



The Risk of Cancer Risk Assessment for Fish Consumption Advisories

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**Authors Declare They Have
No Conflicts of Interest**

Thesis:

Fish advisories are important tools in public health practice. Based on the reasons outlined below, fish consumption recommendations should be limited to non-cancer health effects and not based on cancer risk estimates.

- Significant evidence-based benefits of fish consumption across broad & diverse populations.
- Cancer risk models will likely over-estimate risk (potentially by several orders of magnitude) and are less robust compared with the approach to estimate non-cancer reference values.
- Risk perceptions can interfere with rationale discussions and possibly policy

Scope of thesis:

Applies to fish consumption advisories and not clean up standards, discharge permits, and similar endeavors. This thesis only applies when competing benefits are potentially minimized.

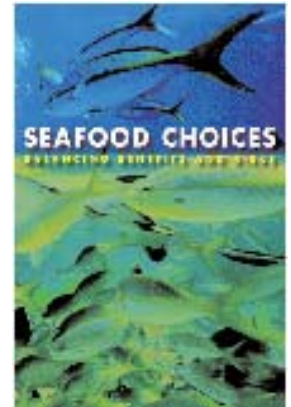
In the event of supported mechanistic information or new approaches, the basic tenets of this thesis could change.

EPA's revised *Guidelines for Carcinogenic Risk Assessment* (2005) provided a fundamental paradigm shift to include using MOA information as opposed to default assumptions and a framework based on Hill's criteria for causality in human studies (big step in the right direction).

What Benefits?

Institute of Medicine Report “Seafood Choices,” 2006

- Seafood is nutritious, high-quality protein, low in saturated fat, rich in polyunsaturated fats, EPA & DHA
- Evidence-based benefit cited: reduced risk in heart disease
- Potential additional benefits: higher cognitive abilities in fetal period and visual acuity



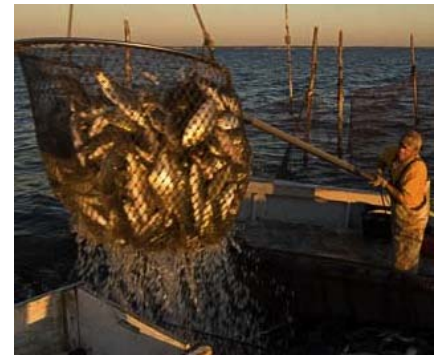
CULTURE



FOOD SECURITY



RECREATION

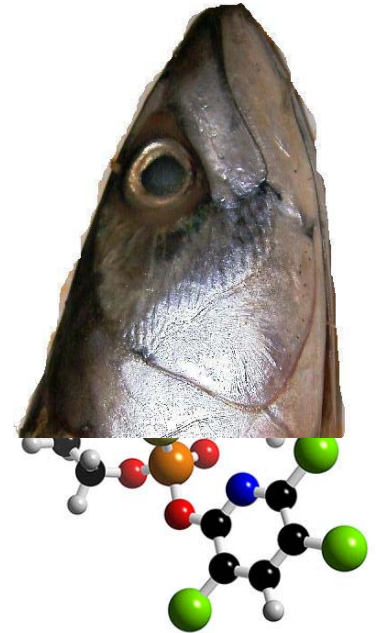


ECONOMY

What Risks?

Institute of Medicine Report “Seafood Choices,”
2006

- Highlighted risk of methylmercury exposure
- Potential PCB toxicity was noted for possible neurodevelopmental and immunosuppressive and neurobehavioral deficits in embryonic or neonatal stages
- The relevance of animal models to predict human cancer at realist doses was viewed skeptically
- All evidence for adverse health effects associated with persistent organic pollutants was characterized as “inconsistent”

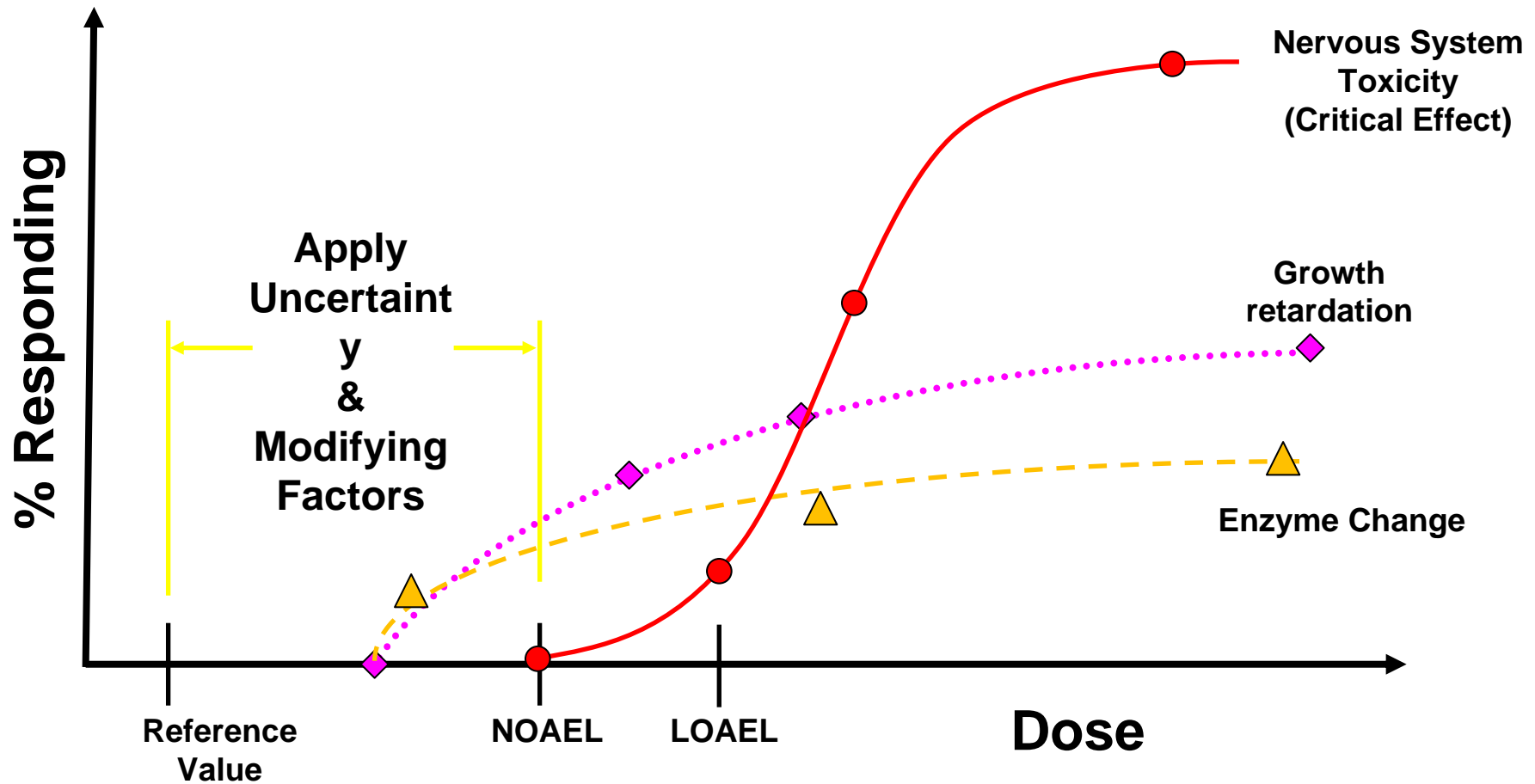


What replaces fish as a source of protein in the diet?

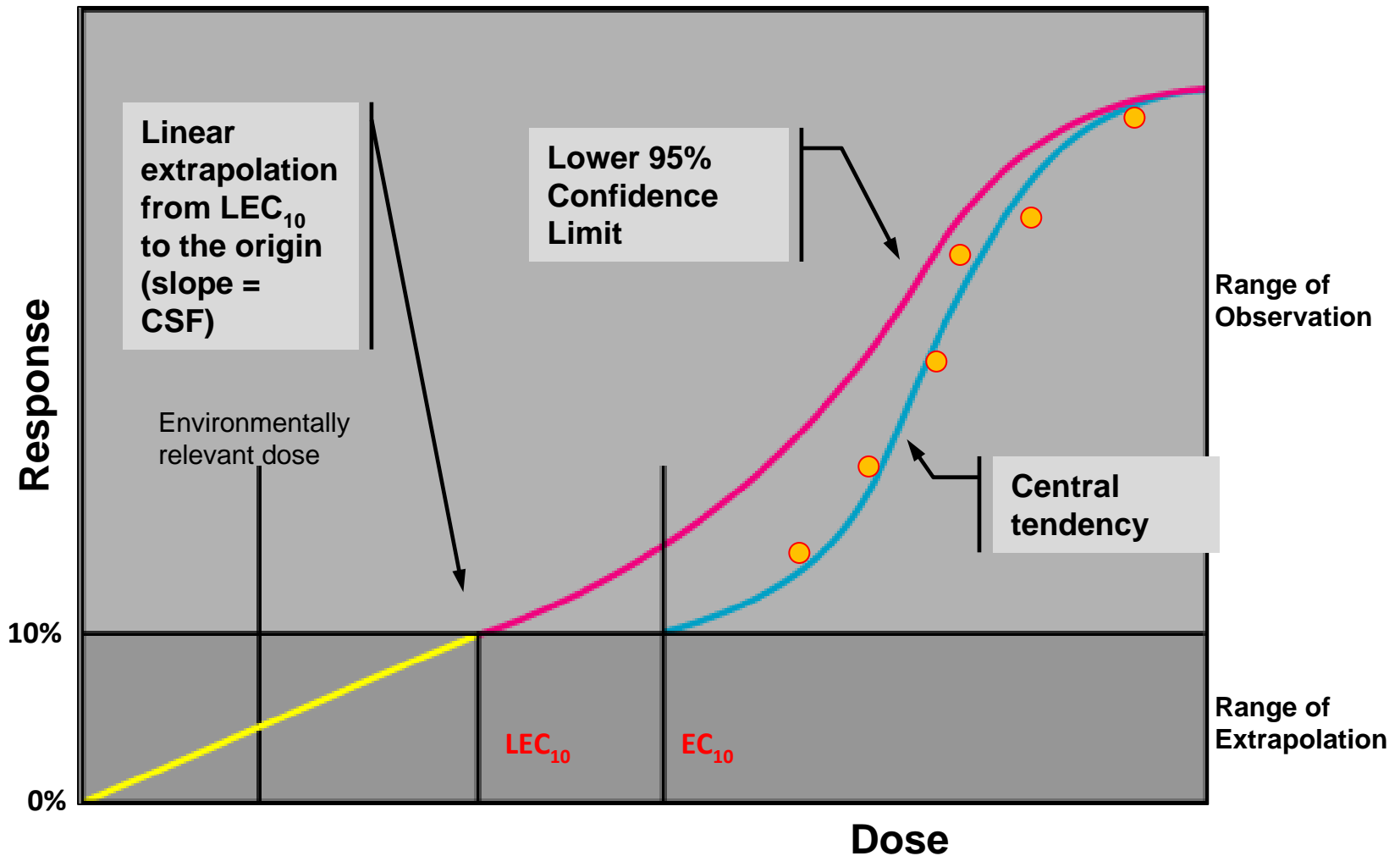
Toxicology Matters

	Avg. level Detected (ug/kg)	Non- cancer Reference Value		Cancer Reference Value
		Adult	Child	
Arsenic	72	1400	750	31
Mercury	138	467	250	---
Total DDT	30.6	2333	1250	137.3
Dieldrin	5.5	233	125	2.92
Chlordane	7.0	2333	1250	133.3
Dioxin/ Furan TEQs	0.0003	---	---	0.0003
Total PCBs	44.8	93	50	23.3

Non-Cancer Risk Assessment



Cancer Risk Assessment



Cancer Prevalence (U.S.)

Based on rates from 2004-2006, 40.58% men and women born today will be diagnosed with cancer at some time during their lifetime (NCI 2009). Typically, risk assessments calculate cancer risks to allow from 10^{-4} to 10^{-6} addition excess *lifetime* cancer risks.

$$10^{-5} + \text{background} = 0.45801$$

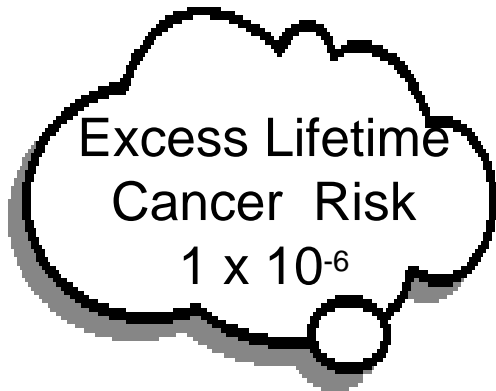
Heart Disease Prevalence (U.S.)

Based on NHANES data from 2005-2006, there were 80,000,000 U.S. adults (or 1 in 3) with one or more types of cardiovascular disease (CDC 2009).

Risk Perception

Expert's
definition of risk

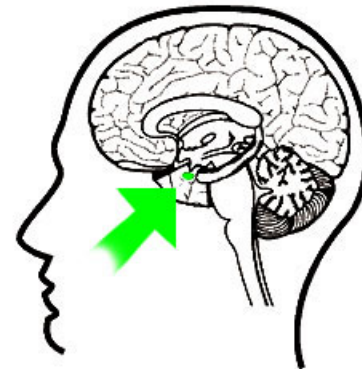
Probability x consequence



=

Public's
definition of risk

Hazard + outrage



Risk Perception may not be reality, but it can affect how people act or don't act, how information is recalled and disseminated and even how legislation is crafted.

Risk Perception

Social research suggests that the public will not accept a risk, no matter how remote, if it is perceived to have serious and delayed or irreversible effects (Klein and Stefanek 2007).

The difference between actual, population-based cancer risk and estimates of 10^{-4} to 10^{-6} lifetime excess cancer risks is abstract; furthermore, it has been suggested that very low risk estimates are viewed with less credibility among the public (Johnson and Slovic, 1995).

Furthermore, if cancer risk is estimated, the focus can shift away from non-carcinogenic effects which are likely more probable compared with remote cancer outcomes.

Summary

There is a sound toxicological underpinning to protect sensitive subpopulations from non-cancer health effects.

Cancer risk assessment should not be used as the basis for determining fish consumption advisories due to: 1) competing, evidence-based benefits; 2) likely over-estimation of risks; and 3) counter-productive risk perception issues.

These suggestions are in concordance with EPA's *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories*, Volume III (2000) that emphasize flexibility in risk management.

You may only have one opportunity to get your message to someone...

