SD River Watershed Report Card

Health Streams Partnership Meeting

March 28, 2014

Report Card Goals

- Watershed-scale assessments of condition
- Track changes in condition over time
- Integrate wider variety of data & information
- Produce products tailored to different audiences
- Provide flexibility to change indicators, thresholds, scoring methods
- Focus attention on gaps and inconsistencies

Massachusetts Example

Millers River

WATER QUALITY REPORT CARD

2000 Assessment

COLOR KEY: GOOD, CONCERN, FAIR, POOR, N/A

	AQUATIC LIFE							RECREATION		FISH EDIBILITY
SEGMENT	BIOLOGY	CHEMISTRY	NUTRIENTS	TOXICS	SEDIMENTS	FLOW	HABITAT	BACTERIA	AESTHETICS	FISH TISSUE
MILLERS RIVER										
to Whitney pond										
to Winchendon WWTF										
to Otter River										
to South Royalston										
to Orange Center										
to Erving WWTF										
to Connecticut River										
OTTER RIVER										
to Gardner WWTF										
to Seaman Paper Co.										
to Millers River										
TULLY RIVER										
East Branch										
Boyce Brook										
West Branch										
Lawrence Brook										
Main Stem										

Beneficial Uses

- Cold Freshwater Habitat (COLD)
- Warm Freshwater Habitat (WARM)
- Wildlife Habitat (WILD)
- Preservation of Rare and Endangered Species (RARE)
- Municipal and Domestic Supply (MUN)
- Water Contact Recreation (REC1)
- Commercial and Sport Fishing (COMM)

Management Questions

1: Are habitats and ecosystems healthy?

2: Is water quality safe for swimming?

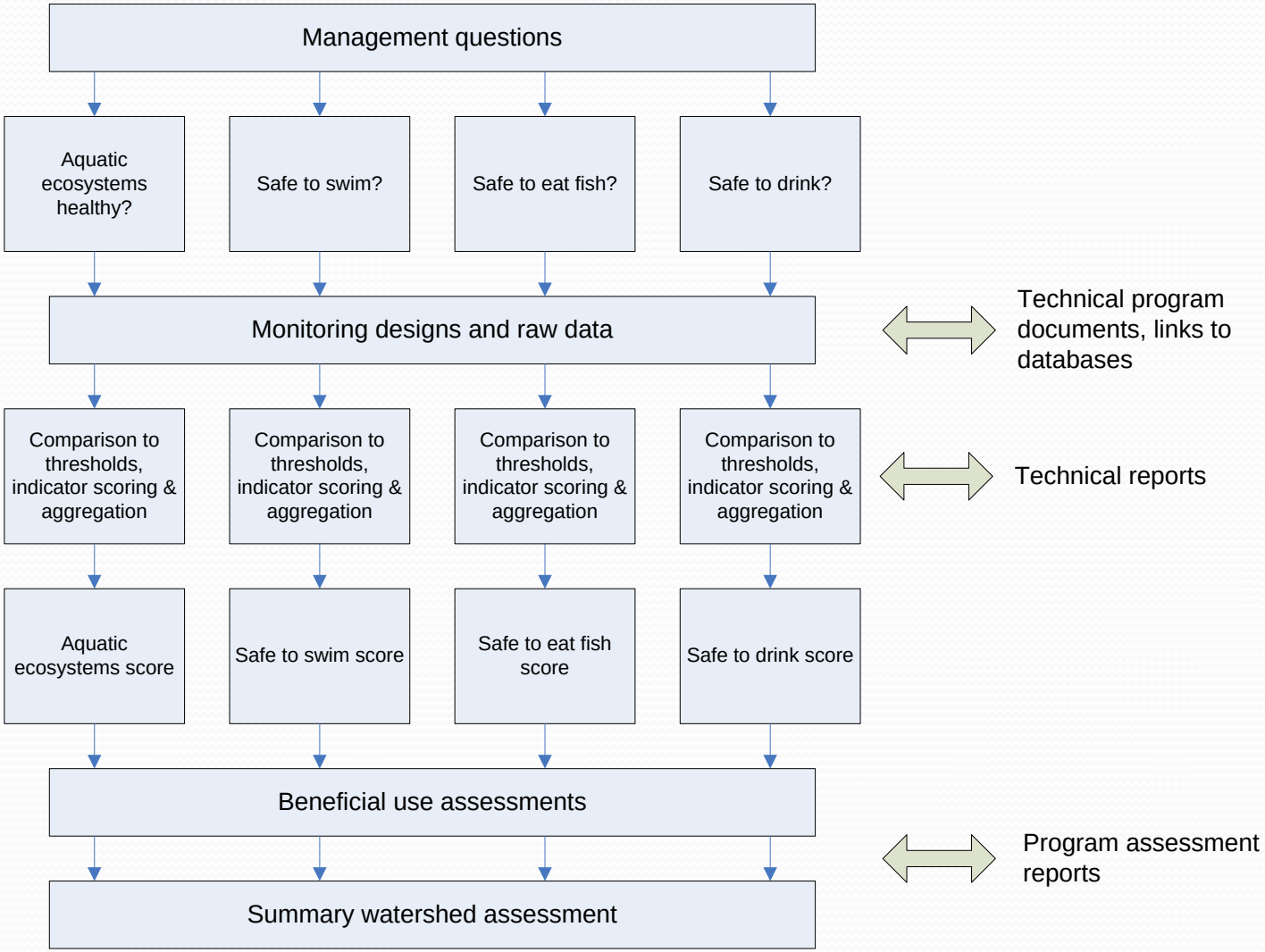
3: Are fish and shellfish safe to eat?

4: Is water safe to drink?

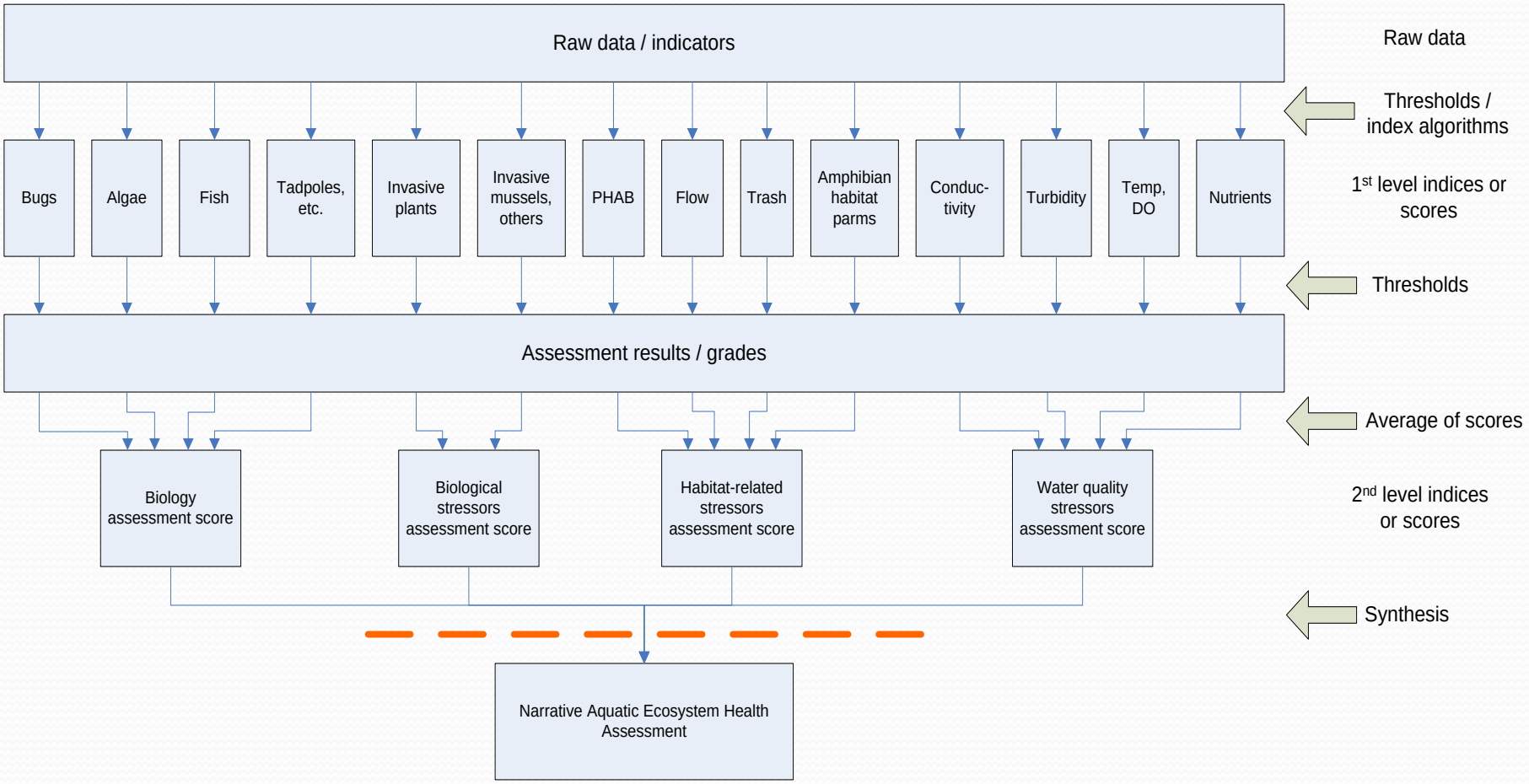
Basic Structure

- Separate report card scores for:
  - Aquatic ecosystem health
    - Biology (bugs, algae, fish, amphibians, reptiles)
    - Biological stressors (invasive plants, invasive mussels, others)
    - Habitat-related stressors (PHAB, flow, trash, amphibian habitat)
    - Water quality stressors (conductivity, turbidity, nutrients, temp, DO)
  - Safe to swim (fecal coliforms, total coliforms, *Enterococcus*)
  - Safe to eat fish (mercury, DDT, PCB, selenium)
  - Safe to drink (nutrient loading and algae in reservoirs)
- Scores averaged within above categories
- No overall integrated score across all uses
- Potential for scores by subwatershed

Hierarchical Structure



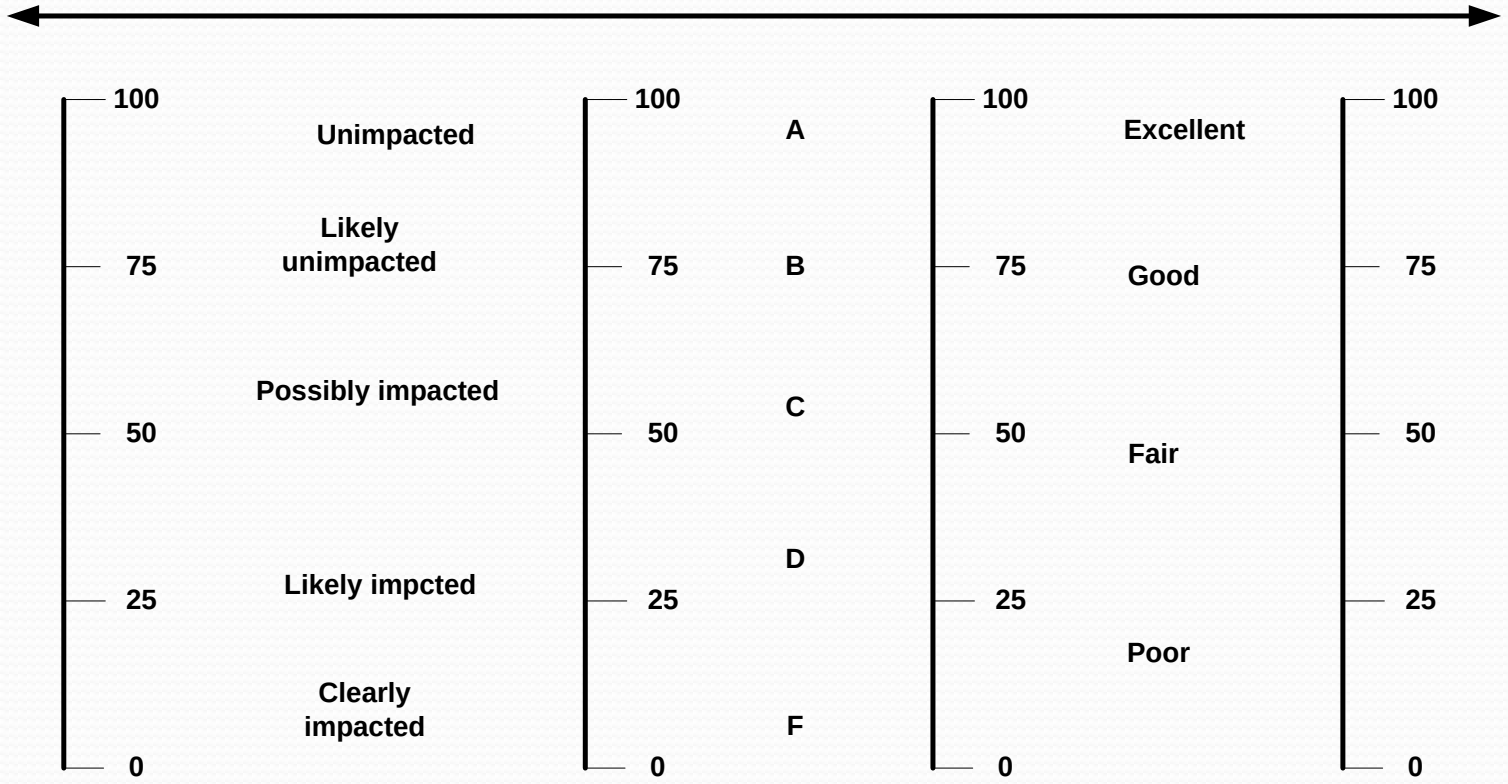
Aquatic Ecosystem Example



Assessment Categories

- Four scoring categories:
  - Excellent: comparable with reference…
  - Good: consistently meets criteria…
  - Fair: usually meets criteria…
  - Poor: frequently or never meets criteria…
- All indicators / indices scored on a 1 – 100 scale
  - Excellent: 95 – 100
  - Good: 80 – 94
  - Fair: 65 – 79
  - Poor: 0 – 64
- At Risk: worsening condition or potential for worse

Converting Scores



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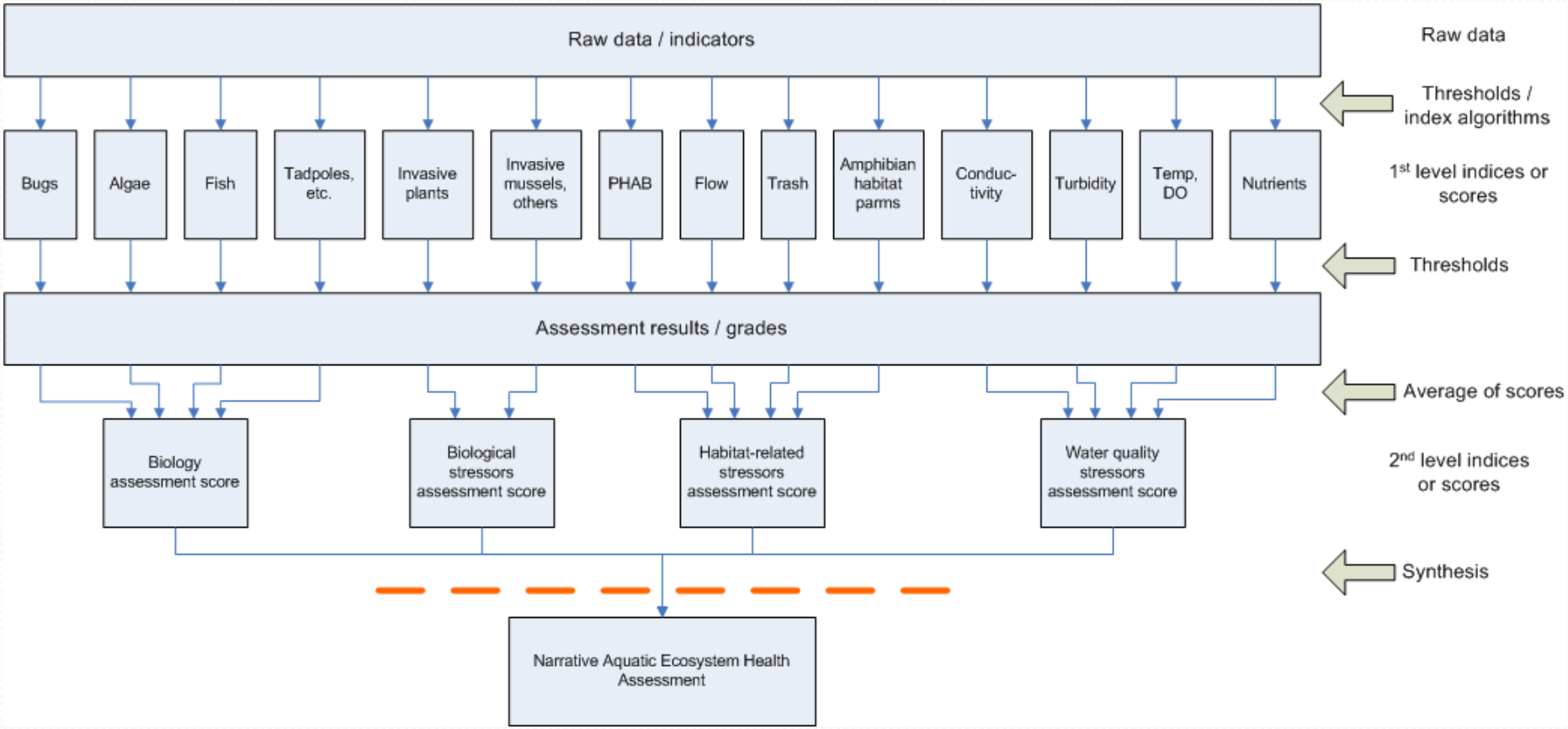
Converting to Standard Scale

- Example 1: Mercury tissue level of 140 mg/kg
  - 70 – 149 mg/kg is Good on SWAMP scale
  - Measured tissue level of 140 is 89% of the way up the SWAMP Good scale
  - 89% of our Good scale of 80 – 94 is 13, which converts to a score on our scale of 92
- Example 2: S Cal IBI score of 45
  - 40 – 59 is Fair on S Cal IBI scale
  - Measured result of 45 is 30% of the way up the Fair scale
  - 30% of the way up our Fair scale of 65 – 79 is 4.5, which converts to a score on our scale of 68.5

Aquatic Ecosystem



Thresholds: Aquatic Ecosystem

Indicators	Proposed thresholds
Biological condition	
• Bugs	S CA BMI for now, then CSCI
• Algae	SWAMP
• Fish community structure	Index based on Moyle's approach
• Amphibians, reptiles, birds	Develop w/USGS & MSCP
Biological stressors	SD River Park Fndn. for invasive plants CA DF&W for invasive mussels Develop w/USGS & MSCP for other invasives
Habitat stressors	PHAB scoring and new index Additional modification metrics Habitat suitability for newts, salamanders SD River Park Fndn. & MS4 for trash
Water quality stressors	WQO / Basin Plan NNE for nitrogen / phosphorus PHAB scoring and new index

Thresholds: Fish Community

- Adapted from 3 Peter Moyle papers

Metric	Scoring
Total # species	1: <3 3: 3 – 5 5: >5
Relative abundance	1: Low numbers present 2: Small numbers present 3: Common 4: Very common 5: Abundant
Total biomass	1 - 5: Defined after initial data reviewed
# age classes	1: 0 – 1 3: 2 5: 3+
% top carnivores	1: < 5% 3: 5 – 10% 5: > 10%

Thresholds: Fish

- Moyle's scoring uses a 5 point scale
- Need to convert this to our four categories

Moyle score	1 – 100 score	Our category
1	20	Poor
2	50	Poor
3	72	Fair
4	86	Good
5	97	Excellent

Thresholds: Safe to Eat

Indicator	Threshold	Category	Detail
Mercury	< 70 70 – 149 150 – 440 > 440	Excellent Good Fair Poor	The ATL range equivalent to >2 servings / week The ATL range equivalent to 2 servings / week The ATL range equivalent to 1 serving / week The ATL range equivalent to no consumption
DDT	< 520 520 – 999 1000 – 2100 > 2100	Excellent Good Fair Poor	The ATL range equivalent to >2 servings / week The ATL range equivalent to 2 servings / week The ATL range equivalent to 1 serving / week The ATL range equivalent to no consumption
PCB	< 21 21 – 41 42 – 120 > 120	Excellent Good Fair Poor	The ATL range equivalent to >2 servings / week The ATL range equivalent to 2 servings / week The ATL range equivalent to 1 serving / week The ATL range equivalent to no consumption
Selenium	< 2500 2500 – 4899 4900 – 15000 > 15000	Excellent Good Fair Poor	The ATL range equivalent to >2 servings / week The ATL range equivalent to 2 servings / week The ATL range equivalent to 1 serving / week The ATL range equivalent to no consumption

Safe to Eat Scoring

- Convert SWAMP scoring ranges to our report card category ranges
- Example 1: Mercury tissue levels
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Thresholds: Safe to Swim

Indicator	Threshold	Detail
Basin Plan		
Fecal coliforms	200 cfu / 100 ml 10% > 400/100 ml	Log or geometric mean of minimum 5 samples in 30 day period Maximum exceedance rate for 30 day period
USEPA 2012 criteria #1		Illness rate 36 / 1,000
E. coli	126 cfu / 100 ml 10% > 410 cfu / 100 ml	Log or geometric mean of minimum 5 samples in 30 day period Maximum exceedance rate for 30 day period
Enterococcus	35 cfu / 100 ml 10% > 130 cfu / 100 ml	Log or geometric mean of minimum 5 samples in 30 day period Maximum exceedance rate for 30 day period

Safe to Swim Scoring

- Based on frequency and magnitude of exceedances
- Three factors
  - Percent of variables not meeting objectives
  - Percent of individual tests not meeting objectives
  - Cumulative amount by which failed test values exceed objectives

Exceedance Index Calculations

$$F_1 = \left(\frac{\text{Number of failed variables}}{\text{Total number of variables}} \right) \times 100$$

$$excursion_i = \left(\frac{FailedTestValue_i}{Objective_j} \right) - 1$$

$$F_2 = \left(\frac{\text{Number of failed tests}}{\text{Total number of tests}} \right) \times 100$$

$$nse = \frac{\sum_{i=1}^{n} excursion_i}{\#\ of\ tests}$$

$$F_3 = \left(\frac{nse}{0.01nse + 0.01} \right)$$

$$CCMEWQI = 100 - \left(\frac{\sqrt{F_1^2 + F_2^2 + F_3^2}}{1.732} \right)$$

Challenges

- Inconsistent spatial and temporal coverage
- Some indicators cannot be measured at all desired scales
- Combination of random and targeted designs
- No widely agreed on assessment methods for many indicators
- Combination of quantitative and qualitative data
- Data distributed across multiple programs and locations

Next Steps

- Assemble data and strengthen partnerships
- First cut at upper/lower watershed scale
  - Draft scoring
  - Assess results and tweak
- Define spatial/temporal scale of indicators
  - Apply to selected segments with more data
  - Assess results and tweak again
- Produce report card with data gaps highlighted