Adapting Status and Trends Monitoring

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Optimizing S&T Monitoring

**Improving Efficiency**

- **1993**: S&T begins with 16 fixed stations for water and sediment and 11 bivalve stations, cruises 2-3 times per year.

- **2002**: Randomized station design adopted for water and sediment; reduced frequency for aquatic toxicity; CEC monitoring begins.

- **2008**: Sediment cruises begin in wet and dry seasons. Added sediment benthos, full suite of PCB congeners.

**Addressing New Challenges**

- **2011**: Water and sediment cruises changed to biennial, alternating years.

- **2013**: Monitoring design is further optimized.
What is the S&T Design Now?

Every 2 Years (alternating)
- WATER

Every 3 Years
- BIRD EGGS

Every 4 Years
- SEDIMENT

Every 5 Years
- SPORT FISH

BIVALVES

Sampled in 2014
Why are we changing S&T (again)?

WE SHOULD.

WE CAN.

WE MUST.
“If you do not change direction, you may end up where you are headed.”

– Lao Tzu
Why Worry About Margins?
Margins Are...

- Historical “hotspots”, bayside dumps
Margins Are

- Nearer terrestrial sources
• Inventory for fate, food web contamination
• Important habitat for wildlife
  – Charismatic fauna ...
Baby Pictures!
Baby Pictures!
RMP v1.0

- Mostly main channels
RMP v2.0

We have nothing to fear but... mud?

- To 1 ft
  @MLLW
One If By Land
Two If By Sea
RMP v2.0+

<table>
<thead>
<tr>
<th>Segment</th>
<th>Margin</th>
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<tbody>
<tr>
<td>SUB</td>
<td>7%</td>
</tr>
<tr>
<td>SPB</td>
<td>17%</td>
</tr>
<tr>
<td>CB</td>
<td>4%</td>
</tr>
<tr>
<td>SB</td>
<td>25%</td>
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<tr>
<td>LSB</td>
<td>74%</td>
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Margins Conceptual Hypotheses

- Bathtub ring model
  - Widespread dirty margin
  - Some dirtier patches

- Chocolate chip cookie model
  - Mostly uniform
  - Discrete “hot” spots

- Commonality
  - Assume higher and/or more variable contamination
You should never **ASSUME**

There are things we don't know we don't know. *Rumsfeld 2002*

知之為知之，不知為不知，是知也。

What you know, you know, what you don't know, you don't know. This is true wisdom. *Confucius ~500BC*
Are Margins Hot(ter)?

Noisy but very significantly lower PCBs w/ depth

PCBs (log ug/kg) vs. Depth (ft)
RMPv1: Margins Maybe Higher?

Depth trend barely not significant (p=0.08)
RMPv2: Previous Data Biased?

No depth trend (p=0.25)
Biased Sampling

- **Pros**
  - Uses previous/expert knowledge
    - Don’t reinvent the wheel
  - Efficiently characterize places you care about
    - Some are more equal than others
  - Condition vs hard criteria
    - Failing is failing
Biased Sampling

• Cons
  – Only observe what you examine
    • Parts of the elephant
  – Not extendable beyond sampled group
    • No description of general characteristics
  – Not good for relative comparison
    • Prioritization/triage difficult/limited
RMPv2+: How Are The Margins?

Only way is to actually measure
Unbiased Margins Survey

• Important complement to targeted sampling
  – “Priority” margin units already known bad?
  – “Representative” evaluation of the rest

• A few samples start providing answers.
  – Are margins widely impacted & how badly?
  – Are targeted sites much different?
  – Are there changes vs this baseline?
  (low statistical power initially, but more with time)
Margins Survey Progress...

- Picked GRTS sample sites
  - <1km spacing in continuous areas (60-120/seg)
- Working through costs/logistics
- Sampling in 2015-2016?
- Review data, future frequency/effort
  - Planned parallel targeted sampling
  - Evaluate needs & timeline for margin data
    - Is it as high/variable as expected?
    - Can we detect trends?
How Not To Sample

- Handling sample w/o gloves
- Sampler surface not precleaned
- Poorly controlled sampling depth