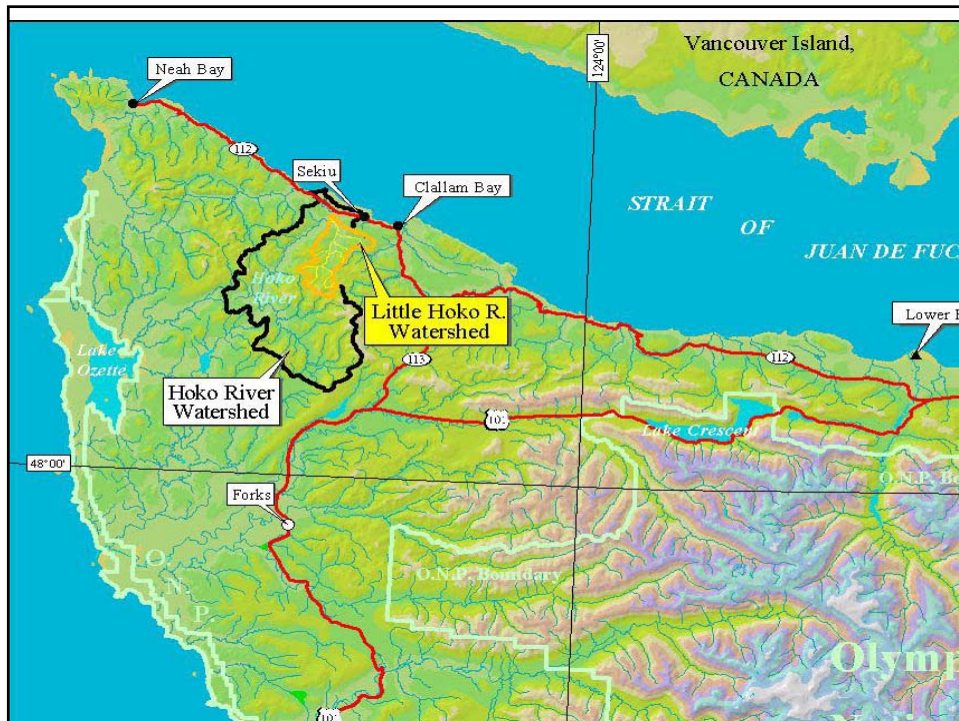


**Effects of channel and riparian restoration on
salmonid populations and habitat in the Little Hoko
River, Washington**

(How much restoration is enough?)

**Michael McHenry
Mel Eloffson
Martin Liermann**



Land Use History

- Homesteads
- Logging
- Channelization/Wood Removal
- Unrestricted Grazing
- Washington State Parks Purchase (1993)



Limiting Factors Determination

- Habitat Surveys-1992
- Temperature
- Pool Habitat
- LWD
- Channel Incision
- Eroding Banks
- Riparian Forest
- Spawning Habitat



Restoration Plan Goal

- *Use restoration to accelerate natural recovery so that habitat forming processes are maintained*



Restoration Treatments (1994-1998)

- *Control/Remove Cattle*
- *Riparian Reforestation*
- *Restructure Channel*
- *Road Abandonment*
- *Off-Channel Development*



Developing a Monitoring Strategy

<i>Objectives</i>	<i>What/How</i>
<i>Remove Stressors</i>	<i>Grazing/Temperature</i>
<i>Riparian Forest</i>	<i>Grow Mature Forest</i>
<i>Reconnect Floodplain</i>	<i>Treat Incision/Bank Erosion</i>
<i>Channel Complexity</i>	<i>Increase LWD Levels</i>
<i>Biological</i>	<i>Fish Response</i>

Monitoring Parameters

<i>What</i>	<i>How</i>	<i>When</i>
<i>Temperature</i>	<i>Thermographs</i>	<i>Annually</i>
<i>Habitat</i>	<i>Ambient Monitoring</i>	<i>2 year intervals</i>
<i>Cross-Sections</i>	<i>Survey</i>	<i>2 year intervals</i>
<i>Pebbles</i>	<i>Wolman</i>	<i>2 year intervals</i>
<i>Riparian</i>	<i>Plots</i>	<i>5 year intervals</i>
<i>Adults</i>	<i>Escapement</i>	<i>Annually</i>
<i>Smolts</i>	<i>Fence Weir</i>	<i>Annually</i>

Monitoring Challenges

- *Limited Pre-project Data*
- *Monitoring “Chases” Restoration*
- *Before-After Design*
- *\$*



Removing Stressors –Part 1

- *Cattle Restricted (1994-1998) & Removed (1998)*

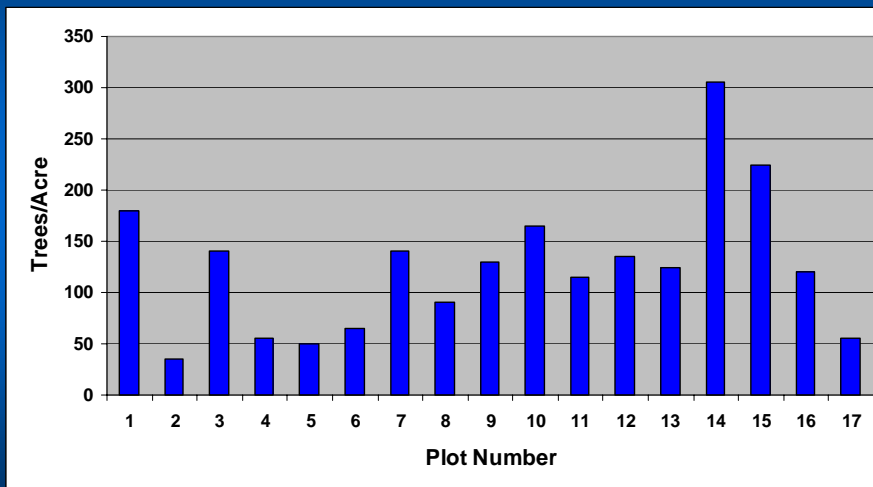


Riparian Monitoring

- *Fixed Radius Plots*
- *0.2 acre*
- *17 Plots (RM 0.2-2.5)*
- *7 years following initial plantings*

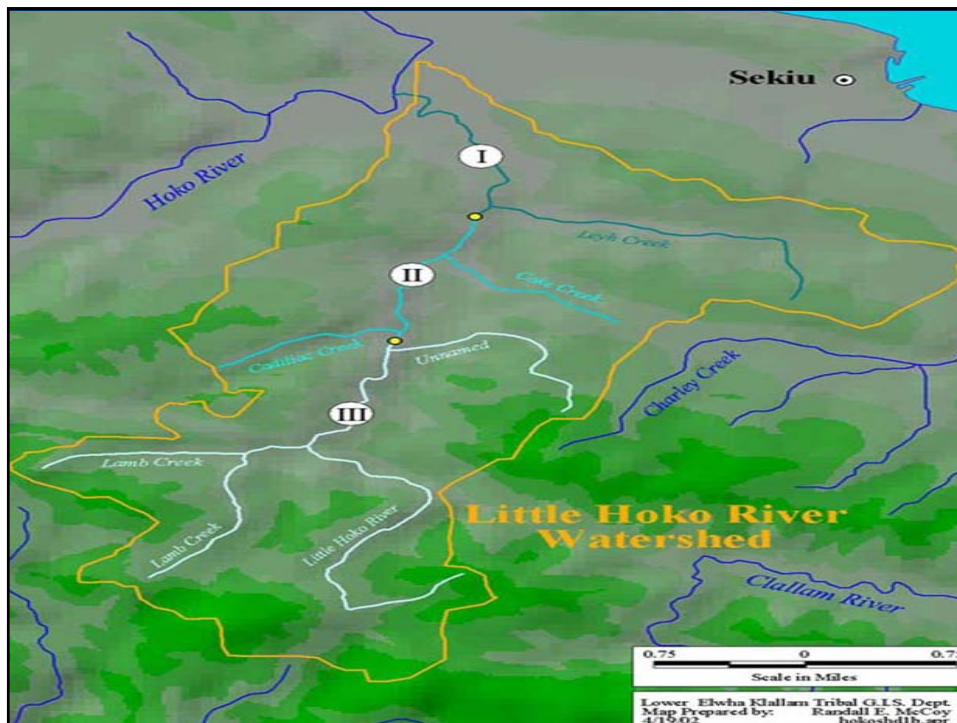


Riparian Response

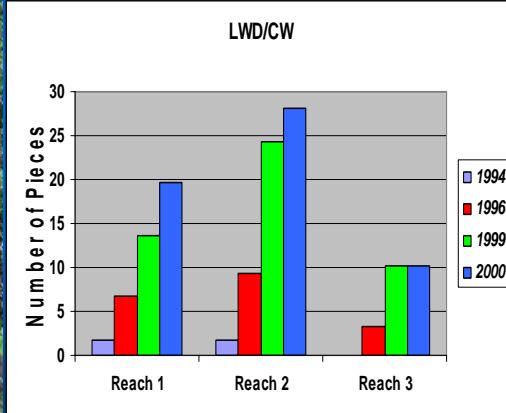


Riparian Response

- **Conifers free to grow in 5 years**
- **~20-30' in 12 years**
- **Minor damage**
- **Pasture exotics prevalent**
- **Functional?**



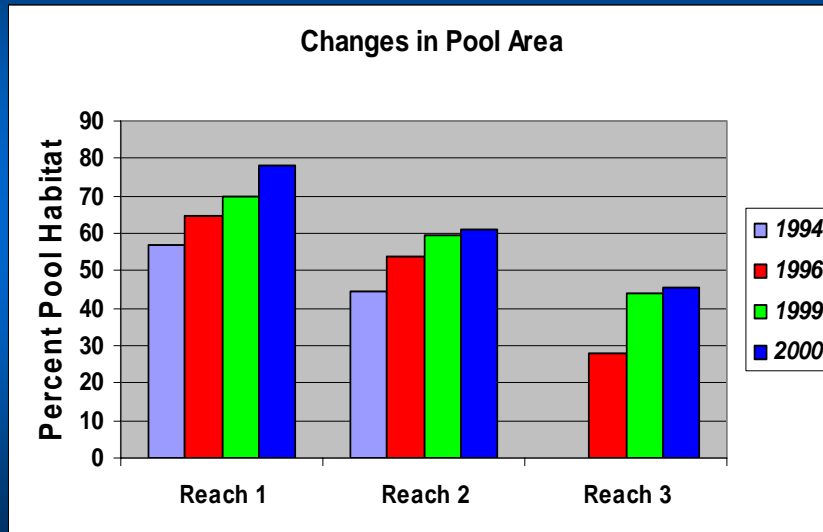
Increasing Channel Complexity



Bank Erosion



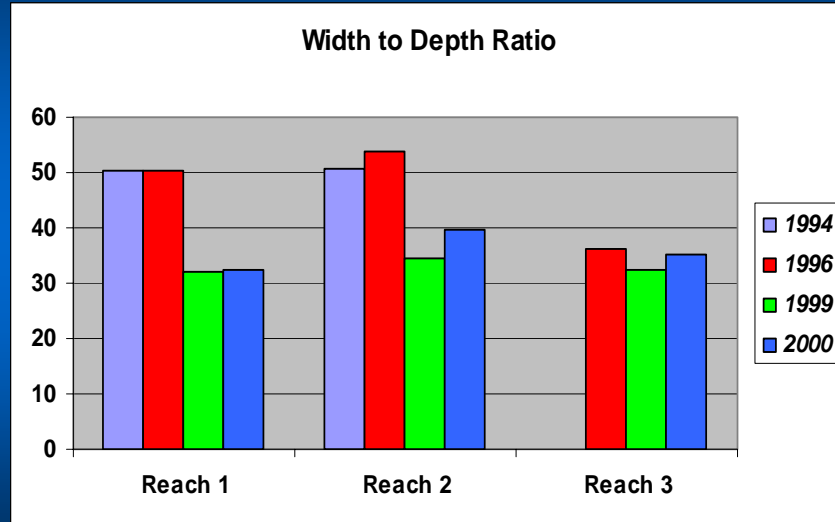
Channel Complexity - Habitat Response



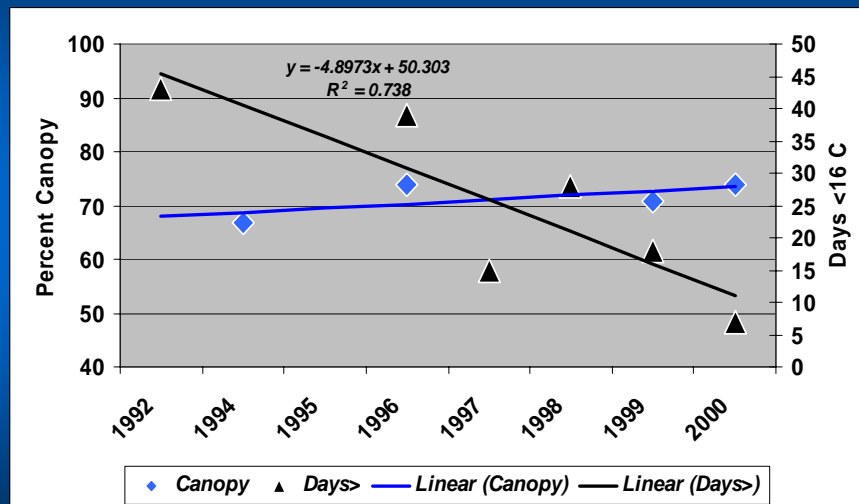
Channel Complexity-Habitat Response

<i>Residual Pool Depth (m)</i>	<i>1994</i>	<i>1996</i>	<i>1999</i>	<i>2000</i>	<i>% Change</i>
<0.25	2	0	0	2	0
.25-0.5	50	70	59	73	54
0.5-.75	47	52	71	86	83
0.75-1.0	22	31	31	50	127
1.0-1.25	15	13	20	23	53
1.25-1.50	7	16	15	13	86
>1.5	10	11	9	3	-70
Total	153	193	205	250	63

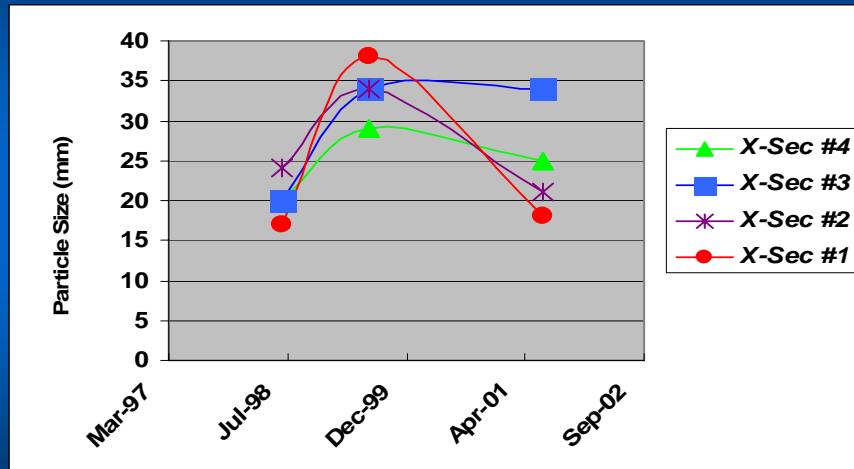
Channel Complexity-Habitat Response



Removing Stressor – Part 2



Habitat Response-Segment 1



Habitat Response-Segment 3

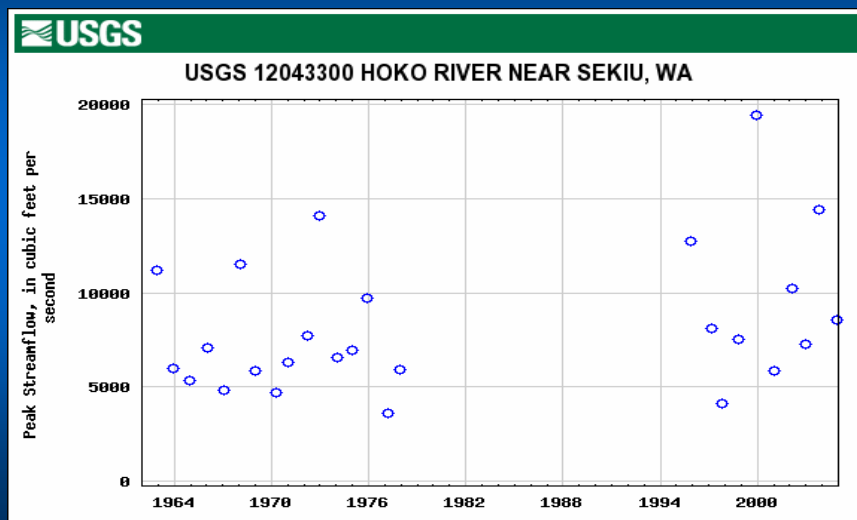
	1996	1998	1999	2000	2004	%Change
X-Sec 13	77	60	40	32	34	-126.5
X-Sec 14		75	120	58	60	-25.0
X-Sec 15	62	53	50	47		-31.9
X-Sec 16	83	18	38	69	60	-38.3
X-Sec 17	100	63		54		-85.2
X-Sec 18		97		25	45	-115.6
X-Sec 19	104	101		60	77	-35.1
Mean	85.2	66.7	62.0	49.3	55.2	-65.4

Habitat Response Summary

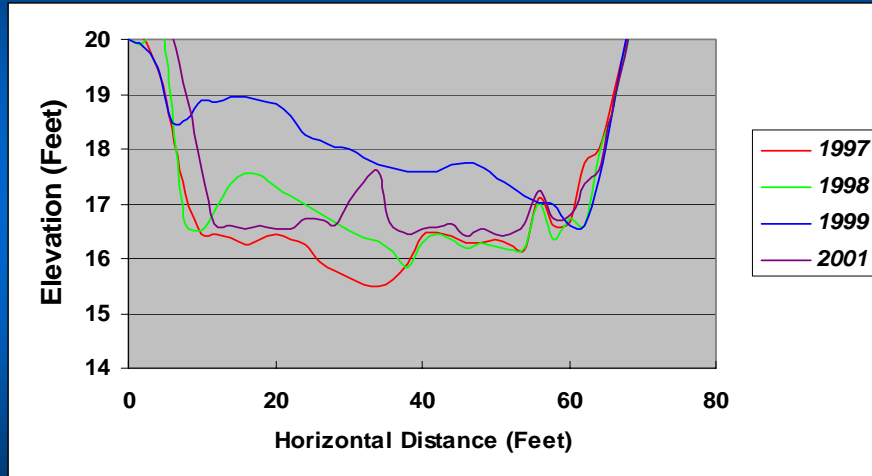
- *Response Rapid*
~2-5 years
- *Response Variable*
by Geomorphology
- *Treatments*
Functional over
Time
- *1999 Flood of*
Record



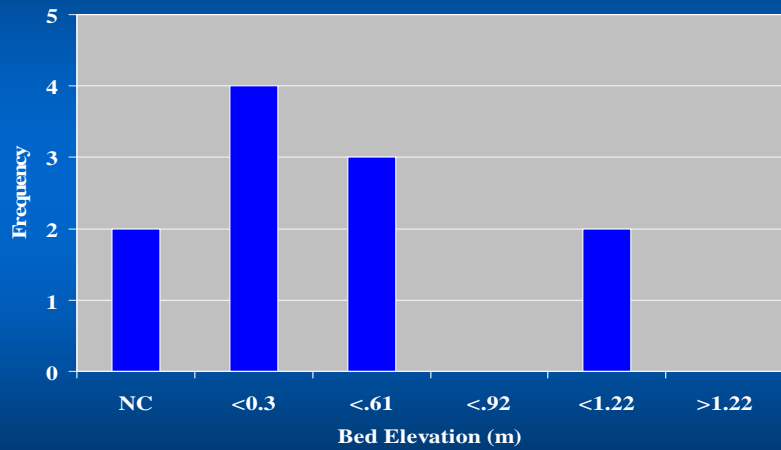
Flood of Record



Floodplain Reconnection



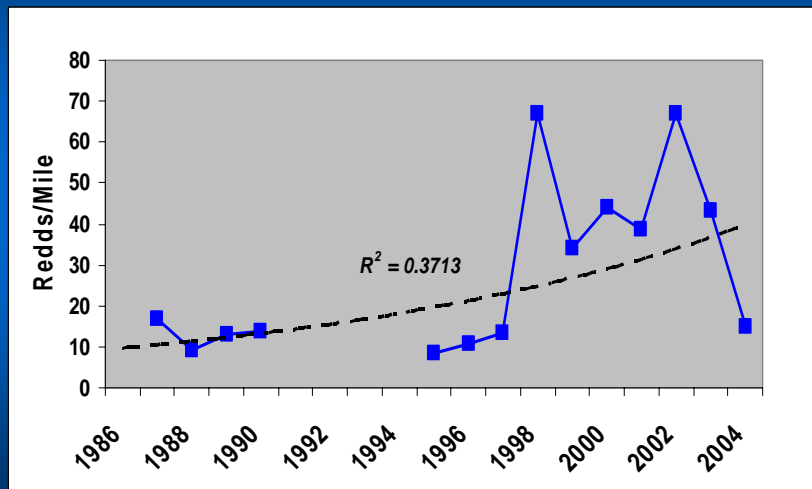
Floodplain Reconnection



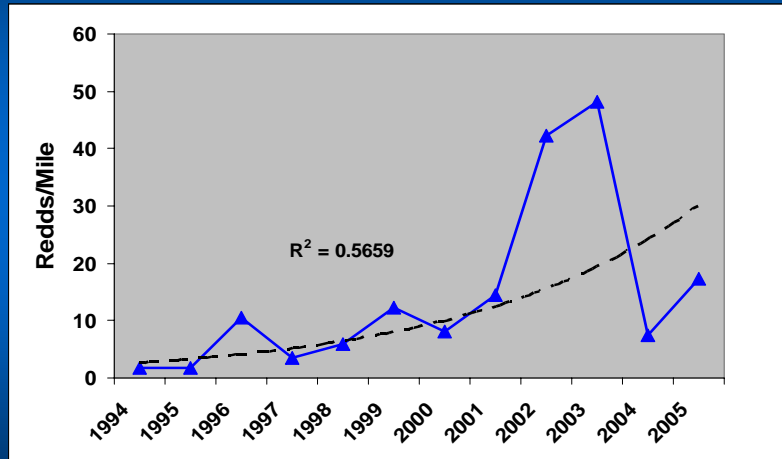
Floodplain Reconnection



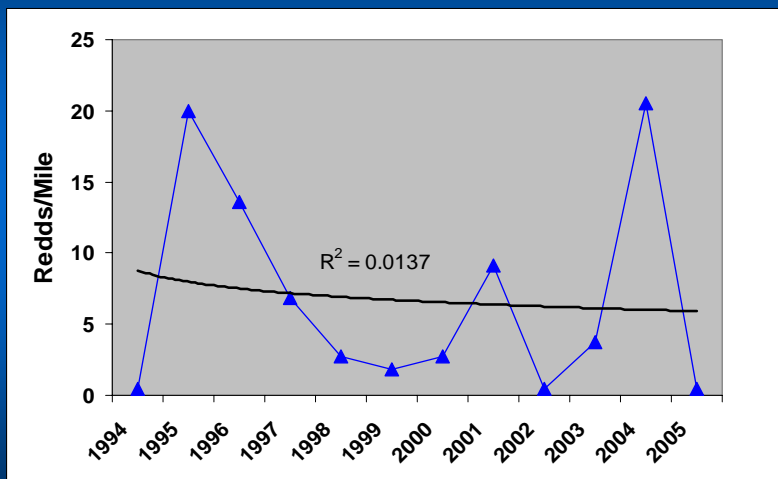
Biological Monitoring - Coho



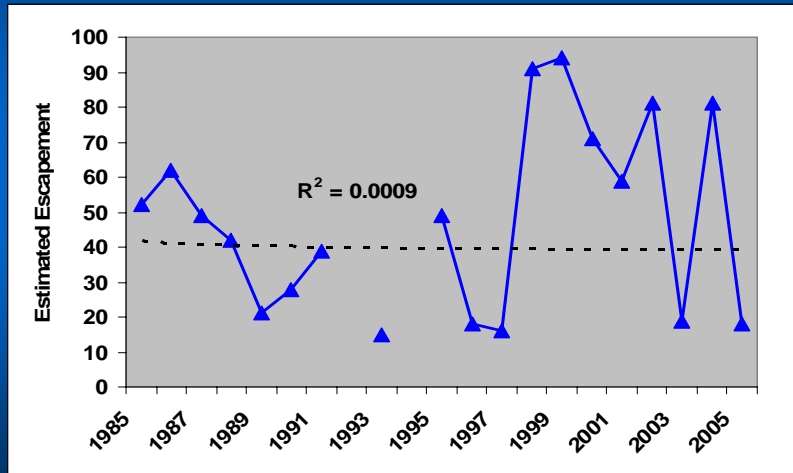
Biological Monitoring- Chum



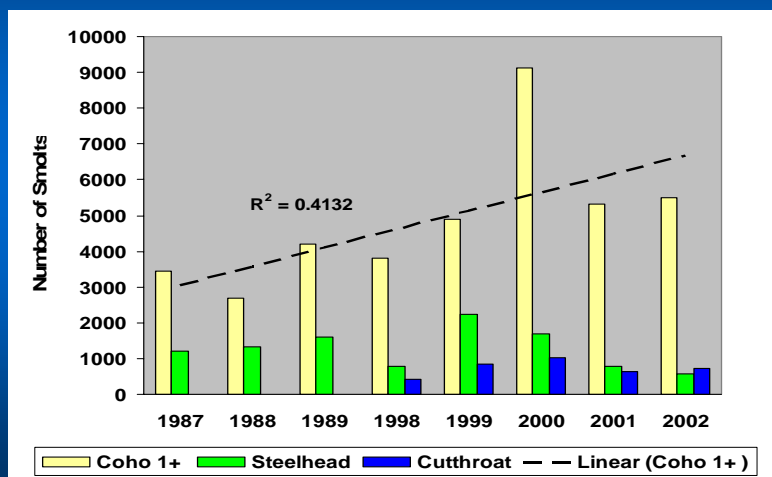
Biological Monitoring - Chinook



Biological Monitoring - Steelhead



Biological Monitoring - Smolts



Restoration Scorecard

Objective	Outcome
<i>Remove Stressors</i>	<i>Yes</i>
<i>Riparian Forest</i>	<i>Established but not Functional</i>
<i>Reconnect Floodplain</i>	<i>No</i>
<i>Channel Complexity</i>	<i>Yes</i>
<i>Biological Response</i>	<i>?</i>

Conclusions

- ***Habitat restoration efforts in combination with natural recovery can rapidly improve stream habitat conditions.***
- ***Restoration efforts focused on treating channel incision must be dramatically scaled up.***
- ***Fish population responses are difficult to measure, expensive and require patience.***
 - *Limitations in study design!*
 - *Other limiting factors?*
 - *Lag in response?*
 - *Restoration incomplete?*

Acknowledgments

- *Washington Department of Parks*
- *WDNR-Jobs for the Environment Program*
- *BIA-Watershed Restoration Program*
- *Dr. Jack Orsborne*

