

Slide 1



Salmon Habitat Restoration Projects:
Success or Learning Opportunity?

Washington Salmon Recovery Funding Board

**Reach Scale Effectiveness
Monitoring Program**

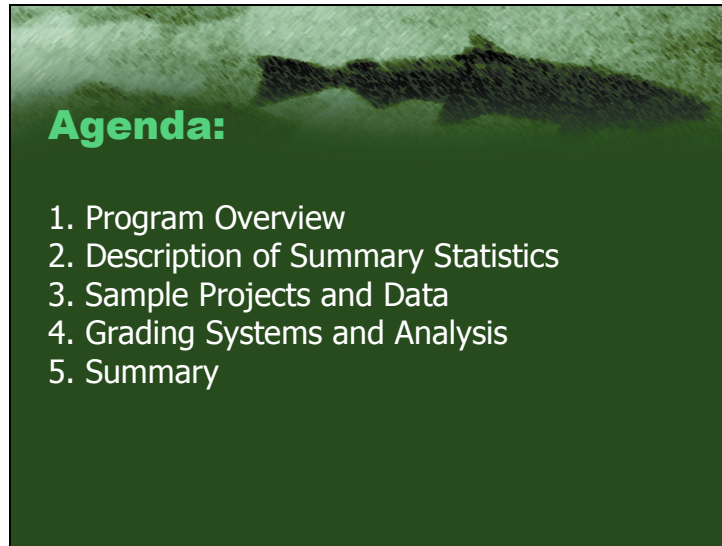
2005 Progress Report

Preliminary Findings



My name is Jennifer O’Neal and I work for Tetra Tech EC here in Seattle. I am the Project Manager for the Washington State Salmon Recovery Funding Board for their Reach Scale Effectiveness Monitoring Program and today will be presenting the preliminary findings from the first year of data collection.

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Initially I will give a brief overview of the program and then move directly into our reporting statistics and sample data for each project type. I will then discuss some of the existing grading systems we are looking at using, and finish with a brief summary.

Program Overview

Restoration vs. Habitat Protection

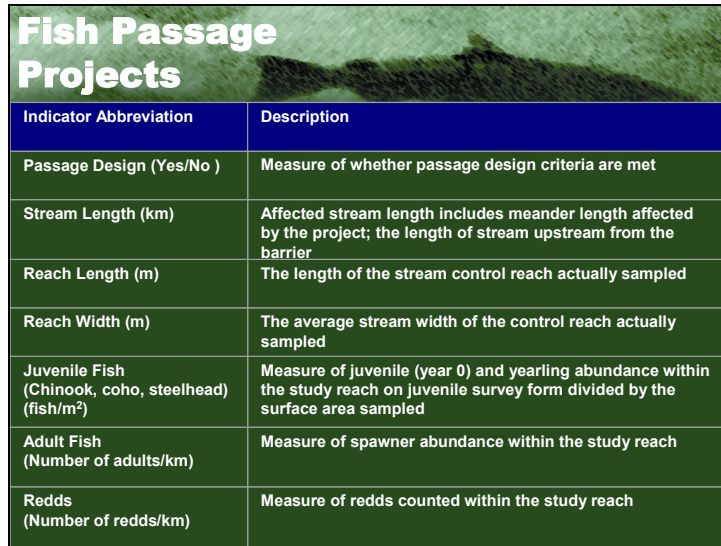
- **Restoration Projects – Monitoring has BACI Design with control and impact reaches; EMAP sample reach; Uses t-test to look for differences before and after implementation (5-10 years)**
- **Habitat Protection Projects – Monitoring focuses on trends in ecological health through time (12 years)**

The Reach Scale Effectiveness Monitoring Program is focused on determining the site specific effectiveness of specific projects funded by the Washington Salmon Recovery Funding Board. These projects broadly fall into two groups – Restoration Projects (where an action takes place on the landscape) and Habitat Protection Projects (where habitat is preserved as is, and the goal is to maintain or improve the condition over time through natural processes). In Restoration Projects, control and impact reaches are generally established and these reaches are sampled before and after the action is implemented to accommodate a Before-After-Control-Impact (or BACI) sample design, and allow for a paired t-test to be used to compare data before and after implementation. Data will be collected after implementation for up to 5 to 10 years depending on project type. For Habitat Protection Projects, ecological health will be tracked through time by measuring in-channel conditions, fish assemblages, aquatic macroinvertebrate communities, riparian vegetation, and upland vegetation over 12 years.



Restoration Projects are grouped into seven project types. The concept is that rather than sample every project, (which is not feasible) that by sampling project types, it would be possible to determine the general effectiveness of a given project type. Each project type has specific goals and specific protocols to collect data that is relevant to whether those goals are achieved or not. As mentioned before, habitat protection projects involve sampling across the parcel and ecological health is tracked through time using a large number of metrics.


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Indicator Abbreviation	Description
Passage Design (Yes/No)	Measure of whether passage design criteria are met
Stream Length (km)	Affected stream length includes meander length affected by the project; the length of stream upstream from the barrier
Reach Length (m)	The length of the stream control reach actually sampled
Reach Width (m)	The average stream width of the control reach actually sampled
Juvenile Fish (Chinook, coho, steelhead) (fish/m ²)	Measure of juvenile (year 0) and yearling abundance within the study reach on juvenile survey form divided by the surface area sampled
Adult Fish (Number of adults/km)	Measure of spawner abundance within the study reach
Redds (Number of redds/km)	Measure of redds counted within the study reach

Explain summary statistics – definitions, methods for collection.


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Stream Physical Characteristics				
	CONTROL		IMPACT	
Variable^{1/}	Year 0	Year 1	Year 0	Year 1
Stream Length (m)	N/A	N/A	1,287.48	1,287.48
Reach Length (m)	150	150	120	120
Reach Width (m)	8.00	8.00	2.82	2.82
Fish Data				
Coho Adults (fish/km)	53.3	73.33	0	173.33
Coho Redds (redds/km)	53.3	6.67	0	6.67
Fish Passage				
Passage Design (y/n)	N/A	N/A	N/A	yes

Example of data from a current fish passage project. This data is “pre-project” or before implementation data. As you can see there is some use by juveniles above the barrier (although these are likely rainbow vs. steelhead) and there was a carcass noted above the barrier, although this may have been moved by animals feeding in the area. The culvert is perched above a pool and does not currently allow sufficient passage. The culvert will be replaced this summer and we will go back to monitor both adults and juveniles after the replacement is complete.

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Instream Structure Projects

Indicator Abbreviation	Description
Artificial Instream Structures (#)	Measure of the number of instream structures within the study reach
Mean Vertical Pool Profile Area (m ² per reach)	Mean thalweg vertical profile area for the study reach
Mean Residual Pool Depth (m ² per 100m)	Mean thalweg residual depth within the study reach
Large Woody Debris Volume (m ³)	Volume of large woody debris of all sizes within the study reach
Stream Length (km)	Affected stream length includes meander length affected by the project
Reach Length (m)	The length of the stream control reach actually sampled
Reach Width (m)	The average stream width of the control reach actually sampled
Juvenile Fish (Chinook, coho, steelhead) (fish/m ²)	Measure of juvenile (year 0) and yearling abundance within the study reach on juvenile survey form divided by the surface area sampled

Summary statistics for Instream Structures. Same reach layout (EMAP reach) as fish passage, but more focused on the in-channel habitat conditions and only use by juvenile fish.

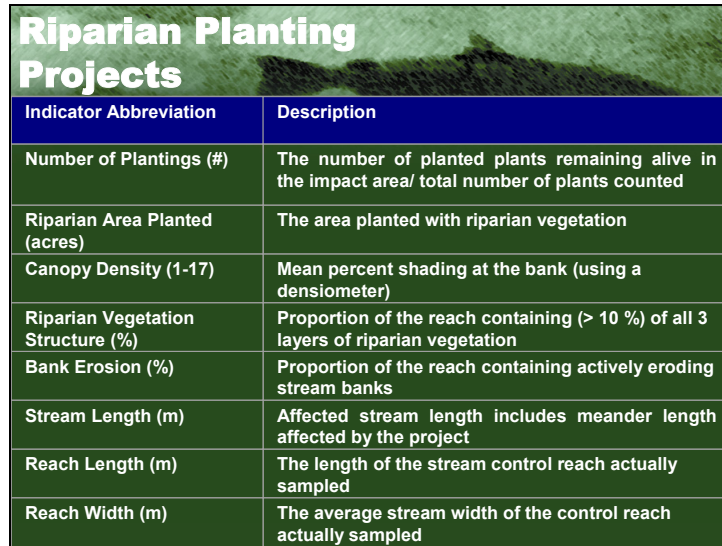
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Stream Physical Characteristics				
Variable^{1/}	CONTROL		IMPACT	
	Year 0	Year 1	Year 0	Year 1
Mean Residual Pool Vertical Profile Area (m ² /reach)	12.33	9.96	18.03	17.56
Mean Residual Depth (m ² /100m)	6.85	5.57	10.02	9.81
Log (Volume of LWD (m ³))	1.16	1.04	0.52	1.46
Stream Length (m)	N/A	N/A	0	1600
Reach Length (m)	180	180	180	180
Reach Width (m)	3.01	3.10	5.49	4.97
Fish Data				
Chinook Juveniles (fish/m ²)	0	0	0.009	0
Coho Juveniles (fish/m ²)	0.179	0.057	0.597	0.105
Steelhead Parr (fish/m ²)	0.020	0.082	0.065	0.055
In-Stream Structures				
Artificial Instream Structures Present (#)	N/A	N/A	N/A	13

Here is data collected from an example site. This is a wood placement project. It is interesting to note that when sampled in 2004, the reach level density of juveniles was higher in the impact reach than in the control reach. The data from 2005, when compared using a paired t-test on the differences between control and impact in 2004 and those same differences in 2005 will help us to calibrate the effectiveness of the project.

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Indicator Abbreviation	Description
Number of Plantings (#)	The number of planted plants remaining alive in the impact area/ total number of plants counted
Riparian Area Planted (acres)	The area planted with riparian vegetation
Canopy Density (1-17)	Mean percent shading at the bank (using a densiometer)
Riparian Vegetation Structure (%)	Proportion of the reach containing (> 10 %) of all 3 layers of riparian vegetation
Bank Erosion (%)	Proportion of the reach containing actively eroding stream banks
Stream Length (m)	Affected stream length includes meander length affected by the project
Reach Length (m)	The length of the stream control reach actually sampled
Reach Width (m)	The average stream width of the control reach actually sampled


Summary Statistics for Riparian Planting Projects. Focus is on complexity of riparian vegetation structure, and canopy density. After implementation, projects will be monitored for changes in these elements, as well as survival of the plantings.

Riparian Planting Projects

02-1446R Centralia Riparian Restoration Project

Stream Physical Characteristics				
Variable ^U	CONTROL		IMPACT	
	year 0	year 1	year 0	year 1
Stream Length (m)	NA	N/A	0	1609.34
Reach Length (m)	150	150	150	150
Reach Width (m)	17	17	25	25
Riparian Characteristics				
Canopy Density (1-17)	2.17	2.62	0.79	1.18
Riparian Vegetation Structure (%)	81.82	45.45	0	7.69
Bank Erosion (%)	0	12	50	50
Riparian Planting				
Number of Plantings	N/A	N/A	0	433.3
Remaining (#/acre)	N/A	N/A	0	24.4

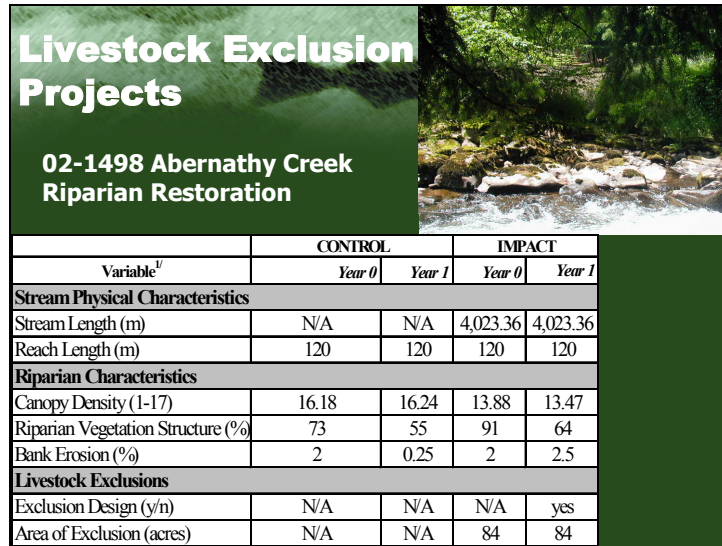
Example data from a riparian planting in Centralia. This area has not been planted yet, so the bottom two numbers are still zero for the impact reach. You can see that both Canopy density and riparian vegetation structure are much higher in the control reach than in the impact reach. Data from 2005 will capture the changes in these variables.



Livestock Exclusion Projects

Indicator Abbreviation	Description
Exclusion Design (y/n)	The number of livestock exclusions meeting the design criteria for excluding livestock from the stream
Area of Exclusion (acres)	The area excluded with fencing
Canopy Density (1-17)	Mean percent shading at the bank (using a densiometer)
Riparian Vegetation Structure (%)	Proportion of the reach containing (> 10 %) of all 3 layers of riparian vegetation
Bank Erosion (%)	Proportion of the reach containing actively eroding stream banks
Stream Length (m)	Affected stream length includes meander length affected by the project
Reach Length (m)	The length of the stream control reach actually sampled
Reach Width (m)	The average stream width of the control reach actually sampled

Summary statistics from livestock exclusions. The focus is on riparian vegetation (canopy density and riparian vegetation structure) as well as the level of bank erosion, the level of function of the exclusion and the area of the exclusion.




Livestock Exclusion Projects

02-1498 Abernathy Creek Riparian Restoration

Variable ¹	CONTROL		IMPACT	
	Year 0	Year 1	Year 0	Year 1
Stream Physical Characteristics				
Stream Length (m)	N/A	N/A	4,023.36	4,023.36
Reach Length (m)	120	120	120	120
Riparian Characteristics				
Canopy Density (1-17)	16.18	16.24	13.88	13.47
Riparian Vegetation Structure (%)	73	55	91	64
Bank Erosion (%)	2	0.25	2	2.5
Livestock Exclusions				
Exclusion Design (y/n)	N/A	N/A	N/A	yes
Area of Exclusion (acres)	N/A	N/A	84	84


Example data from a livestock exclusion. Planned exclusion for this site is 84 acres. Canopy density is currently lower in the impact site, but the complexity of riparian vegetation structure is slightly higher. The control site is not expected to change during the monitoring, but by measuring change in the impact site, we will be able to measure the effectiveness of the livestock exclusion.



Constrained Channel Projects

Indicator Abbreviation	Description
Bankfull Height (m)	Mean bankfull height within the study reach
Bankfull Width (m)	Mean bankfull width within the study reach
Mean Vertical Pool Profile Area (m ² per reach)	Mean Thalweg vertical profile area for the study reach
Mean Residual Pool Depth (m ² per 100m)	Mean Thalweg residual depth within the study reach
Mean Bankfull Cross-Sectional Area (m ²)	Study reach bankfull channel capacity
Stream Length (m)	Affected stream length includes meander length affected by the project
Reach Length (m)	The length of the stream control reach actually sampled
Channel Constraint Removed (y/n)	Is the setback still in place?

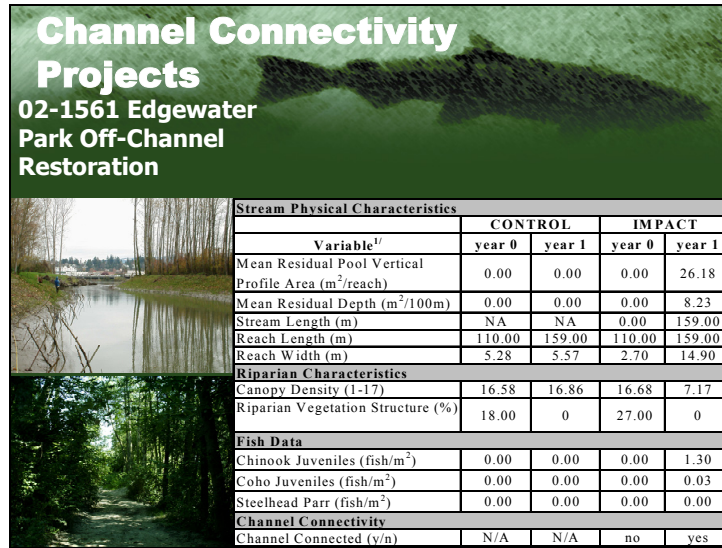
Summary Statistics for constrained Channels. Focus is on channel capacity as measured by bankfull height times bankfull width, as well as the presence/absence of the channel constraint, and in-channel habitat features.

				
Stream Physical Characteristics				
Variable ^{1/}	CONTROL		IMPACT	
	Year 0	Year 1	Year 0	Year 1
Height of Constraining Structure at Bankfull Width (m)	2.69	2.00	3.05	2.20
Bankfull Width (m)	175.00	183.67	144.26	151.18
Mean Residual Pool Vertical Profile Area (m ² /reach)	215.95	351.66	754.69	792.60
Mean Residual Depth (m ² /100m)	43.19	66.98	143.74	158.52
Reach Length (m)	500.00	500.00	500.00	500.00
Stream Length (m)	N/A	N/A	0.00	762.00
Channel Constraint				
Mean Bankfull Cross-Sectional Area	470.31	367.34	439.73	332.6
Channel Constraint Removed (y/n)	N/A	N/A	no	yes


Example data from a dike removal project on the Skagit River. Mean residual depth at this site is in meters, not in cm. The bankfull cross sectional areas in the control and impact reaches are currently similar. The dike has been removed and subsequent monitoring will show the effects of that action.

Channel Connectivity Projects	
Indicator Abbreviation	Description
Mean Vertical Pool Profile Area (m ² per reach)	Mean Thalweg vertical profile area for the study reach
Mean Residual Pool Depth (m ² per 100m)	Mean Thalweg residual depth within the study reach
Canopy Density (1-17)	Mean percent shading at the bank (using a densiometer)
Riparian Vegetation Structure (%)	Proportion of the reach containing (> 10 %) of all 3 layers of riparian vegetation
Juvenile Fish (Chinook, coho, steelhead) (fish/m ²)	Measure of juvenile (year 0) and yearling abundance within the study reach on juvenile survey form divided by the surface area sampled
Stream Length (m)	Affected stream length includes meander length affected by the project
Reach Length (m)	The length of the stream control reach actually sampled
Channel Connected (y/n)	Measure of whether the channel has remained connected to the stream

Summary statistics for channel connectivity. Focus is on in-channel habitat, juvenile fish use (can be summer or overwintering), riparian vegetation, and the status of the channel connection.



Example data from a reconnection project also on the Skagit River. Very similar conditions currently between control and impact reaches. Both are off-channel habitat. Subsequent monitoring will show the effects of the reconnection which will occur this summer.




Indicator Abbreviation	Description
Area of Gravel (m ²)	Measure of gravel present after placement
Percent Fines (%)	Mean percent of the study substrate in fines
Percent Embedded (%)	Mean percentage of the substrate that is embedded within the study reach
Adult Fish (Number of adults/km)	Measure of spawner abundance within the study reach
Redds (Number of redds/km)	Measure of redds counted within the study reach

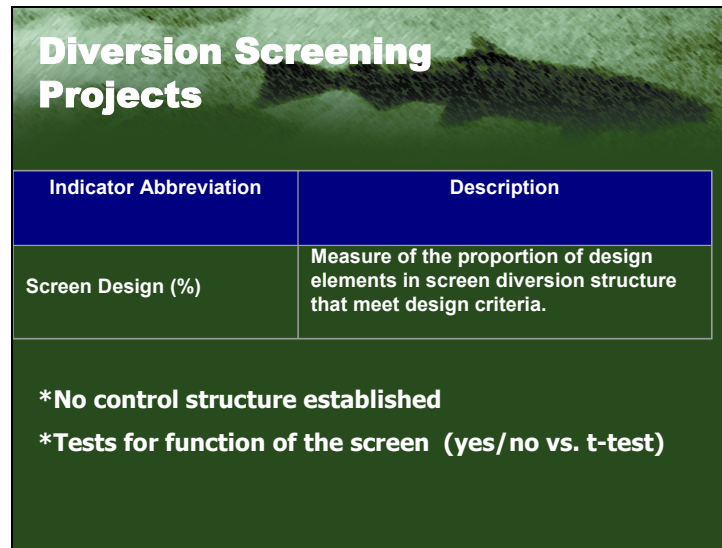
Summary statistics for spawning gravel projects. Focus is on the number of spawners and redds in the affected area, as well as substrate conditions. There are no current projects available for monitoring in this category from 2004. There are two project sites that will be monitored starting in the 2005 field season.

Spawning Gravel Projects

04-1209 Chico Creek Restoration



Substrate data		
Variable ^{1/}	Control	Impact
Gravel Present after placement (m ²)	1849.01	1266.26
%study substrate in fines	0	0
Mean %substrate embeddedness	26.63	32.64
Fish Data		
Chum redds (#/km)	372	784
Chum spawners (#/km)	3408	6864



Diversion Screening Projects

Indicator Abbreviation	Description
Screen Design (%)	Measure of the proportion of design elements in screen diversion structure that meet design criteria.

***No control structure established**
***Tests for function of the screen (yes/no vs. t-test)**

Summary statistics for Diversion Screening Projects. These projects do not follow the BACI design as there is not a control to use for the screen or diversion. The evaluation is a functional evaluation of the screen or diversion structure. Projects were not available for monitoring in 2004, but several projects have been identified for the 2005 field season.

Diversion Screening Characteristics


Characteristic
Parallel to River Flow
Approach Velocity < 0.20ft/s
Uniform Flow
Sweep Velocity > Approach Velocity
Sweep Velocity Does Not Decrease
Screen Mesh Size is Compliant
Screen Media is Corrosion Resistant
Gap Size is Compliant
Withdrawal Does not Exceed Maximum
Sweep Velocity is Sufficient to Sweep Away Debris
Clearance is Within Compliance

NOAA Fisheries Criteria

**Diversion Screening
Projects**

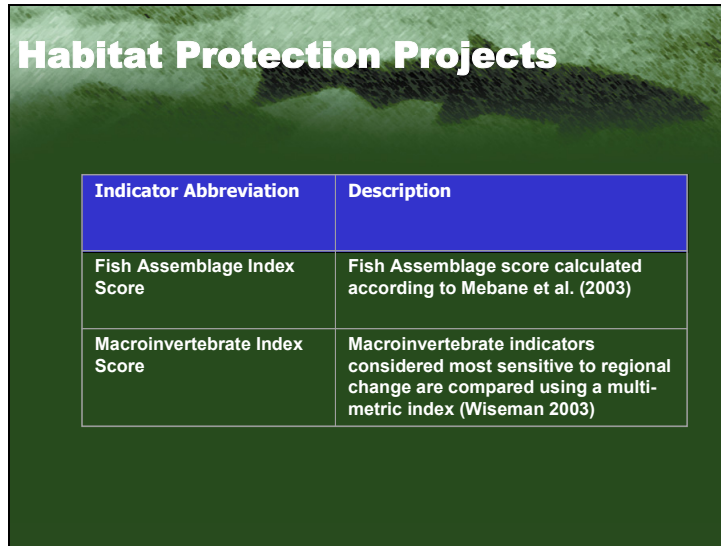
**02-1543 Walla Walla
Fish Screening Project**

Screen Design (%)	100
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Habitat Protection Projects	
Indicator Abbreviation	Description
Reach Length (m)	The length of the stream control reach actually sampled
Reach Width (m)	The average stream width of the control reach actually sampled
Mean Vertical Pool Profile Area (m ² per reach)	Mean Thalweg vertical profile area for the study reach
Mean Residual Pool Depth (m ² per 100m)	Mean Thalweg residual depth within the study reach
Large Woody Debris Volume (m ³)	Volume of large woody debris of all sizes within the study reach
Percent Fines (%)	Mean percent of the study substrate in fines
Percent Embedded (%)	Mean percentage of the substrate that is embedded within the study reach
Canopy Density (1-17)	Mean percent shading at the bank (using a densiometer)
Riparian Vegetation Structure (%)	Proportion of the reach containing (> 10 %) of all 3 layers of riparian vegetation
Bank Erosion (%)	Proportion of the reach containing actively eroding stream banks

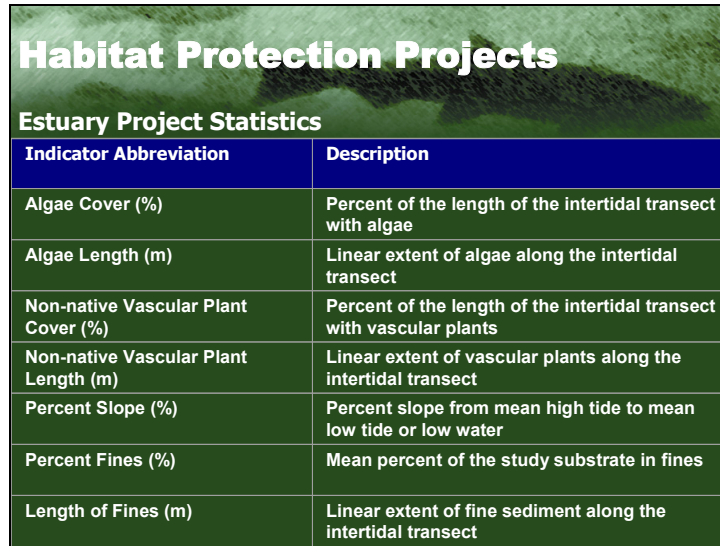
Summary statistics for Habitat Protection Projects. Many more monitoring activities to track ecological health through time. These are the summary variables for the inchannel habitat assessment for freshwater systems. Many of the same variables as we have already seen from the other project types.



Habitat Protection Projects

Indicator Abbreviation	Description
Fish Assemblage Index Score	Fish Assemblage score calculated according to Mebane et al. (2003)
Macroinvertebrate Index Score	Macroinvertebrate indicators considered most sensitive to regional change are compared using a multi-metric index (Wiseman 2003)

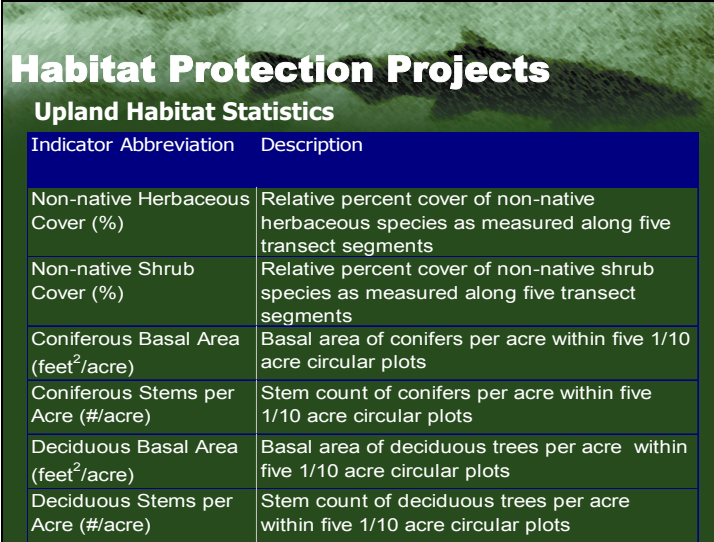
For freshwater habitats, we also collect data on fish assemblages, focusing on salmonids and sculpin species, as well as macroinvertebrates. These data are evaluated using index scores with established rating criteria.



Habitat Protection Projects
Estuary Project Statistics

Indicator Abbreviation	Description
Algae Cover (%)	Percent of the length of the intertidal transect with algae
Algae Length (m)	Linear extent of algae along the intertidal transect
Non-native Vascular Plant Cover (%)	Percent of the length of the intertidal transect with vascular plants
Non-native Vascular Plant Length (m)	Linear extent of vascular plants along the intertidal transect
Percent Slope (%)	Percent slope from mean high tide to mean low tide or low water
Percent Fines (%)	Mean percent of the study substrate in fines
Length of Fines (m)	Linear extent of fine sediment along the intertidal transect

For estuary habitat projects, we look at a different set of summary statistics. The focus is on sediment and vegetation in the estuary habitat.

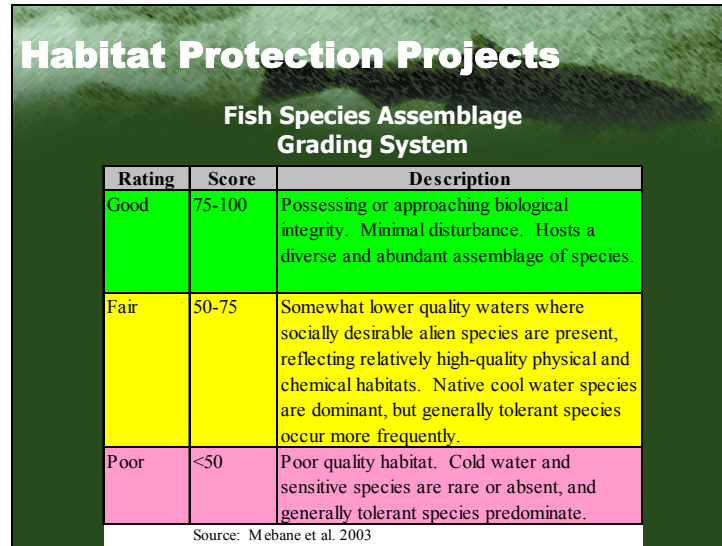


Habitat Protection Projects

Upland Habitat Statistics

Indicator	Abbreviation	Description
Non-native Herbaceous Cover (%)		Relative percent cover of non-native herbaceous species as measured along five transect segments
Non-native Shrub Cover (%)		Relative percent cover of non-native shrub species as measured along five transect segments
Coniferous Basal Area (feet ² /acre)		Basal area of conifers per acre within five 1/10 acre circular plots
Coniferous Stems per Acre (#/acre)		Stem count of conifers per acre within five 1/10 acre circular plots
Deciduous Basal Area (feet ² /acre)		Basal area of deciduous trees per acre within five 1/10 acre circular plots
Deciduous Stems per Acre (#/acre)		Stem count of deciduous trees per acre within five 1/10 acre circular plots

For all habitat protection projects, we conduct an assessment of the upland habitat that is being protected. These data are used to develop a relative disturbance rating that has been developed Natureserve and the Washington Natural Heritage Group.



Habitat Protection Projects

Fish Species Assemblage Grading System

Rating	Score	Description
Good	75-100	Possessing or approaching biological integrity. Minimal disturbance. Hosts a diverse and abundant assemblage of species.
Fair	50-75	Somewhat lower quality waters where socially desirable alien species are present, reflecting relatively high-quality physical and chemical habitats. Native cool water species are dominant, but generally tolerant species occur more frequently.
Poor	<50	Poor quality habitat. Cold water and sensitive species are rare or absent, and generally tolerant species predominate.

Source: Mebane et al. 2003

As previously mentioned, these are the rating criteria for the fish assemblage index scores from Mebane et al. 2003. The color coding indicates ranges of good, fair, and poor scores identified in the literature.

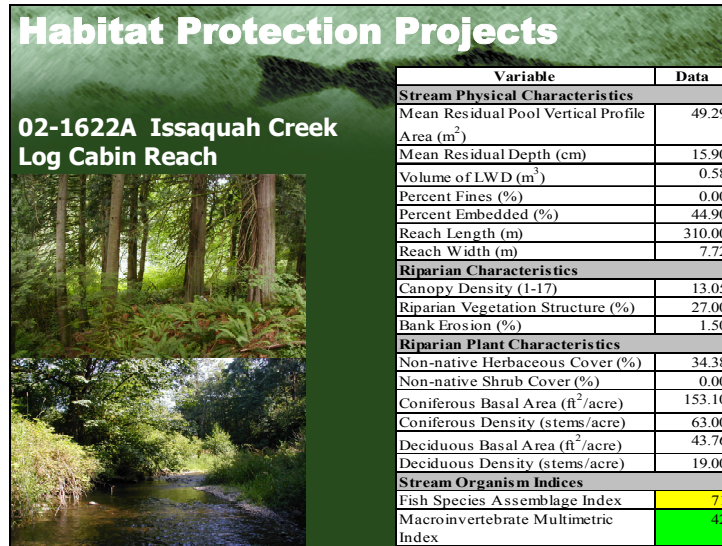
Habitat Protection Projects

Macroinvertebrate Multimetric Index Grading System

Narrative Assessment	Puget Lowlands	Cascades	Columbia Plateau
Good	>30	>28	>34
Fair	20-30	23-28	23-33
Poor	<20	<23	<22

Source: Wiseman 2003

This slide shows the rating criteria we used for the invertebrate index scores. These ratings come from Washington Department of Ecology research, and as you can see, are region specific for different areas of the state. They are also divided into good, fair, and poor and are color coded for ease of use.



Here is some example data from a habitat protection site in Western Washington. As mentioned previously, there are not controls for these sites, so we will have to look at subsequent data sets to establish the ecological trend for each site. The bottom two cells show the index scores and the color coded rating associated with them. As you can see the fish index rating is fair, and the invertebrate rating is good.

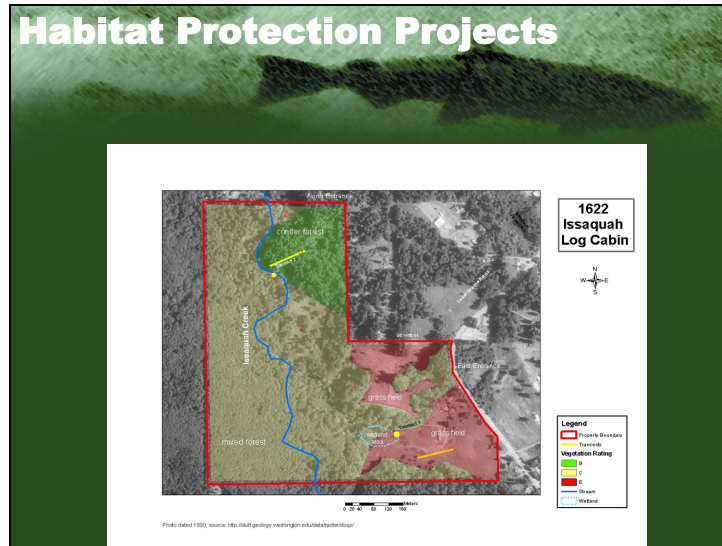
Habitat Protection Projects

Rating Criteria for Vegetation Quality

Rating	Description
A Excellent	Plant association is pristine, appears to have experienced little or no present or past disturbance by post-industrial humans, is a large stand, or exhibits exceptional species diversity.
B Good	Plant association is in good to very good condition. Species composition and diversity are within the range expected for the type.
C Moderate	Plant association is somewhat degraded or recovering. While species diversity is typically low, environment and species composition are similar to published source.
D Poor	Plant association is degraded by logging, grazing, development, or by non-native species, although it is still recognizable as a described community.
E Extirpated	Plant association is completely altered and unrecognizable. Non-natives dominate.

Source: Adapted from Washington Natural Heritage Program Field Methodology (NatureServe 2002)

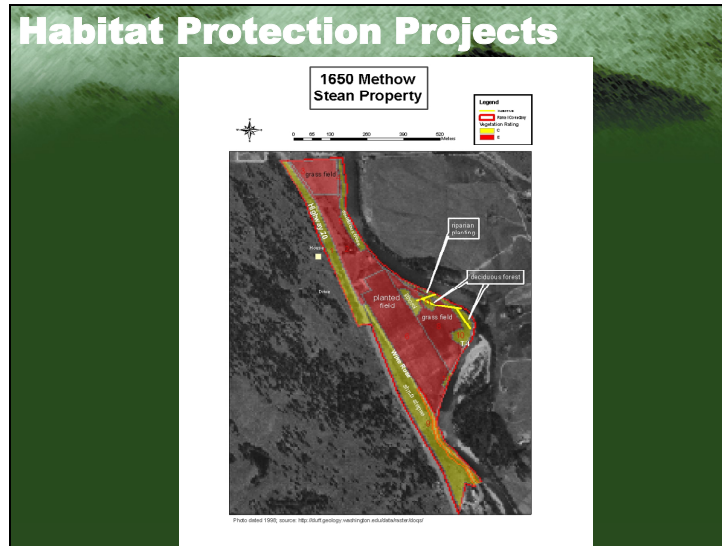
For the upland vegetation, these are the rating criteria that were used for the condition class. Again, we have divided the ratings into good, fair, and poor, and have color coded them for ease of use.



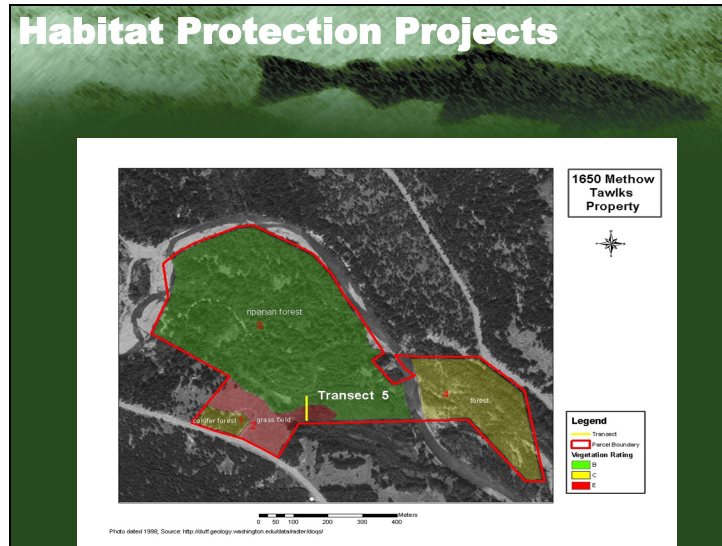
This slide shows a map of the west side project we were just looking at. The vegetation polygons have been sampled and color coded based on current condition class. As you can see, the parcel contains vegetation that is rated as good (in the green), fair, (in the yellow), and poor (in the red).

Habitat Protection Projects	
Variable	Data
02-1650 Methow Critical Habitat Area Acquisition	
	
Stream Physical Characteristics	
Mean Residual Pool Vertical Profile Area (m ²)	9.65
Mean Residual Depth (cm)	1.93
Volume of LWD (m ³)	1.50
Percent Fines (%)	0.00
Percent Embedded (%)	9.45
Reach Length (m)	500.00
Reach Width (m)	23.30
Riparian Characteristics	
Canopy Density (1-17)	3.68
Riparian Vegetation Structure (%)	9.00
Bank Erosion (%)	22.50
Riparian Plant Characteristics	
Non-native Herbaceous Cover (%)	64.69
Non-native Shrub Cover (%)	0.00
Coniferous Basal Area (ft ² /acre)	1.75
Coniferous Density (stems/acre)	30
Deciduous Basal Area (ft ² /acre)	1,618.40
Deciduous Density (stems/acre)	446
Stream Organism Indices	
Fish Species Assemblage Index	62
Macroinvertebrate Multimetric Index	38

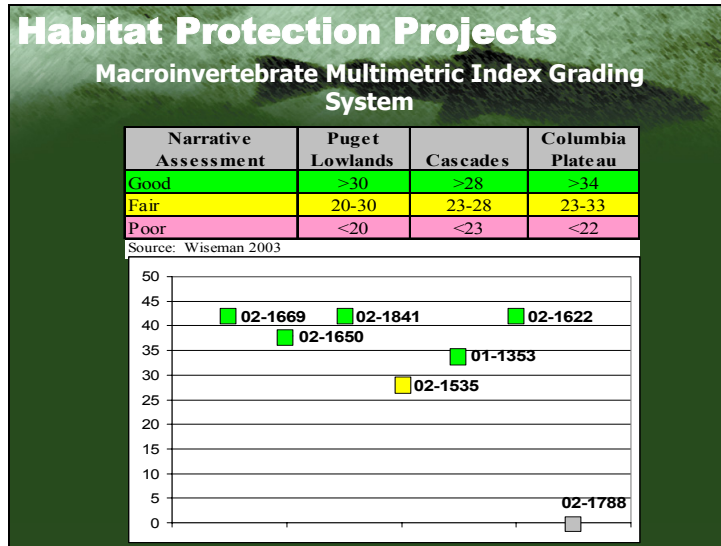
Here is one more set of example data from a habitat protection project in along the Methow River on the east side of the mountains. As shown by the data in the lower left hand corner, the current fish assemblage rating is fair, and the invertebrate rating is good. The other data are baseline data for current conditions. Trends in these conditions will be available after subsequent data collection.

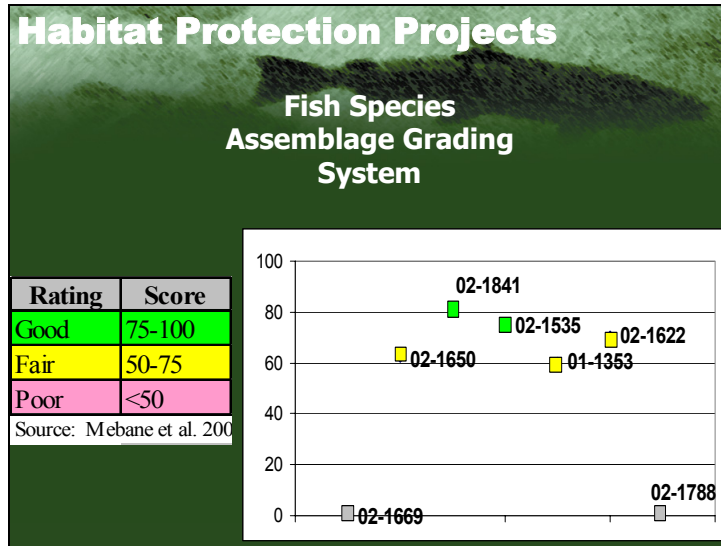


This project involved more than one piece of land along the river. As you can see the vegetation condition class ratings on this parcel are fair and poor...



While the vegetation condition class on this parcel is mostly good with some areas in fair condition and some agricultural areas rated as poor.





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Data Analysis-Project Life				
SRFB Category	Longevity for MC (years)	Restoratoin Action	Response (years)	Longevity (years)
Fish Passage Projects (MC-1)	10-50+	Culverts	1-5	10-50+
		Bridges		
		Fishways		
		Log jams		
		Dam removal		
In-Stream Habitat Projects (MC-2)	5-20	Channel reconfiguration		
		Deflectors	1-5	5-20
		Log and rock control weirs	1-5	5-20
		Roughened channels	1-5	5-20
		Woody debris removal		
Riparian Planting Projects (MC-3)	10-50+	Riparian planting projects	5-20	10-50+
Riparian Livestock Exclusion Projects (MC-4)	10-50+	Riparian livestock exclusion	5-20	10-50+
Constrained Channels (MC-5)	10-50+	Dike removal/setback		
		Riprap removal		
		Road removal/setback	5-20	Decades-centuries
		Landfill removal		
Channel Connectivity, Off Channel Habitat, and Wetland Restoration Projects (MC-6)	10-50+	Channel connectivity	1-5	10-50+
		Off channel habitat	1-5	10-50+
		Wetland restoration	1-5	1-50+
Spawning Gravel Projects (MC-7)	No Information	Spawning gravel	No Information	No Information
Instream Diversion Projects (MC-8)	10-50+	Irrigation diversion dams	1-5	10-50+
		Water treatment plants		
		Pipes		
		Ditches		
		Headgates		
Habitat Protection Projects (MC-10)	Decades-centuries	Hydropower Penstocks		
		Habitat protection	Decades-centuries	Decades-centuries

Table Modified from Roni et al. 2002. Type of specific restoration action taken under each monitoring category (MC), longevity of action (how long the project will last; plus sign (+) means it could extend beyond the indicated duration).

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Data Analysis									
Types of Data Collected	Fish Passage Projects (MC-1)	In-Stream Habitat Projects (MC-2)	Riparian Planting Projects (MC-3)	Riparian Livestock Exclusion Projects (MC-4)	Constrained Channels (MC-5)	Channel Connectivity (MC-6)	Spawning Gravel Projects (MC-7)	Instream Diversion Projects (MC-8)	Habitat Protection Projects (MC-10)
Juvenile Fish Abundance	X	X				X			
Adult Fish Abundance	X						X		
Mean Trout wet vertical profile area for the study reach (AFRESUM)		X			X	X			X
Mean Trout wet residual depth within the study reach (FP100)		X			X	X			X
Log of volume of large woody debris of all sizes within the study reach (Log10VWMI00)		X							X
Mean percent shading at the bank (XCENBR)			X	X		X			
Proportion of the reach containing all 3 layers of riparian vegetation, canopy cover, under-story, and ground cover (PFCMG)			X	X		X			
Proportion of the reach containing actively eroding stream banks (BANK)			X	X					
Mean percent of the study substrate in fines (PCT_FN)						X	X		X
Mean percentage of the substrate that is embedded within the study reach (EMBED)							X		X

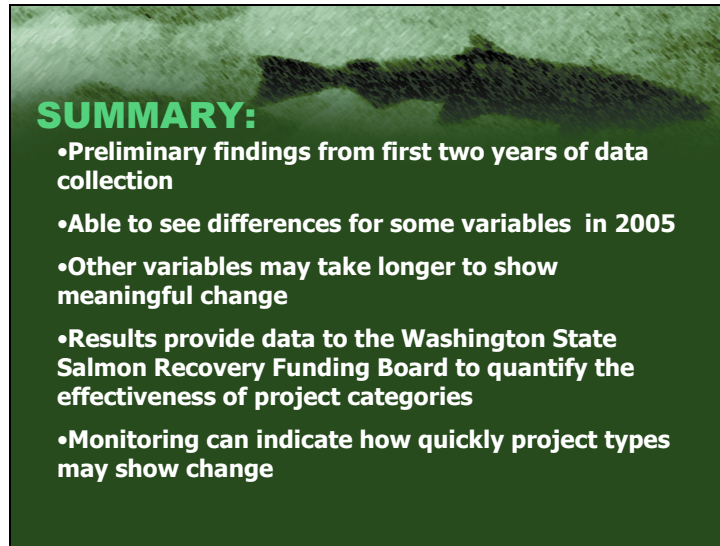


Project Enhancements

- Upland Vegetation and Estuary Habitat Protocols
- GIS Analysis of vegetation condition
- Additional Substrate Protocol Analysis
- Additional Studies – University of Washington

Independent QA/QC Analysis

Potential study on standards for summary statistics

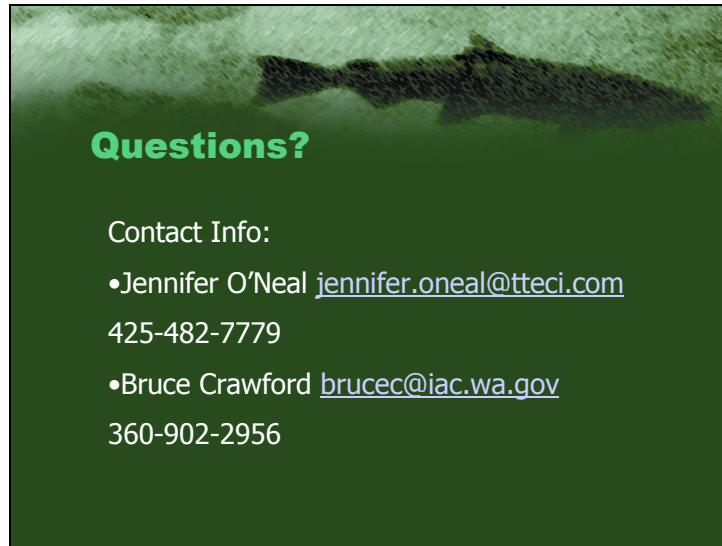


SUMMARY:

- Preliminary findings from first two years of data collection
- Able to see differences for some variables in 2005
- Other variables may take longer to show meaningful change
- Results provide data to the Washington State Salmon Recovery Funding Board to quantify the effectiveness of project categories
- Monitoring can indicate how quickly project types may show change

Varying rates of change for different project types, and for different summary variables within project types.

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Questions?

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Protocols are available on the SRFB website under documents and reports.