

Delta Challenges Workshop

Contaminants

What We Know-

- Contaminants are one of multiple stressors impacting the Bay and Delta
 - IEP POD Synthesis (2010)
 - ISB (2011)
 - US EPA ANPR (2011)
 - NRC (2012)
 - PPIC (2013)
 - Delta Smelt MAST (2014)
- Successful Delta restoration will require that contaminants are managed

What we know – US Chemical Use

- 100,000 Registered Chemicals
- 84,000 industrial chemicals
- 9,000 food additives
- 3,000 cosmetic ingredients
- 3,000 pharmaceuticals
- 1,000 pesticide active ingredients

- 3,000 new chemicals annually

What We Know-Bay Delta

- Known Delta Contaminants (2010 303d Listings):
 - Persistent organics (PCBs, PAHs, etc.)
 - Pesticides (OC's, OP's, herbicides, pyrethroids)
 - Mercury
 - Selenium
 - Unknown Toxicity
- Cyanotoxins from harmful algal blooms
- Detected Constituents of Emerging Concern
 - Industrial (flame retardants)
 - Personal care products (Triclosan)
 - Pharmaceuticals (birth control, anti-depressants, anti-anxiety, NSAIDs, and caffeine)

What we don't know: Delta Contaminants –An Incomplete Picture

- What chemicals are present in the Delta?

No Delta Regional Monitoring Program – 2015?

- How are contaminants impacting aquatic life?

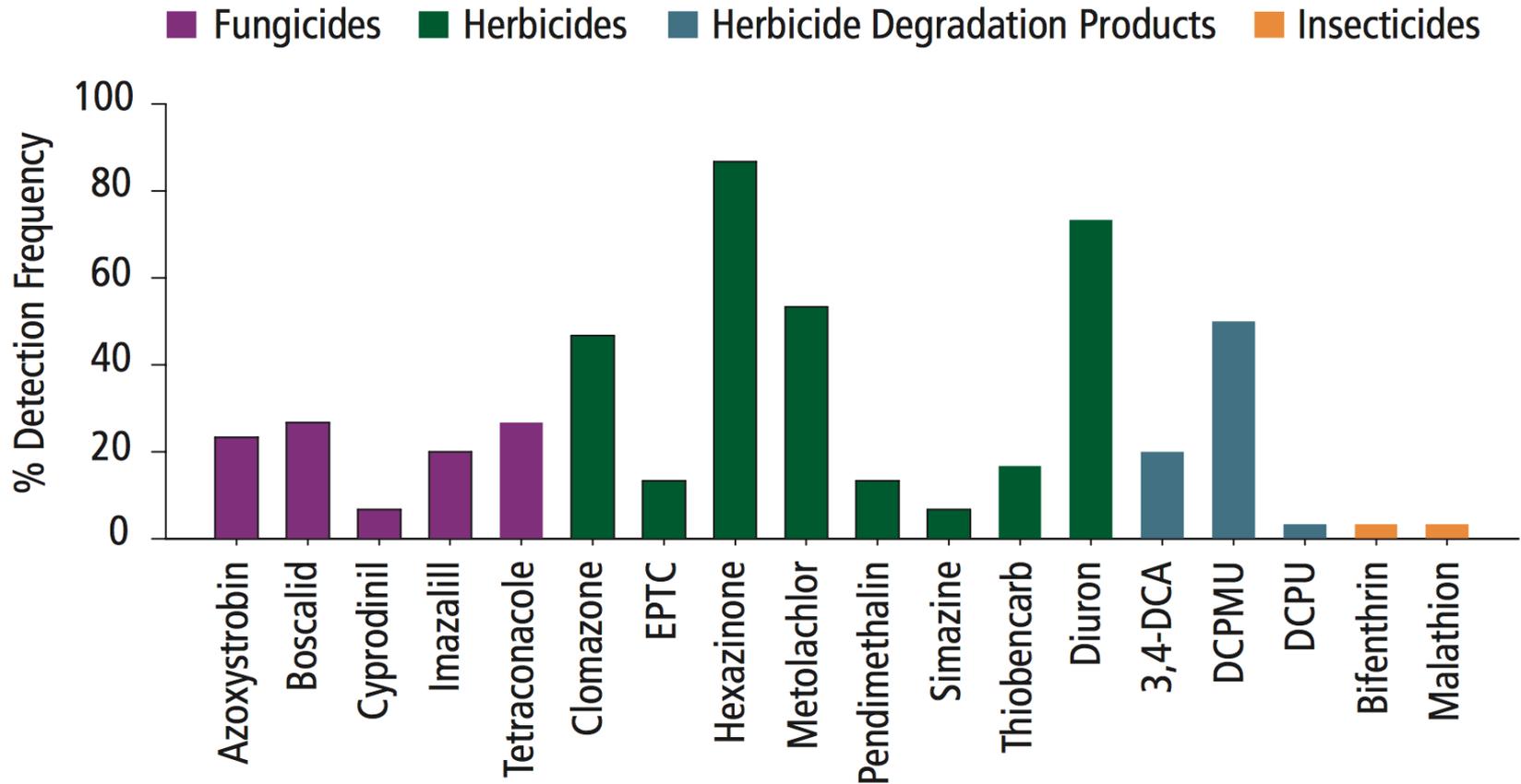
No current IEP contaminant component

“Little to no progress over the last 5 years in understanding the role of contaminants”

What we know - Special Studies

- USGS Pesticide monitoring
- Toxicity Testing
- Observed Endocrine Disruption
- Salmon Olfaction Disruption

What we know-Pesticide Mixtures



Toxicity Testing

- 25 years of special studies
- Demonstrated toxicity in Central Valley and Delta
- Sources: point and non-point sources
- Constituents:
 - Diazinon, chlorpyrifos, diuron
 - Pyrethroids
 - Ammonia
 - Metals
- Unknown Toxicity common

Evidence of Endocrine Disruption

- Commonly used pesticide (bifenthrin) acts as an estrogen at 1 ng/L and more estrogenic effects with metabolites than whole compound (Brander 2012)
- Silversides collected from Suisun Marsh (near cattle ranch) showed masculinization – reduced gonad size and health, 30% reduced fertilized egg output (Brander 2013)

Low Levels of Copper and Olfactory Disruptions

- One of the most widely used pesticides in the Central Valley (Johnson et al 2010), urban runoff, mining
- Disrupt olfactory receptor neurons and in lateral line mechanosensory neurons (Hansen 1999, Hecht 2007, Linbo 2009, McIntyre 2008, Sandahl 2007)
 - Resulting in measured behavior alterations (e.g., predator avoidance response, contaminant avoidance, and swimming)
- Reduced growth, survivability, and reproduction in Chinook and rainbow trout (Hansen 1999, Sandahl 2007)

Technical Challenges

- Ever Increasing number of chemicals
- Lack of practical analytical methods
- Lack of ambient chemical and biological effects monitoring
- Lack of Water Quality Objectives and Adverse Effect Thresholds
- Lack of knowledge on if/how contaminants are affecting key Delta species

Scientific Uncertainties

- “Appropriate” Water Quality Objectives
- Interpretation of Toxicity Tests and Laboratory Studies
 - genetic-level responses: population level effects.
 - behavioral-scale, and sometimes transient, responses: population level effects.

Future Challenges

- Pesticide switching
- Climate Change (Hydrology, Temperature)
- Population Growth
- Hydrology Changes (loads and concentrations)
- Tidal Marsh Restoration (mercury)

Summary

Chemical contaminants are a pervasive stress in any aquatic ecosystem that is surrounded by human activities—almost every chemical we use ends up getting into the water.

What we call “sublethal” effects are in fact highly damaging in an ecological context, so we need a better word!...and we really are almost guessing when it comes to estimating effects on very early life stages, where animals are undergoing profound developmental changes.

Combined with the complexity of chemical mixtures entering the surface waters of the Delta, these facts make it obvious that more effort and better tools are needed to address the human-caused chemical stress in the Delta.”

--Tracy Collier, Chair, Delta Independent Science Board (2015)

Conceptual Model

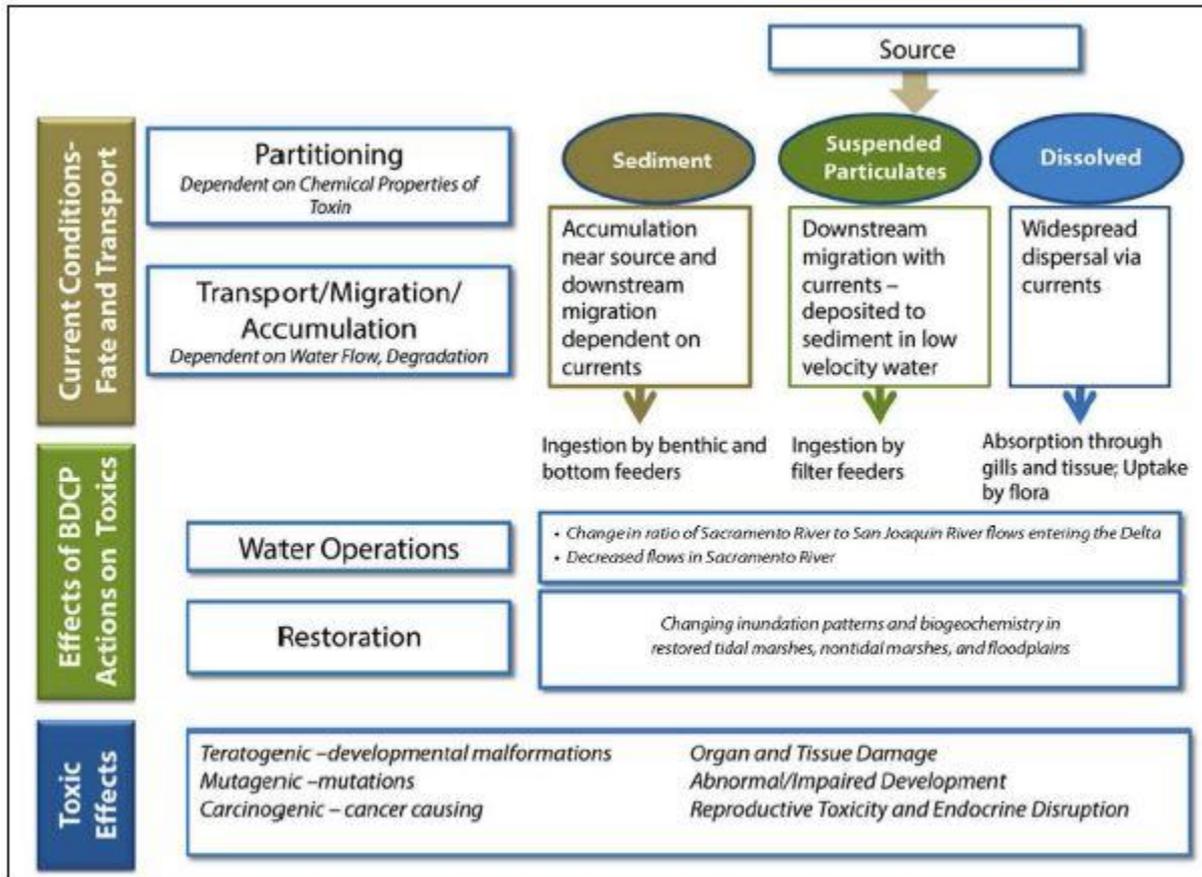


Figure 5.D.3-1. Generic Conceptual Model to Evaluate BDCP Contaminant Effects