Asking the right questions and getting meaningful answers:

A monitoring framework for Chinook salmon recovery in the Lake Washington/ Cedar/ Sammamish Watershed

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WRRA 8*

- Lake Washington
- Lake Sammamish
- Cedar River Basin
- Sammamish River Basin
- Puget Sound Nearshore

* WRIA = Water Resource Inventory Area
Monitoring is crucial to measuring our progress

- Plan calls for periodic updates on progress
- State requires annual reporting
- NOAA five-year ESA status review is on the horizon
What do we need to know?

- Is the watershed producing more or less Chinook? (Status and Trends Monitoring)

- Are watershed conditions improving or declining? (Status and Trends Monitoring)

- Are we doing what we said we’d do in our Plan? (Implementation Monitoring)

- Is what we said we’d do, doing what we said it would? (Effectiveness Monitoring)
Implementation

Effectiveness

Status & Trends (fish)

Status and Trends (habitat)

\[ \text{Estimated at} \quad \sim \$1.8 \text{ million annually in WRIA 8} \]
Is the watershed producing more or less Chinook? (Status and Trends Monitoring)

- Also called ‘fish in – fish out’ monitoring

- Considered most crucial information need

- Funded annually by King County, KCD, Seattle, WDFW, MIT, others

- Should be collected in context of NOAA VSP parameters (esp. abundance and productivity)
Is the watershed producing more or less Chinook? (Status and Trends Monitoring)

- Spawner surveys, redd location, abundance estimates
- Hatchery vs. wild spawners assessments
- Juvenile trapping
- Juvenile tagging to track migration and survival
Limitations

- Spawner surveys are not performed above the Landsburg dam
- Adult surveys of Sammamish population are index reaches
- Smolt trapping locations miss part of the migration corridor
- PIT tagging studies have challenges
Remote Sensing
- Forest Cover
- Lakeshore Habitat

Field Surveys
- Riparian Function
  - Riparian Cover
  - Channel Stability
  - Pool Habitats
  - Channel Confinement

Hydrologic Monitoring and Modeling
- Water Quantity (Intensity, Duration, Timing)
- Groundwater
- Passage through Locks and Ship Canal

Water Quality Monitoring
- Water Quality (Sediment, Temperature, Chemistry)
Are watershed conditions improving or declining? (Status and Trends Monitoring)

- Follow regional guidelines
- Focus on priority areas
- Use existing data sources to supplement information

Diagram:
- Habitat
  - Field Assessments
    - Wadeable streams
    - Rivers
  - Remote Sensing
    - Forest cover
    - Impervious cover
  - Water Quality
    - Q min, max
    - Flashiness
  - Hydrologic Monitoring and Modeling
    - Upstream and edge habitat
  - Lakeshore Assessments
  - Other
    - Locks/Ship Canal Passage
Follow regional guidelines

Wadeable streams:

Survey protocol based on EPA’s EMAP survey – used nationally and regionally; e.g.,

- Pool frequency
- Substrate
- Riparian habitat
- Fish
- (Benthic macroinvertebrates)
Focus on priority areas

Subbasins prioritized by watershed condition and level of use by Chinook salmon:

1. Core/migratory
2. Satellite
3. Episodic/None

• Random sample of wadeable streams in Tier 1 and Tier 2 areas
• Rivers: Priority on Cedar River
Use existing data sources to supplement information

- Green = BIBI* sites
- Red = WRIA 8 WS sites

* BIBI = Benthic Index of Biotic Integrity
Are watershed conditions improving or declining? (Status and Trends Monitoring)

- Follow regional guidelines
- Focus on priority areas
- Use existing data sources to supplement information
Use existing data sources to supplement information

- 1991, 2001 classified
- 2006 available in May or June
Focus on priority areas

Land Cover Change, 1991-2001

- Pink = Tier 1 areas
- Blue = Tier 2 areas
  - Red: Forested → Developed
  - Green: Unforested → Forested
Finer-scale analyses can be focused on priority areas

- Impervious cover change
- Spatial configuration
  - Patch size
  - Aggregation index
Hydrologic Monitoring and Modeling

- DeGasperi et al. 2009
- Brett et al. 2005

Use County gauge data where available

Quantify ‘flashiness’ metrics, e.g., increases in frequency and range of high pulses during summer and winter
Water Quality

- Rely on County data where available
Lakeshore Assessments

- Use protocol similar to Toft et al. 2003

-- Since change if it comes will be slow, assessments can be made on a longer time frame.

Figure 15. Dock types along the surveyed shoreline. Also included are major pipe outfalls, that are large and clearly noticeable at the shoreline.
Project Implementation and Effectiveness Monitoring

- Rely on other entities to the greatest extent possible
Implementation Monitoring

**Floodplain Connectivity:** Setback and remove dikes and levees to restore floodplain connectivity. Floodplains provide off-channel and margin refuge habitats, as well as lower velocity areas during periods of high flow. (5 projects)
- **Goal:** 6,800 Linear Feet  
  - **Actual:** 4,350 Linear Feet  
  - **Progress:** 64% Completed

  - Progress towards goal (4,350)
  - Remaining (2,450)

**Habitat Protection:** Protect property within the Cedar River basin through easements, acquisitions, or transfer of development rights. These actions will protect floodplain, riparian, and upland watershed processes and enable future restoration efforts. (18 projects)
- **Goal:** 606 Acres  
  - **Actual:** 93.2 Acres  
  - **Progress:** 15% Completed

  - Progress towards goal (93.2)
  - Remaining (512.8)

**Channel Complexity:** Add large woody debris to create pools. Channel complexity provides juvenile Chinook with refuge and foraging opportunity, while adult Chinook benefit from areas to rest on their upstream migrations. (5 projects)
- **Goal:** 3,500 Feet  
  - **Actual:** 800 Feet  
  - **Progress:** 23% Completed

  - Progress towards goal (800)
  - Remaining (2,700)
Effectiveness Monitoring

- Focus monitoring on actions with highest uncertainty
- Use existing efforts to improve our project designs wherever possible
  - SRFB effectiveness monitoring
  - CIP monitoring requirements
  - Other opportunities (support local or regional initiatives)
WRISA 8 Monitoring Framework

Status and Trends
- Field Assessments
  - Wadeable streams
  - Rivers
  - Remote Sensing
    - Forest cover
    - Impervious cover
  - Hydrologic Monitoring and Modeling
    - Q_min, max
    - Flashiness
  - Water Quality
  - Lakeshore Assessments
    - Upland and edge habitat
    - Littoral habitat
  - Other
    - Locks/Ship Canal Passage

Implementation
- Education/outreach
- Land use
- Programs
- Projects

Direct Effectiveness
- See limiting factors matrix for more info
- Levee setbacks/floodplain reconnection
  - Lakeshore modification
  - Pool habitat creation
  - Riparian restoration
  - Improving water quality
  - Managing exotic species
  - Reducing fine sediment
- Education/outreach
- Programs
- Land use
<table>
<thead>
<tr>
<th>Major Habitat Limiting Factor</th>
<th>PCSRF Treatments Addressing Major Habitat Limiting Factors (from PCSRF database)</th>
<th>Potential Habitat Indicator (from other data sources)</th>
</tr>
</thead>
</table>
| Degraded habitat — Estuine and nearshore marine (ESU: 1,3) | • Channel modification  
• Creation of new estuine area  
• Dike breaching/removal  
• Increasing floodwater flow  
• Removal of existing fill material  
• Estuine and nearshore land acquisition projects | Change in area, distribution, and type of tidal and submerged wetlands. |
| Degraded habitat — floodplain connectivity and function (ESU: 1-3) | • Wetland creation/ improvement / enhancement,  
• Invasive species removal, vegetation planting  
• Conservation grazing management/ Livestock exclusion  
• Fencing  
• Irrigation practice improvement  
• Water gap development  
• Channel connectivity  
• Riparian and wetland land acquisition projects  
• Bank stabilization  
• Channel connectivity & reconfiguration  
• Defenders-barcs  
• Log and Rock control (weir)  
• Vegetation planting and/or removal / control  
• Roughened channels  
• Site and stream channel maintenance  
• Spawning gravel replacement  
• Woody debris placement  
• Fencing  
• Riparian land acquisition projects | Change in condition of physical habitat - pool density and depth; cover, wood quantity and quality. |
| Degraded habitat — channel structure and complexity (ESU: 1-3) | • Conservation grazing management/ Livestock exclusion  
• Irrigation practice improvement  
• Water gap development | Change in condition of physical habitat - pool density and depth; cover, wood quantity and quality. |
| Degraded habitat — riparian areas and LWD recruitment (ESU: 1-3) | | Change in area, distribution, and type of riparian vegetation. |
Programmatic Effectiveness and Implementation Monitoring

- Implementation: WRIA 8 annual survey
- Effectiveness: suggest third party
WRIA 8 Monitoring Framework

Status and Trends
- Fish
  - Juveniles
  - Adults
- Adults
  - Spawner surveys
  - Redd counts
  - Smolt trapping
    - PIT tagging
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  - See limiting factors matrix for more info
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