33rd Annual Salmonid Restoration Federation Conference

March 11-14, 2015, Santa Rosa, CA

Coho Salmon Workshop

'Innovative Trans-Boundary Approaches to Coho Salmon Recovery'

Conveners: Stephen Swales, Fisheries Branch, California Department of Fish & Wildlife,

Charlotte Ambrose, NOAA Fisheries, West Coast Region.

Workshop Outline

Coho salmon populations in central and northern California coastal watersheds are in severe decline and are listed as threatened or endangered under both the state and federal Endangered Species Acts. Many coho populations are extirpated, and many others may be heading towards extirpation in the near future. While coho populations appear to be declining throughout the Pacific Northwest and southern British Columbia, those in California are at the southernmost limit of the geographic range of the species, and are the most threatened. Coho recovery plans, developed by both state and federal governments, aim to restore populations to viable levels.

This workshop was intended to stimulate discussions on recovery efforts and assemble specialists in coho salmon recovery from California, British Columbia and the Pacific Northwest. The workshop focused on innovative, trans-boundary approaches to recovery that can prevent further population extirpations and lead to full recovery. It is hoped the fresh perspectives and lessons learned will help with the development and implementation of new approaches to the recovery of coho salmon in California.

The goals of the workshop were as follows: i) to have participants exchange regional and national information on the current status of coho salmon populations and the major stresses, ii) to share information on various approaches to the recovery of coho salmon populations – what does or does not work, and iii) to develop proposals that will lead to the implementation of innovative approaches to the recovery of coho salmon populations.

MAIN SUMMARY POINTS OF PANEL DISCUSSION

1. Need to understand (particularly under an extinction scenario) the importance of planning ahead for recovery.
2. Protect ‘stronghold’ watersheds e.g. Smith River, to maintain the best and viable populations.
3. An implementation framework is an important (vital) element of recovery plans.
4. Importance of planning on a local scale within a sub-watershed (e.g. within Sproul Creek, SF Eel River) not just 'population wide' - needed to put recovery plans into action on the ground.
5. Importance of working with both landowners and stakeholders – need to be mindful of landowner assurances.
6. A multi-pronged approach to recovery is needed – including habitat protection, habitat restoration and population supplementation, where necessary.
7. Population monitoring is important to assess the success, or otherwise, of recovery programs.
8. Need to develop an experimental approach to determine the effectiveness of habitat restoration.
9. Focus on priority watersheds and where to best invest limited resources - a smaller number of populations, the "priority" populations for listed species recovery.
10. Need to move away from the 'fund something everywhere' approach to the 'fund lots of things in these places’ approach.
11. Need to develop a more ‘holistic’ approach to coho recovery in which the restoration of ecosystem processes in watersheds is a key element.

Workshop Presentations

1.California Coho Salmon - A Species 'at the edge' – An Assessment of Current Recovery Status. Presenters: Stephen Swales, California Department of Fish & Wildlife, Charlotte Ambrose NMFS, Julie Weeder NMFS.

2.Are California Coho Salmon Doomed? How to Improve Their Prognosis by Applying Lessons Learned from Studies on Canadian Coho Salmon. Presenter: Jim Irvine, Pacific Biological Station, Fisheries and Oceans Canada.

3.Use of System Dynamic Modeling as a Tool for Coho Recovery in Olema Creek, Point Reyes National Seashore, Marin County, California. Michael Reichmuth, National Park Service.

4.Creating Rearing Habitat for ESA Listed Coho Salmon With Multiple Life History Strategies. Michael Wallace. California Department of Fish & Wildlife.

5.Investigation of the Relationship Between Physical Habitat and Salmonid Abundance in Two Coastal Northern California Streams. Sean Gallagher. California Department of Fish & Wildlife.

6.The Effectiveness of Artificial Upstream Migration Flows for Coho Salmon. Eric Ettlinger. Marin Municipal Water District.

7.[1]Coho Salmon in a Spring Creek: Life history tactics of coho salmon in the Shasta River and a method for quantifying survival to evaluate and prioritize restoration efforts. Chris Adams. California Department of Fish & Wildlife.

8.Population Spatial Structure is an Essential Metric for Defining and Prioritizing Coho Salmon Restoration Projects. Justin Garwood, California Department of Fish & Wildlife.

9.[2]Juvenile Coho Salmon (Oncorhynchus kisutch) Exhibit Compensatory Mechanisms in a Large Volcanic Spring-fed River. Robert Lusardi, UC Davis Center for Watershed Sciences.

10.What You Do Matters: The Latticework of Federal Listing Factors. Charlotte Ambrose, NOAA Fisheries.

[1] , Presentations not included as studies are ongoing
[2]

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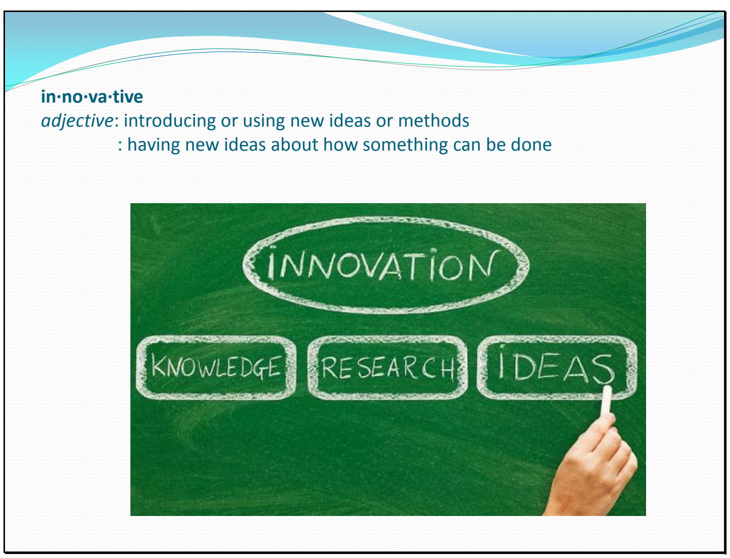

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"People who refer to 'out-of-the-box' see the box … People who don't know the box even exists are the innovative thinkers"

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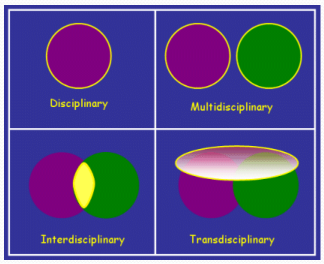
Trans-Boundary Approaches to Coho Recovery



Transdisciplinary: **Focus on an issue**, such as pollution or species recovery, both **within and beyond discipline boundaries** with the possibility of **new perspectives**

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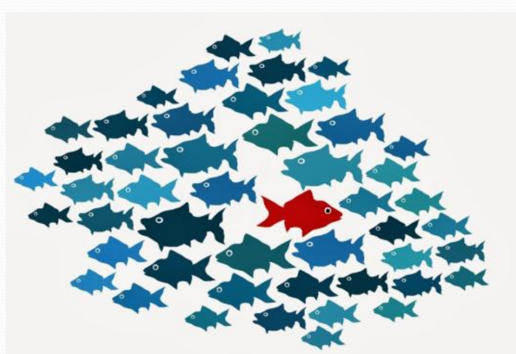
Go against the flow….



Title: California coho salmon - a species 'at the edge' – an assessment of current recovery status.

Presenters: Stephen Swales, Fisheries Branch, California Department of Fish & Wildlife. Stephen.swales@wildlife.ca.gov.

Charlotte Ambrose, NOAA Fisheries, charlotte.a.ambrose@noaa.gov. Julie Weeder, NOAA Fisheries, julie.weeder@noaa.gov.

Abstract:

In California, coho salmon populations can be considered to be 'at the edge' from two perspectives; 1. They are situated at the southernmost limit of the global geographic range of the species, 2. Recent population declines in many of California's coastal watersheds has resulted in the species being listed, under both the state and federal Endangered Species Acts, as either threatened or endangered, and many populations may be at the edge of local extinction. As a result of these listings, state and federal agencies recently produced separate coho salmon recovery plans. In 2004, California Department of Fish & Game produced the Recovery Strategy for California Coho Salmon, while more recently, in 2012, the NOAA National Marine Fisheries Service produced the Final Recovery Plan for Coho Salmon in the CCC ESU. In 2014, NOAA Fisheries also released the Final Recovery Plan for Coho Salmon in the SONCC ESU. However, coho salmon populations in many of California's coastal watersheds continue to decline, some to the point of extirpation. The plight of the species is further compounded by on-going severe drought conditions across most of California, which leads to reduced stream flows and increased water temperatures, potentially increasing fish mortality across the range of distribution. The situation of California coho salmon at the southernmost edge of the natural range of the species may also make fish more susceptible to any adverse effects of climate change. In this paper it is intended to review the current status of coho salmon recovery in California's coastal watersheds, including habitat restoration, inter-agency collaborations, captive rearing programs and other recovery efforts.

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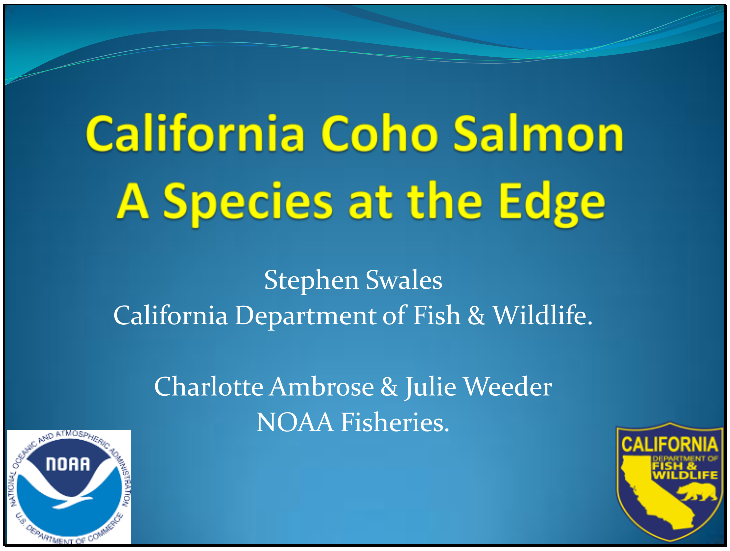

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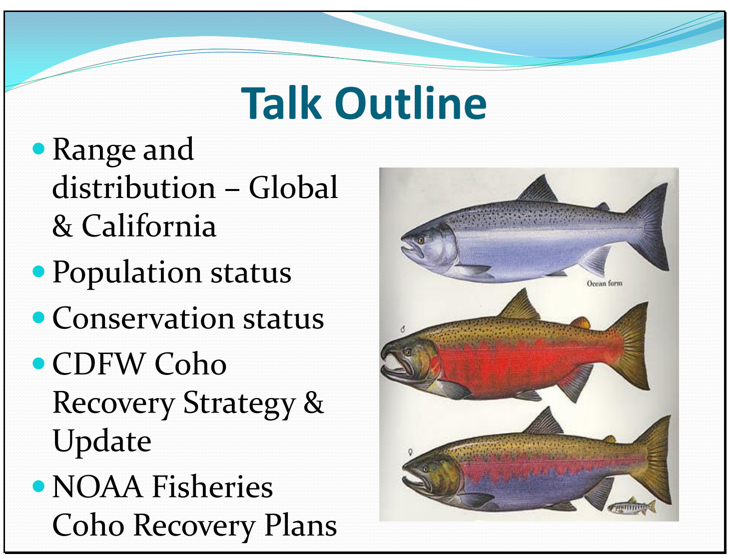

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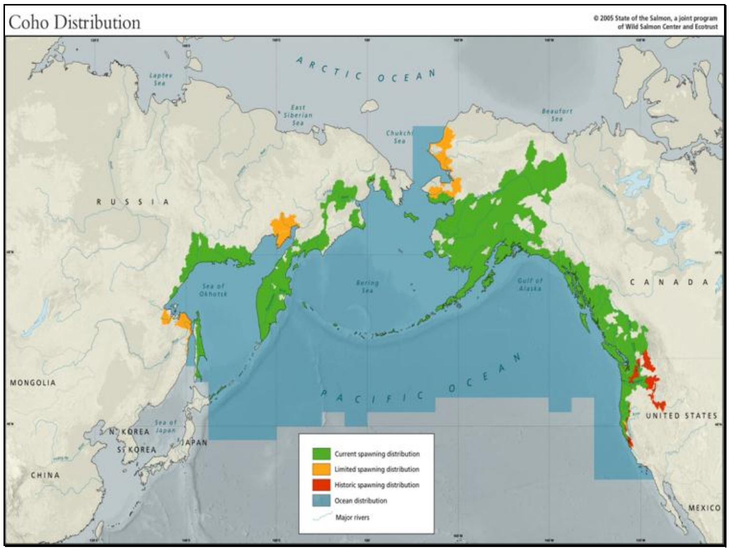

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The Current Situation

- In California, we are experiencing the steepest decline in coho salmon populations on the west coast of North America
- As the footprint of humans continues to expand, the issues we face here in California will become more common across the entire range of wild coho salmon.
- On-going drought conditions, together with climate change, are likely to greatly exacerbate the situation

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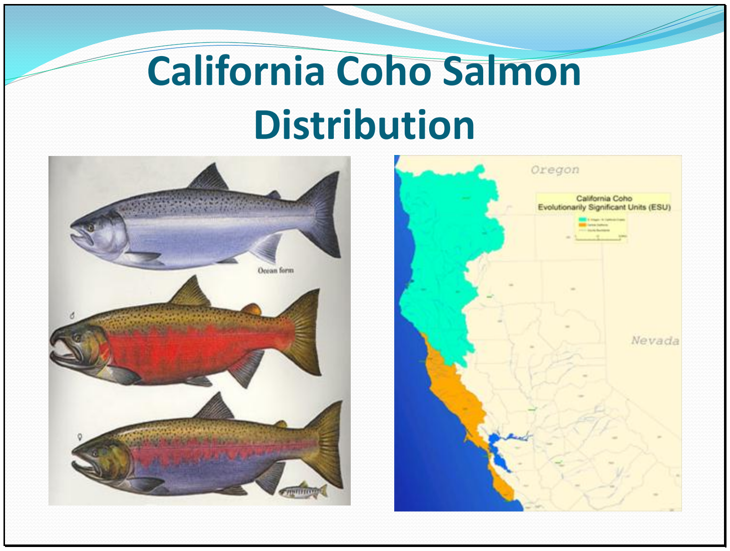

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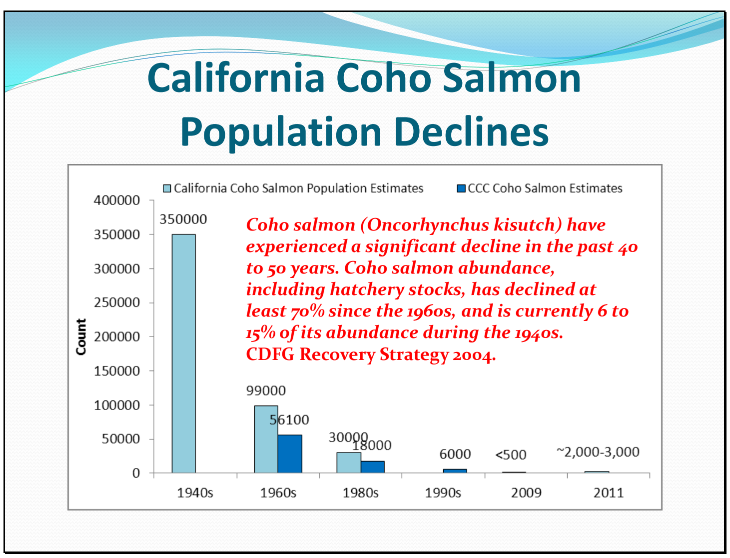

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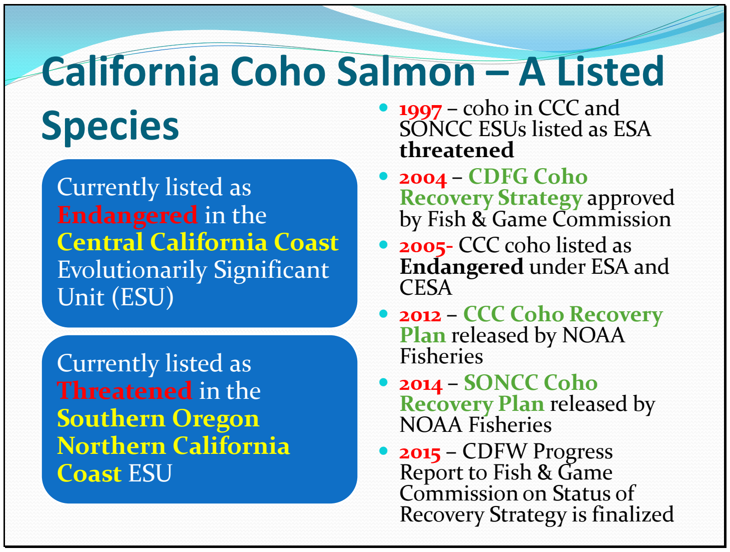

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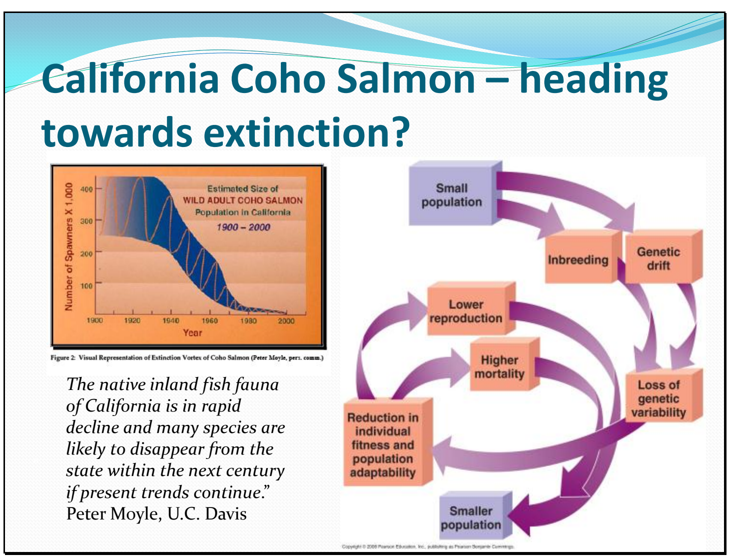

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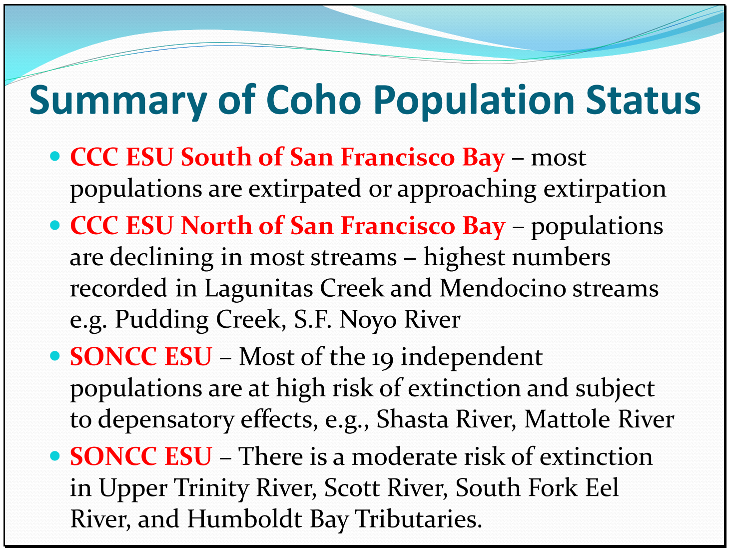

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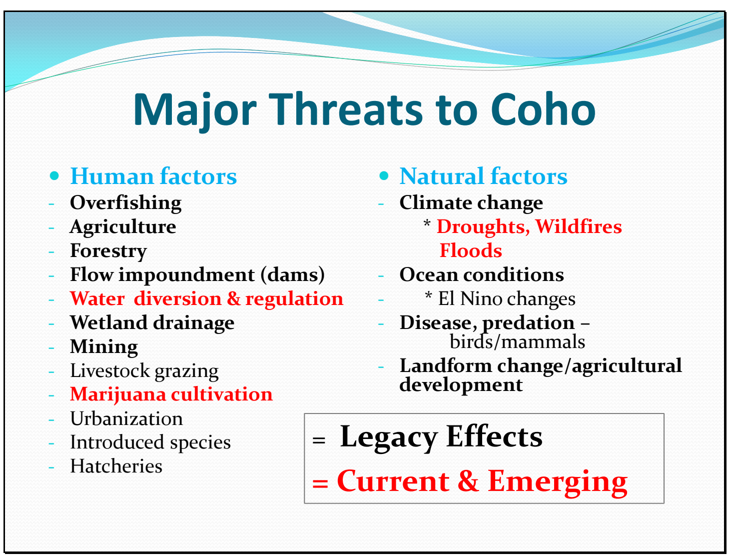

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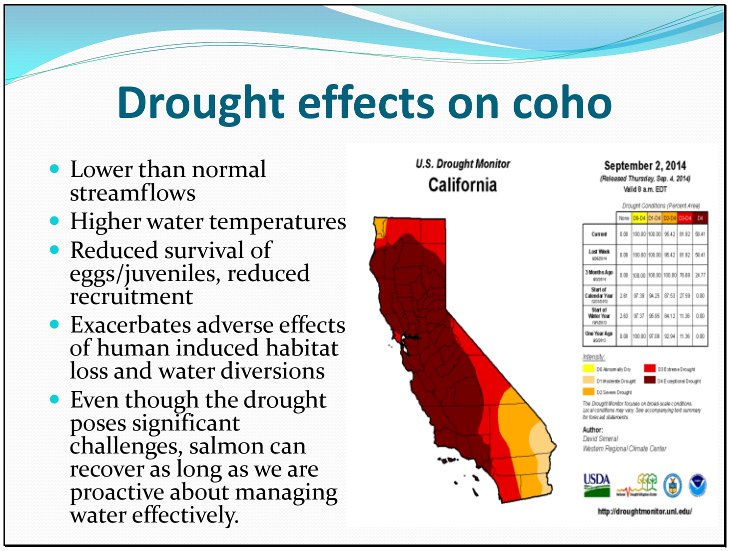

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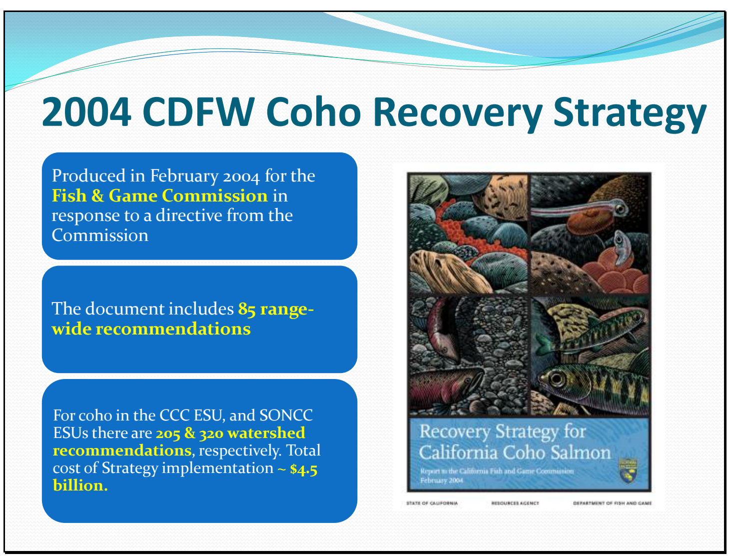

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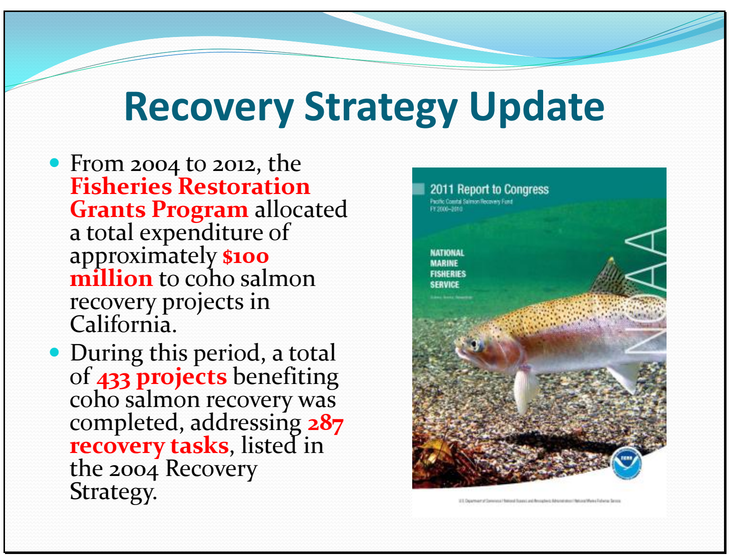

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Priorities and innovations needed to recover coho

- **Scale of recovery efforts** – need to rethink time-scales needed to implement species recovery
- **Strategic investment** – how to increase funding allocations to fully implement recovery plans?
- **Environmental stochasticity** – how can we better plan for and incorporate such changes?
- **Habitat restoration** – need for new, innovative, watershed scale, holistic, process-based restoration – prioritizing areas for restoration, narrowing scope of efforts etc.
- **Scientific communication**– need for better understanding of the processes involved in species recovery - ‘out of the box’ thinking – improved dialog between science/academia and the restoration community.

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Mapping the way forward

- Increased inter-agency collaboration
- Coho recovery/extirpation prevention in the CCC ESU– P.A.C.T.
- Coho recovery in the SONCC – recovery focus on priority areas e.g. Shasta
- Developing a watershed approach to recovery
- Habitat improvement - restoration of ecosystem processes
- Defining the role of captive breeding for extinction prevention

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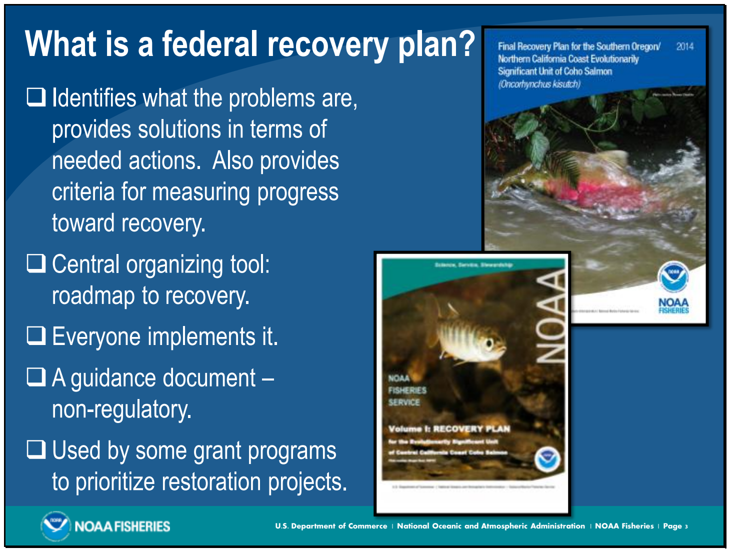

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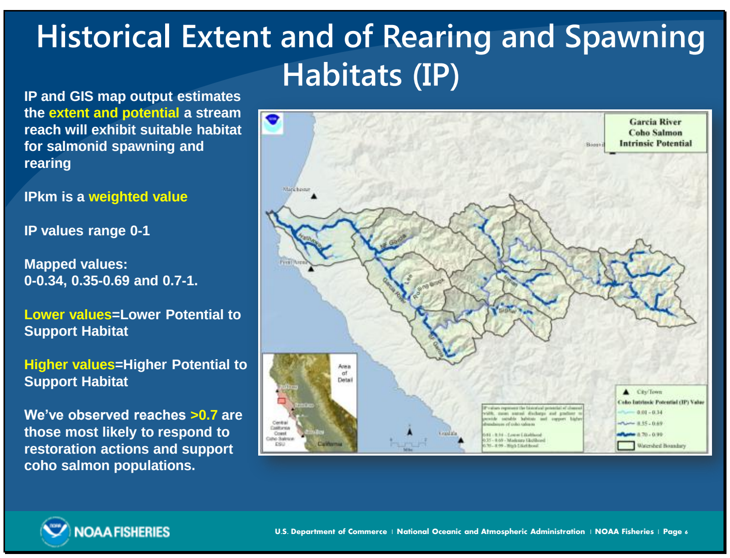

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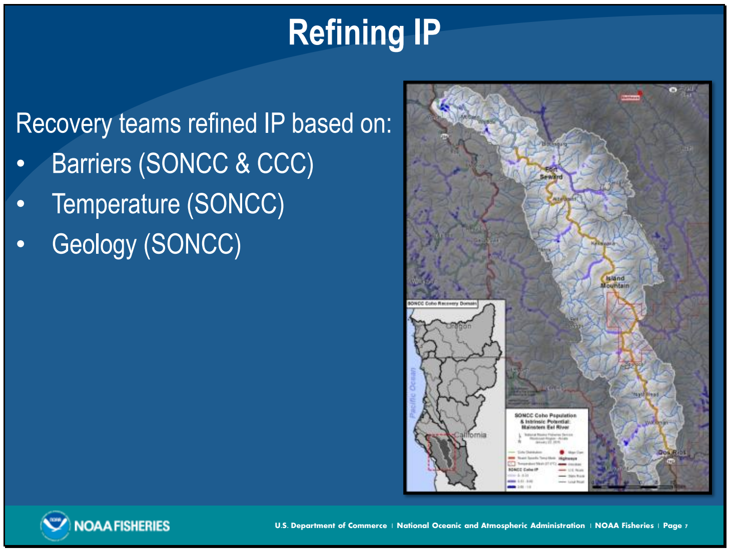

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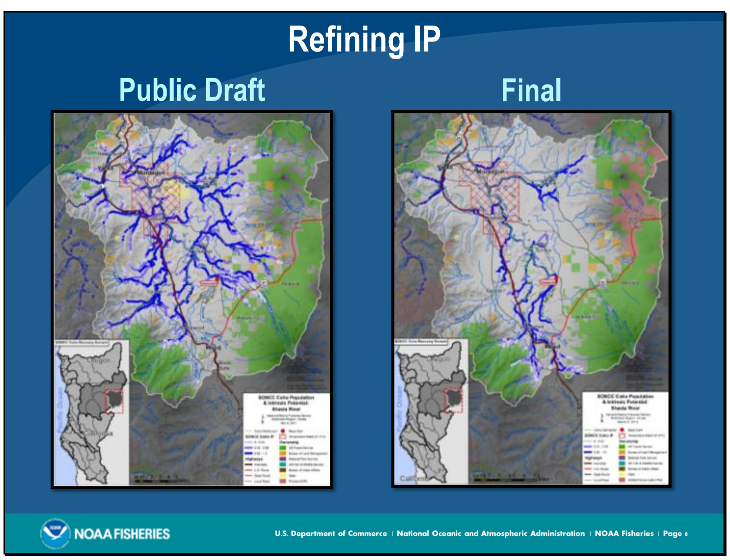

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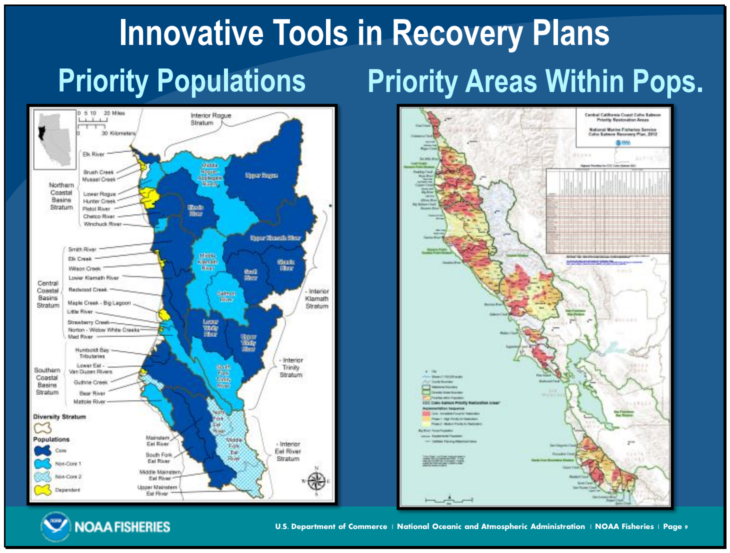

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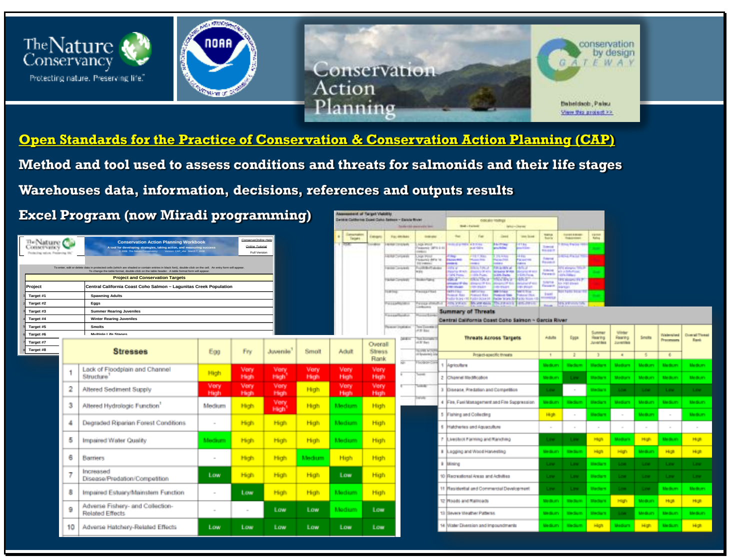

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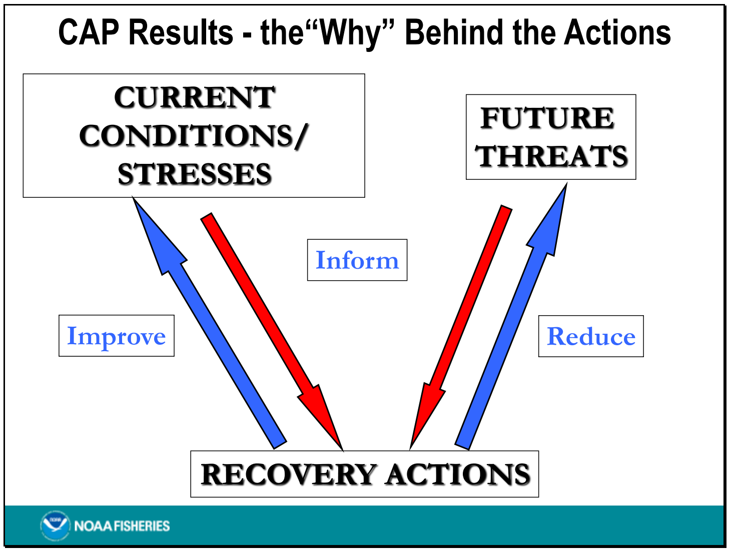

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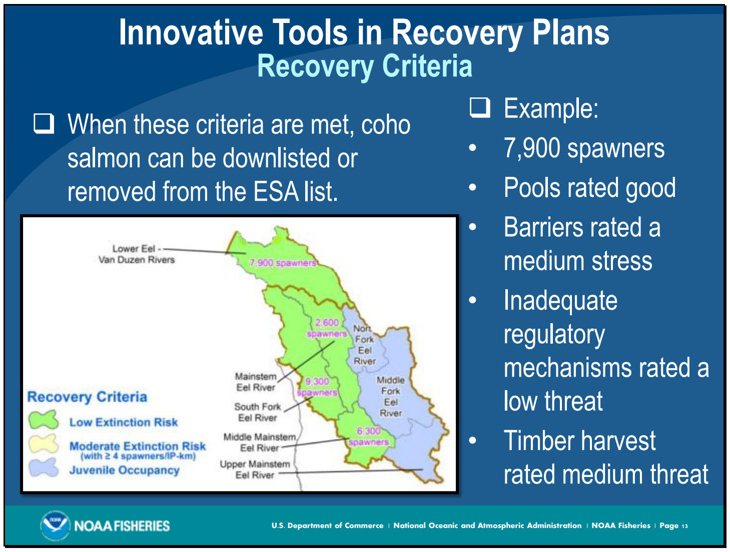

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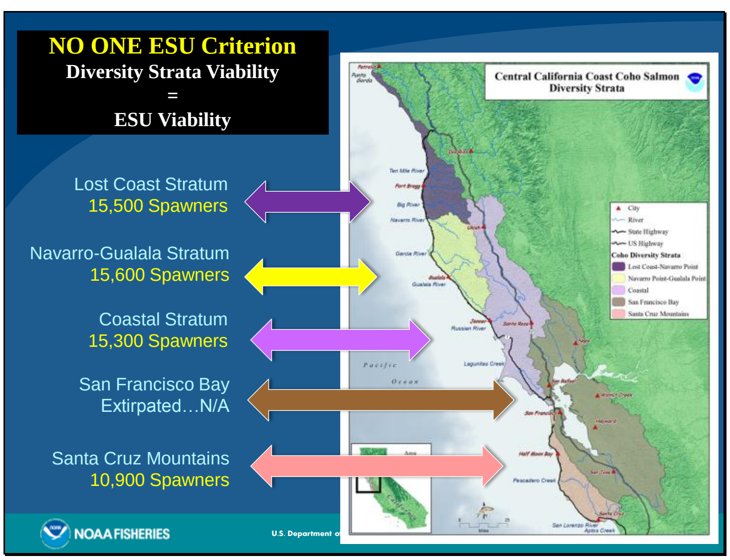

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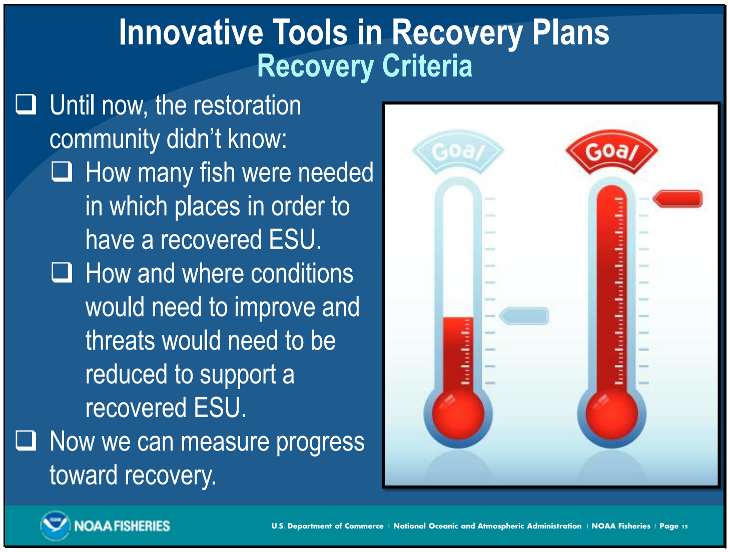

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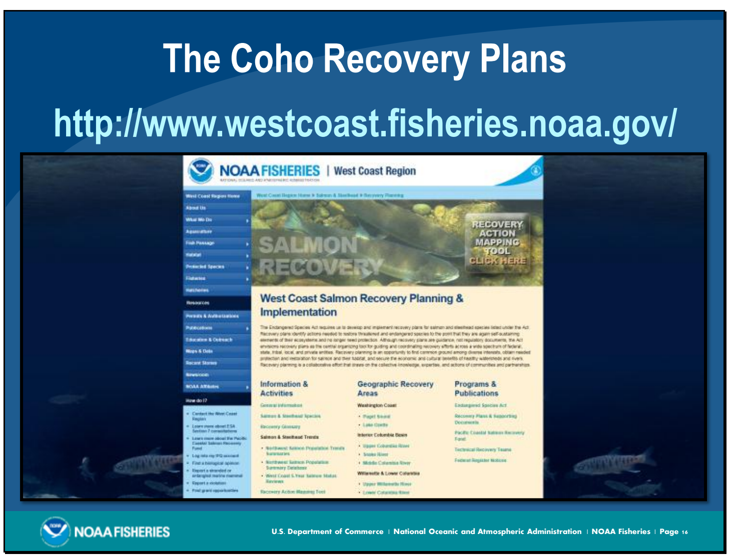

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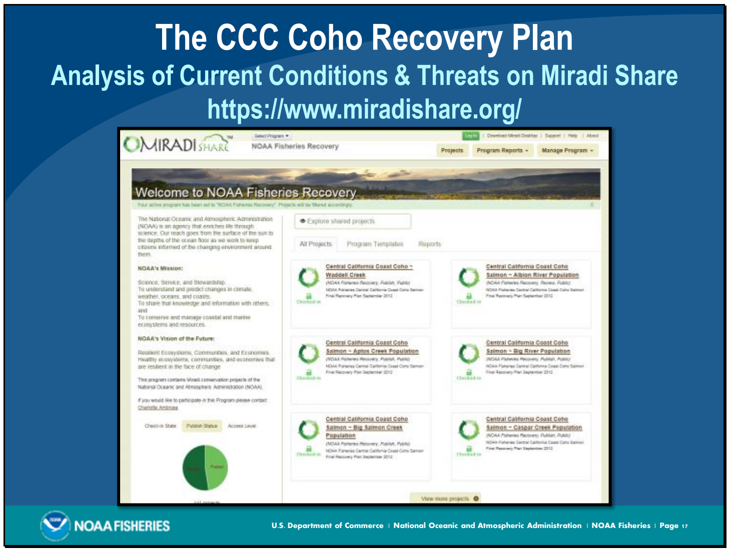

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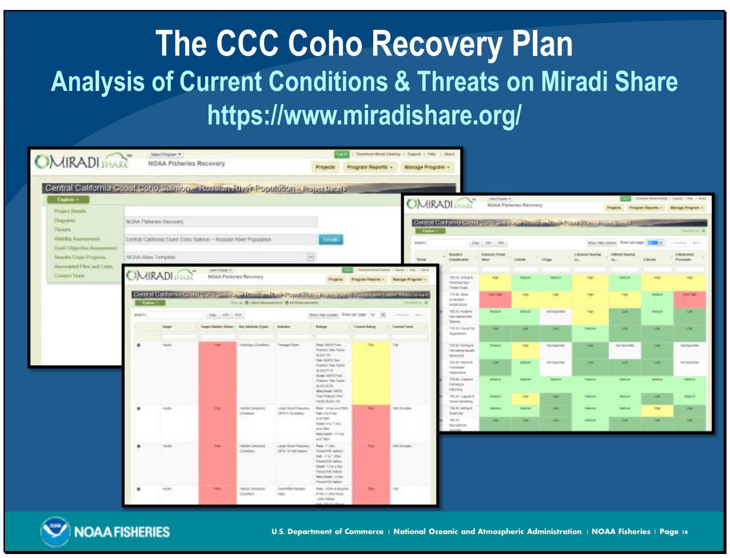

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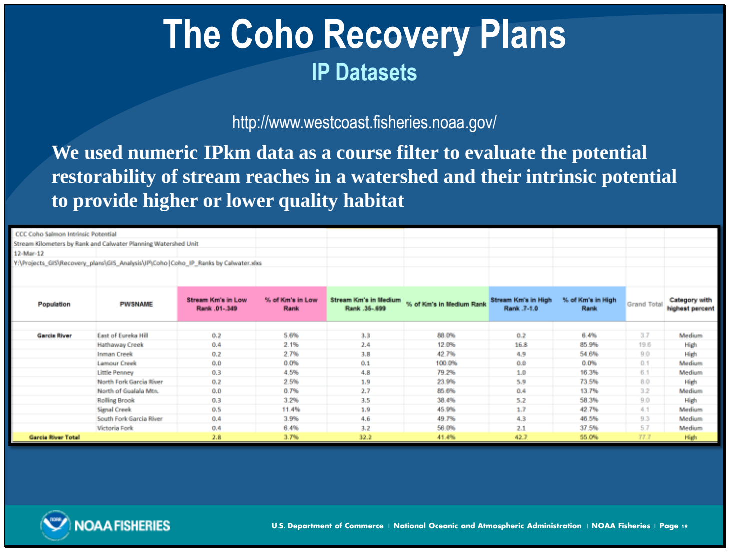

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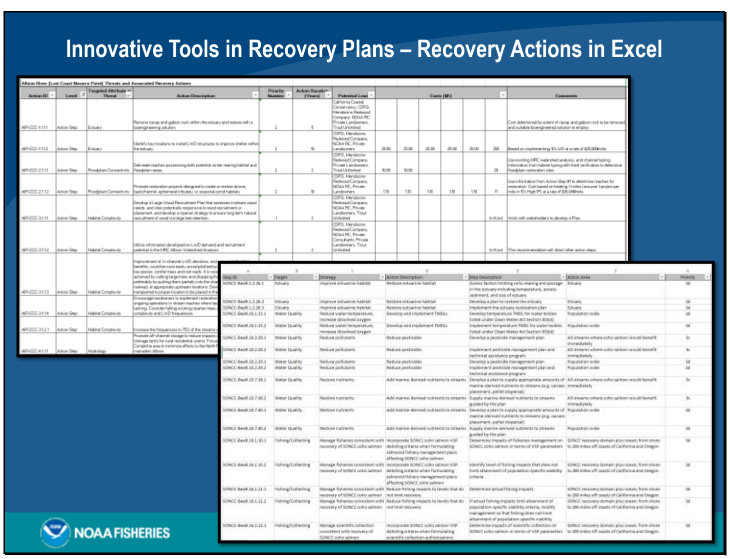

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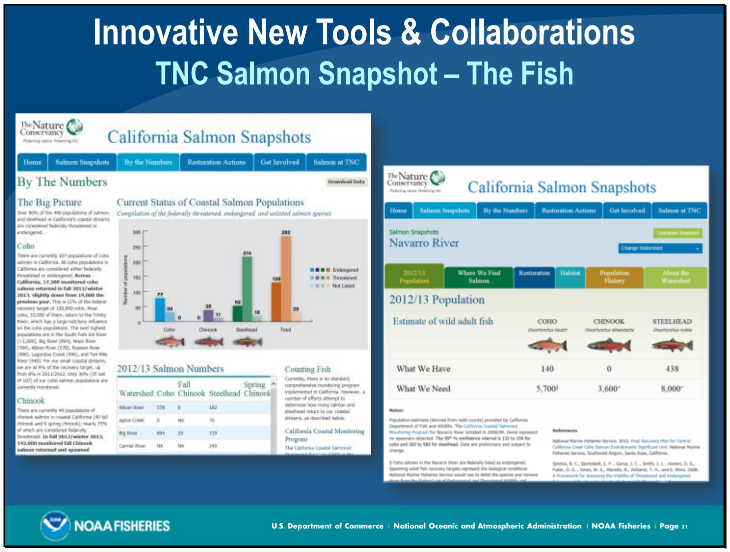

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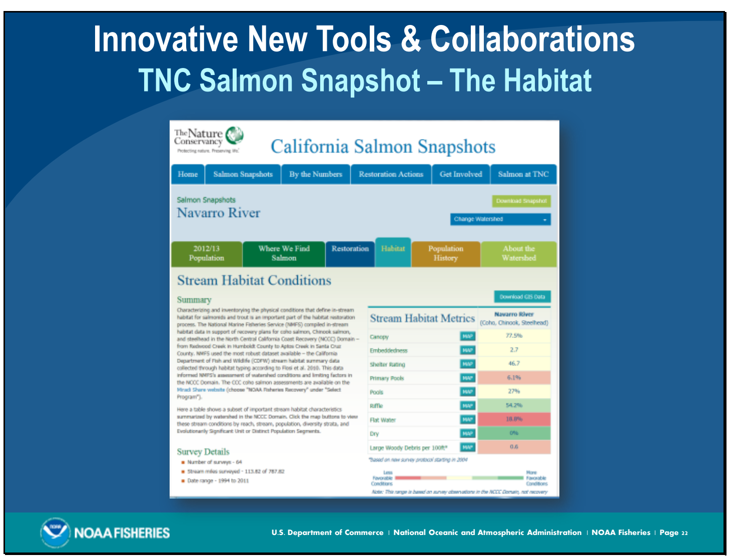

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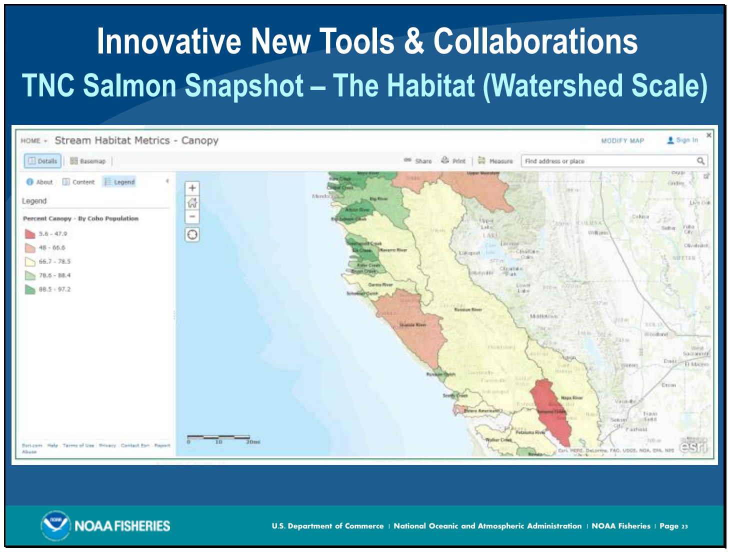

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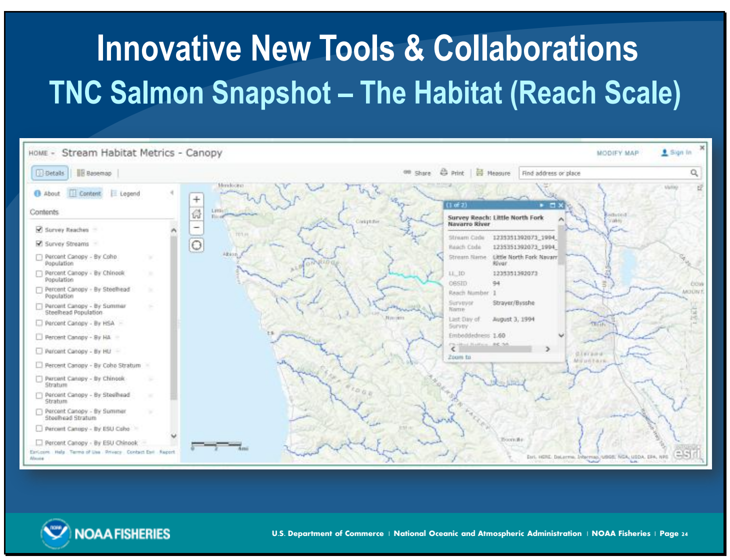

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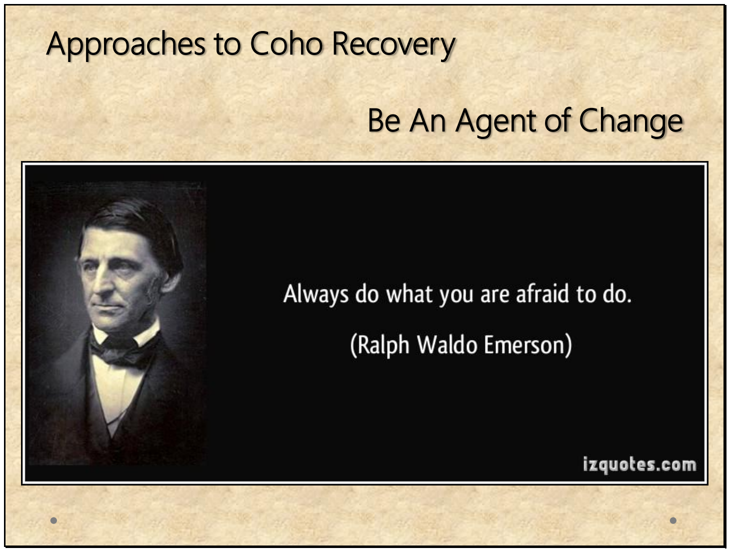

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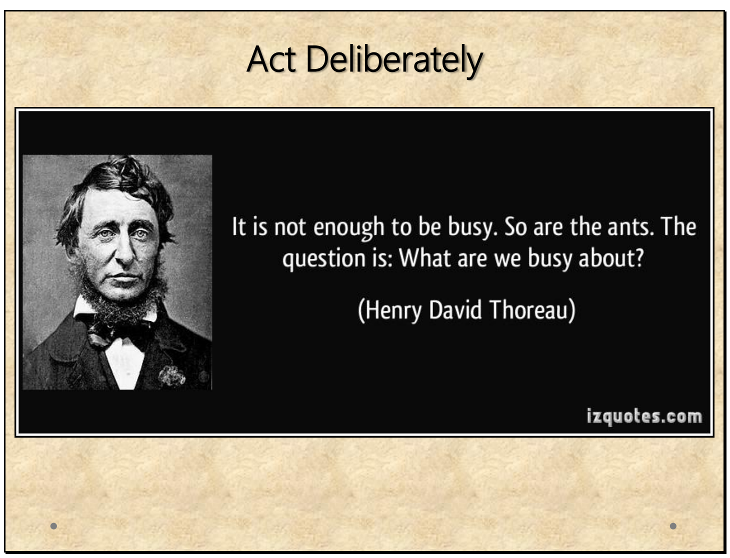

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One Person Can Make All The Difference
Taking The Path To Bring A Species Back

Title: Are California Coho Salmon Doomed? How to Improve Their Prognosis by Applying Lessons Learned from Studies on Canadian Coho Salmon.

Presenter: J.R. Irvine, Pacific Biological Station, Fisheries and Oceans Canada.

James.Irvine@dfo-mpo.gc.ca

Abstract: Coho Salmon in the Central California Coast Evolutionarily Significant Unit are listed as endangered. A recent draft Recovery Strategy listed hundreds of range-wide and watershed restoration recommendations to aid in their recovery. Yet, even though ~$100 million has been spent since 2004 on these efforts, numbers of adult Coho Salmon returning to most monitored California systems continue to decline. Approximately 1500 kilometers to the north, Coho Salmon returning to the Interior Fraser River watershed in British Columbia, listed as endangered by the Committee on the Status of Endangered Wildlife in Canada in 2002, show recent evidence of recovery. We argue that applying important lessons learned from studying Canadian Coho Salmon can reduce the likelihood of extirpation of Central California Coho Salmon. Fishing, habitat perturbations, and climate change were identified as primary threats to the recovery of Interior Fraser Coho Salmon. Significant declines in spawning escapements and total returns during the 1990s were largely the result of declining smolt-adult survivals exacerbated by overfishing. An abrupt decrease in productivity (recruits per spawner) coincided approximately with the 1989-1990 shift in marine conditions in the North Pacific Ocean. Smolt survival remains low – recent variability in adult returns, including the minor increases seen for some populations, were the result of variable survivals in fresh water. The putative recovery of Interior Fraser Coho Salmon required: 1) long-term commitment to reduced fishery exploitation (~66% prior to 1998 to ~15% post 1998; 2) understanding the relative role of changes to survival in freshwater versus the ocean; 3) determining the geographic extent of reproductively isolated populations called Conservation Units; 4) investigating the pros and cons of enhancement; and 5) identifying abundance-based benchmarks that enable the determination of biological status. It is hard to be optimistic of the fate of California's Coho Salmon at the southern extent of their distribution during a period of climate warming. In order for Coho Salmon from the Central California Coast Evolutionarily Significant Unit to return to levels of sustained viability or to achieve harvestable populations, studies that investigate the relevant items listed above are required. In addition, a properly designed approach to evaluate the effectiveness of restoration efforts in California is crucial (e.g. http://www.monitoringadvisor.org/).

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Are California Coho Salmon Doomed? How to Improve Their Prognosis by Applying Lessons Learned from Studies on Canadian Coho Salmon

Jim Irvine[1], Chuck Parken[2], Scott Decker[2], Jake Schweigert[3], Mara S. Zimmerman[4]

Innovative Trans-Boundary

Coho Salmon Recovery Workshop

11 March 2015

Santa Rosa California

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[3] Retired, Fisheries and Oceans Canada, Pacific Biological Station, 3190 Hammond Bay Road, Nanaimo, BC V9T 6N7 CANADA

[4] Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia, Washington 98501, U.S.A

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Background

- Coho salmon in southern BC experienced significant declines ~2 decades ago

- One group, Interior Fraser coho listed as endangered by COSEWIC[1] in 2002 are currently being re-assessed by COSEWIC

- Evidence for declines, why did they decline, what was done about it, has status improved, and are there lessons learned that are applicable in California?

[1]Committee on the Status of Endangered Wildlife in Canada

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Objectives

- 1) Review relevant findings from “northern” studies of coho salmon
- 2) Provide recommendations relevant to studies of coho salmon in California

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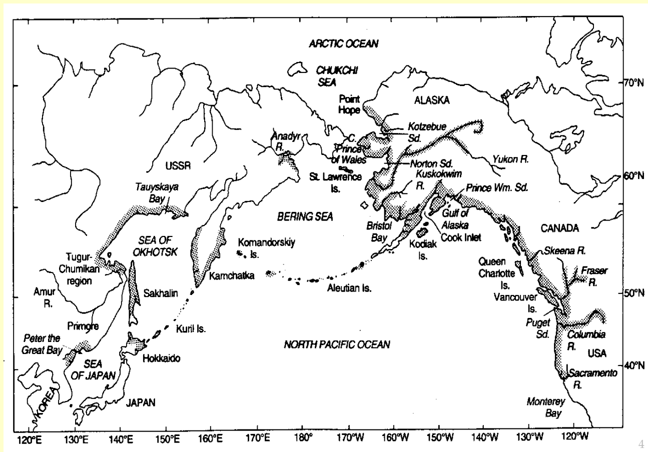
Approximate global distribution of naturally spawning Coho Salmon (from Sandercock 1991).



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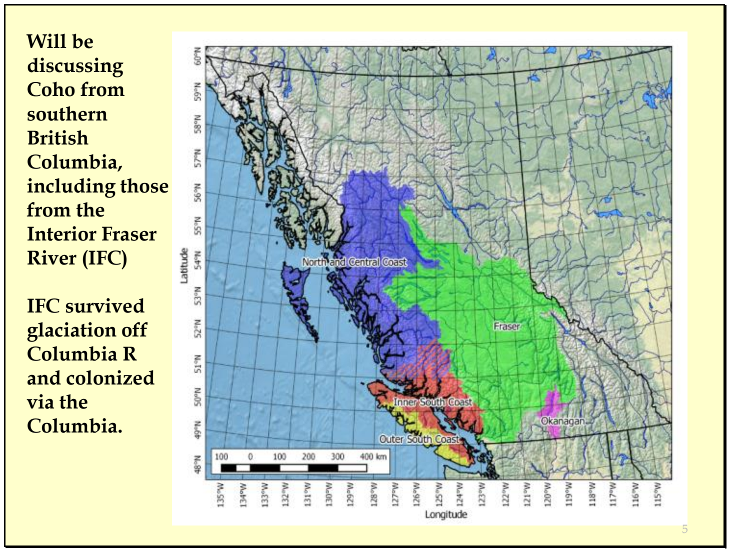

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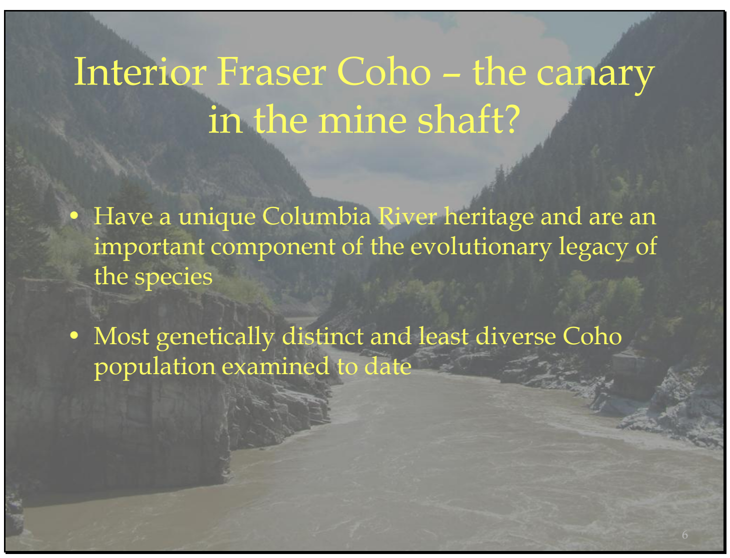

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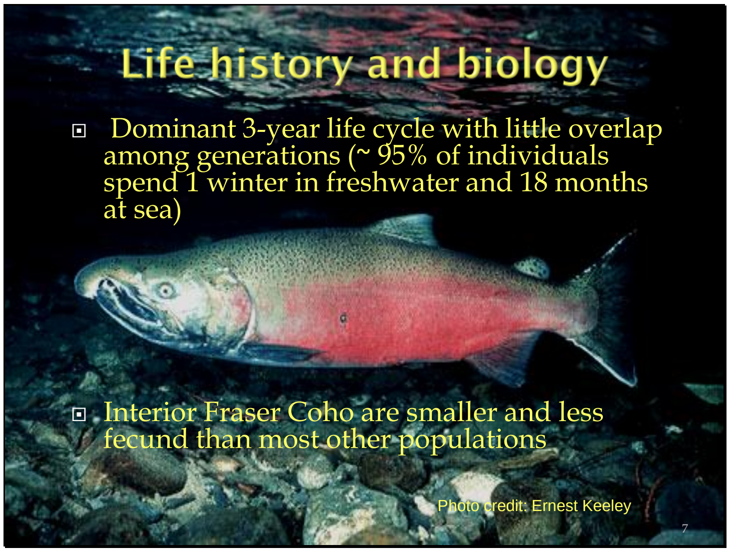

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Let’s look at some abundance and survival data

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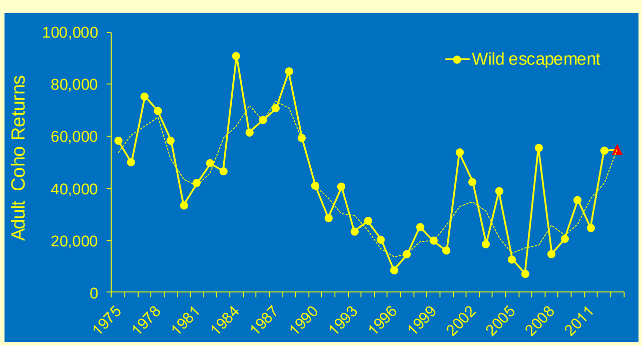
IFC escapement time series



Period of decline in 1980’s and 90’s, variable since then with recent increases

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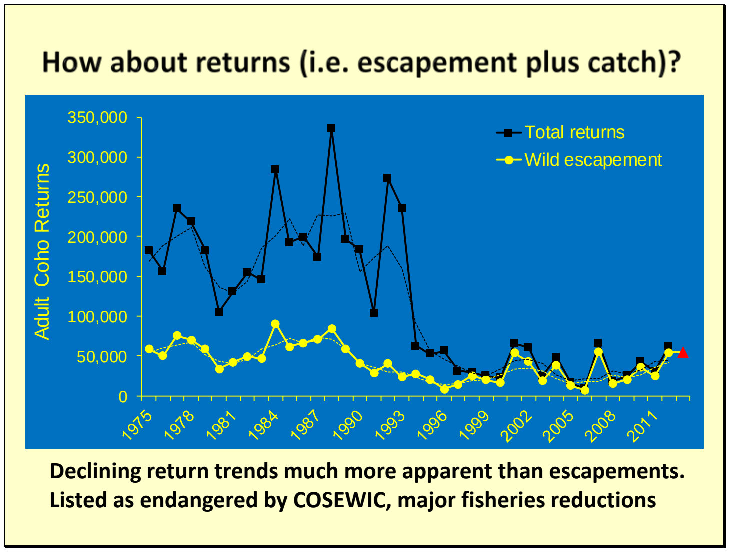

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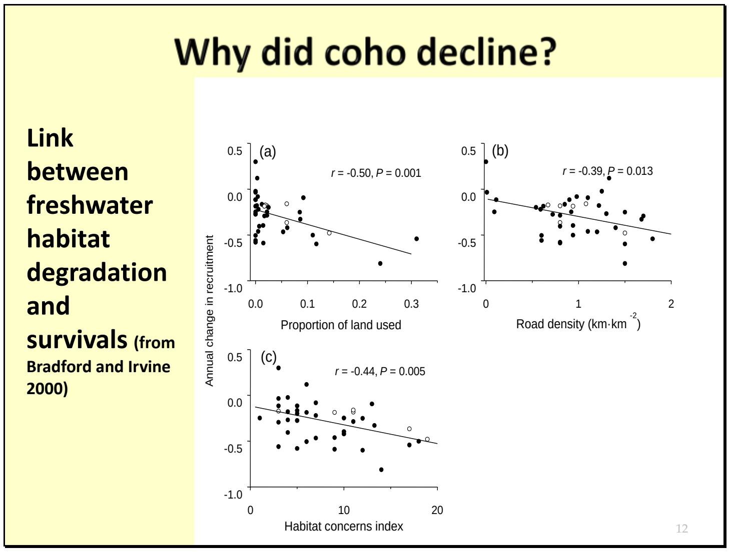

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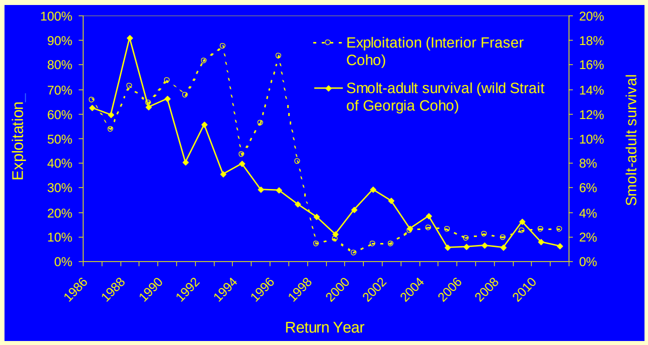
However, primary reason for declining trends was reduced smolt survivals



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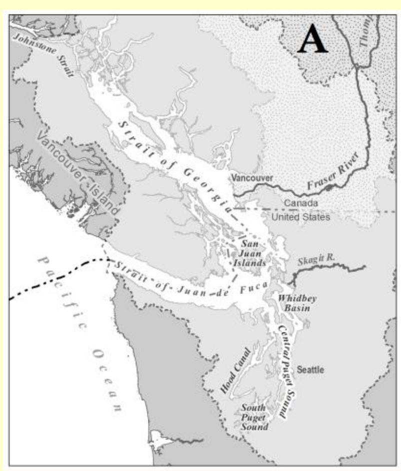
What are smolt survivals for other populations (from Zimmerman et al 2015)**?**

Will look at Strait of Georgia, Puget Sound, and outer Pacific Coast (BC, Wa, Oregon)



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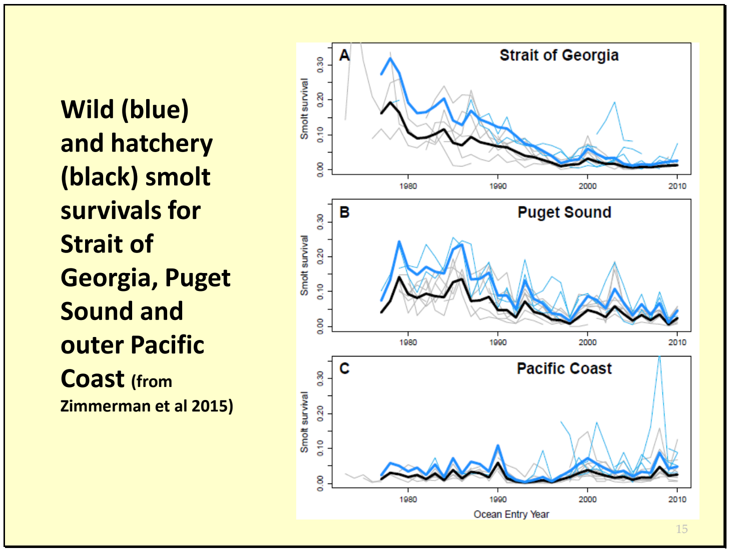

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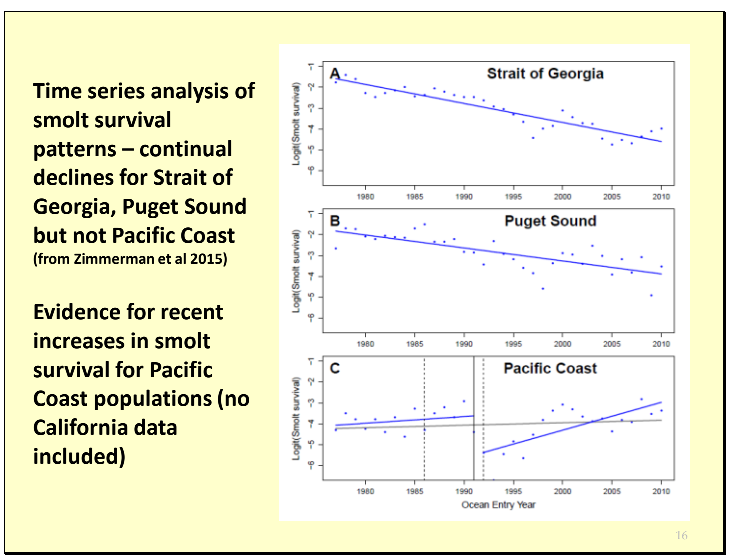

Slide 17

Summary

- - Southern BC coho declines in 1990's resulted in 1 population being listed by COSEWIC as endangered
- - Declines resulted from decreased smolt survivals exacerbated by changes in freshwater habitat. Significant reductions in fisheries followed a lag in abundance declines (i.e. overexploitation).
- - Low exploitations maintained since; improved assessments documented subsequent increases in coho abundances
- - Outer coast populations appear to have distinct patterns of smolt survival (similar in California?)

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Lessons for California From the North

- **1) understand the relative role of changes to survival in freshwater versus the ocean**

Need time series of spawners and smolts
Where are the bottlenecks? Perhaps recent smolt survivals have been increasing?

18

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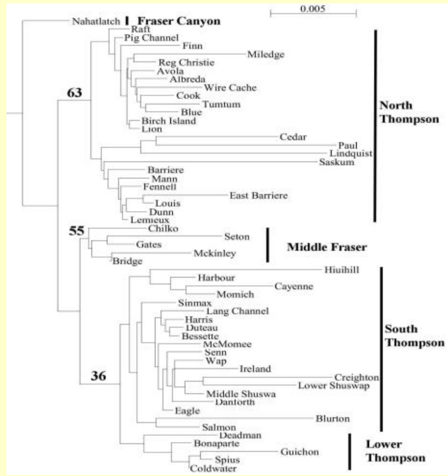
2) determine geographic extent of reproductively isolated populations

(Supplemental Fig 1 in Beacham et al. (2011))



Where do the fish you produce end up spawning?

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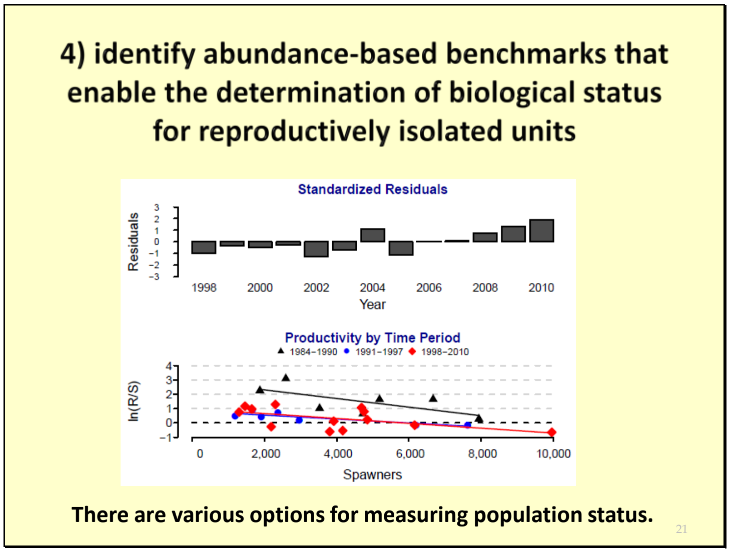
3) investigate the pros and cons of enhancement

Do wild salmon survive better than enhanced salmon?

20

Slide 21



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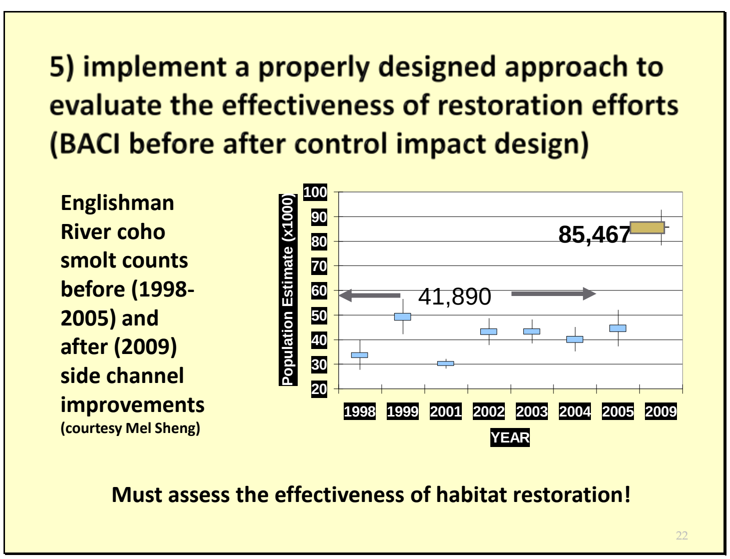

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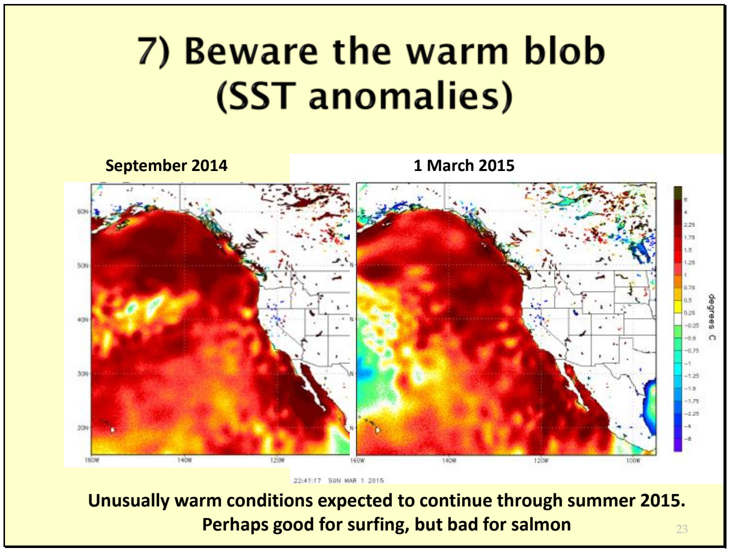

Updated from presentation by L. Weitcamp.
http://polar.ncep.noaa.gov/sst/ophi/color_newdisp_anomaly_160W_95W_15N_65N_ophi0.png

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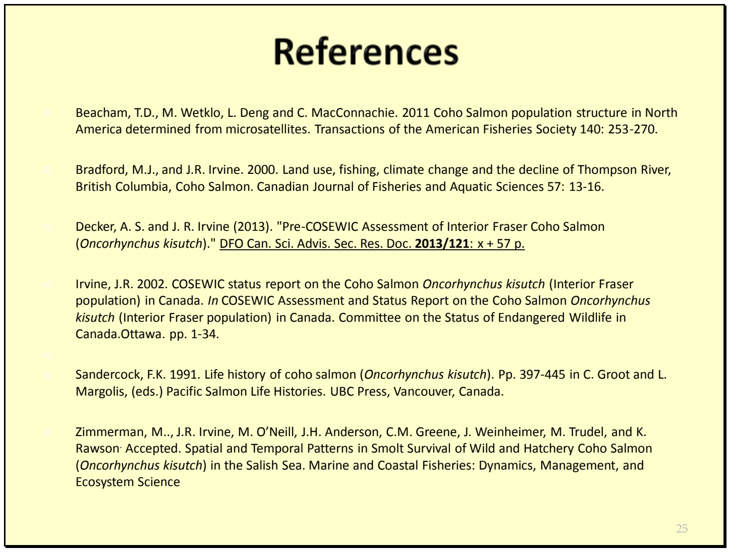
References
Beacham, T.D., M. Wetklo, L. Deng and C. MacConnachie. 2011 Coho Salmon population structure in North America determined from microsatellites. Transactions of the American Fisheries Society 140: 253-270.
Bradford, M.J., and J.R. Irvine. 2000. Land use, fishing, climate change and the decline of Thompson River, British Columbia, Coho Salmon. Canadian Journal of Fisheries and Aquatic Sciences 57: 13-16.
Decker, A. S. and J. R. Irvine (2013). "Pre-COSEWIC Assessment of Interior Fraser Coho Salmon (Oncorhynchus kisutch)." DFO Can. Sci. Advis. Sec. Res. Doc. 2013/121: x + 57 p.
Irvine, J.R. 2002. COSEWIC status report on the Coho Salmon Oncorhynchus kisutch (Interior Fraser population) in Canada. In COSEWIC Assessment and Status Report on the Coho Salmon Oncorhynchus kisutch (Interior Fraser population) in Canada. Committee on the Status of Endangered Wildlife in Canada.Ottawa. pp. 1-34.
Sandercock, F.K. 1991. Life history of coho salmon (Oncorhynchus kisutch). Pp. 397-445 in C. Groot and L. Margolis, (eds.) Pacific Salmon Life Histories. UBC Press, Vancouver, Canada.
Zimmerman, M.., J.R. Irvine, M. O'Neill, J.H. Anderson, C.M. Greene, J. Weinheimer, M. Trudel, and K. Rawson. Accepted. Spatial and Temporal Patterns in Smolt Survival of Wild and Hatchery Coho Salmon (Oncorhynchus kisutch) in the Salish Sea. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science
25

Title: Use of System Dynamic Modeling as a tool for Coho Recovery in Olema Creek, Point Reyes National Seashore, Marin County, California.

Presenter: Michael Reichmuth, National Park Service. michael_reichmuth@nps.gov

Abstract:

Olema Creek is a primary tributary to Lagunitas Creek, which is considered a coho salmon (Oncorhynchus kisutch) stronghold within the Central California Coast ESU. With over eight years of existing data, the U.S. Geological Service collaborated with the National Park Service to develop a system dynamic model to investigate potential factors limiting survival and production, identify data gaps, and improve monitoring and restoration prescriptions. A key component of the model was the use of both coho monitoring data and physical parameter data such as water quality and stream flow. In addition to existing data, surrogate data from outside sources, commonly reported in peer-reviewed literature, and professional judgment were utilized when existing data was not available. This model was completed in 2014 giving park managers a new assessment method for evaluating the freshwater survival of coho salmon in Olema Creek. For example, summer juvenile coho estimates plotted against spring coho smolt estimates suggest a smolt production threshold. Using the Olema Creek model it was determined that a data gap exists for winter habitat on Olema Creek which may be a significant driver on overwintering coho survival. Models such as this one developed for Olema Creek are becoming a valuable management tool in the face of climate change and limited funds for salmonid restoration and monitoring.

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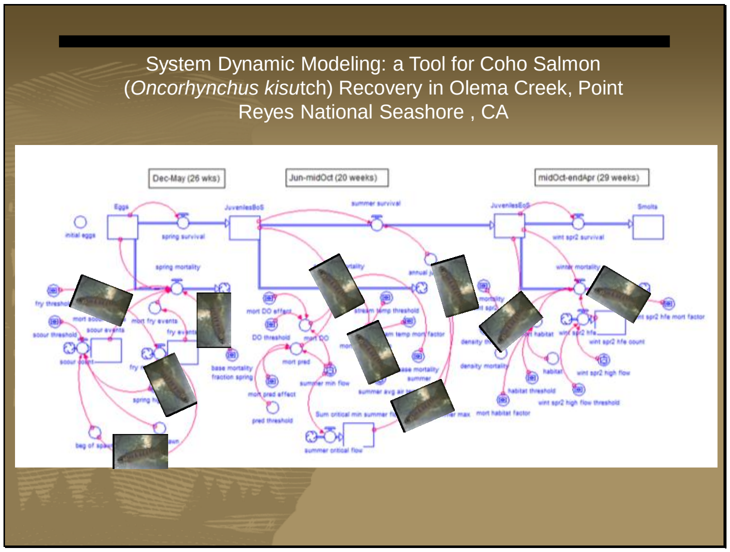

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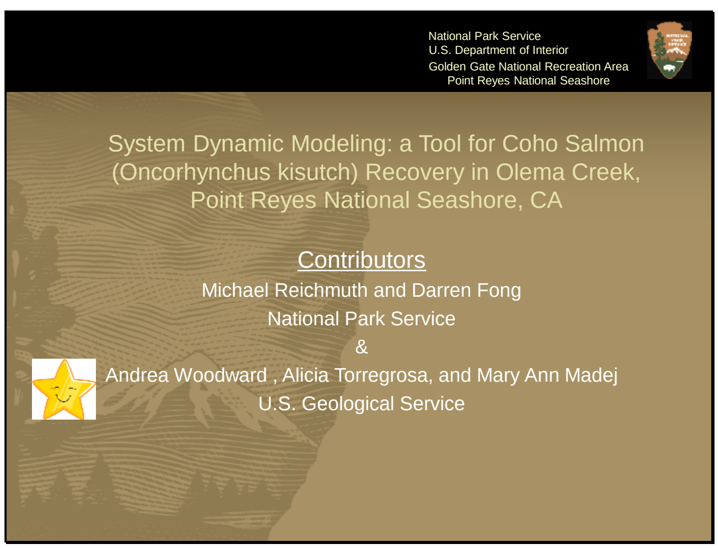

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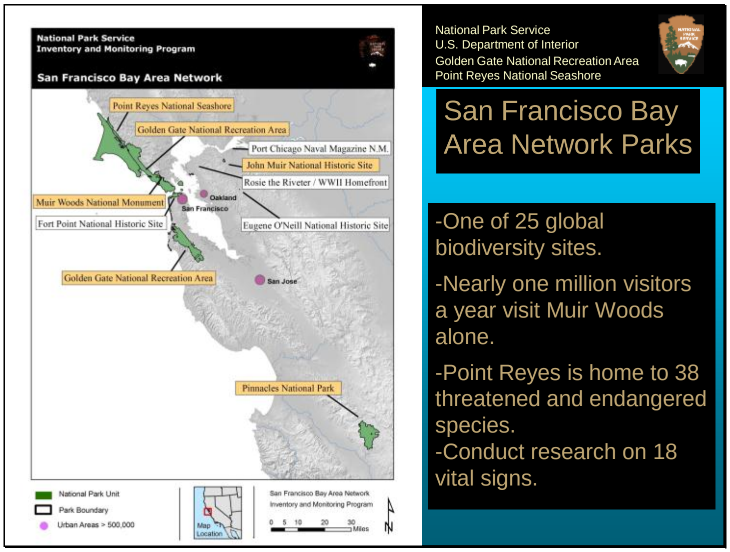

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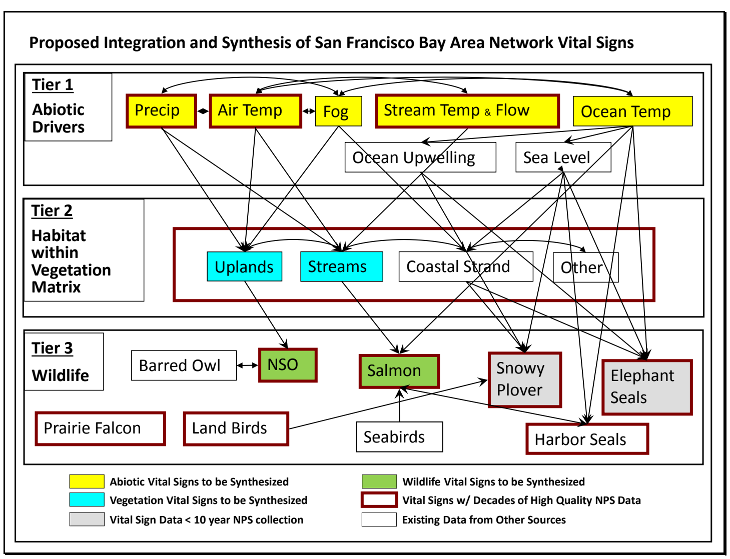

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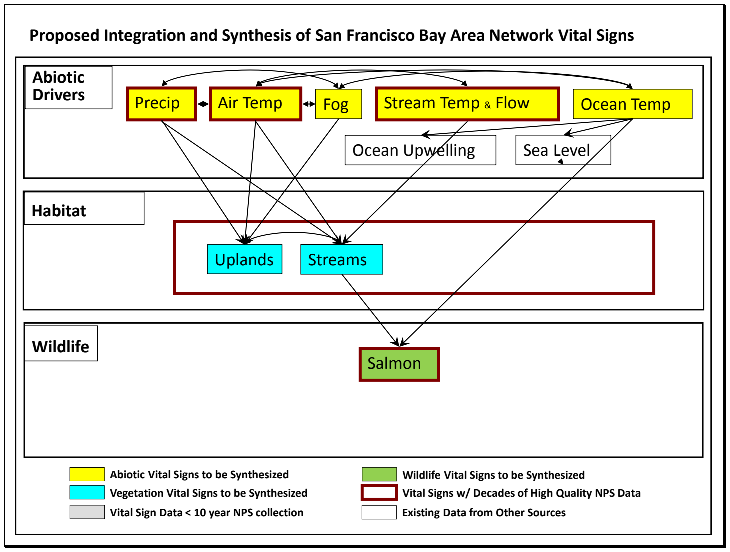

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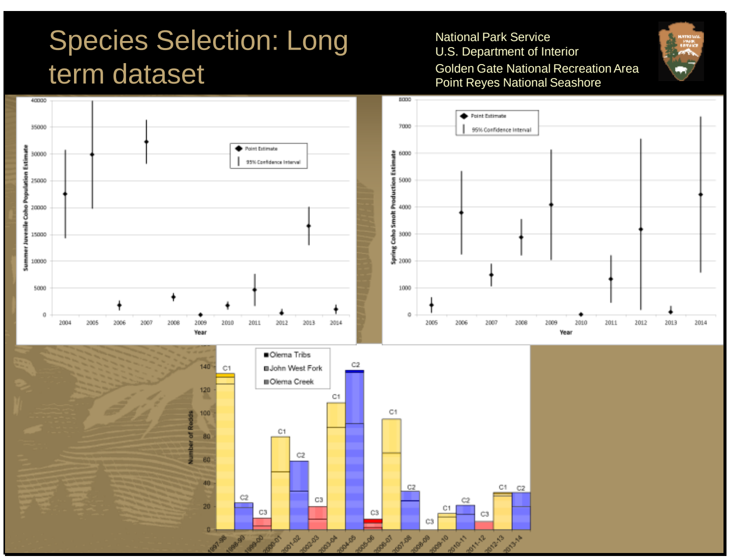

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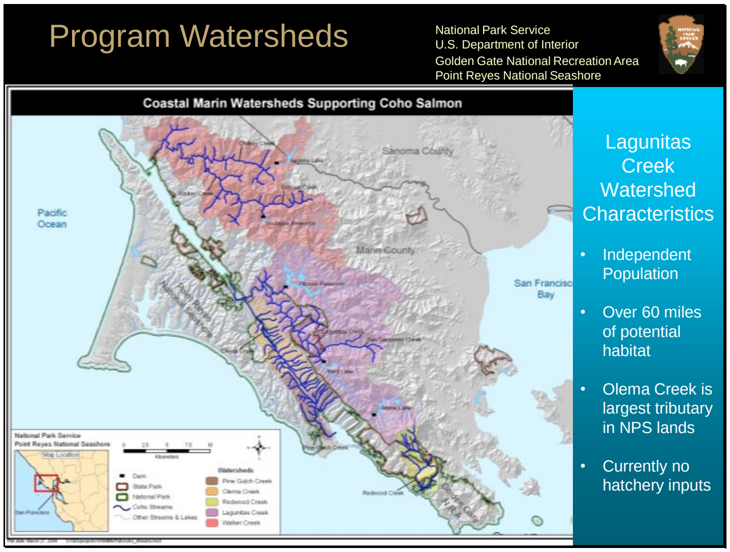

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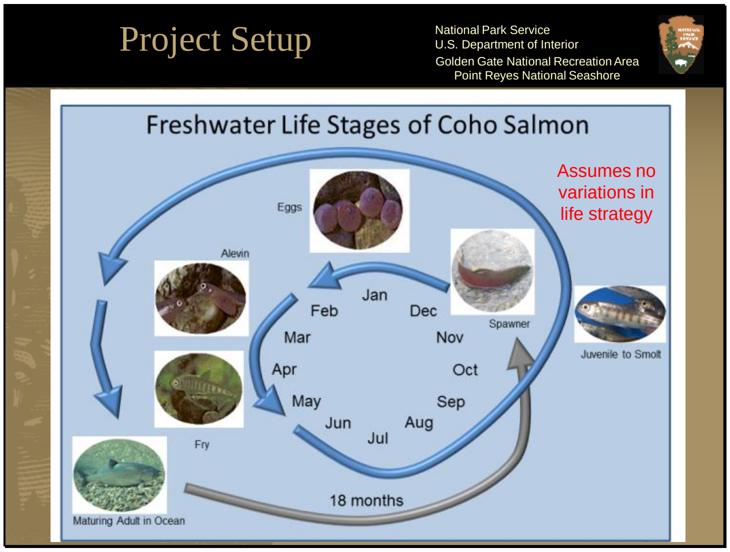

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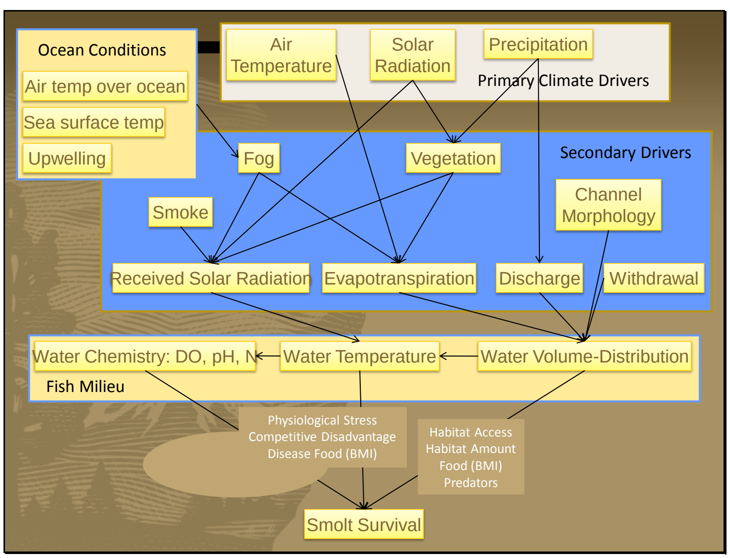

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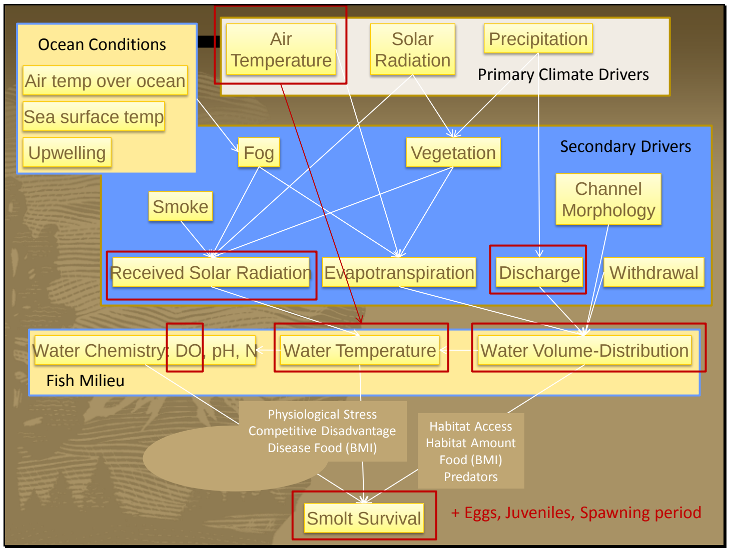

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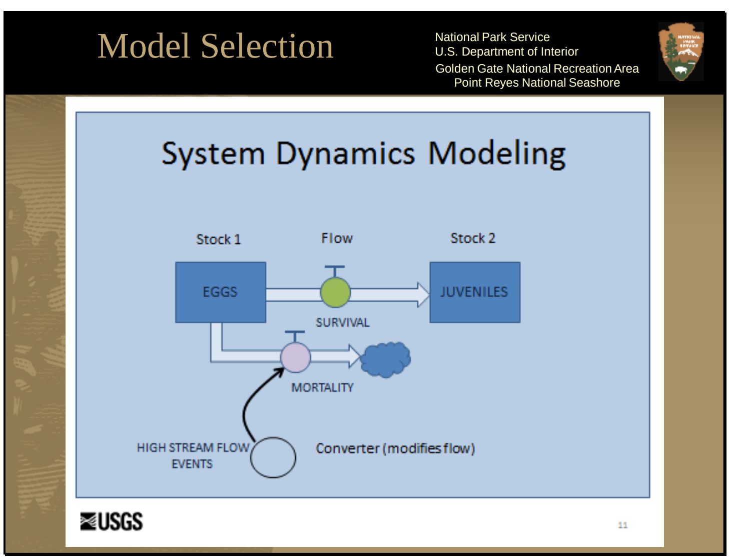

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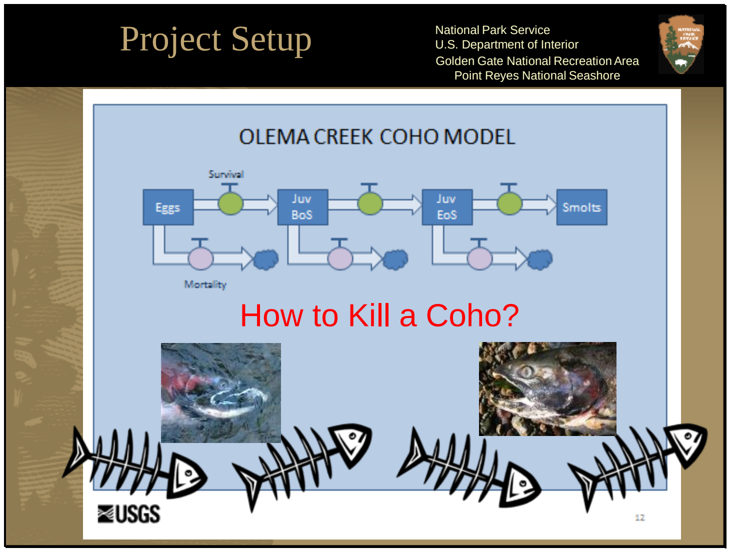

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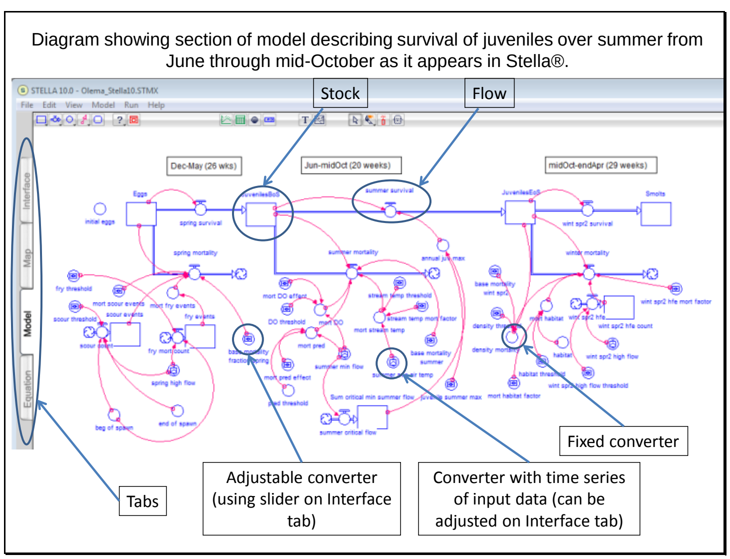

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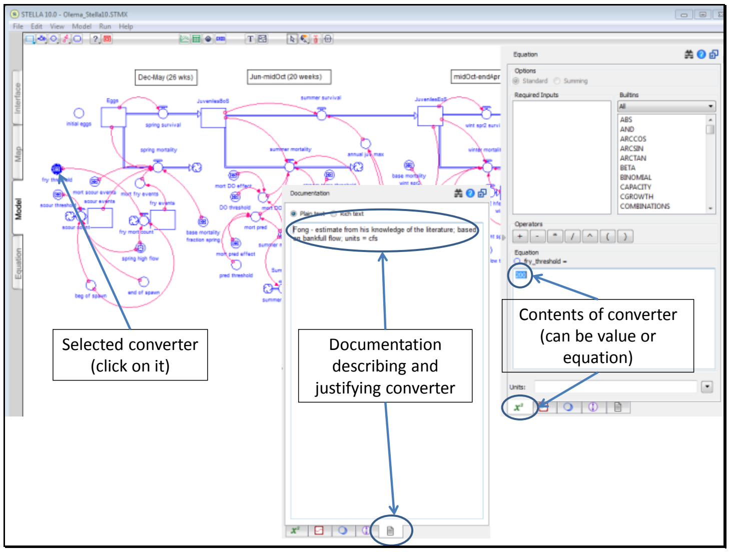

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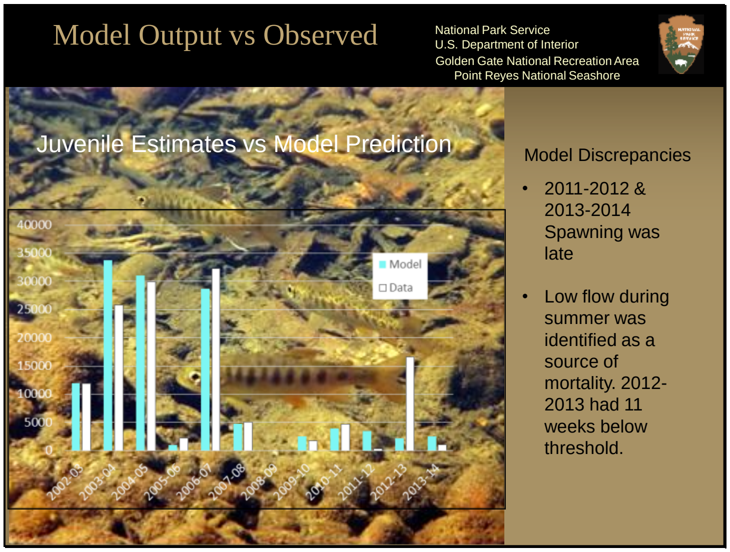

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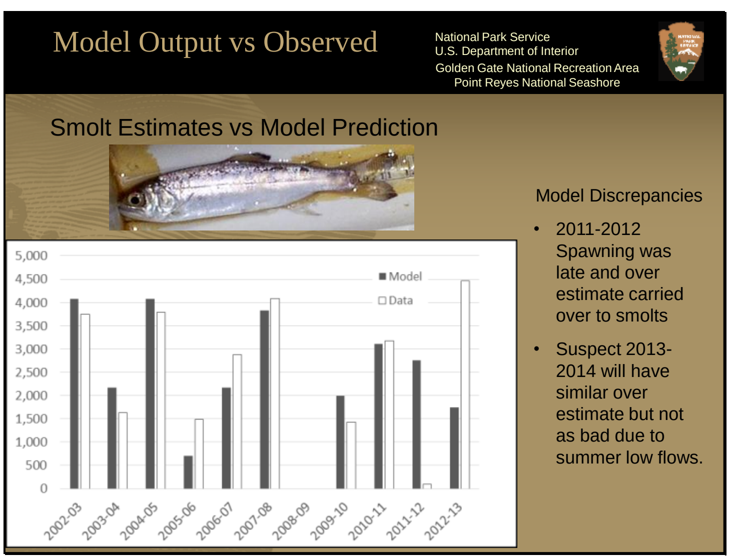

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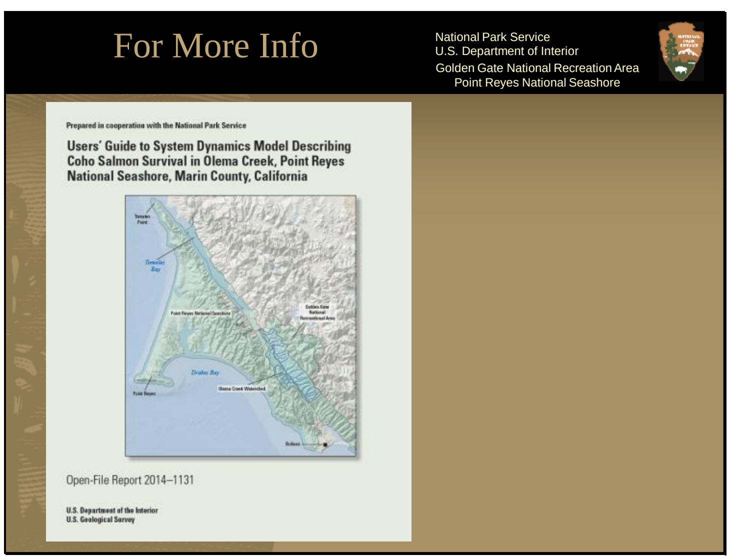

Creating Rearing Habitat for ESA Listed Coho Salmon With Multiple Life History Strategies.

Presenter*:* Michael Wallace, California Department of Fish & Wildlife, Arcata.

mike.wallace@wildlife.ca.gov

Abstract:

There has been a growing appreciation of the importance of the stream-estuary ecotone (SEE) to juvenile coho salmon (Oncorhynchus kisutch) which has resulted in numerous habitat restoration projects being planned and completed in this habitat throughout northern and central CA. This talk will present examples of various SEE restoration projects to improve habitat and restore access to Humboldt Bay tributaries. These projects occur throughout the entire continuum of the SEE from brackish water through tidal freshwater to low gradient stream habitat in the lower portion of broad valley floors. The California Department of Fish & Wildlife (DFW) is sampling many of these projects to assess their performance and working with the restoration community to help design and improve future restoration projects. Initial results show that juvenile salmonids, especially coho salmon, moved into the newly restored sites as soon as they were accessible and water quality conditions allowed. The completed restoration projects in the lower portion of the SEE provided mostly over winter rearing habitat from December to June and individual juvenile coho reared at these sites for up to six months. DFW also found that juvenile coho captured in the SEE are larger than their cohorts rearing upstream in stream habitat and that restoring SEE habitat can benefit coho from the entire basin. This talk will show results of various SEE restoration techniques such as tide gate removal/modification, levee removal, and constructing or reconnecting off channel habitat. Providing access to and improving connections between small tributaries entering the SEE and creating off channel habitat appear to benefit juvenile salmonids.

Slide 1

Slide 2

Slide 3

Pertinent Literature

Miller, B.A. and S. Sadro. 2003. Residence time and seasonal movements of juvenile coho salmon in the ecotone and lower estuary of Winchester Creek, South Slough, Oregon. Transactions of the American Fisheries Society 132(3): 546-559.

Koski, K.V. 2009. The fate of coho salmon nomads: the story of an estuarine-rearing strategy promoting resilience. Ecology and Society 14 (1): 4.

Slide 4

The Stream-Estuary Ecotone is Important Rearing Habitat for Coho Salmon

Impaired Estuary Function is a Stressor and a Threat to Coho Salmon

NOAA Draft Recovery Plan for SONCC Coho Salmon

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Common Restoration Techniques

Provide Access and Decrease Isolation

- Tide gate replacement or removal
- Remove or improve culvert passage
- Remove or set back levees
- Reconnect stream channel to adjacent floodplain

Improve Habitat

- Re-establish muted tidal cycle
- Increase tidal prism
- Create off channel habitat such as ponds, side channels, and alcoves
- Add large wood
- Create additional edge habitat
- Remove reed canary grass and other invasive spp

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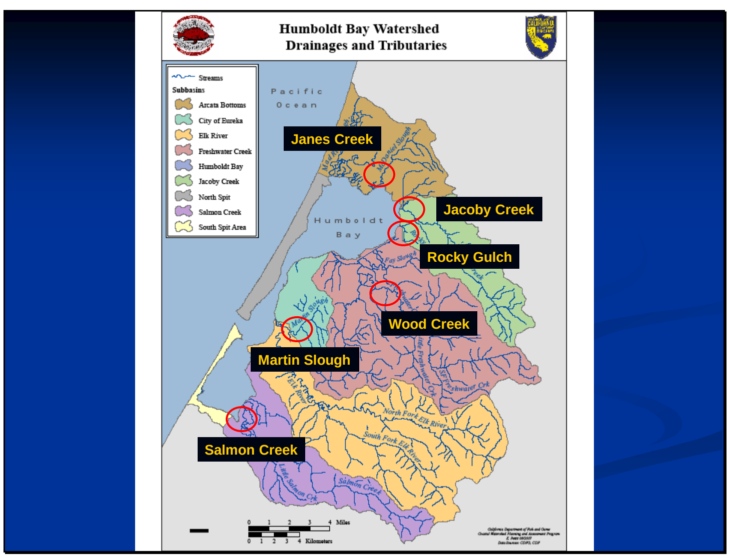

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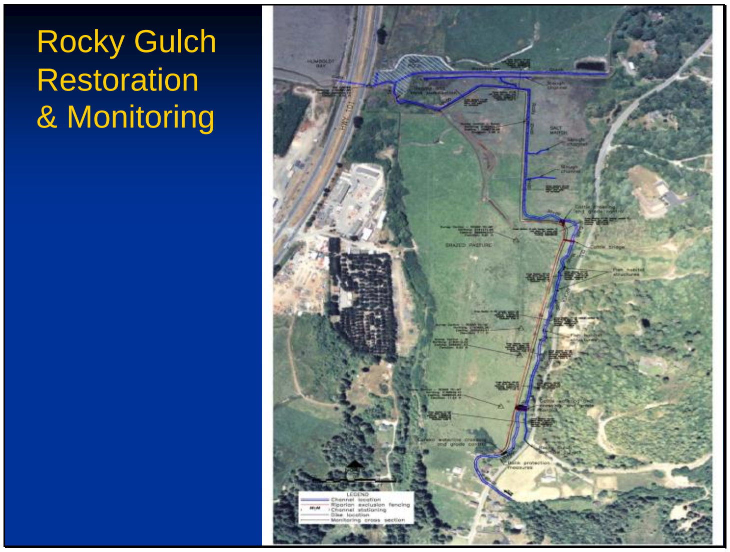

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Coho Salmon Catches 2007-2009

Dates	Rocky Gulch	Wood Creek	Martin Slough	Total
Jan-Mar 07	**48**	86	4	138
Apr-Jun 07	**29**	29	71	129
Jul-Sep 07	**0**	17	17	34
Oct-Dec 07	**1**	17	22	40
Jan-Mar 08	**20**	125	123	268
Apr-Jun 08	**16**	50	76	142
Jul-Sep 08	**0**	1	7	8
Oct-Dec 08	**0**	5	17	22
Jan-Mar 09	**28**	46	435	509
Apr-Jun 09	**3**	22	247	272

Three life history types for coho salmon

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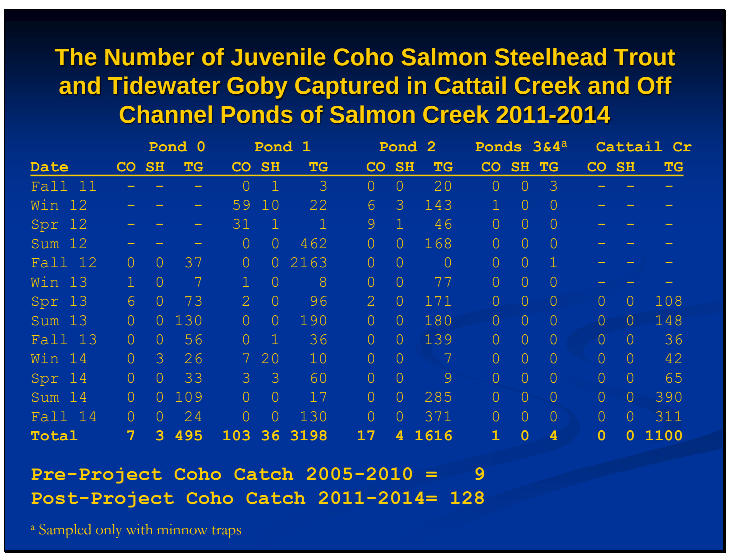

The Number of Juvenile Coho Salmon Steelhead Trout and Tidewater Goby Captured in Cattail Creek and Off Channel Ponds of Salmon Creek 2011-2014

	Pond 0			Pond 1			Pond 2			Ponds 3&4[a]			Cattail Cr		
Date	CO	SH	TG	CO	SH	TG	CO	SH	TG	CO	SH	TG	CO	SH	TG
Fall 11	–	–	–	0	1	3	0	0	20	0	0	3	–	–	–
Win 12	–	–	–	59	10	22	6	3	143	1	0	0	–	–	–
Spr 12	–	–	–	31	1	1	9	1	46	0	0	0	–	–	–
Sum 12	–	–	–	0	0	462	0	0	168	0	0	0	–	–	–
Fall 12	0	0	37	0	0	2163	0	0	0	0	0	1	–	–	–
Win 13	1	0	7	1	0	8	0	0	77	0	0	0	–	–	–
Spr 13	6	0	73	2	0	96	2	0	171	0	0	0	0	0	108
Sum 13	0	0	130	0	0	190	0	0	180	0	0	0	0	0	148
Fall 13	0	0	56	0	1	36	0	0	139	0	0	0	0	0	36
Win 14	0	3	26	7	20	10	0	0	7	0	0	0	0	0	42
Spr 14	0	0	33	3	3	60	0	0	9	0	0	0	0	0	65
Sum 14	0	0	109	0	0	17	0	0	285	0	0	0	0	0	390
Fall 14	0	0	24	0	0	130	0	0	371	0	0	0	0	0	311
Total	**7**	**3**	**495**	**103**	**36**	**3198**	**17**	**4**	**1616**	**1**	**0**	**4**	**0**	**0**	**1100**

Pre-Project Coho Catch 2005-2010 = 9
Post-Project Coho Catch 2011-2014= 128

[a] Sampled only with minnow traps

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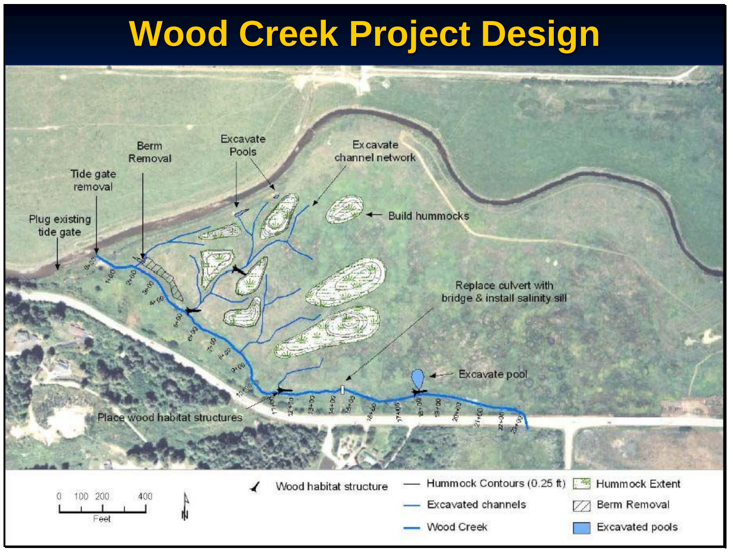

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Number of juvenile salmonids captured by season during opportunistic seining in Wood Creek Pond, January 2011 to December 2014. Winter is January-March, Spring is April-June, Summer is July-September, and Fall is October-December.

Date	Coho Yearling	Coho YOY	Steelhead/ RT	Cutthroat Trout.
Winter 2011	11	1	0	1
Spring 2011	1	46	0	1
Summer 2011	0	0	0	0
Fall 2011	0	1	0	0
Winter 2012	211	0	1	0
Spring 2012	26	73	0	1
Summer 2012	0	2	0	0
Fall 2012	0	15	0	0
Winter 2013	61	0	0	0
Spring 2013	3	0	0	0
Summer 2013	0	0	0	0
Fall 2013	0	10	0	0
Winter 2014*	1	0	0	0
Spring 2014*	4	0	0	0
Summer 2014*	0	0	0	0
Fall 2014*	0	2	0	0

*reduced effort due to heavy algae growth; used small 10X4 ft. seine designed to capture tidewater goby.

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Origin of PIT tagged juvenile coho salmon tagged in Freshwater Creek basin detected at Wood Creek pond antennas during January to September 2010, October 2010 to October 2011, October 2011 to July 2012, October 2012 to June 2013, and September 2013 to June 2014

Fish Origin	2010	10/11	11/12	12/13	13/14
Stream Estuary Ecotone	7	1	-	1	0
Lower Mainstem Freshwater Creek	11	6	26	2	0
Middle Mainstem Freshwater Creek	-	11	16	1	1
Upper Mainstem Freshwater Creek	7	6	12	4	0
Little Freshwater Creek	12	-	-	-	0
Cloney Gulch	9	4	6	4	0
South Fork Freshwater Creek	-	0	10	2	0
Freshwater Creek (total)	46	28	70	14	1
Wood Creek Pond	74	8	199	42	5
Wood Creek	27	19	20	11	11
Ryan Slough/Creek	0	0	7	2	0
Freshwater Creek Slough	5	0	8	6	0
HFAC Weir	1	0	2	0	4
Estuary Ecotone (total)	107	27	236	61	20
Grand Total	153	55	306	75	21

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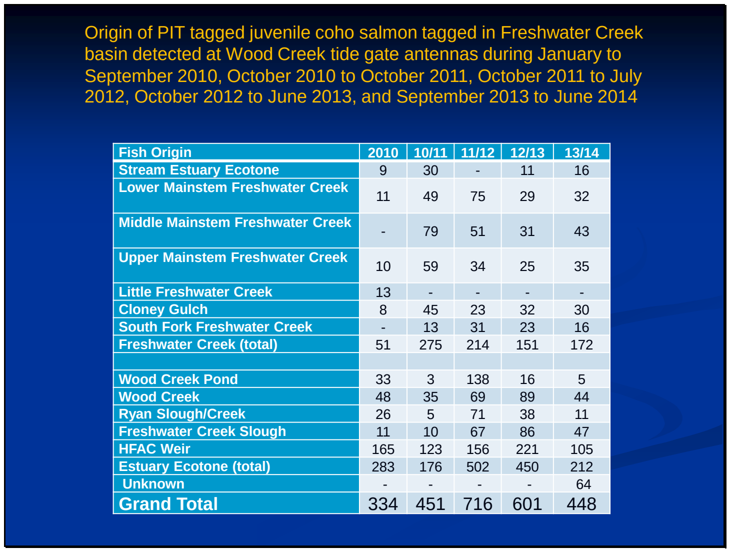
Origin of PIT tagged juvenile coho salmon tagged in Freshwater Creek basin detected at Wood Creek tide gate antennas during January to September 2010, October 2010 to October 2011, October 2011 to July 2012, October 2012 to June 2013, and September 2013 to June 2014

Fish Origin	2010	10/11	11/12	12/13	13/14
Stream Estuary Ecotone	9	30	-	11	16
Lower Mainstem Freshwater Creek	11	49	75	29	32
Middle Mainstem Freshwater Creek	-	79	51	31	43
Upper Mainstem Freshwater Creek	10	59	34	25	35
Little Freshwater Creek	13	-	-	-	-
Cloney Gulch	8	45	23	32	30
South Fork Freshwater Creek	-	13	31	23	16
Freshwater Creek (total)	51	275	214	151	172
Wood Creek Pond	33	3	138	16	5
Wood Creek	48	35	69	89	44
Ryan Slough/Creek	26	5	71	38	11
Freshwater Creek Slough	11	10	67	86	47
HFAC Weir	165	123	156	221	105
Estuary Ecotone (total)	283	176	502	450	212
Unknown	-	-	-	-	64
Grand Total	334	451	716	601	448

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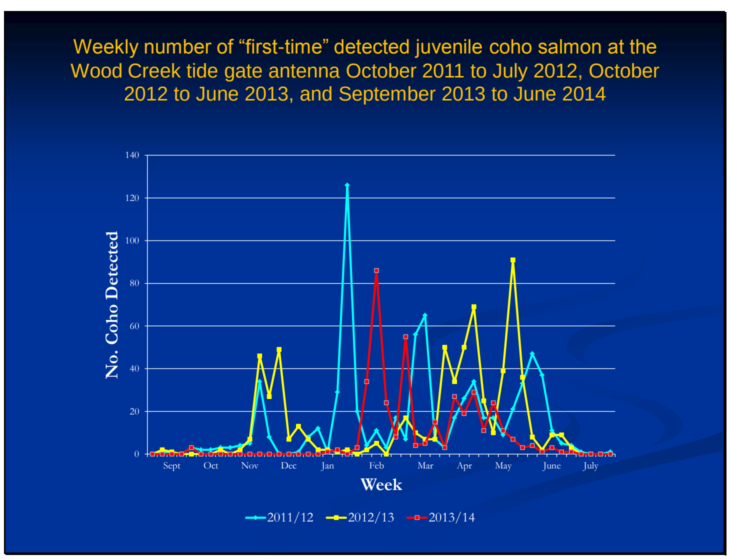

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Number of juvenile salmonids and TWG captured in Martin Slough 2007 to 2014

Date	Coho Yearling	Coho YOY	Steelhead/ RT	Cutthroat Trout.	TWG
Winter 2007	4	0	0	0	0
Spring 2007	71	0	0	3	0
Winter 2008	68	0	0	0	0
Spring 2008	70	0	0	5	0
Winter 2009	435	0	0	0	0
Spring 2009	246	1	1	11	0
Winter 2010	198	0	0	1	0
Spring 2010	83	0	0	3	0
Spring 2011	66	33	0	24	2
Summer 2011	0	97	0	19	158
Fall 2011	0	121	0	20	411
Winter 2012	553	0	0	6	25
Spring 2012	74	1	0	1	5
Winter 2013	80	0	1	0	46
Spring 2013	159	2	0	6	119
Summer 2013	0	0	0	1	0
Fall 2013	0	4	0	0	0
Spring 2014	10	0	0	7	189
Summer 2014	0	15	0	7	16
Fall 2014	2	1	0	0	132

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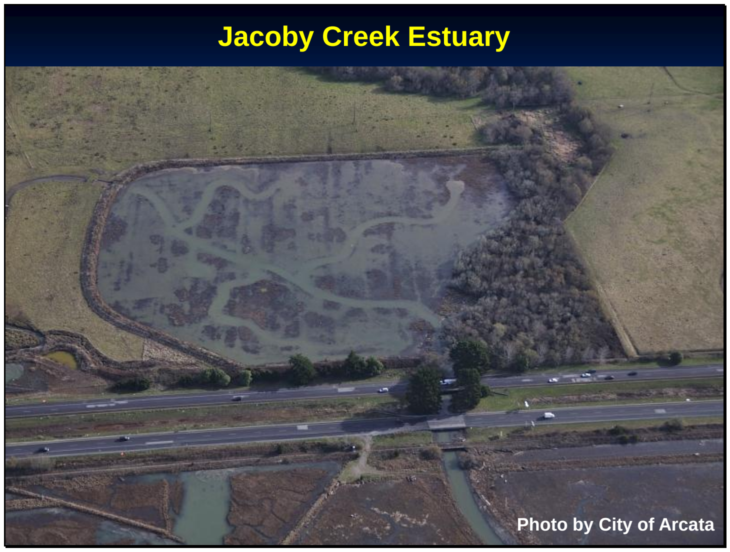

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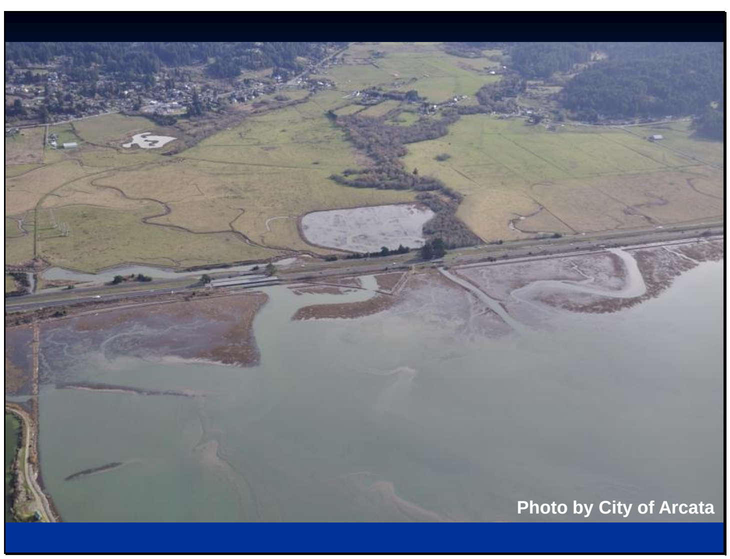

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Number of juvenile salmonids captured in constructed Jacoby Creek Marsh and mainstem Jacoby Creek, 2012 to 2014. Winter is January-March, Spring is April-June, and Summer is July-September.

	Jacoby Creek Marsh			Jacoby Creek		
Date	Coho Yearling	Coho YOY	Steelhead/ RT	Coho Yearling	Coho YOY	Steelhead/ RT
Spring 2012	6	148	0	-	-	-
Summer 2012	0	0	0	-	-	-
Winter 2013	0	0	0	0	0	0
Spring 2013	0	0	0	1	0	2
Winter 2014	5	0	0	0	0	0
Spring 2014	0	1	0	15	0	0

Data from City of Arcata

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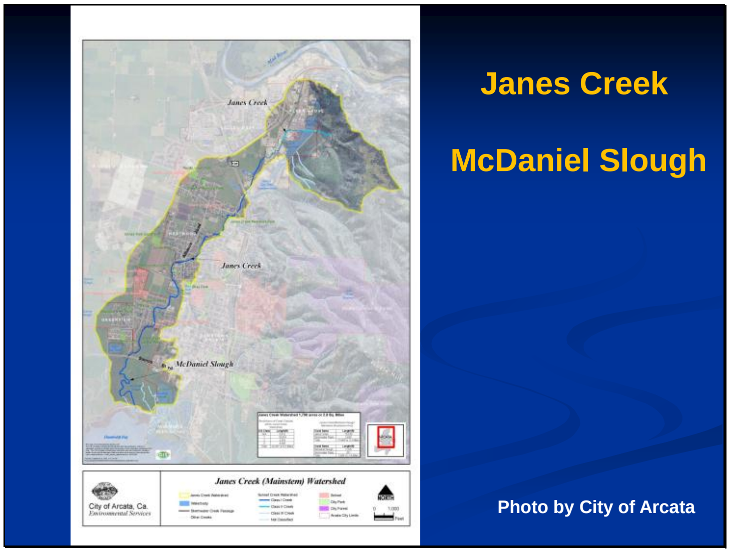

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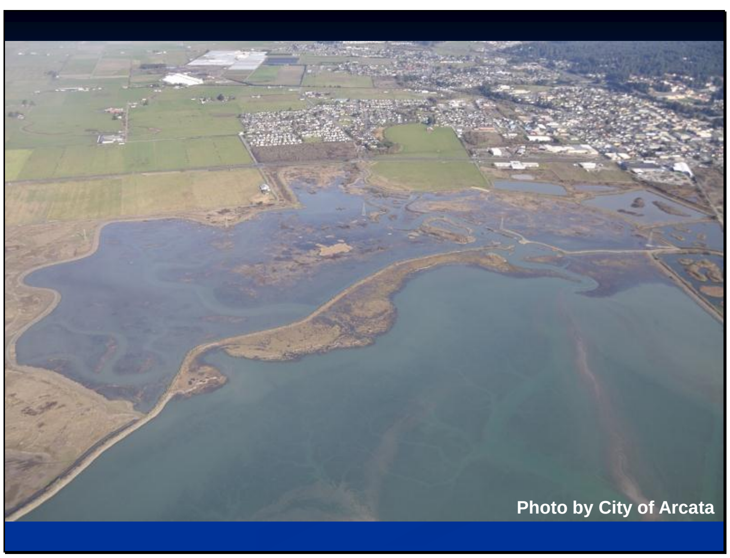

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Number of juvenile salmonids captured in Janes Creek and McDaniel Slough 2010 to 2011 and 2013 to 2014. Winter is January-March, Spring is April-June, Summer is July-September, and Fall is October-December.

Date	Coho Salmon	Cutthroat Trout	TWG
Fall 2010	0	12	1
Winter 2011	0	3	0
Spring 2011	0	2	4
Summer 2011	0	6	~200
Fall 2011	0	4	1
Winter 2013	0	14	0
Spring 2013	0	22	0
Summer 2013	0	33	0
Fall 2013 (breach 9/13)	0	3	0
Winter 2014	10	26	0
Spring 2014	4	24	0
Summer 2014	2	21	0
Fall 2014	0	8	0

Data from City of Arcata

Slide 44

Slide 45

Investigation of the relationship between physical habitat and salmonid abundance in two coastal Northern California streams.

Presenter*:* Sean Gallagher. California Department of Fish & Wildlife.

sean.gallagher@wildlife.ca.gov

Abstract:

To design and implement effective freshwater habitat restorations that improve conditions for coho salmon and other anadromous salmonids requires clear understanding of the relationships between fish abundance and stream habitat variables. In this study we investigated the relationships between summer Coho salmon and steelhead parr abundance and physical stream habitat variables in Caspar and Pudding Creeks in Mendocino County, California. The relationship between summer habitat and juvenile abundance were investigated using a stratified random experimental design. Our null hypothesis was that one or more of the habitat unit types and variables examined would be associated with salmonid abundance. We also examined habitat differences between the streams and tested our hypotheses regarding habitat variables and salmonid abundance, using two-way ANOVA, factor analysis, and negative binomial regression modeling. The abundance of juvenile Coho salmon and steelhead was positively associated with slow water, volume, and dry large wood abundance, and negatively associated with fast water habitat variables. Larger steelhead were also associated with cover habitat formed by wet and dry wood. We discuss our findings relative to the use of large wood in anadromous salmonid habitat recovery programs in California coastal watersheds.

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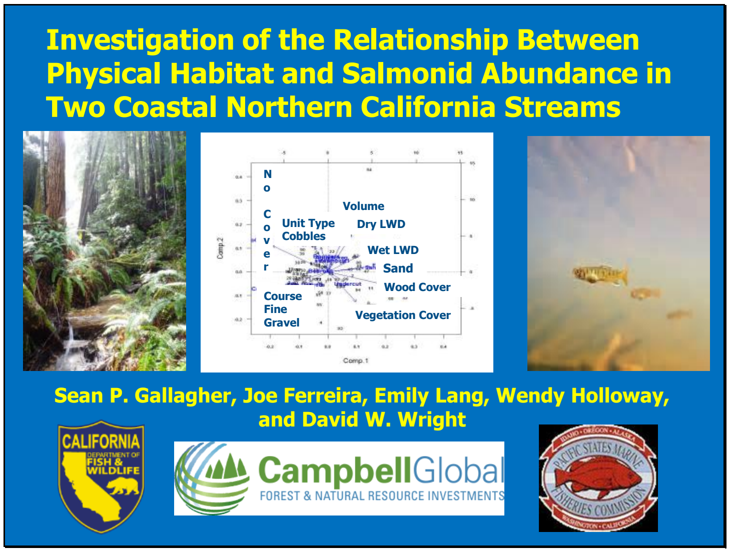

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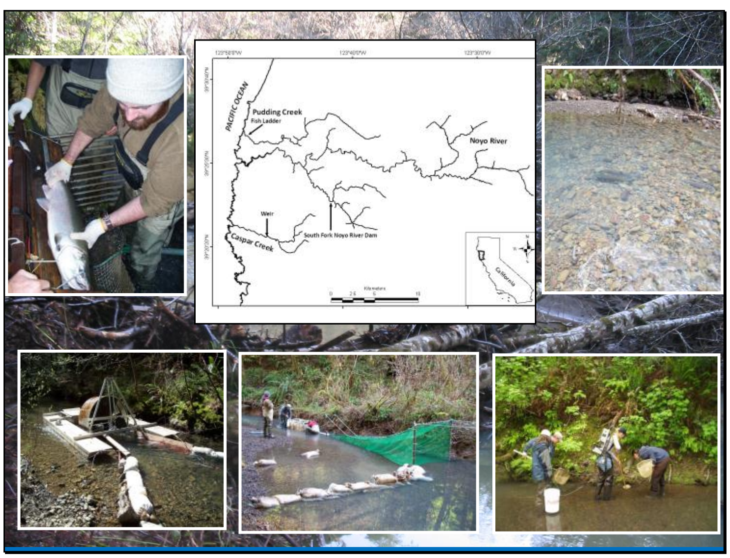

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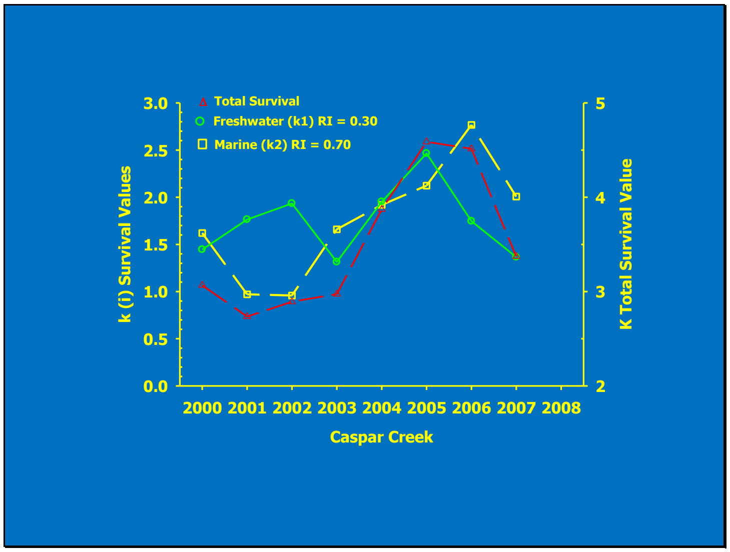

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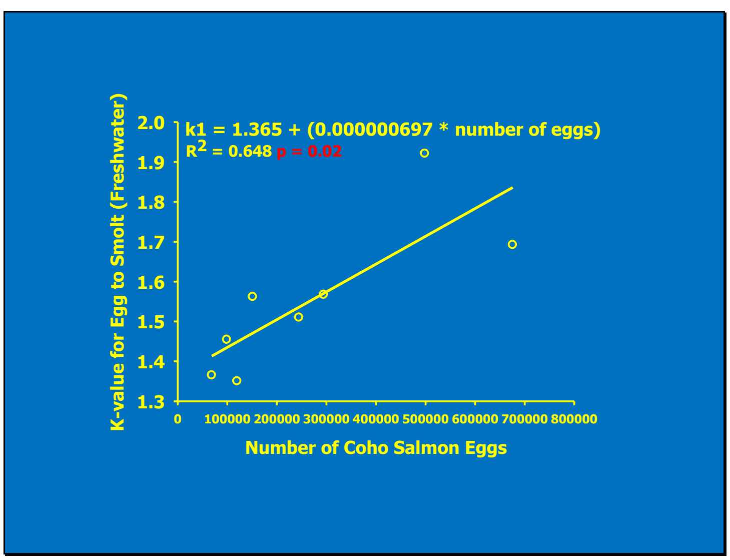

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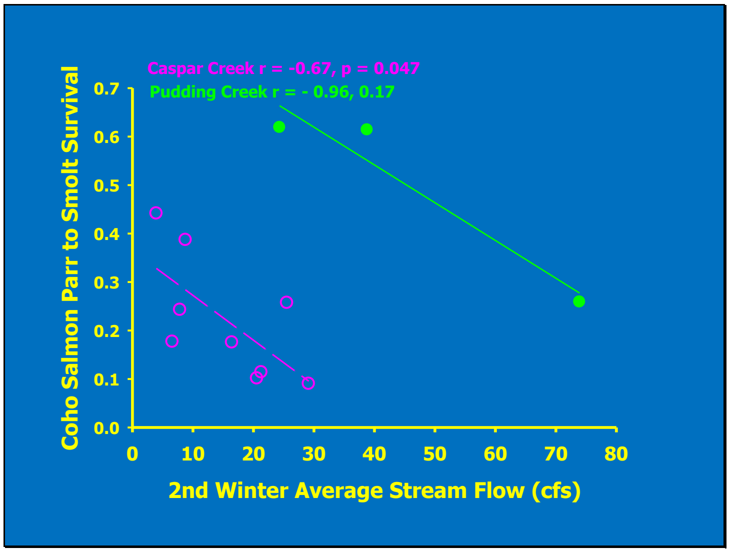

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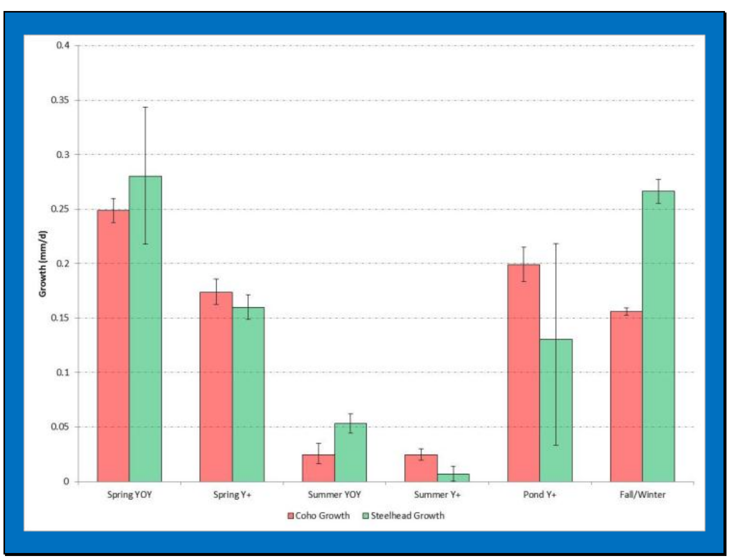
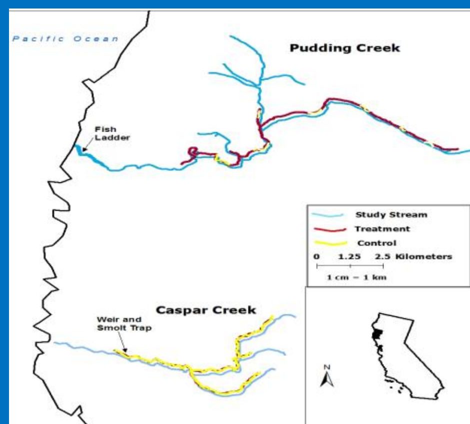


Slide 7

Will Addition of LWD Increase Habitat and Salmonid Abundance: A Before, After, Control, Impact Experiment



Slide 8

Analytical layout of population and habitat metrics for the BACI Experiment.

Parameter			Data collection period		
Physical Habitat			Pretreatment Years	Transition	Post Treatment
	Summer and winter	Habitat number, size, volume, heterogenaity, and geomentry	2013-2015	2015	2016-2019
		Channel Morphology/ geometry, substrare compostion, sinuosity	2013-2015	2015	2016-2019
		Wood density, volume, and rate of input	2013-2015	2015	2016-2019
		Seasonal stream flow, water temperature, and others (Bouwes et al. 2011)	2013-2015	2015	2016-2019
	Winter only	Percent slow water habitat, Percent off channel habitat, floodplan channel length	2012-2014	2015	2016-2019
Biological					
	Summer	Steelhead 0+ abundance	2006 -2010, 2012, 2013, 2014	2015	2016-2019
		Coho abundance	2006 -2010, 2012, 2013, 2014	2015	2016-2019
		Coho and Steelhead Growth*	2011-2014	2015	2016-2019
		coho and steelhead Survival	2011-2014	2015	2016-2019
	Winter	Coho and Steelhead Growth*	2011-2014	2015	2016-2019
		coho and steelhead Survival	2011-2014	2015	2016-2019
	Annual	Coho salmon and Steelhead smolt abundance	2006 -2010, 2012, 2013, 2014	2015	2016-2019
		Coho salmon and Steelhead adult abundance	2006 -2010, 2012, 2013, 2014	2015	2016-2019
		Over-summer survival	2006 -2010, 2012, 2013, 2014	2015	2016-2019
		Winter survival	2006 -2010, 2012, 2013, 2014	2015	2016-2019
		Habitat specific survival and growth	2011-2014	2015	2016-2019
		Proportion of two-year old coho residents	2006 -2010, 2012, 2013, 2014	2015	2016-2019

* This will also be related to speficic habitat unit types and site fidelity (Bell et al. 2003).

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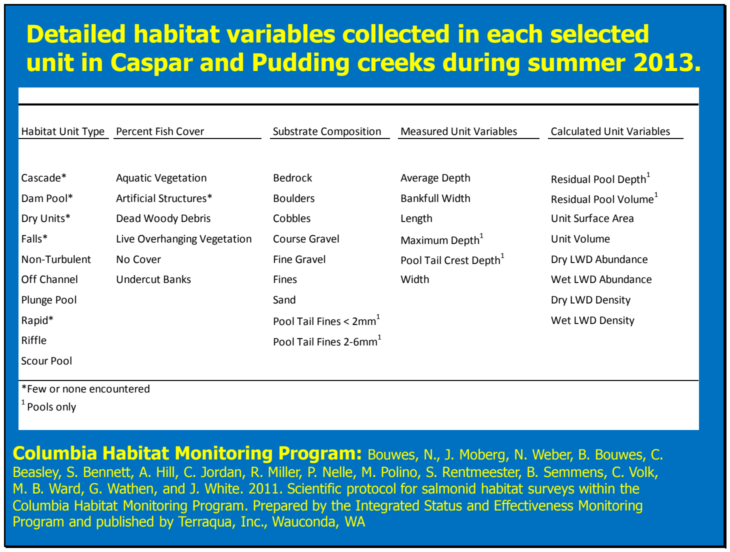

Detailed habitat variables collected in each selected unit in Caspar and Pudding creeks during summer 2013.

Habitat Unit Type	Percent Fish Cover	Substrate Composition	Measured Unit Variables	Calculated Unit Variables
Cascade*	Aquatic Vegetation	Bedrock	Average Depth	Residual Pool Depth[1]
Dam Pool*	Artificial Structures*	Boulders	Bankfull Width	Residual Pool Volume[1]
Dry Units*	Dead Woody Debris	Cobbles	Length	Unit Surface Area
Falls*	Live Overhanging Vegetation	Course Gravel	Maximum Depth[1]	Unit Volume
Non-Turbulent	No Cover	Fine Gravel	Pool Tail Crest Depth[1]	Dry LWD Abundance
Off Channel	Undercut Banks	Fines	Width	Wet LWD Abundance
Plunge Pool		Sand		Dry LWD Density
Rapid*		Pool Tail Fines < 2mm[1]		Wet LWD Density
Riffle		Pool Tail Fines 2-6mm[1]		
Scour Pool				

*Few or none encountered
[1] Pools only

Columbia Habitat Monitoring Program: Bouwes, N., J. Moberg, N. Weber, B. Bouwes, C. Beasley, S. Bennett, A. Hill, C. Jordan, R. Miller, P. Nelle, M. Polino, S. Rentmeester, B. Semmens, C. Volk, M. B. Ward, G. Wathen, and J. White. 2011. Scientific protocol for salmonid habitat surveys within the Columbia Habitat Monitoring Program. Prepared by the Integrated Status and Effectiveness Monitoring Program and published by Terraqua, Inc., Wauconda, WA

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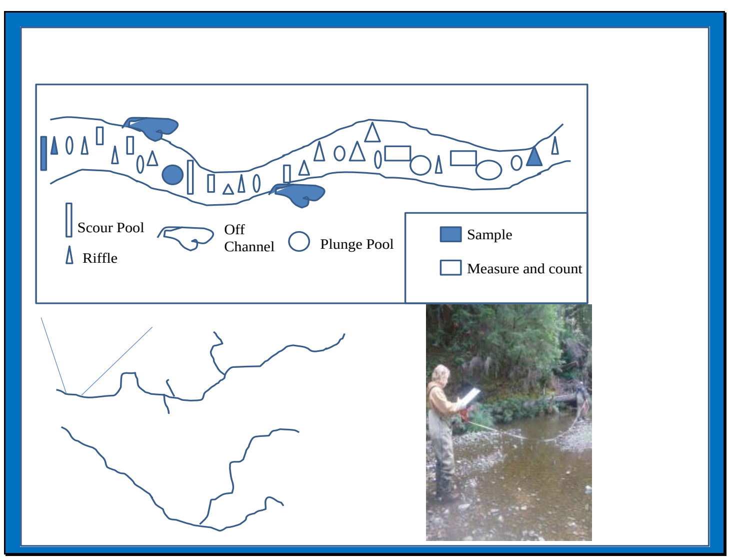

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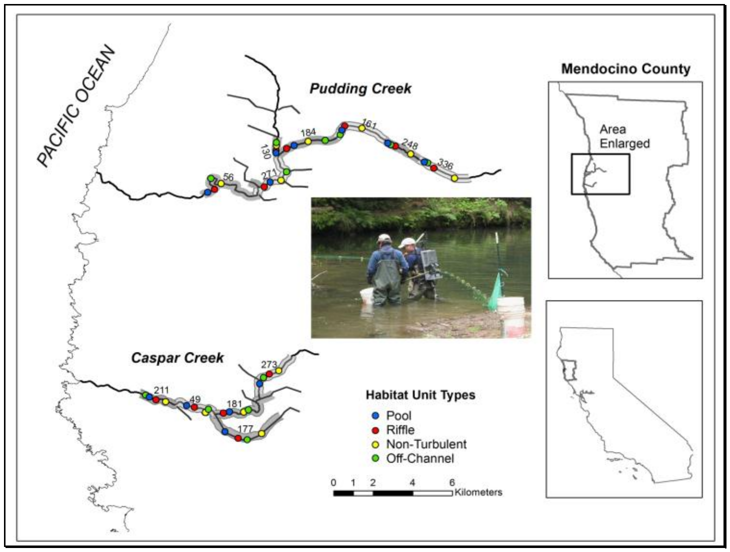


Slide 12

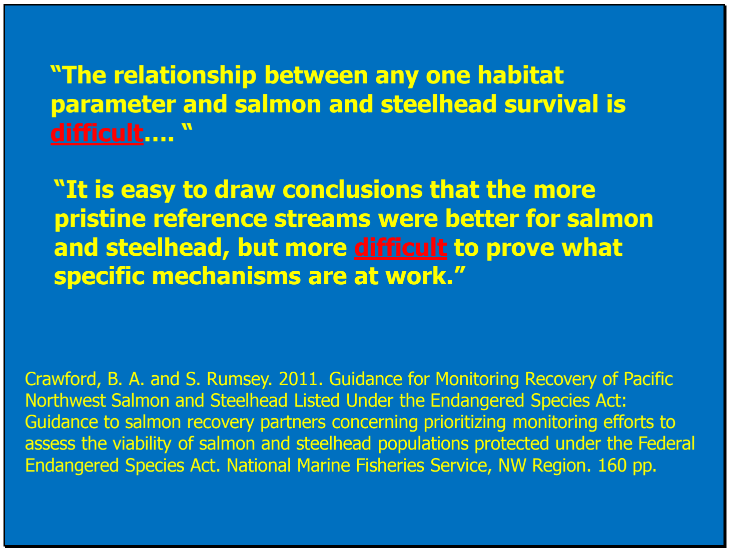
Salmonid Unit Abundance:

Coho Parr, Steelhead YoY, Y+, Y++

Habitat Unit Type	Percent Fish Cover	Substrate Composition	Measured Unit Variables	Calculated Unit Variables
Cascade*	Aquatic Vegetation	Bedrock	Average Depth	Residual Pool Depth[1]
Dam Pool*	Artificial Structures*	Boulders	Bankfull Width	Residual Pool Volume[1]
Dry Units*	Dead Woody Debris	Cobbles	Length	Unit Surface Area
Falls*	Live Overhanging Vegetation	Course Gravel	Maximum Depth[1]	Unit Volume
Non-Turbulent	No Cover	Fine Gravel	Pool Tail Crest Depth[1]	Dry LWD Abundance
Off Channel	Undercut Banks	Fines	Width	Wet LWD Abundance
Plunge Pool		Sand		Dry LWD Density
Rapid*		Pool Tail Fines < 2mm[1]		Wet LWD Density
Riffle		Pool Tail Fines 2-6mm[1]		
Scour Pool				

*Few or none encountered
[1] Pools only

Slide 13



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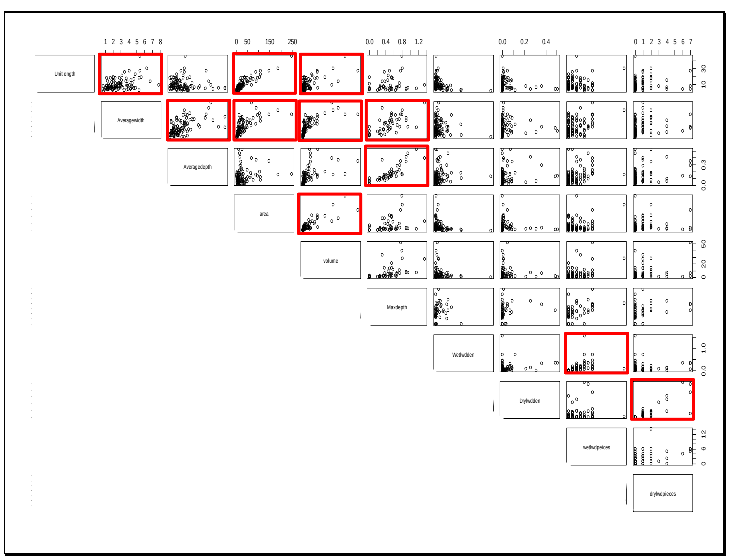

Slide 15

Reduced data set of variables used in factor analysis to evaluate relationships between salmonid abundance and physical stream habitat.

Unit Abundance*	Stream	Unit Type	Percent Bedrock	Boulders	Cobbles
Coarse Gravels	Fine Gravels	Sand	Fines	Woody Debris Cover	Live Overhead Cover
Undercut Banks	No Cover	Aquatic Vegetation Cover	Unit Volume	Dry LWD Abundance	Wet LWD Abunance

* Dependent variable: coho salmon, steelhead YoY, Steelhead Y+, or Steelhead Y++.

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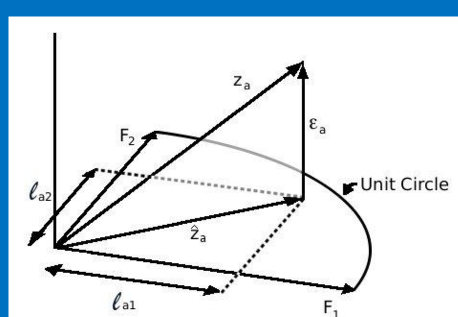

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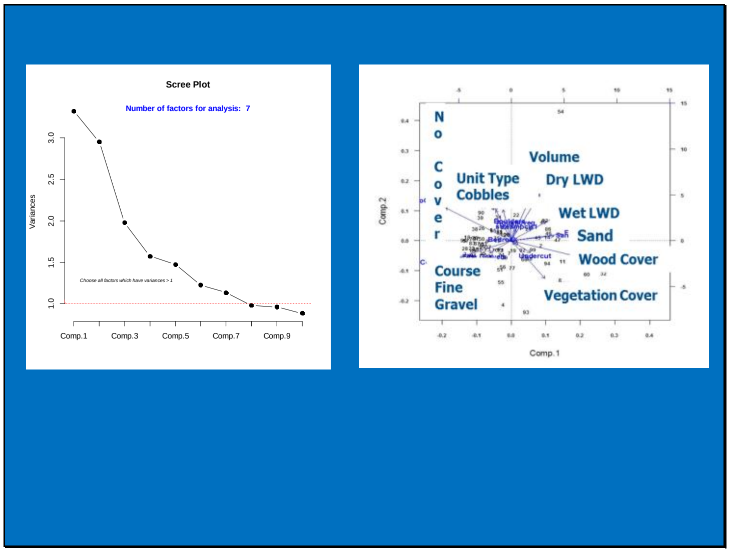

Slide 18

Factor Analysis:

Factor names, factor loadings (variables), and loading coefficients. Bold indicates significant coefficients.

Variable	Factor Names						
	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**	**Factor 7**
Bedrock							
Boulders				**0.59**			
Cobbles				**0.89**			
Coarse Gravels					-0.38	**-0.74**	
Fine Gravels						**-0.46**	
Sand					**0.96**		
Fines						**0.64**	
Large Wood Wet		**0.75**					
Large Wood Dry	0.31	**0.47**		0.34			
Overhead Vegetation Cover			**0.76**				
Overhead Wood Cover		**0.72**					
Aquatic Vegetation Cover							
Undercut Banks							**0.98**
No Cover		**-0.43**	**-0.86**				
Unit Type							
Unit Volume	**0.79**				0.32		
Stream				**0.33**			

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Negative Binomial Regression Modeling

Habitat factors associated with salmonid abundance

	Factor Names						
Salmonid Abundance	Volume and Dry Large Wood	Wood	Overhead Vegetation	Turbulent Water Stream And Dry Large Wood	Slow Water Volume	Fast Water	Undercut Banks
Coho Salmon	**Positive**	NS	NS	NS	**Positive**	**Negative**	NS
Steelhead YoY	**Positive**	NS	**Negative**	**Negative**	NS	**Negative**	NS
Steelhead Y+	**Positive**	**Positive**	**Negative**	**Negative**	**Positive**	**Negative**	**Positive**
Steelhead Y++	**Positive**	**Positive**	NS	NS	NS	NS	NS

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Coho Salmon Abundance and Habitat Variables

	Factor Names						
Variable	Volume and Dry Large Wood	Wood	Overhead Vegetation	Turbulent Water Stream And Dry Large Wood	Slow Water Volume	Fast Water	Undercut Banks
Bedrock							
Boulders				**0.59**			
Cobbles				**0.89**			
Coarse Gravels					-0.38	**-0.74**	
Fine Gravels						**-0.46**	
Sand					**0.96**		
Fines						**0.64**	
Large Wood Wet		**0.75**					
Large Wood Dry	0.31	**0.47**		0.34			
Overhead Vegetation Cover			**0.76**				
Overhead Wood Cover		**0.72**					
Aquatic Vegetation Cover							
Undercut Banks							**0.98**
No Cover		**-0.43**	**-0.86**				
Unit Type							
Unit Volume	**0.79**				0.32		
Stream				**0.33**			

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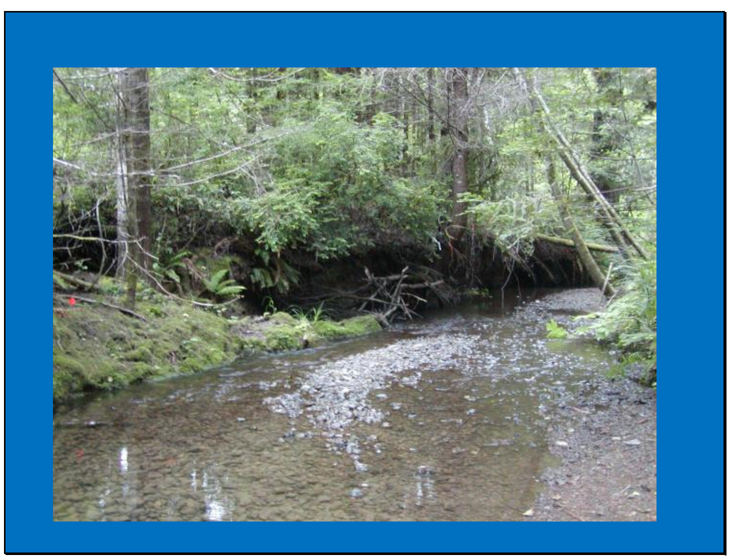

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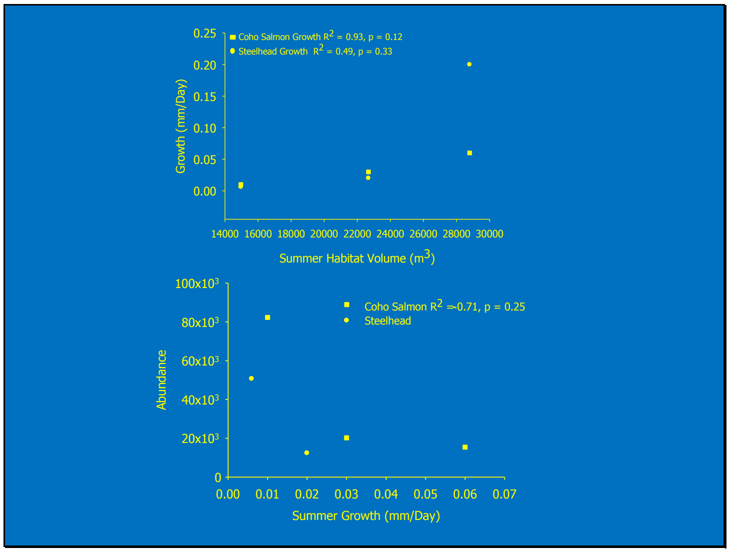

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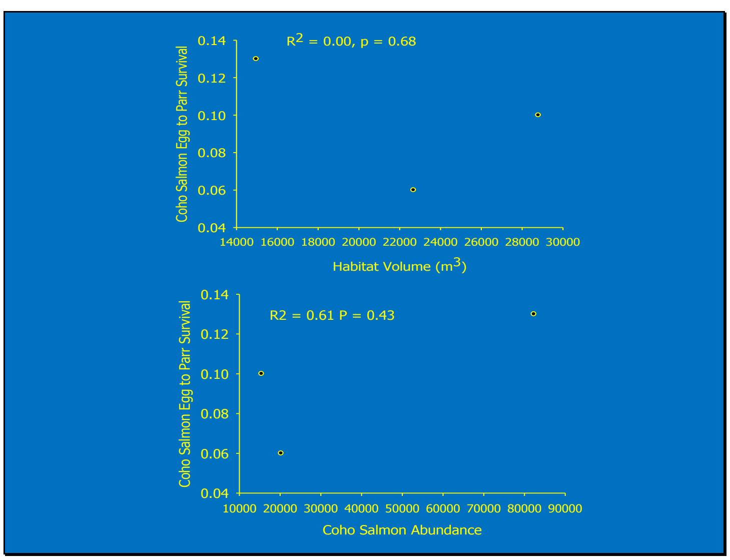

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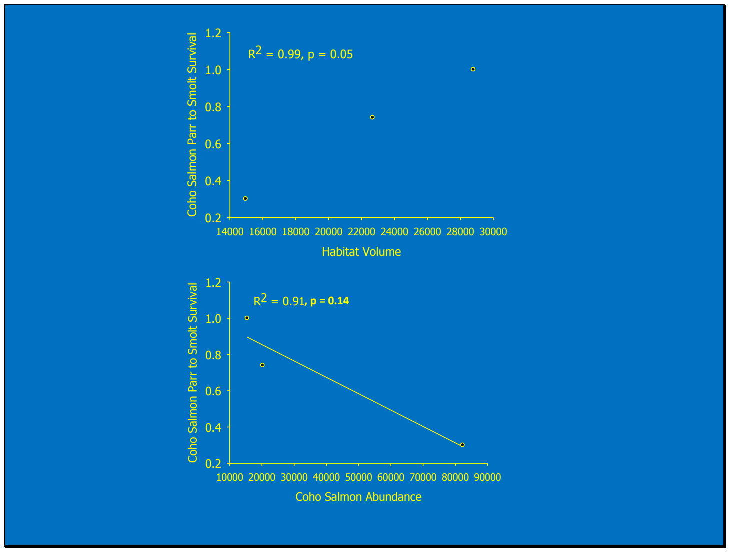

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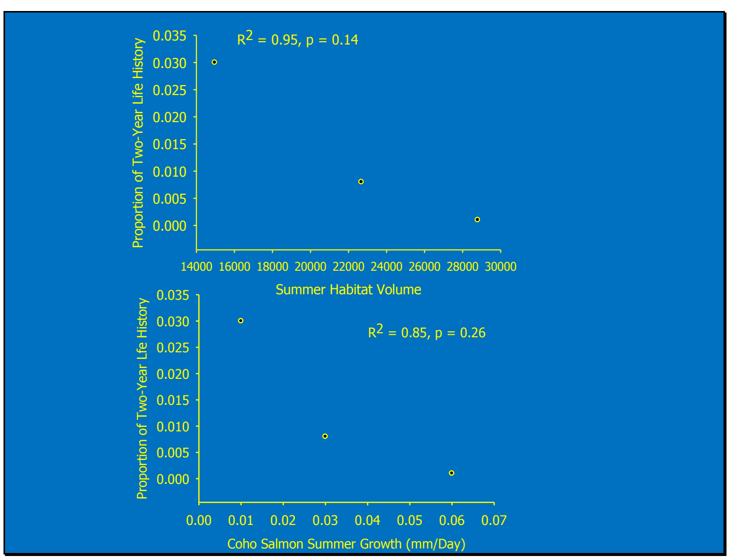

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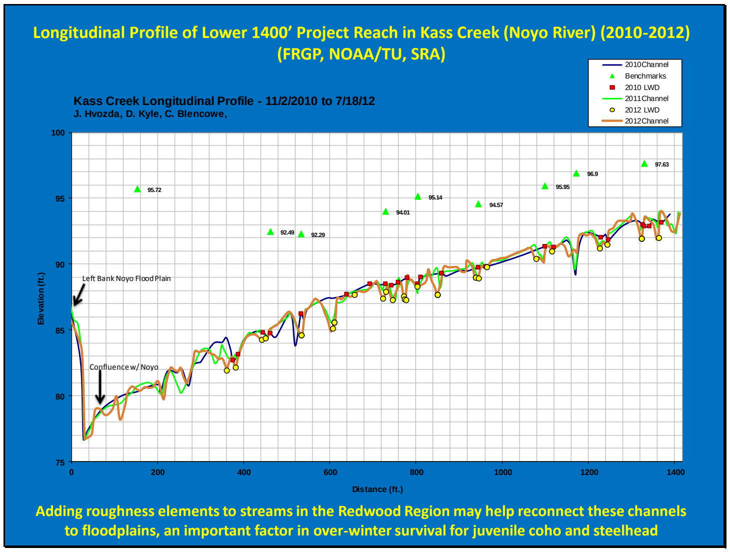

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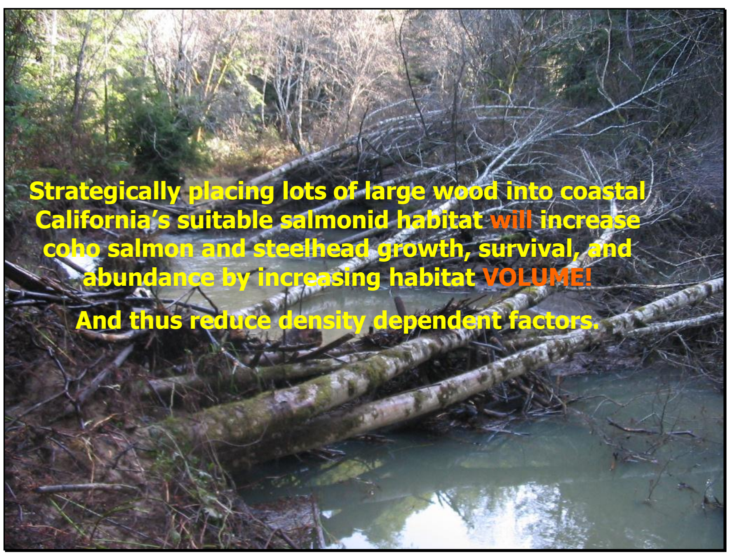

The Effectiveness of Artificial Upstream Migration Flows for Coho Salmon.

Presenter*:* Eric Ettlinger. Marin Municipal Water District. eettlinger@marinwater.org

Abstract:

The Marin Municipal Water District releases extra water into Lagunitas Creek to provide fall and winter "upstream migration flows" when rain does not provide adequate runoff to facilitate adult salmon migration. Assessing the effectiveness of these cold water releases is particularly important during critically dry years when water supplies are stretched. We analyzed 18 years of stream flow and spawner data, including time-lapse video monitoring, to assess the effectiveness of these water releases. With very few exceptions these releases failed to trigger upstream migration or increase spawning. Even very small runoff events elicited stronger migration responses, indicating that water depth is not the most important factor for encouraging salmon to migrate in Lagunitas Creek. Opportunities to improve stream flow management and obstacles to change will be discussed.

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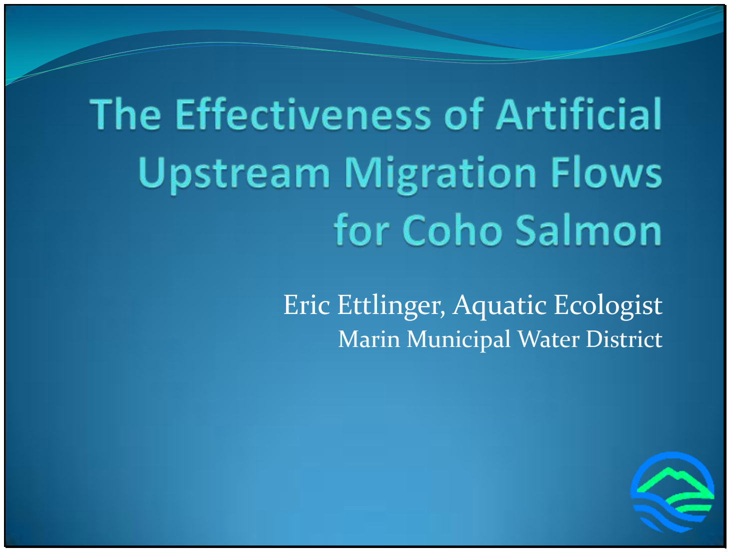

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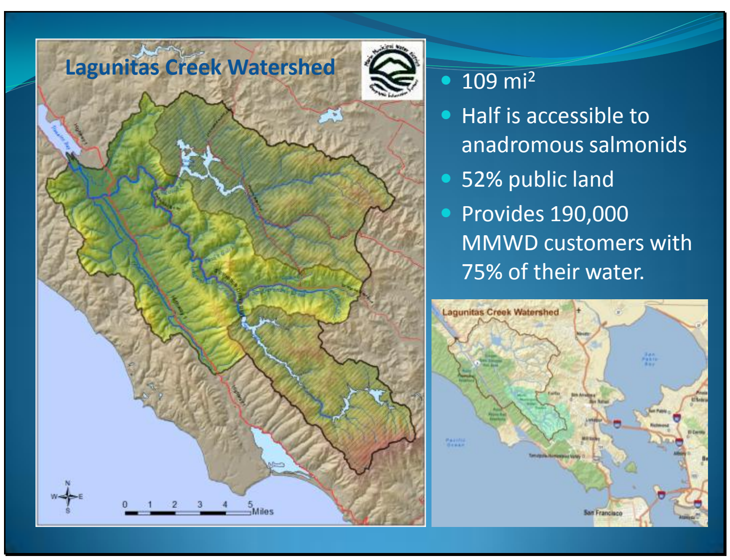

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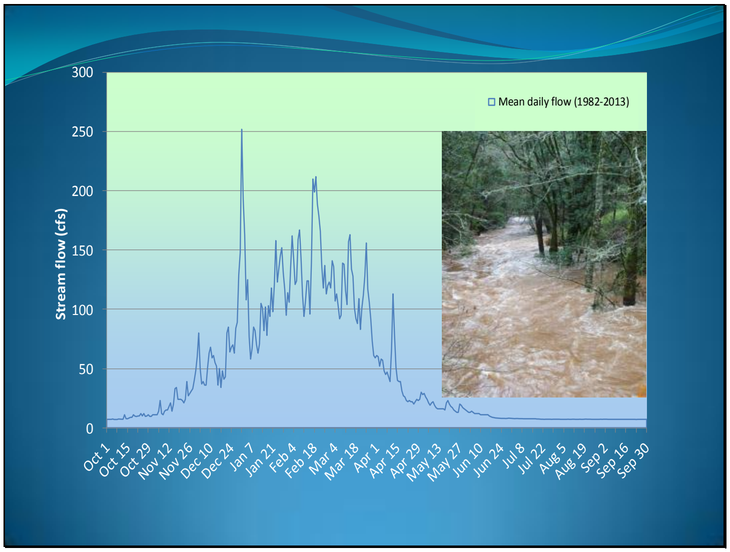

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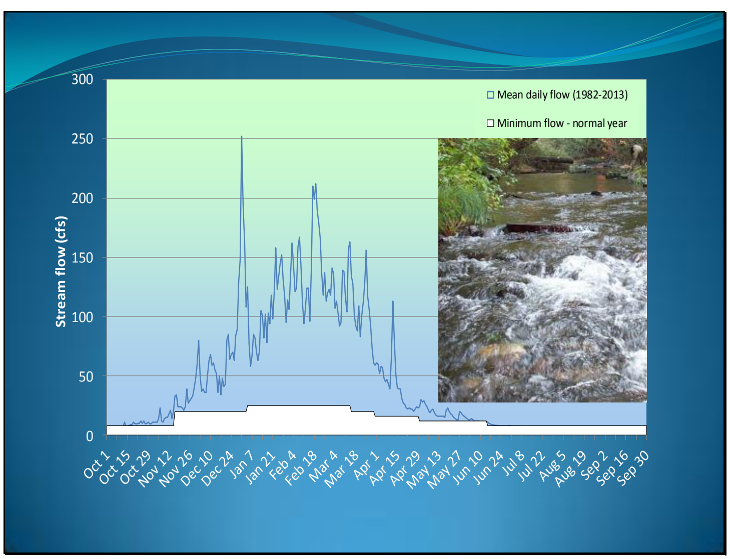

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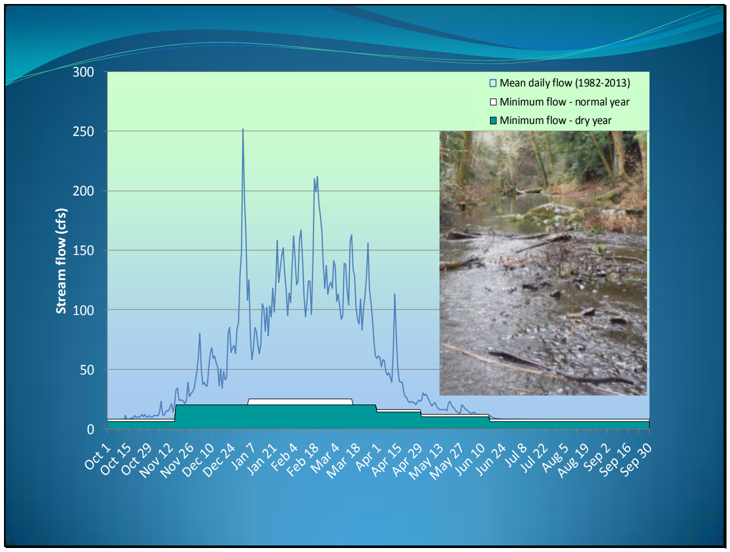

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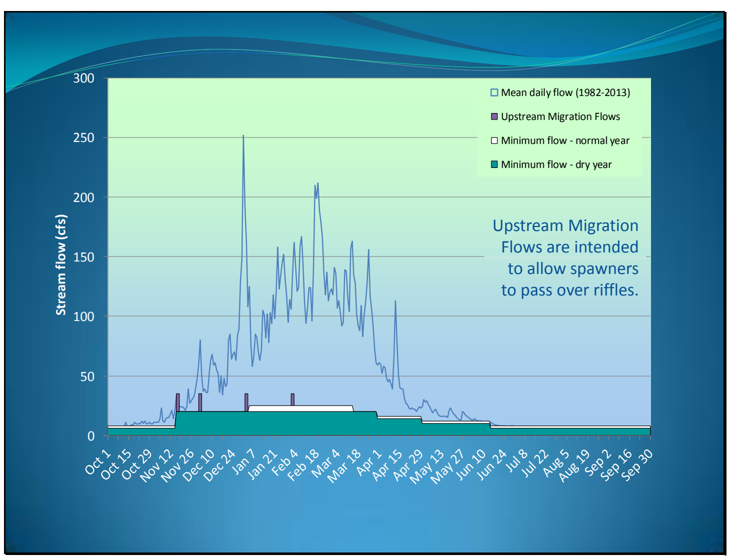

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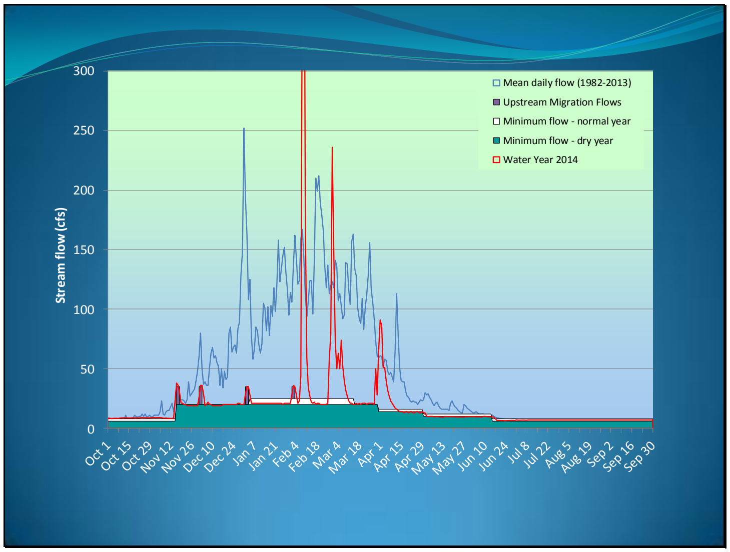

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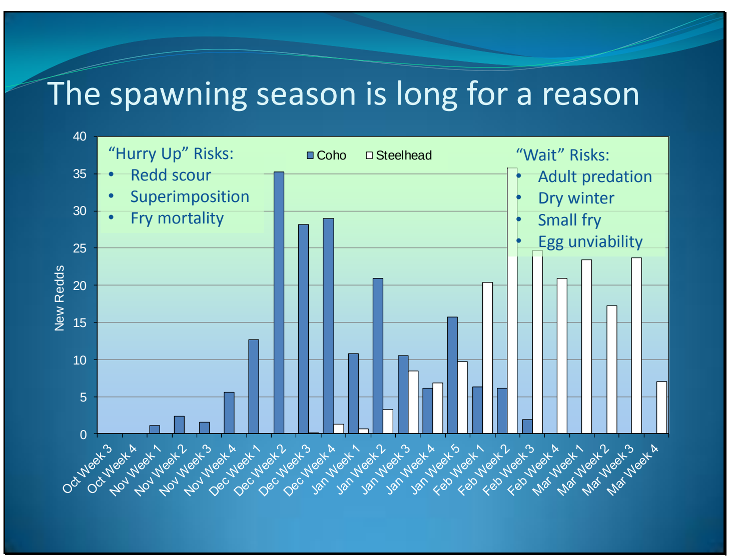

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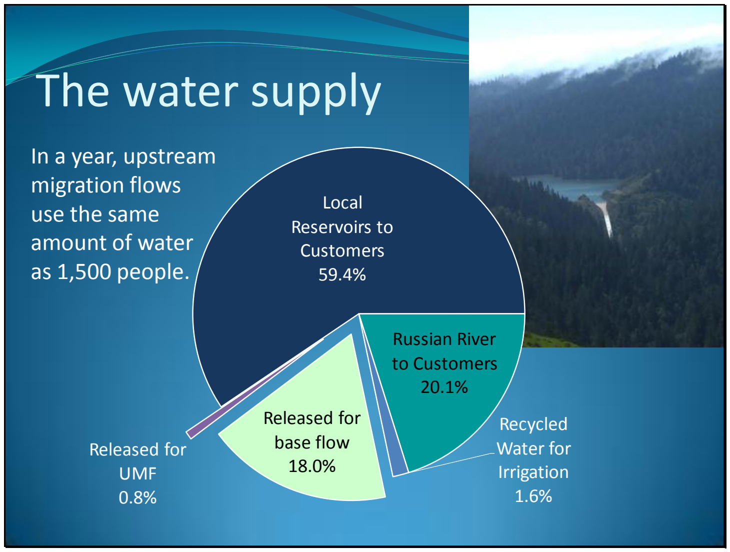

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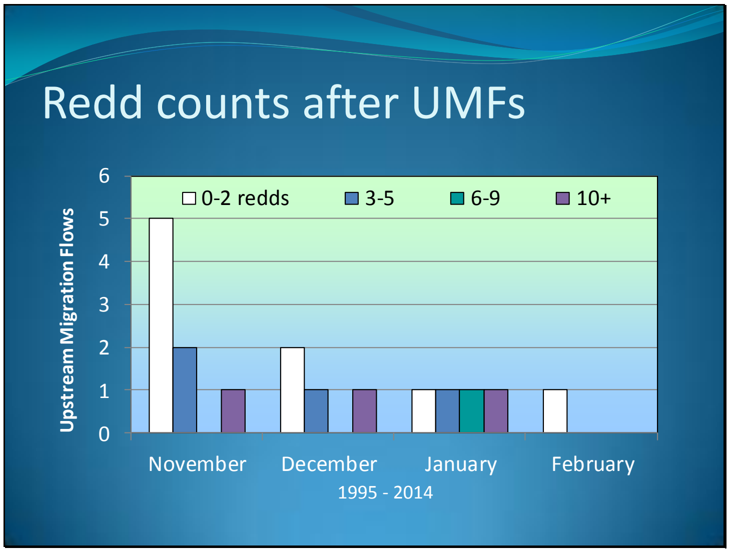

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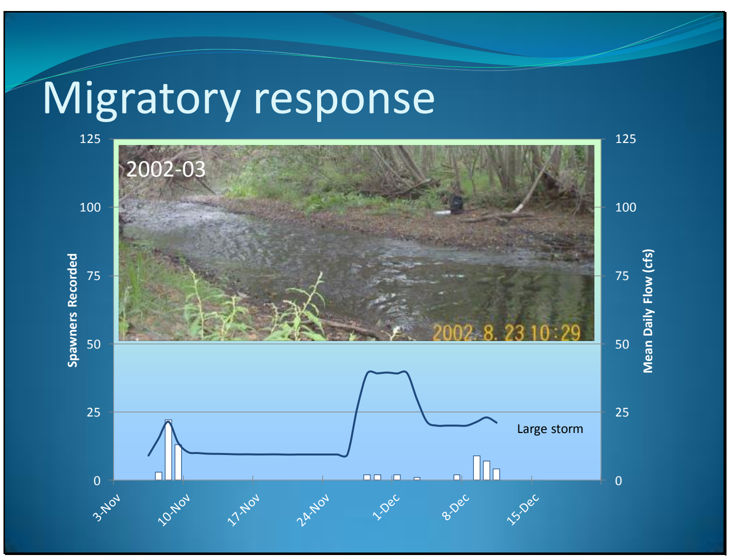

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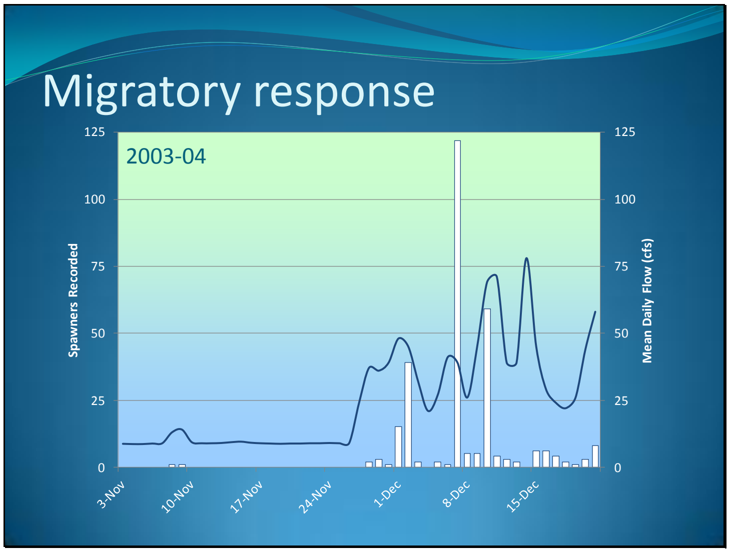

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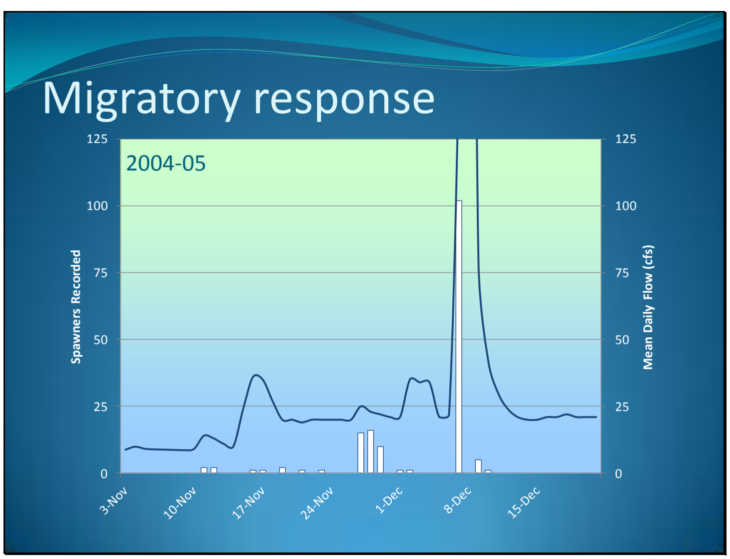

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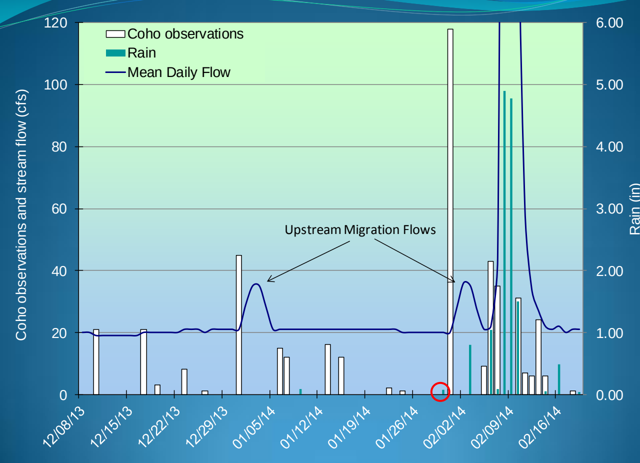
Coho reviews of MMWD water

- "Okay, but there's not enough of it."
- "It just doesn't smell right."
- "I like my water a little cloudier."

Slide 16



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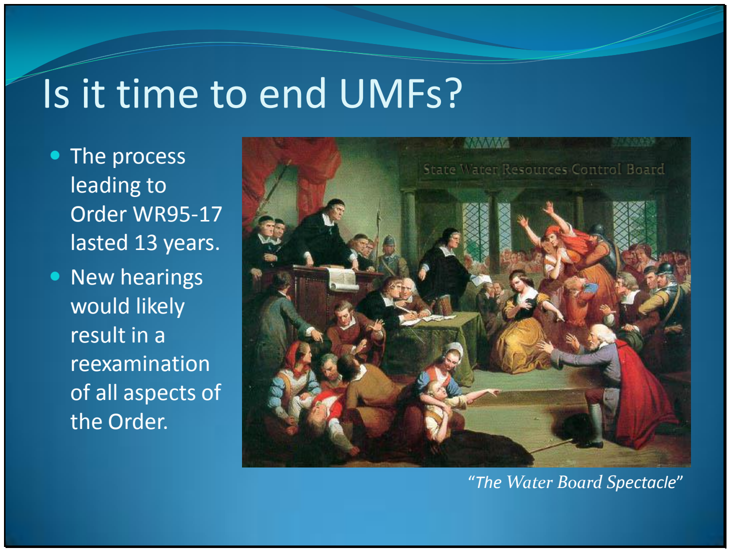

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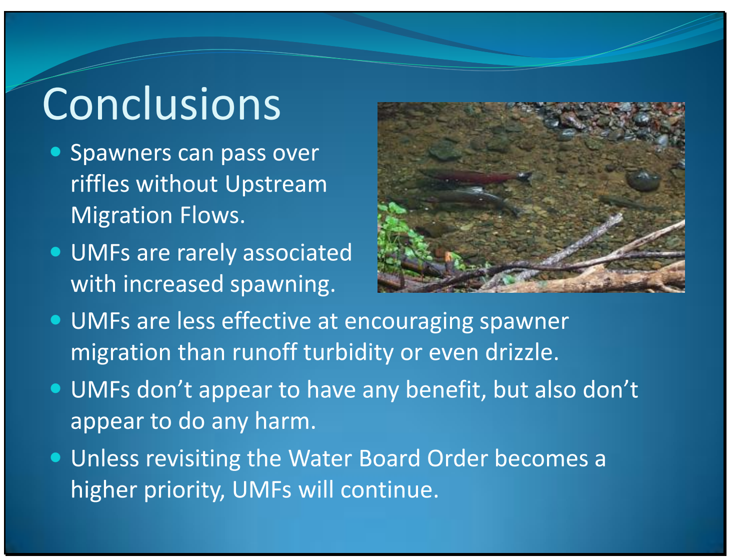

Coho Salmon in a Spring Creek: Life history tactics of coho salmon in the Shasta River and a method for quantifying survival to evaluate and prioritize restoration efforts.

Presenter: Chris Adams, California Department of Fish & Wildlife. Chris.adams@wildlife.ca.gov

Abstract:

The Shasta River was historically among the top producers of coho salmon in the Klamath system. Its unique spring-dominated hydrology promotes rapid growth rates and provides consistent inter and intra-annual flow. However, surface water diversions degrade the river and its salmonid habitat. A network of approximately twenty PIT tag detection stations have been in operation at key locations throughout the watershed for several years, providing detailed information on habitat use by tagged juvenile coho salmon. During periods of juvenile coho redistribution in early summer, we have documented extensive upstream movements to headwater springs, as well as extensive downstream movements to thermal refugia areas in the mid-Klamath. Some age-0 coho salmon grow to over 100 mm by June when they appear to undergo smoltification and leave the Shasta River. A multi-state mark-recapture modeling framework has been established to estimate seasonal survival and movement parameters in different areas. These analyses have indicated that survival is lowest in summer and as high as 100% in winter. This data has been used to prioritize and evaluate restoration efforts including conservation of cold springs, tailwater reduction, riparian fencing, and coordination among diverters to reduce impacts on coho salmon habitat.

Juvenile coho salmon (Oncorhynchus kisutch) exhibit compensatory mechanisms in a large volcanic spring-fed river.

Presenter: Robert Lusardi, UC Davis Center for Watershed Sciences. ralusardi@ucdavis.edu

Abstract: Southern Oregon/Northern California Coast (SONCC) coho salmon are currently listed as threatened under both the federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA). Populations are depressed throughout the SONCC ESU and in many watersheds all three brood-year lineages may have too few individuals to be self-sustaining. Consequently, there is an urgent need to identify and understand the habitats and ecological processes that can assist recovery planning and enhance viability. Recent thermal restoration on the Shasta River, a spring-fed tributary to the Lower Klamath River, has extended downstream rearing habitat for juvenile coho salmon. The longitudinal influence of cold water spring sources, rich in naturally-occurring nutrients, and their effects on the growth and prey availability of coho salmon were studied. Specifically, we quantified the growth and production of juvenile coho in five stream segments that differed in their spatial proximity to cold water spring sources on the Shasta River. We found strong differences in mean weekly maximum temperatures (MWMT), invertebrate prey availability, and the growth and condition factor of juvenile coho salmon. Coho salmon reared in close proximity to springs experienced MWMTs ranging from 14.8°C to 16°C, exhibited an apparent growth rate of 0.13 mm/day, and a 26% increase in mass over the nine week study period. Conversely, individuals reared six kilometers downstream from cold water spring sources experienced MWMTs ranging from 17.6°C to 21°C, exhibited a growth rate of 0.27 mm/day, and a 161% increase in mass during the same period. Downstream individuals subjected to warmer water temperatures exhibited an 18% increase in fork length and two-fold increase in mass when compared with upstream individuals in closer proximity to spring sources. Our results indicate that juvenile coho salmon may have the ability to metabolically compensate for elevated water temperatures when food resources are near saturation. Moreover, our results suggest that volcanic spring-fed rivers may be areas of extraordinary intrinsic potential for the recovery of federally threatened coho salmon and should continue to be the focus of thermal restoration efforts.

Population spatial structure is an essential metric for defining and prioritizing coho salmon restoration projects.

Presenter: Justin Garwood, California Department of Fish & Wildlife. Justin.Garwood@wildlife.ca.gov

Abstract: The spatial arrangement of resources across a landscape can have profound effects on species distribution. Resources are not randomly distributed, but reflect geological and geomorphic processes dictating physical and biological characteristics of fish habitat. For coho salmon, juvenile life stages are the most widely distributed across the riverscape, with patchy habitats being spatially and temporally dynamic. The spatial structure of a population refers both to the spatial distribution of individuals in the population and to the processes that generate that distribution. Winter and summer seasons represent distinctive time periods during which there is a high likelihood of contrasting stream habitat availability for juvenile coho salmon. Understanding seasonal habitat patch size, utilization, connectivity and colonization, and also the extinction processes affecting a population, will help managers define source patches, while also identifying isolated patches that are much more vulnerable to extinction. This information is critical to defining restoration goals that are based on current population distributions. Restoration of areas currently being used by coho salmon, or areas in close proximity to population centers, will likely have a rapid positive effect on productivity. I developed an affordable snorkel survey protocol to sample juvenile coho salmon throughout a population space during the summer, using a randomly selected set of reaches with pools defined as the primary sampling unit. I applied multi-scaled occupancy models (i.e. Nichols et al. 2008) to estimate the probability of coho salmon occupancy simultaneously at two spatial scales, while accounting for detection probabilities. The larger scale corresponds to the probability of occupancy at the sample reach (ψ), whereas the smaller scale corresponds to the probability of occupancy at the sample pool (θ), given the species was present in the sample reach. Detection probability (p) is modeled at the smaller pool scale based on individual snorkel passes in each sampling unit. The advantage to modeling occupancy at two spatial scales in both landscape and local spatial distributions of a given species can be calculated while accounting for individual survey detection probabilities in a single framework. By tracking occupancy at both scales, the overall proportion of area occupied (PAO) can be determined for the population. Results from each year can be directly compared to assess the relative change in annual spatial structure. I will report on the first three years of spatial structure monitoring across four coho salmon populations in northern California and provide examples of prioritized restoration opportunities. I will also report on the recent development and application of annual PAO metrics in coastal plain and estuarine habitats employed during the winter.

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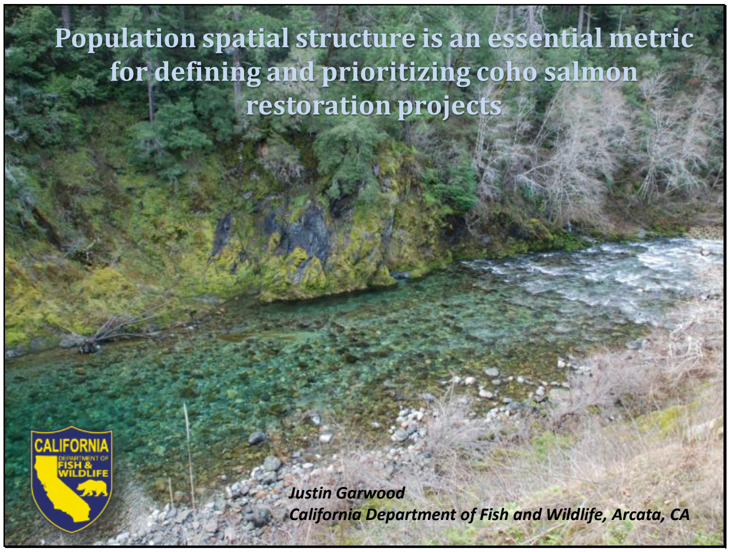

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California Coastal Salmonid Monitoring Program

Viable Salmonid Conceptual Framework:

- Abundance
- Productivity
- Spatial Structure
- Diversity

Trend monitoring for these VSP parameters is the measure by which extinction risk and recovery status of listed salmonids are determined

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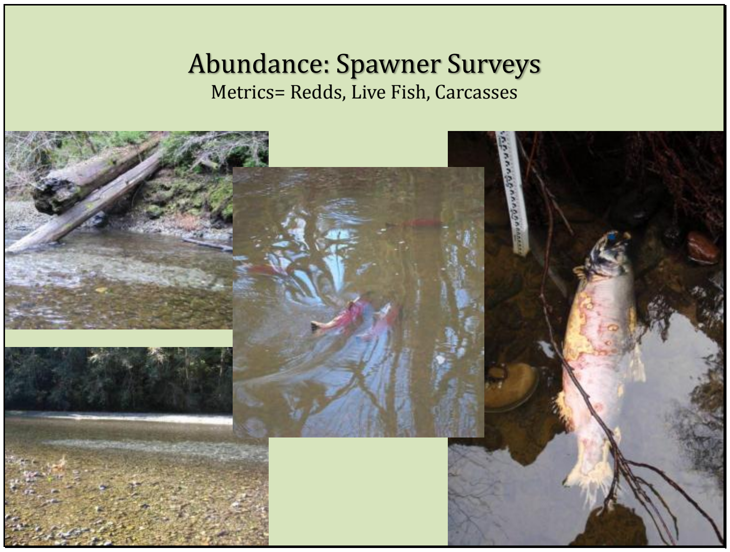

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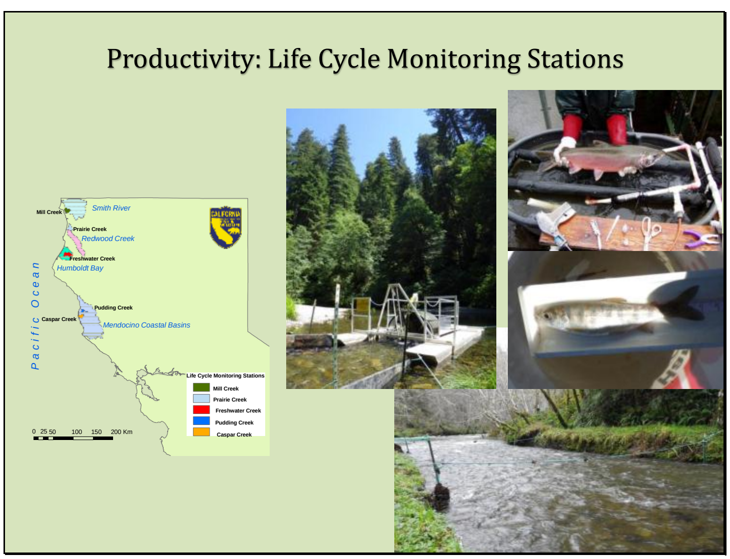

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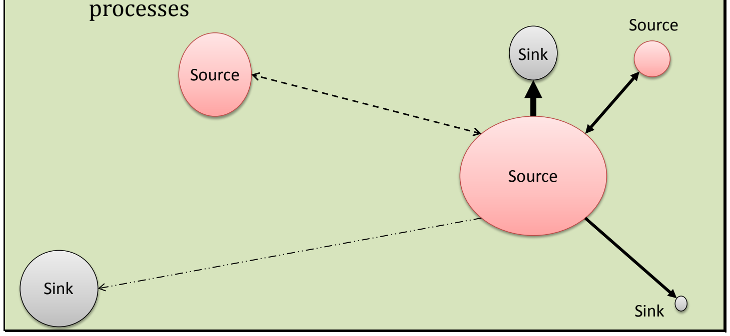
Why Spatial Structure?

- Resources are not randomly distributed
- Salmonids have complex life history needs
- Population and life history diversity reduce variability in abundance and ecosystem function

Slide 6

Inference from Spatial Structure

- Patch use
- Patch size
- Patch connectivity
- Patch colonization and extinction processes



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What do we know about 'historic' Spatial Structure?

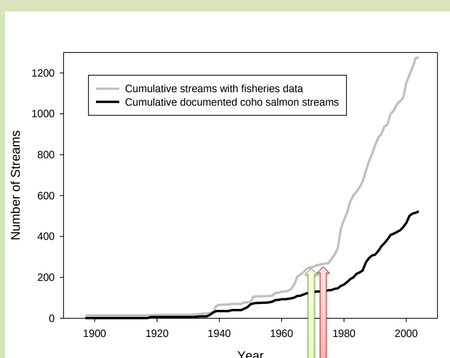
SONCC Basin	Net Total Coho Streams
Del Norte Coastal	17
Smith River	36
Klamath River	184
Humboldt Coastal	21
Redwood Creek	30
Mad River	22
Humboldt Bay Tributaries	40
Eel River	148
Mattole River	44
Total:	**542**

Garwood, J. 2012a. Historic and Recent Occurrence of Coho Salmon (*Oncorhynchus kisutch*) in California Streams within the Southern Oregon/ Northern California Evolutionarily Significant Unit. California Department of Fish and Game, Fisheries Branch Report 12-3; 77p.

Garwood, J. 2012b. Supporting evidence in defining historic and recent occurrence of Coho Salmon (*Oncorhynchus kisutch*) in California streams within the Southern Oregon/ Northern California Evolutionary Significant Unit. California Department of Fish and Game, Arcata, CA: 317 p.

Slide 8

Lack of historic data…



California Forest Practice Rules

NEPA, CESA, and CEQA laws in place

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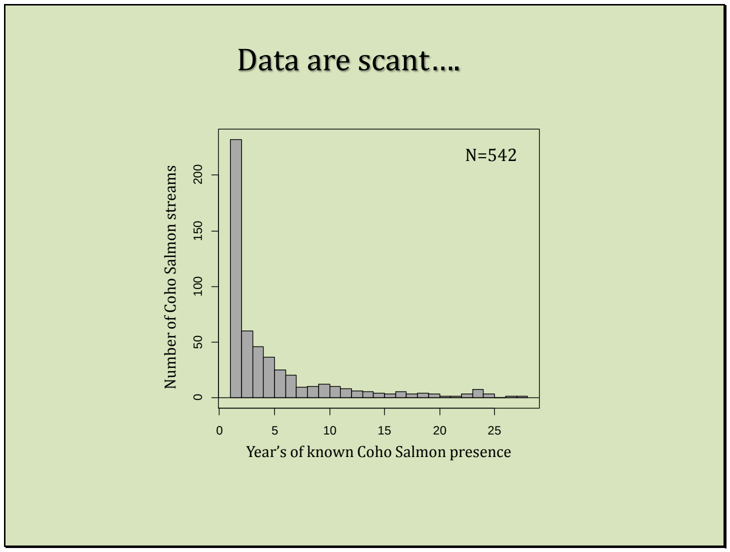

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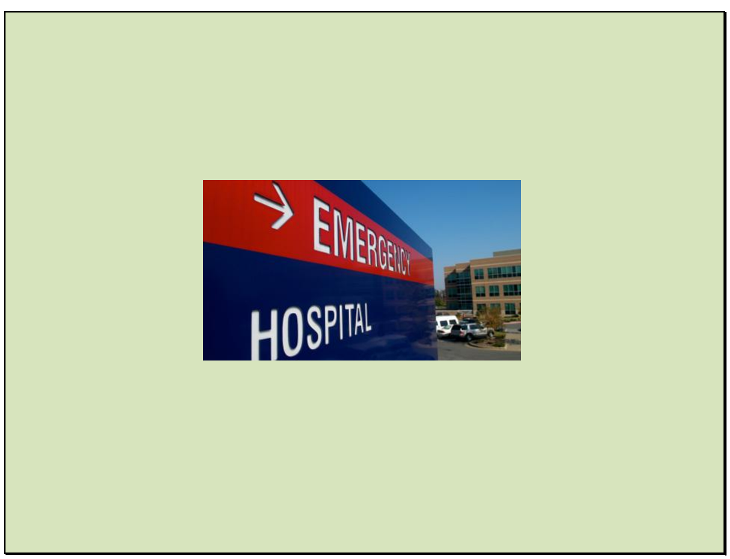

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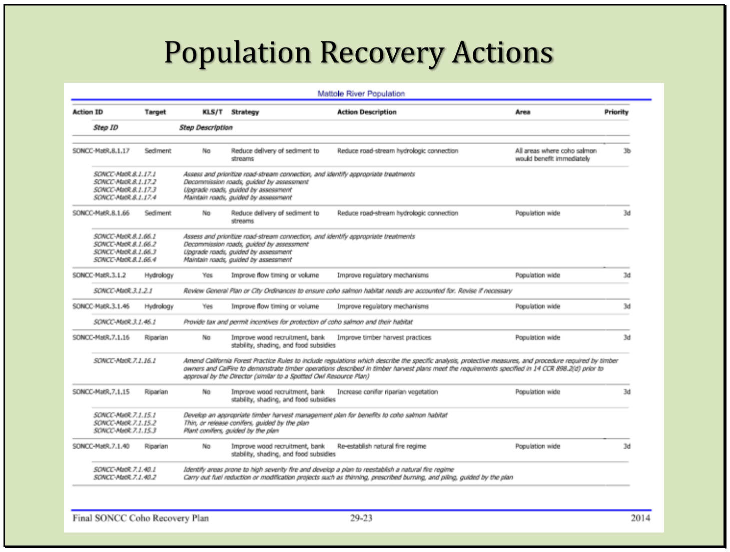

Population Recovery Actions

Mattole River Population

Action ID	Target	KLS/T	Strategy	Action Description	Area	Priority
Step ID	*Step Description*					
SONCC-MatR.8.1.17	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	All areas where coho salmon would benefit immediately	3b
SONCC-MatR.8.1.17.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-MatR.8.1.17.2	*Decommission roads, guided by assessment*					
SONCC-MatR.8.1.17.3	*Upgrade roads, guided by assessment*					
SONCC-MatR.8.1.17.4	*Maintain roads, guided by assessment*					
SONCC-MatR.8.1.66	Sediment	No	Reduce delivery of sediment to streams	Reduce road-stream hydrologic connection	Population wide	3d
SONCC-MatR.8.1.66.1	*Assess and prioritize road-stream connection, and identify appropriate treatments*					
SONCC-MatR.8.1.66.2	*Decommission roads, guided by assessment*					
SONCC-MatR.8.1.66.3	*Upgrade roads, guided by assessment*					
SONCC-MatR.8.1.66.4	*Maintain roads, guided by assessment*					
SONCC-MatR.3.1.2	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	3d
SONCC-MatR.3.1.2.1	*Review General Plan or City Ordinances to ensure coho salmon habitat needs are accounted for. Revise if necessary*					
SONCC-MatR.3.1.46	Hydrology	Yes	Improve flow timing or volume	Improve regulatory mechanisms	Population wide	3d
SONCC-MatR.3.1.46.1	*Provide tax and permit incentives for protection of coho salmon and their habitat*					
SONCC-MatR.7.1.16	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Improve timber harvest practices	Population wide	3d
SONCC-MatR.7.1.16.1	*Amend California Forest Practice Rules to include regulations which describe the specific analysis, protective measures, and procedure required by timber owners and CalFire to demonstrate timber operations described in timber harvest plans meet the requirements specified in 14 CCR 898.2(d) prior to approval by the Director (similar to a Spotted Owl Resource Plan)*					
SONCC-MatR.7.1.15	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Increase conifer riparian vegetation	Population wide	3d
SONCC-MatR.7.1.15.1	*Develop an appropriate timber harvest management plan for benefits to coho salmon habitat*					
SONCC-MatR.7.1.15.2	*Thin, or release conifers, guided by the plan*					
SONCC-MatR.7.1.15.3	*Plant conifers, guided by the plan*					
SONCC-MatR.7.1.40	Riparian	No	Improve wood recruitment, bank stability, shading, and food subsidies	Re-establish natural fire regime	Population wide	3d
SONCC-MatR.7.1.40.1	*Identify areas prone to high severity fire and develop a plan to reestablish a natural fire regime*					
SONCC-MatR.7.1.40.2	*Carry out fuel reduction or modification projects such as thinning, prescribed burning, and piling, guided by the plan*					

Final SONCC Coho Recovery Plan 29-23 2014

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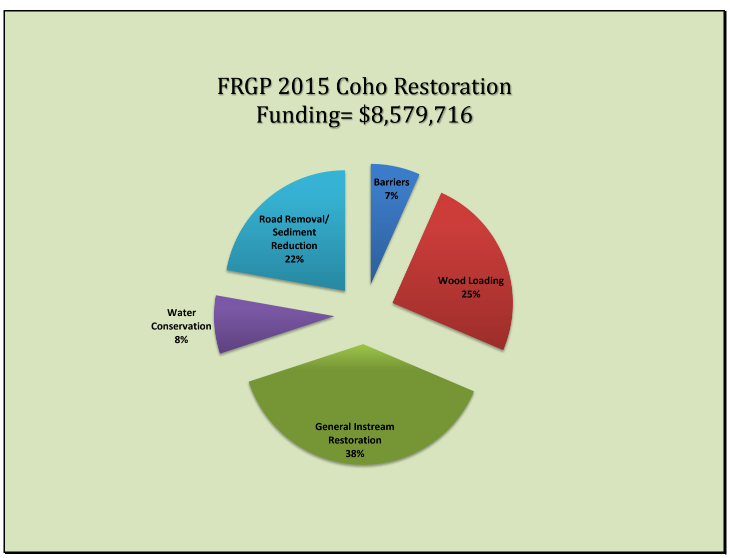

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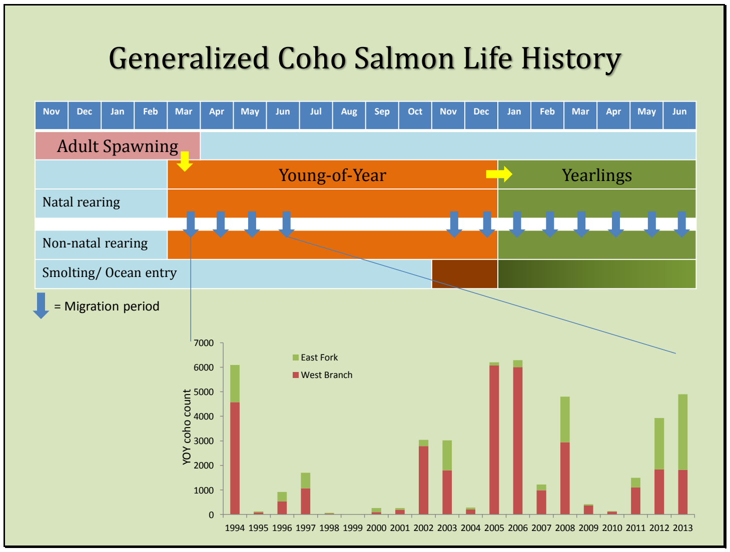

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Why use Juveniles?

- Most widely distributed stage
- Reliable detection
- Accessibility of habitat
- Cost
- Much of the restoration effort focused on juvenile stage

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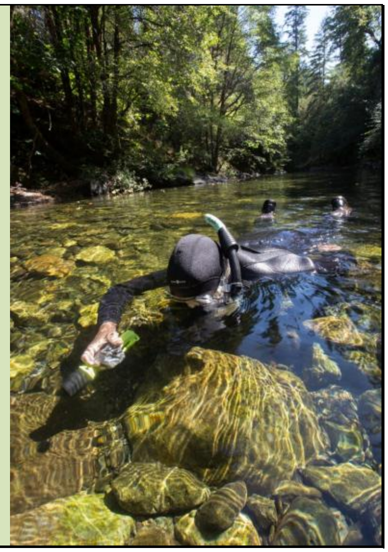
Summer Spatial Structure



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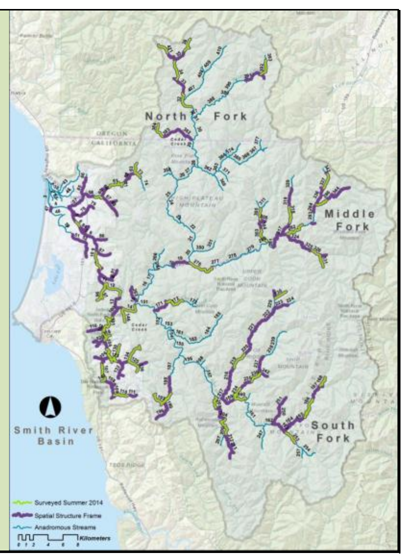
Sampling Approach

- Season Specific
- Unbiased spatial extents
- GRTS (Reaches)
- High sampling fraction
- Sample Unit: Pools



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Sample Units Defined

Pool Parameter	Small Stream (<3 meters wide)	Large Stream (>3 meters wide)	River	Side Channel/ Off Channel
Average Pool Width (Meters)	> One half channel	> One half channel	NA	> half side channel
Pool Surface Area (Square Meters)	≥ 3 m^2	≥ 6 m^2	≥ 6 m^2	≥ 3 m^2
Pool Depth (Centimeters)	≥25, or ≥ 30 cm	≥ 30, ≥ 40, or ≥ 50 cm	≥ 50 cm	≥ 30 cm
Water Temperature (Celsius)	≤ 21° C	≤ 21° C	≤ 21° C	≤ 21° C
Visibility (Meters)	Secchi > 1.25 m	Secchi > 1.25 m	Secchi > 1.25 m	Secchi > 1.25 m
Sample Rate	Every other unit	Every other unit	Every unit	Every unit
Re-sample Rate	Every 4^{th} unit	Every 4^{th} unit	Every unit	Every unit

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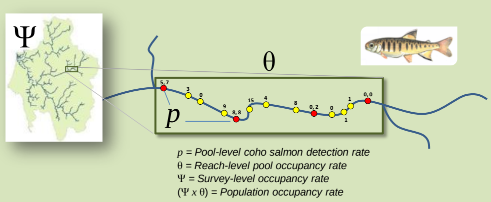
Level of Inference: Multi-scaled occupancy models



Nichols. J. , L. Bailey, A. O'Connell, Jr., N. Talancey, E. Campbell Grant, A. Gilbert, E. Annand, T. Husband, and J. Hines. 2008. **Multi-scale occupancy estimation and modeling using multiple detection methods.** Journal of applied ecology 45: 1321-1329.

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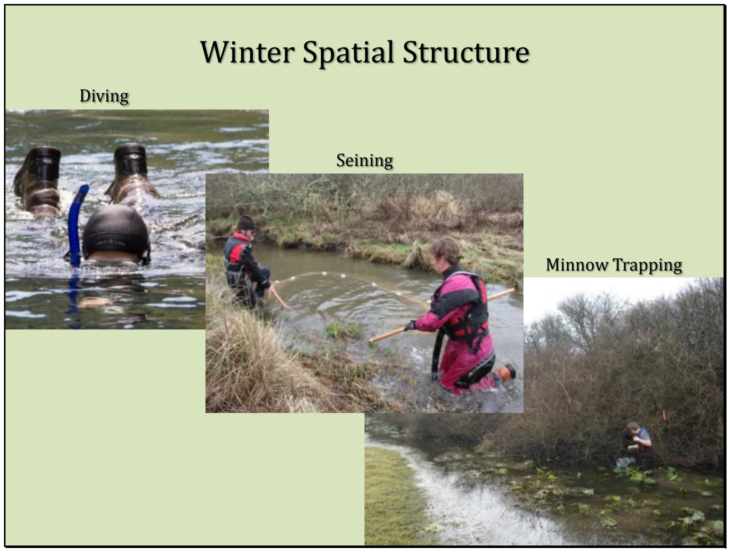

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Summer Spatial Structure Effort

Basin	Years	Frame Size	Sampled km	Pools Sampled
Smith River	2012-2014	298 km	320 km	4093
Redwood Creek	2013-2014	149 km	91 km	1146
Eel/ van Duzen	2013-2014	397 km	240 km	1337
Mattole River	2013-2014	262 km	112 km	1279
Totals:		1106 km	763 km	7855

Cost per annual population survey (~30k-50k)

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Regional Coho Salmon Spatial Structure

Basin	Reach-level occupancy (ψ)	Conditional Pool-level occupancy (θ)	Detection Probability (*p*)	Occupancy Rate (ψ * θ)	# of Reaches present	Mean pool count
Smith 2012	0.42	0.68	0.94	0.29	17 of 41	27.2
Smith 2013	0.39	0.60	0.95	0.23	24 of 60	24.7
Smith 2014	0.35	0.67	0.92	0.23	23 of 67	20.8
Redwood 2013	0.53	0.74	0.96	0.39	10 of 19	25.5
Redwood 2014	0.80	0.70	0.94	0.56	16 of 20	23.5
Eel 2013	0.25	0.27	0.89	0.07	11 of 55	11.5
Eel 2014	0.15	0.49	0.88	0.07	8 of 59	9.0
Mattole 2013	0.31	0.43	0.86	0.13	7 of 24	5.7
Mattole 2014	0.35	0.37	0.68	0.13	12 of 37	10.3

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Regional YOY Trout Spatial Structure

Basin	Reach-level occupancy (ψ)	Conditional Pool-level occupancy (θ)	Detection Probability (*p*)	Occupancy Rate (ψ * θ)	# of Reaches present	Mean pool count
Smith 2012	0.98	0.93	0.96	0.91	40 of 41	23
Smith 2013	0.98	0.98	1.00	0.96	59 of 60	34.5
Smith 2014	1.00	0.96	0.96	0.96	67 of 67	31.1
Redwood 2013	1.00	0.96	0.90	0.96	19 of 19	16.9
Redwood 2014	1.00	0.83	0.92	0.83	20 of 20	16.9
Eel 2013	0.52	0.82	0.95	0.43	28 of 55	18.6
Eel 2014	0.68	0.66	0.93	0.45	38 of 59	17.5
Mattole 2013	1.00	0.95	0.98	0.95	25 of 25	27.2
Mattole 2014	1.00	0.82	0.97	0.82	37 of 37	44.8

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Regional Invasive Species Spatial Structure

Basin	Species	Reach-level occupancy (ψ)	Conditional Pool-level occupancy (θ)	Detection Probability (*p*)	Occupancy Rate (ψ * θ)	# of Reaches present	Mean pool count
Eel 2013	California Roach	0.60	0.47	0.93	0.28	31 of 55	36.4
Eel 2014	California Roach	0.28	0.47	0.98	0.13	16 of 59	50.3
Eel 2013	Pikeminnow	0.65	0.50	0.94	0.33	34 of 55	471.0
Eel 2014	Pikeminnow	0.45	0.62	0.99	0.28	26 of 59	379.0

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Smith River

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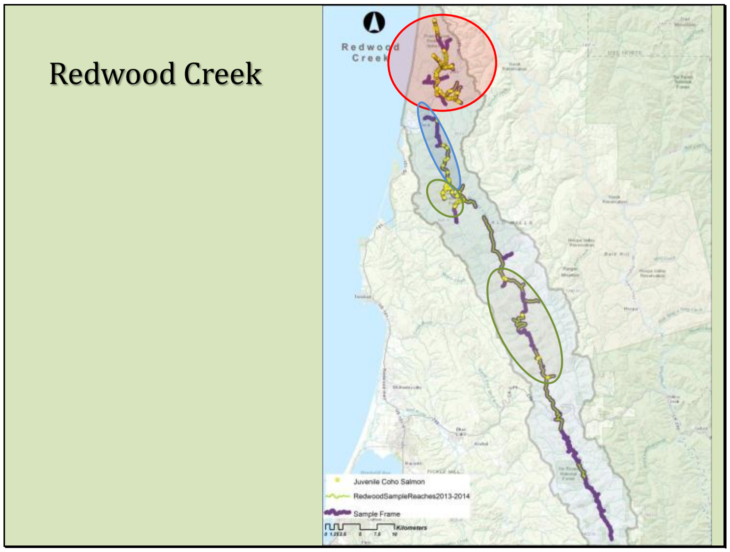

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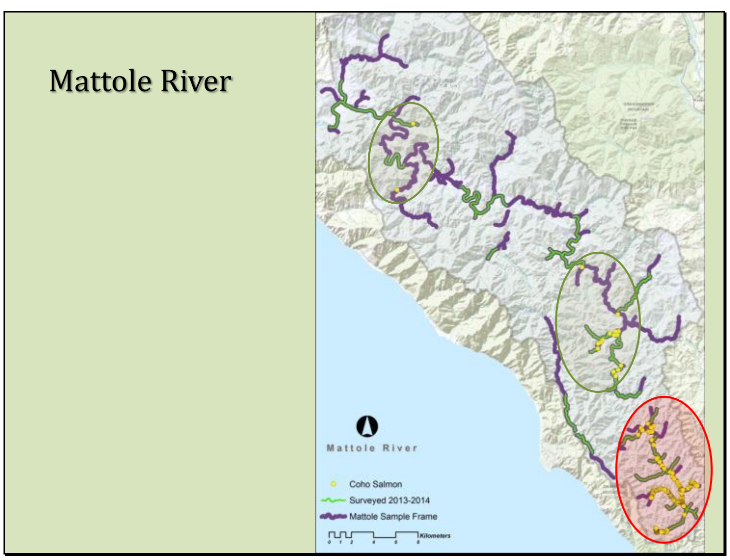

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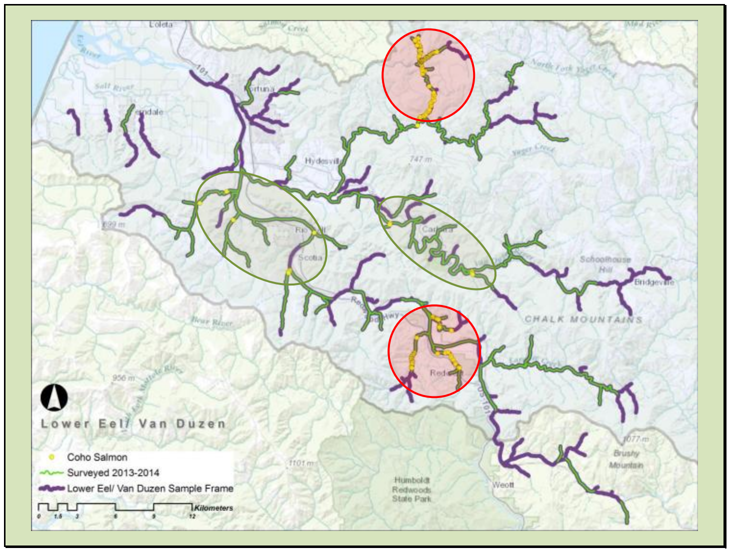

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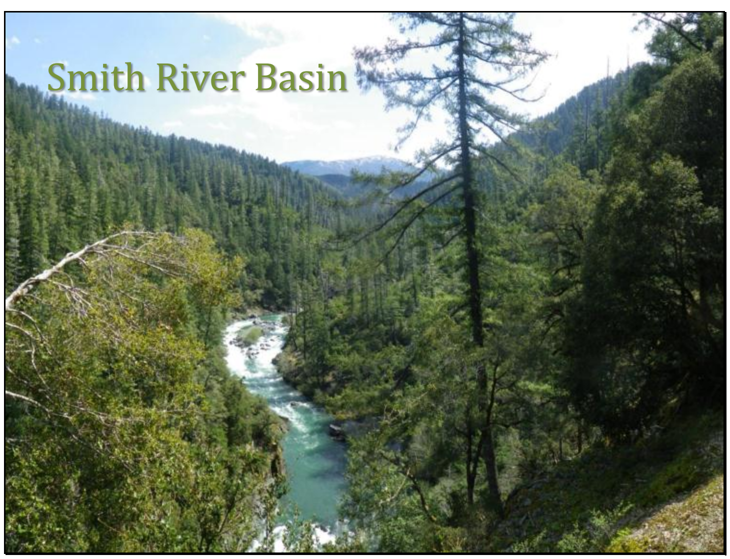

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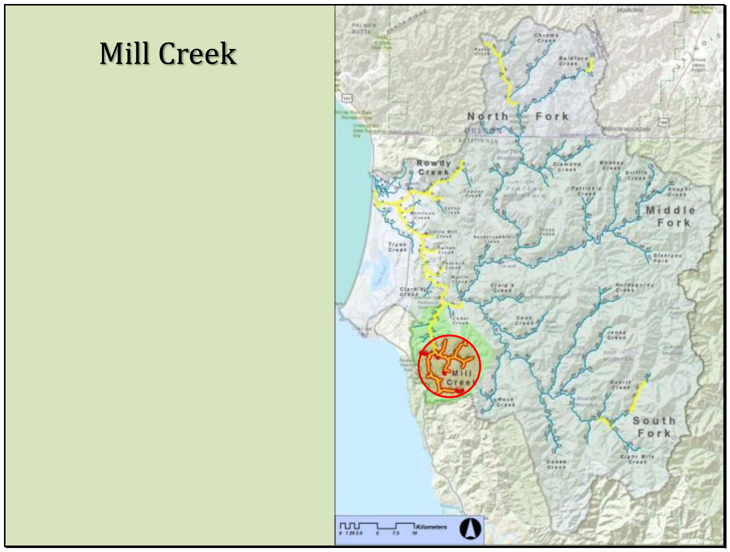

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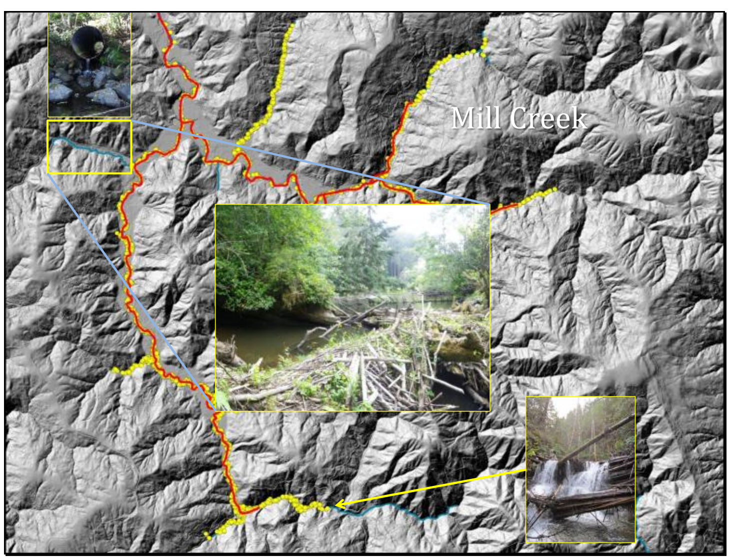

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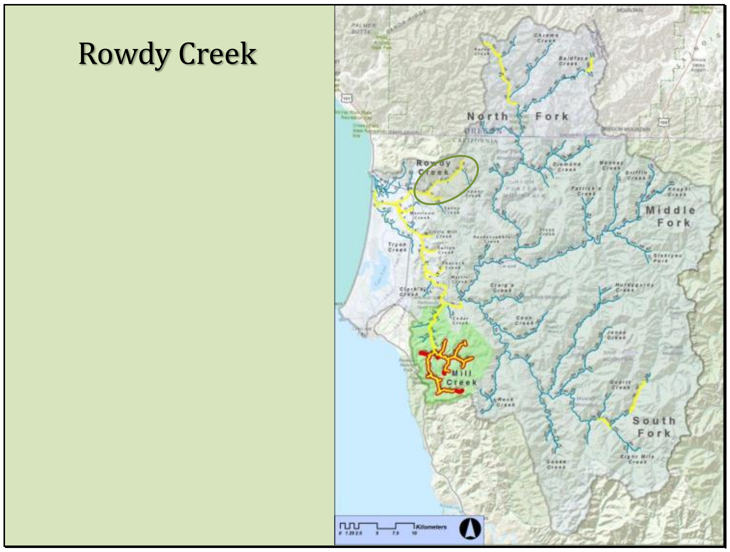

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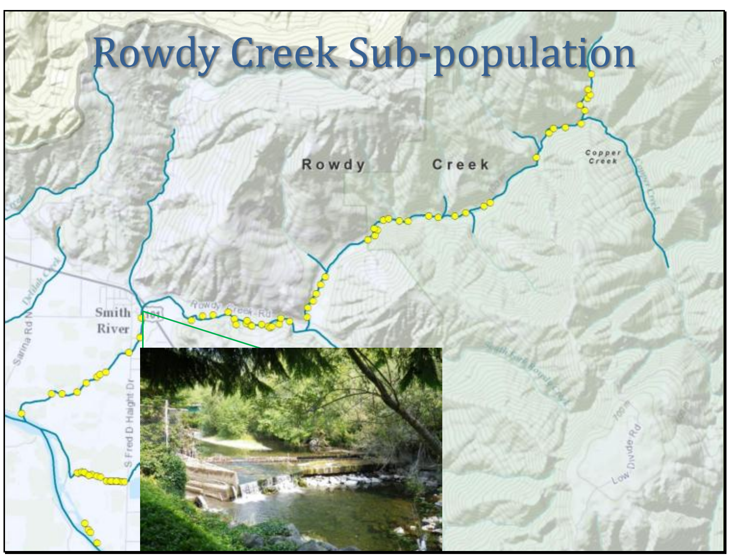

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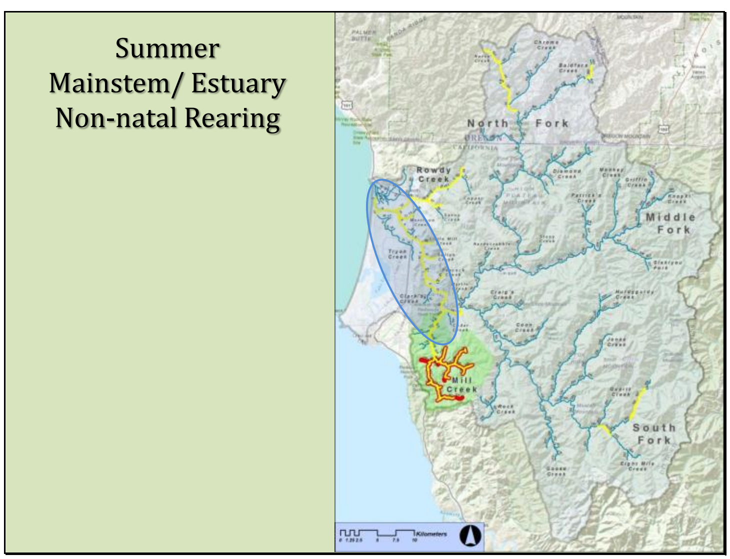

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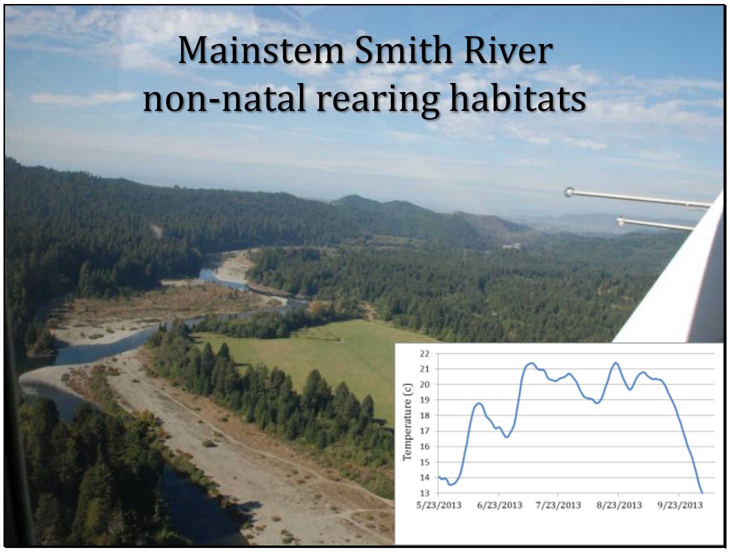

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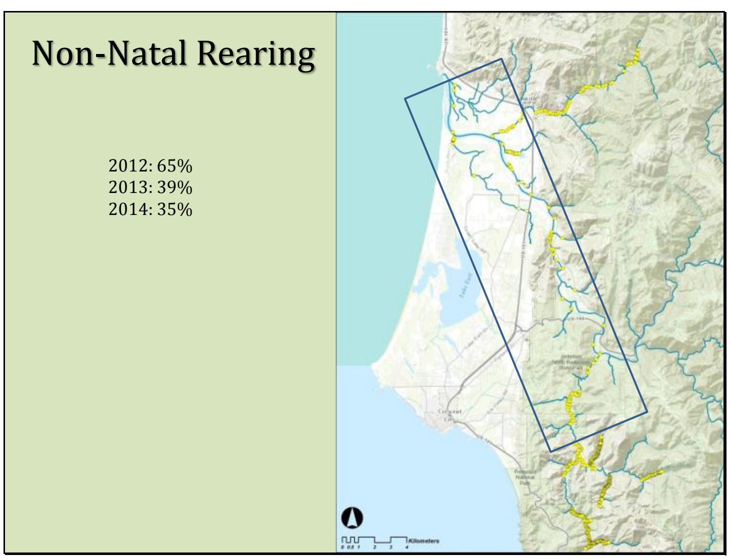

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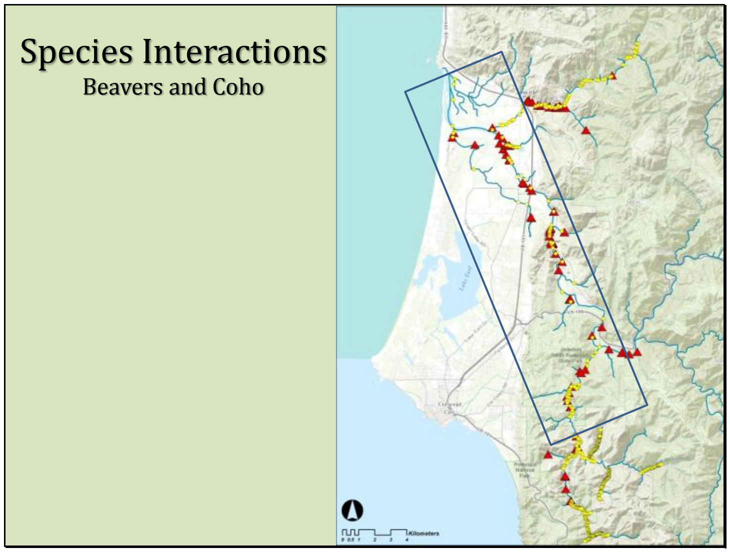

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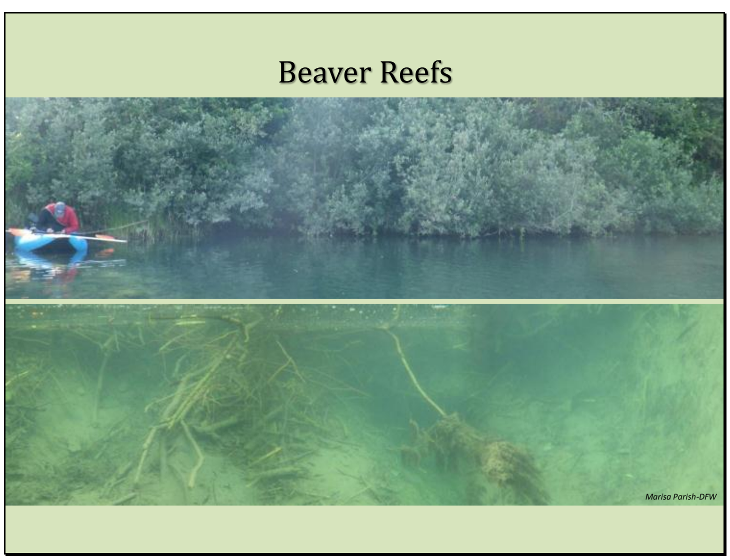

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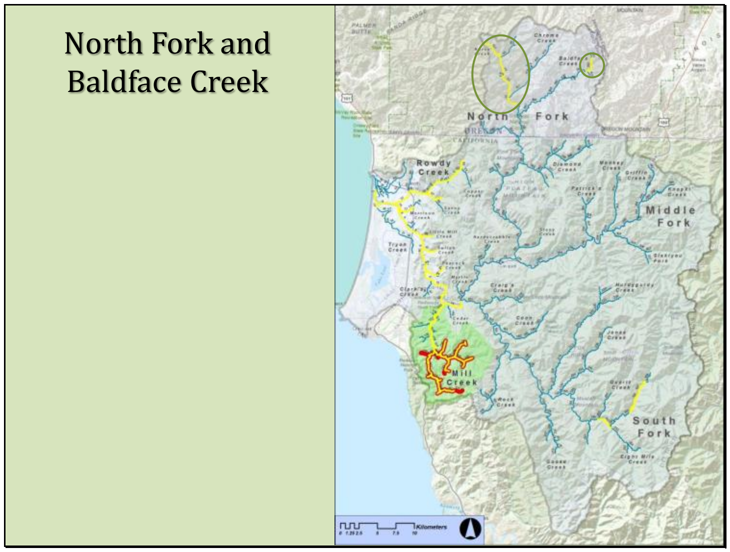

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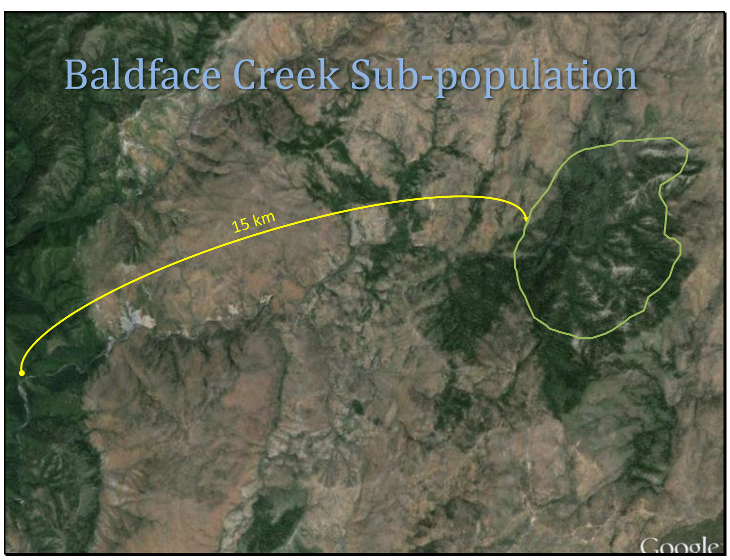

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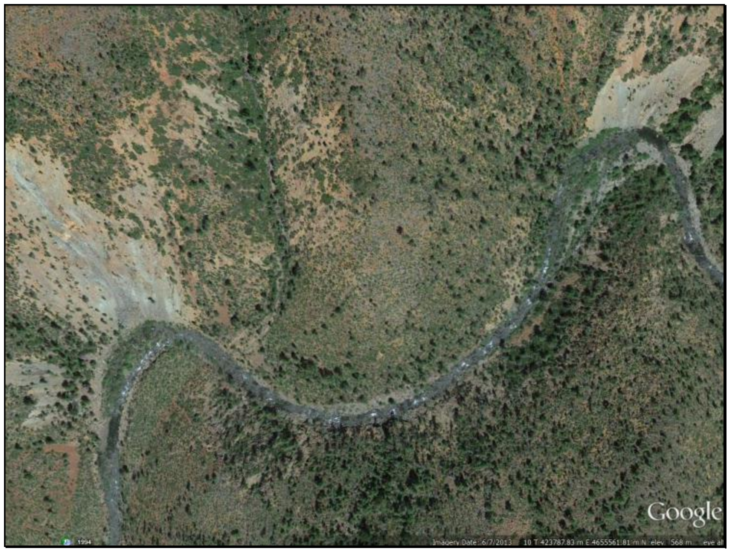

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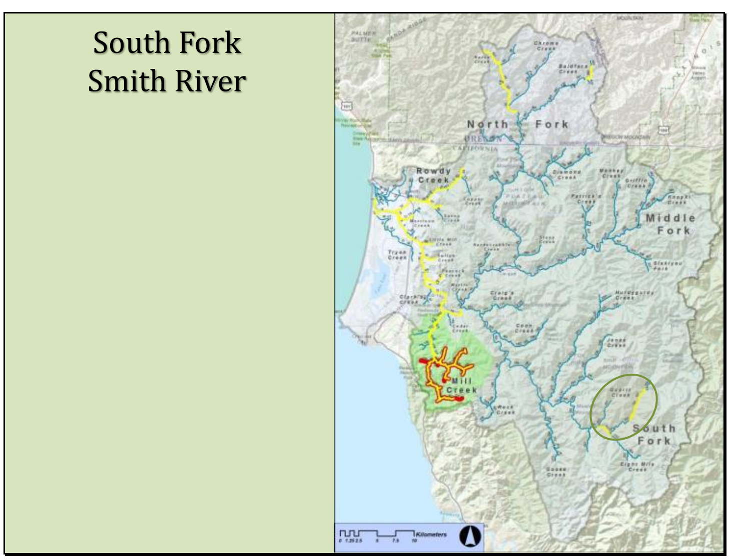

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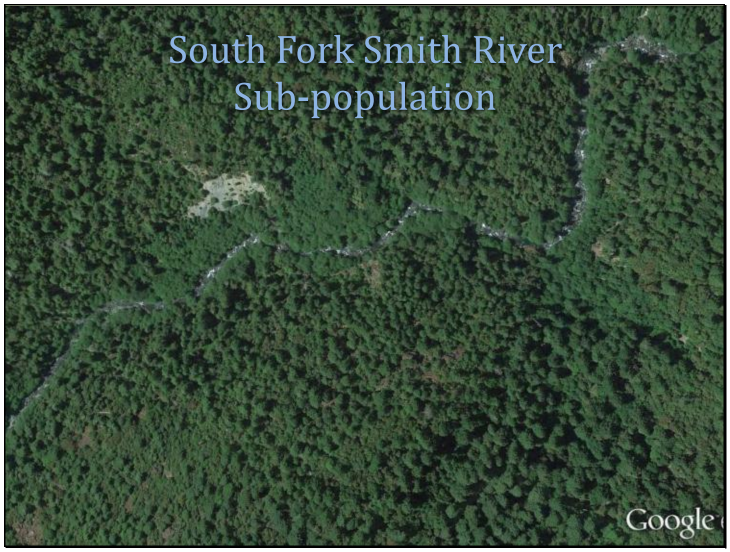

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Conclusions

- Snorkel surveys provide rapid, affordable, and high quality distribution data.
- Coho salmon populations are collections of discrete patches.
- Life-history expressions appear to be basin-specific.
- Restoration can be specifically tailored to have immediate results for specific life-histories.
- Monitoring data needs to be more available to restoration groups.
- Monitoring folks need to have beverages with restoration folks.

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Thanks!
2012 Smith Crew
2013 Smith Crew
2014 Smith Crew
Support: Smith River Alliance, CDFW Fisheries Restoration Grants Program
Regional Collaboration: Mattole Salmon Group, CDFW Fortuna, Humboldt Redwood Company, CDFW Arcata

What You Do Matters: The Latticework of Federal Listing Factors.

Presenter: Charlotte Ambrose, NOAA Fisheries. charlotte.a.ambrose@noaa.gov

Abstract:

Section 4(a)(1) of the Federal Endangered Species Act requires Federal agencies to determine whether a species is endangered or threatened based on the threats associated with one or more of the following five factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; or (5) other natural or manmade factors affecting its continued existence. Section 4(b) also requires the determination be made on the basis of the best scientific and commercial data available after taking into account those efforts, if any, being made by any State or foreign nation, to protect such species.

In 2015, NOAA Fisheries will be conducting a 5-year status review for all listed salmon and steelhead in the Pacific Northwest. This review will assess the accuracy of the listing classifications and determine if conditions have changed to warrant a delisting or status reclassification. To ensure that the 5-year reviews are complete and based on the best available information, we are soliciting new information from the public, concerned governmental agencies, Tribes, the scientific community, industry, environmental entities, and any other interested parties concerning the status of salmon and steelhead and conservation efforts conducted to improve the threats associated with the five listing factors.

Specifically, we will be requesting new information that has become available since the respective species' previous status review on: (1) population abundance; (2) population productivity; (3) changes in species distribution or population spatial structure; (4) genetics or other diversity measures; (5) changes in habitat conditions; (6) conservation measures that have been implemented that benefit the species, including monitoring data demonstrating the effectiveness of such measures in addressing identified limiting factors or threats; (7) data concerning the status and trends of identified limiting factors or threats; (8) for Pacific salmon and steelhead, information on changes to hatchery programs that may affect their ESU or DPS membership; and (9) other new information, data, or corrections including, but not limited to, taxonomic or nomenclatural changes, identification of erroneous information in the previous listing determination, and improved analytical methods.

This presentation will provide an overview of the 5-year status review process, how NOAA Fisheries reviews threats associated with the five listing factors, and how the innovative approaches of what you do (or not do) is evaluated against the Federal listing status of Pacific Northwest salmon and steelhead.

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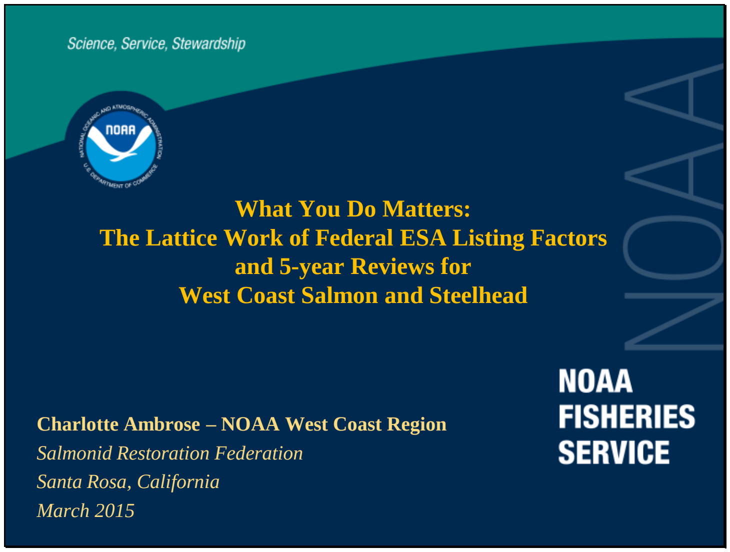

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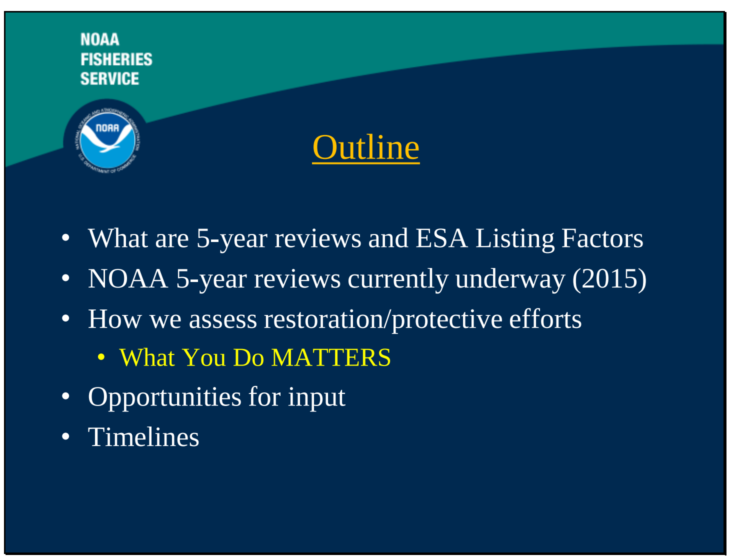

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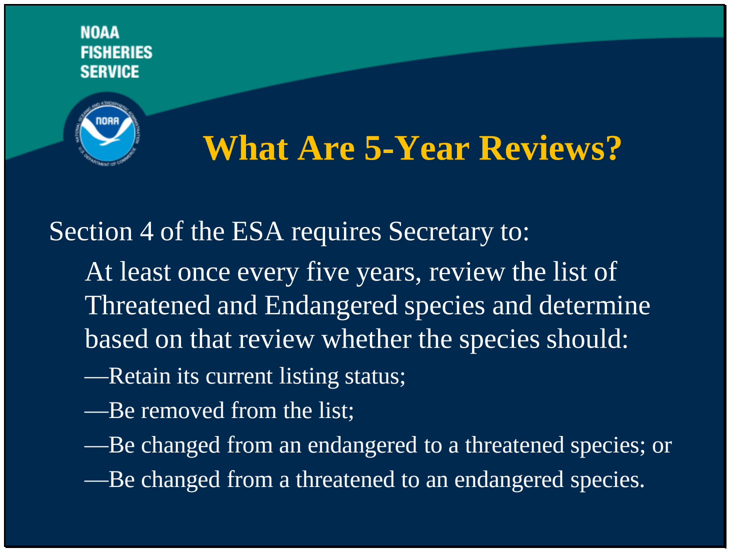

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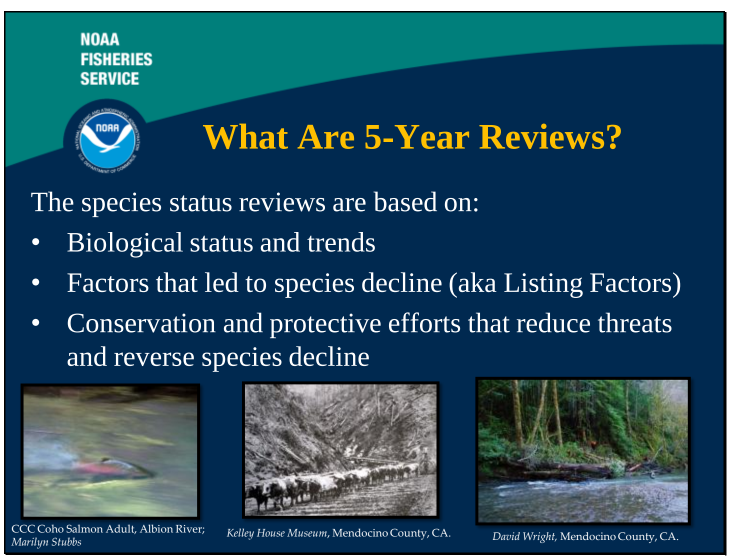

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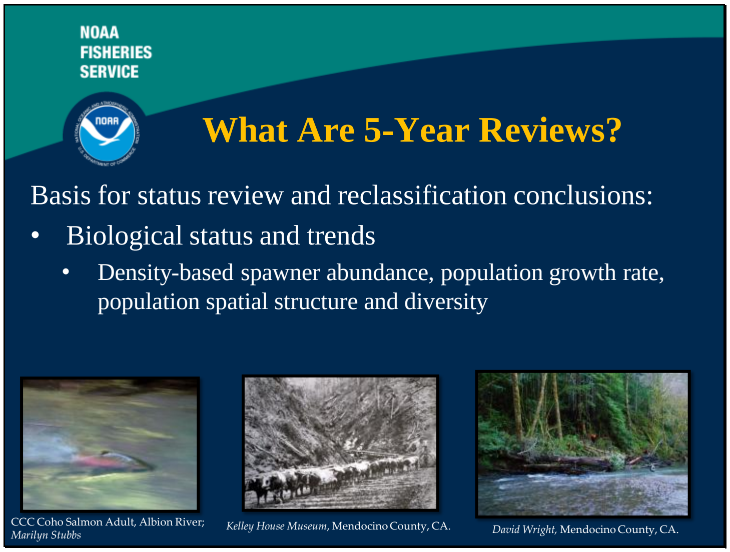

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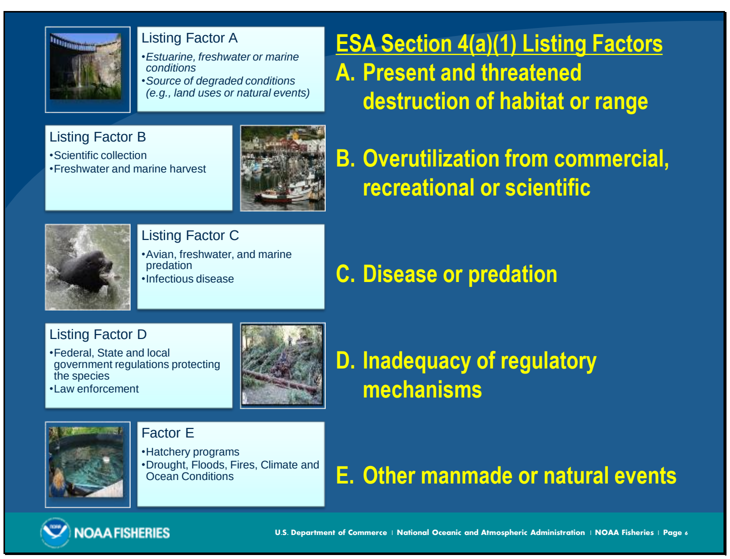

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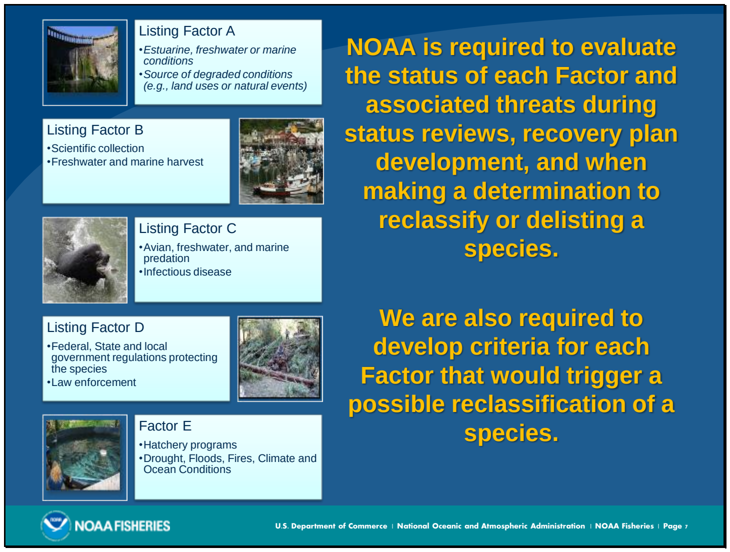

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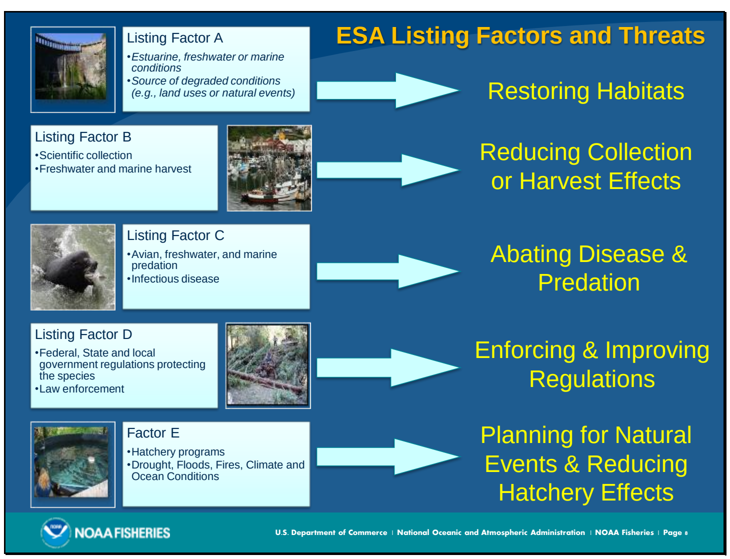

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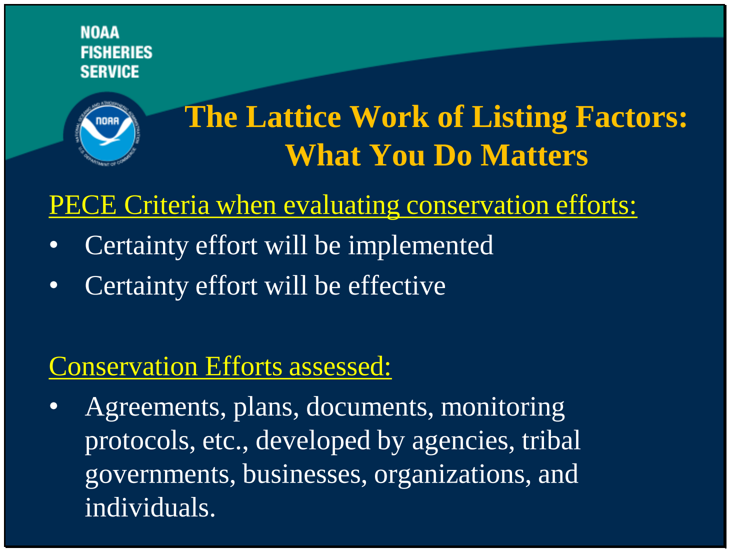

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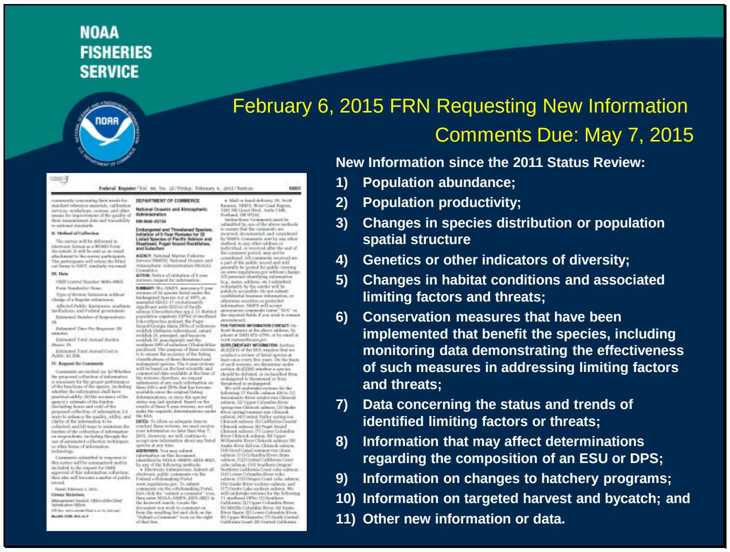

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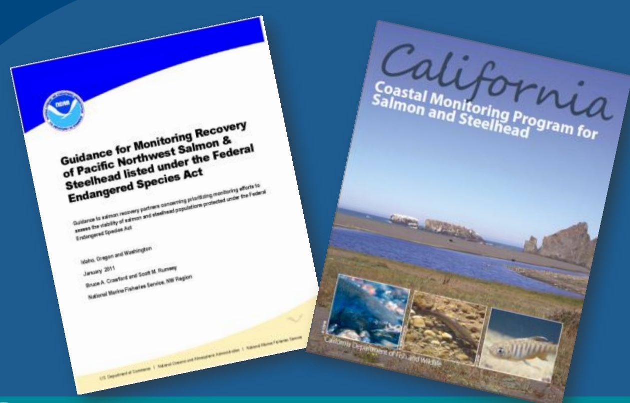
Draft Timeline for 2015 Reviews

- Feb. 2015 – Federal Register notice announcing 5-year reviews
- **May 2015** – Comment period closes
- Jun. 2015 – Science Centers submit draft viability report(s) to Region
- Jul. 2015 – "Domain teams" convene and evaluate status/trends in listing factors
- Nov. 2015 – Internal draft 5-year review reports complete
- Jan. 2016 – Transmit recommended findings to HQ
- Mar. 2016 – 5-year review findings published in Federal Register

Slide 14

Compelling Data Needs for Status and Trends, and the Five Listing Factors for 5-Year Reviews and Reclassification Decisions



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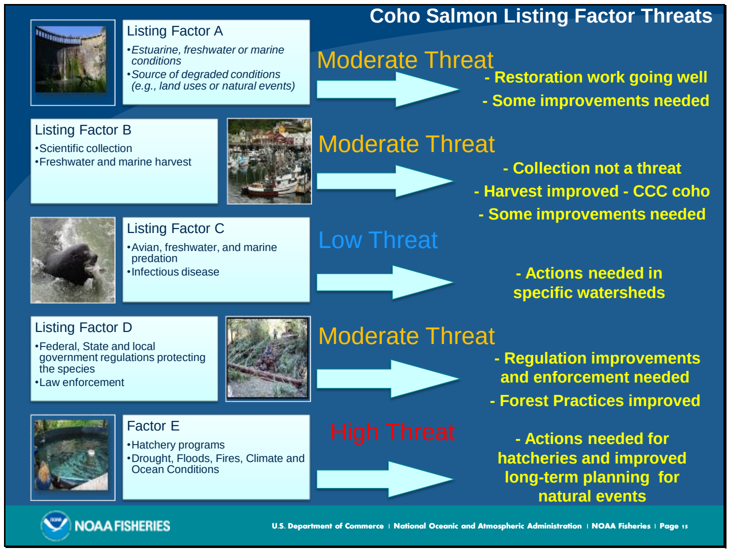

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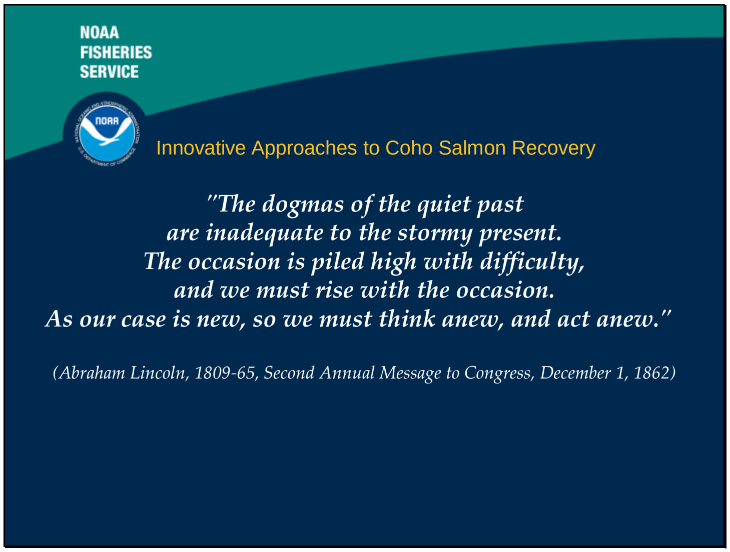
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Innovative Approaches to Coho Salmon Recovery
"The dogmas of the quiet past
are inadequate to the stormy present.
The occasion is piled high with difficulty,
and we must rise with the occasion.
As our case is new, so we must think anew, and act anew."
(Abraham Lincoln, 1809-65, Second Annual Message to Congress, December 1, 1862)