



Steelhead Diversity in Puget Sound Streams

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- Importance of diversity to steelhead populations
- List and categorize basins monitored for juvenile steelhead
- Summarize age, size at age and timing of smolts
- Future conditions and likely change



Acknowledgements:

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Location	Agency
Skagit Mainstem	WDFW
Bacon Creek (Skagit)	WDFW/ Upper Skagit Indian Tribe
Illabot Creek (Skagit)	WDFW/ Upper Skagit Indian Tribe
Finney Creek (Skagit)	WDFW/ Upper Skagit Indian Tribe
Hansen Creek (Skagit)	WDFW/ Upper Skagit Indian Tribe
Green River	WDFW
Nisqually River	WDFW
Dungeness	WDFW
Matriotti Creek	James Town S'Klallam Tribe
Big Beef Creed	WDFW
Duckabush River	WDFW
Dewatto River	HCSEG
Tahuya River	HCSEG
Little Quilcene	HCSEG
SF Skokomish	Skokomish Tribe
Hamma Hamma	Long Live the Kings

-Likely more data to pull into this...Nooksack, Stillaguamish, Puyallap, Snow Creek?

Biocomplexity and fisheries sustainability

Ray Hilborn*†, Thomas P. Quinn*, Daniel E. Schindler‡, and Donald E. Rogers*

Population diversity and the portfolio effect in an exploited species

Daniel E. Schindler, Ray Hilborn, Brandon Chasco, Christopher P. Boatright, Thomas P. Quinn, Lauren A. Rogers
& Michael S. Webster

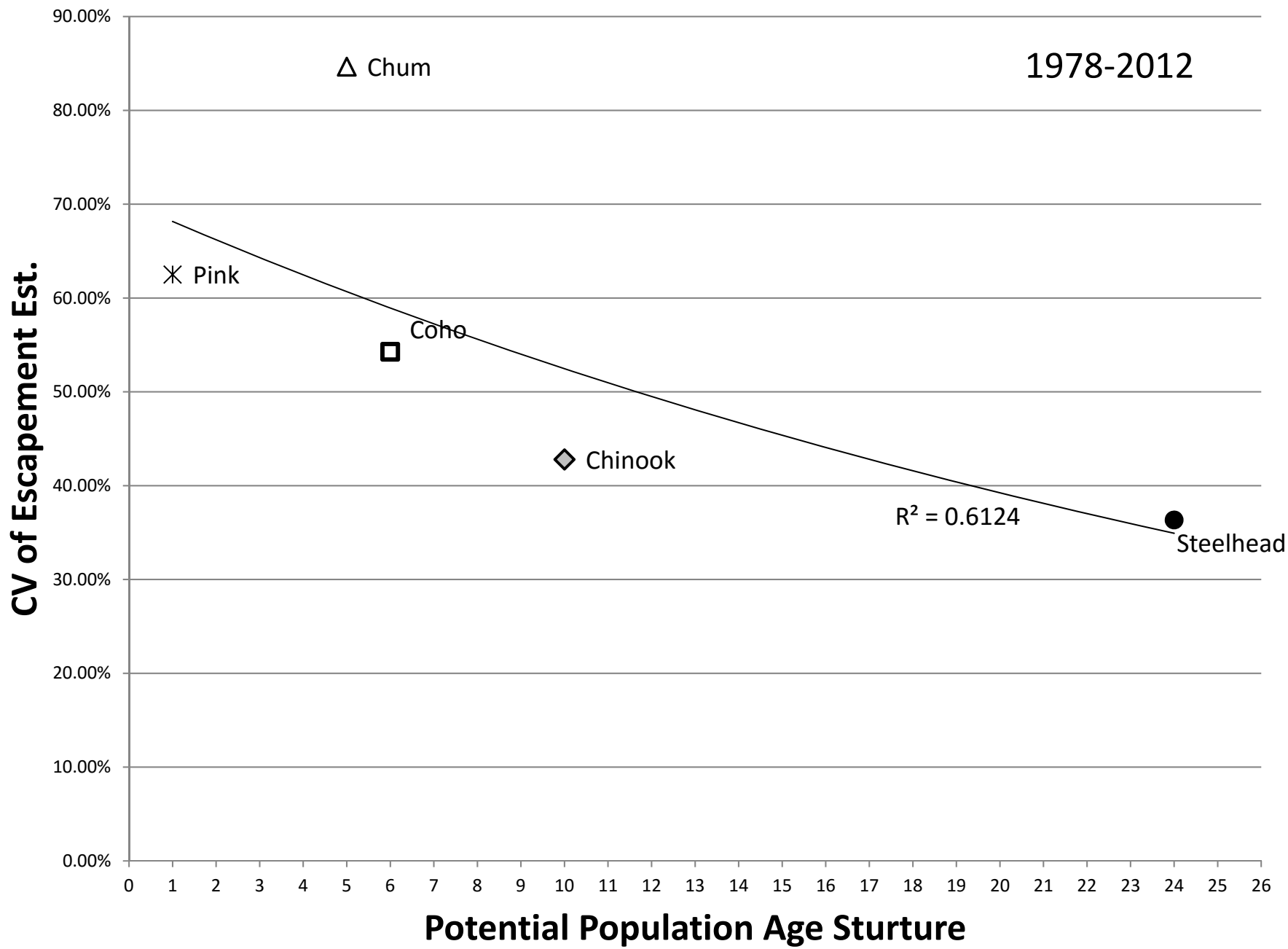
Life-history diversity and its importance to population stability and persistence of a migratory fish: steelhead in two large North American watersheds

Jonathan W. Moore, Justin D. Yeakel, Dean Peard, Jeff Lough and Mark Beere



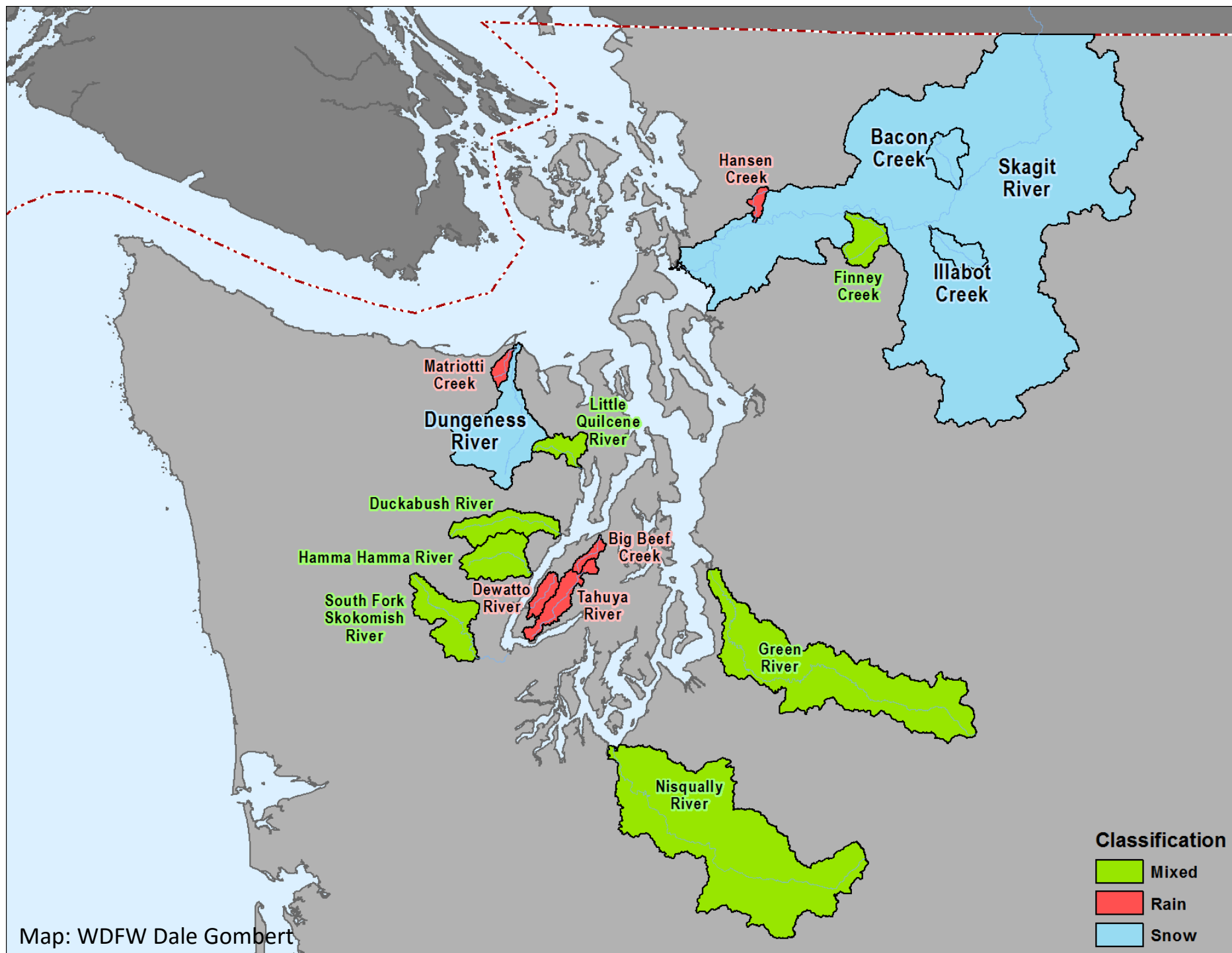
Skagit River Salmonid Population Structure

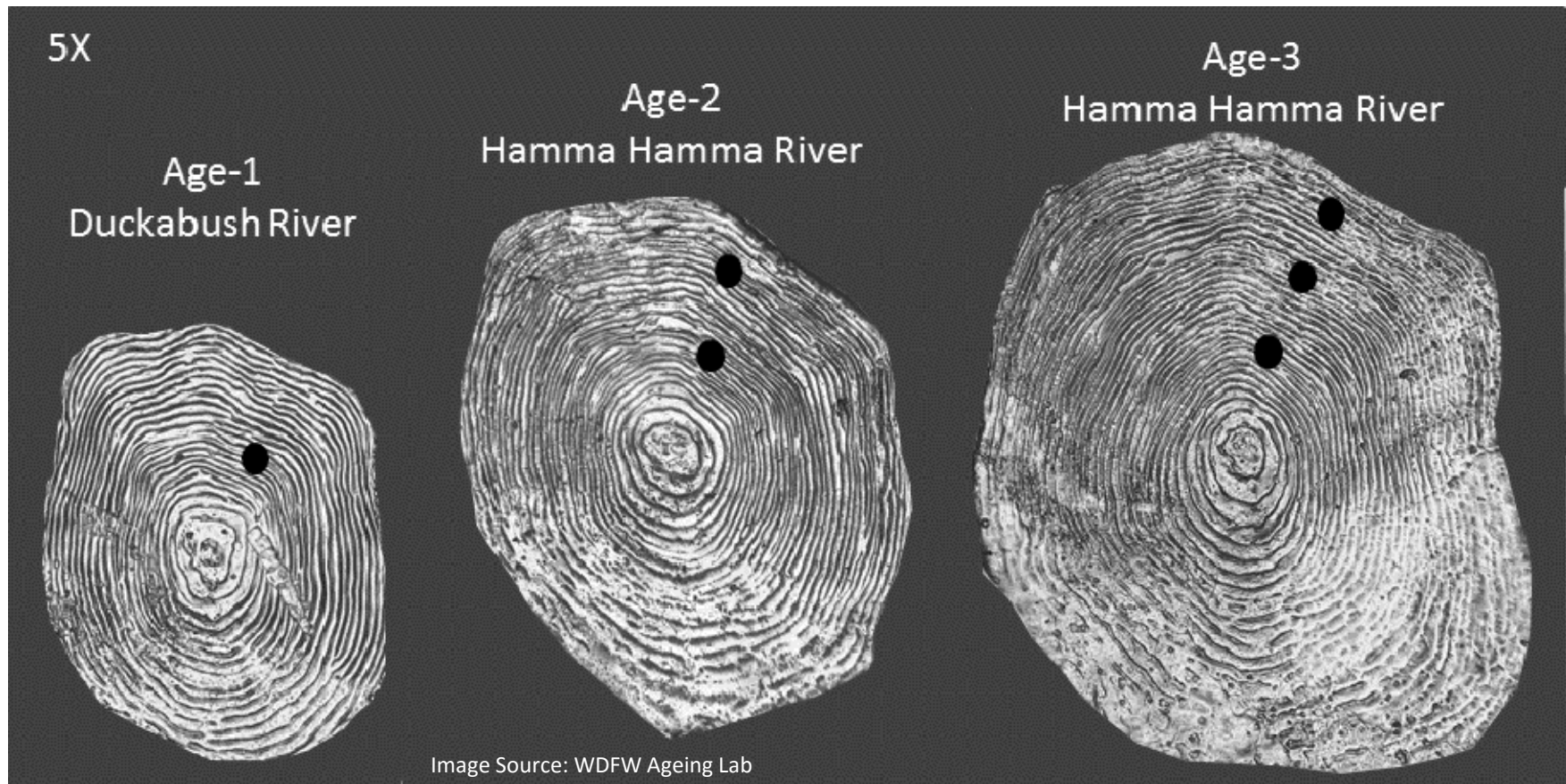
		Steelhead	Chinook	Coho	Chum	Pink
Fresh Water Age/ Juvenile Types	0		x	x	x	x
	1	x	x	x		
	2	x		x		
	3	x				
	4	x				
Saltwater Summers/ Adults Types	Resident	x				
	1 (jack)	x	x	x	x	
	2	x	x	x	x	x
	3	x	x		x	
	4	x	x		x	
	5		x		x	
	repeat spawners	x				
Potential Population age Structure (juv types*adult types)		24	10	6	5	1



Basin Characterization	Mean Basin Elevation	Peak Flow Month
Rain	<1300'	Peak flow late Fall early winter.
Mixed	>1300'<3300'	Two peaks:late fall, spring
Snow	>3300'	Peak Flow in the Spring
Dam Dominated	Various	

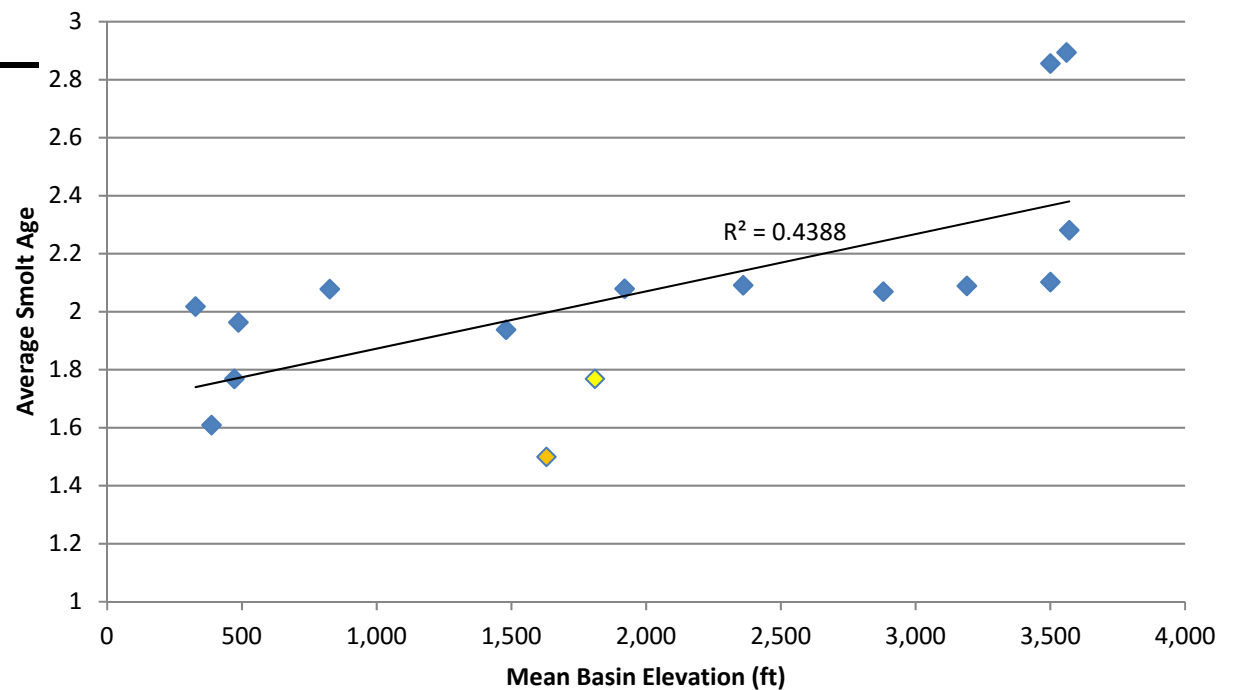






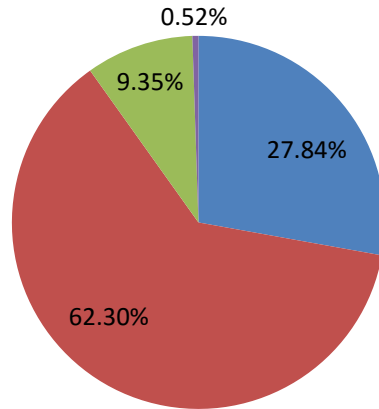
- Age and size data on steelhead smolts
 - Identified smolts by silver coloration, fading or barely visible parr-marks and darkening of dorsal and caudal fin tips.

Stream	Avg. Smolt Age	Mean Basin Elevation in Feet
Matriotti Creek	2.02	328
Dewatto	1.61	387
Tahuya	1.77	472
Big Beef	1.96	487
Hansen Creek	2.08	826
Little Quilcene	1.94	1,480
Green River	1.50	1,630
Nisqually	1.77	1,810
SF Skokomish	2.08	1,920
Finney Creek	2.09	2,360
Hamma Hamma	2.07	2,880
Duckabush	2.09	3,190
Dungeness	2.10	3,500
Illabot Creek	2.86	3,500
Bacon Creek	2.89	3,560
Skagit	2.28	3,570



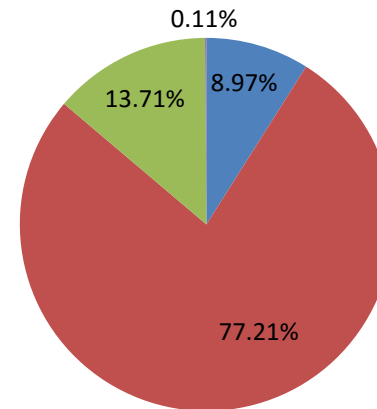
Steelhead Smolt Age By Basin Type

Rain



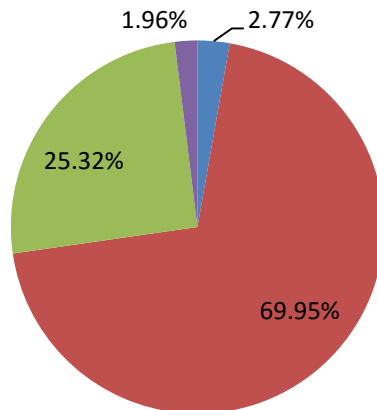
% Age-1
% Age-2
% Age-3
% Age-4

Mixed



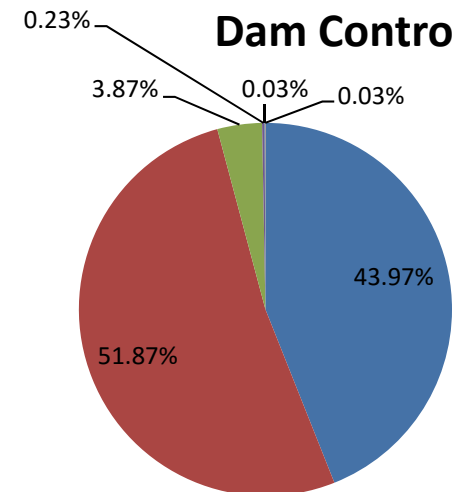
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% Age-3
% Age-4

Snow



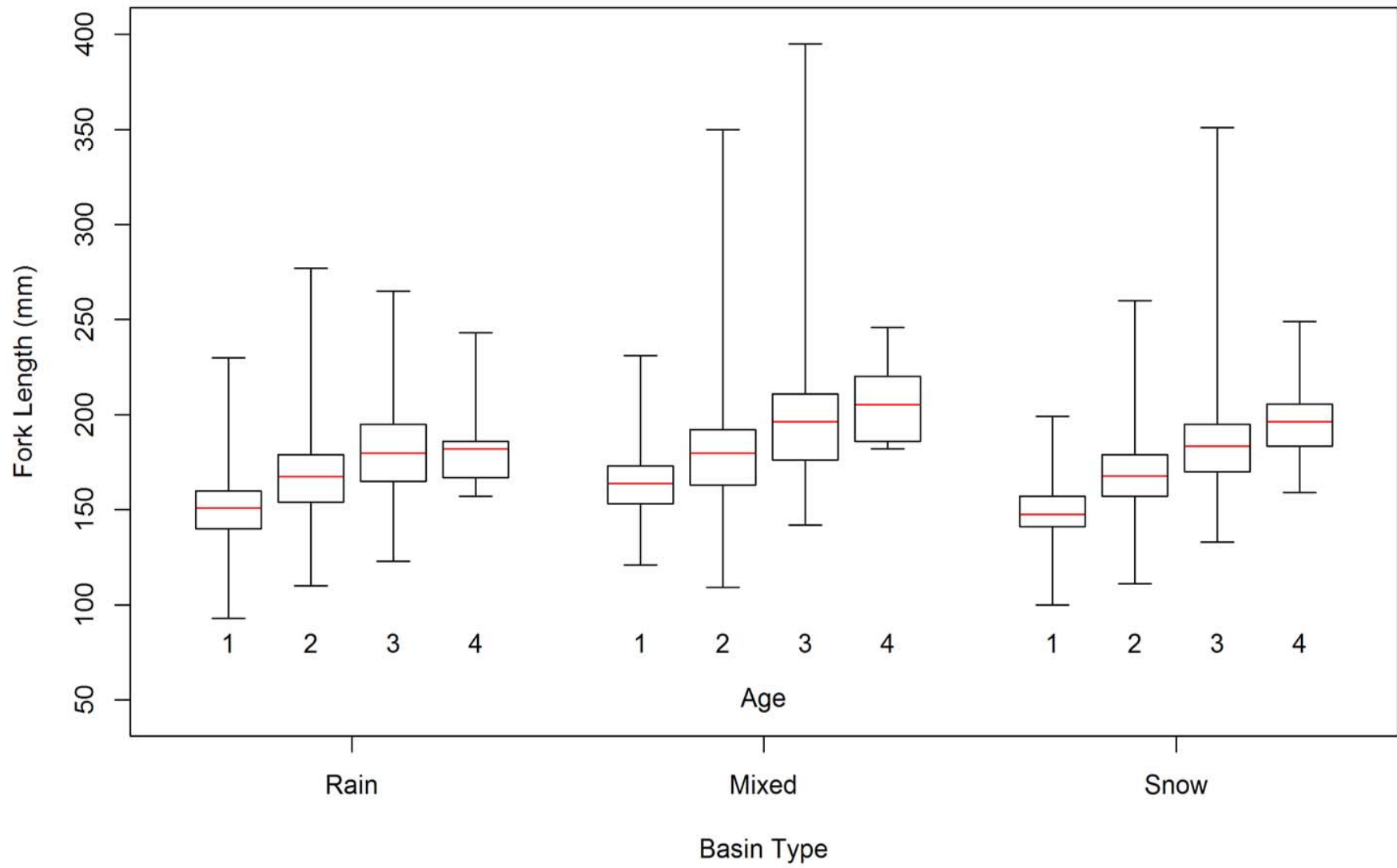
% Age-1
% Age-2
% Age-3
% Age-4

Dam Control

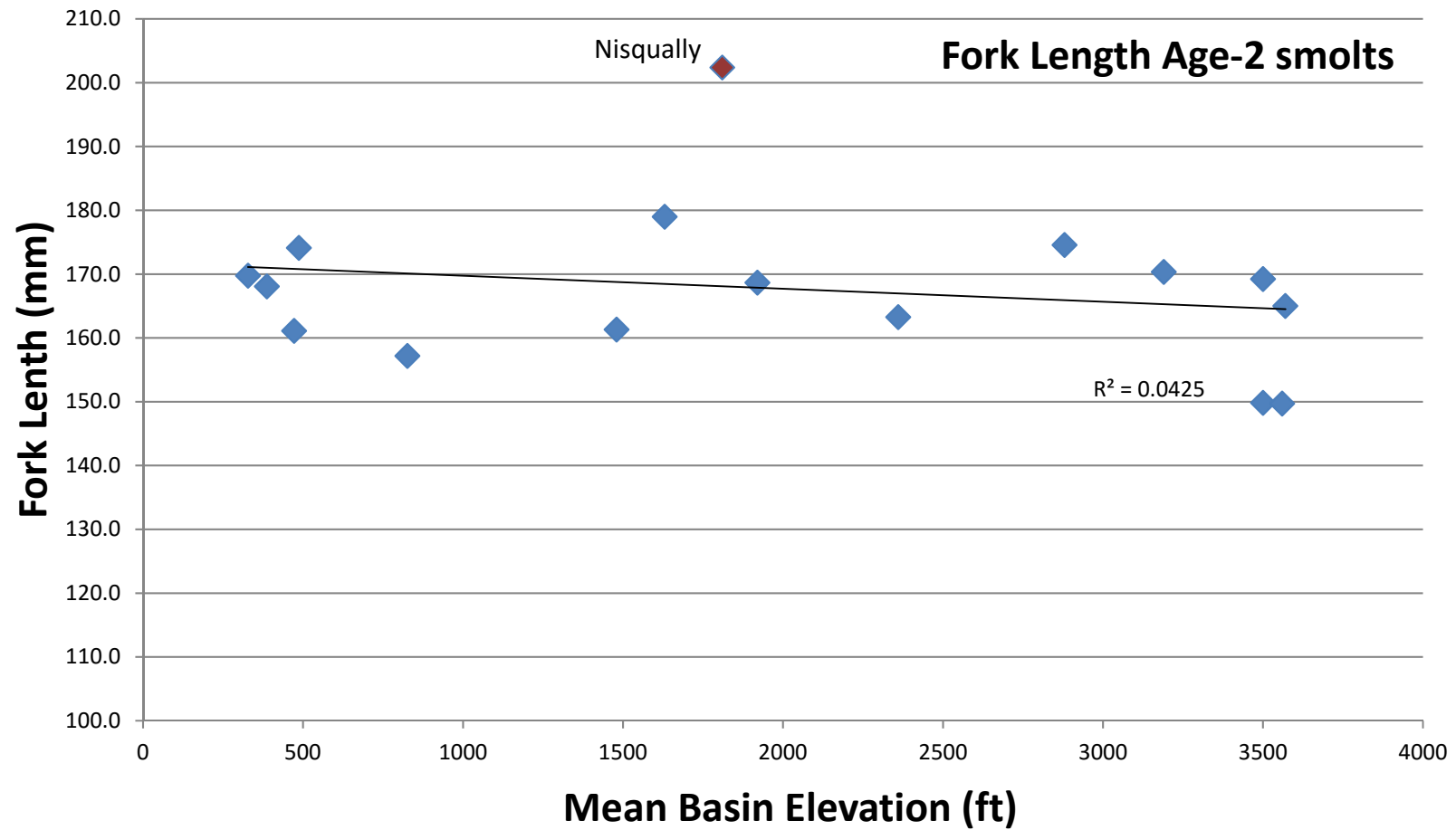


% Age-1
% Age-2
% Age-3
% Age-4
% Age-5
% Age-6

Mean Fork Length(mm) at Age for all Puget Sound Steelhead Smolts

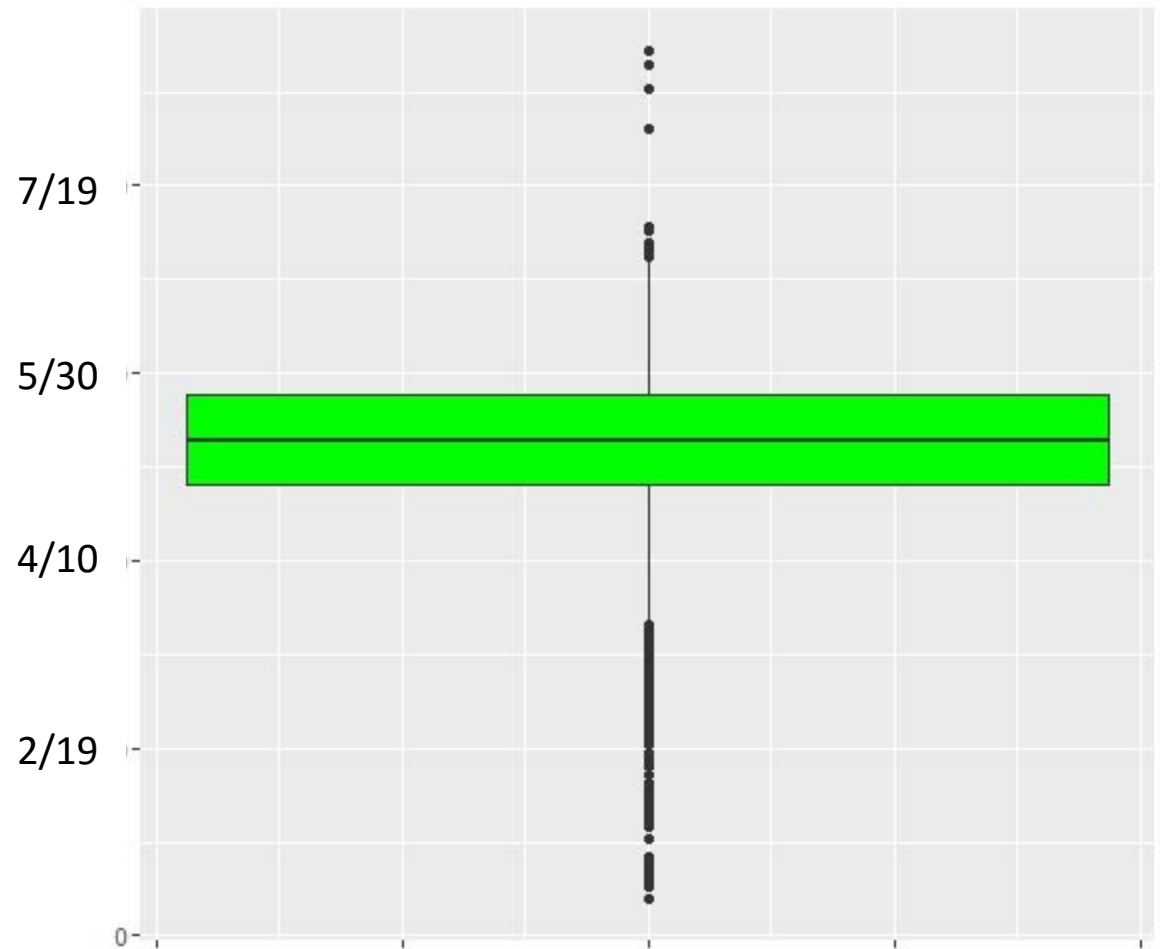


Length of Age-2 Smolts By Basin Elevation



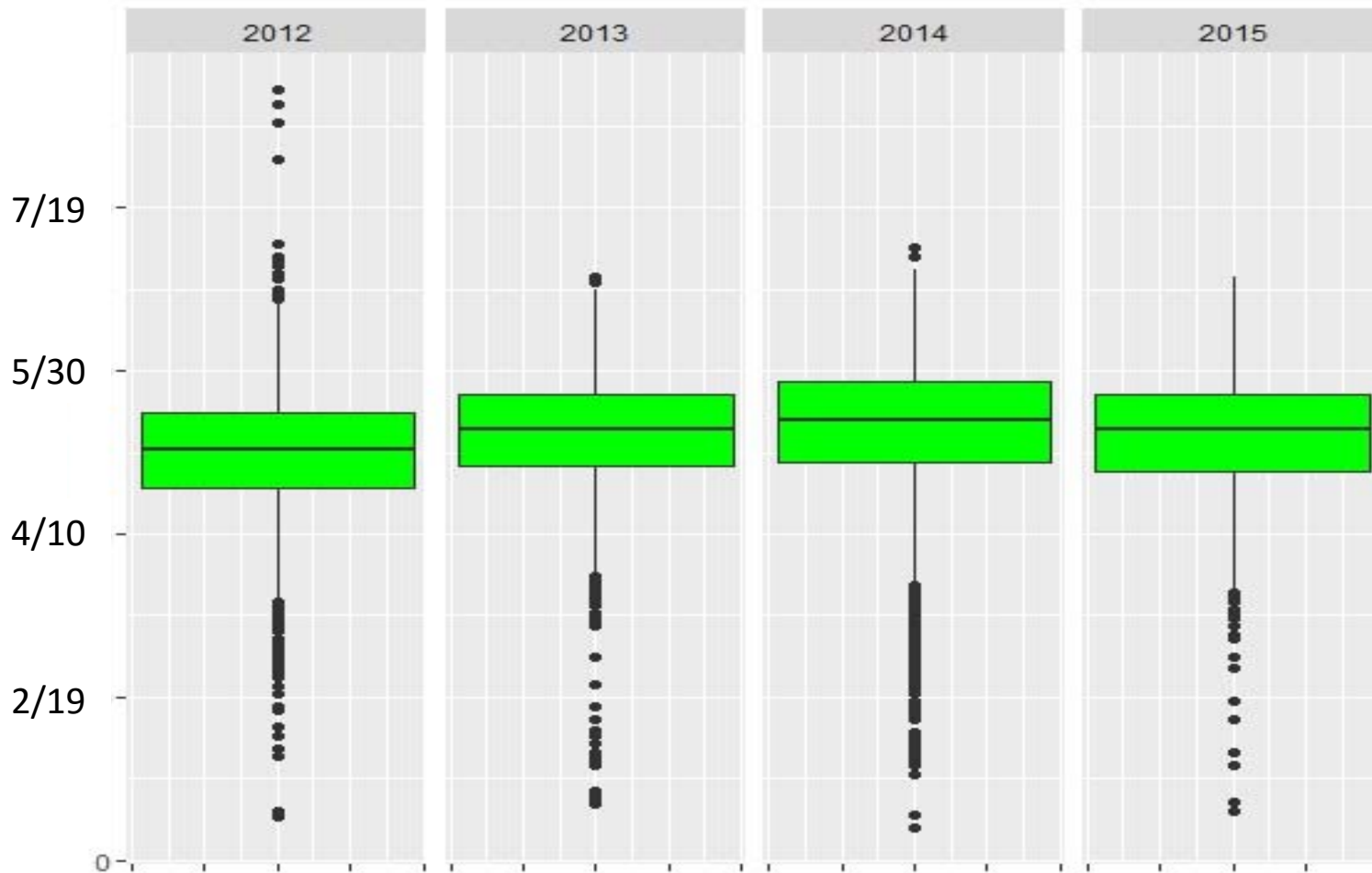
Steelhead Smolt Catch Timing For All Streams

Median Catch Date	May-12
25%	April-30
75%	May-24
Earliest	January-10
Latest	August-24



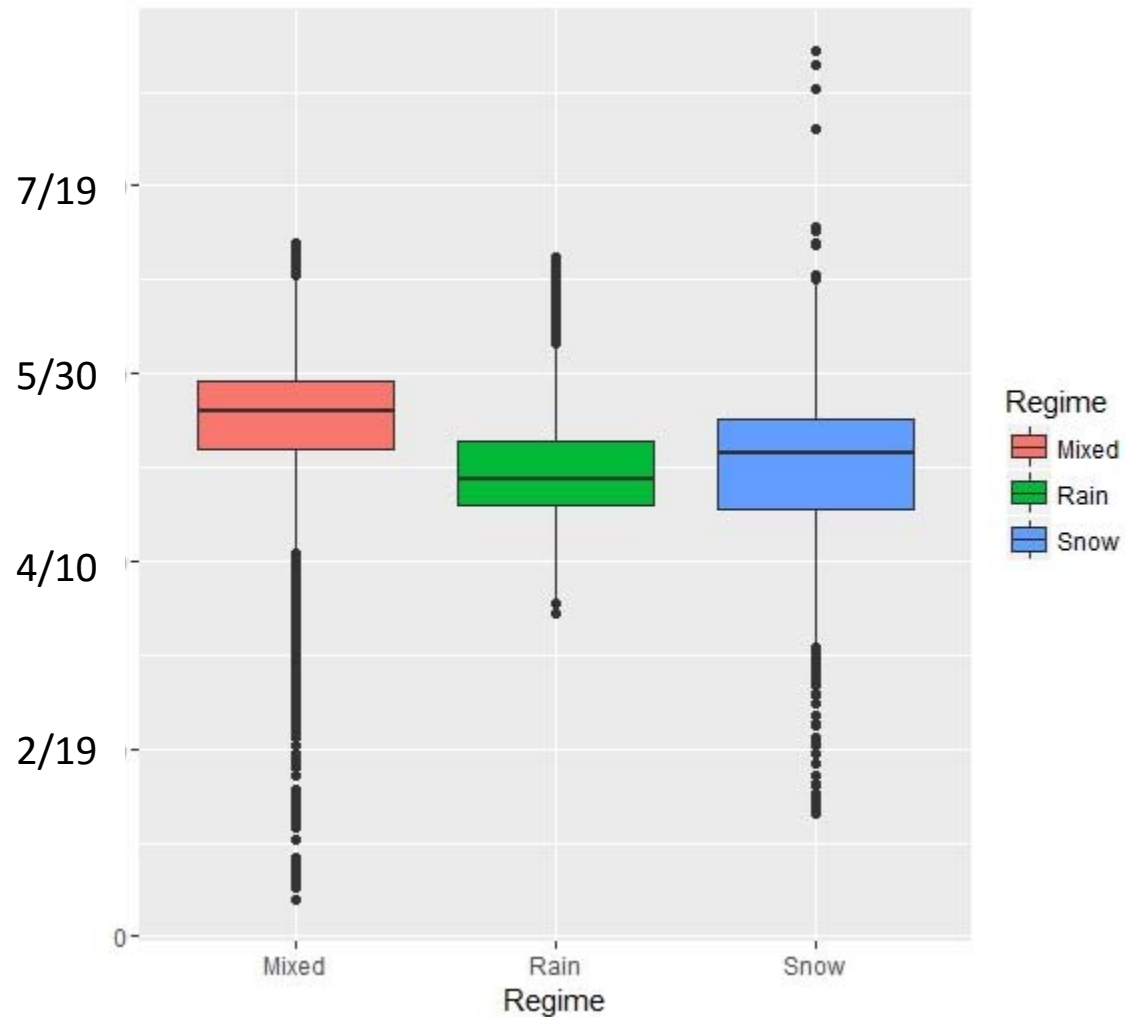
Catch Timing For All Streams By Year

	2012	2013	2014	2015
Median Catch Date	May-6	May-12	May-15	May-12

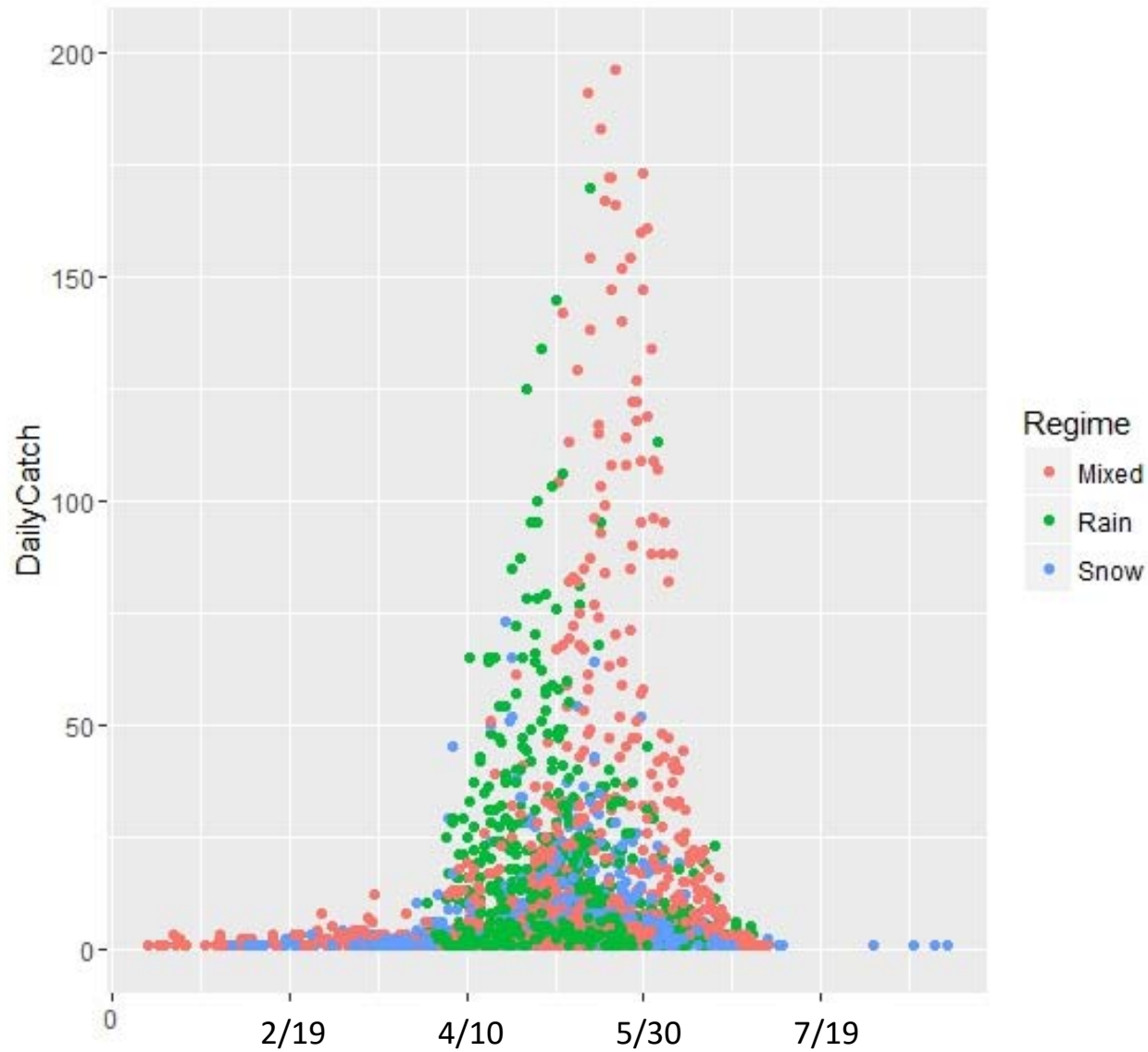


Steelhead Smolt Catch All Years By Regime

	Rain	Mixed	Snow
Median Catch Date	May-2	May-20	May-9

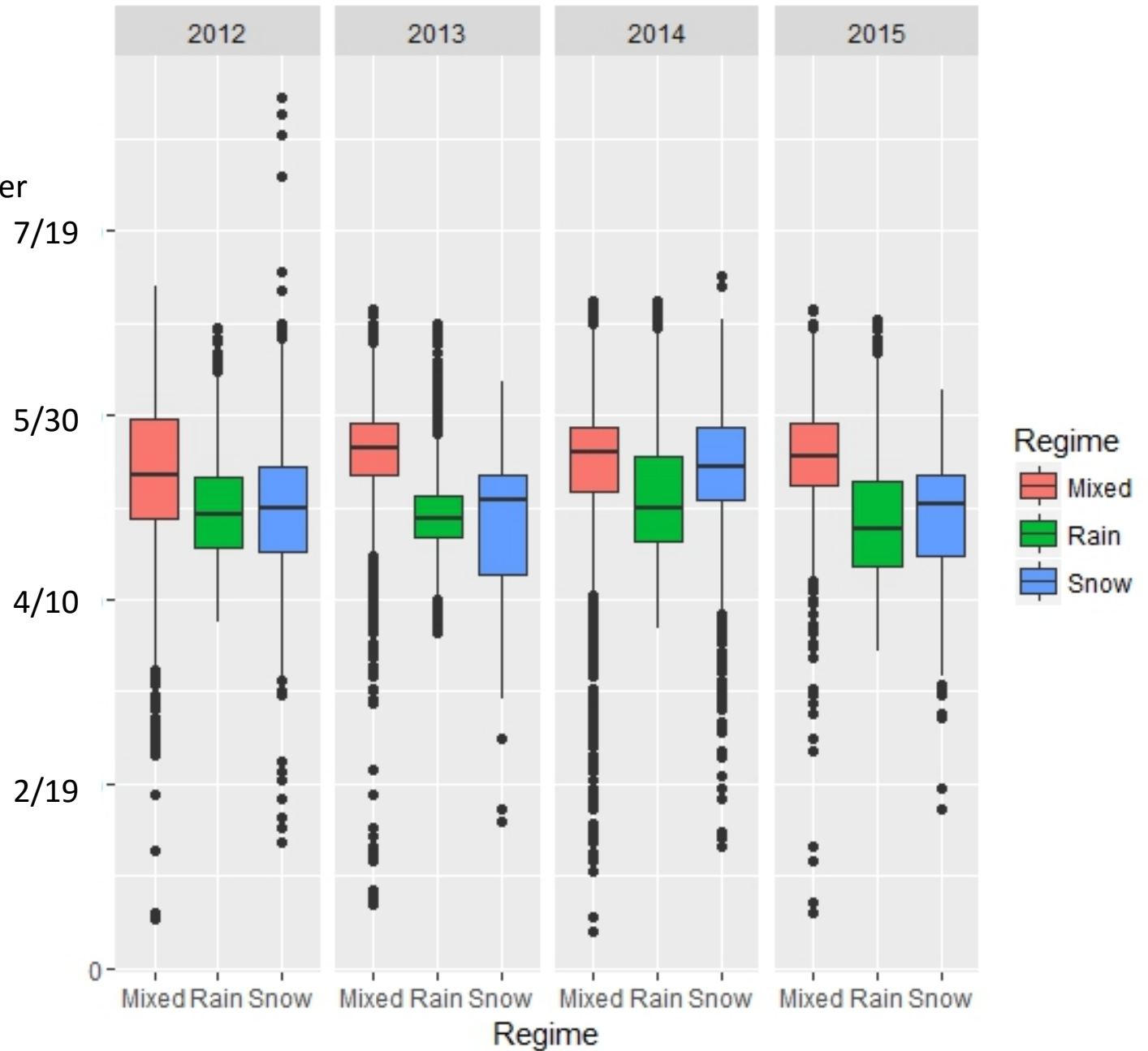


Scatter Plot All Years By Regime



Smolt Timing By Regime For Each Year

-Pattern is consistent over the years.



Summary

- Higher elevation snow dominated systems have older smolts
- Younger smolts are smaller...Duh!
- Dam dominated systems have youngest, largest and late timed smolts
- Size at age across basins is fairly consistent.
- Low elevation rain dominated systems have earliest smolt timing



Changing Conditions

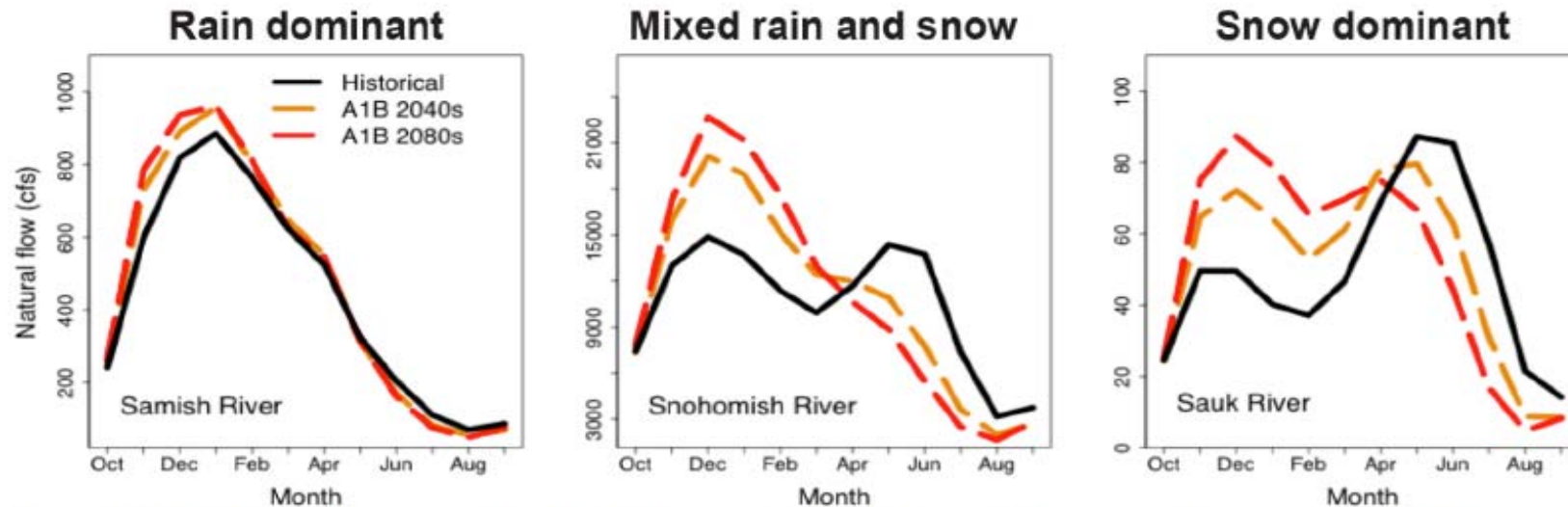


Figure ES-3. Streamflow is projected to increase in winter and decrease in summer, and changes are greatest for watersheds located near the current snowline. Changes in the seasonal timing of streamflow, on average, for three illustrative watersheds in Puget Sound: The Samish River, a warm basin (left); the Sauk River, a cold basin with source waters at high elevations (right); and the Snohomish River, a middle-elevation basin with substantial area near the current snowline (middle). *Data source: Downscaled hydrologic projections developed by Hamlet et al. 2013³*

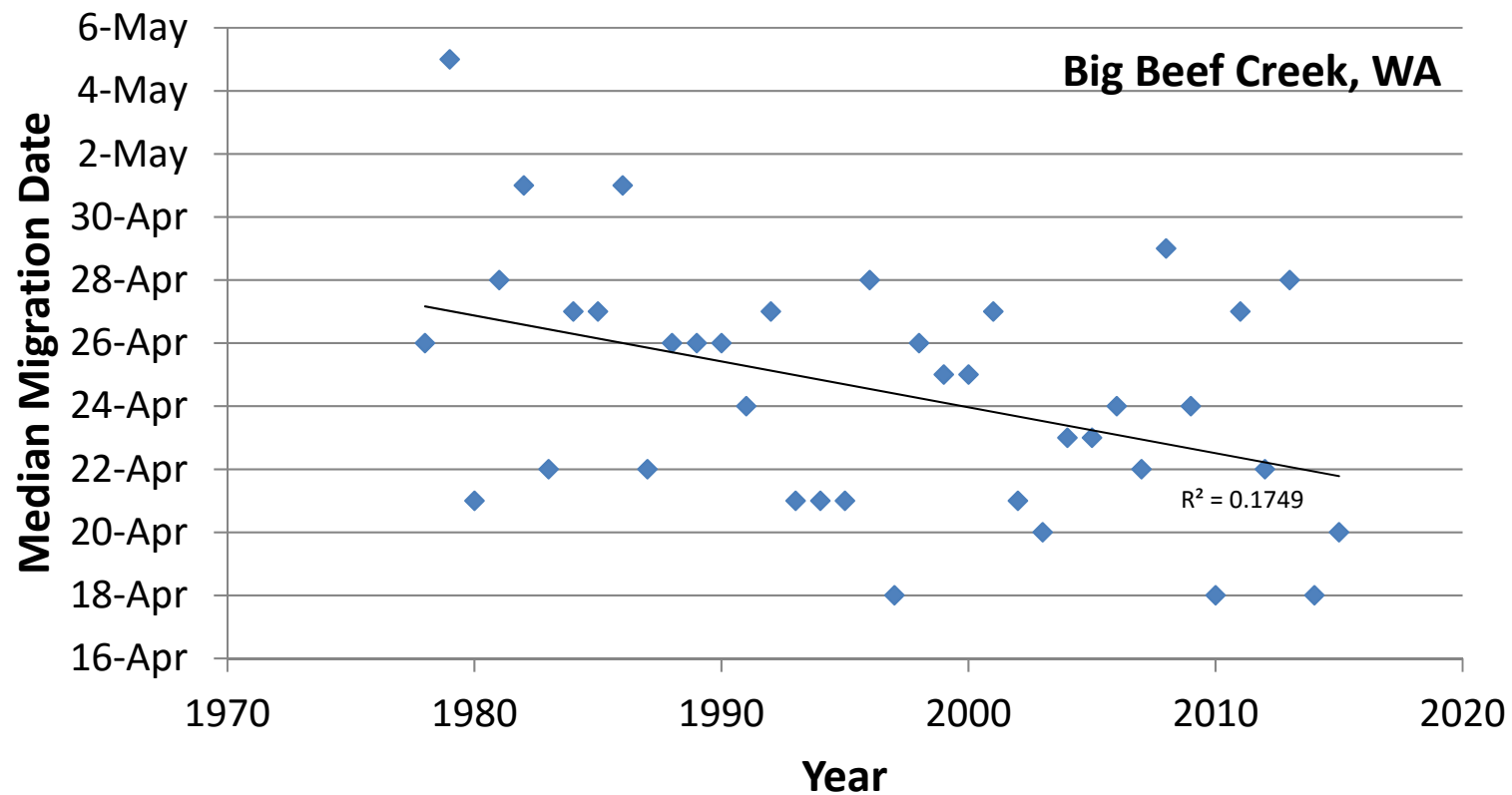
- Stream Temp. Projected to Increase in Puget Sound Area 4.0-4.5F by 2080
- Decreased Summer Flows

Climate change projections and likely impacts on steelhead:

- Lowland rain dominated streams will become too warm in some years for rearing steelhead in the summer months.
- Likely smolts will be younger/ smaller with warming
- Migration timing will trend earlier.



Steelhead Smolt Median Migration Date 1978-2015



Take away message:

- Habitat Diversity=Life History Diversity
- Preserve diversity of habitat types
- Smolt age, size and timing will likely change
- Monitoring is very important





Thanks:

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