# Assessing Effects on Fish and Their Predators

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# General Sources of Impact

- Conventional Pollutants
- Toxic Contaminants
- Contaminants of Emerging Concern

# Conventional Pollutants

- Generally elicit immediate response, easily measured
  - Low oxygen – acute effects
  - Eutrophication due to enhanced nutrient loading may result in community level changes such as ichthyoplankton community changes
  - Increased suspended solids – effects on visual predators
  - Organic carbon as habitat alteration – substrate modification to breeding areas especially
  - Thermal impacts – may affect survival, growth, reproduction

# Toxic Contaminants

- Concern with bioaccumulating and biomagnifying compounds
  - Methyl mercury
  - Hydrophobic organics
- Concern with compounds directly toxic
  - Aluminum release in low pH waters
  - Tributyl tin from ship maintenance
  - PAHs which may cause tumors, developmental changes

# Assessing Effects from Water Column Exposures

- National Recommended Water Quality Criteria
- Measured effect levels from concentration response experiments
  - Lethal (e.g. LC-50) and chronic endpoints
    - Whole water tox tests
    - Elutriate testing
  - Life cycle and sensitive life stage exposures
    - Larval, juvenile, egg survival, growth, development

# Assessing Effects from Food Chain Exposures

- Residue effect levels
- Narcosis Models
- Food Chain Models

# Comparison to Residue Effect Levels

- Whole body or tissue-specific concentrations associated with a experimentally measured adverse effect
- USACE provides readily available data base
  - Includes fish and invertebrates
  - In best instances provides NOED and a LOED
  - Searchable by species, effect, chemical, life stage
- Uncertainty – do these experimentally derived effect levels translate to population level effect?
  - The nominal basis of assessing adverse ecological effect

# Narcosis Models

- Sum of lipid normalized molar concentrations of hydrophobic organics
  - The summed molar concentration of in aquatic organisms at death
    - 2 to 8 mmol/kg organism
    - in vivo membrane 40 to 160 mmol/kg lipid
  - Chronic effect assumed to be 0.1 of this lethal concentration

# Food Chain Models

- Ratios
  - BSAF, BAF
- Steady State Models
  - Essentially thermodynamic – fugacity models
  - Usually dependent on TOC, DOC, POC and lipid phases
- Dynamic Models
  - Account for Life History
  - Response to changing environment
  - Growth of fish

# Compounds of Emerging Concern (CEC)

- Broad Range of Chemicals
  - Pharmaceuticals, personal care, endocrine disrupters, current use pesticides,
- Wide Variety of Sources
  - STP effluent
  - CSO
  - Agricultural runoff
  - Groundwater discharge from septic systems

# Compounds of Emerging Concern (CEC)

- Broad Range of Physical Properties
  - Kow over 8 orders of magnitude dictating partitioning
- General paucity of ecotoxicological data
- Often endocrine issues, feminization of fish populations,
- Interagency efforts to develop lists and approaches for assessing ecological risk