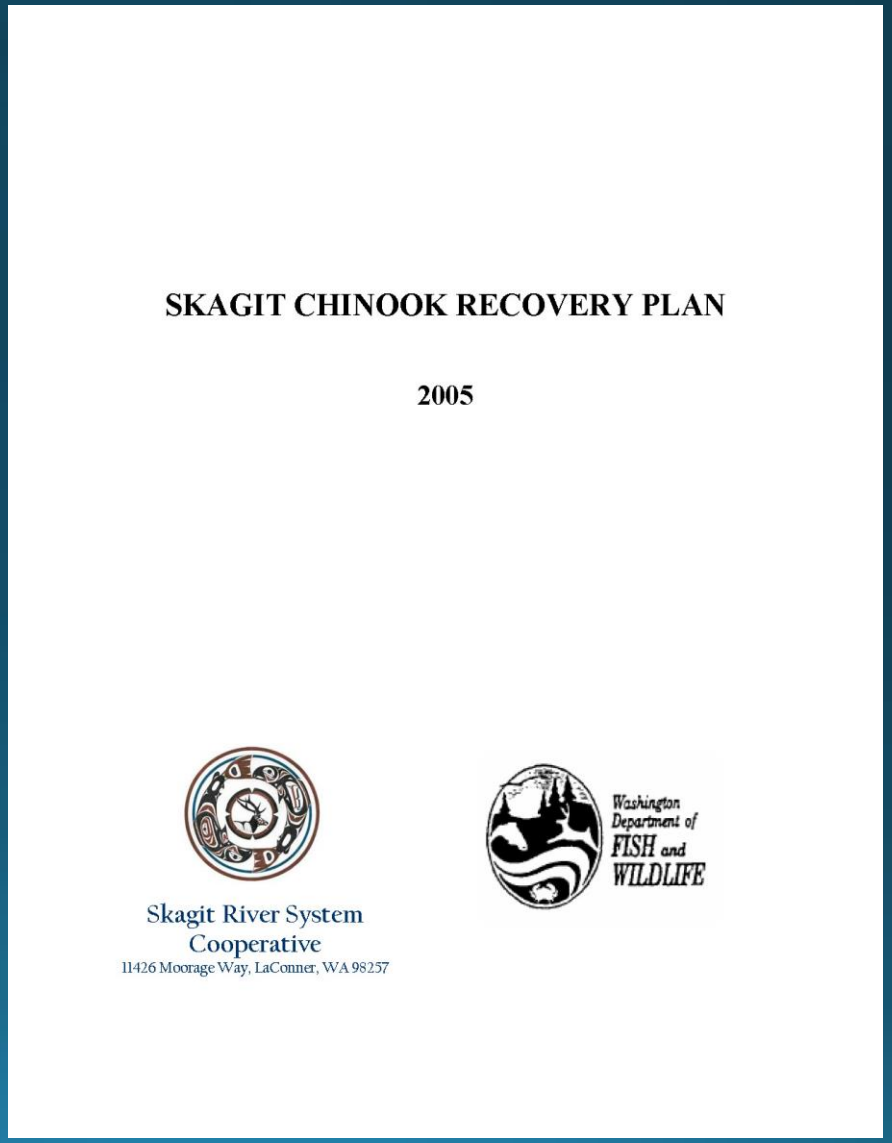
The 2005 Skagit Chinook Recovery Plan (SRP) Explained

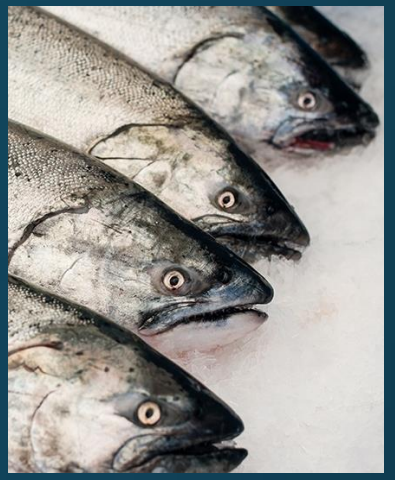
Presentation to the Skagit Watershed Council May 4, 2022

Eric Beamer

Skagit River System Cooperative (SRSC)



Outline



- SRP Context
- SRP Background (Ch 1-3, 5)
- SRP Goals & Objectives (Ch 4, Ch 16)
- SRP Action Chapters
  - Linking action strategies to SRP Objectives
  - Ch 6, 7, 8, 9, 10, 11, 12, 13
- How does it all add up (Ch. 16)
- Knowledge gaps and learning
  - Research (Ch 14)
  - Monitoring (Ch 15)

SRP Context

Endangered Species Act (ESA)

ESA "the Puget Sound way"

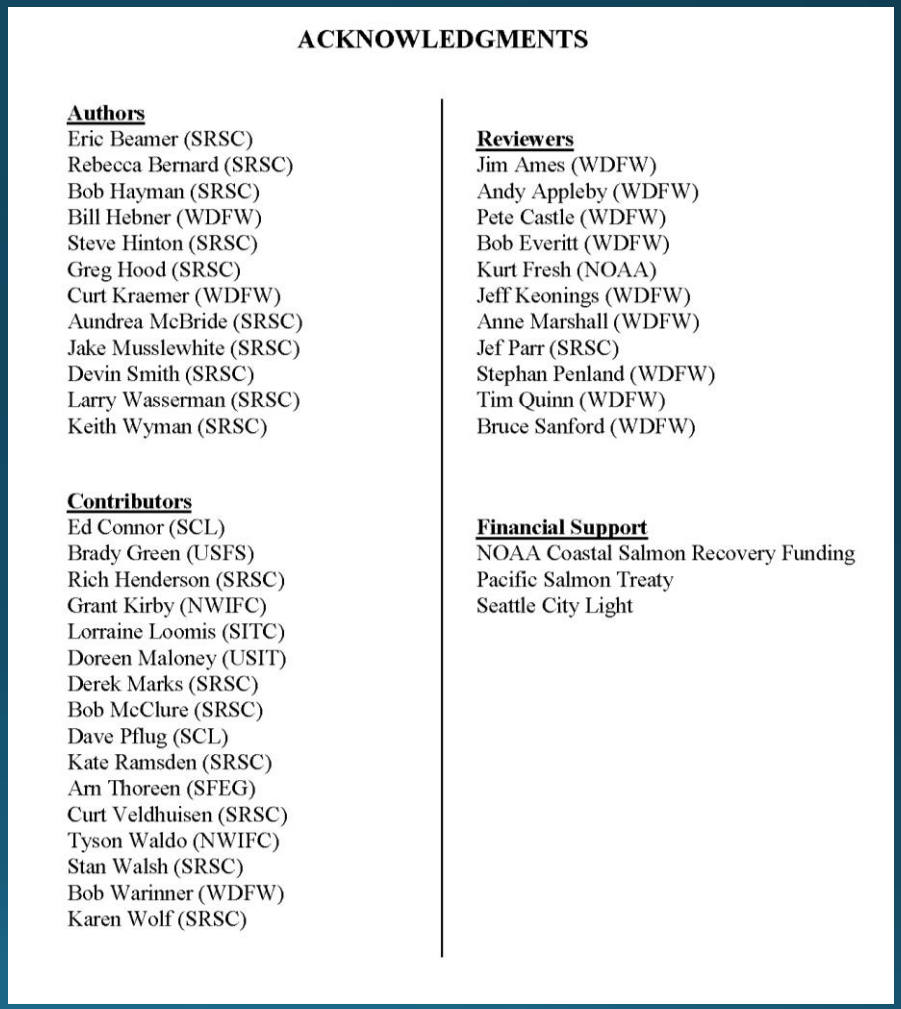
- Approach to recovery planning/implementation includes a "bottom up" step

SRP Review and Adoption

- Puget Sound Chinook salmon were listed as Threatened under ESA in 1999 (Federal Register / Vol. 64, No. 56 / Wednesday, March 24, 1999).
- The Puget Sound Chinook Salmon Recovery Plan, including the Skagit Chinook Recovery Plan chapter, was submitted to NOAA on June 30, 2005.
- July 2005 – January 2007 NOAA Fisheries technical and policy review of Puget Sound Chinook Salmon Recovery Plan, including the Skagit Chinook Recovery Plan chapter.
- Technical review by Puget Sound Technical Recovery Team (TRT)
  - M. Ruckelshaus (Chair), NOAA Fisheries
  - K. Currens, Northwest Indian Fisheries Commission
  - R. Fuerstenberg, King County
  - W. Graeber, Washington Department of Natural Resources
  - K. Rawson, Tulalip Tribes
  - N. Sands, NOAA Fisheries
  - J. Scott, Washington Department of Fish and Wildlife
- The Puget Sound Chinook salmon recovery plan, including the Skagit Chinook Recovery Plan chapter, was adopted by NOAA in 2007 (Federal Register /Vol. 72, No. 12 / Friday, January 19, 2007).

SRP Context, cont.

- **Citation**: Skagit River System Cooperative and Washington Department of Fish and Wildlife. 2005. Skagit Chinook Recovery Plan.
- **Authors etc.**



ACKNOWLEDGMENTS

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Seattle City Light

SRP Context, cont.

Intent (***see SRP Forward***)

- The co-managers present this document as our best effort to detail a specific pathway that will meet joint recovery goals for Skagit Chinook populations.
- We acknowledge that the pathway described herein is not the only pathway that could achieve our collective goals.

Purpose (***see Executive Summary or Introduction***):

- Define biologically-based recovery goals
- Identify what is known or assumed about factors that limit production of Skagit River Chinook
- Propose scientifically-based actions that will restore Skagit River Chinook to optimum levels, including fisheries management, artificial production, habitat protection, habitat restoration, effectiveness monitoring, and applied research

Where do I find the SRP?

At least two hosting sources:

https://www.fisheries.noaa.gov/resource/document/recovery-plan-puget-sound-chinook-salmon

- NOAA Fisheries Supplement to the Salmon Recovery Plan
- Recovery Plan Volume II - link to Puget Sound Partnership page which now host watershed chapters (download by watershed in zip files)

http://skagitcoop.org/documents/

- Separate links to the 327-page plan and each Appendix:
  - SRSC and WDFW. 2005. Skagit Chinook Recovery Plan.
  - Appendix A: Trends in Spawning Escapement.
  - Appendix B: Linking Egg-to-Fry Survival to Chinook Recovery.
  - Appendix C: Linking Riverine Habitat Restoration to Chinook Recovery.
  - Appendix D: Linking Estuary Restoration to Wild Chinook Salmon Populations.
  - Appendix E: Intensively Monitored Watersheds Plan.
  - Appendix F: Excerpts from Management Recommendations for WA Priority Habitats.
  - Appendix G: Excerpts from the Governor's "Extinction Is Not An Option".
  - Appendix H: Skagit Recovery Goals.

SRP Background

Ch. 1 Introduction

- Purpose, parties, and History of SRP development

Ch. 2 Terms and Definitions

Ch 3 Assumptions

- Life cycle & life stage approach
- life history diversity
- Population dynamics
- Marine survival

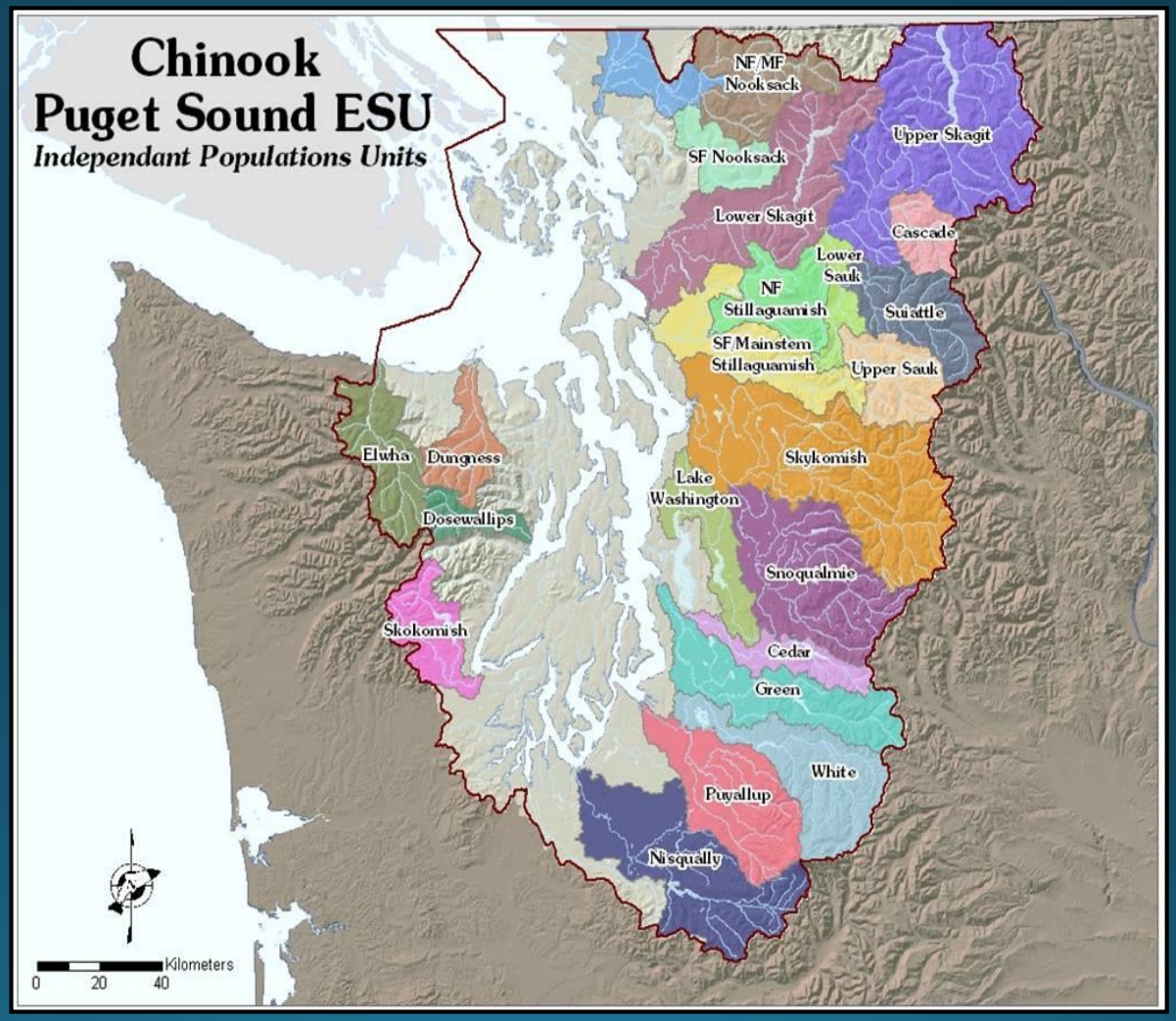
Ch. 5 Factors Limiting Chinook Production

- Significant factors
- Evaluated and assumed not significant
- Linkage with Action Chapters and Appendices

ESA Listed Chinook Salmon in Puget Sound

Skagit:

- Largest source of natural origin salmon and freshwater in Puget Sound
- 6 out of 22 ESA listed Chinook salmon spawning populations



Spatial extent of Skagit Salmon Recovery

Chinook salmon life cycle

Redd

Eggs

Freshwater

Emergent Fry

Spawning Adults

Estuary

Juveniles

Adults

Nearshore

Juveniles

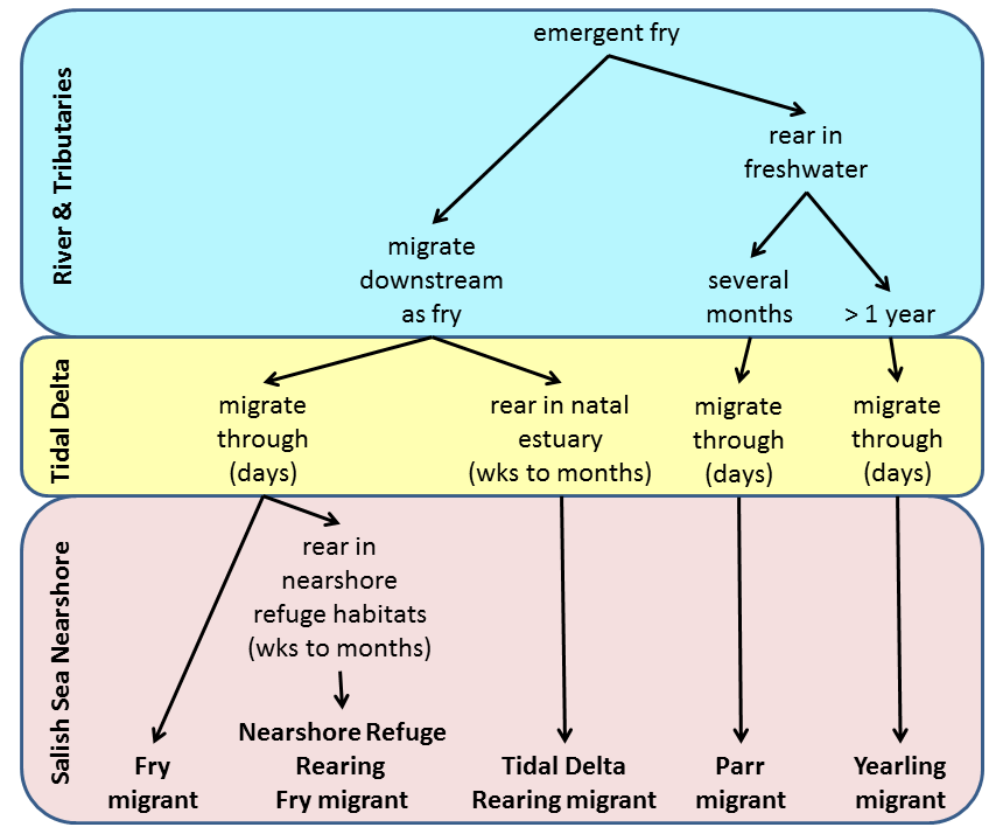
Adults

Ocean

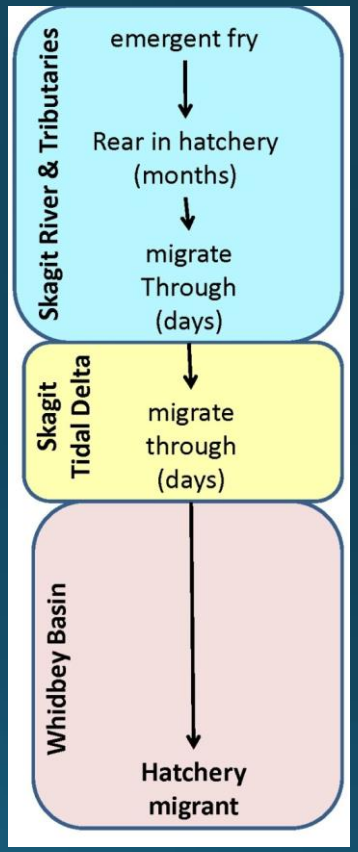
Adults

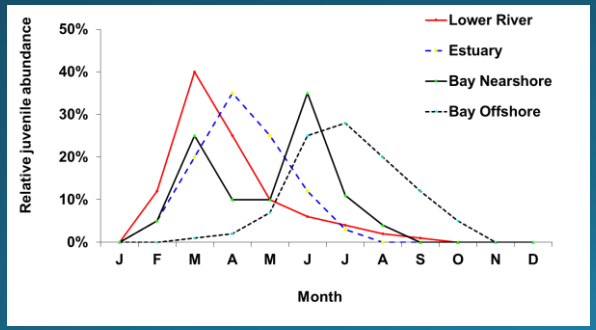
Juvenile Life History Diversity

Skagit Natural Origin Populations

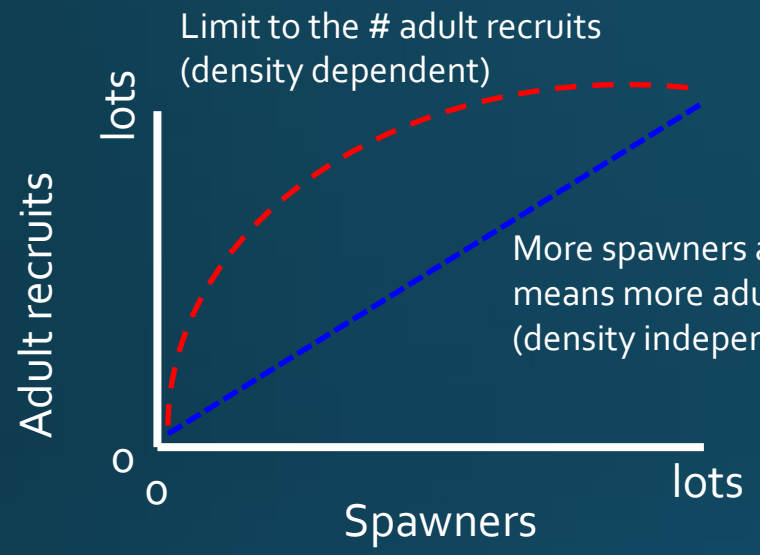


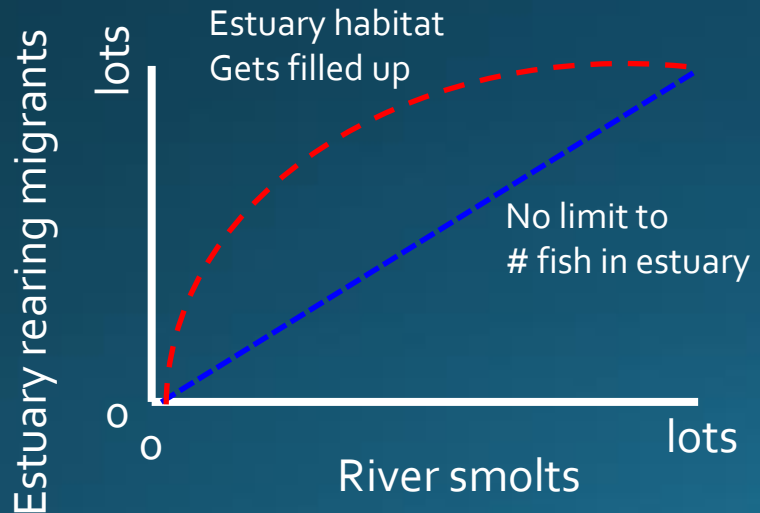
Skagit Hatchery Populations





Stock>recruit analysis concepts





Full life cycle analysis:

- Spawner to next generation adult recruits (spawners + fish caught in fisheries)

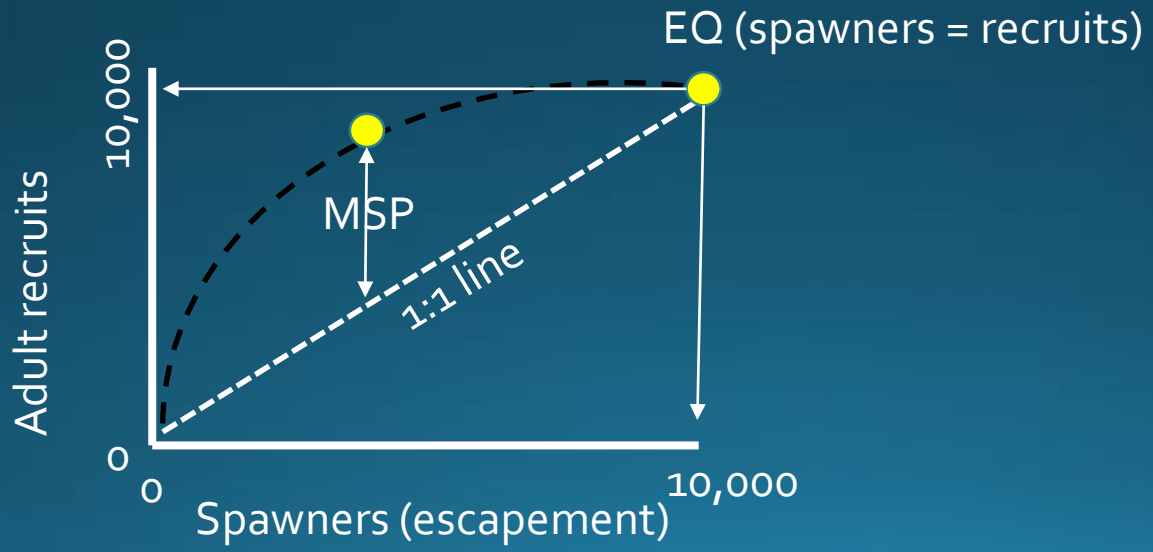
Life stage analysis:

- Smolts outmigrating the river to fish rearing in the estuary

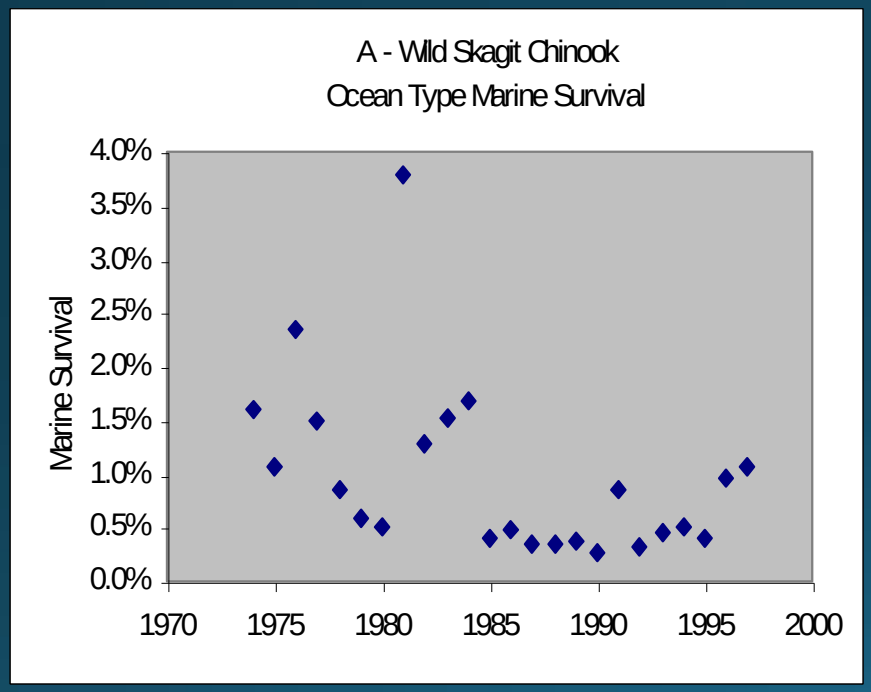
SRP Goals & Objectives

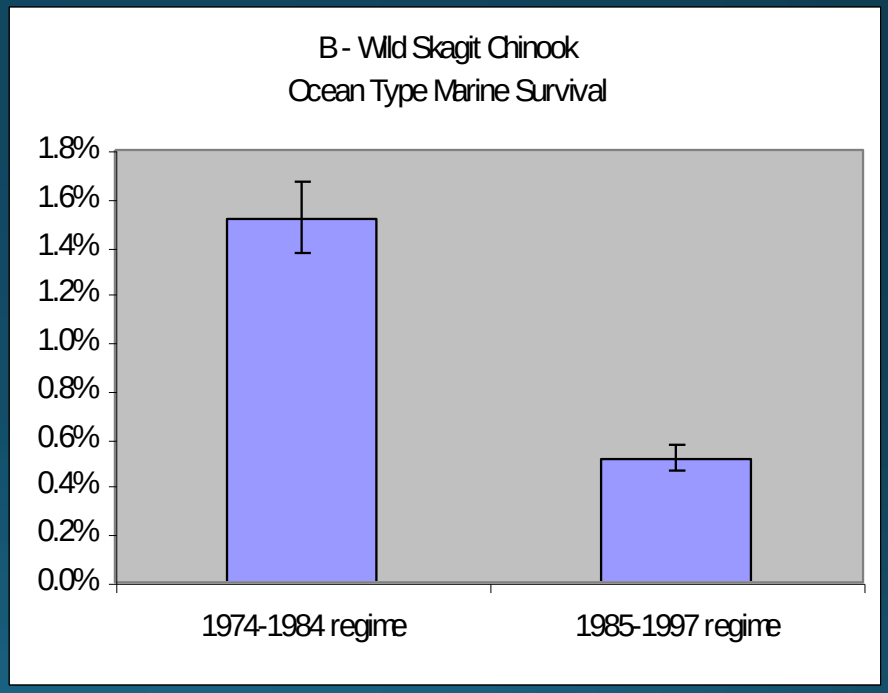
Adult Chinook Salmon Goals (Ch. 4, also see Appendix H)

- Developed across Puget Sound by Co-managers
- Goals are biologically based (possible), achieve population viability and include meaningful harvest
- Adult goals are a specific stock-recruit function, but are communicated in tables for two points along the function for high and low marine survival periods
  - Maximum Surplus Production (MSP)
  - Equilibrium (EQ)



Marine Survival of natural origin Skagit Chinook Salmon





Adult Chinook Goals

Lower marine survival years

	At Point of Maximum Surplus Production			At Point of Equilibrium	
Population/MU	Escapement	Resulting Recruitment	Recruits Per Spawner	Escapement	Resulting Recruitment
Upper Cascade	290	870	3.0	1,160	1,160
Suiattle	160	450	2.8	610	610
Upper Sauk	750	2,270	3.0	3,030	3,030
Skagit Spring MU	1,200	3,600	3.0	4,800	4,800
Lower Skagit	3,900	11,900	3.0	15,800	15,800
Upper Skagit	5,380	20,600	3.8	26,000	26,000
Lower Sauk	1,400	4,200	3.0	5,580	5,580
Summer/fall MU	10,630	37,000	3.5	47,630	47,630

Adult Chinook Goals

High Marine Survival Scenario

	At Point of Maximum Surplus Production			At Point of Equilibrium	
Population/MU	Escapement	Resulting Recruitment	Recruits Per Spawner	Escapement	Resulting Recruitment
Upper Cascade	510	2,340	4.6	2,860	2,860
Suiattle	270	1,150	4.2	1,420	1,420
Upper Sauk	1,340	5,530	4.1	6,900	6,900
Skagit Spring MU	2,100	9,000	4.3	11,100	11,100
Lower Skagit	7,400	39,700	5.4	47,100	47,100
Upper Skagit	9,400	61,800	6.6	71,200	71,200
Lower Sauk	2,700	12,700	4.8	15,400	15,400
Summer/fall MU	19,200	115,000	6.0	134,000	134,000

SRP Juvenile Life Stage Objectives

Juvenile Chinook Life stage specific Objectives (found within individual chapters, summarized in Ch. 16)

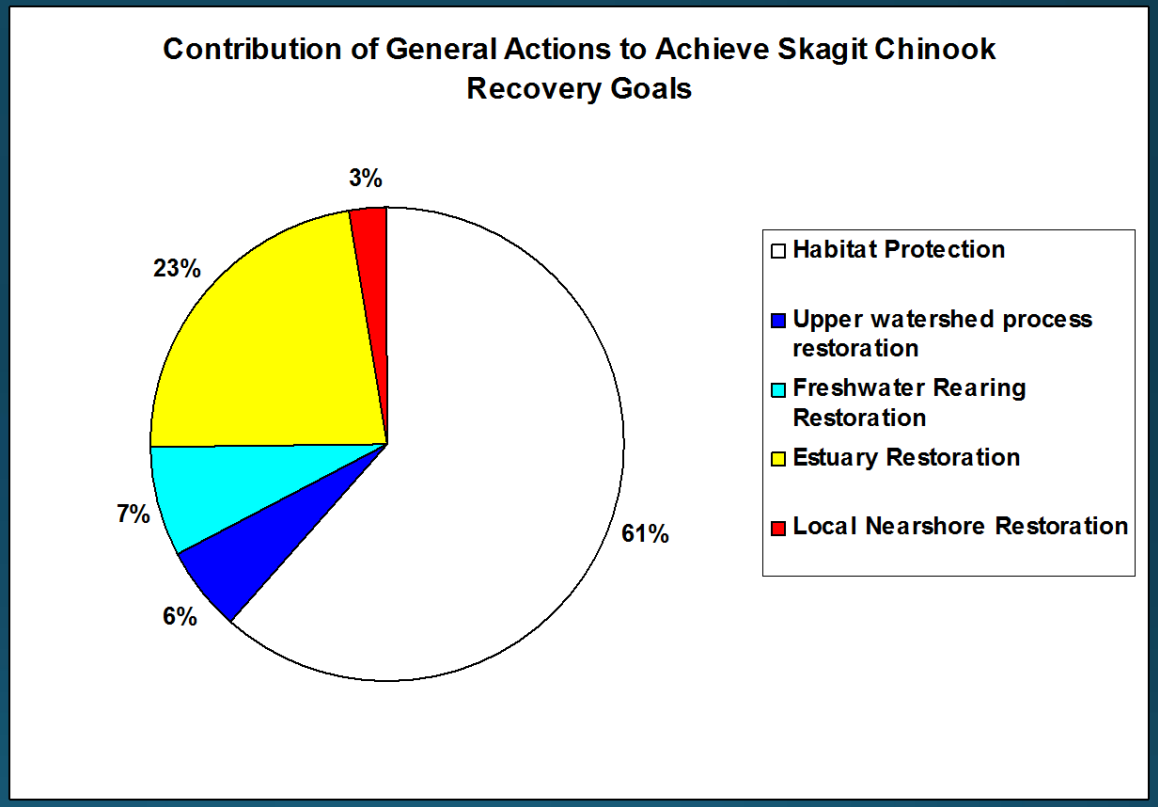
Habitat Objectives coincide with juvenile Chinook salmon Objectives

Life History Strategy	Current Capacity	Restored Capacity
Yearling	107,000	130,000 (23% increase)
Parr migrant	1,300,000	1,600,000 (23% increase)
Tidal Delta	2,250,000	3,600,000 (60% increase)
Pocket Estuary	70,000	220,000 (214% increase)

SRP Action Chapters

Link action strategies to SRP Objectives

- Harvest (Ch 6)
- Habitat (Ch 7-12)
  - Protection (Ch7)
  - General Restoration Strategy (Ch 8)
  - Spawning (Ch 9)
  - Freshwater Rearing (Ch 10)
  - Estuary (Tidal Delta) and Nearshore (Ch 11 & 12)
- Hatcheries (Artificial Production) Ch 13



Note: Some chapters adopted existing regulations or administrative processes as the SRP action (e.g., Harvest & Hatchery, provisions of Skagit Hydroelectric license, Forest/Fish regulation on industrial forest lands)

Harvest Management (Ch. 6)

SRP adopts the existing regional process to manage Chinook Salmon Fisheries

- NOAA must approve state and tribal salmon fisheries – ESA permit to impact listed Chinook salmon
- Biological opinion (BiOp) – annual salmon fisheries plan cannot jeopardize the species

Artificial Production (Ch. 13)

SRP adopts the existing processes to manage hatcheries including 4(d) consultation and HSRG guidance

Chinook Actions

- Continue 3 Indicator Stock Programs
- Initially, No new Chinook programs
- Develop a Contingency Conservation Plan
- Rejected Ideas, & Criteria for Reconsidering

Habitat Protection (Ch. 7)

(regulatory protection, not protecting habitat through acquisition)

Underlying Principles:

- Based on the principle that proposed restoration actions will achieve recovery goals only if we maintain current levels of productivity and capacity.
- Recognize that implementation is largely under the jurisdiction of governmental entities other than the co-managers (success is dependent upon the actions ultimately taken by others.
- In many instances, we have proposed default actions. Others may provide alternate measures for protection that provide for equivalent levels of protection.
- For alternative actions, proponents should demonstrate that alternative actions will result in no loss of productivity or capacity (or included additional restoration to make up the difference).

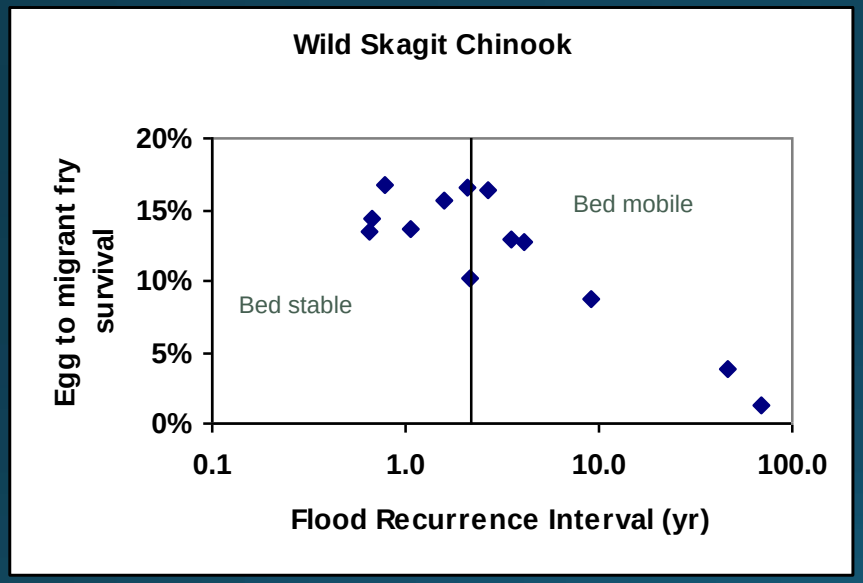
Spawning and egg incubation habitat (Ch. 9)

Details in Appendix B of SRP

Why do we need Spawning Habitat Restoration?

- Current biological mechanisms (evidence of an egg to fry survival limitation)
- Current habitat conditions
- Leads to watershed level sediment supply and hydrology restoration
- Used survival model to predict benefit of broad restoration strategy

Chinook Salmon Egg to Fry Stage

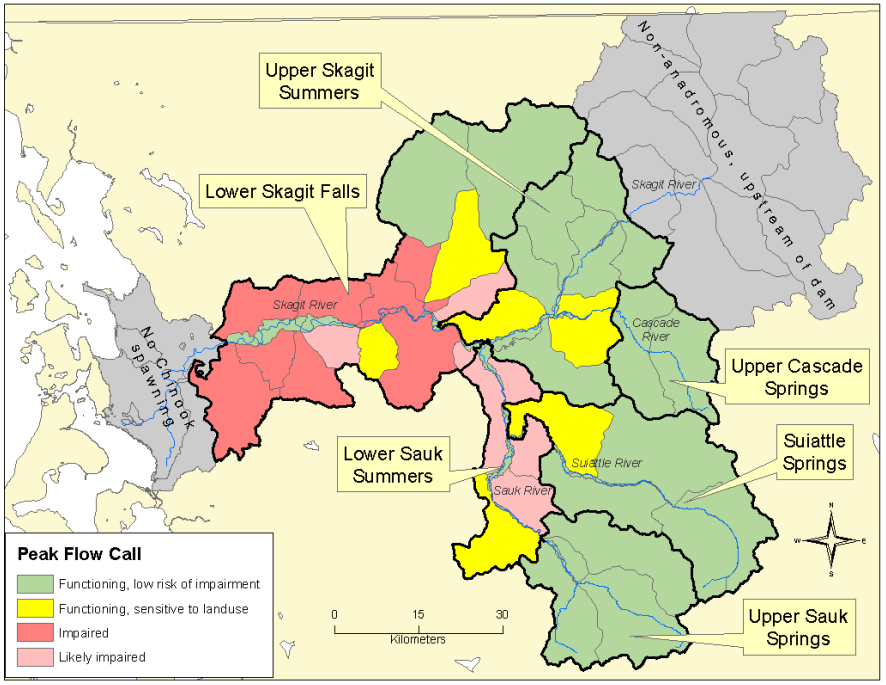


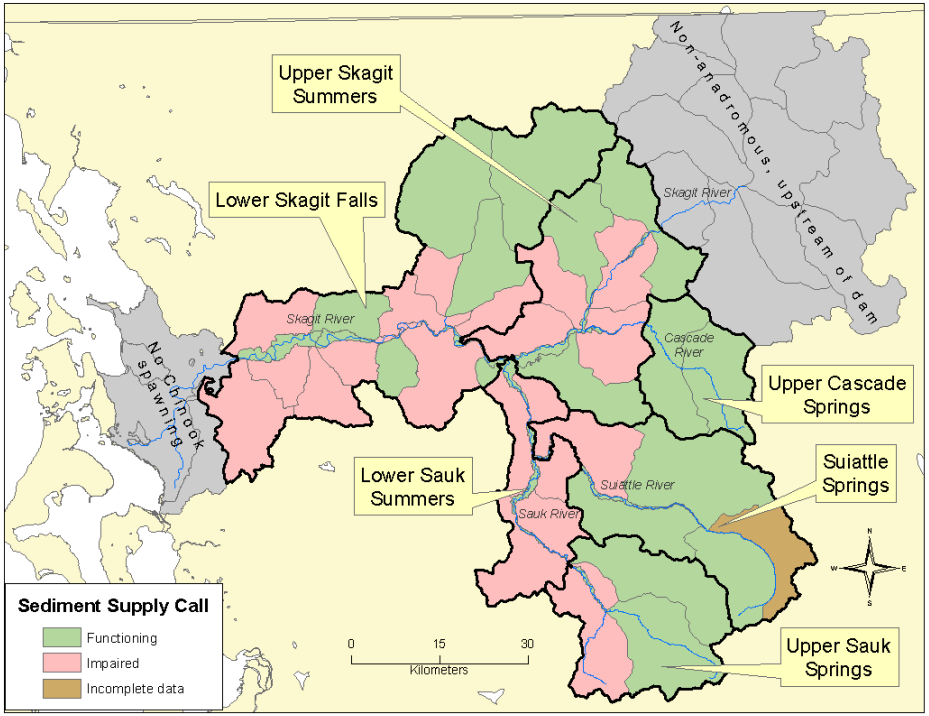
- Flood events trigger salmon mortality but watershed conditions vary the overall result.
- Impaired peak flow hydrology or sediment supply will contribute to lower egg to fry survival
- Possible mechanisms include:
  - Streambed movement – scour or crush eggs or bury eggs so deep that emergence is not successful
  - Infiltration of fines into egg pockets suffocates eggs

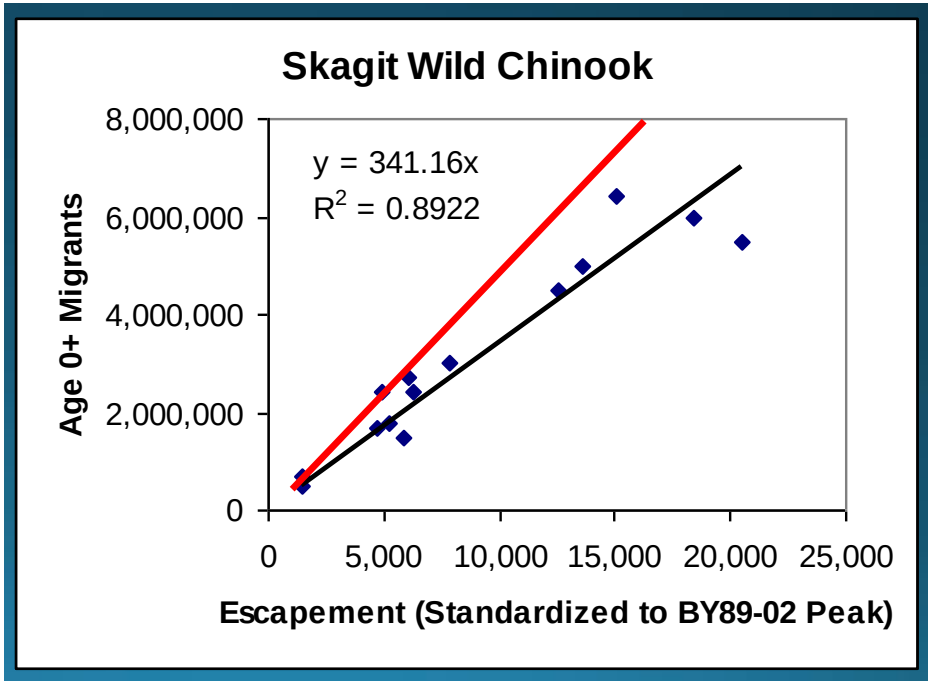
We compared watershed condition data in the Skagit to the North Fork Stillaguamish River where peak flows have increased over the period of record giving us a tool to estimate the effect of changed peak flow hydrology on egg to migrant fry survival.

Current egg to migrant fry survival is 341 fry per spawner.

Restored is 435 fry per spawner.







Egg to fry survival recovery actions:

- restore sub-basins where flood hydrology and sediment dynamics are impaired (higher than normal)

Achieved by reconstructing or decommissioning roads in mountain basins dealing with sediment potential and hydrology (stream channel compounding)

- Forest and Fish laws for industrial landowners will restore some watersheds
- Restoration is needed on federal forest lands and smaller landownerships of private lands

Note: The SRP doesn't advocate flood protection to improve egg to fry survival because flood events create and maintain other habitats important to Chinook salmon

Freshwater Rearing (Ch. 10)

Details in Appendix C of SRP

Why do we need Freshwater Rearing Habitat Restoration?

- Current habitat conditions (loss of habitat area and identification of significant gaps in rearing opportunity)
- Current biological mechanisms (evidence of a freshwater rearing limitation)
- Leads to large river floodplain and alluvial fan restoration to restore natural processes that create and maintain habitats used by juvenile Chinook
- Used intrinsic capacity model to predict benefits of individual candidate restoration projects

Freshwater Rearing Habitat Conditions

Skagit Non-tidal Delta:

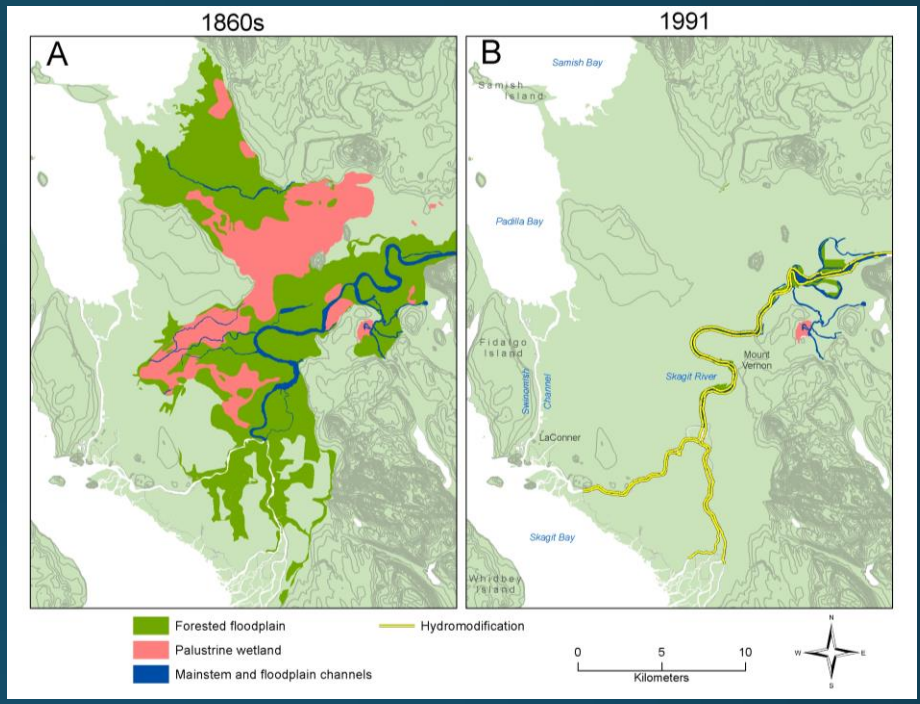
- 98% loss of area where freshwater rearing habitat could form

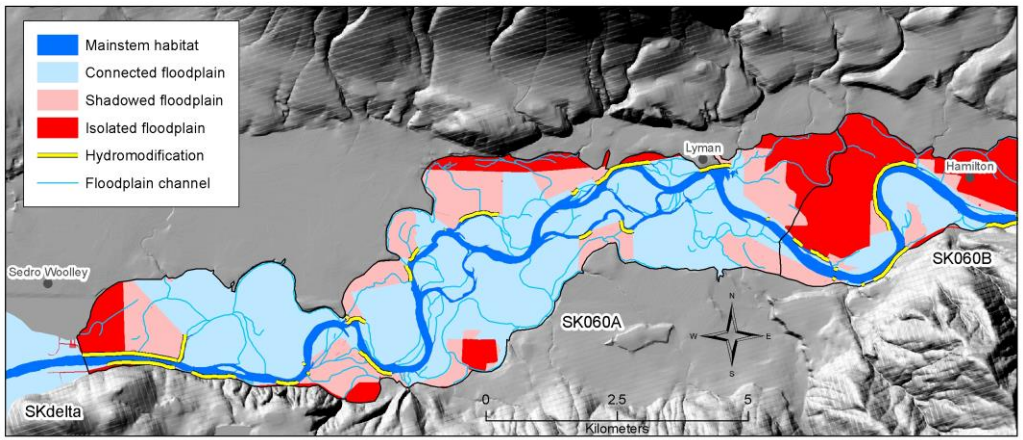
Large River floodplains & channels:

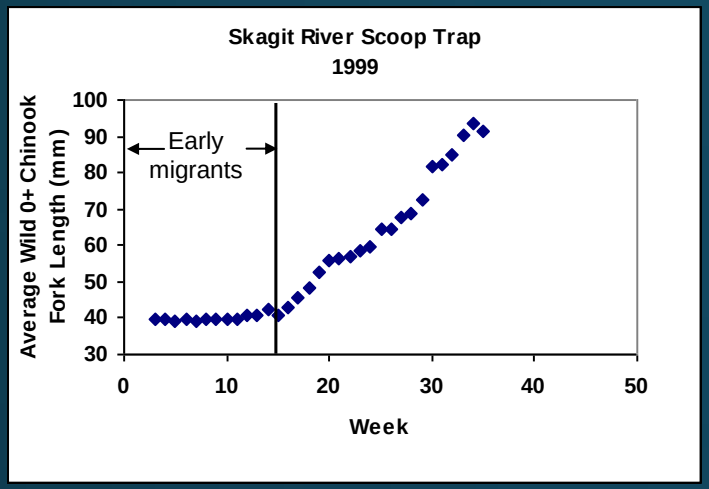
- 31% loss of floodplain isolated or shadowed from river hydrology
- 17% of large river edge is hardened (riprap)
- loss of off channel length, backwater area, and natural bank habitat

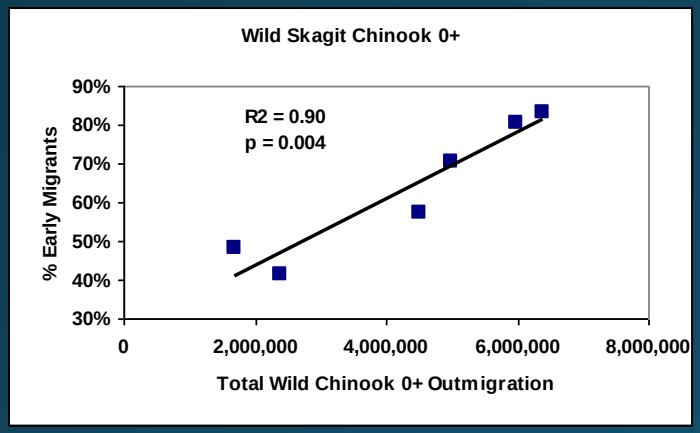
Overall:

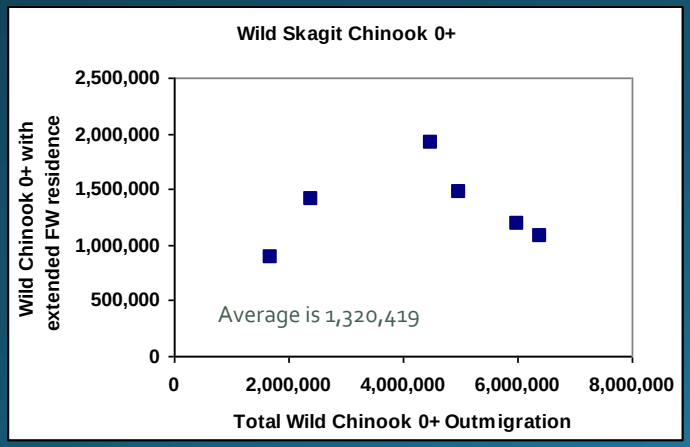
- Reductions in floodplain area and streambank hardening has reduced juvenile Chinook habitat capacity and created gaps in significant rearing opportunity











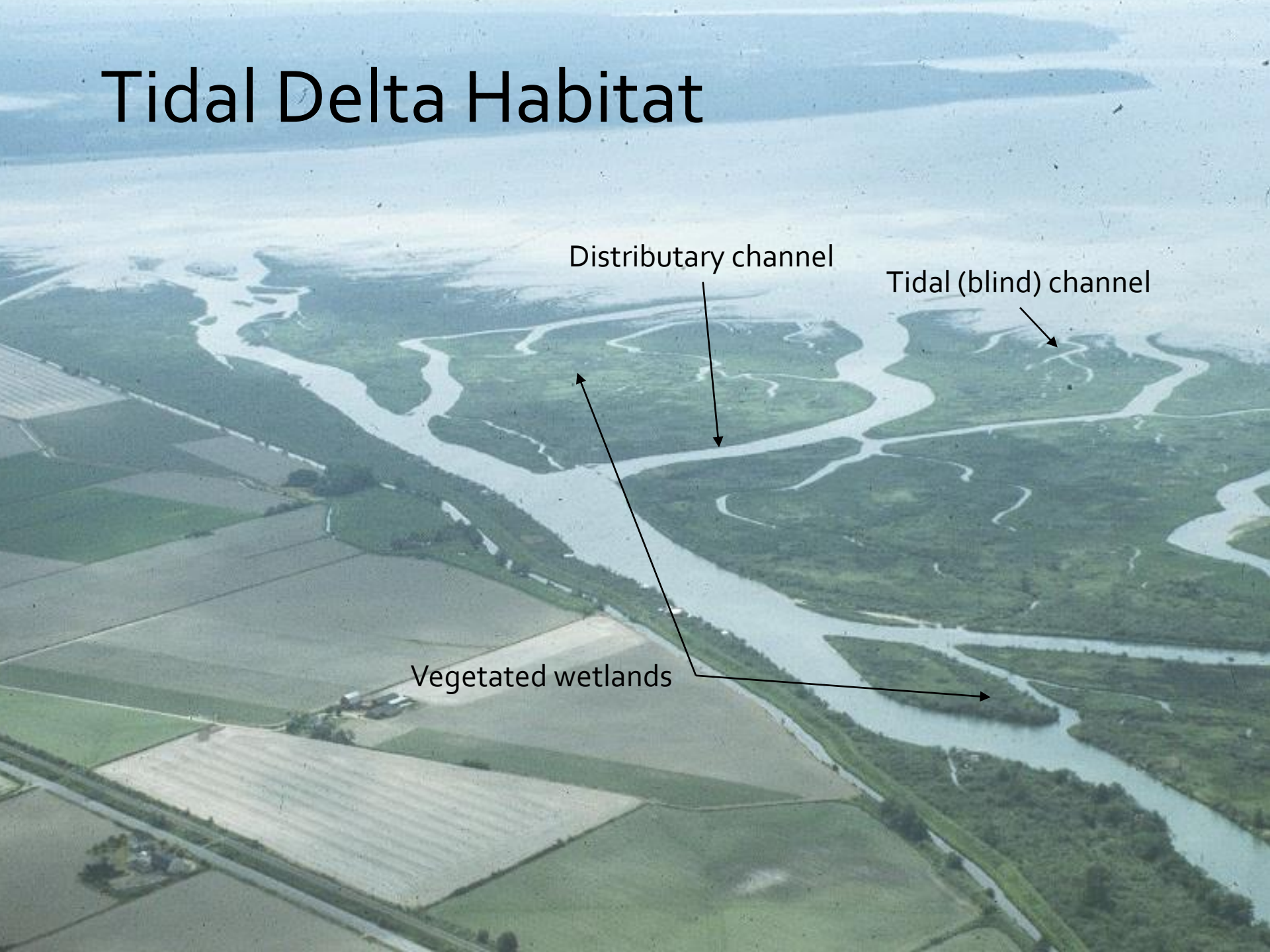
Freshwater Rearing:

- Observed increase in the number of fry that migrate early as a response to increased freshwater population size (evidence for density dependent migration)
- The number of parr migrants averages about 1.3 million per year.
- We estimate the number of yearling migrants at about 107,000 per year based on scale data taken from spawners expanded by marine survival.

Tidal Delta (Ch. 11) & Nearshore (Ch. 12) Rearing (aka, estuary rearing)

Details in Appendix D of SRP

Tidal Delta Habitat



Pocket Estuary Habitat

(example: Lone Tree Lagoon)

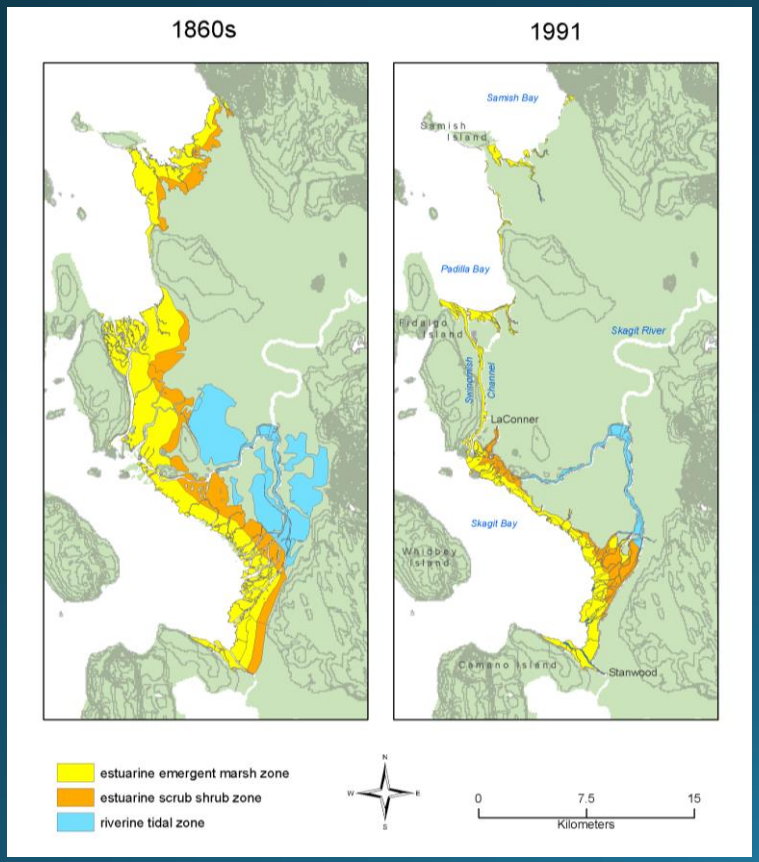
Why do we need Estuary Restoration?

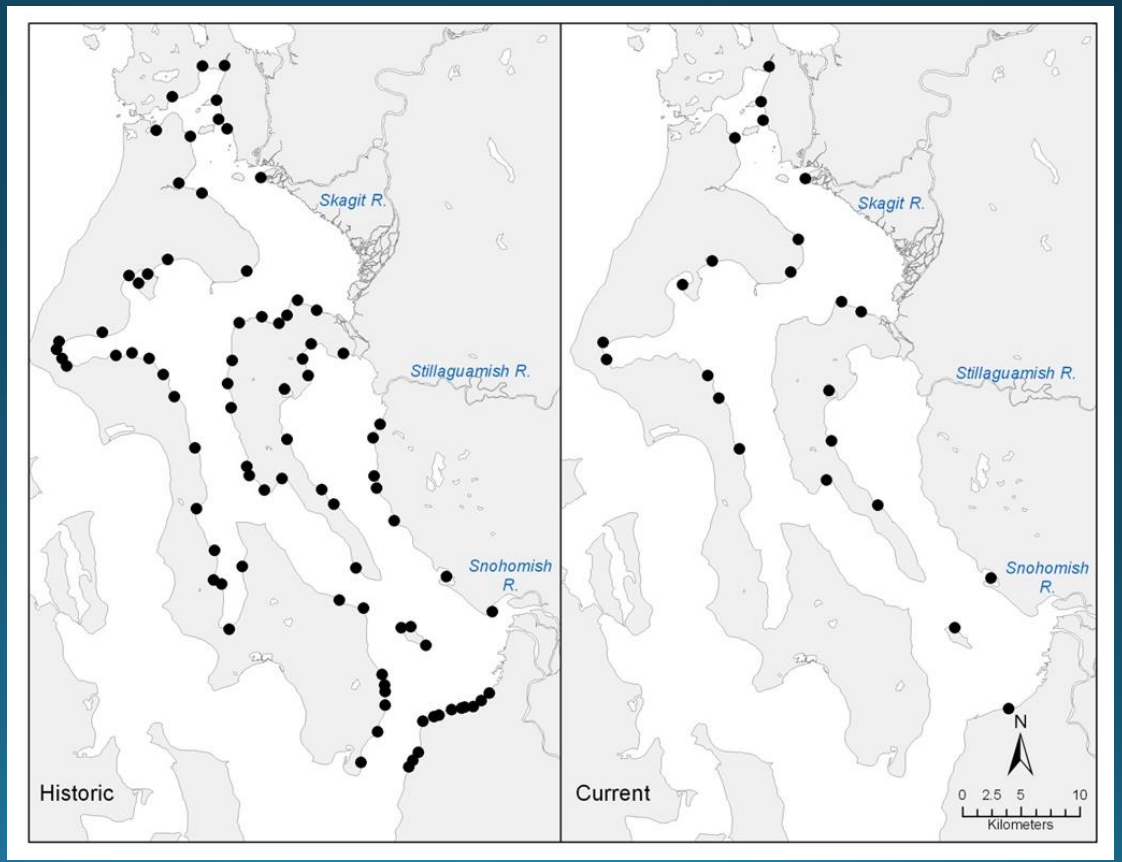
- Current habitat conditions
- Current biological mechanisms
- Migration pathways

- Leads to delta and pocket estuary restoration
- Use stock-recruit carrying capacity model to predict benefits of individual candidate restoration projects

Skagit Tidal Delta & Pocket Estuary Habitat Change

- Both are smaller in area & fragmented
- Tidal delta: 88% loss of habitat fish use directly
- Pocket estuaries: 86% loss in habitat fish use directly

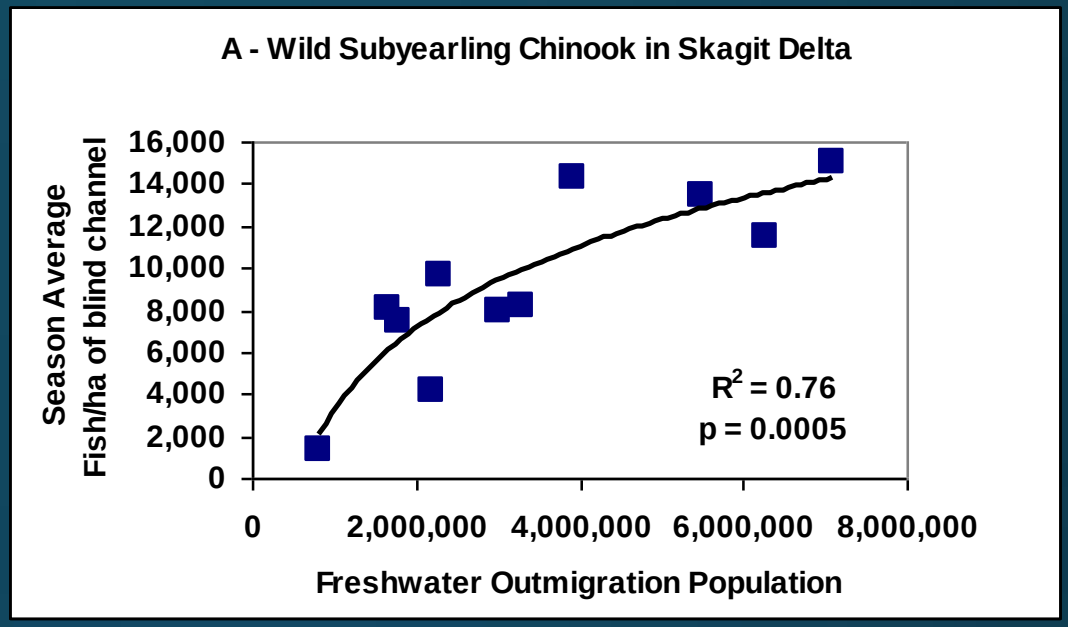


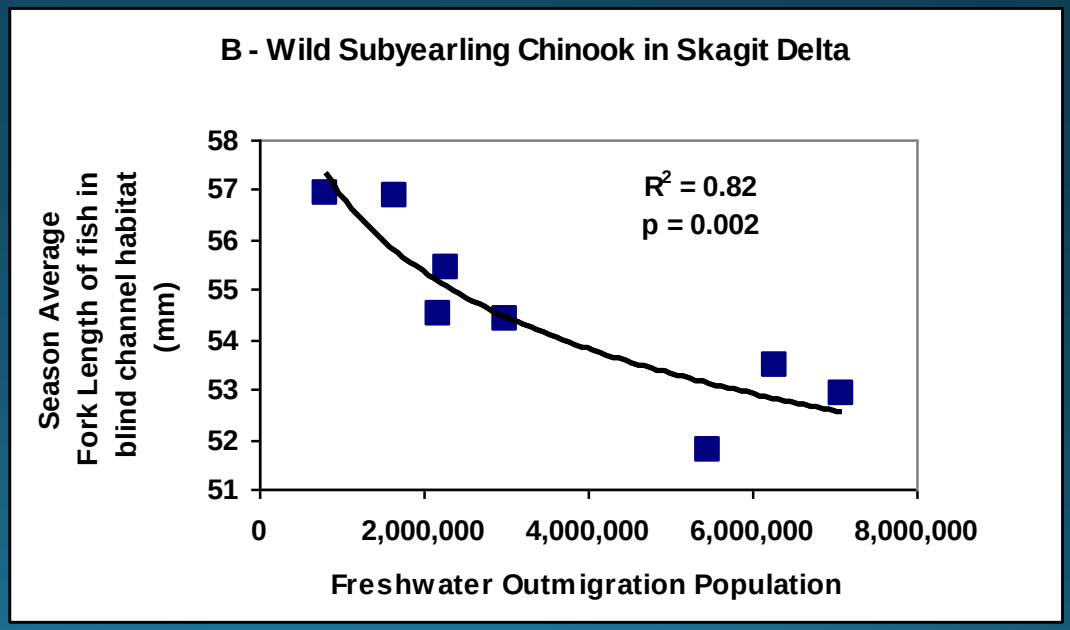


Density dependence in the tidal delta

- The relationship between freshwater outmigration population and juvenile Chinook abundance in delta habitat is asymptotic

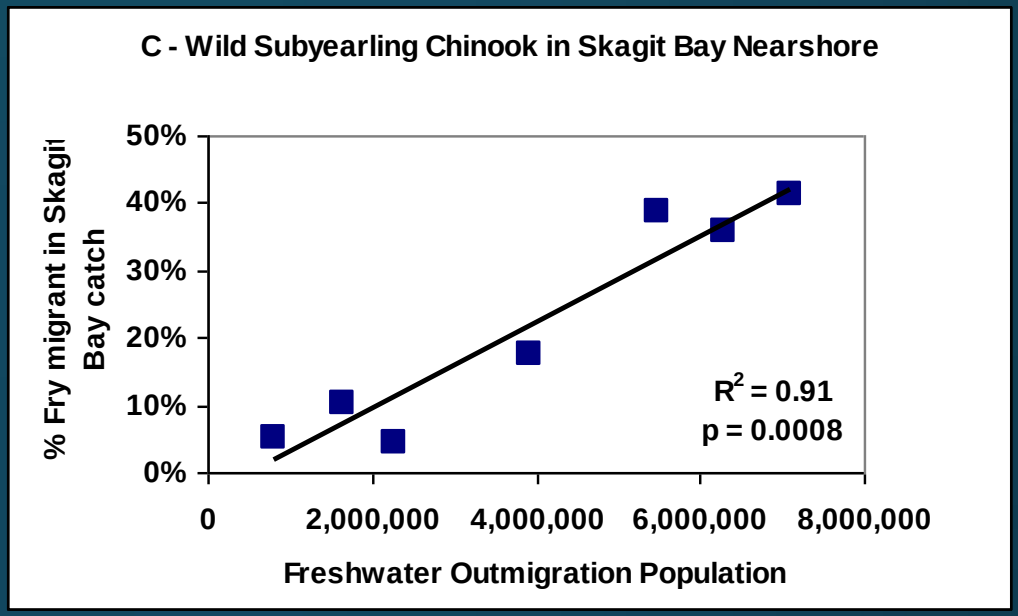
- The size of Chinook in delta habitat decreases as a function of freshwater outmigration





Nearshore

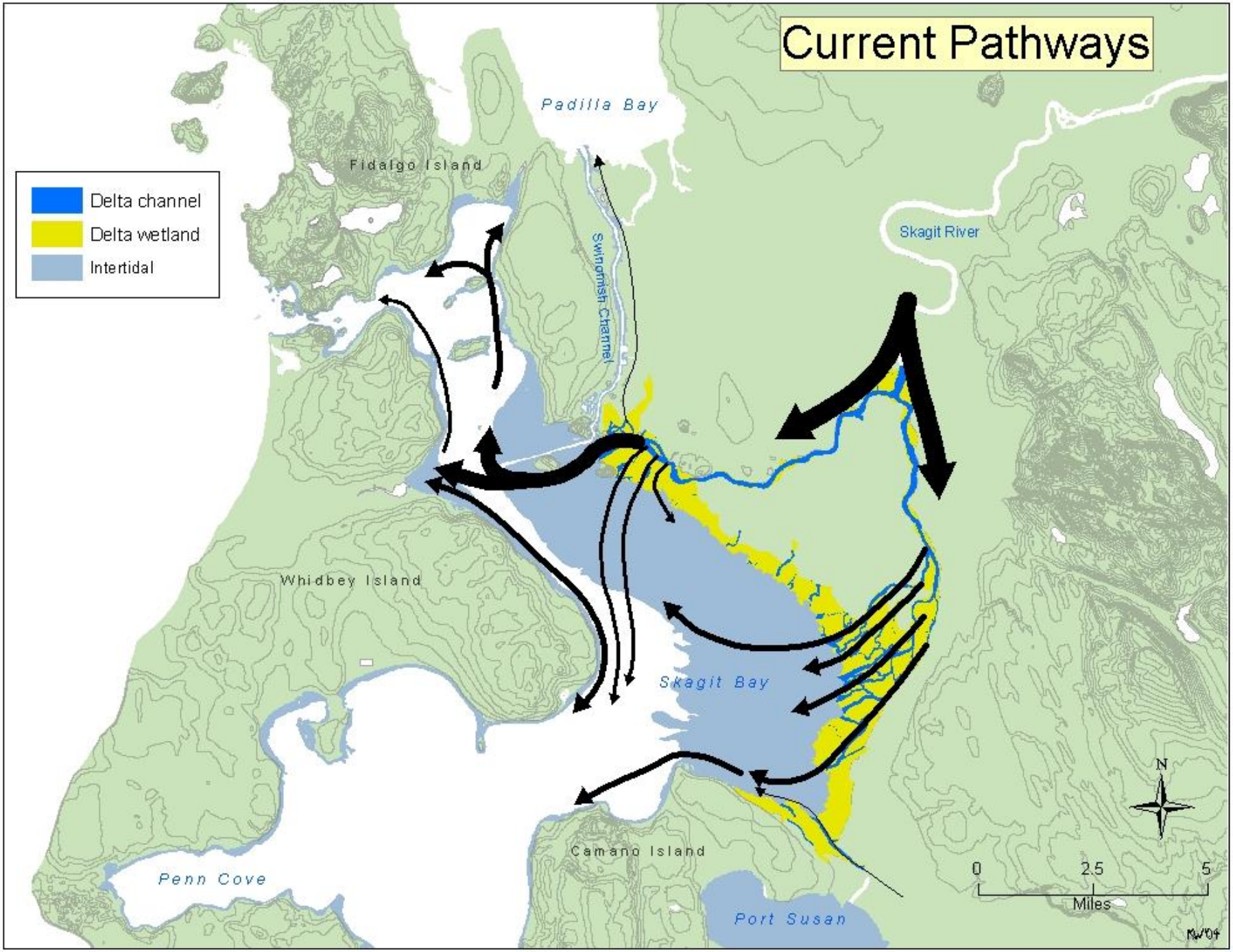
•The proportion of fry migrants increases as a function of freshwater smolt outmigration population size (density dependent movement in the delta)

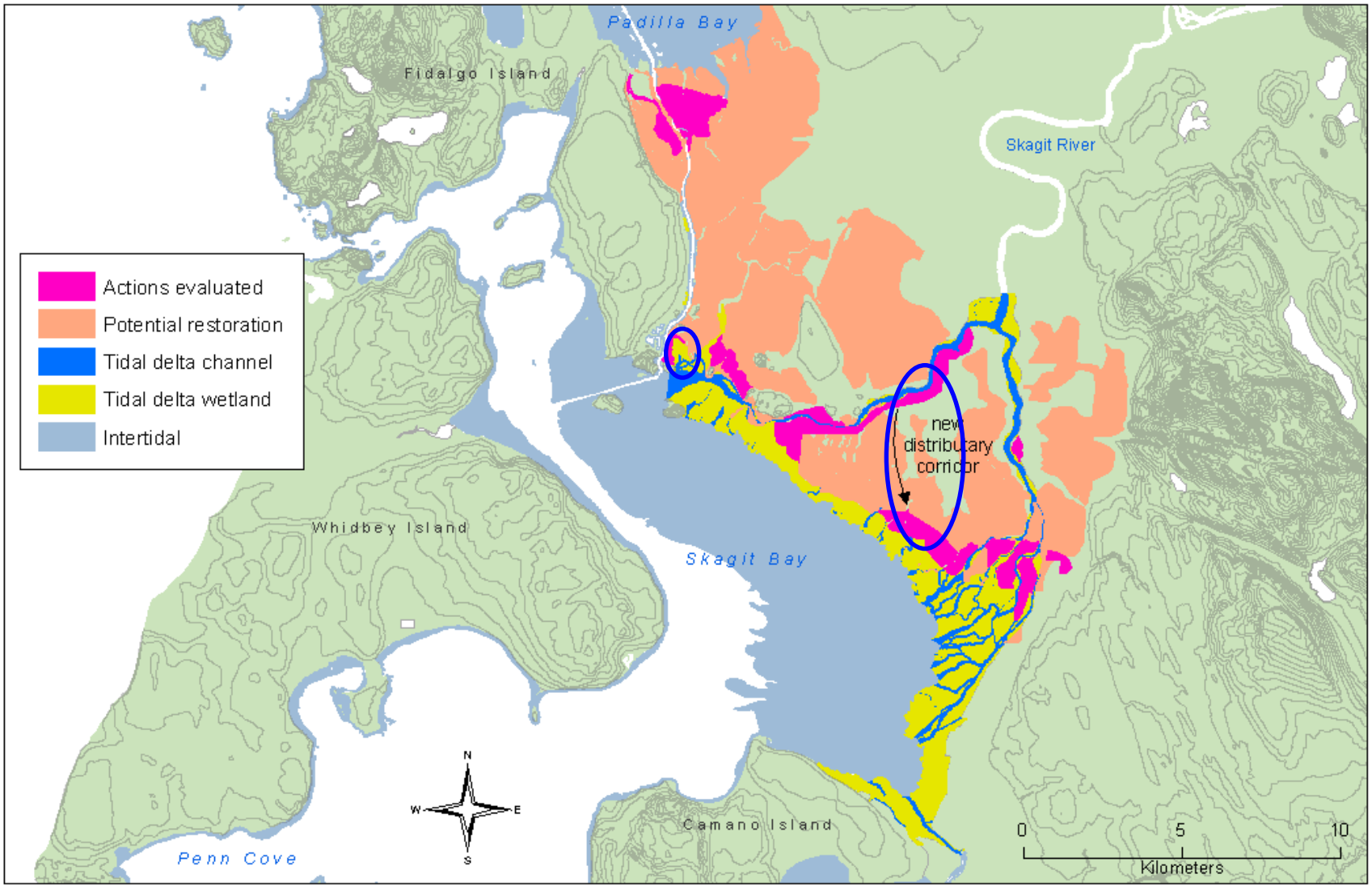


Where do they go in the nearshore?

•Wild Chinook fry accumulate in pocket estuaries (and small streams) from January through May

- increased growth
- refuge from predators


Current Pathways
Delta channel
Delta wetland
Intertidal
Padilla Bay
Fidalgo Island
Swinomish Channel
Skagit River
Whidbey Island
Skagit Bay
Camano Island
Penn Cove
Port Susan
N
0
2.5
5
Miles
MW04


Padilla Bay
Fidalgo Island
Skagit River
Actions evaluated
Potential restoration
Tidal delta channel
Tidal delta wetland
Intertidal
new distributary corridor
Whidbey Island
Skagit Bay
N
W
E
S
Camano Island
Penn Cove
0
5
10
Kilometers

P


Padilla Bay
Fidalgo Island
Similk Beach
Turners Bay
Skagit River
Kiket Lagoon
Lone Tree Lagoon
SneeOosh Lagoon
Ala Lagoon
Dugualla Lagoon
Dugualla Bay Heights
Whidbey Island
Skagit Bay
Crescent Harbor
Mariners Cove
Arrowhead Lagoon
English Boom Lagoon
Camano Island
Penn Cove
Delta channel
Delta wetland
Intertidal
N
W
E
S
0
5
10
Kilometers

Predicted Effectiveness of Plan (Chapter 16)

Result – The SRP goals are not necessarily reached with *quantified* actions in plan

Discussion

- There are actions in the SRP that are *not quantified* that we assume will have recovery benefits.
- More freshwater rearing habitat projects are likely necessary
- We strongly advocate follow a restoration paradigm that restores landscape processes; and increases habitat connectivity & complexity (should generate productivity benefits – not currently quantified)

Conclusion - We believe the plan (if implemented) will achieve the SRP goals

Compared at MSY

Recruitment

Marine Survival	Recovery Goal (Adults per Year)	Before Plan Actions		After Plan Actions		Percent Change
		Adults per Year	Percent of Goal	Adults per Year	Percent of Goal	
Low regime	40,600	20,369	50.2%	29,252	**72.0%**	+21.9%
High regime	124,000	59,774	48.2%	85,844	**69.2%**	+21.0%

Productivity

Marine Survival	Recovery goal for recruits (Adults per Spawner)	Before Plan Actions		After Plan Actions		Percent Change
		Adults per Spawner	Percent of goal	Adults per Spawner	Percent of goal	
Low regime	3.4	1.7	50.2%	2.5	**72.0%**	+21.9%
High regime	5.8	5.1	86.8%	7.3	**124.6%**	+37.9%

Compared at Equilibrium

Recruitment

Marine Survival	Recovery Goal (Adults per Year)	Before Plan Actions		After Plan Actions		Percent Change
		Adults per Year	Percent of Goal	Adults per Year	Percent of Goal	
Low regime	52,430	28,611	54.6%	39,767	**75.8%**	+21.3%
High regime	145,100	83,962	57.9%	116,700	**80.4%**	+22.6%

Productivity

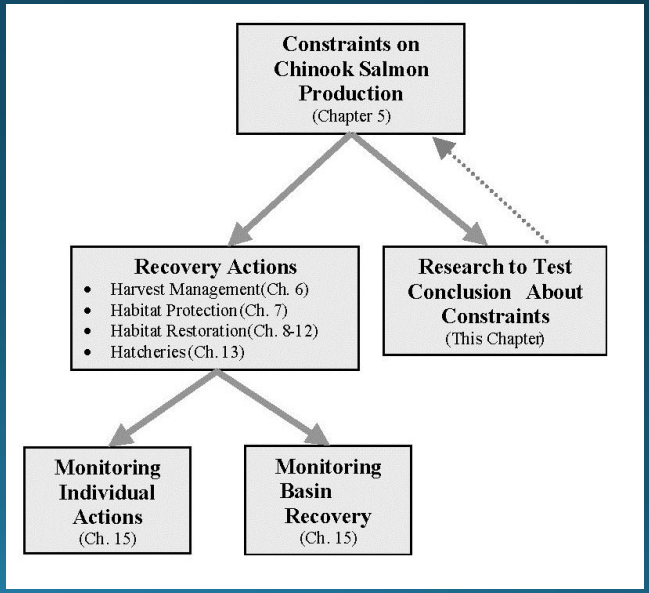
Marine Survival	Recovery goal for recruits (Adults per Spawner)	Before Plan Actions		After Plan Actions		Percent Change
		Adults per Spawner	Percent of goal	Adults per Spawner	Percent of goal	
Low regime	1.0	0.5	54.6%	0.8	**75.8%**	+21.3%
High regime	1.0	1.6	160.1%	2.2	**222.6%**	+62.4%

Actions in Chapter 7 that provide positive recovery benefits (not just protecting 2005 status of habitat)

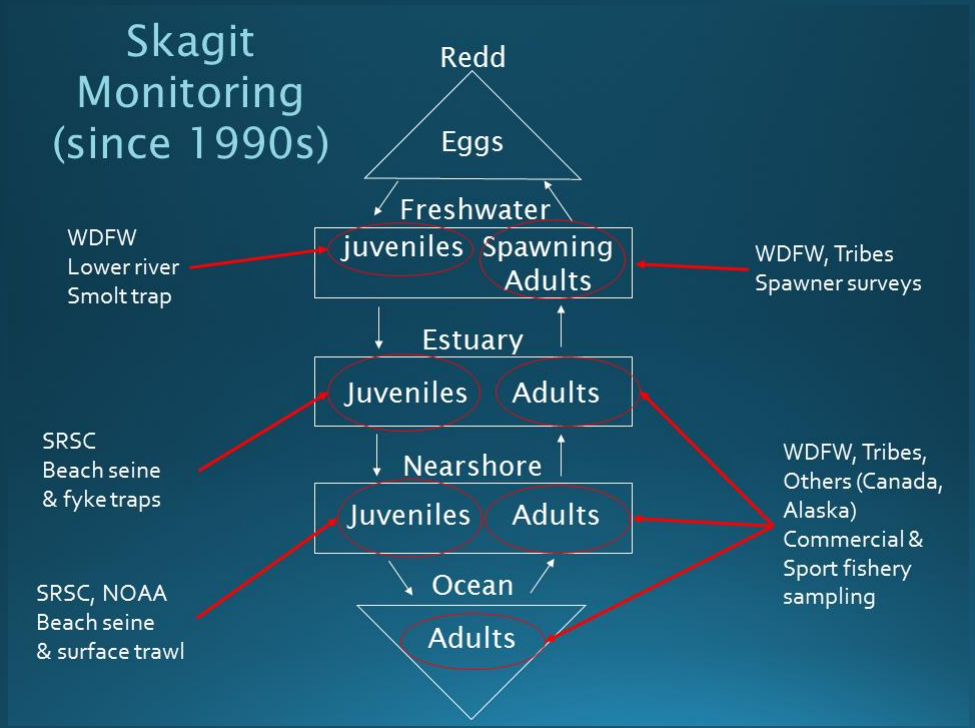
- Rec 8 – Baker hydropower relicensed flows
- Rec 13 – Skagit flood control (potential to improve conditions)
- Recs 14 and 15 – Forest practices (already modeled benefit for basins with Industrial Land Owners)
- Rec 17 – Agricultural Practices and/or Riparian Protection Act
- Rec 18 – TMDL's for Chinook streams
- Rec 19 – Drainage maintenance plans per Skagit Drainage and Fish Initiative
- Rec 21 – Modify Shorelines Management Act
- Rec 22 – Increased water quality improvement funding
- Rec 29 – LWD and bridges
- Rec 40 – Stream buffer regulations
- Rec 41 – Critical Area Ordinances
- Rec 42 – Funding for CREP
- Rec 52 – Enforce hydraulic code
- Rec 53 – Provide fish passage at culverts

Knowledge Gaps & Learning

- Research (Ch 14) & Monitoring (Ch 15)
- Approach is meant to be adaptive
- Approach is applied at various scales/forums
  - Skagit watershed, Region/ESU
  - FERC, For/Fish, Harvest & Hatchery regulatory forums
  - Role of SWC MAM Committee
- Broad and specific biological and habitat monitoring
- A few specific learning topics examples
  - Whidbey Basin Pocket Estuaries
  - Yearling Chinook life history
  - Protecting 2005 habitat status (tidal delta status/trends example)
  - Pinniped predation

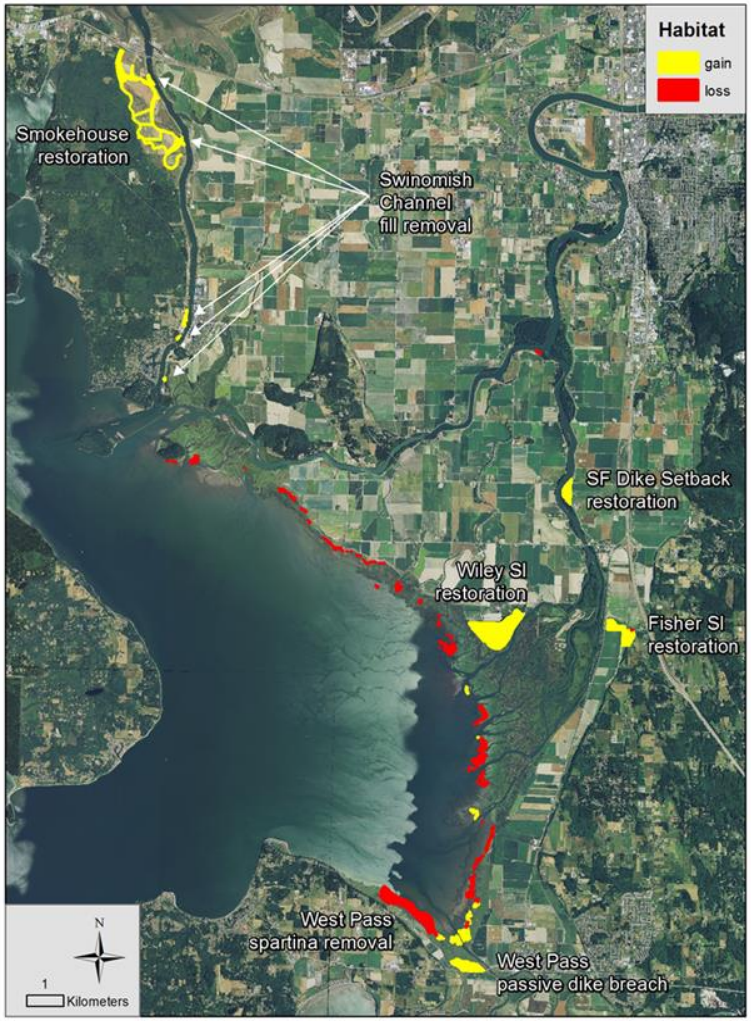


Comprehensive life stage biological monitoring

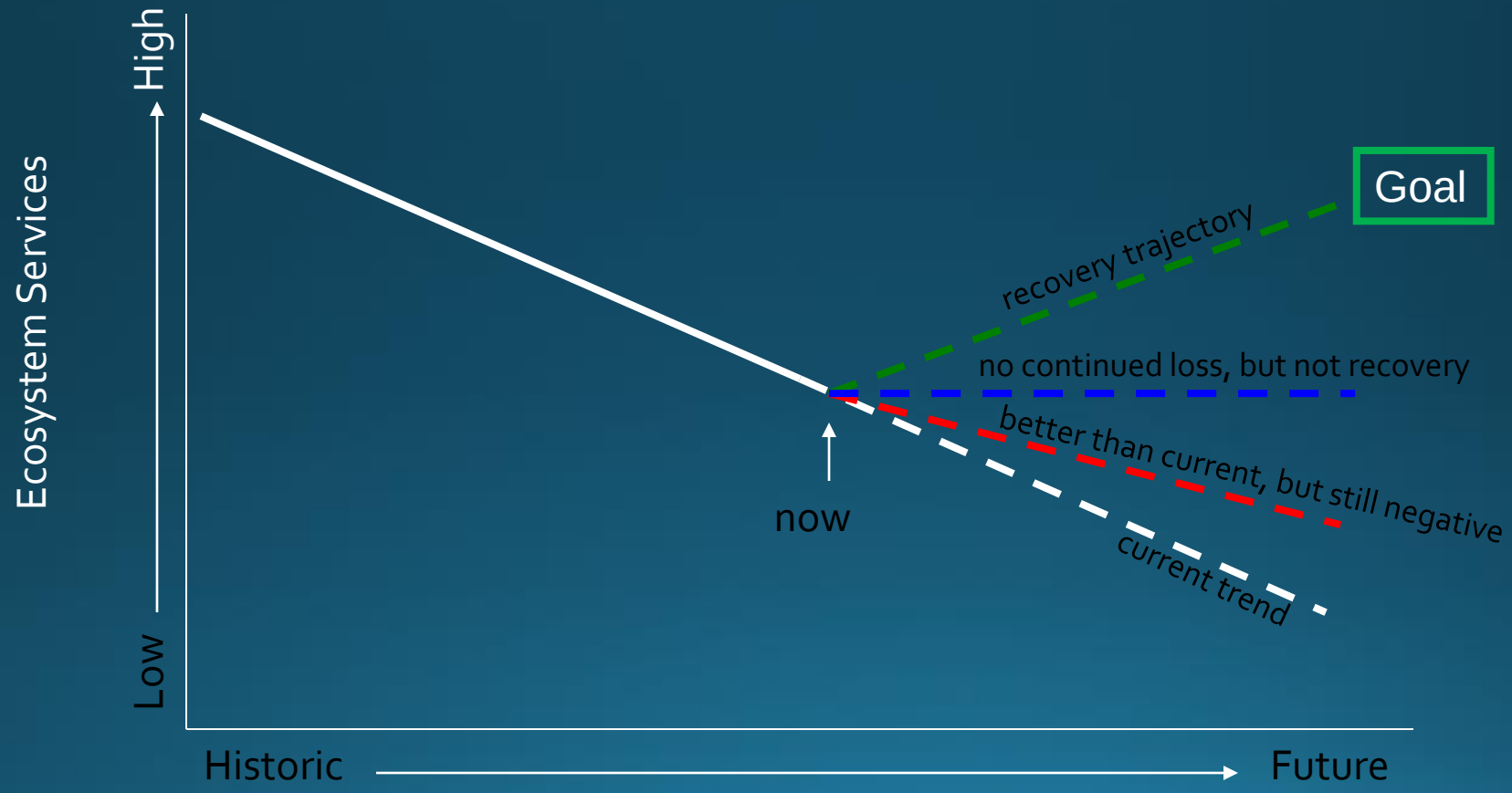


Example of a habitat S/T monitoring result

Skagit estuary gains/loss 2004-2013



Reminder of SRP Intent when in the weeds of planning and implementing recovery actions



New research findings or ideas: are they useful or a distraction?

- Skagit SRP is open to alternate actions and/or adjustments to actions but not without evidence and connection the SRP
- SRP adaptations occur through adaptive management processes

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