Risk Management When Benefits Are at Risk

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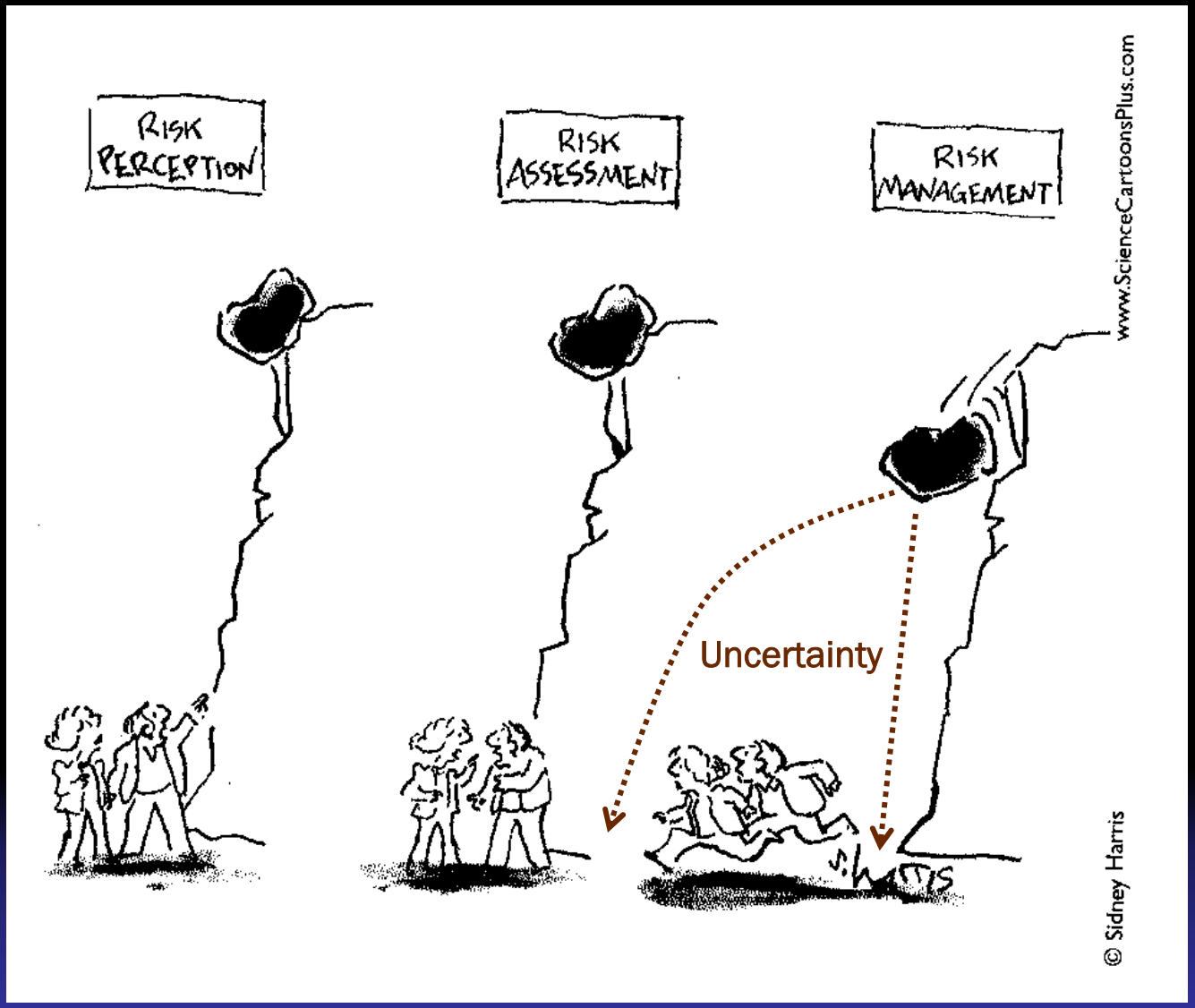
If it were this simple...



"Risk"

- A potential negative consequence
  - "People could be impacted by contaminants"
- Of some specified severity (magnitude of loss)
  - To health (non-cancer, cancer)
  - To economic, social, or cultural systems
- With some uncertainty about it actually happening
  - Where probability is one measure of uncertainty
    - Probability that exposure and dose-response will collude to increase the chance of an adverse health outcome
- Risk $\approx f$(consequence, magnitude, uncertainty)

Risk Management

- Acceptable risk problems are decision problems
- Problems which require a choice among alternative courses of action
- Where at least one course includes a threat to life or health among its consequences
- Where choosing an alternative is facilitated by knowledge of its full set of relevant positive and negative consequences

Risky Fish

- Fish consumption offers risk and benefits
  - Risk from contaminants
  - Benefits from fatty acid consumption, recreational opportunities, and fulfillment of cultural needs
- Advisory must therefore manage for risk greater than zero, lest benefits be unnecessarily sacrificed
- So decision makers must understand
  - Consumption limits and their estimation
  - Policy and technical allowances for uncertainty
  - Discussion of risk-benefit tradeoffs with stakeholders

Questions for the Risk Manager

- How certain are you that an advisory will minimize adverse health outcomes from fish consumption, while preserving some or all benefits related to such consumption?
- What techniques are used to reduce uncertainty in consumption limit calculations?
- How might use of these techniques affect your decision and perhaps interfere with obtaining benefits from fish consumption?

Limits for Non-Carcinogens

$$CL_{nc} = \frac{\text{Reference Dose} \times \text{Body Weight}}{\text{Tissue Concentration}}$$

- CL_{nc} is NOT about risk (probability) - only a yes or no
- Reference dose is down-shifted from a NOAEL by uncertainty and modifying factors
  - Thus exceeding it does not mean an adverse health effect will occur or is necessarily more likely
  - Only that these allowances for uncertainty have been eroded

Limits for Carcinogens

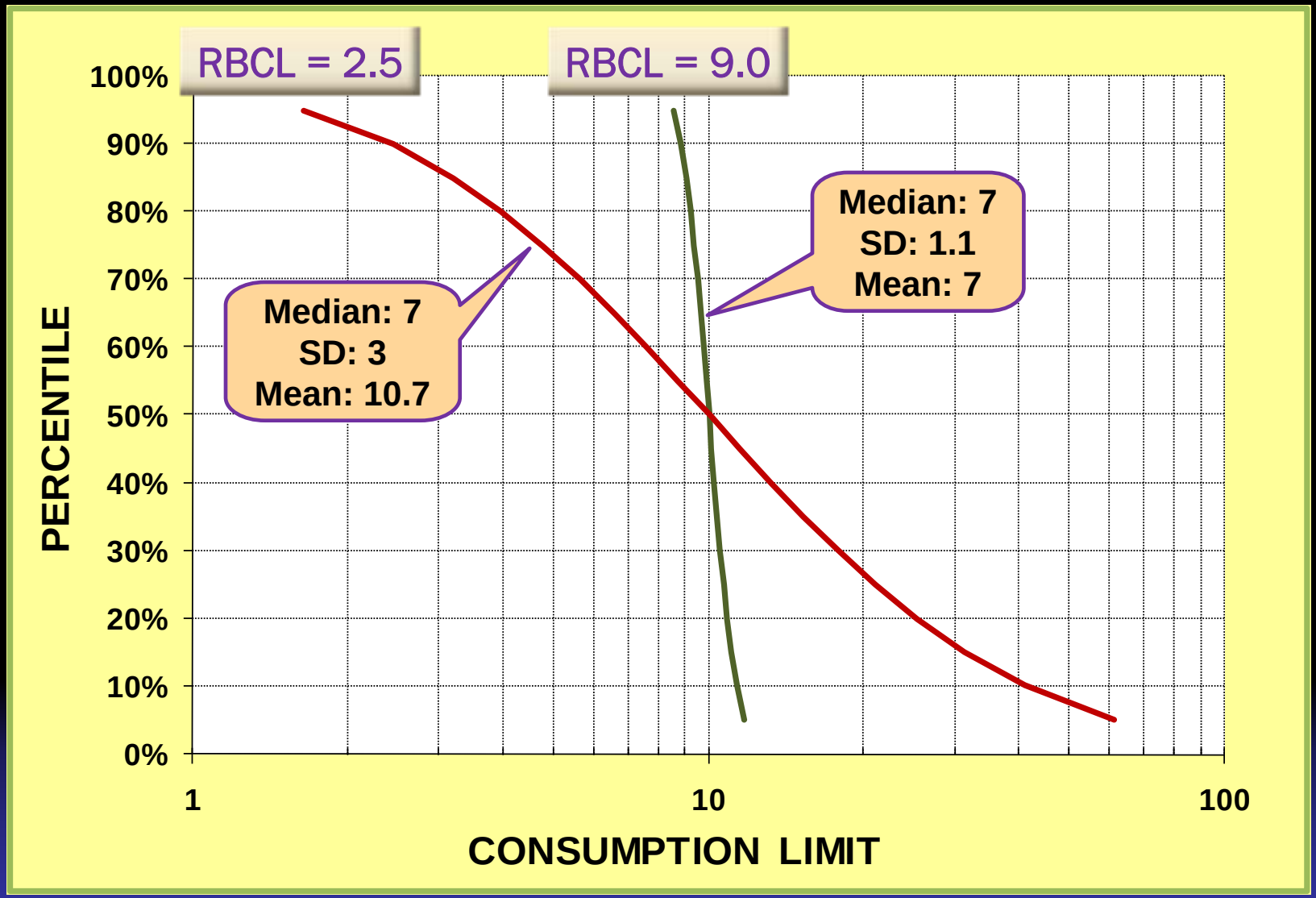
$$CL_C = \frac{\text{Acceptable Risk Level} \times \text{Body Weight}}{\text{Cancer Slope Factor} \times \text{Tissue Concentration}}$$

- CL_c is "risk-based" in that allowable uncertainty is explicit as the acceptable risk level
  - This level is purely a policy choice, not science
  - Risk level is for excess risk - that in addition to the background cancer incidence rate (25-33%, all cancers)
- Cancer slope factor is a 1-hit model extrapolation down-shifted to the 95th percentile LCL

Tissue Concentration

- Major source of uncertainty
  - As stochastic variability + lack of knowledge
- Number & time/space distribution of samples
  - Lack of knowledge - too few samples too few places
- Appropriate species?
  - Stochastic variability - individual fish will always vary
  - Different species uptake pollutant in similar manner?
- Representation of value
  - Data usually have lognormal distribution
  - Arithmetic mean (>50th percentile) versus median (50th)

Impact of Concentration Variance



Suggestions

- #1! Build trust & communication with stakeholders
- Read Fish Advisory Guidance Volume III
  - Suggests opportunities for management flexibility
- Consumption limits already allow for uncertainty
  - No necessary to add more
  - Re-consider cancer or an acceptable cancer risk >10^{-6}
- Emphasize characterization of tissue concentration
  - Sample to minimize variance
  - Check representativeness of species sampled
  - Consider median in addition to or in place of average