

# Monitoring and Evaluation of Coho Salmon Habitat Restoration Projects

Washington Department of Fish and Wildlife  
Habitat Program, Environmental Restoration Division,  
(SSHEAR) TAPPS

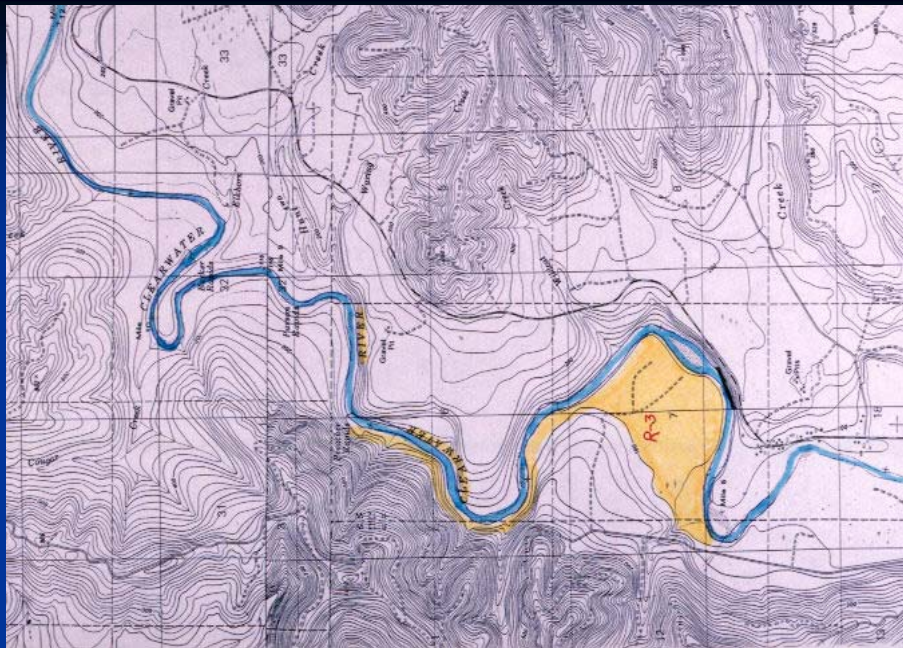
Alex Uber

## Background

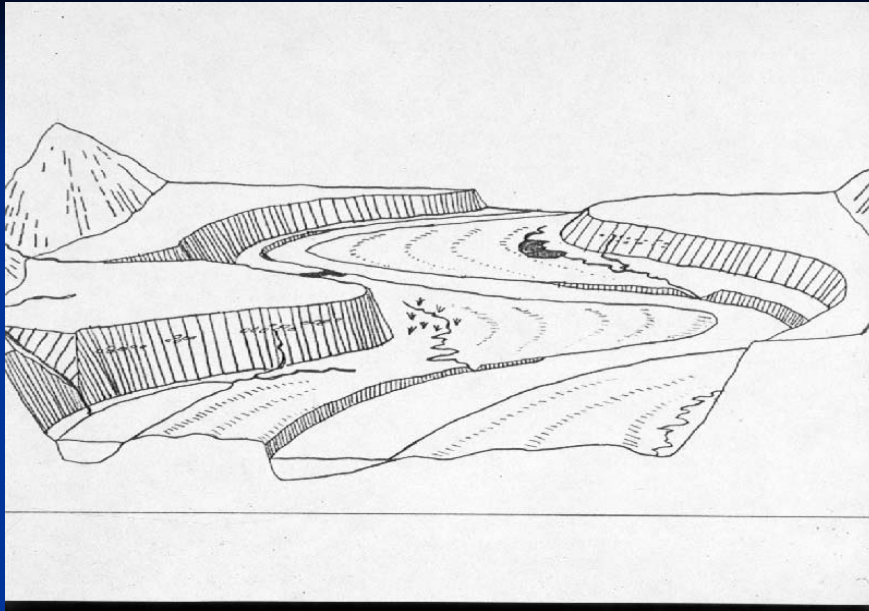
- Wild coho stocks: weak link in mixed stock fisheries
- Enhancement program initiated in watersheds managed for wild stocks (North Puget Sound and North Coast of Washington)
- Goal of enhancement program: “Increase and stabilize key coho production habitats”

## Objective: Restore coho salmon refugia habitat lost due to human activities

- Restore/recreate off-channel spawning/rearing areas and tributaries
- Restore lost habitat within 'wall-based' and floodplain channels
- Natural seeding through straying, spring/fall juvenile migrations



Wall-based Floodplain Channel, Clearwater River, WA



Floodplain Cross-section, Wall-based Channels



## Habitat Inventory and Assessment

Initiated in 1980's using aerial photos, maps, field surveys

Surveys ongoing on North Coast and North Sound

Identify and Prioritize:

- Impassable human-made barriers
- Stable hydrology (avoid summer low flow limitations)
- Groundwater interception channels (North Sound)

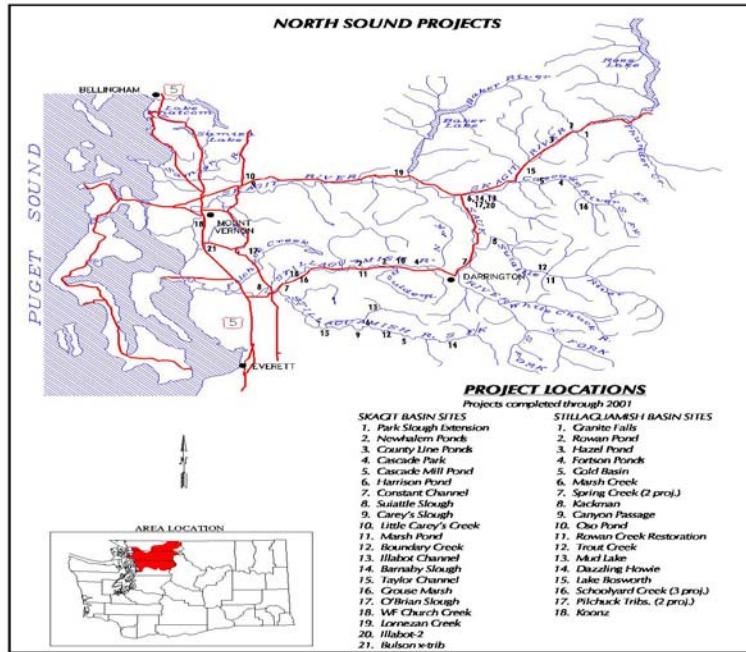


Figure 1.

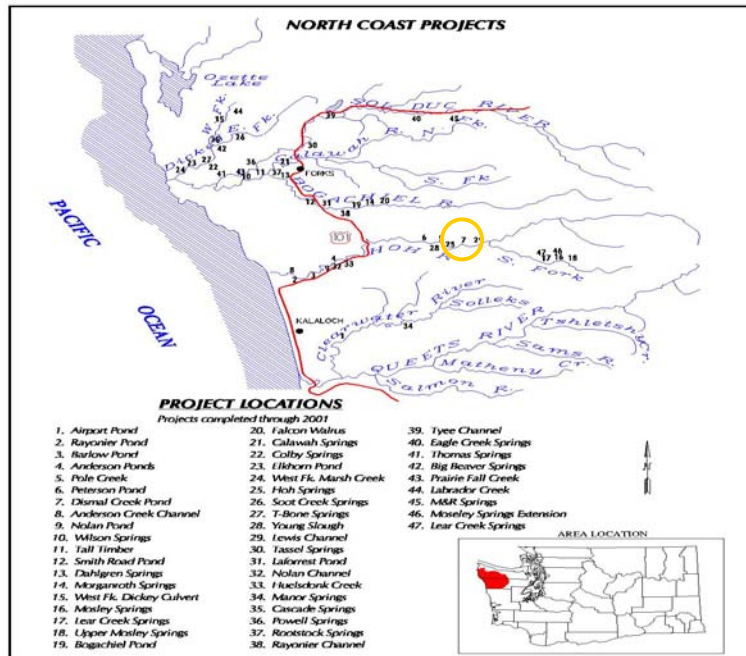


Figure 5.

## Hoh River Valley



## Dismal Pond, Hoh River, pre-construction



**Dismal Pond, under construction**



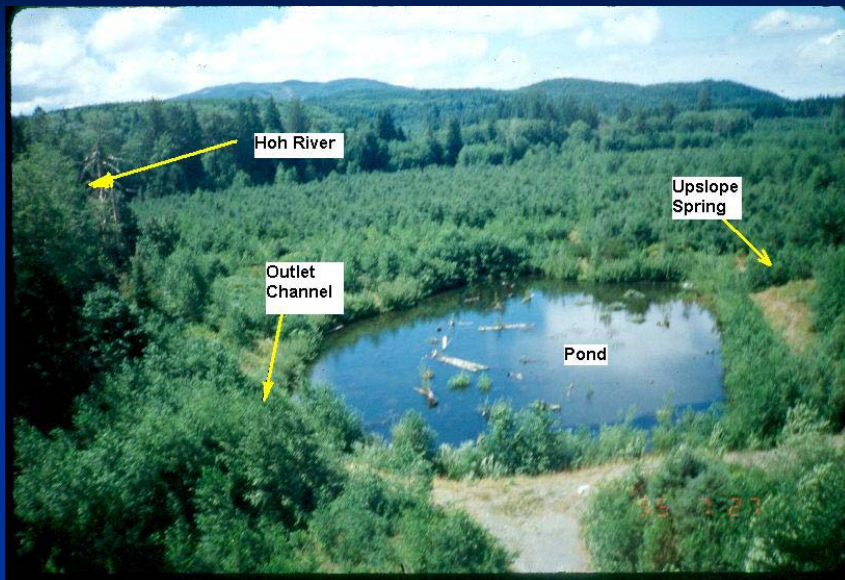
**Dismal Pond, restoration complete**



Dismal Pond, 2000



Dismal Pond, 1995



## Hoh Flows vs Immigrant Coho Dismal Pond '91/92

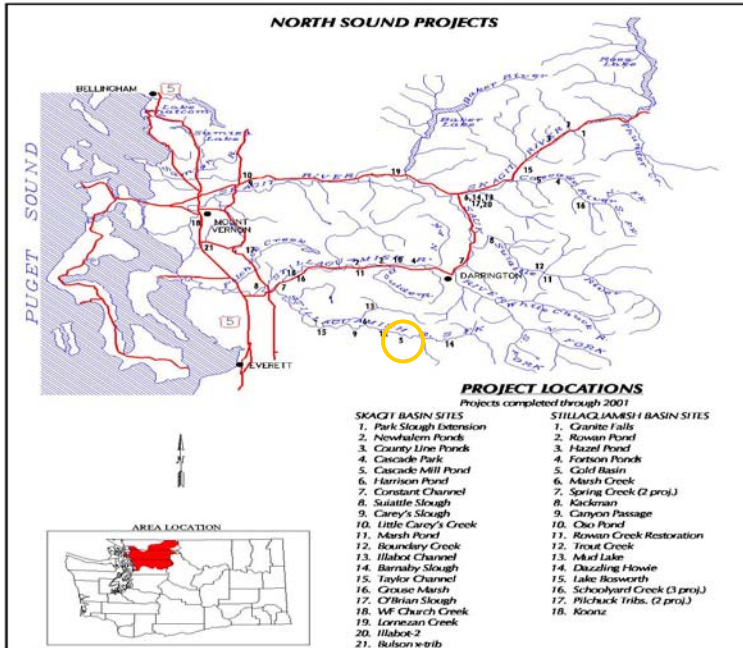
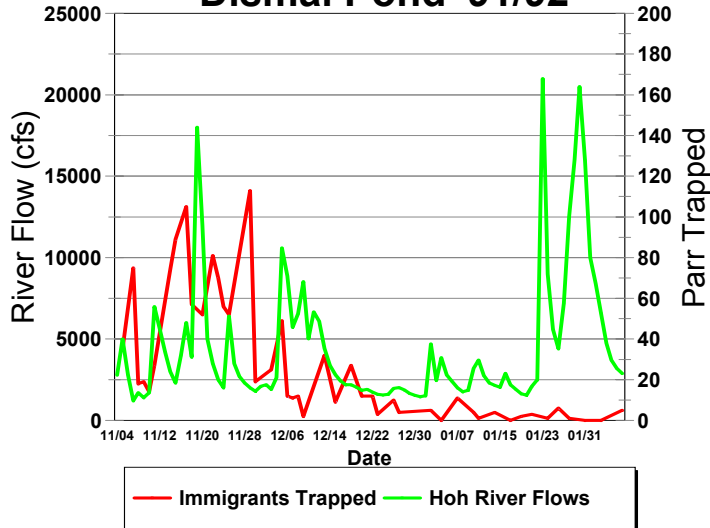
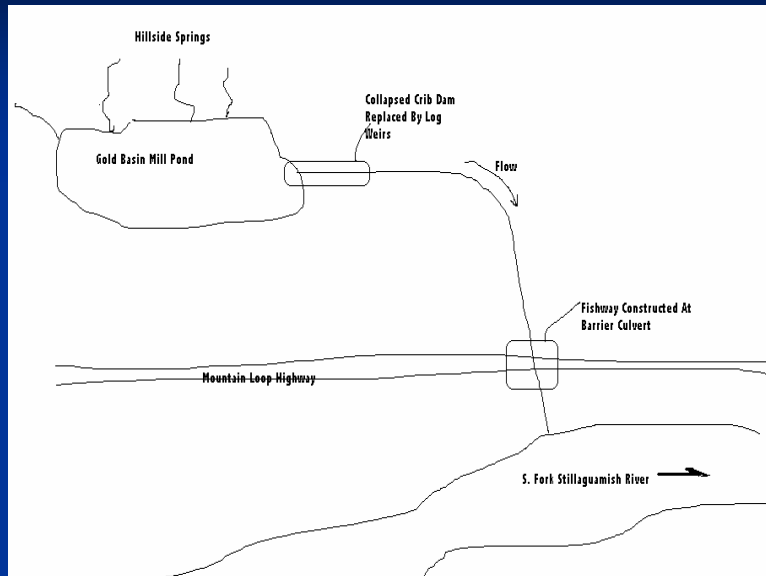


Figure 1.

# Gold Basin Restoration Site S. Fork Stillaguamish



## Gold Basin Site, abandoned mill pond





**Gold Basin Site,  
mill pond outlet  
restored access**

**Gold Basin Site, SF Stillaguamish  
highway culvert pre-construction**



**Gold Basin Site, highway culvert fishway**



**Gold Basin Restoration Site Outlet, S Fk Stillaguamish**



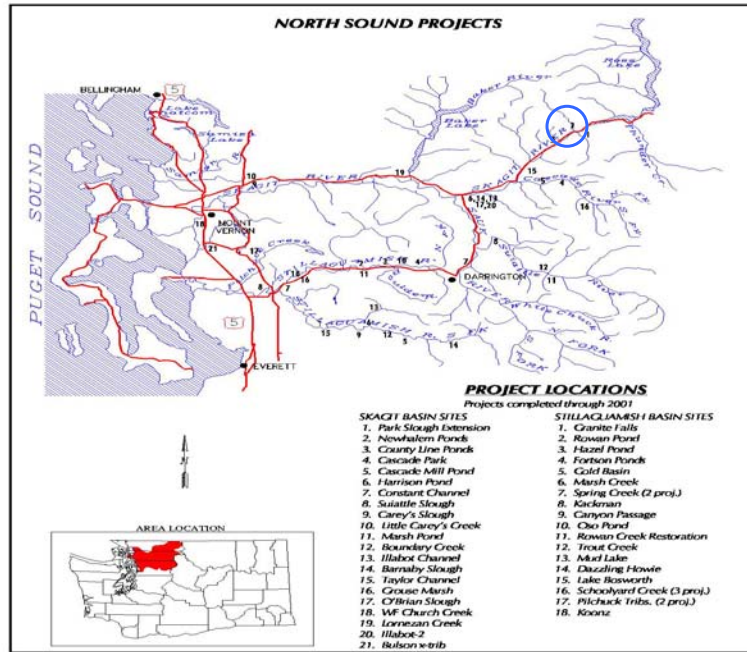
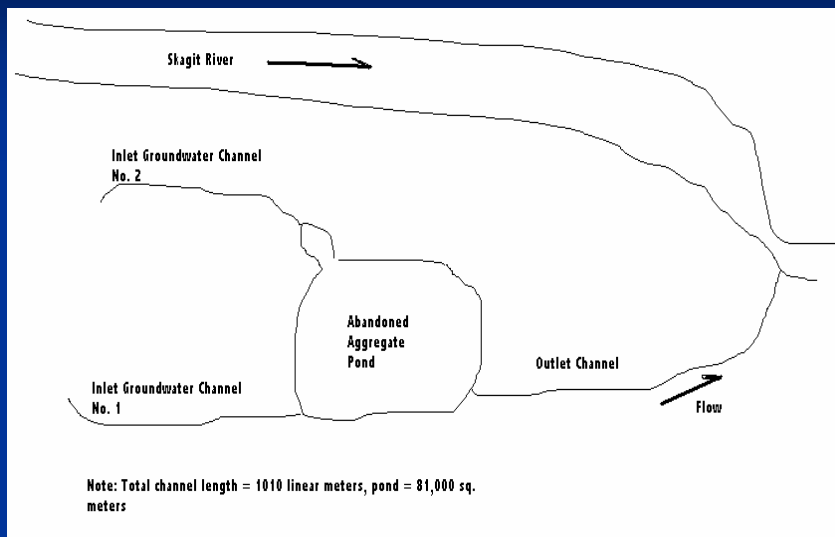


Figure 1.

## Newhalem Restoration Site, Skagit River



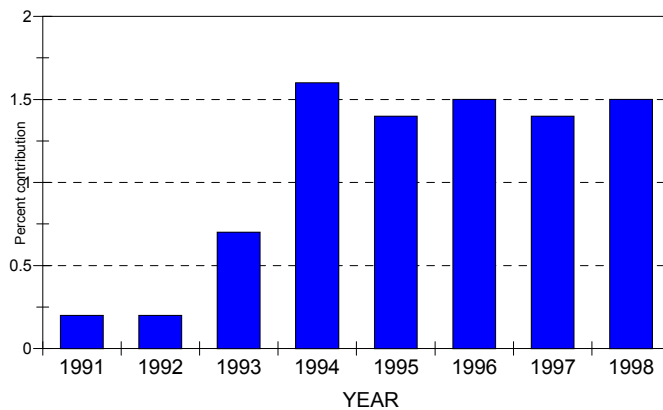


## Groundwater Channels, Newhalem Restoration Site, Skagit River



## NEWHALEM PONDS

% Coho Spawner Contribution to Skagit



## Restored/Recreated Habitat Totals

- North Sound
  - 39 projects since 1991
  - ~888,800 m<sup>2</sup> (220 acres)
- North Coast
  - 48 projects since 1987
  - ~216,000 m<sup>2</sup> (52 acres)
- **Overall Habitat Area Restored: >1,100,000 m<sup>2</sup> (272 acres)**

## Monitoring and Evaluation



- Spawner Surveys
  - restored habitat use
  - density
- 2-way weirs
  - Juvenile seasonal migrations
  - rearing density
  - overwinter survival
  - growth

## Adult Coho Spawner Surveys

- Density varied between 0.007 and 0.343 fish/m<sup>2</sup>
- Skagit mean density 0.39 fish/m<sup>2</sup>
- Stillaguamish mean density 0.21 fish/m<sup>2</sup>

## Juvenile Immigrant/Emigrant Surveys



Immigrant/Emigrant  
Juvenile Trap

Measuring, Marking  
Juvenile Migrants





Marked Juvenile Coho

## Overwinter Survival

- **North Sound** (3 trap sites, 8 sample yrs)

Overwinter survival 20% -50%

Ave = 40%

- **North Coast\*** (14 trap sites, 53 sample yrs)

Overwinter survival 4% - 90%

Ave = 37%

\* Hoh system = 34%, Bogachiel system = 39%

# Mean Annual Smolt Production Estimates\*

- **North Sound** (11 Skagit traps, 5 Stillaguamish traps)
  - ~182,000 smolts from 22 Skagit sites
  - ~68,000 smolts from 25 Stillaguamish sites
  
- **North Coast** (17 Hoh traps, 10 Quillayute traps)
  - ~16,000 smolts from 18 Hoh Sites
  - ~32,000 smolts from 27 Quillayute sites

\*As of 2001

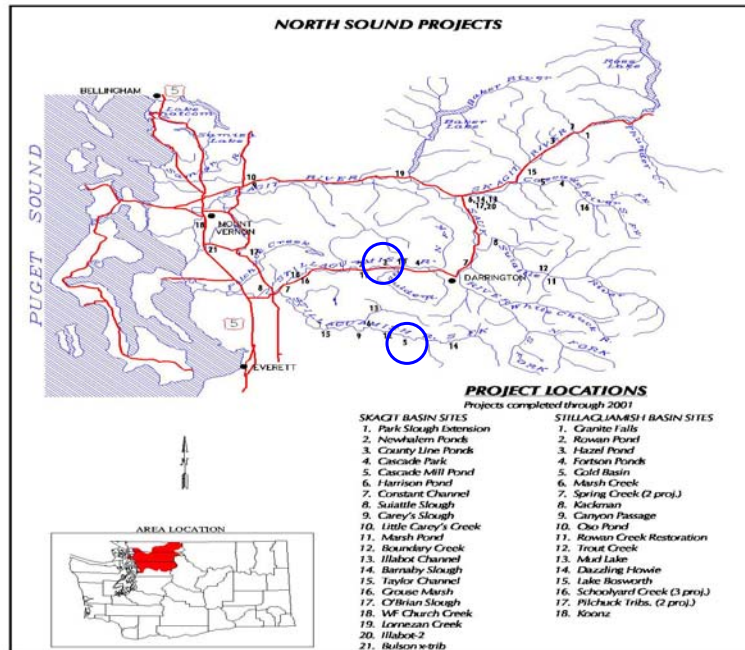
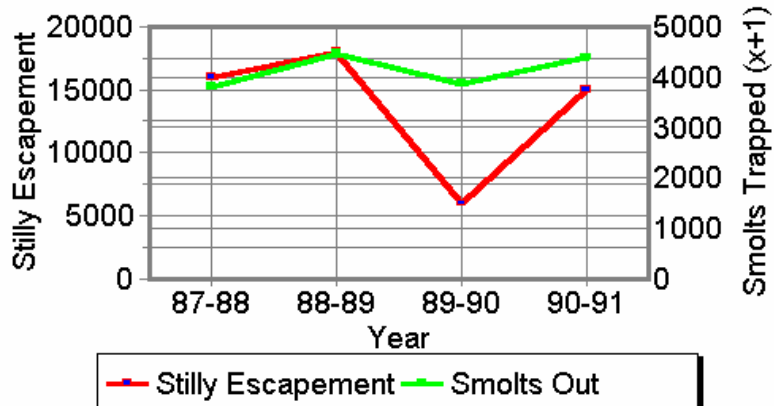


Figure 1.

## Hazel Project Site N.F. Stillaguamish



Area/Basin	No. of Projects	Habitat Restored (m <sup>2</sup> )	Total Project Smolt Production	Basin Smolt Production	Potential Project Contribution (% Total Basin)
<b>North Sound</b>					
Skagit	22	507,000	182,000	1,015,080 <sup>a</sup>	18
Stillaguamish	25	382,000	68,000 <sup>e</sup>	276,000 <sup>b</sup>	24
<b>North Coast</b>					
Hoh	18	74,000	16,000	80,000 <sup>c</sup>	20
Quillayute	27	118,000	32,000	306,000 <sup>d</sup>	10

<sup>a</sup> 11 yr sampling average  
<sup>b</sup> 3 yr sampling average (1981-1983)  
<sup>c</sup> 20 yrs of Clearwater River sampling  
<sup>d</sup> 6 yr sampling average: Bogachiel (1987-1990), Dickey (1992-1994)  
<sup>e</sup> does not include 4 large projects on SF Stillaguamish

# Summary

- >1,100,000 m<sup>2</sup> high quality refugia habitat restored/recreated by TAPPS (SSHEAR) since 1987
- Direct benefits: Significant coho production contribution to North Sound and North Coast watersheds
- Indirect benefits: Creation of coho refugia habitat. Improved ecosystem function

([www.wa.gov/wdfw/hab](http://www.wa.gov/wdfw/hab))