Agenda

• Part 1: Update
  – Chehalis Basin Strategy, ASRP Work to date, Restoration expert meeting, Conceptual Model, Salmon and other species

• Part II: Development of ASRP Strategies
  – Process overview, Role of Ecosystem Diagnosis and Treatment (EDT), Newaukum case study

• Part III: Next Steps
  – Process and timelines, New sources of information, Assistance from local experts
Chehalis Basin Strategy

Focused on:

• Reducing flood damage
• Restoring/protection aquatic species habitat
Reducing Flood Damage

**Structural Approaches**
- Flood Retention Dam (Temporary reservoir)
- Flood Retention/Flow Augmentation Dam (Permanent reservoir)

**Non-Structural Approaches**
- Floodplain Retention
- Floodproofing
Protecting/Restoring Species and Habitat
Salmonids, Other Fish,
Protecting/Restoring Species and Habitat
Salmonids, Other Fish, Amphibians, Waterfowl

Chinook

Coho

Olympic mudminnow

6 Species sculpin

Longnose dace

Western toad

Torrent salamander

Bufflehead

Red-legged frog

Oregon spotted frog

Northern pikeminnow

Hooded merganser

Redside shiner
Research/Modeling

Research

• **Salmon** — telemetry, population structure, spawner abundance, diversity
• **Non-salmon** — presence, distribution
• **Amphibians** — egg mass (intensive, extensive), instream, stream associated, off-channel habitat mapping, invasive species
• **Waterfowl utilization**

Modeling

• **EDT** - salmon
• **PHABSIM** - fish
• **Watershed Assessment** - landscape change, restoration potential/site identification, incorporates fish and non-fish
• **Occupancy** — amphibians, non-salmon
• **Inundation** — historical, current
## Milestones

<table>
<thead>
<tr>
<th>Fall/Winter 2015</th>
<th>Spring 2016</th>
<th>Summer/Fall 2016</th>
<th>Winter 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual model; Restoration strategies; Compile data</td>
<td>Finalize Restoration Strategies; Update EDT</td>
<td>New EDT runs; Identify restoration priorities</td>
<td>Final ASRP</td>
</tr>
</tbody>
</table>

### 2012-2014

- Alternative development
- Identified data gaps
- Aquatic Species Enhancement Plan
- Hydrology
- Small projects/Floodproofing
- Preliminary EDT runs

**Conversion Table**

- Fall/Winter 2015
- Spring 2016
- Summer/Fall 2016
- Winter 2016
ASRP Schedule

Draft Aquatic Species Restoration Plan

<table>
<thead>
<tr>
<th>ASRP Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ASRP Schedule</strong></td>
</tr>
<tr>
<td><strong>Draft Aquatic Species Restoration Plan</strong></td>
</tr>
<tr>
<td><strong>W.12 Aquatic Species Restoration Plan (ASRP)</strong></td>
</tr>
<tr>
<td><strong>Guiding Principles</strong></td>
</tr>
<tr>
<td><strong>W.13.1 Restoration Strategies</strong></td>
</tr>
<tr>
<td><strong>Ecosystem Analysis</strong></td>
</tr>
<tr>
<td><strong>Implementation Section</strong></td>
</tr>
<tr>
<td><strong>Governance Section</strong></td>
</tr>
<tr>
<td><strong>Bank Erosion Strategy</strong></td>
</tr>
</tbody>
</table>

**2015**
- Jul: Develop Table of Contents
- Aug: Restoration Experts Workshop
- Sep: Develop Conceptual Models
- Oct: Final Restoration Strategies
- Nov: Update EDT
- Dec: Frame Restoration Scenarios

**2016**
- Jan: Run Restoration Scenarios in EDT
- Feb: Draft ASRP

**2017**
- Mar: Final ASRP
- Apr: WDFW Draft
- May: Input from Tribes (Ongoing)
- Jun: Continued Refinement through project (ongoing)
- Jul: Refine Strategies
- Aug: Draft Sections
- Sep: Workshop - Priorities and Feasibility
- Oct: Draft Section Completed
- Nov: Final Sections

**2018**
- Dec: Review Final Sections

**Barrier Removal, ASRP/EDIT Modeling, Climate Change Modeling Using EDIT, Intrinsic Potential, Watershed Analysis**
Science Visioning Workshop

Take Home Messages

- Protect first, restore second - factored by social, economic and political issues
- Start with conceptual model - work towards restoration blueprint
- Protection/restoration blueprint must be dynamic
- Restore impaired watershed processes linked to important places
- Go big or go home - large and long-term effort
- Protect most important areas first but represent all habitat diversity
- Learn by experimentation
- Build resilience into system provide latitude for system recovery
Science Visioning Workshop
Take Home Messages

- Protect first, restore second - factored by social, economic and political issues
- Start with conceptual model - work towards restoration blueprint
- Protection/restoration blueprint must be dynamic
- Restore impaired watershed processes linked to important places
- Go big or go home - long-term effort
- Protect most important areas first but represent all habitat diversity
- Learn by experimentation
- Build resilience into system provide latitude for system recovery

START WITH SIMPLE
CONCEPTUAL MODEL
TO DEFINE GUIDING
HYPOTHESES
Simple Conceptual Model

- Process Drivers
  - Watershed Processes
  - Physical and Ecological Responses
    - Goods and Services
    - Important Locations
  - Habitat Conditions
    - Biological Response
Goal: Restore processes

Evaluate stressors to the expression of habitat and species drivers

Conceptual Model

Formulate strategies

Implement actions

Monitor effectiveness

Adaptive mgmt.

Achieved?

Refine?

New Data

Refine?
Part II

Development of Restoration Strategies
Strategy Definitions

General:

“A careful plan or method for achieving a particular goal usually over a long period of time”

ASRP strategy template:

Restore/protect habitat processes to maintain or improve habitat conditions at important locations in order to achieve desired ecological response
Overview of Strategy Development Process

- Focus on watershed habitat processes
- Strategies reflect current state of knowledge
- As new data are available strategies will evolve
What is different this time?

• Use of conceptual model (CM) to provide roadmap depicting how watershed processes affect habitat conditions and productivity

• The use of CM allows clearer focus on watershed processes for restoration and protection strategies

• New biological and physical data are available

• Spatial scale has increased

• More species are being considered

• Local knowledge will continue to contribute to CM and strategies

• Additional modeling tools will help confirm strategies
Proposed Strategy Development Process

- **Conceptual Model (CM) Template by Sub-Basin (No Detailed Strategy)**
  - December-Early January 2016

- **Workshop Process for Strategy Development and Straw Man Strategy for Newaukum**
  - January 21, 2016

- **CM with Preliminary Draft Detailed Strategy by Sub-Basin**
  - Late January-Mid February 2016

- **Workshop Preliminary Draft Strategies by Sub-Basin**
  - Early March 2016

- **Draft Strategies by Sub-Basins**
  - End of March 2016

- **Quantify Benefit of Restoration Strategies**
  - April to June 2016

- **EDT Diagnostics**

- **EDT Diagnostics + Input from Local Experts**

- **Final Prioritized Strategies Integrated into ASRP**
  - June to October 2016

- **Complete ASRP**
  - End of December 2016

- **Integrate Watershed Assessment**
  - 2017

- **Implement and Adaptively Manage ASRP**
  - 2017 and Beyond
Role of Ecosystem Diagnosis and Treatment (EDT)

- Developing restoration strategies
- Quantify benefits
- Prioritization of strategies
Role of EDT in the ASRP

• Evaluate habitat potential for anadromous salmonids
  – Spring Chinook
  – Fall Chinook
  – Coho
  – Chum
  – Steelhead

• In regard to:
  – Abundance
  – Productivity
  – Biological diversity
  – Spatial diversity

• Based on conceptual models of species-habitat relationships and life history
Products of the EDT Analysis

• Limiting habitat conditions (Diagnosis)
  – By species, by life stage
  – By reach
  – By sub-watershed (“populations”)

• Restoration potential

• Prioritization of sub-watersheds and reaches
  – Protection of current habitat potential
  – Restoration of historic habitat potential

• Evaluation of habitat change (Treatment)
  – ASRP habitat restoration actions
  – Flood control alternatives
  – Climate change
Evaluation of Restoration and Protection Opportunities using EDT

Degradation Reference

% Change with Degradation

Current

% Change with Restoration

Restoration Reference

Protection

Restoration

Neq = 6,000

Neq = 10,000
Neq = 12,000
Neq = 15,000
Neq = 8,000
Neq = 6,000

% Change with Restoration

% Change with Degradation
Basin Scale Restoration and Protection Ranking - Spring Chinook Salmon

Basin-wide Change in NEQ with Restoration

- Withdrawals
- Width
- Temperature
- Sediment load
- Predation
- Pathogens
- Oxygen
- Key Habitat
- Harvest
- Habitat diversity
- Food Index
- Flow
- Competition (with other species)
- Competition (with hatchery fish)
- Chemicals
- Channel Stability
- Channel length
Basin Scale Restoration and Protection Ranking—Coho Salmon

Coho Basin-wide Change in NEQ with Restoration

- Withdrawals
- Width
- Temperature
- Sediment load
- Predation
- Pathogens
- Oxygen
- Key Habitat
- Harvest
- Habitat diversity
- Food Index
- Flow
- Competition (with other species)
- Competition (with hatchery fish)
- Chemicals
- Channel Stability
- Channel length

Graph showing the percentage change in NEQ with restoration.
Newaukum River – Subwatershed Scale
Restoration/Protection Priorities–Spring Chinook Salmon
Newaukum River – Subwatershed Scale Restoration Priorities - Coho Salmon
Newaukum Reach Scale, Restoration/Protection Priorities, Spring-run Chinook Salmon
Newaukum Reach Scale, Restoration/Protection Priorities, Coho Salmon
EDT Conceptual Model for Habitat Diversity: Coho Summer Rearing Life Stage

Productivity = Life stage Benchmark X Factor Adjustment

Potential Actions:
- Riparian Plantings
- Engineered Structures
- Both
EDT Next Steps

• Extend analysis to all species and populations
• Link to processes controlling habitat conditions
• Link to strategies for addressing limiting conditions
• Identify spatial priorities for restoration and protection
• Create public sites for mapping products
Break
Newaukum River Case Study

- Watershed process drivers
- What we know about habitat conditions/processes and biological responses
- Hypothesized pathways to impaired habitat conditions
- Preliminary strategies
Google Earth Tour of Newaukum River
Watershed Process Drivers

- Topography
- Geology
- Climate
- Land use
Knowledge of Impaired Habitat Conditions from Literature and other Data Sources

- Lack of large wood
- Poor riparian function
- High temperatures
- Low flows
- Large quantities of fine sediments
- Channel confinement
- Barriers
Newaukum River Limiting Habitat Conditions

Coho

Spring Chinook
Habitat Diversity has Largest Limiting Effect

Driven by

- Riparian function
- Large wood
Newaukum River: Large Wood

**Process Drivers**
- Land use that removes or displaces riparian vegetation

**Impaired Watershed Process**
- Disturbed forest growth and succession
- Impaired recruitment or delivery of large wood

**Physical and Ecological Responses**
- Reduced large wood loading
- Loss of subordinate habitat forming processes

**Habitat Condition**
Lack of large wood reduces habitat diversity which reduces salmonid habitat quality (survival) and quantity (capacity)

**Biological Response**
Reduced salmonid abundance and productivity

**Important Locations (TBD)**

**Strategy:** Restore riparian forest growth, succession, and recruitment processes to increase quantity of large wood and improve Coho and Spring-run Chinook salmon abundance in Newaukum River
Newaukum River: High Water Temperatures

**Process Drivers**
- Water withdrawals
- Land use that removes riparian vegetation

**Impaired Watershed Process**
- Low flows
- Disturbed forest growth and succession
- Reduced shading

**Physical and Ecological Responses**
- Increased solar heating
- Higher summer temperatures

**Habitat Condition**
High water temperatures reduce salmonid habitat quality (survival) and quantity (capacity)

**Biological Response**
Reduced salmonid abundance and productivity

**Important Locations (TBD)**

Strategy: Restore instream flows and riparian vegetation to reduce summer water temperatures and improve Coho and Spring-run Chinook salmon abundance in Newaukum River
Summary of Preliminary Strategies

1. Restore/protect riparian forest succession and recruitment processes to increase quantity of large wood

2. Restore/protect riparian forest growth and shading to improve riparian function

3. Restore/protect instream flows and riparian vegetation to reduce summer water temperatures
Summary of Preliminary Strategies

4. Restore altered hydrograph to increase summer flows

5. Restore vegetation and exposed soils in disturbed upland and riparian areas to reduce the deposition of fine sediments in aquatic habitats

6. Restore/protect connections between the river and CMZ to reduce channel confinement

7. Restore/protect longitudinal connectivity in stream habitats to reduce barriers to fish passage
Part III: Next Steps

• Incorporate new information from on-going/current research and assessments
• Update EDT diagnoses
• Run EDT on all sub-basins
• Overlay EDT, amphibian and waterfowl occupancy
• Evaluate and prioritize restoration strategies
• Input from stakeholders
Next Steps

Conceptual Model (CM) Template by Sub-Basin (No Detailed Strategy)
December-Early January 2016

Workshop
Process for Strategy Development and Straw Man Strategy for Newaukum
January 21, 2016

CM with Preliminary Draft Detailed Strategy by Sub-Basin
Late January-Mid February 2016

Workshop
Preliminary Draft Strategies by Sub-Basin
Mid-Late February 2016

Draft Strategies by Sub-Basins
End of March 2016

Quantify Benefit of Restoration Strategies
April to June 2016

EDT Diagnostics

EDT Diagnostics + Input from Local Experts

Final Prioritized Strategies Integrated into ASRP
June to December 2016

Complete ASRP
End of December 2016

Integrate Watershed Assessment
2017

Implement and Adaptively Manage ASRP
2017 and Beyond
Information to Refine Strategies

Near-term

• Floodplain habitat conditions – NOAA Watershed Assessment
• Culvert barriers – WDFW, Fish Passage Board
• Refined temperature - WDFW
• Chum spawning distributions - WDFW
• Spring Chinook holding and spawning locations - WDFW
• Biological response to near-term restoration- NOAA Watershed Assessment, EDT
• Identification of important locations, goods and services
Information to Refine Strategies

Long-term

• Climate change - CIG
• Sediment supply, routing - geotechnical support at identified restoration sites
• Biological response to restoration - Watershed Assessment, EDT
• Juvenile salmon summer rearing habitat and run-timing - WDFW
• Chinook population level spawn-timing - WDFW
• Steelhead population structure - WDFW
• Geomorphology – subbasin large wood, sediment input/transport
Unknowns

• Precise impact of climate change

• How/if/where land use patterns will change

• Habitat interactions under different restoration scenarios and need for adaptive management
What We Need From You

• Developing sub-basin specific strategies, restoration actions

• Identifying important locations – rare habitat, thermal refugia, cultural

• Identifying and acquiring new sources of information/data for habitat and species

• Continuous involvement
Sub-basins

- Humptulips
- Hoquium
- Wishkah
- Elk River
- Elk Creek
- Johns
- Wynoochee
- Satsop
- Skookumchuck - to South Fork

- Newaukum
- Black
- Lower Chehalis – mainstem and tributaries
- Middle Chehalis - tributaries
- Scatter Creek
- South Fork Chehalis - to Pe Ell
- Upper Chehalis
How to Help

• Provide information today using flipcharts

• Contact Carol Cloen at WDFW by February 12
  Email: carol.cloen@dfw.wa.gov
  Phone: 360-902-2603

• Review outputs from EDT online:
  http://ecosystems.azurewebsites.net/Maps/Chehalis_Salmon_Priorities/
A habitat assessment approach for restoration planning

Tim Beechie
NOAA Fisheries, Seattle
Two main objectives

• Identify habitats that limit salmon population recovery

• Identify restoration scenarios that provide the largest benefit to salmon populations
Q1: How have habitats changed and altered biota?
What do we need to know?

- Q2: What are the root causes of habitat and biological change?
- Q1: How have habitats changed and altered biota?
Q1: habitat and species changes

- Summarize habitat changes across the restoration area
- Quantify importance of each habitat loss to species of interest

Beechie et al. (2010)
Q2: Root causes of habitat change

Sediment supply

Hydrology

Migration barriers

Floodplain connection

Riparian condition

Aggregate score

Beechie et al. (2013)
Evaluate restoration alternatives

From Beamer et al, 2000
Develop a strategy

Beechie et al. (2013)
Data needs

- Historical and current habitat areas by habitat type for tributary, large river, beaver pond, delta, lakes
- Fish density and survival data by habitat type or condition
- Natural and current watershed processes rates or conditions (e.g., sediment supply, riparian function, connectivity)
Species and scales

- The model can be used to evaluate restoration alternatives for any species for which sufficient density and survival data exist.

- Source data are habitat unit scale, but life-cycle model is run on areas no smaller than sub-watersheds (and preferably population scale).
Model outputs

- **Question 1:**
  - Change in smolt or adult population size resulting from past land use effects
  - Change in smolt or adult population size resulting from future restoration alternatives

- **Question 2:**
  - Changes in watershed process rates or functions by process
References


References


Questions/Discussion