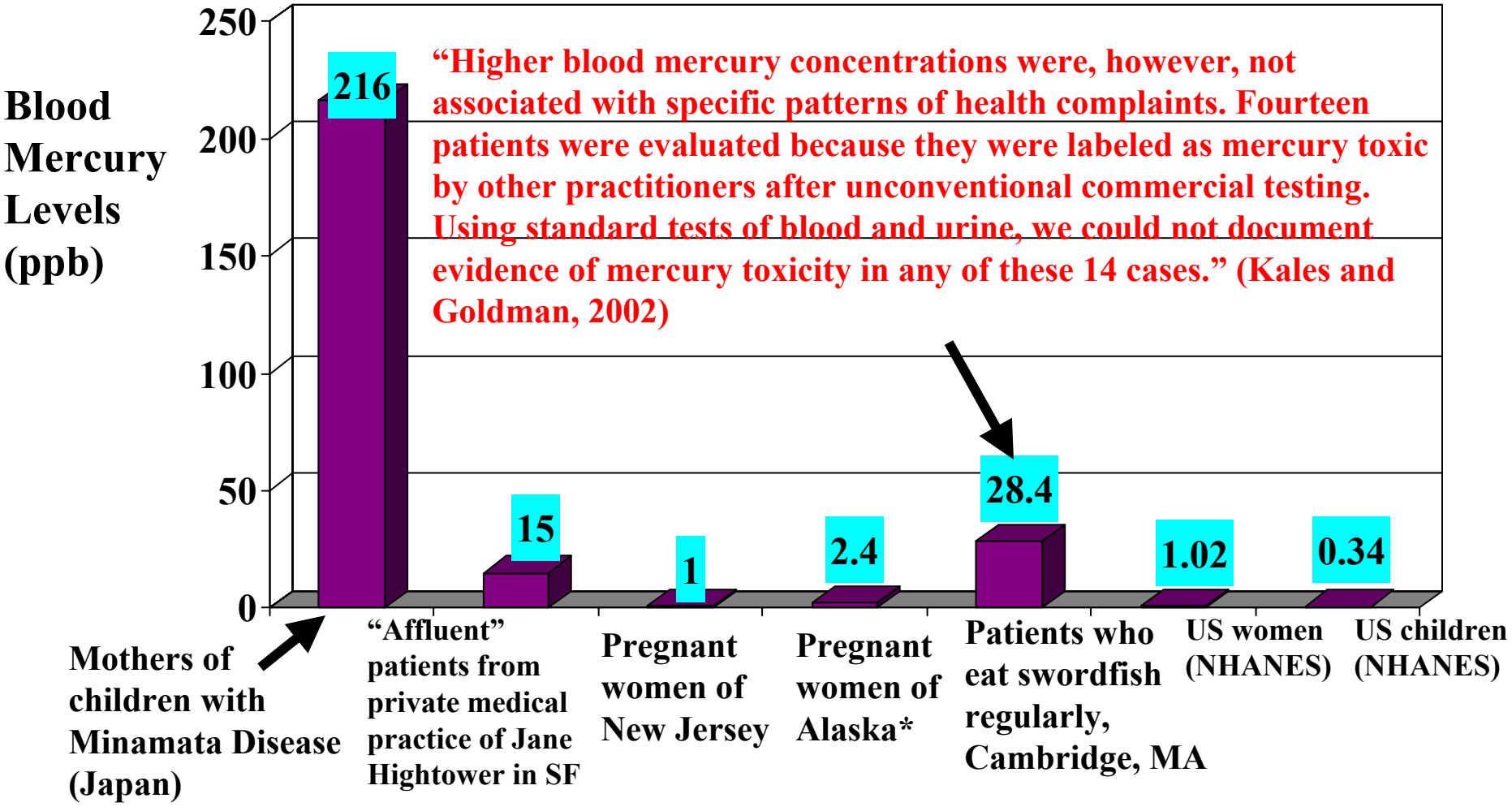
Mercury level in cord blood

← **20 µg/L**

← **8 µg/L**

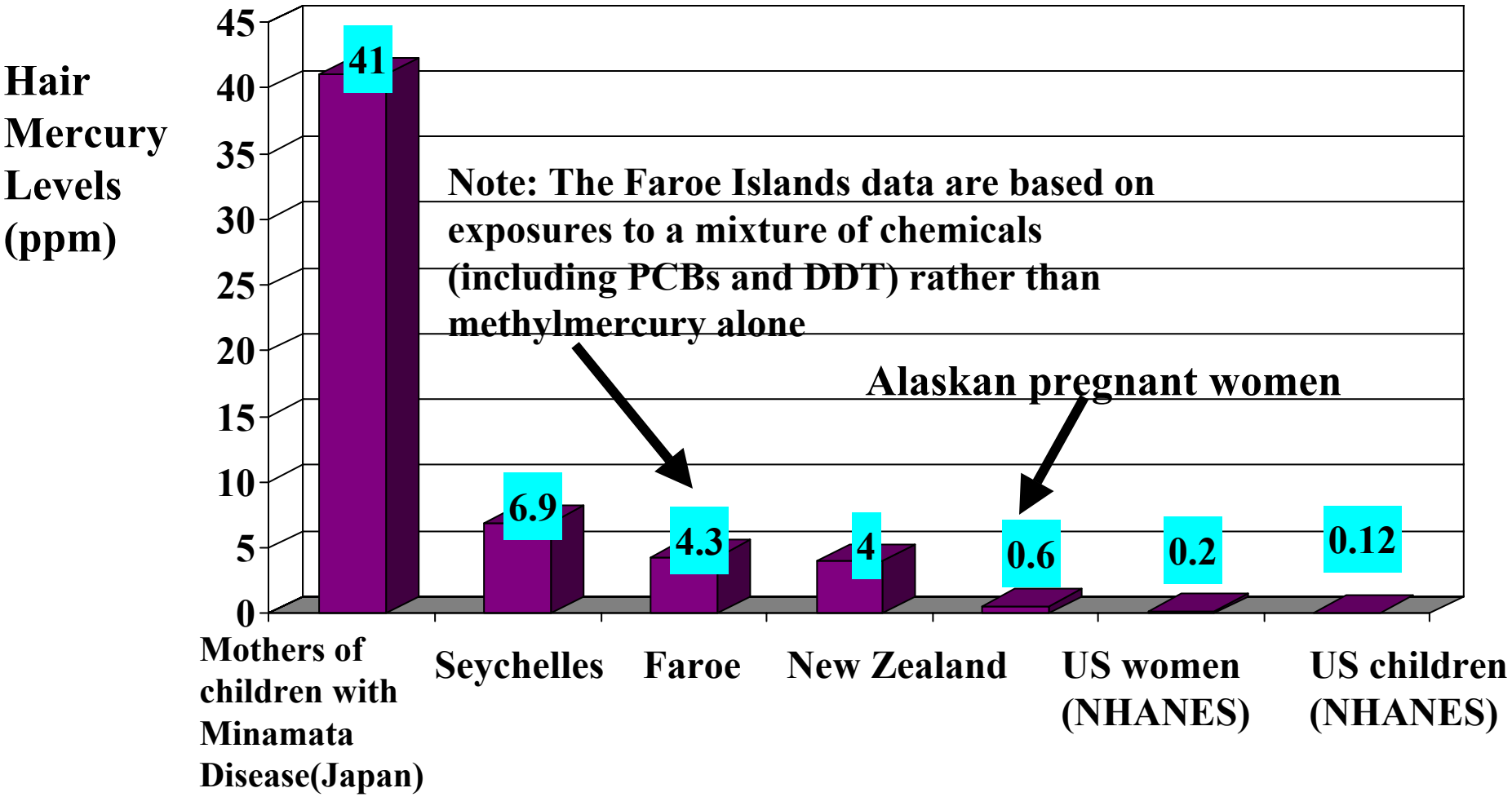
Dallaire et al, 2003, Environmental Health Perspectives, vol. 111, 1660-1664

A comparative overview of exposure to mercury: Average US woman or child <u>are NOT</u> in any danger from consuming a wide variety of fish from restaurants and grocery stores



*converted from hair measurement of 600 ppb divided by 250 for approximate blood mercury level
[All data sources are available upon request to CSPP]

A comparative overview of exposure to mercury: Average US woman or child <u>are NOT</u> in any danger from consuming a wide variety of fish from restaurants and grocery stores

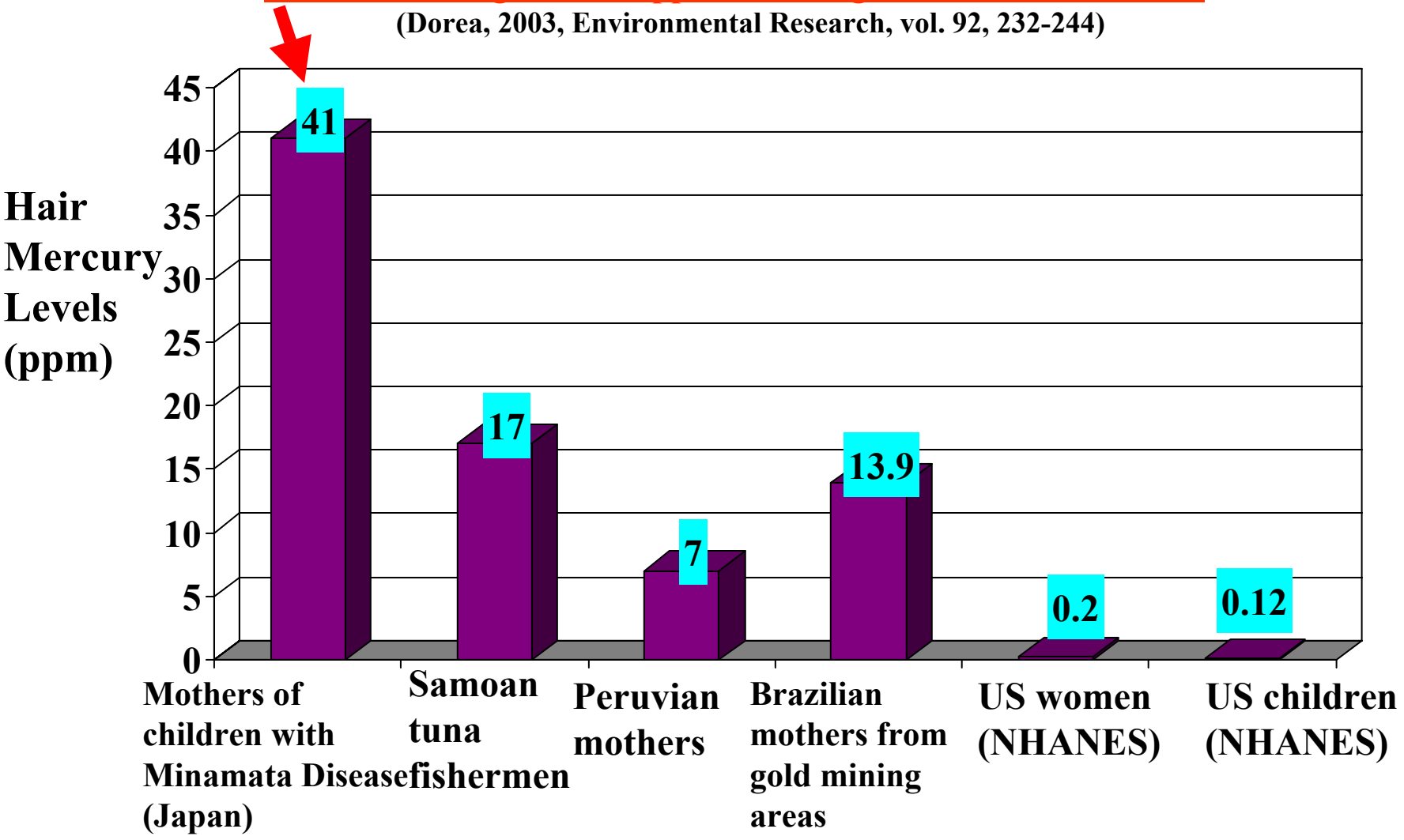


[All data sources are cited in a separate page]

Note that the actual negative health symptoms by MeHg depends clearly on the nature of the MeHg exposure: Minamata is a poisoning incidence from industrial pollution and

"despite several reports showing mean hair Hg above threshold levels of 10 ppm hair, the typical symptoms of Minamata disease were never diagnosed in [Amazonian] fish-eating riparians even with extreme values of 303.1 ppm hair. Riparians of the Rio Maderia showed a prevalence of 3% of hair Hg above 50 ppm but no signs of Minamata disease."

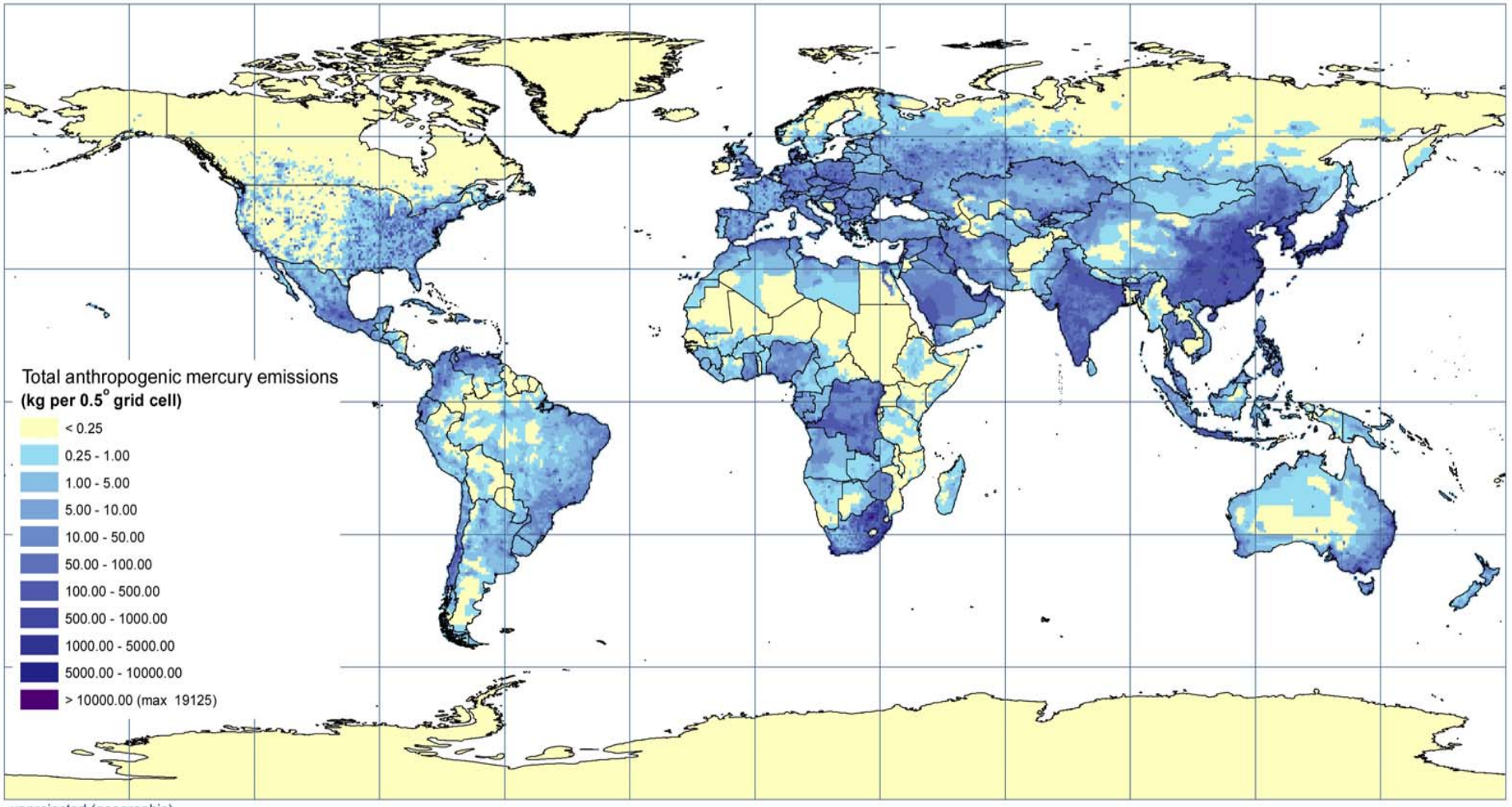
(Dorea, 2003, Environmental Research, vol. 92, 232-244)



[All data sources are available upon request to CSPP]

Spatially Distributed Inventories of Global Anthropogenic Emissions of Mercury to the Atmosphere, 2000

Total Hg, point sources + distributed sources, 0.5° grid



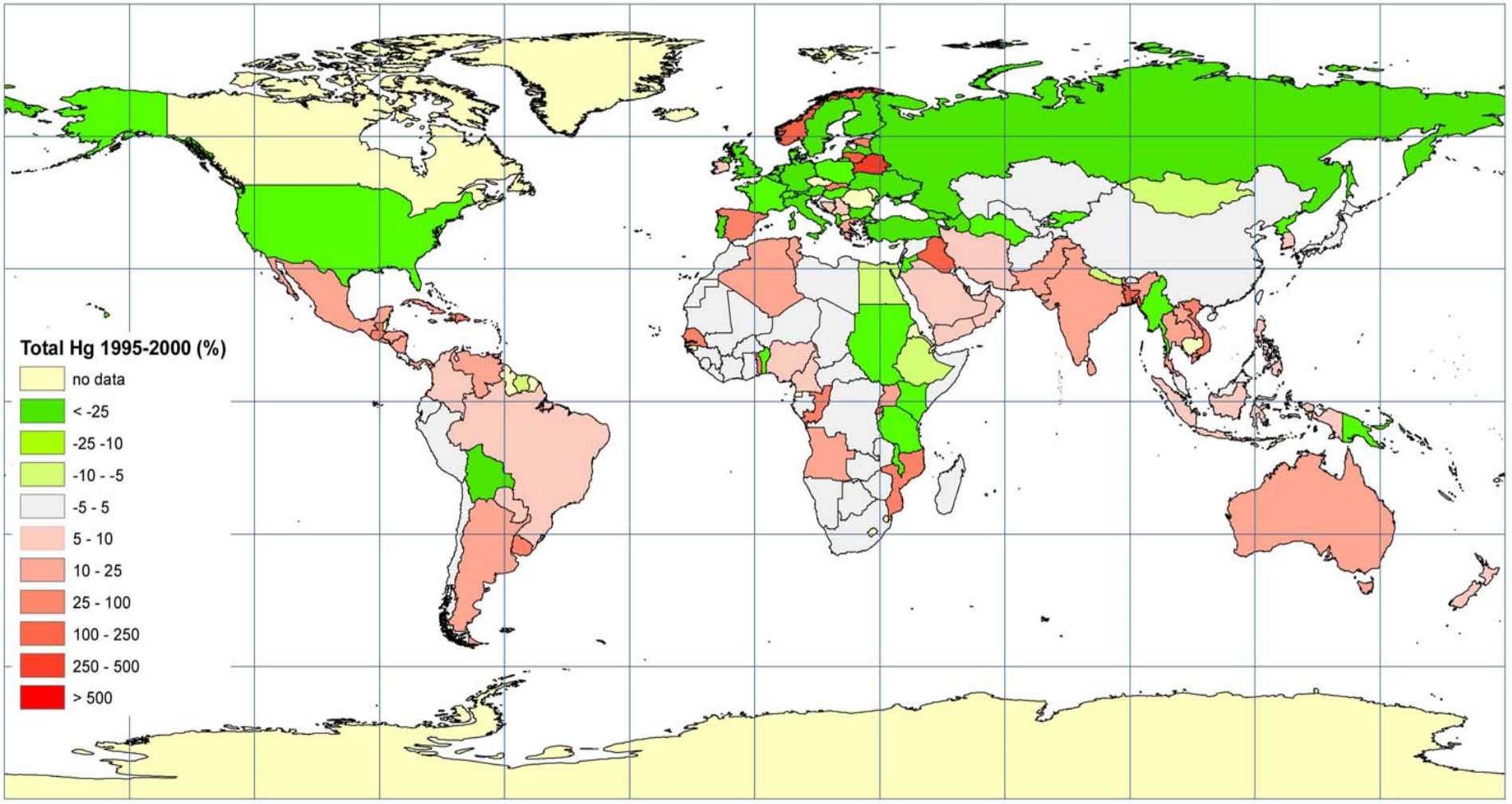
unprojected (geographic)

citation:
Pacyna, J., S. Wilson and F. Steenhuisen. 2005.
Spatially Distributed Inventories of Global Anthropogenic
Emissions of Mercury to the Atmosphere.
(www.amap.no/Resources/HgEmissions/HgInventoryMain.html)

S. Wilson (AMAP), F. Steenhuisen (Arctic Centre, RuG), J. Pacyna (NILU)

Spatially Distributed Inventories of Global Anthropogenic Emissions of Mercury to the Atmosphere

Total Hg, 1995-2000 difference (%)



unprojected (geographic)

citation:
Pacyna, J., S. Wilson and F. Steenhuisen. 2005.
Spatially Distributed Inventories of Global Anthropogenic
Emissions of Mercury to the Atmosphere.
(www.amap.no/Resources/HgEmissions/HgInventoryMain.html)

S. Wilson (AMAP), F. Steenhuisen (Arctic Centre, RuG), J. Pacyna (NILU)

Mercury, Methylmercury and Human Health: 10 Facts and Points

(1) US mercury(Hg) emission is very small and we have been getting cleaner over the 1990s compared to others.

(2) US power plants do not give out methylmercury (CH_3Hg or MeHg)—the toxic form of mercury.

(3) The production and destruction of MeHg are controlled by environmental and ecosystem factors that are independent of power plant mercury emissions.

(4) High levels of mercury had been found naturally both in fish and human hairs from about 100-550 years ago.

(5) The general US population, women and children are not in any real danger of MeHg exposure through fish consumption.

Mercury, Methylmercury and Human Health: 10 Facts and Points

(6) The best study from the Seychelles Island show, consistently over 9 years for 57 tests, no bad health effects of MeHg on young children because their mothers ate a lot of fish during pregnancy.

(7) The Faroe Island study examined health effects from PCBs, DDT and MeHg from whale meat and fat.

(8) The CDC's NHANES results show that US women and children are *not in any real danger* from eating fish.

(9) Ultra-precautions over hypothetical bad health effects from eating fish in US can incur a public health crisis.

(10) The current intakes of fatty acids from fish by average American are already 3 to 6 times lower than recommended.