November 8, 2016

MEMORANDUM

TO: **Council members**

FROM: **Nancy Leonard, Fish Wildlife and Ecosystem Monitoring and Evaluation Manager**

SUBJECT: **Guiding and Evaluating Habitat Actions using Status and Trend Results - The Confederated Tribes of Colville Reservation's Okanagan Basin Monitoring and Evaluation Program (OBMEP, 2003-022-00)**

BACKGROUND:

Presenter: John Arterburn, Research Monitoring and Evaluation Subdivision Lead, Confederated Tribes of the Colville Reservation

Chip McConnaha, ICF Ecosystems Modeling Group

Summary: The OBMEP is a Program funded program that gathers aquatic habitat status and trends monitoring data to prioritize habitat mitigation actions and to assess effectiveness of these actions. The OBMEP focuses on gathering information at the stream reach scale and synthesizing this information to inform decision-making products, including succinct report cards, revising subbasin plans, and climate change scenarios.

Relevance: The 2014 Program is committed to an adaptive management approach that relies on monitoring data to assess status and performance and to guide on the ground mitigation actions.

Workplan: Related to Program Adaptive Management tasks

Background: BPA and other federal, state, private and local agencies expend considerable funds each year to restore salmon and steelhead habitat in the Columbia Basin and to rehabilitate key ecological functions.

BPA also funds an extensive research and monitoring effort to address basic scientific issues, evaluate restoration techniques and monitor physical and biological change. Habitat data is often difficult to integrate into the selection of habitat projects and to develop restoration strategies because its many aspects are measured in different metrics and often lack intuitive meaning. The OBMEP program has addressed this issue by use of a life-cycle habitat model, Ecosystem Diagnosis & Treatment (EDT). EDT is used to integrate systematic monitoring of environmental conditions in the Okanogan sub-basin to update restoration priorities, identify restoration needs and to estimate the biological benefits of BPA investments every four years. This application of enhanced modeling and reporting developed by OBMEP is useful for drawing conclusions regarding habitat trends and evolving restoration priorities.

Ecosystem Diagnosis & Treatment (EDT)

The EDT model used by the OBMEP is not new to the region as it was developed in the late 1990's as part of the Council's Model Watershed program in the Grande Ronde basin. The model was used in the Council's Subbasin Planning process and supported development of the majority of salmon-related sub-basin plans for the Council's program. The latest version of the model, designated EDT3, has been built to contemporary software standards to provide the transparency and flexibility necessary to address modern resource management challenges.

The EDT model is typically used to evaluate habitat for salmon and steelhead and identify priority habitats and limiting factors. The model evaluates habitat across the salmonid life-history to create habitat analogs to the Viable Salmonid Population (VSP) metrics. The model uses available information to assess the impacts of past and future changes in habitat on fish production and weight these decisions based on the certainty in the model inputs. EDT has been widely used by federal and state agencies and tribes in the Columbia Basin, the Chehalis River, Puget Sound and California to develop watershed plans (e.g. Columbia Basin Subbasin Plans), species recovery plans (e.g. Puget Sound Chinook, upper Columbia summer steelhead, Spring Chinook and lower Columbia River Chinook recovery plans) and to evaluate climate change impacts on salmon and steelhead.

EDT has been developed over a two decades through the cooperative efforts of numerous users in the Columbia Basin and Puget Sound. A private consulting group (ICF) has taken responsibility for maintenance and software innovation and has been the primary practitioner assisting clients in the use of EDT. The EDT computer code is available publically as are all datasets and results.

Okanogan Basin Monitoring and Evaluation Program (OBMEP)

The OBMEP was created by the Colville Confederated Tribes to track the status and trends in the condition of aquatic habitat and fish production in the Okanogan Basin. Its purpose is to monitor habitat conditions over time, provide a rationale for prioritizing investments in habitat restoration, and track progress towards the tribes' fishery management goals. The program is designed to be consistent with recent policy guidance for habitat status and trends monitoring developed by federal resource management agencies, BPA and the Council. This guidance provided seven objectives

that policy makers considered to be critical for an effective habitat status and trend monitoring program:

1) Integrate habitat monitoring with VSP[1] criteria set forth for ESA salmon recovery.
2) Inform the expert panel process[2].
3) Provide information to update limiting factors and planning documents.
4) Integrate multiple life stages into limiting factors.
5) Inform the development of future habitat actions.
6) Provide a mechanism for prioritizing habitat actions.
7) Help inform higher level indicators of regional environmental conditions.

The OBMEP is the tribes' response to this policy guidance. From 2009-2013 the Colville Tribes funded the development of an entirely new set of EDT reports designed to convert OBMEP data into useful conclusions. These efforts produced a series of scalable report cards that were published in their first habitat status and trends report in 2013. This analysis incorporated habitat data collected by OBMEP from 2005 to 2009 into the EDT model and compared fish performance under current habitat to performance under pre-development conditions. A presentation of these results was provided to the NPCC fish and wildlife committee at the July 2014 meeting in Portland (2014 Update on OBMEP).

The tribes' and ICF staff completed our second habitat status and trend report for the 2010 to 2013 monitoring cycle in late 2015. This analysis compares fish performance between the 2013 and 2009 habitat conditions. These are the first results that can be used to measure the effectiveness of specific actions. This approach has outperformed our original expectations and our presentation will share the details of our results. Additionally we will present on enhancements to our reporting platform using an interactive mapping interface and the approach to model climate change.

This modeling approach provides a platform for testing differing scenarios regarding future climate conditions on salmon and steelhead life histories and population performance. In some cases, prioritization of restoration actions looks quite different in the context of future climate compared to priorities based on a continuation of current conditions in the future. Future climate may favor a different mix of salmon and steelhead life histories and dramatically alter the distribution of productive habitat in many sub-basins. These types of analyses have important implications for BPA funding priorities for restoration and meeting species recovery needs under ESA.

The OBMEP contributes to the Fish and Wildlife Program by providing information to guide prioritization of habitat restoration actions (status) within the Okanogan Sub-basin based on the biological benefits of aquatic habitat investments. Once actions are

[1] VSP refers to the Viable Salmonid Population concept developed by NMFS to characterize performance of salmonid populations listed under ESA. This concept describes desired qualities for viable populations in terms of fish abundance, productivity, biological diversity and spatial population structure.

[2] The expert panels were created by NMFS under the FCRPS Biological Opinion to report on habitat status and trends.

completed, the habitat monitoring can help evaluate the magnitude of change expected (trend) and the fish monitoring provides the final validation of response. The presentation will show specific examples of just how effectiveness of restoration actions can be evaluated without the need for additional efforts.

This summer, OBMEP began a pilot project in the Methow Sub-basin that applies the EDT model and status and trend reporting platform. The Methow program is a good example of how to integrate information from a variety of sources to create useful conclusions. The program uses existing monitoring data collected by several monitoring programs operating under the Fish and Wildlife Program including CHaMP, reach assessments sponsored by the BOR, the Yakama Nation, and Forest service programs. Data for salmon and steelhead population viable salmonid parameters (VSP) collected by WDFW will be used to validate the EDT habitat-based estimates of the VSP parameters and to update life history assumptions related to spring Chinook and steelhead. OBMEP complements these broader scale efforts by guiding restoration efforts on-the-ground that aim to reduce limiting factors thereby improving habitat conditions at the local scale, translating to improved conditions at the broader subbasin and fish population scale (Figure 1).

There is now interest in using the OBMEP-EDT approach in other sub-basins to move from data collection to policy-level synthesis and guidance. For example, the Upper Columbia Salmon Recovery Board and the Regional Technical Team and have both endorsed OBMEP's application of EDT model and their related status and trend reporting tools (see attachment 1).

Much of the attraction to the Colville's approach stems from the need to create usable information to improve decision making in multiple processes. For example, the "Expert Panel" approach resulting from the FCRPS Biological Opinion is in need of being updated to "give deference to the fish" and the OBMEP approach provides this type of information. The Upper Columbia Salmon Recovery Board and others see this approach as a platform for adaptive management by providing a systematic rationale for prioritizing habitat restoration.

The OBMEP, EDT model, and habitat status and trend reporting tools directly address the seven monitoring program priorities outlined above and support informed conclusions using factors and scales that are useful to policy decisions. Lot of lessons have been learned since the OBMEP began and one of the most important lessons is one that could greatly benefit the region.

Scale is critically important for answering our key management questions related to habitat restoration. For the last decade, the scale of focus has been the population or subbasin. Unfortunately having monitoring programs focus on this scale does not provide information to those that are trying to restore habitat. Limiting factors become biased toward only the largest habitats thus placing the priorities for restoration on only a very select habitat. The OBMEP developed a method that can eliminate this bias and can easily be applied to the entire Columbia River Basin. Each subbasin is divided into reaches based upon a simple set of rules;

1) 4th order HUC's are used to define each subbasin.
2) 6th order HUC's are used to establish assessment unit polygons.
3) Reaches begin at the Mouth of a streams and end at the anadromous terminus (waterfalls or lack of water).
4) Wherever possible reach breaks remain consistent with existing geomorphic reach assessments.
5) Lidar or other existing GIS data are used to establish geomorphic reach breaks based upon gradient and confinement.
6) All reaches are 1 to 4 KM in length to avoid any size bias in results

Coarser scale (larger than the 4th order HUC's) can be rolled up from more refined data.

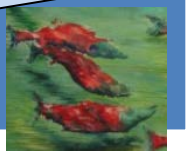
Program Habitat Framework

(monitoring and evaluating the status and trend of habitat and the effectiveness of the Program's actions)

Current Conditions	Limiting Factors	Actions Implemented	Impact of Actions over Time on Habitat Characteristics	Impact of Actions on FW Life Stage	Impacts of Actions on FW Life-Cycle
(e.g., habitat and fish status and trend)	(e.g., elevated water temperature)	(e.g., riparian improvements)	(e.g. improved watershed conditions)	(e.g., increased productivity	(e.g., increased spawner abundance, populations)





OBMEP – Guiding Habitat Work
Monitors environmental conditions, prioritizes habitat actions, identify restoration needs, estimates biological benefits to habitat and fish of the restoration action).

Once restorations actions are implemented OBMEP monitors the status and informs further restoration actions as needed (ongoing loop).

OBMEP – Habitat Status &Trend
Repeated habitat and fish monitoring (4-year cycle).

More Info:

- The Okanogan Basin Monitoring and Evaluation Program website http://www.okanoganmonitoring.org

Attachment 1: Upper Columbia Salmon Recovery Board's Letter of Support of the OBMEP and application of EDT.

The mission of the Upper Columbia Salmon Recovery Board is to restore viable and sustainable populations of salmon, steelhead, and other at-risk species through the collaborative, economically sensitive efforts, combined resources, and wise resource management of the Upper Columbia region.

11Spokane St, Ste 101, Wenatchee, WA 98801 phone: (509) 662-4707 ucsrb.org

June 23, 2014

Tony Grover
Northwest Power & Conservation Council
Fish and Wildlife Division Director
851 SW 6th Avenue, Suite 1100
Portland, OR 97204

Dear Mr. Grover:

I am writing this letter in support of the Okanogan Basin Monitoring and Evaluation Program (OBMEP) and their application of the Ecosystem Diagnosis and Treatment (EDT) model and reporting tools. We understand representatives of OBMEP are presenting at your July 8th meeting in Portland. We strongly support habitat monitoring investments in the region and are actively working to make those investments as valuable as possible to recovery efforts. Closely aligning habitat investments, monitoring, and biological priorities moves the region closer to its stated recovery targets. The OBMEP monitoring program is one of several large-scale monitoring programs in the region and is on the leading edge of collaboration, monitoring, analysis, and reporting for the Upper Columbia. Their adaptive approach and use of the EDT model to make complex and extensive habitat monitoring data more useful to decision making and project development is forward-thinking and is very responsive to our organization's initiative to make monitoring and research applicable to recovery plan implementation. This project is a high priority for salmon and steelhead recovery and habitat restoration and protection in the Upper Columbia region, and through OBMEP has proven a useful approach.

Since federal approval of the *Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan* (UCSRB, 2007), monitoring programs have been collecting large amounts of data on fish and habitat in the region, but few tools have been developed from these efforts to help guide decision makers and habitat restoration partners. The Colville Tribe's Fish and Wildlife Program is currently in the unique position of having the right partners and staff in place to design and implement the OBMEP program to provide the right information, at the right scale (reach and watershed scale), and in the right format that is easily interpretable and accessible to their partners working to design and implement habitat projects in the Okanogan subbasin. This project provides for a strategy to target watersheds where the greatest opportunities exist to improve habitat and advance recovery efforts. The OBMEP program is actively

working to help fill important data and information gaps identified by the Upper Columbia Salmon Recovery Board and the Upper Columbia Regional Technical Team within the Okanogan.

The Colville Tribe's OBMEP Program has a proven track record of collaboration, and a reputation for providing a high level of service. The scientific integrity of their monitoring, comprehensive analyses, reporting, and data and information accessibility stand out within the Upper Columbia region. In comparison with other large-scale monitoring programs, OBMEP is currently being implemented explicitly to identify and prioritize actions through use of an applied model (EDT). Development of an applied EDT model will add value to the UCSRB's on-going efforts to prioritize and evaluate habitat restoration actions, particularly in the Okanogan subbasin, and will help fill some of the critical information gaps identified for the region. These include tributary and reach scale habitat status, restoration project effectiveness, and survival bottlenecks. Additionally, the fish and habitat monitoring that is being conducted by the OBMEP program to help inform the model and better understand fish and habitat in the Okanogan subbasin may help us better understand juvenile steelhead distribution and habitat use.

We are impressed with the Okanogan EDT project and are actively trying to expand a modeling effort to the Methow, Entiat, and Wenatchee subbasins. Having regional-scale modeling that would provide consistent, comparable information for all Upper Columbia subbasins, consistent and comparable with past and other results from across the Columbia Basin, would be invaluable. Possible uses for such information include updates to regional recovery strategies, information and analyses for regional expert panels, and easily understandable information for project sponsors. Currently, in the absence of such a regional-scale program, we are working with monitoring funders and implementers in the region to better align monitoring and modeling with the information needs identified for recovery plan implementation (such as those identified in the 2010 Upper Columbia Adaptive Management Conference).

Please do not hesitate to contact me if you have any questions (509-670-1462 or derek.vanmarter@ucsrb.org).

Sincerely,

Derek Van Marter
Executive Director

cc: Tom Karier – WA Council Member
Phil Rockefeller – WA Council Member
Nancy Leonard – Council Staff
John Arterburn – Colville Tribes
Chuck Peven – RTT Chair
Keely Murdoch – RTT Monitoring and Data Management Committee Chair

Guiding and Evaluating Habitat Actions

Presentation Outline

- Quick look at the Program's Habitat Framework and how the parts fit together.
- Brief presentation on the importance of scale
- In-depth discussion of Okanogan Basin Monitoring and Evaluation Program – how it guides and evaluates habitat mitigation actions with status and trend monitoring
- Lastly, present some new products OBMEP will complete by the end of the next year.

Fish and Wildlife Committee meeting
November 15, 2016
Coeur d'Alene, Idaho

Okanogan Basin Monitoring & Evaluation Program (OBMEP)

Where does OBMEP & EDT3 fit in the Program's Habitat Logic Steps

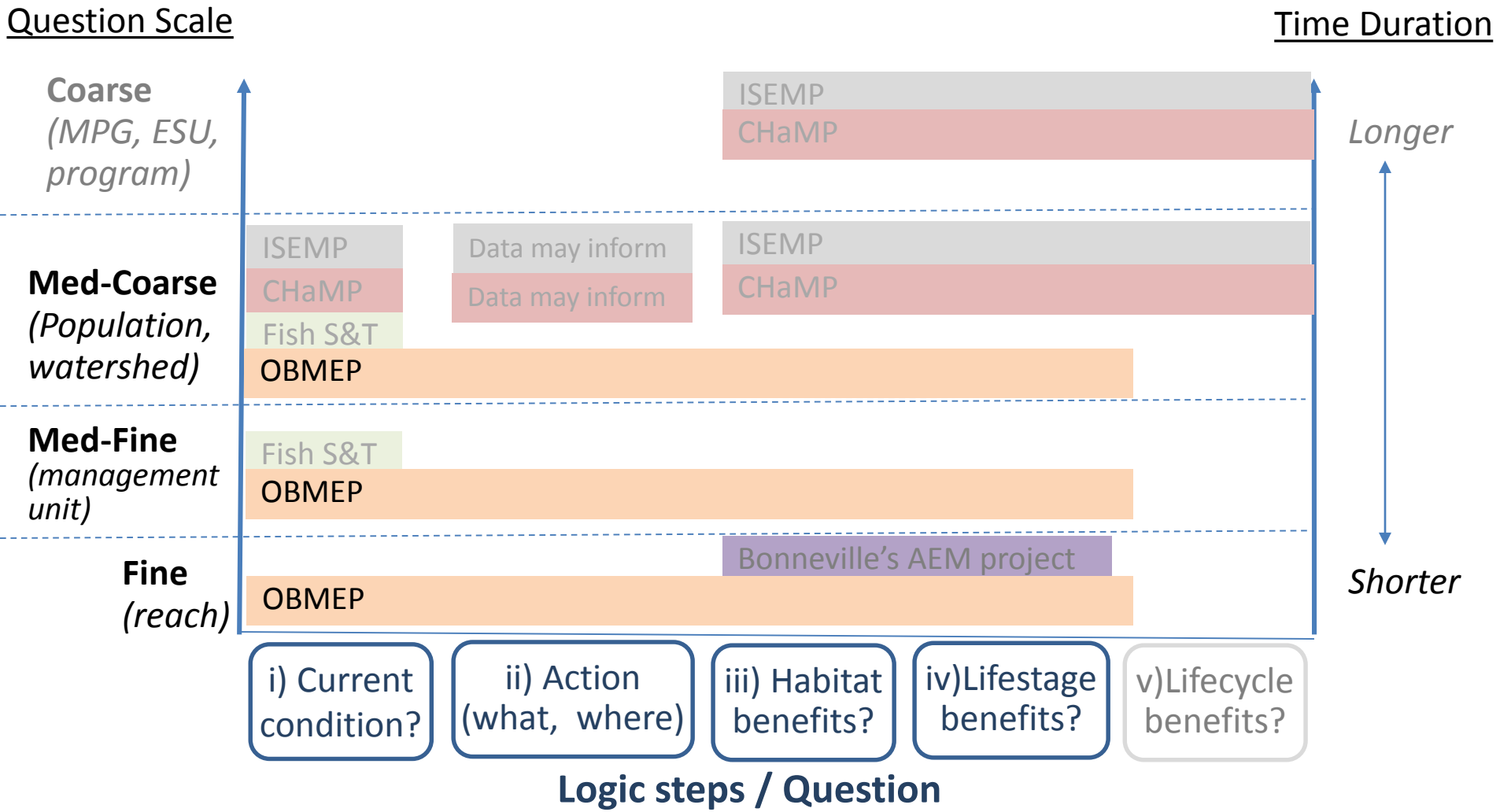
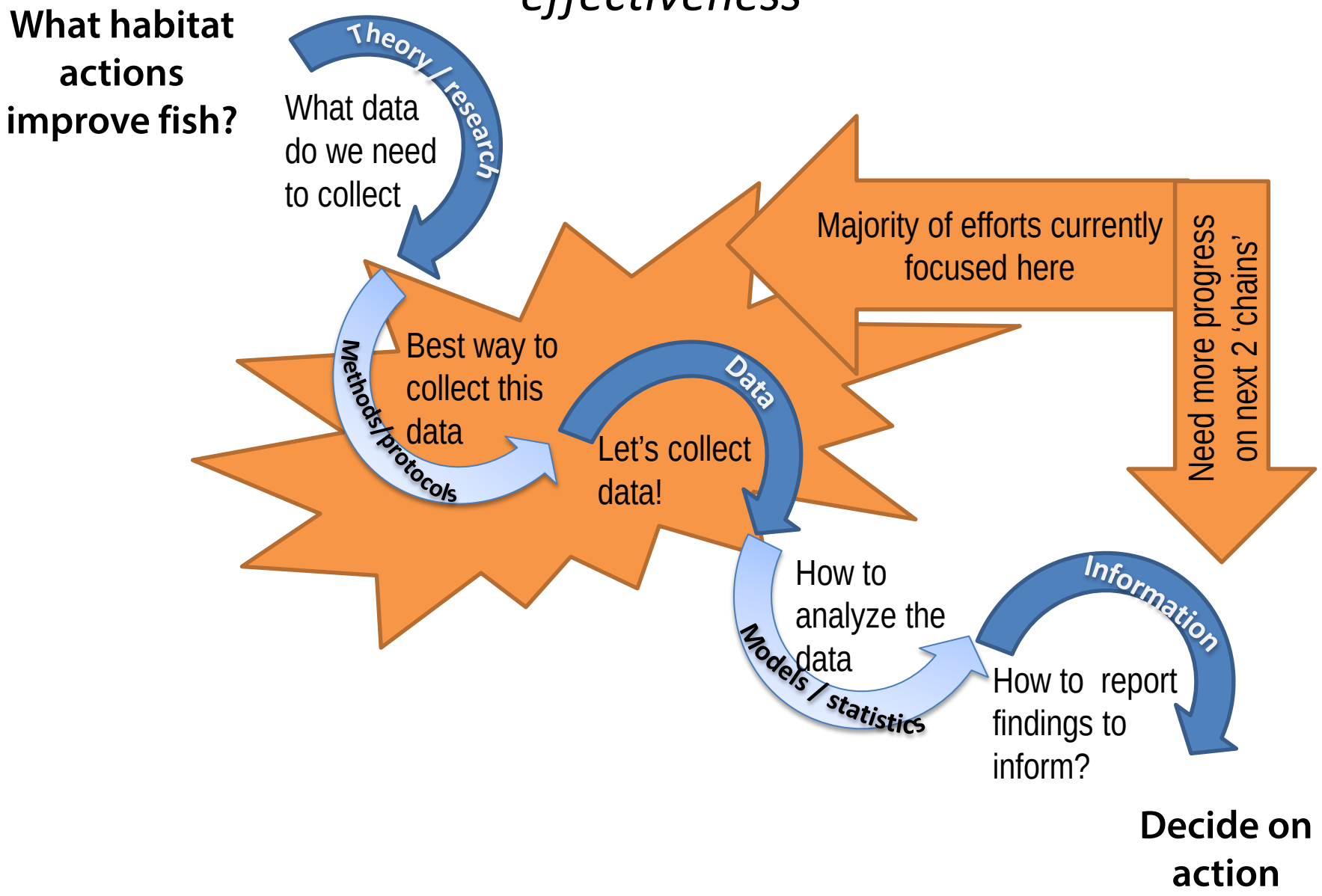


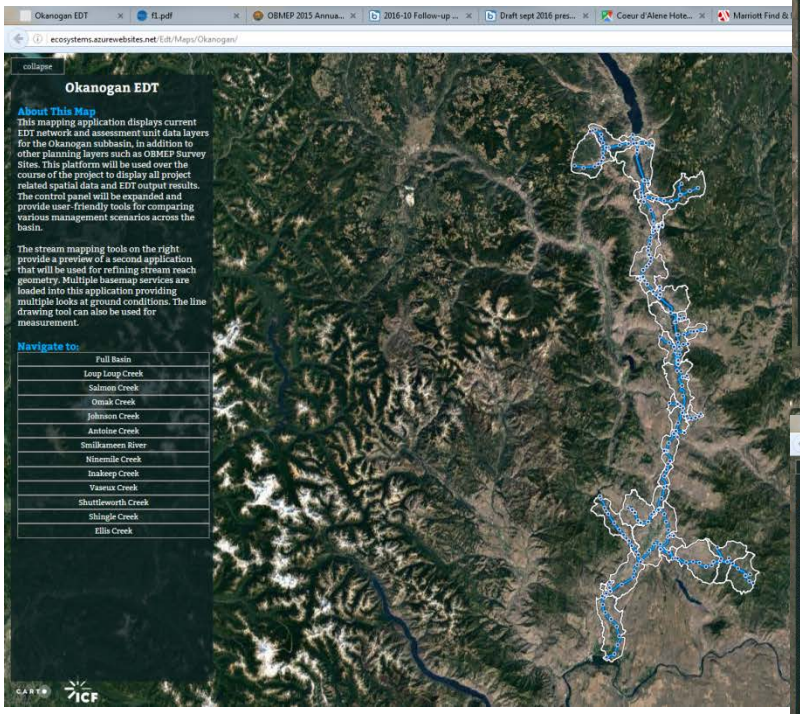
Figure is for illustration purpose only, not comprehensive

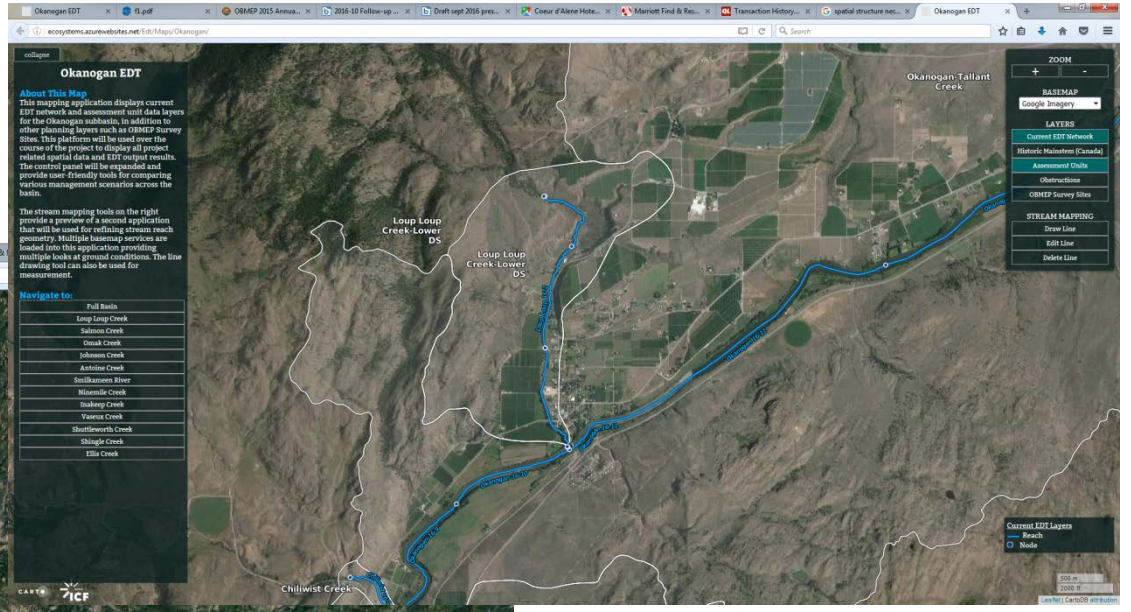
From Question to Decision-making

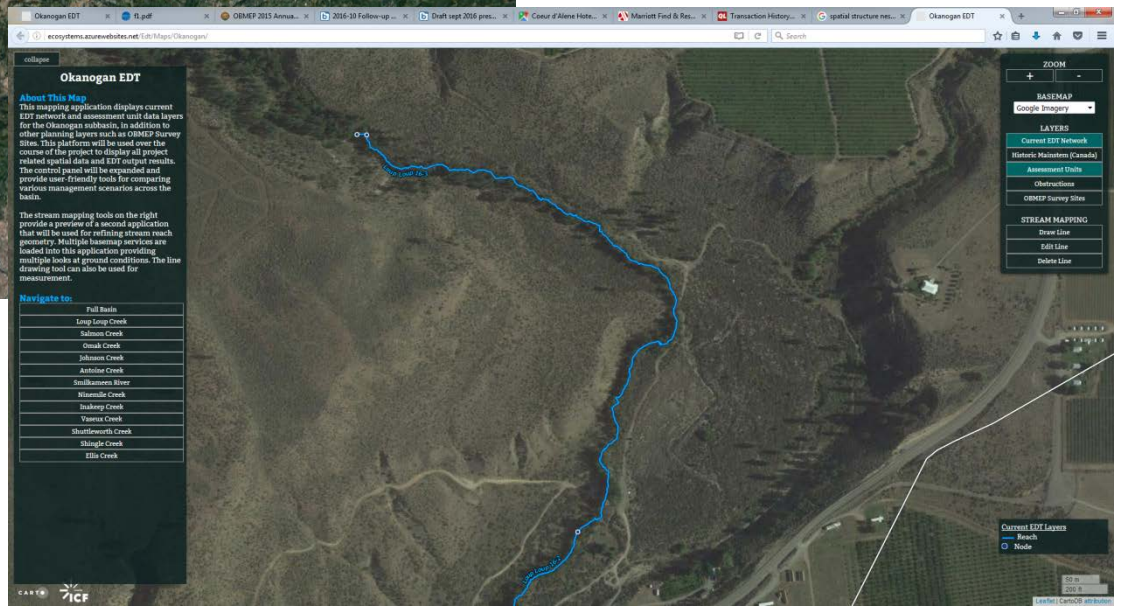
where we are in the production-chain of habitat action effectiveness



Spatial Scale







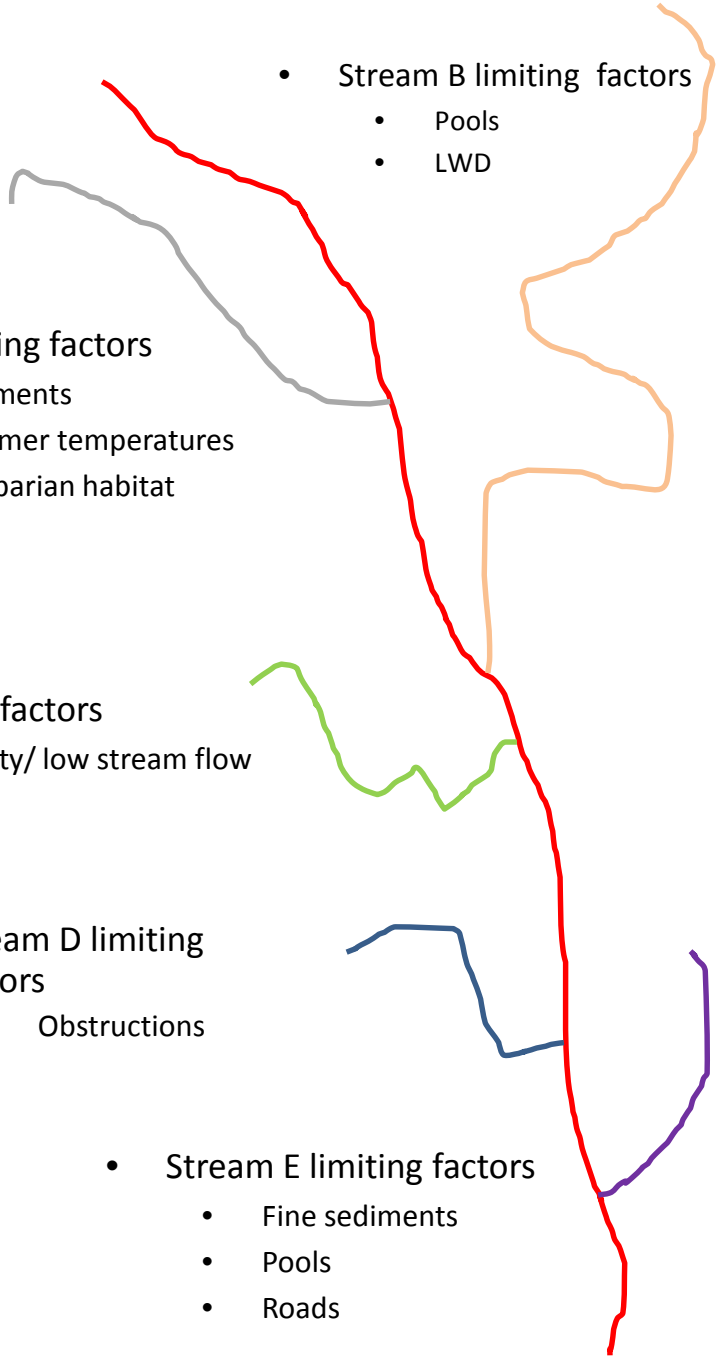
Presenter: John Arterburn

Why care about spatial scale?

- Data can be “rolled up” but **NOT** down
- A working spatial scale currency has been lacking in the Columbia River for a long time.
  - Early efforts created ecoprovinces and subbasins (4th order HUC).
- Foundation for M&E, Reporting, and AM.
- Population/subbasin scale focus is misaligned with salmon life history and habitat restoration needs.

Theoretical Spatial Scale Example

- Subbasin/Population level limiting factors
  - Floodplain connectivity
  - Side channel reconnection
  - Predation
- Life stage use 1+ rearing and migration



- Stream B limiting factors
  - Pools
  - LWD
- Stream A limiting factors
  - Fine sediments
  - High summer temperatures
  - Lack of riparian habitat
- Stream C limiting factors
  - Water quantity/ low stream flow
  - Withdrawals
- Stream D limiting factors
  - Obstructions
- Stream E limiting factors
  - Fine sediments
  - Pools
  - Roads

What can we do about it?

- NRCS has completed 6th order subwatershed HUC's
  - Adopting this as "subwatersheds or assessment units" consistent with existing NPCC structure.
    - Standard guidance for geomorphic reaches
      1. Existing geomorphic reach breaks from existing efforts.
      2. Mouth of creek to anadromous barrier or fish terminus.
      3. Use GIS data to establish breaks based upon gradient and confinement.
      4. Systematic reach length 1-4km
- Once complete a strong foundation for the future would be established.

Guiding and Evaluating Habitat Actions using Status and Trend Results

Results from OBMEP's 2nd habitat status and trend report

Presenters: John Arterburn
Chip McConnaha
Eric Doyle

THE OKANOGAN BASIN MONITORING AND EVALUATION PROGRAM

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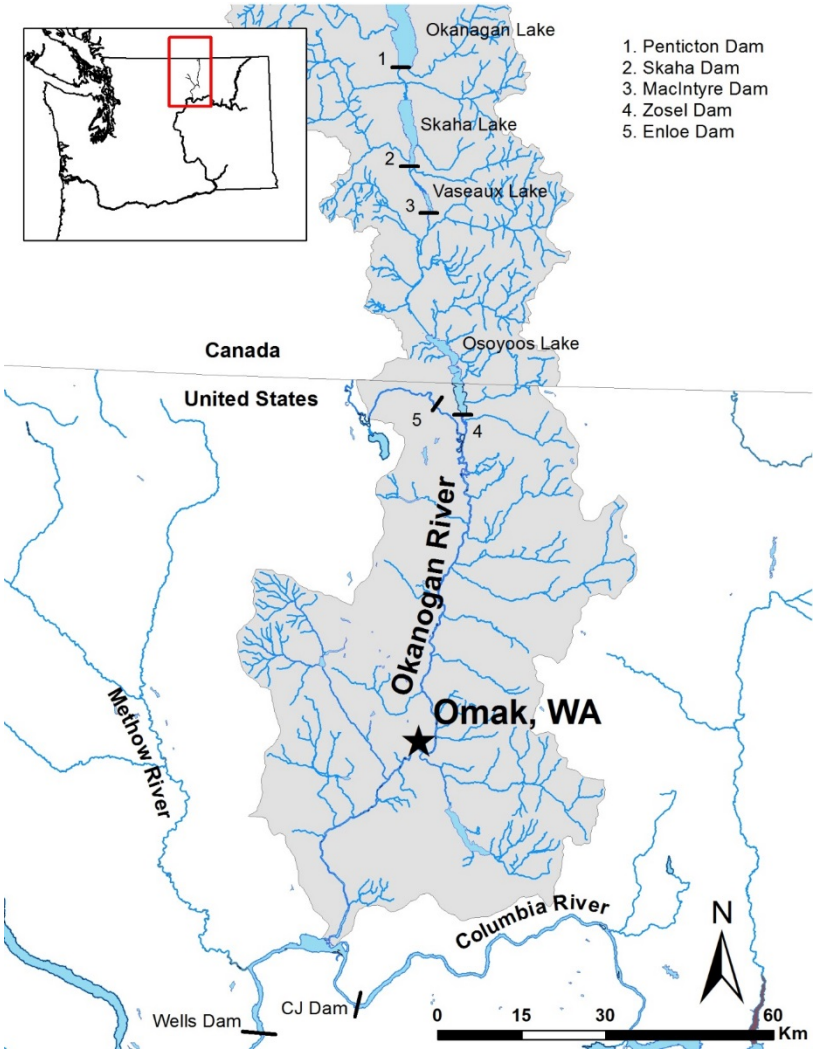
Edward Berrigan
Chip McConnaha
Joe Enns
Past Employees
Brian Miller
Ryan Klett
Jackie Roy
Sonya Schaller
Mike Miller
Lindsay George

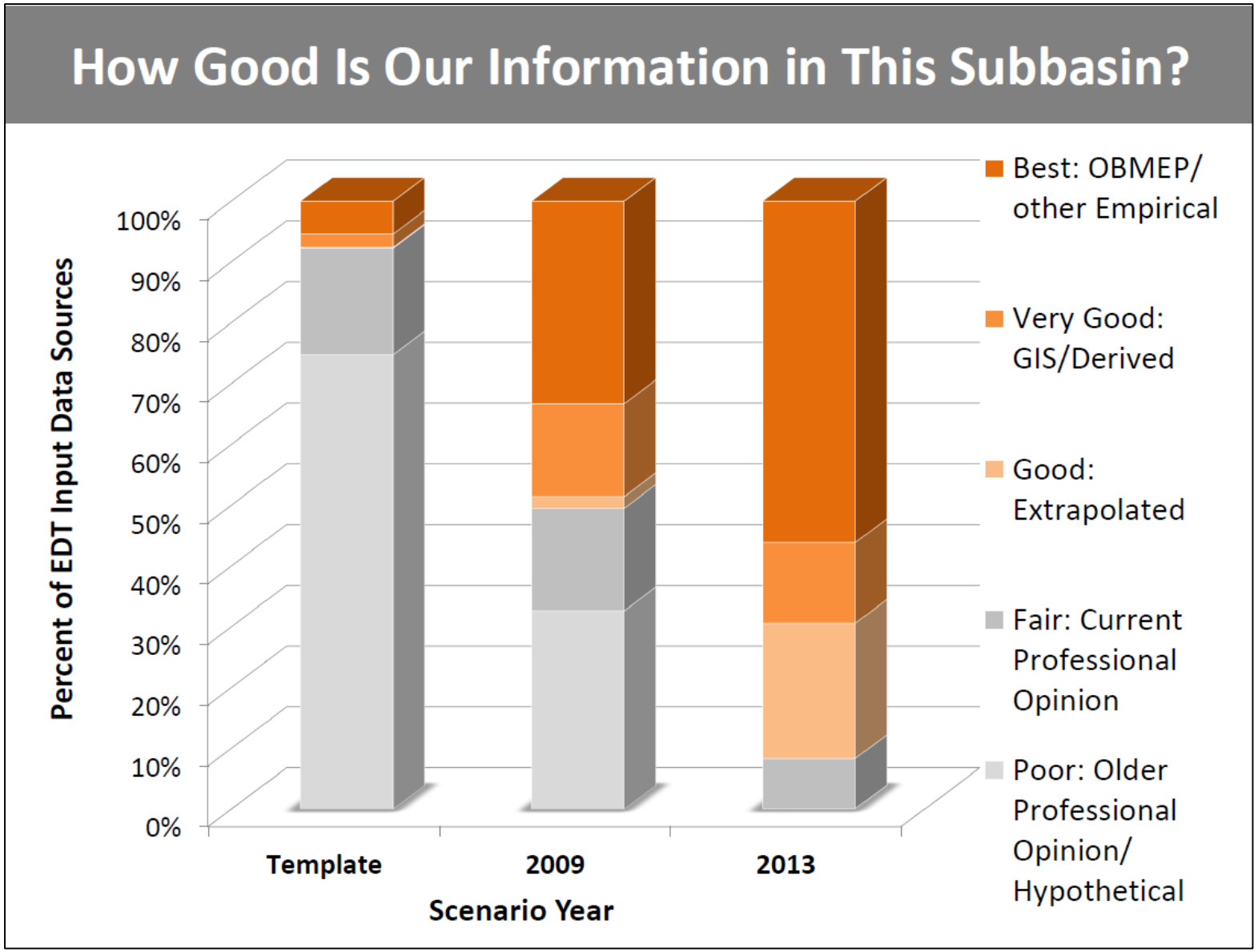
What is OBMEP
(Okanogan Basin Monitoring and Evaluation Program)



The Okanogan River Basin

- Initiated in 2004
- Main hypotheses:
  - are anadromous habitats changing over time?
  - how do these changes in habitat impact fish?
  - and what can we do about these impacts?
- All this is done in an economically efficient manner.

OBMEP continues to Improve Data Quality



OBMEP basics

Steelhead Life History

- Spawner distribution
- Run timing
- Age at migration
- Marine age
- Historical diversity

OBMEP Data

- Habitat Types
- Temperature
- Discharge
- Large wood
- Substrate fines and composition
- Channel width
- Riparian structure and function
- Etc.....

EDT

Survival probabilities used to evaluate habitat potential & limiting factors across multiple scales

- ❑ Populations
  - o Subbasin 4th order HUC's
- ❑ Assessment Units
  - o Based on 6th order HUC's
- ❑ Reach
  - o 212 stream reaches

The Challenge

- Statistical lingo (mean, median, mode) are not meaningful tools to communicate about habitat and fish survival.
  - Mean LWD/mile, Average water temperature, primary substrate

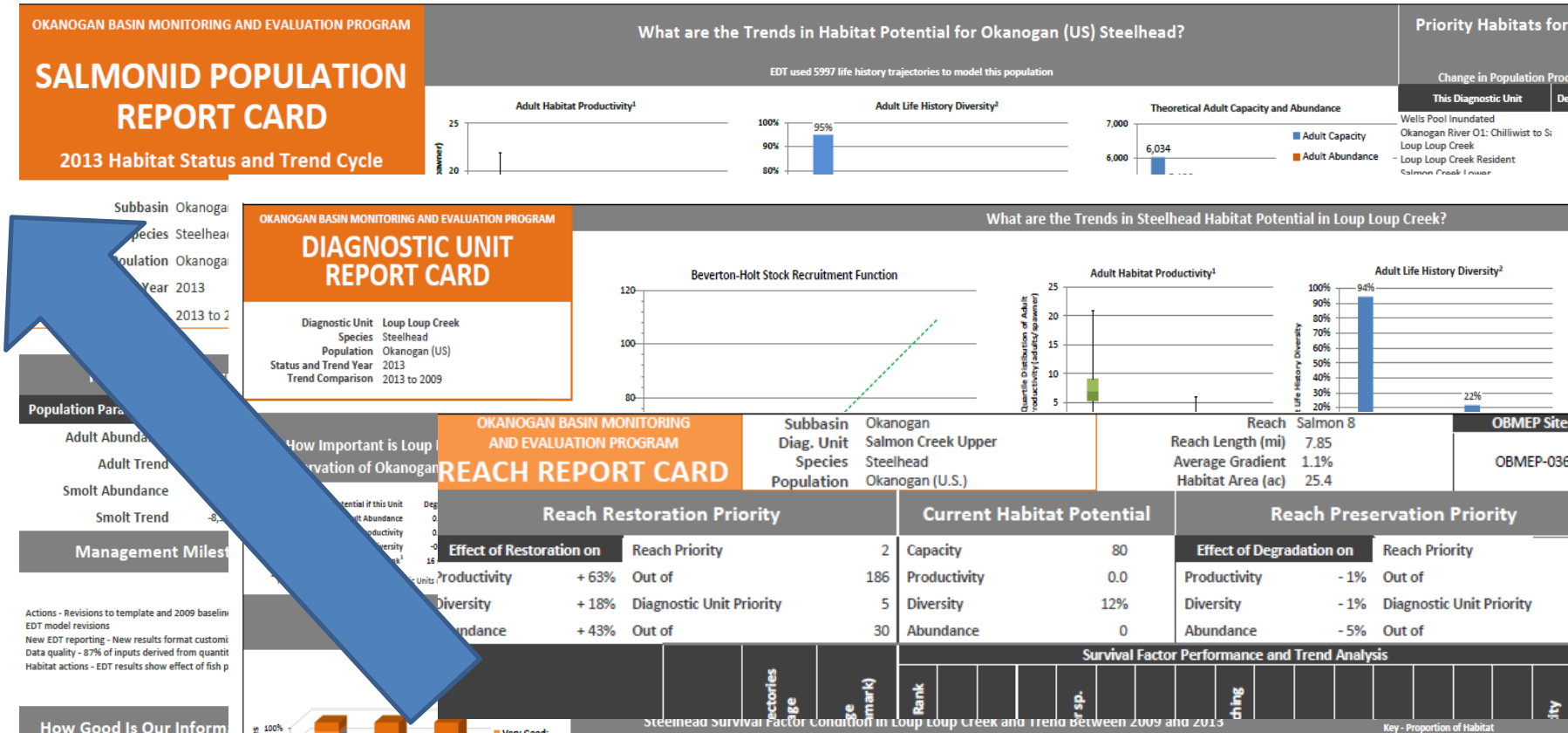
- Fish usually experience the culmination of the entire habitat (flow, temperature, food) and not just one variable at a time (e.g., flow)

- Goals for informative, effective, habitat reporting include:
  - **Provide needed information to guide habitat work.**
  - **Assess effectiveness of actions**.
  - **Provide a mechanism for prioritizing projects.**
  - **Provide a way to update habitat limiting factors by life stage.**
  - **Linkage habitat to Viable Salmonid Population(VSP) criteria.**
  - **Inform expert panel process for ESA-listed salmon and steelhead.**

The Solution

Effective Communication of Results

- Visually summarizing data to inform questions at multiple spatial scales



Population Report Card

OKANOGAN BASIN MONITORING AND EVALUATION PROGRAM

SALMONID POPULATION REPORT CARD

2013 Habitat Status and Trend Cycle

Subbasin	Okanogan (US)
Species	Steelhead
Poulation	Okanogan Summer
Stauts & Trend Year	2013
Trend Comparison	2013 to 2009

Population Performance Summary

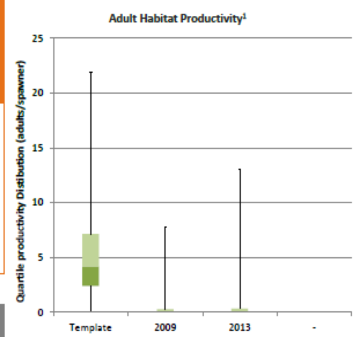
Population Parameter	EDT Estimate	Observed
Adult Abundance	876 Wild	291 wild, 2,098 total (2013 6-yr geomean) Wild +31/yr, total +189/yr (2005-2013)
Adult Trend	-203	
Smolt Abundance	22,475	n/a
Smolt Trend	-8,374	n/a

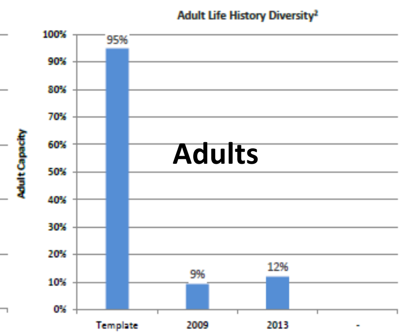
Management Milestones: 2009—2013

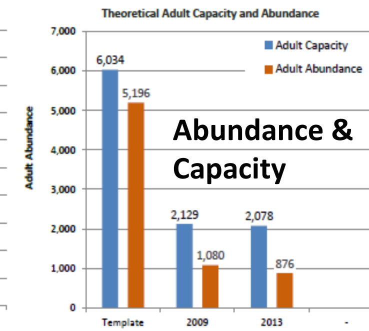
Actions - Revisions to template and 2009 baseline required due to substantial Okanogan EDT model revisions
New EDT reporting - New results format customized for CCT reporting needs
Data quality - 87% of inputs derived from quantitative data
Habitat actions - EDT results show effect of fish passage at McIntyre Dam

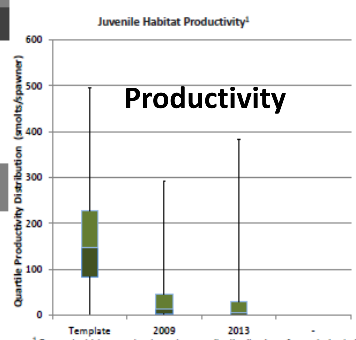
What are the Trends in Habitat Potential for Okanogan (US) Steelhead?

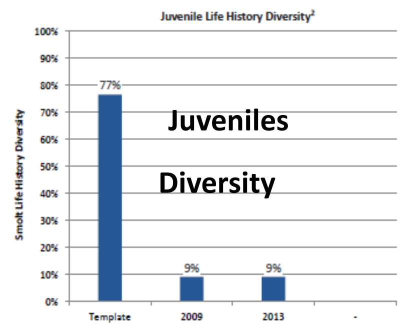
EDT used 5997 life history trajectories to model this population

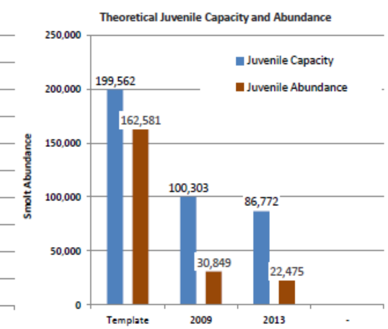






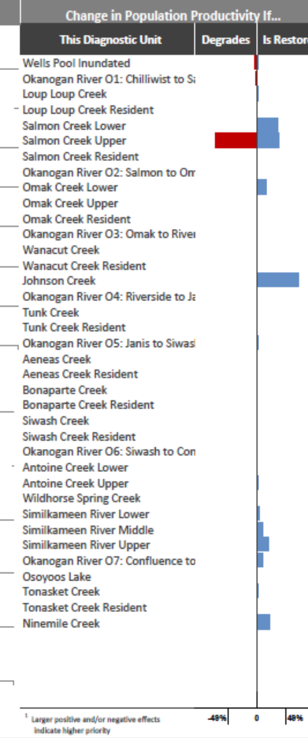






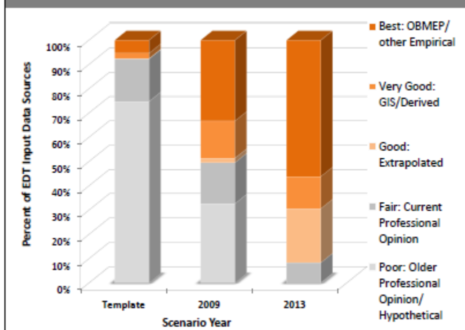
[1] Box and whisker graphs show the quartile distribution of cumulative habitat productivity for all 5997 EDT trajectories used to model this population.
[2] The percent of adult trajectories having a productivity >1.0 or juvenile productivity >100 juveniles/spawner represent the range of life history diversity each habitat scenario can support.

Priority Habitats for Steelhead



[1] Larger positive and/or negative effects indicate higher priority

How Good Is Our Information in This Subbasin?



READ ME - The subbasin planning EDT model used different data quality rating criteria and had a different reach structure and shorter overall reach length compared to the current model. Therefore subbasin planning ratings are not directly comparable to current or template conditions.

How Has Steelhead Habitat Potential Changed Between 2009 and 2013?

DIAGNOSTIC UNIT

Population Parameter and Trend Since Template	Productivity	Trend	Abundance	Trend	Habitat Capacity	Trend	Diversity	Trend
--	--	--	--	--	--	--	--	--
Okanogan River O1: Chilliwist to Salmon	0.0	▬	0	▬	0	▬	0%	▬
Loup Loup Creek	3.0	↑	27	↑	37	↑	[illegible]2%	↑
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Salmon Creek Lower	2.2	↑	22	↑	40	↓	19%	↑
Salmon Creek Upper	6.1	↑	307	↑	367	↑	71%	↑
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Okanogan River O2: Salmon to Omak	0.0	↓	0	↓	153	↓	0%	↓
Omak Creek Lower	4.3	▲	96	▼	125	▼	19%	↓
Omak Creek Upper	0.0	▬	0	▬	36	↑	0%	▬
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Okanogan River O3: Omak to Riverside	0.0	▬	0	▬	0	▬	0%	▬
Wanacut Creek	1.2	↓	2	↓	9	↓	2%	▼
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Johnson Creek	0.0	↓	0	↓	6	↓	0%	▬
Okanogan River O4: Riverside to Janis	1.2	↓	55	↓	364	↓	1%	▼
Tunk Creek	1.3	↓	2	↓	7	↓	7%	↓
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Okanogan River O5: Janis to Siwash	1.3	↓	46	↓	185	↓	1%	↓
Aeneas Creek	0.0	▬	0	▬	0	↑	0%	▬
--	--	--	--	--	--	--	--	--
Bonaparte Creek	0.0	↓	0	↓	15	↓	0%	▼
--	--	--	--	--	--	--	--	--
Siwash Creek	0.0	▬	0	▬	0	▬	0%	▬
--	–	--	–	--	–	--	–	--
Okanogan River O6: Siwash to Confluence	0.0	▬	0	▬	0	▬	0%	▬
Antoine Creek Lower	1.0	▬	0	▬	8	↑	2%	▬
Antoine Creek Upper	1.5	▬	9	▬	29	↑	6%	▲
Wildhorse Spring Creek	1.9	▬	1	▬	3	↑	2%	▬
Similkameen River Lower	1.7	▼	84	↑	195	↑	2%	▬
Similkameen River Middle	2.4	↓	102	↓	177	▼	38%	▬
Similkameen River Upper	1.7	↓	47	↓	119	▼	15%	↓
Okanogan River O7: Confluence to Zosel Dam	0.0	↓	0	↓	97	↓	0%	↓
Osoyoos Lake	0.0	▬	0	▬	0	▬	0%	▬
Tonasket Creek	3.9	↑	24	↑	33	↑	29%	▬
--	–	--	–	--	–	--	–	--
Ninemile Creek	3.7	▼	53	↓	73	↓	43%	▬

Symbol Key

Parameter Trend	Negative	Positive
<1%	▬	▬
>1-5%	▼	▲
>5%	↓	↑

Diagnostic Unit Report Card

OKANOGAN BASIN MONITORING AND EVALUATION PROGRAM

DIAGNOSTIC UNIT REPORT CARD

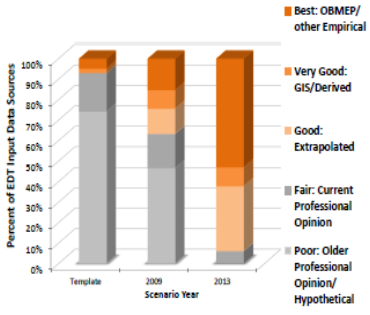
Diagnostic Unit	Loup Loup Creek
Species	Steelhead
Population	Okanogan (US)
Status and Trend Year	2013
Trend Comparison	2013 to 2009

How Important is Loup Loup Creek for Conservation of Okanogan (US) Steelhead?

Effect on Population Potential if this Unit	Degrades	Is Restored
Adult Abundance	0.0%	0.0%
Adult Productivity	0.0%	+7.9%
Life History Diversity	-0.5%	0.0%
Diagnostic Unit Priority Rank[1]	16 of 28	17 of 28

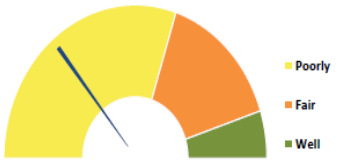
[1] Relative to all Okanogan (US) Diagnostic Units used by this Steelhead population

How Good is Our Information in Loup Loup Creek?

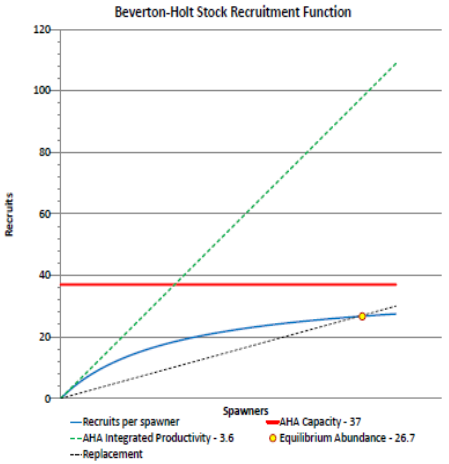


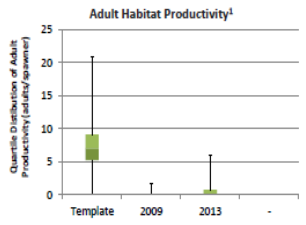
How is Loup Loup Creek Performing as Steelhead Habitat?

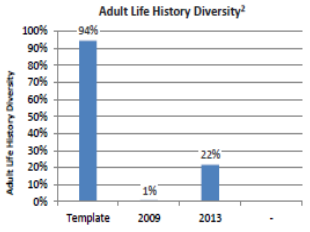
Currently Functioning at 28% of Template Habitat Potential

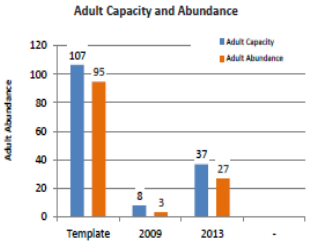


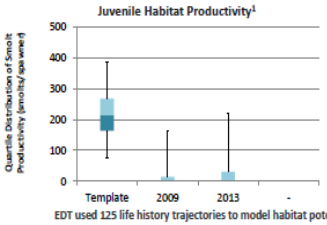
What are the Trends in Steelhead Habitat Potential in Loup Loup Creek?

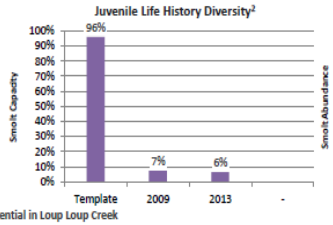


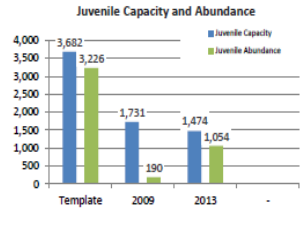












EDT used 125 life history trajectories to model habitat potential in Loup Loup Creek

[1] Box and whisker graphs show the quartile distribution of cumulative habitat productivity for all 125 EDT trajectories used to model this Diagnostic Unit.

[2] The percent of adult trajectories having a productivity >1.0 or juvenile productivity >100 smolts/spawner represent the range of life history diversity each habitat scenario can theoretically support.

Steelhead Survival Factor Condition in Loup Loup Creek and Trend Between 2009 and 2013

Limiting Factors Analysis

Channel Stability	Sediment Conditions	Flow Conditions	Withdrawals	Habitat Diversity
% of Template: 96%	% of Template: 76%	% of Template: 84%	% of Template: 100%	% of Template: 86%
Factor Wt.: 5%	Factor Wt.: 32%	Factor Wt.: 25%	Factor Wt.: 0%	Factor Wt.: 18%
Factor Trend: —	Factor Trend: ↓	Factor Trend: —	Factor Trend: —	Factor Trend: —
Level of Proof: 1.99	Level of Proof: 1.62	Level of Proof: 1.87	Level of Proof: 4.00	Level of Proof: 1.37

Temperature	Dissolved Oxygen	Competition-Hatchery	Competition-Other	Food	Predation	Obstructions
% of Template: 106%	% of Template: 100%	% of Template: 100%	% of Template: 100%	% of Template: 98%	% of Template: 100%	% of Template: 94%
Factor Wt.: 8%	Factor Wt.: 0%	Factor Wt.: 1%	Factor Wt.: 0%	Factor Wt.: 2%	Factor Wt.: 0%	Factor Wt.: 8%
Factor Trend: ↑	Factor Trend: —	Factor Trend: —	Factor Trend: —	Factor Trend: —	Factor Trend: —	Factor Trend: ↑
Level of Proof: 2.66	Level of Proof: 2.83	Level of Proof: 1.54	Level of Proof: 1.57	Level of Proof: 1.27	Level of Proof: 2.57	Level of Proof: 2.00

READ ME - Pie charts describe how well each EDT Survival Factor is functioning based on its overall effect on Steelhead productivity; % of Template describes current Survival Factor condition relative to template; Factor Weight rates relative importance of each Survival Factor based its proportional impact on Steelhead productivity relative to other survival factors; Factor Trend describes change in Survival Factor % of Template between the 2009 and 2013 habitat scenarios.

Change in Function Relative to Benchmark

Key - Proportion of Habitat

Categorical Ranking	Productivity Impact
Not properly functioning	>5.1% reduction
Functioning at High Risk	2.6% to 5% reduction
Functioning at Risk	1.1% to 2.5% reduction
Properly Functioning	0% to 1% reduction

Key - Survival Factor Trend

Change	Neg.	Pos.
<1%	—	—
>1-5%	▽	△
>5%	↓	↑

Habitat Priorities - Change in Population Abundance If (values normalized to %change/river mile)

This Reach, Length (mi)		Degrades	is Restored
Loup Loup 1	0.16		
Loup Loup 3	0.10		
Loup Loup 5	0.79		
Loup Loup 7	0.31		
Loup Loup 9	0.76		

Sub-watershed Obstruction Report Card

OKANOGAN BASIN MONITORING AND EVALUATION PROGRAM

DIAGNOSTIC UNIT REPORT CARD

OBSTRUCTIONS AND KEY HABITAT

Subbasin: Okanogan (US)
Species: Steelhead
Population: Okanogan Summer
Monitoring Cycle: 2009-2013
Diagnostic Unit: Loup Loup Creek

Diagnostic Unit Habitat Statistics	
Stream Length (mi):	2.02
Template Adult Capacity:	107

Diagnostic Unit Obstruction Statistics			
# of Obstructions:	4	# Manmade:	4
Factor Weight:	8% of DU productivity impairment		

There Were 4 Manmade Obstructions in Loup Loup Creek in 2013
With the Following Effects on Steelhead Productivity (NR = Obstruction not rated)

Loup Loup 2 (culvert) - 92% of DU reach length upstream

	Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq		Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq
Adult	100%	0	86	76	Adult	--	--	--	--
Juvenile	100%	0	3,283	2,834	Juvenile	--	--	--	--

Loup Loup 4 (culvert) - 89% of DU reach length upstream

	Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq		Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq
Adult	100%	0	86	76	Adult	--	--	--	--
Juvenile	NR	NR	3,283	2,834	Juvenile	--	--	--	--

Loup Loup 6 (culvert) - 52% of DU reach length upstream

	Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq		Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq
Adult	88%	11	36	32	Adult	--	--	--	--
Juvenile	NR	NR	1,558	1,321	Juvenile	--	--	--	--

Loup Loup 8 (diversion dam) - 37% of DU reach length upstream

	Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq		Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq
Adult	100%	0	26	23	Adult	--	--	--	--
Juvenile	100%	0	1,180	997	Juvenile	--	--	--	--

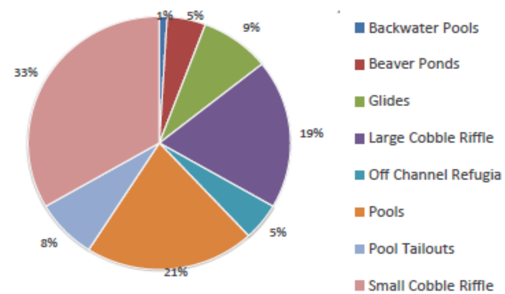
	Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq		Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq
Adult	--	--	--	--	Adult	--	--	--	--
Juvenile	--	--	--	--	Juvenile	--	--	--	--

	Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq		Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq
Adult	--	--	--	--	Adult	--	--	--	--
Juvenile	--	--	--	--	Juvenile	--	--	--	--

	Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq		Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq
Adult	--	--	--	--	Adult	--	--	--	--
Juvenile	--	--	--	--	Juvenile	--	--	--	--

	Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq		Minimum Passage	# of Barrier Months	Habitat available upstream of this barrier: Template Capacity	Template Neq
Adult	--	--	--	--	Adult	--	--	--	--
Juvenile	--	--	--	--	Juvenile	--	--	--	--

Loup Loup Creek Habitat Composition and Key Habitat Area for Steelhead Under Template Conditions

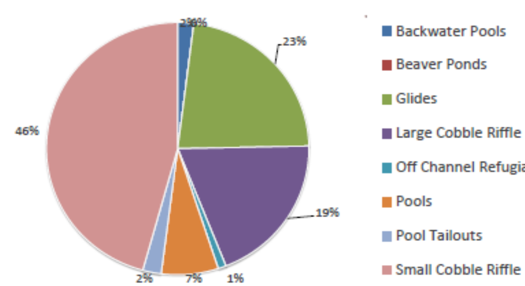


Lifestage	Key Habitat Area*
Spawning	4%
Fry colonization	5%
0-age active	17%
0-age inactive	17%
1-age active	17%
1-age inactive	17%
2+-age migrant	20%
Prespawn holding	4%

Template Habitat Capacity

Scenario	Adult	Juvenile
Template	107	3,682

Loup Loup Creek Habitat Composition in 2009 and Trend in Steelhead Key Habitat Area Since Template

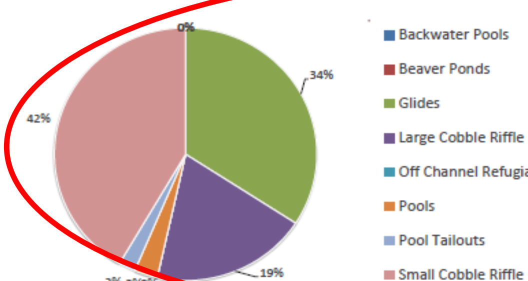


Lifestage	Key Habitat Area*	Trend
Spawning	5.0%	23%
Fry colonization	5.0%	0%
0-age active	17.1%	1%
0-age inactive	16.9%	1%
1-age active	17.0%	1%
1-age inactive	17.3%	1%
2+-age migrant	20.0%	0%
Prespawn holding	1.6%	-55%

Net Habitat Capacity and Change Since Template

Comparison	Adult	Juvenile
Template to 2009	8 (-93%)	1731 (-53%)

Loup Loup Creek Habitat Composition in 2013 and Trend in Steelhead Key Habitat Area Since 2009



Lifestage	Key Habitat Area*	Trend
Spawning	5.5%	9%
Fry colonization	5.0%	0%
0-age active	17.0%	-1%
0-age inactive	16.9%	-1%
1-age active	16.9%	-1%
1-age inactive	17.3%	-1%
2+-age migrant	20.1%	0%
Prespawn holding	1.3%	-19%

Net Habitat Capacity and Change Since 2009

Comparison	Adult	Juvenile
2009 to 2013	37 (363%)	1474 (-15%)

* Percent of reach providing key habitat for this life stage in EDT in this habitat scenario

OKANOGAN BASIN MONITORING AND EVALUATION PROGRAM

REACH REPORT CARD

Subbasin	Okanogan
Diag. Unit	Salmon Creek Upper
Species	Steelhead
Population	Okanogan (U.S.)

Reach	Salmon 8
Reach Length (mi)	7.85
Average Gradient	1.1%
Habitat Area (ac)	25.4

OBMEP Sites

OBMEP-036

Reach Restoration Priority

Effect of Restoration on			
Productivity	+ 63%	Reach Priority	2
Diversity	+ 18%	Out of	186
Abundance	+ 43%	Diagnostic Unit Priority	5
		Out of	30

Current Habitat Potential

Capacity	80
Productivity	0.0
Diversity	12%
Abundance	0

Reach Preservation Priority

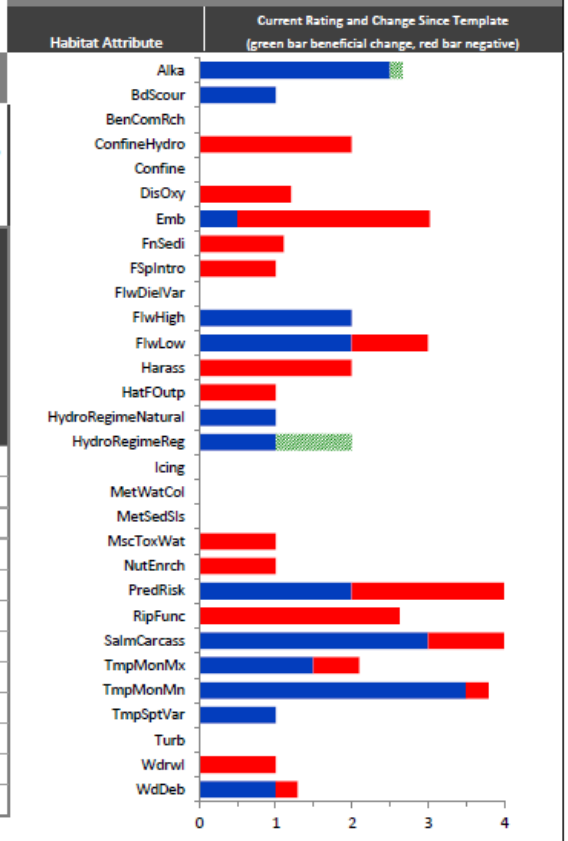
Effect of Degradation on			
Productivity	- 1%	Reach Priority	21
Diversity	- 1%	Out of	186
Abundance	- 5%	Diagnostic Unit Priority	2
		Out of	30

Survival Factor Performance and Trend Analysis

Life Stage	Relevant months	Proportion of trajectories exposed by life stage	Productivity change (relative to benchmark)	Life Stage Priority Rank	Channel stability	Chemicals	Competition-Hatchery	Competition-other sp.	Flow	Food	Habitat diversity	Harassment/ poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity	Life stage trend
Spawning	Apr-Jun	3.5%	-31.1%	3					●											●	↑
Egg Incubation	Apr-Jul	3.5%	-59.6%	1					●											●	↑
Fry colonization	May-Jul	3.7%	-14.3%	5					●							●				●	↑
0-age active rearing	Jun-Oct	3.6%	-15.1%	4																●	↓
0-age inactive	Nov-Apr	3.1%	-44.4%	2													●	●		●	↑
1-age migrant	May-Jun	4.6%	-0.3%	11																●	↓
1-age active rearing	Apr-Oct	3.1%	-9.2%	7																●	↓
1-age inactive	Nov-Apr	0.8%	-44.8%	6													●	●		●	↓
2+-age migrant	May-Jun	1.6%	-0.1%	14																●	↓
2+-age transient rearing	Apr-Oct	0.0%	0.0%	0																	–
Prespawning migrant	Oct-Dec	7.4%	-0.2%	12																●	↓
Prespawning holding	Oct-Apr	3.5%	-0.1%	13																●	↓
Survival Factor Trend					↓	–	–	–	↓	↓	↓	–	–	↓	–	↓	↓	↓	–	–	

Limiting Factors by Life Stage

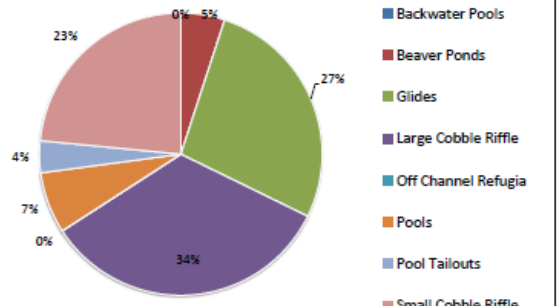
EDT Level 2 Attribute Ratings



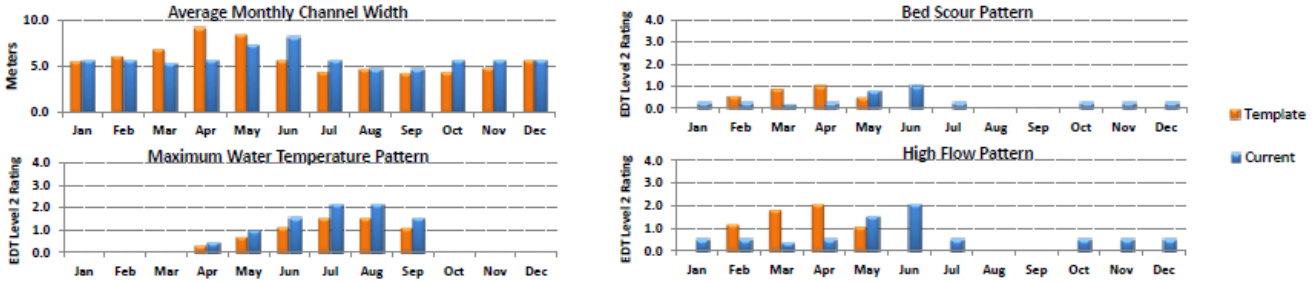
Habitat Productivity Impact Key					
Impact	Extreme	High	Moderate	Small	None
Loss	●	●	●	●	-
Gain	●	●	●	●	-

Trend Key		
Trend	Neg.	Pos.
<2.5%	–	–
>2.5-10%	↓	↑
>10%	↓	↑

EDT Habitat Composition Ratings



Temporal Patterns for Selected EDT Level 2 Attributes



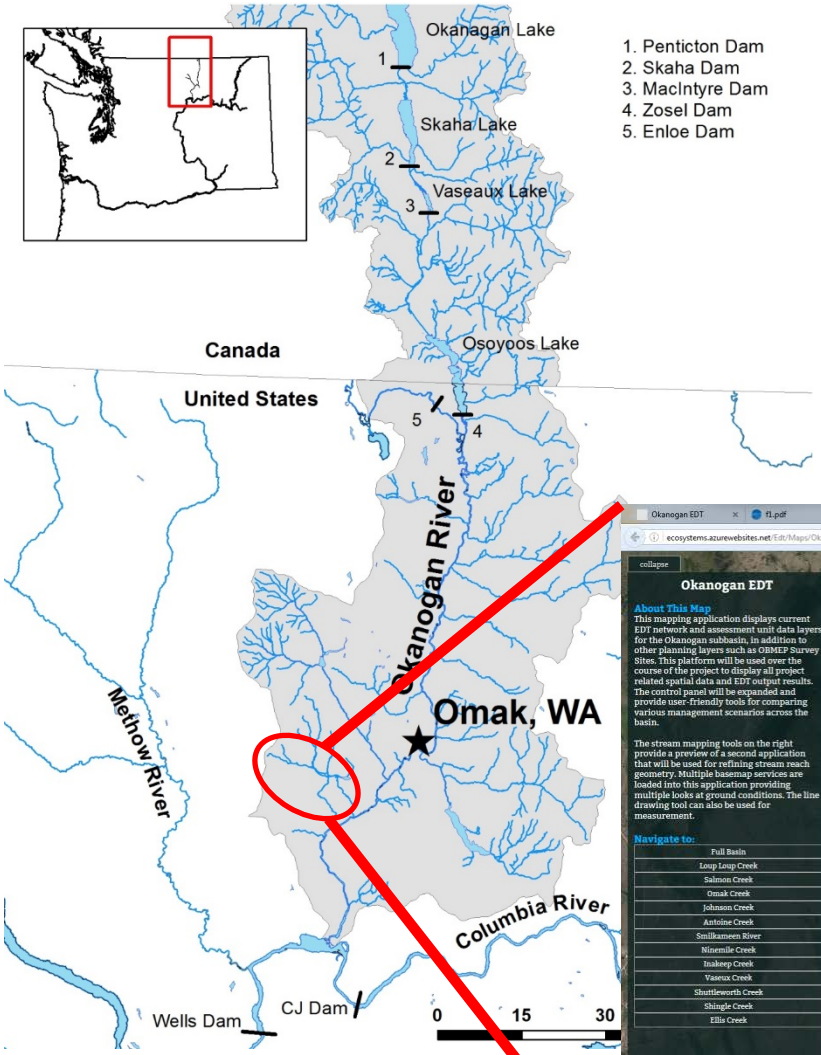
Lifestage	Key Habitat Area[1]	Trend
Spawning	11.6%	↑
Fry Colonization	17.0%	–
Active Rearing	28.6%	–
Inactive Rearing	28.6%	–
Prespawn Holding	14.3%	↓

[1] Percent of reach providing key habitat function for this life stage in EDT

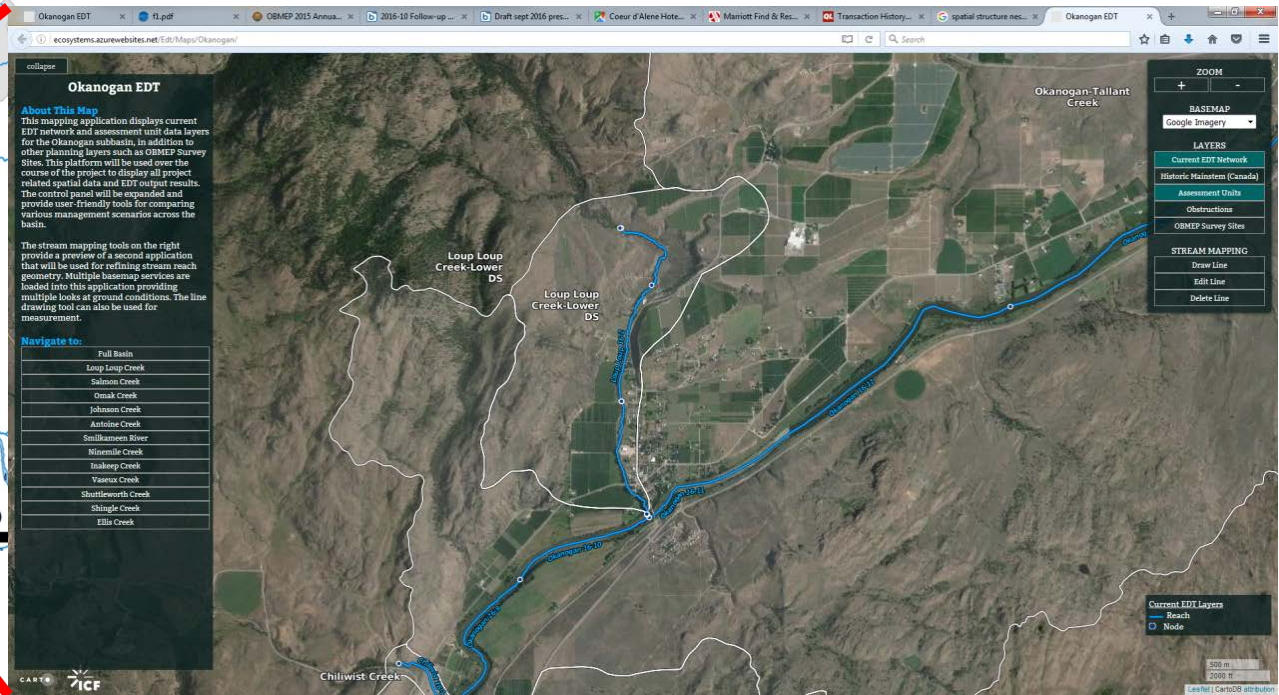
Action Effectiveness

- OBMEP was designed to produce status and trend information.
- OBMEP has never receive funding tied to effectiveness monitoring or IMW's.
- OBMEP's focus on 6th order HUC assessment units and superior design allows status and trend results to be leveraged for effectiveness inference.
- What follows is an example taken from our 2015 habitat status and trend report results for Loup Loup Creek.

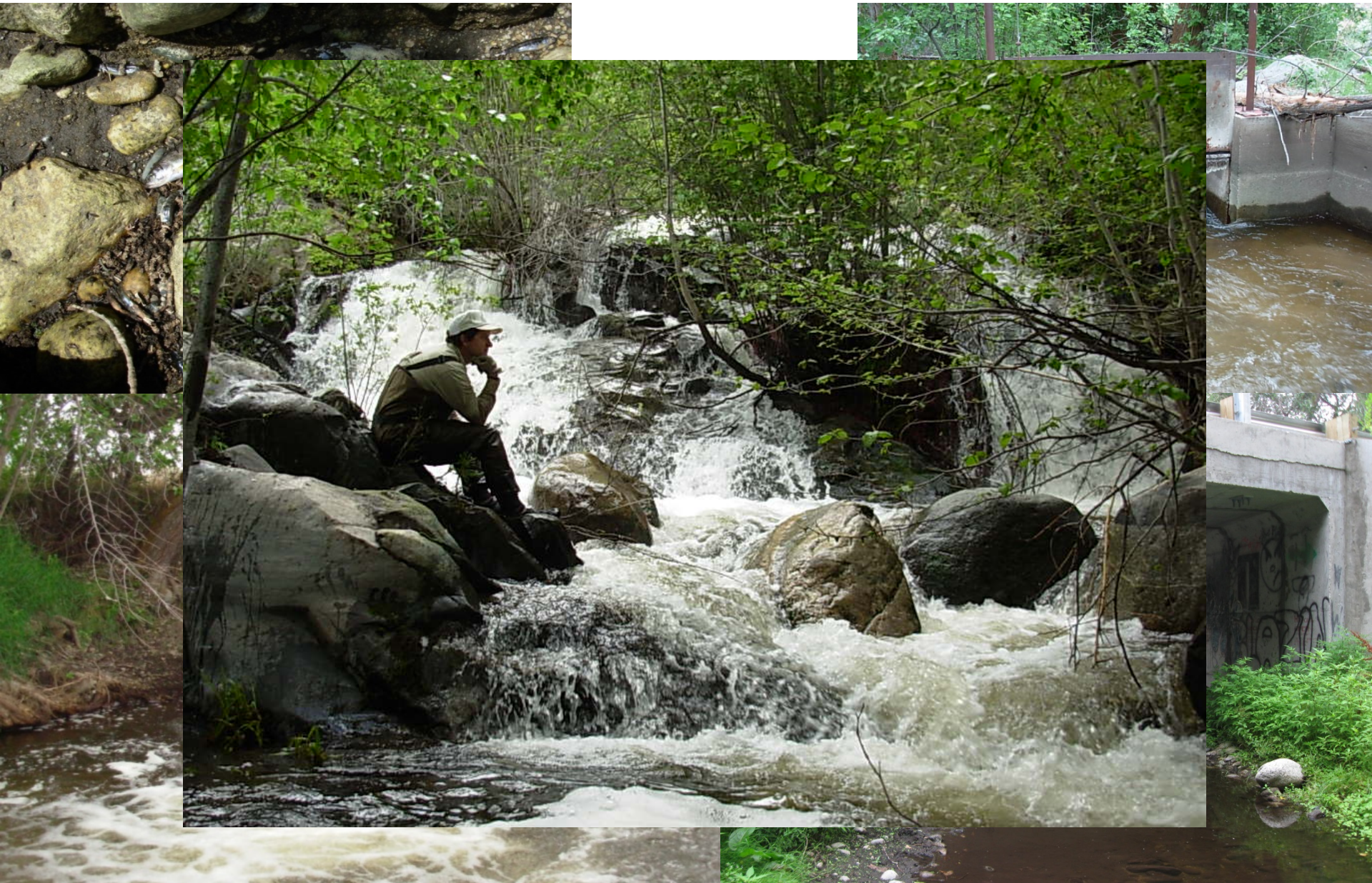
Loup Loup Creek-Case Study



- First Okanogan River tributary stream upstream of Columbia River confluence.
- Limiting factors prior to 2010:
  - Low Flow
  - Obstructions



Taking Action- Loup Loup Creek



Diagnostic Unit Report Card

OKANOGAN BASIN MONITORING AND EVALUATION PROGRAM

DIAGNOSTIC UNIT REPORT CARD

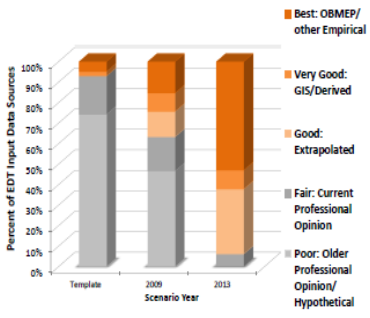
Diagnostic Unit	Loup Loup Creek
Species	Steelhead
Population	Okanogan (US)
Status and Trend Year	2013
Trend Comparison	2013 to 2009

How Important is Loup Loup Creek for Conservation of Okanogan (US) Steelhead?

Effect on Population Potential if this Unit	Degrades	Is Restored
Adult Abundance	0.0%	0.0%
Adult Productivity	0.0%	+7.9%
Life History Diversity	-0.5%	0.0%
Diagnostic Unit Priority Rank[1]	16 of 28	17 of 28

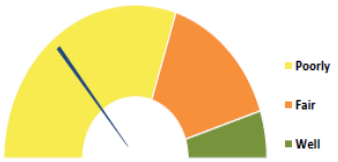
[1] Relative to all Okanogan (US) Diagnostic Units used by this Steelhead population

How Good is Our Information in Loup Loup Creek?

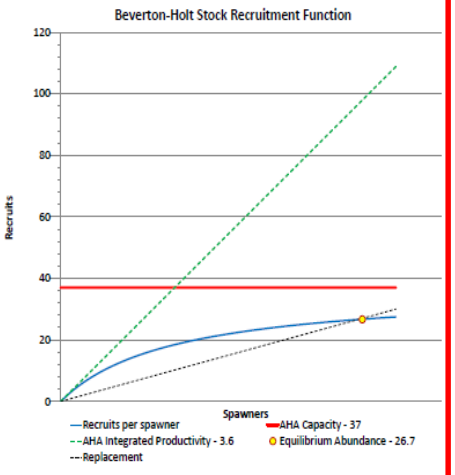


How is Loup Loup Creek Performing as Steelhead Habitat?

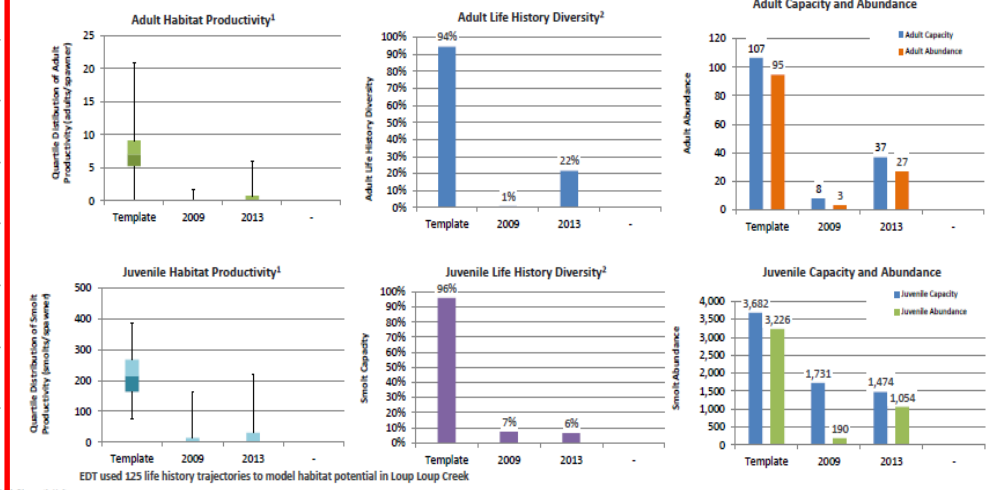
Currently Functioning at 28% of Template Habitat Potential



Beverton-Holt Stock Recruitment Function



What are the Trends in Steelhead Habitat Potential in Loup Loup Creek?

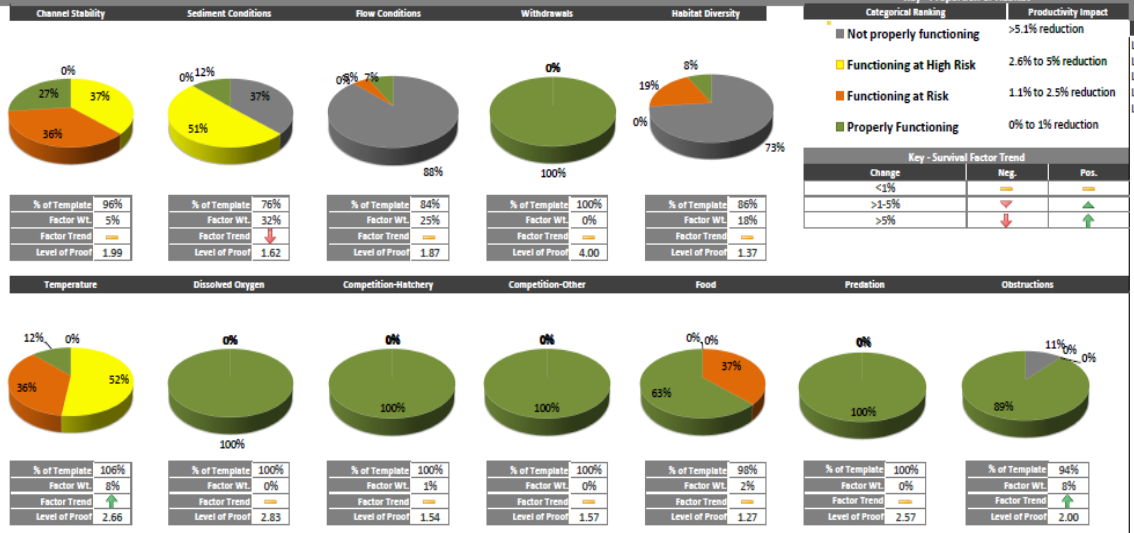


[1] Box and whisker graphs show the quartile distribution of cumulative habitat productivity for all 125 EDT trajectories used to model this Diagnostic Unit.

[2] The percent of adult trajectories having a productivity >1.0 or juvenile productivity >100 smolts/spawner represent the range of life history diversity each habitat scenario can theoretically support.

EDT used 125 life history trajectories to model habitat potential in Loup Loup Creek

Steelhead Survival Factor Condition in Loup Loup Creek and Trend Between 2009 and 2013



	Channel Stability	Sediment Conditions	Flow Conditions	Withdrawals	Habitat Diversity
% of Template	96%	76%	84%	100%	86%
Factor Wt.	5%	32%	25%	0%	18%
Factor Trend	—	↓	—	—	—
Level of Proof	1.99	1.62	1.87	4.00	1.37

	Temperature	Dissolved Oxygen	Competition-Hatchery	Competition-Other	Food	Predation	Obstructions
% of Template	106%	100%	100%	100%	98%	100%	94%
Factor Wt.	8%	0%	1%	0%	2%	0%	8%
Factor Trend	↑	—	—	—	—	—	↑
Level of Proof	2.66	2.83	1.54	1.57	1.27	2.57	2.00

Change in Function Relative to Benchmark

Key - Proportion of Habitat

Categorical Ranking	Productivity Impact
Not properly functioning	>5.1% reduction
Functioning at High Risk	2.6% to 5% reduction
Functioning at Risk	1.1% to 2.5% reduction
Properly Functioning	0% to 1% reduction

Key - Survival Factor Trend

Change	Neg.	Pos.
<1%	—	—
>1-5%	▽	△
>5%	↓	↑

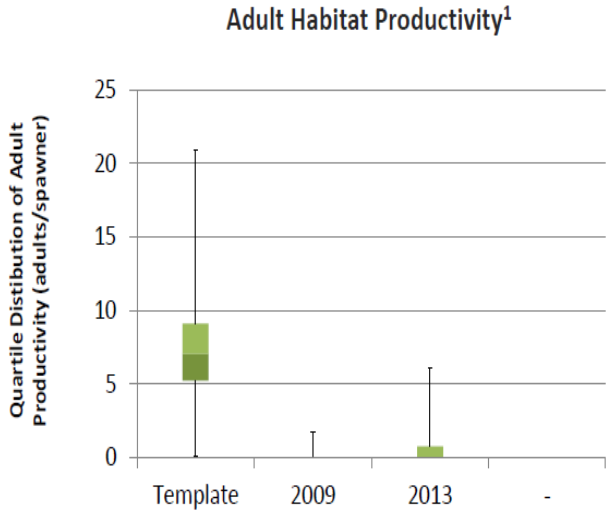
Habitat Priorities - Change in Population Abundance If (values normalized to %change/river mile)

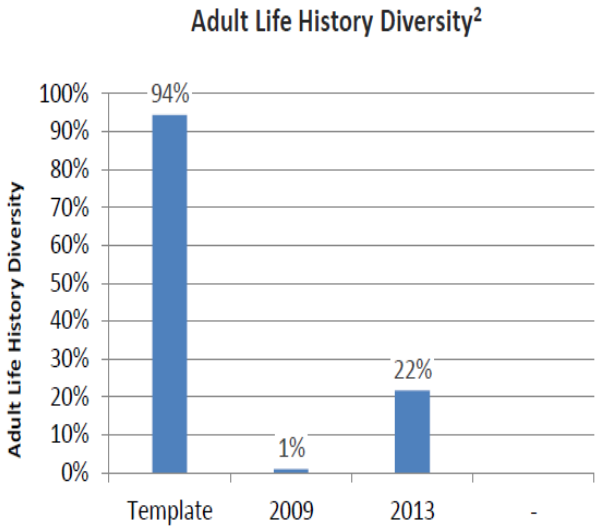
This Reach, Length (mi)		Degrades	is Restored
Loup Loup 1	0.16		
Loup Loup 3	0.10		
Loup Loup 5	0.79		
Loup Loup 7	0.31		
Loup Loup 9	0.76		

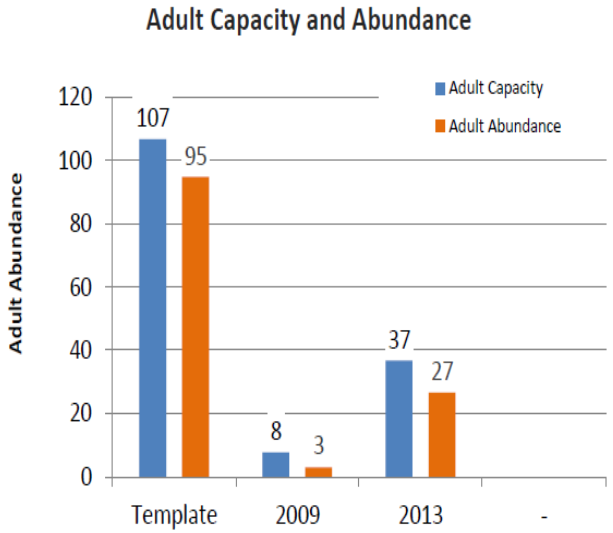
READ ME - Pie charts describe how well each EDT Survival Factor is functioning based on its overall effect on Steelhead productivity; % of Template describes current Survival Factor condition relative to template; Factor Weight rates relative importance of each Survival Factor based its proportional impact on Steelhead productivity relative to other survival factors; Factor Trend describes change in Survival Factor % of Template between the 2009 and 2013 habitat scenarios.

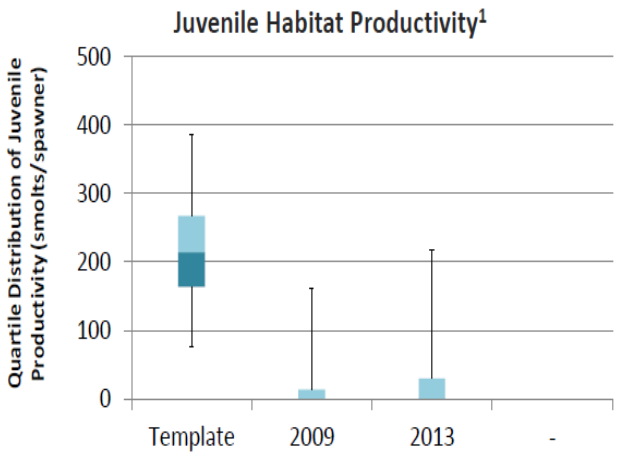
Habitat Monitoring Data Synthesized

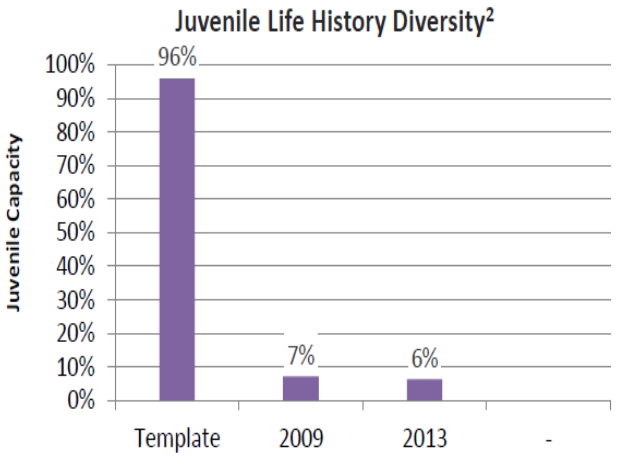
Effects of Habitat Actions

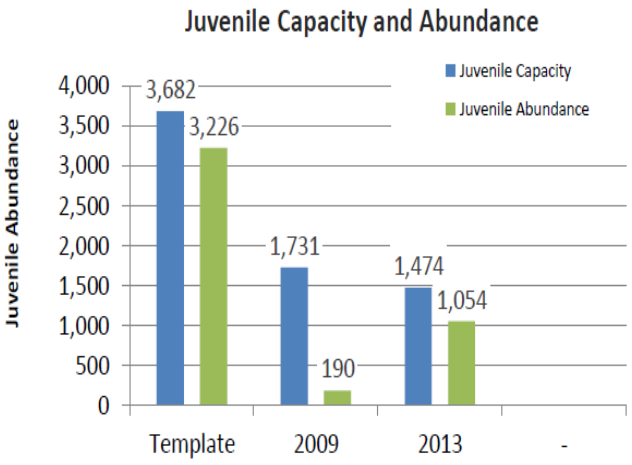




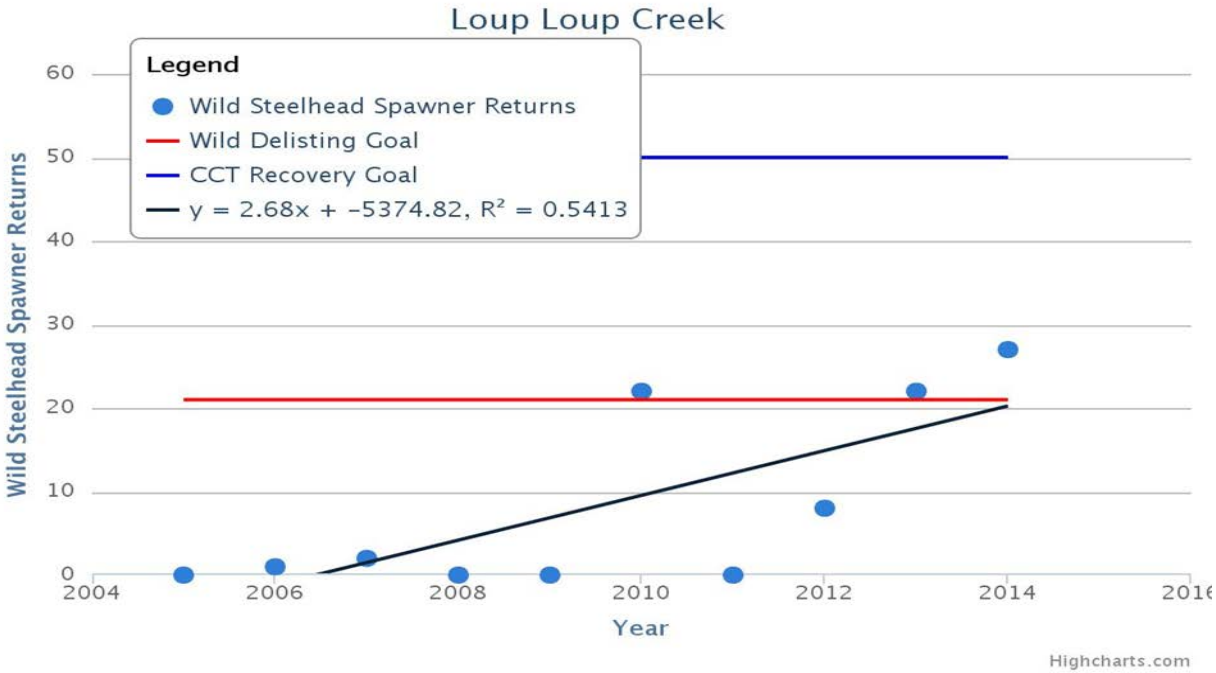








Real Fish Response

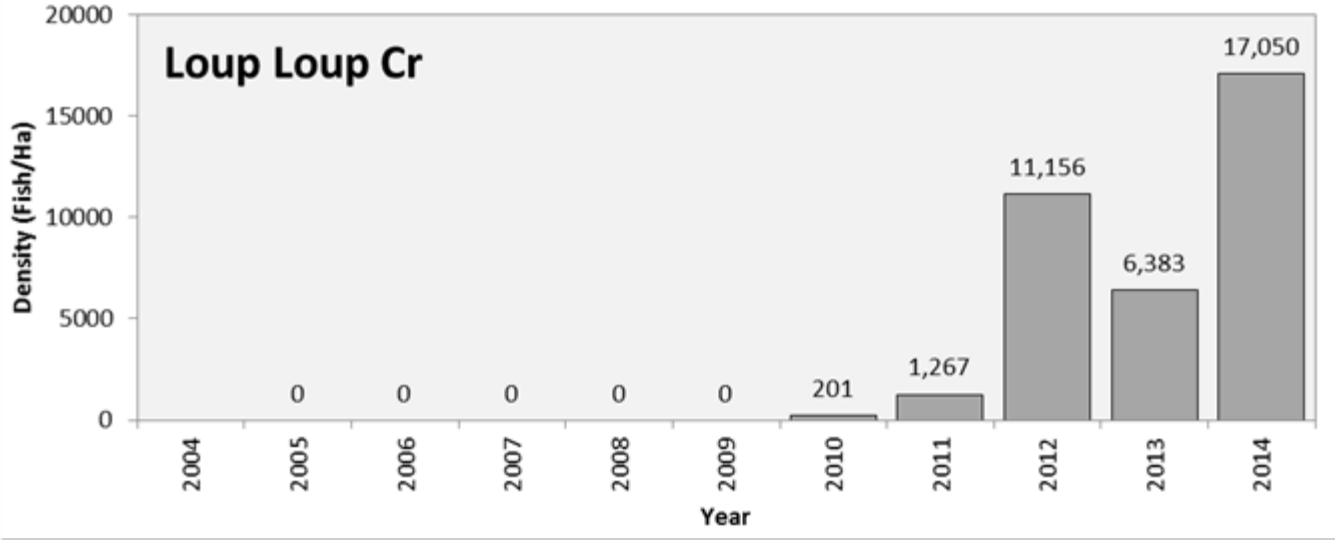


Model predicted 27 wild adult steelhead abundance

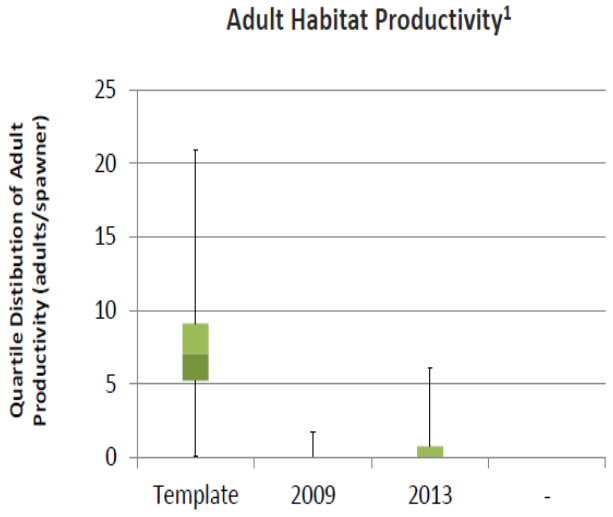
In 2014, 27 wild adult steelhead came back to spawn

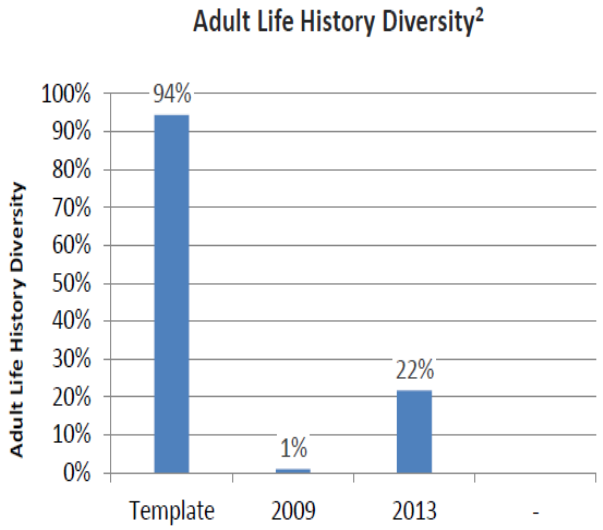
Model predicted a five fold increase in wild Juvenile O. Mykiss abundance

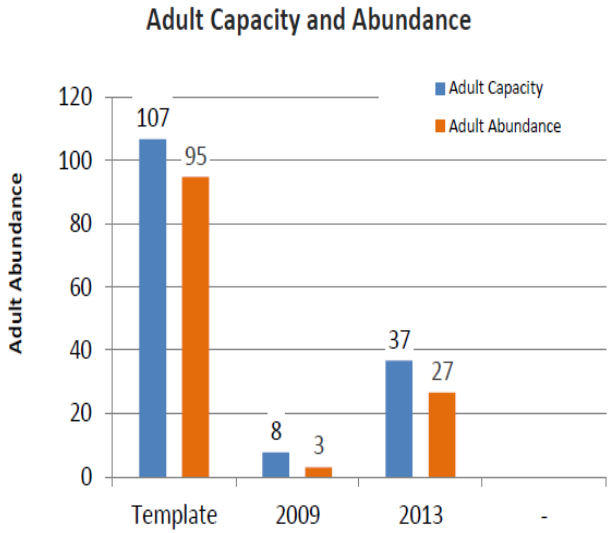
Actual juvenile O. Mykiss increases have been more like a 10 fold increase.

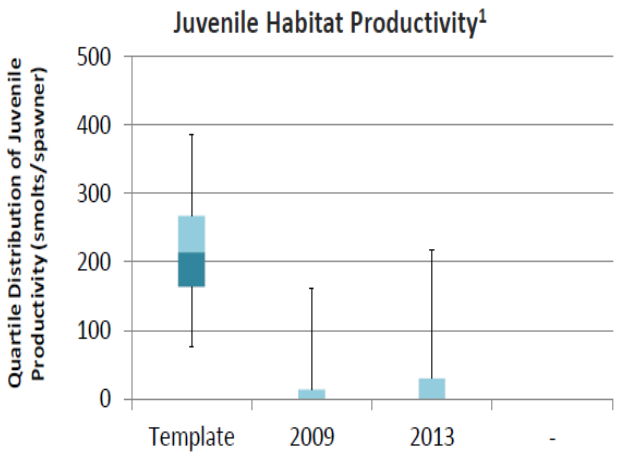


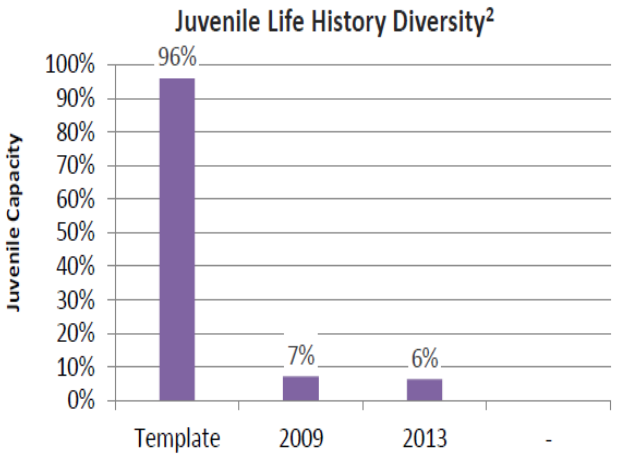
Habitat Monitoring Data Synthesized
Effects of Habitat Actions

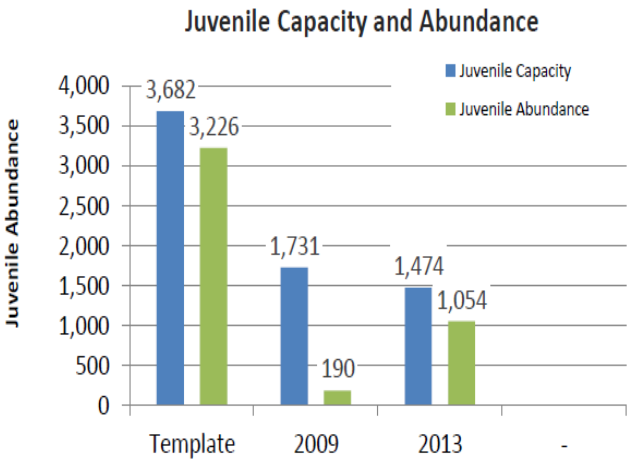












Diagnostic Unit Report Card

OKANOGAN BASIN MONITORING AND EVALUATION PROGRAM

DIAGNOSTIC UNIT REPORT CARD

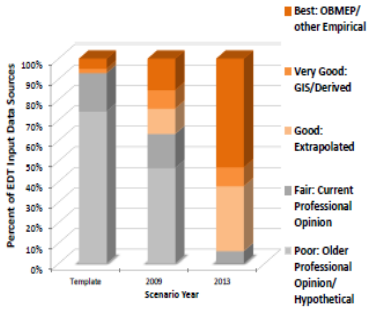
Diagnostic Unit	Loup Loup Creek
Species	Steelhead
Population	Okanogan (US)
Status and Trend Year	2013
Trend Comparison	2013 to 2009

How Important is Loup Loup Creek for Conservation of Okanogan (US) Steelhead?

Effect on Population Potential if this Unit	Degrades	Is Restored
Adult Abundance	0.0%	0.0%
Adult Productivity	0.0%	+7.9%
Life History Diversity	-0.5%	0.0%
Diagnostic Unit Priority Rank[1]	16 of 28	17 of 28

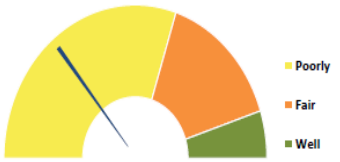
[1] Relative to all Okanogan (US) Diagnostic Units used by this Steelhead population

How Good is Our Information in Loup Loup Creek?

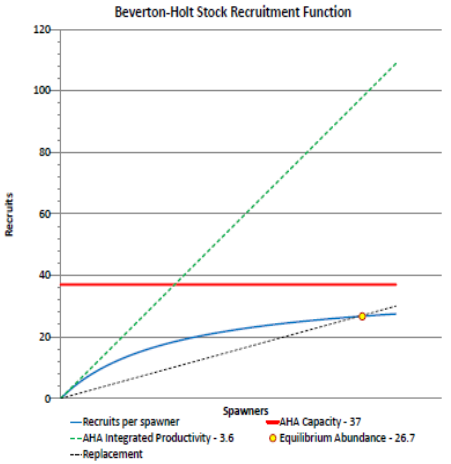


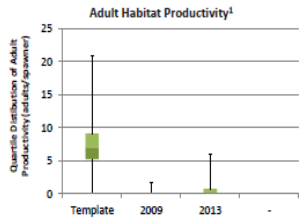
How is Loup Loup Creek Performing as Steelhead Habitat?

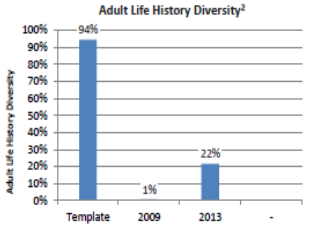
Currently Functioning at 28% of Template Habitat Potential

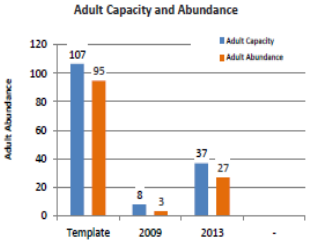


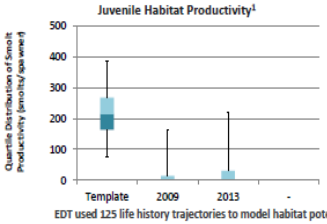
What are the Trends in Steelhead Habitat Potential in Loup Loup Creek?

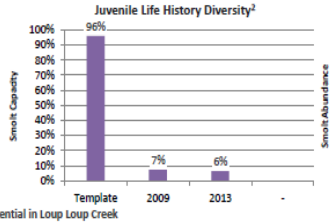


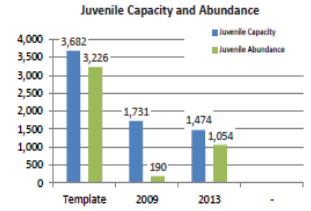








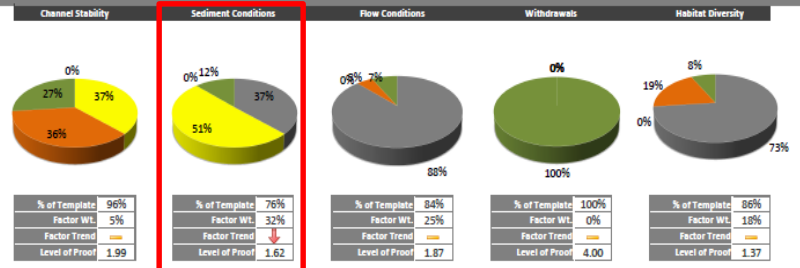




[1] Box and whisker graphs show the quartile distribution of cumulative habitat productivity for all 125 EDT trajectories used to model this Diagnostic Unit.
[2] The percent of adult trajectories having a productivity >1.0 or juvenile productivity >100 smolts/spawner represent the range of life history diversity each habitat scenario can theoretically support.

EDT used 125 life history trajectories to model habitat potential in Loup Loup Creek

Steelhead Survival Factor Condition in Loup Loup Creek and Trend Between 2009 and 2013

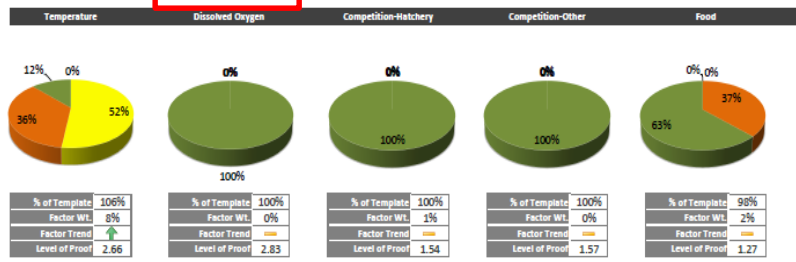


Change in Function Relative to Benchmark
Key - Proportion of Habitat

Categorical Ranking	Productivity Impact
Not properly functioning	>5.1% reduction
Functioning at High Risk	2.6% to 5% reduction
Functioning at Risk	1.1% to 2.5% reduction
Properly Functioning	0% to 1% reduction

Key - Survival Factor Trend

Change	Neg.	Pos.
<1%		
>1-5%		
>5%		



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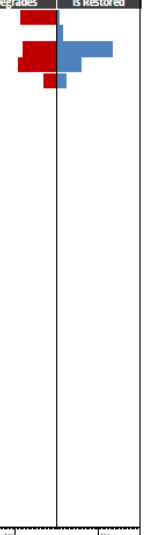
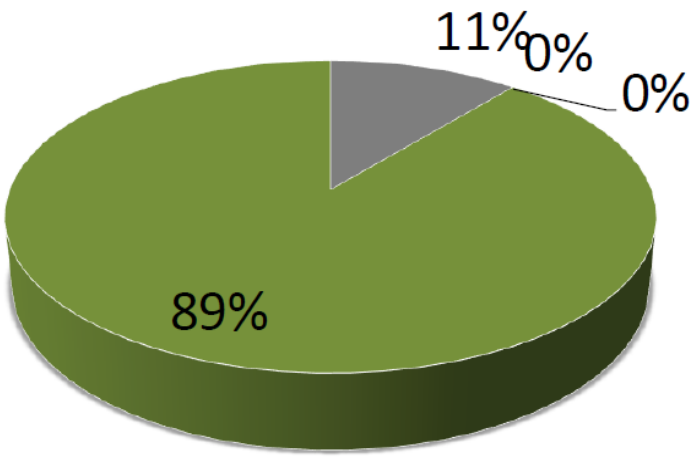


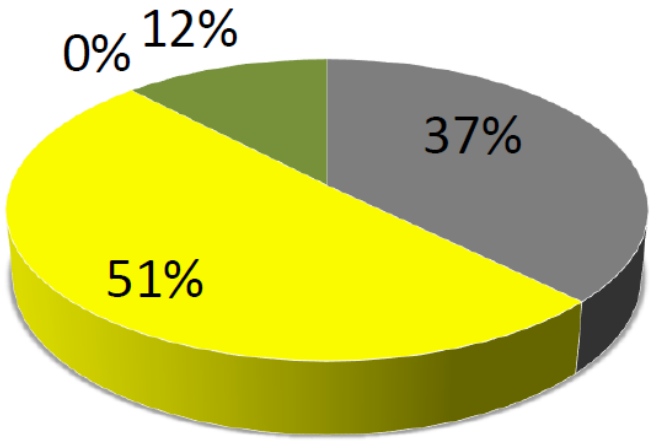
Learning From Results
(extract from Report Card)

Obstructions



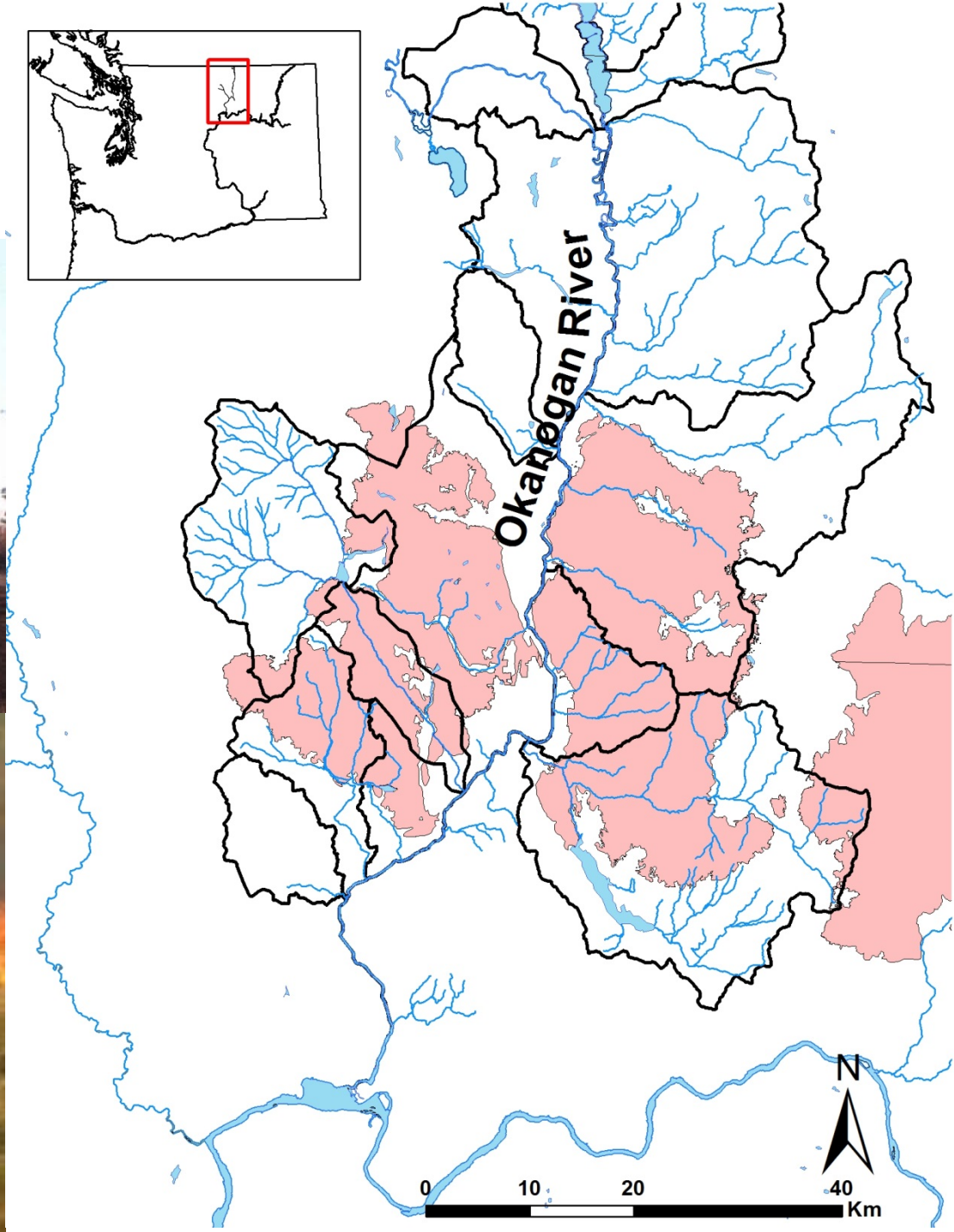
% of Template	94%
Factor Wt.	8%
Factor Trend	↑
Level of Proof	2.00

Sediment Conditions

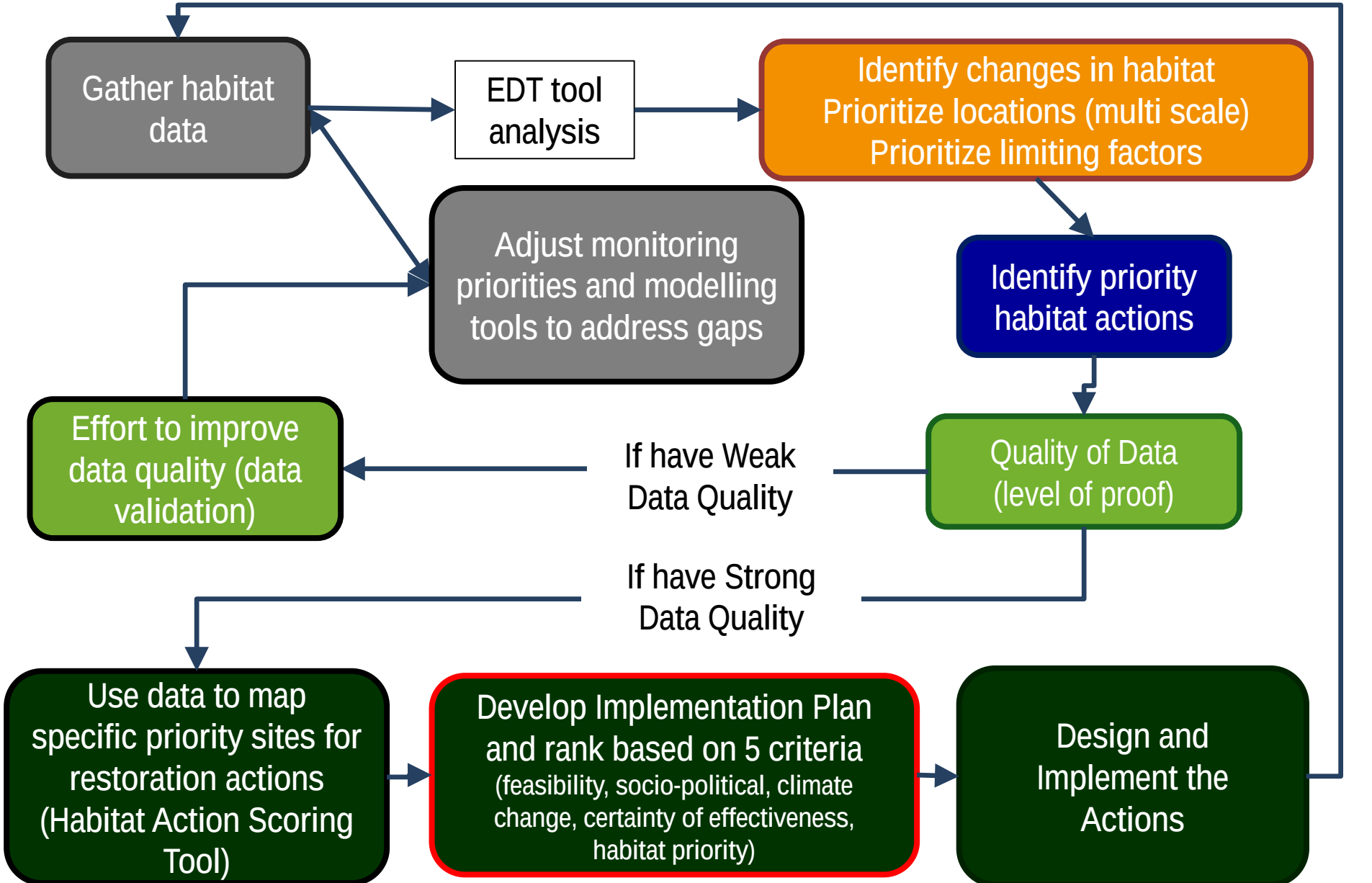


% of Template	76%
Factor Wt.	32%
Factor Trend	↓
Level of Proof	1.62

Wildfires

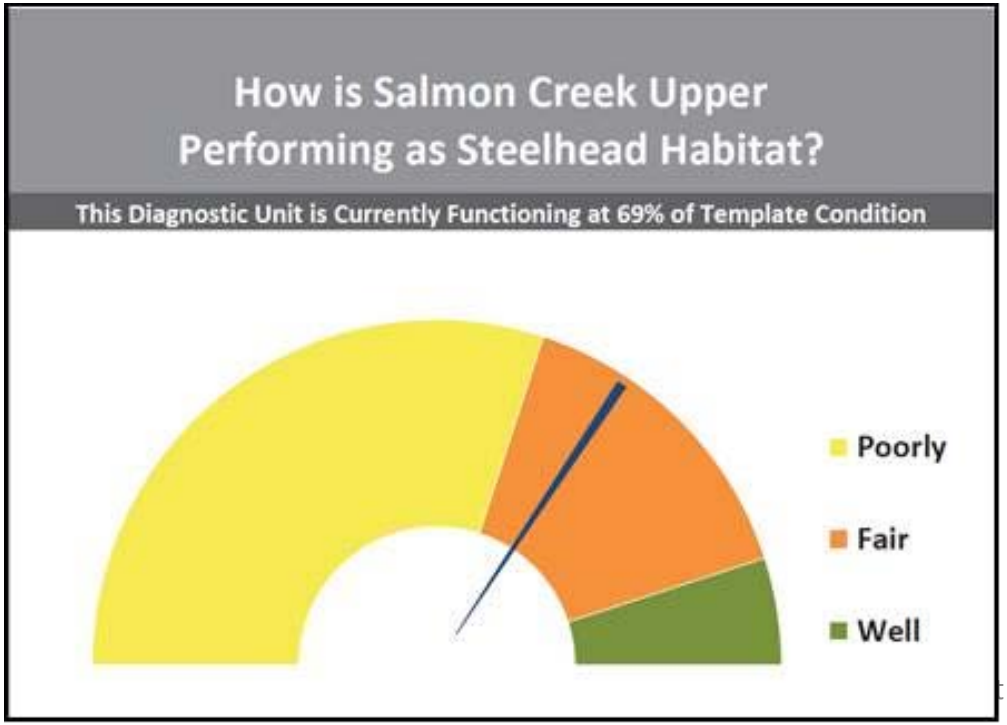


OBMEP Approach for using Habitat Status and Trends In Decision Making



Subbasin Performance

- The OBMEP/EDT integration can provide a platform for large landscape analysis of habitats



Okanogan River Habitat Function					
Diagnostic Unit	Level of function				Trend
Name	Poor	Fair	Good	Percentage	
Okanogan River O1	1			23%	
Okanogan River O2	1			26%	
Okanogan River O3	1			18%	
Okanogan River O4	1			30%	
Okanogan River O5	1			40%	
Okanogan River O6	1			41%	
Okanogan River O7	1			48%	
Similkameen Lower	1			16%	
Similkameen Middle	1			26%	
Similkameen Upper	1			46%	
Chiliwist Creek	1			32%	
Loup Loup Creek	1			2%	
Salmon Creek Lower	1			0%	
Salmon Creek Upper		1		69%	
Lower Omak Creek	1			45%	
Wanacut Creek	1			0%	
Johnson Creek	1			5%	
Tunk Creek	1			32%	
Aeneas Creek	1			0%	
Bonapare Creek	1			28%	
Antoine Creek Lower	1			16%	
Antoine Creek Upper			1	97%	
Wildhorse Spring Creek	1			15%	
Tonasket Creek		1		61%	
Ninemile Creek	1			27%	
Okanogan River Total	**88%**	**8%**	**4%**	**30%**	

Species Specific Results can be "Rolled Up" to Any Scale

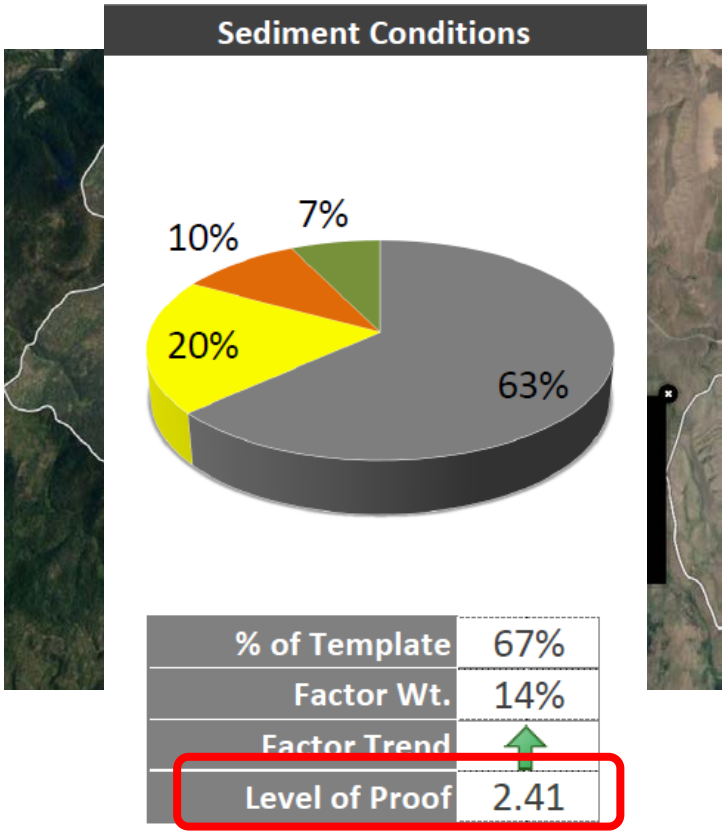
Upper Columbia ESU Habitat Function					
Subbasin	Percent of DU'S			Average Function	Trend
Name	Poor	Fair	Good		
Okanogan River	88%	8%	4%	30%	
Methow River	22%	46%	32%	72%	
Entiat River	32%	28%	40%	74%	
Wenatchee River	15%	62%	22%	68%	

Emerging priorities for the next year

- Okanogan subbasin plan update and adaptive management Template
- Taking lessons learned from the Okanogan experience to the Methow
- Leveraging new tools and capabilities
  - New model Input/Results mapping tools
  - Climate change scenarios!
  - Life cycle model integration?

Learning from the Okanogan Experience

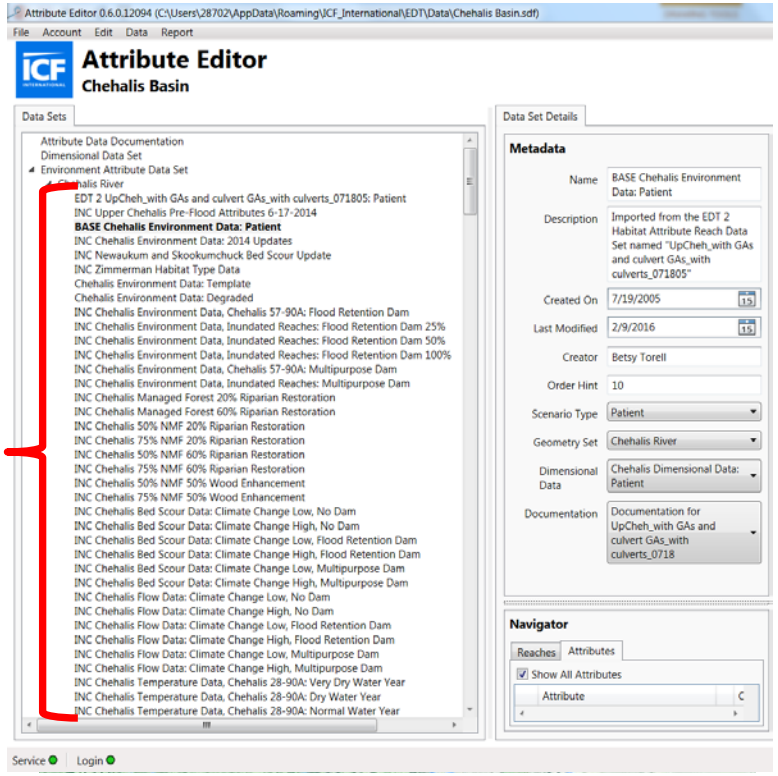
- Align model configuration with program needs!
  - UCSRB recovery planning framework
  - Scale for status and trends reporting
  - Results useful for restoration planning
- Feedback!
  - Incorporating outside feedback*
  - Creating feedback loops within program



* NMFS – Tim Beechie

Taking Okanogan Approach to Methow

- How is Methow similar to Okanogan?
  - Model configuration needs to match program needs
  - Same spatial scale requirements for reporting/recovery planning

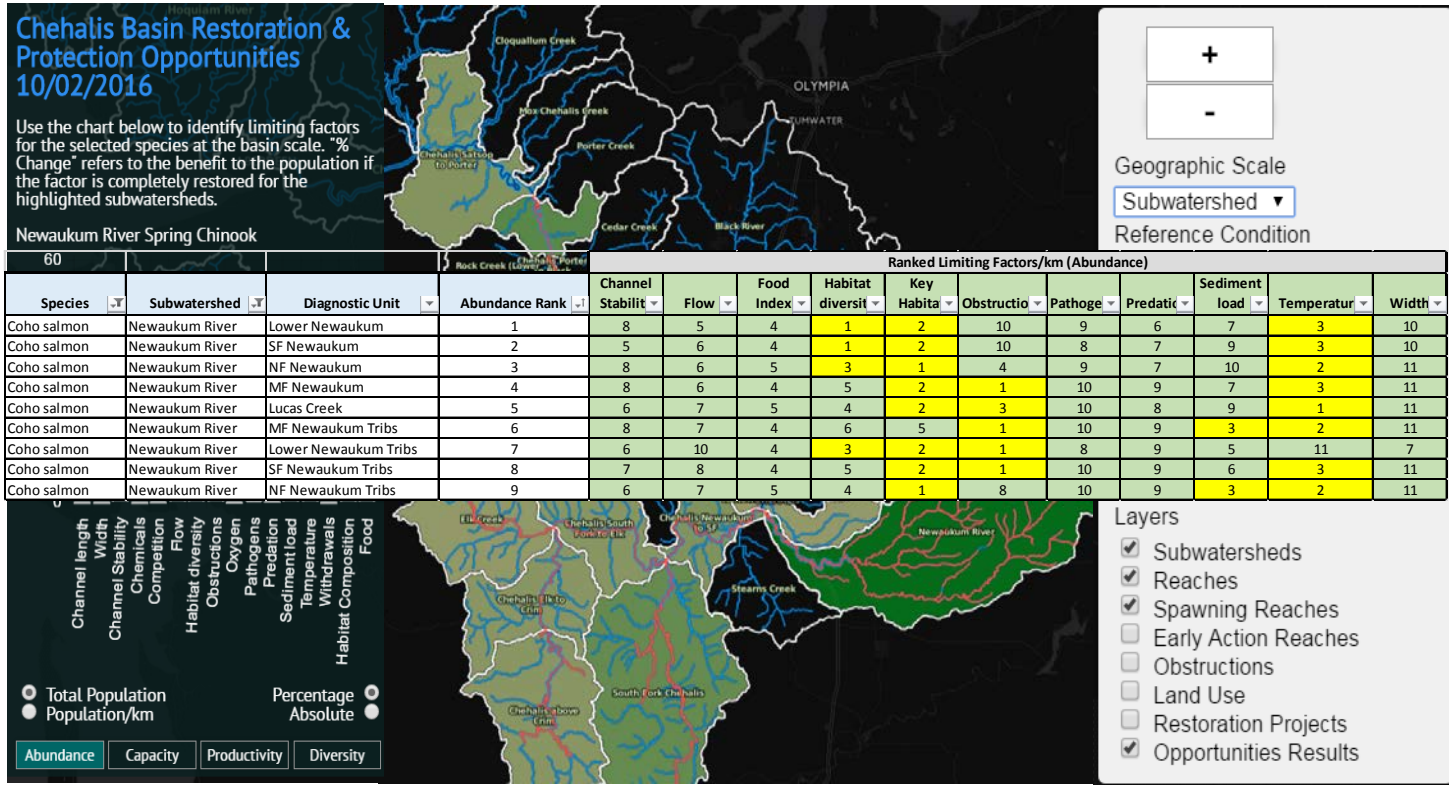


- How is Methow different from Okanogan?
  - Spring Chinook!
  - Several data sources/time series
  - Need to manage data pedigree
- Identify data gaps using EDT
- Fill data gaps using efficient OBMEP protocols
- Success here proves transportability

Chehalis Project - New Tools and Capabilities

- EDT mapping tools
  - View EDT inputs/results side by side in a map environment
- Mapping tools support
  - Alternative analysis
  - Climate change impact assessment
  - Restoration planning

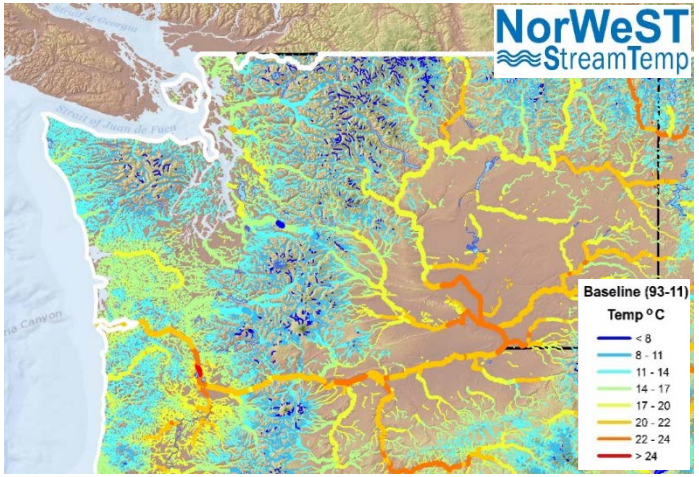
Selection and Prioritization of Restoration Actions

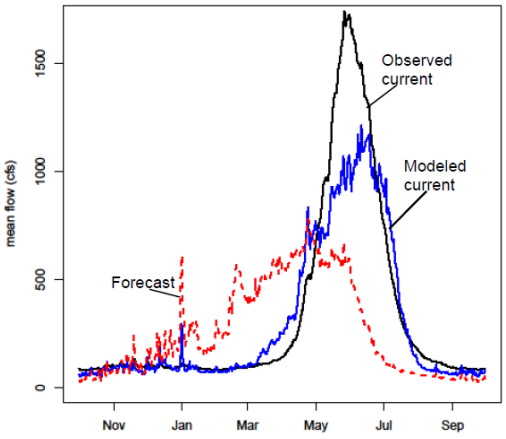


Species	Subwatershed	Diagnostic Unit	Abundance Rank	Ranked Limiting Factors/km (Abundance)										
				Channel Stabilit	Flow	Food Index	Habitat diversit	Key Habita	Obstructio	Pathoge	Predatic	Sediment load	Temperatur	Width
Coho salmon	Newaukum River	Lower Newaukum	1	8	5	4	1	2	10	9	6	7	3	10
Coho salmon	Newaukum River	SF Newaukum	2	5	6	4	1	2	10	8	7	9	3	10
Coho salmon	Newaukum River	NF Newaukum	3	8	6	5	3	1	4	9	7	10	2	11
Coho salmon	Newaukum River	MF Newaukum	4	8	6	4	5	2	1	10	9	7	3	11
Coho salmon	Newaukum River	Lucas Creek	5	6	7	5	4	2	3	10	8	9	1	11
Coho salmon	Newaukum River	MF Newaukum Tribs	6	8	7	4	6	5	1	10	9	3	2	11
Coho salmon	Newaukum River	Lower Newaukum Tribs	7	6	10	4	3	2	1	8	9	5	11	7
Coho salmon	Newaukum River	SF Newaukum Tribs	8	7	8	4	5	2	1	10	9	6	3	11
Coho salmon	Newaukum River	NF Newaukum Tribs	9	6	7	5	4	1	8	10	9	3	2	11

Building Climate Change Scenarios

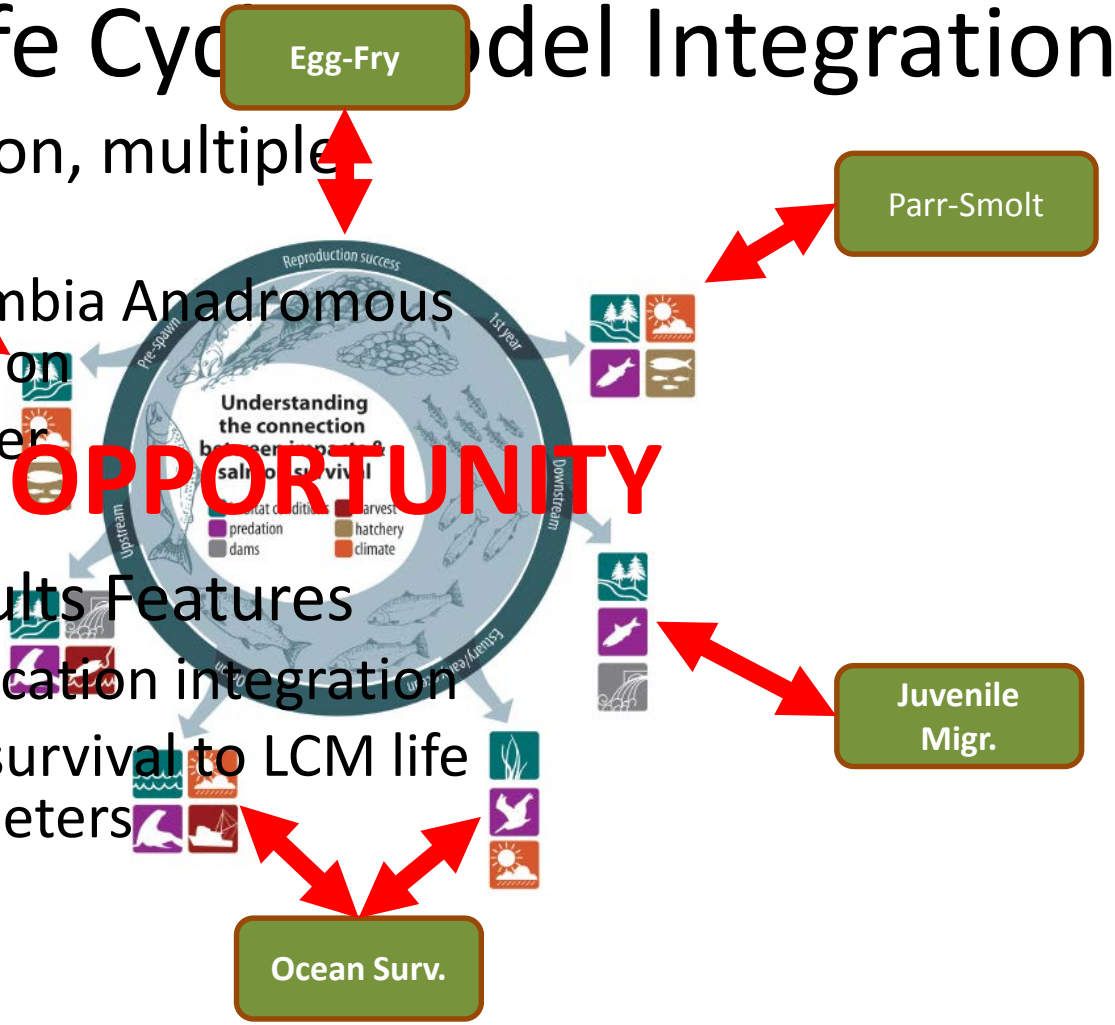
- Chehalis
- Yakima Tribes
  - Building EDT climate change scenarios
  - Working with Rocky Mountain Research Station
    - NorWeST
    - Western U.S. Streamflow Metrics
    - 2030-2059 climate change scenario
  - Yakima or Wenatchee?
- OBMEP
  - Program efficiencies = Resources for investment
  - Leverage Yakima effort
  - 2030-2059 climate change scenario for Okanogan
  - Integrate climate change with restoration planning
  - Statistical modeling platform/tools to improve program efficiency





EDT and Life Cyc[illegible]odel Integration

- LCM integration, multiple [illegible]
  - [illegible]Columbia Anadromous Reintroduction
  - Chehalis River
  - Lewis River
- New EDT Results Features
  - Life stage/location integration
  - EDT survival to LCM life stage parameters



Take Home Messages

- Subbasin Plan Update
  - Incorporating adaptive management template
- Taking successful Okanogan approach to Methow
  - Common platform for reporting and planning
  - Efficiently fill data gaps
- Web mapping/reporting tools to make us more effective
  - Take better advantages of the full capabilities of EDT
  - Improve delivery of information to managers and stakeholders
- Climate change impact analysis
  - Using EDT to incorporate climate change into restoration planning
- New reporting metrics = opportunities for collaboration
  - EDT and Life Cycle Model integration

Getting the Download

http://cctobmep.com/obmep_publications.php

Important OBMEP references:

Can be found by googling:

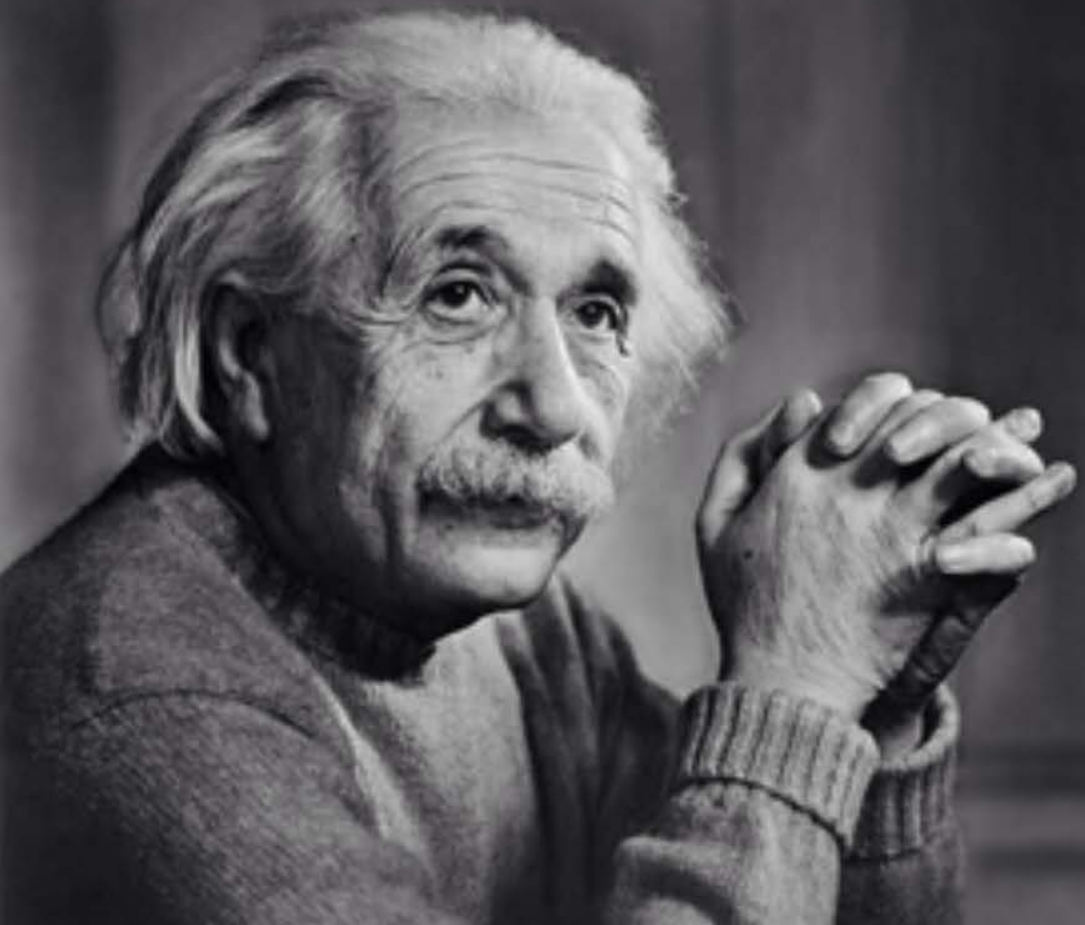
"cctobmep"

Copies of the 2015 OBMEP/EDT Habitat Status and Trend report for both Summer/Fall Chinook and Summer Steelhead

Can be downloaded from our publication page.

If you can't explain it **simply**, you don't understand it well enough.

– Albert Einstein



Extra slides

Ecosystem Diagnosis & Treatment (EDT)

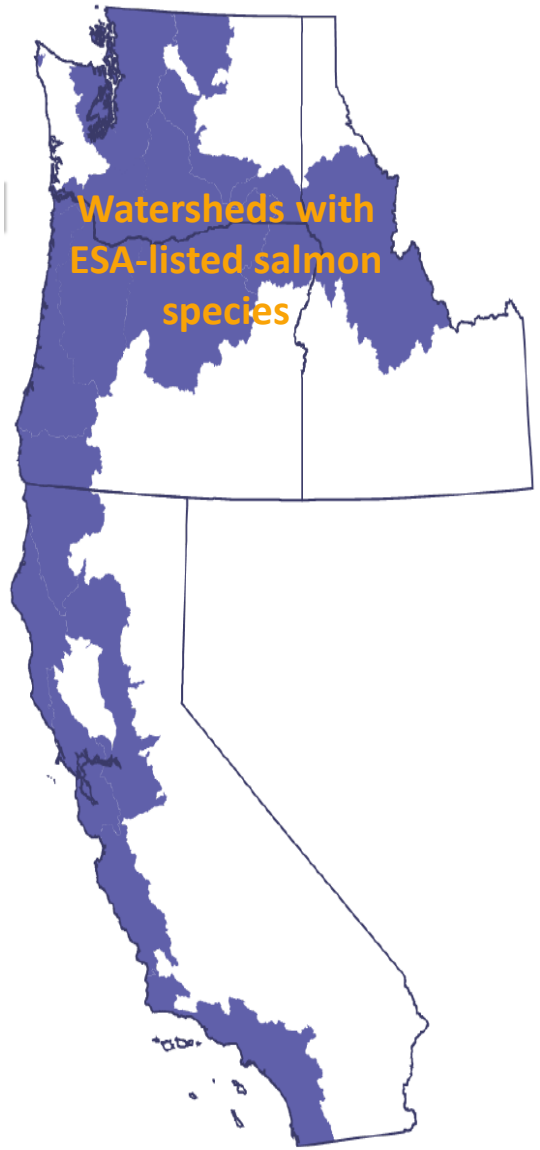
- EDT was developed within the region by fishery agencies and tribes
  - Maintained and enhanced by ICF
- Primary tool for Council's Sub-basin Planning
  - Used to develop most plans with anadromous salmon
- Applications
  - ESA Recovery plans
  - Habitat Conservation Plans
  - Prioritization of Restoration Investments

Ecosystem Diagnosis & Treatment

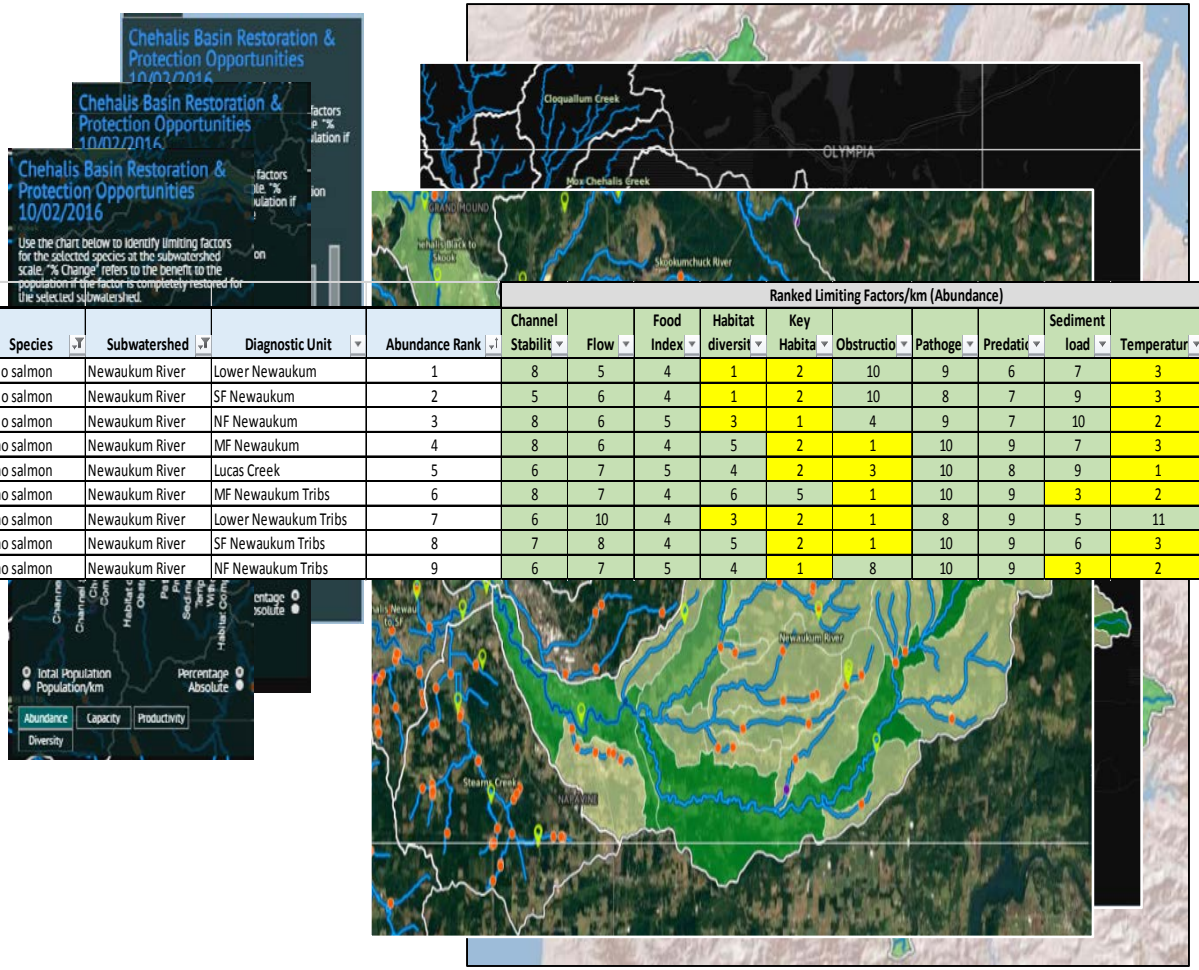
- EDT is a fish lifecycle habitat model that assesses habitat using metrics relevant to fishery managers
  - Describes potential of habitat to support salmon
    - Abundance
    - Productivity
    - Diversity
  - Synthesizes available data and information
    - Empirical data
    - Model projections
    - Expert knowledge
  - Identifies limiting factors
    - Where are problems?
    - What needs to be fixed?
  - Prioritizes restoration needs and actions
    - Priorities for restoration
    - Limiting factors

The History of EDT

- EDT1 (1995): Initial concept developed on MS Access platform
- EDT2 (2005): Web-based platform developed for regional applications
- EDT3 (2014): Third generation model built on SQL platform
  - Integrated with Excel
  - More powerful, flexible, transparent
  - New species capabilities
- All current applications of the model are using EDT3

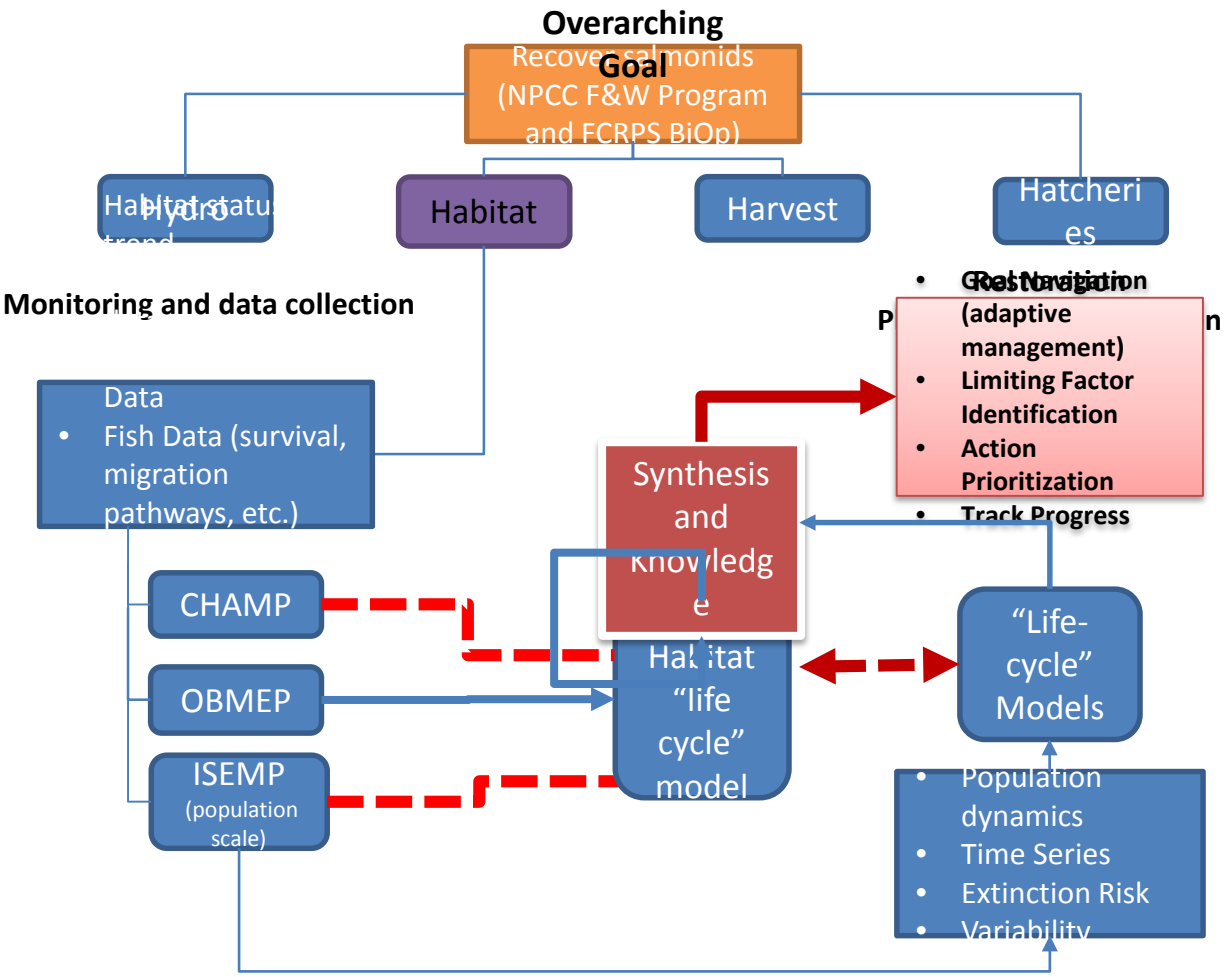


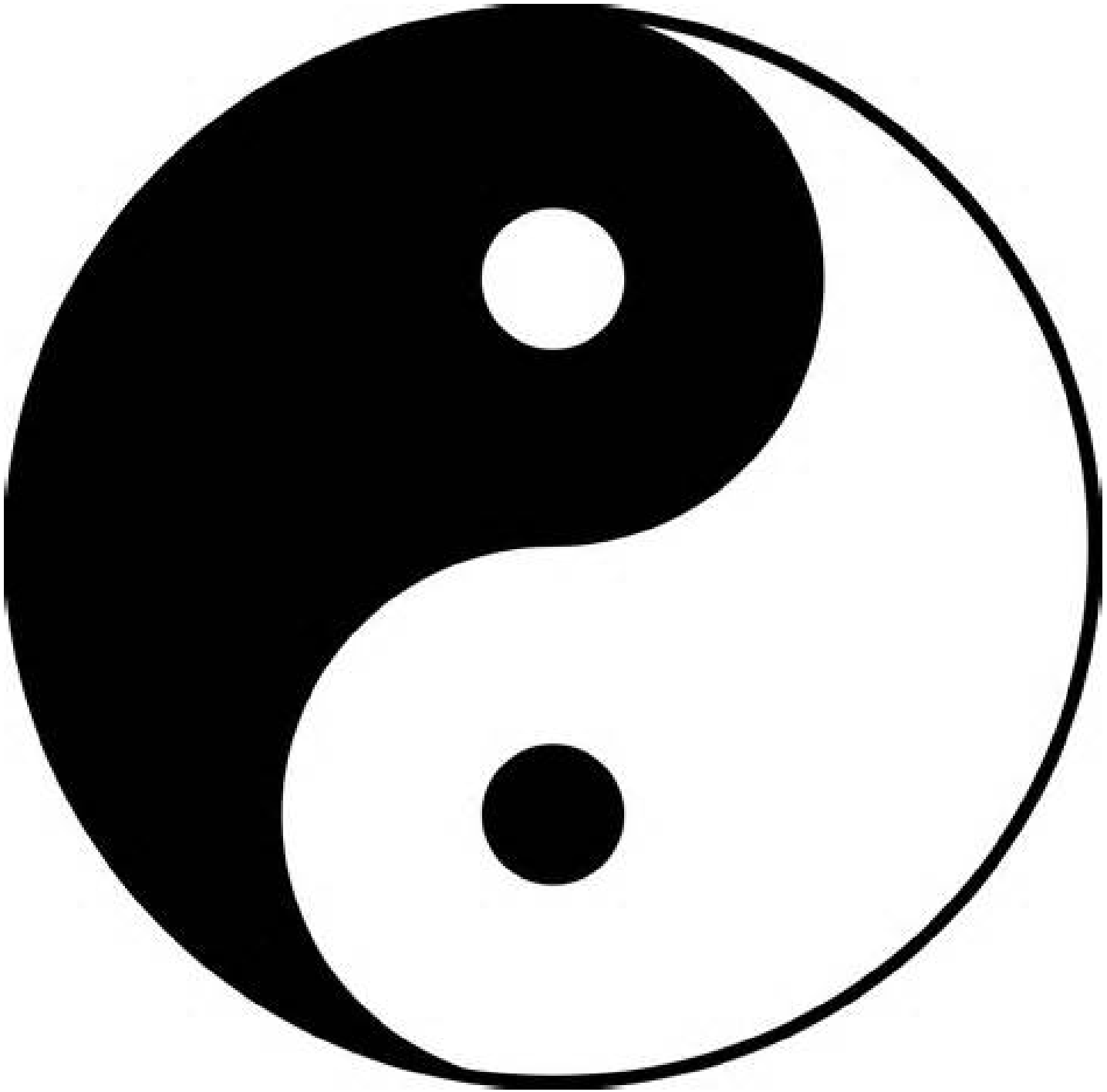
Prioritization and Selection of Restoration Actions using EDT—Chehalis River Coho



				Ranked Limiting Factors/km (Abundance)											
Species	Subwatershed	Diagnostic Unit	Abundance Rank	Channel Stabilit	Flow	Food Index	Habitat diversit	Key Habita	Obstructio	Pathoge	Predati	Sediment load	Temperatur	Width
Coho salmon	Newaukum River	Lower Newaukum	1	8	5	4	1	2	10	9	6	7	3	10
Coho salmon	Newaukum River	SF Newaukum	2	5	6	4	1	2	10	8	7	9	3	10
Coho salmon	Newaukum River	NF Newaukum	3	8	6	5	3	1	4	9	7	10	2	11
Coho salmon	Newaukum River	MF Newaukum	4	8	6	4	5	2	1	10	9	7	3	11
Coho salmon	Newaukum River	Lucas Creek	5	6	7	5	4	2	3	10	8	9	1	11
Coho salmon	Newaukum River	MF Newaukum Tribs	6	8	7	4	6	5	1	10	9	3	2	11
Coho salmon	Newaukum River	Lower Newaukum Tribs	7	6	10	4	3	2	1	8	9	5	11	7
Coho salmon	Newaukum River	SF Newaukum Tribs	8	7	8	4	5	2	1	10	9	6	3	11
Coho salmon	Newaukum River	NF Newaukum Tribs	9	6	7	5	4	1	8	10	9	3	2	11

How we get it done (how it all fits together)





- In Chinese philosophy, **yin and yang** (also *yin-yang* or *yin yang*, 陰陽 *yīnyáng* "dark—bright") describes how opposite or contrary forces are actually complementary, interconnected, and interdependent in the natural world, and how they give rise to each other as they interrelate to one another.

Highlights of Ecological Diagnostic Tool (EDT)
What it is and what it isn't

- Habitat focused tool that predicts how habitat changes may impact fish
- Not a fish tool, won't provide population abundance estimate
- It is a tool, need to build it and include the data /criteria to produce what you want
- etc