Hood Canal Steelhead Project

A conservation hatchery experiment

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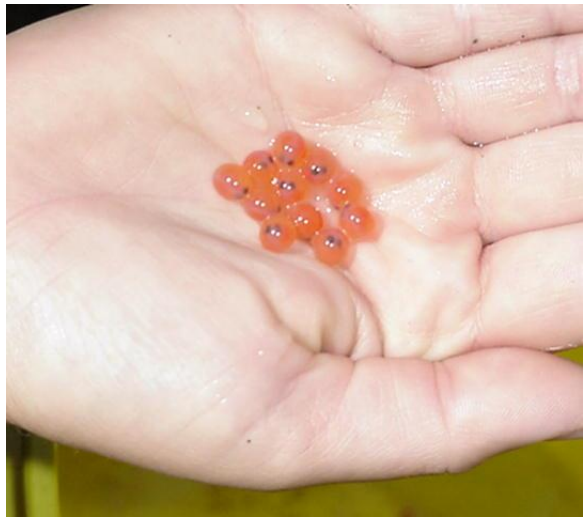
LONG LIVE THE KINGS

Restoring Wild Salmon



Cooperating Project Partners:

NOAA: NWFSC Behavioral Ecology Team
Long Live the Kings
WA Department of Fish and Wildlife
US Fish and Wildlife Service
Skokomish Tribe
Point No Point Treaty Tribes
Hood Canal Salmon Enhancement Group
US Forest Service
Hood Canal Private Landowners

How did the project come to be?

- Hamma Hamma Steelhead Supplemenation Project (1998-2007): Efforts responding to population on extinction vortex in the Hamma Hamma River.
- May 2007: Puget Sound (Hood Canal) steelhead listed as threatened on the Endangered Species Act.
- Hatchery Scientific Review Group: Use hatcheries as a tool for recovery and conservation.

Hood Canal Steelhead Project Goals

- Can artificial propagation be utilized to increase a wild population's abundance and productivity over the long term while preserving the genetic, demographic, and life history traits of the population?

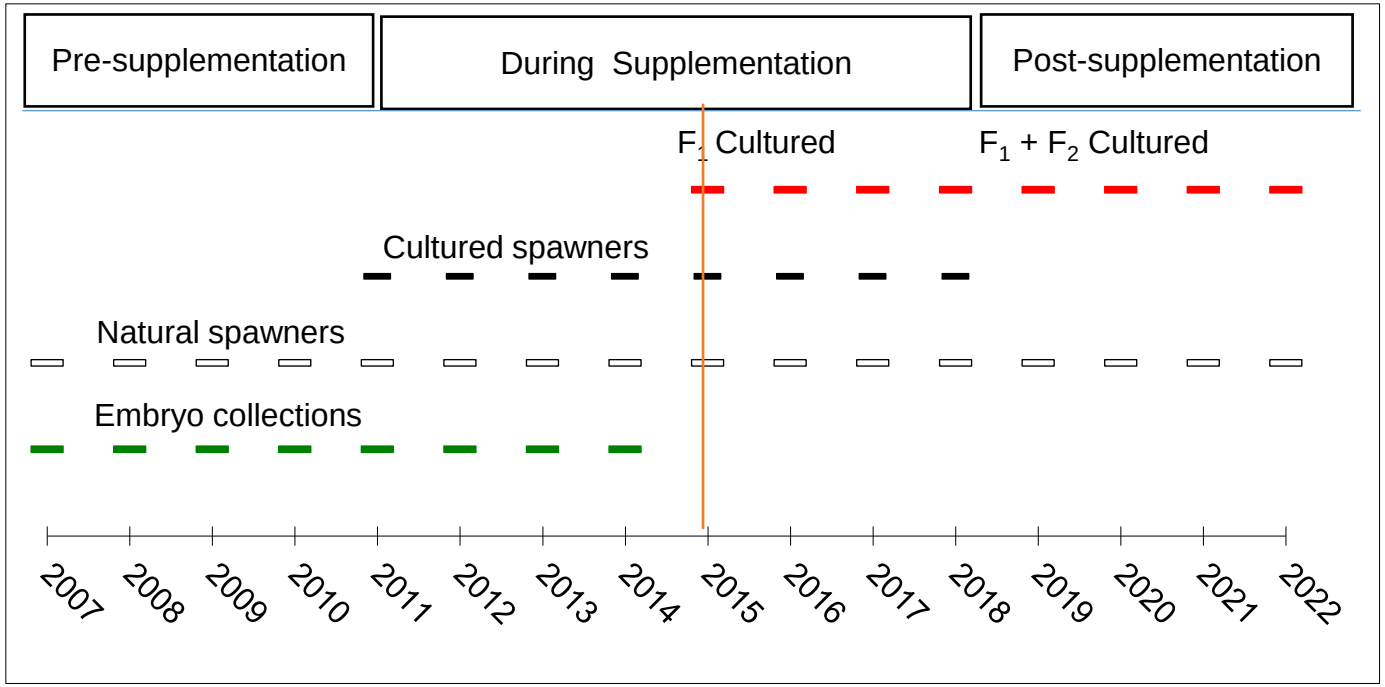
Oncorhynchus Mykiss

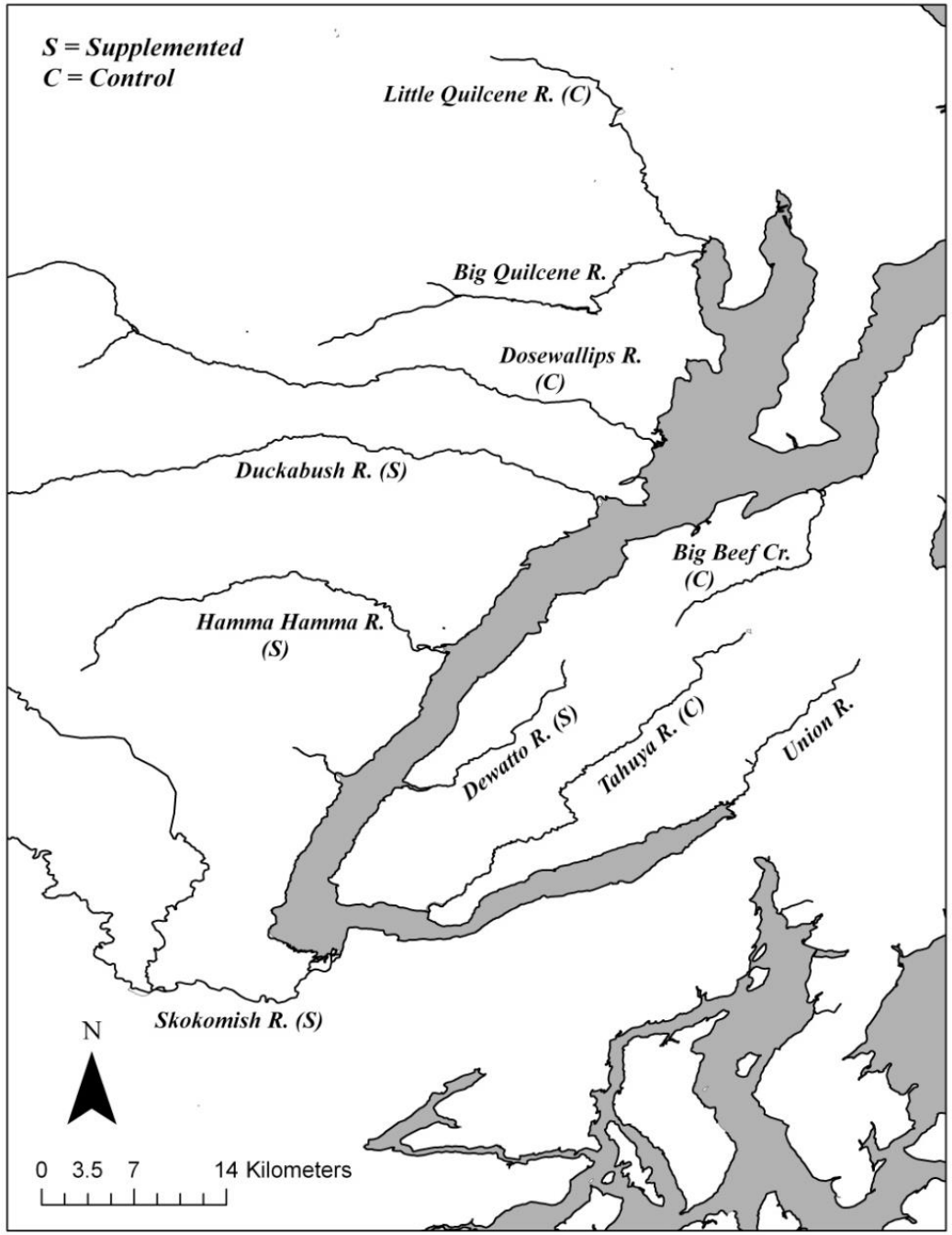
Conservation Hatchery Experiment

Replicated, before-during-after-control-impact experiment (RBACI)

Response variables =

- Spawner abundance and spawn timing
- Freshwater productivity (egg to smolt)
- Life history diversity
- Genetic variation
- Local adaptation
- Early marine survival





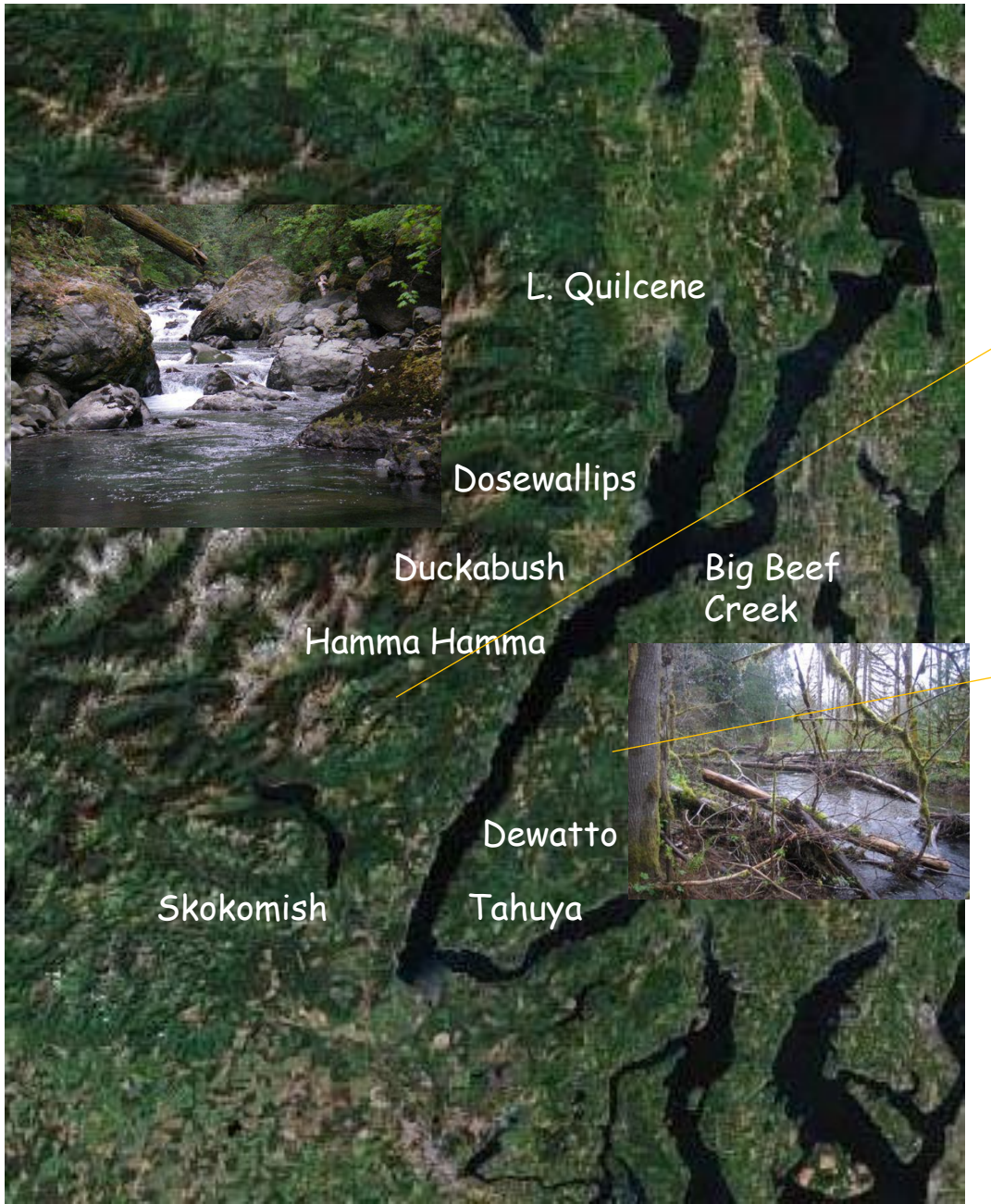
Project streams

Supplemented: Dewatto, Duckabush & SF Skokomish Rivers

Control: Big Beef Cr, Tahuya, Little Quilcene & Dosewallips* Rivers

Post-Supplemented: Hamma Hamma River

Hood Canal stream characteristics



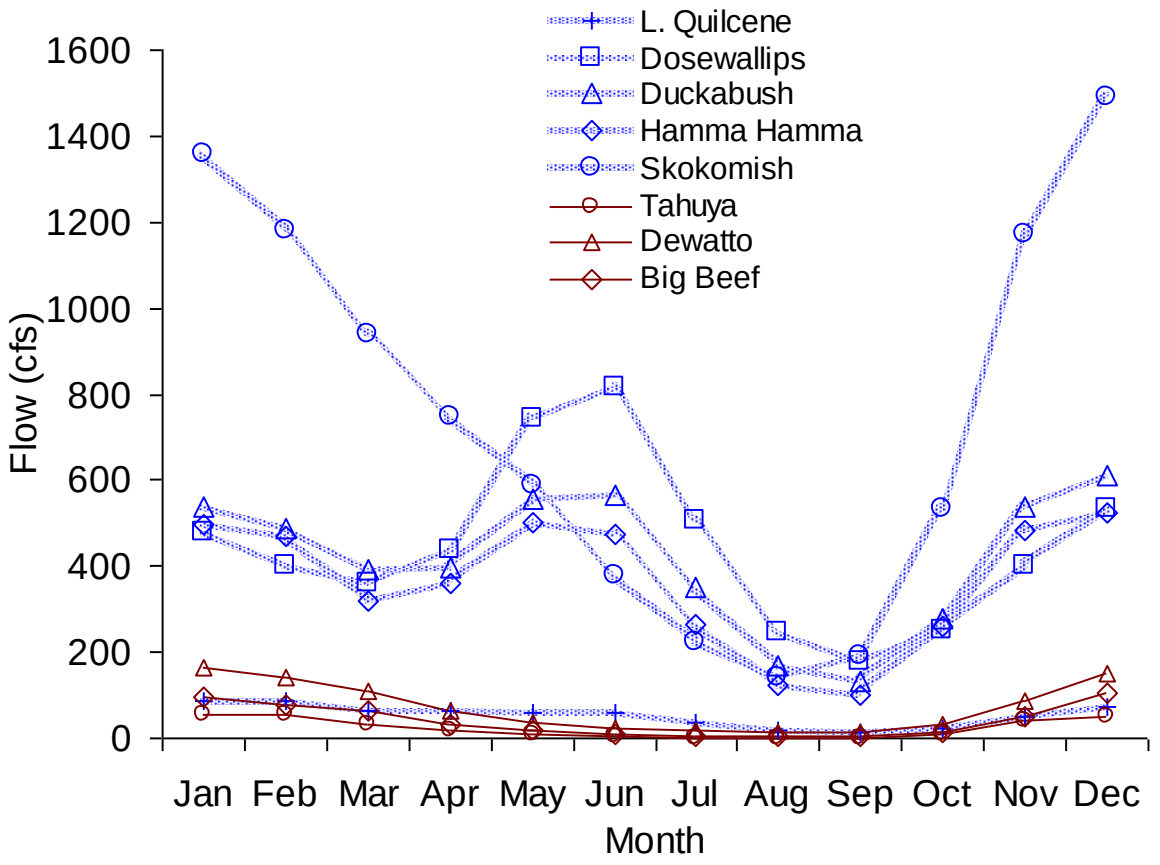
Olympic Peninsula streams

Bedrock/cobble
High elevation
High gradient
Glacial/snow melt
Anadromous barriers (except Skokomish)

Kitsap Peninsula streams

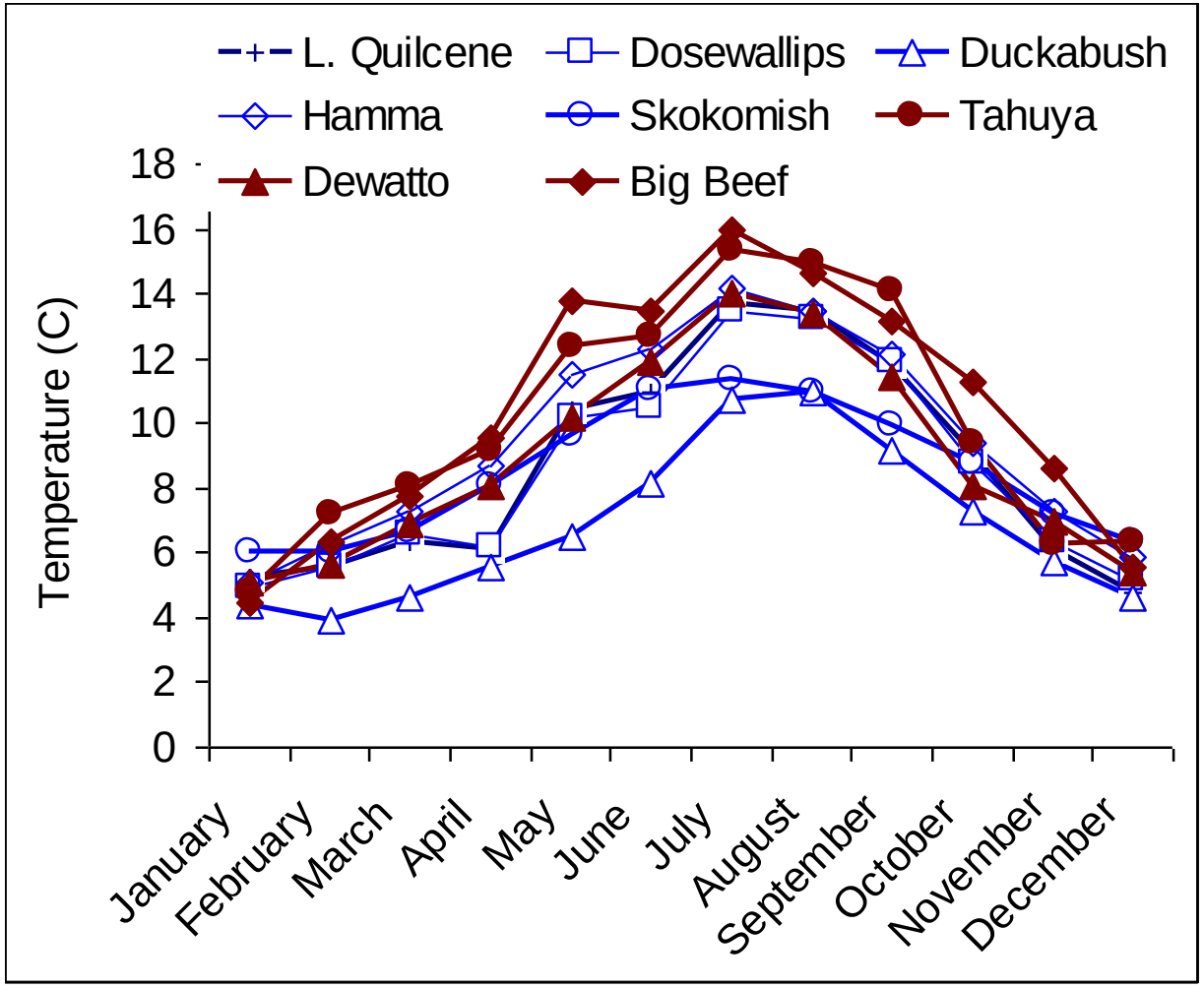
Sand and gravel soils
Low elevation
Low gradient
Low flow
Rain and aquifers
No anadromous barriers

Mean monthly streamflow



Data from: http://waterdata.usgs.gov/wa/nwis

Temperature



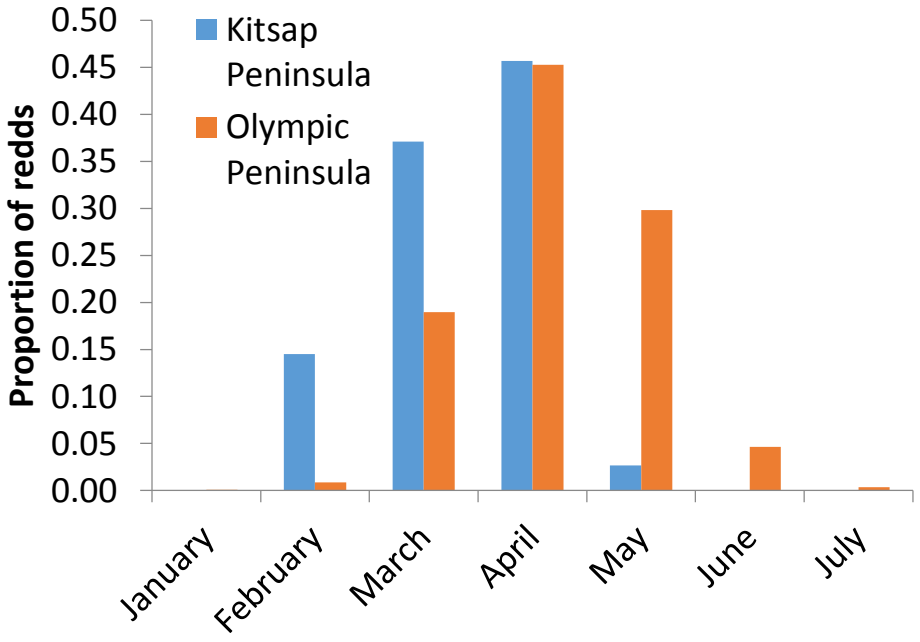
Data compiled from WA State DOE and USGS

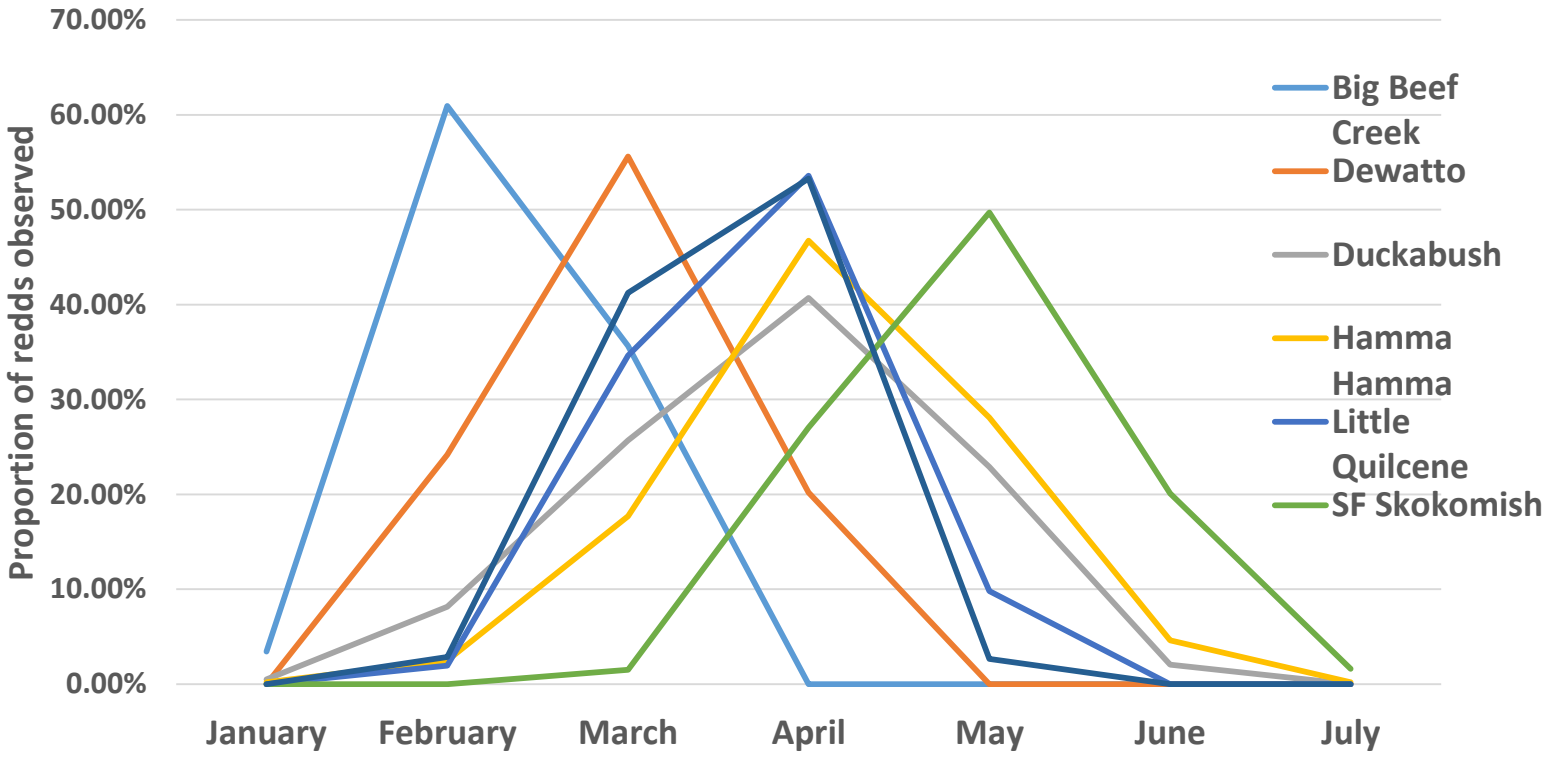
How do we accomplish our goals?

- Redd and snorkel surveys conducted weekly throughout spawning season
- Eyed embryos collected
- Hatchery reared smolts and adults
- Smolt collections
- Summer parr sampling

Spawn timing

2007-2016



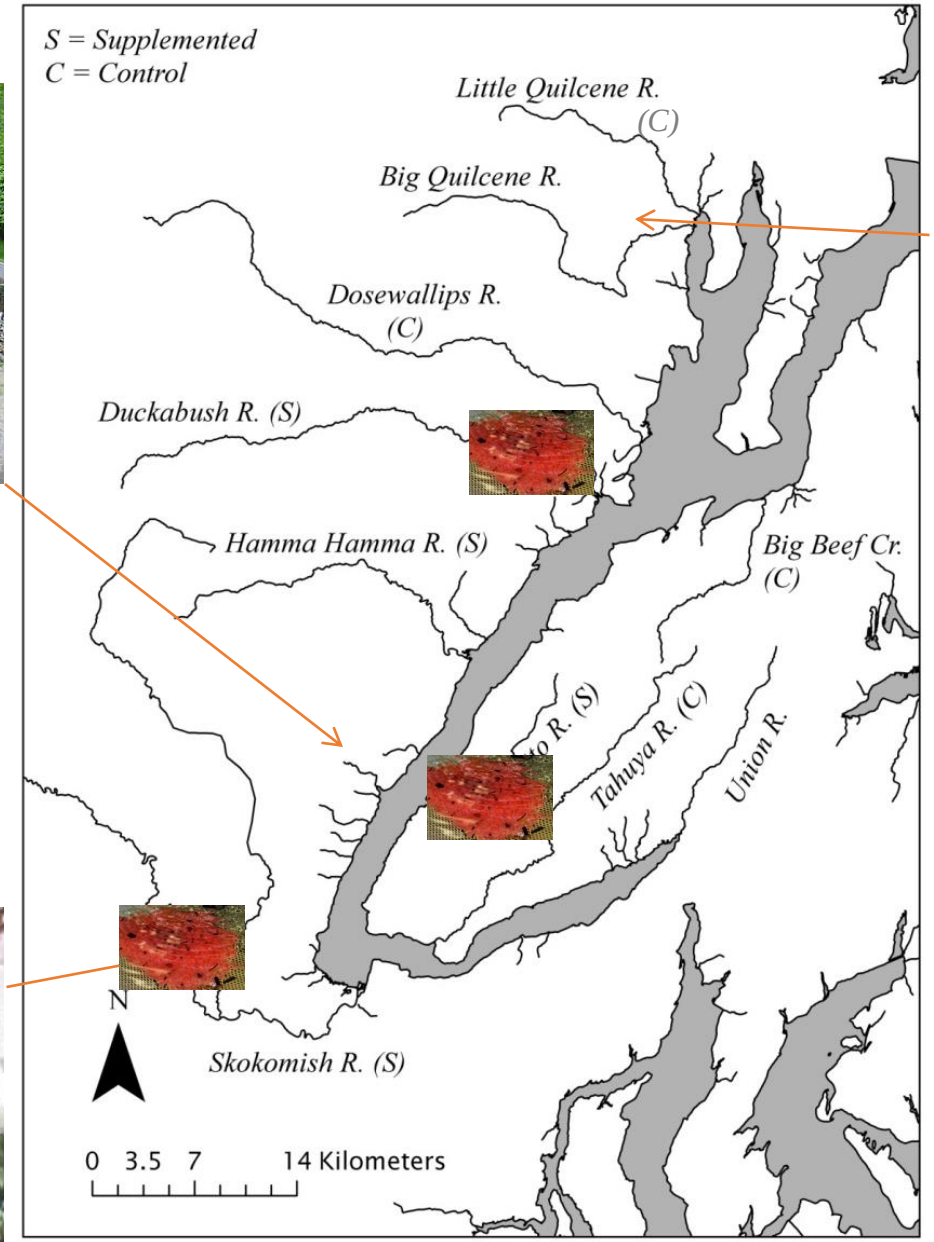


Collecting eyed embryos

HCSP incubation and rearing facilities

LLTK Lilliwaup Hatchery

WDFW McKernan Hatchery



Quilcene National Fish Hatchery

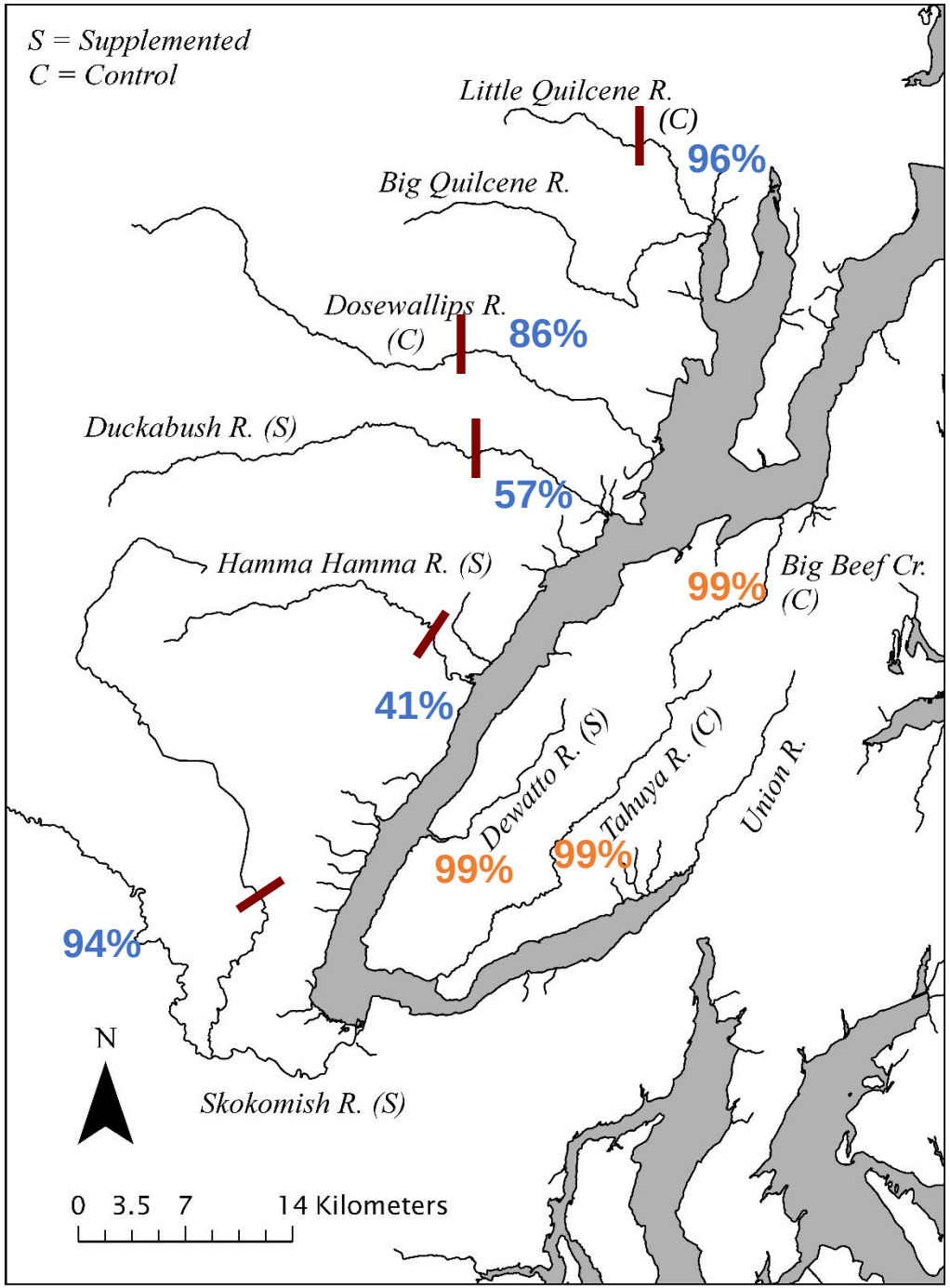
Quilcene National Fish Hatchery Photo Credit: Ron Wong

Fish Culture and Release Strategies

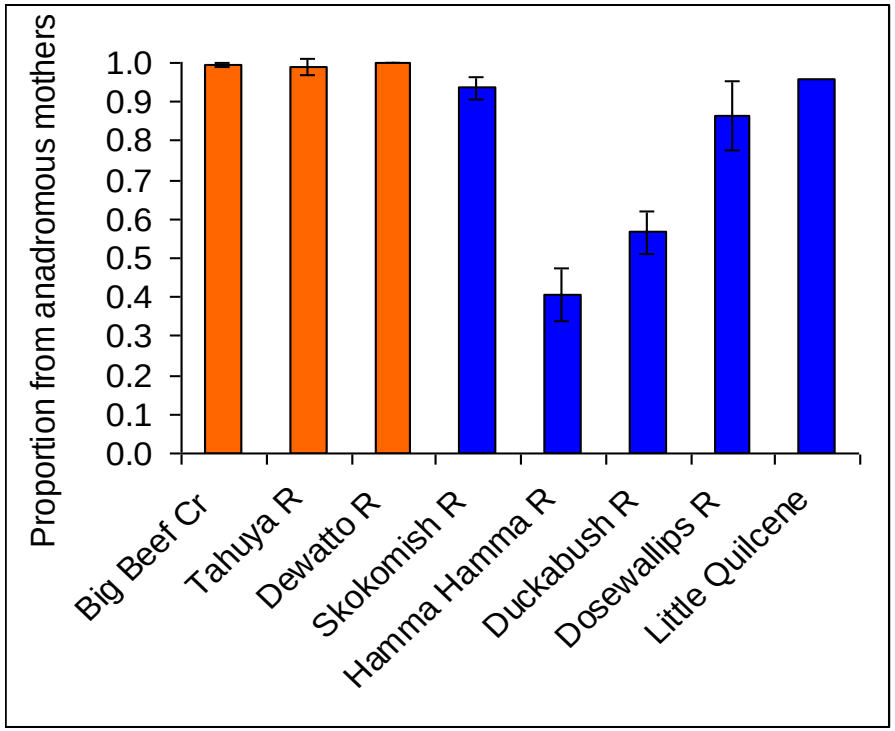
- Sample fish quarterly to adjust feed schedule.
- Adipose fin clip parr.
- Release smolts at age-2.
- Release adults at age-4, or when mature, with external floy tags.

Smolt & Adult Release Totals

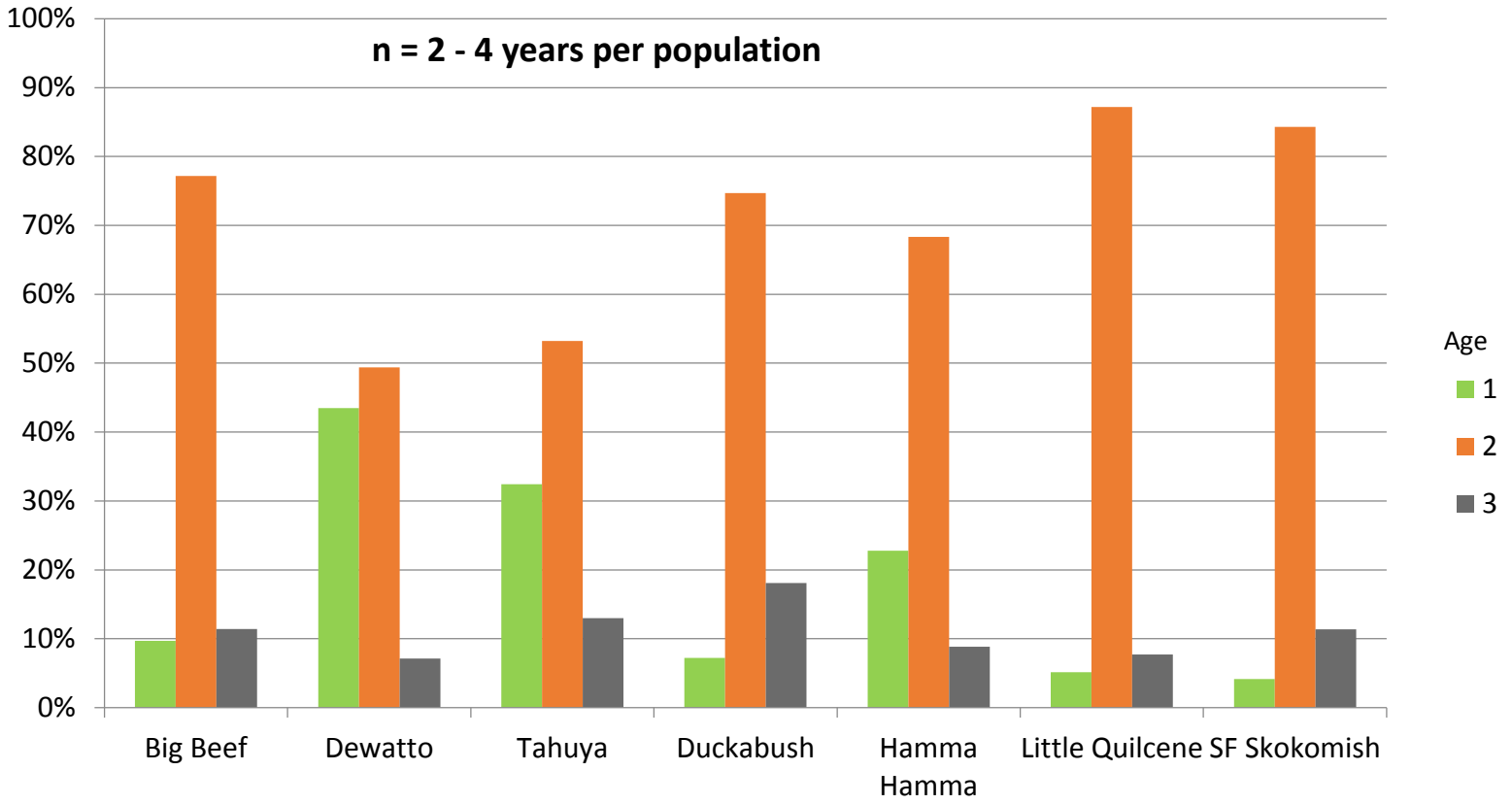
		SRG		ARG			
River	Brood Year	Age-1	Age-2	Age-4	Age-5	Age-6	*Total released*
Dewatto	2007	0	7,375	226	26	1	*7,628*
Dewatto	2008	0	6,807	0	0	0	*6,807*
Dewatto	2009	0	6,571	228	31	3	*6,833*
Dewatto	2010	51	4,905	0	0	0	*4,956*
Dewatto	2011	0	5,272	213	48	0	*5,533*
Dewatto	2012	0	6,183	0	0	0	*6,183*
Dewatto	2013	0	6,473				*6,473*
Dewatto	2014	0	4,239	0	0	0	*4,239*
	Total	*51*	*47,825*	*667*	*105*	*4*	*48,652*
Duckabush	2007	0	1,574	164	45	0	*1,783*
Duckabush	2008	0	4,671	65	70	4	*4,810*
Duckabush	2009	0	0	0	0	0	*0*
Duckabush	2010	140	1,743	196	0	0	*2,079*
Duckabush	2011	0	2,550	0	0	0	*2,550*
Duckabush	2012	0	4,782	211			*4,993*
Duckabush	2013	0	4,713	0	0	0	*4,713*
Duckabush	2014	0	1,700	0	0	0	*1,700*
	Total	*140*	*21,733*	*636*	*115*	*4*	*22,628*
Skokomish	2007	4,091	23,747	54	17	0	*27,909*
Skokomish	2008	200	20,529	0	0	0	*20,729*
Skokomish	2009	0	26,642	228	29	0	*26,899*
Skokomish	2010	0	23,989	0	0	0	*23,989*
Skokomish	2011	0	22,717	329	28	0	*23,074*
Skokomish	2012	0	27,258	0	0	0	*27,258*
Skokomish	2013	0	18,005				*18,005*
Skokomish	2014	0	14,769	0	0	0	*14,769*
	Total	*4,291*	*177,656*	*611*	*74*	*0*	*182,632*



Percentages of summer parr produced by anadromous mothers

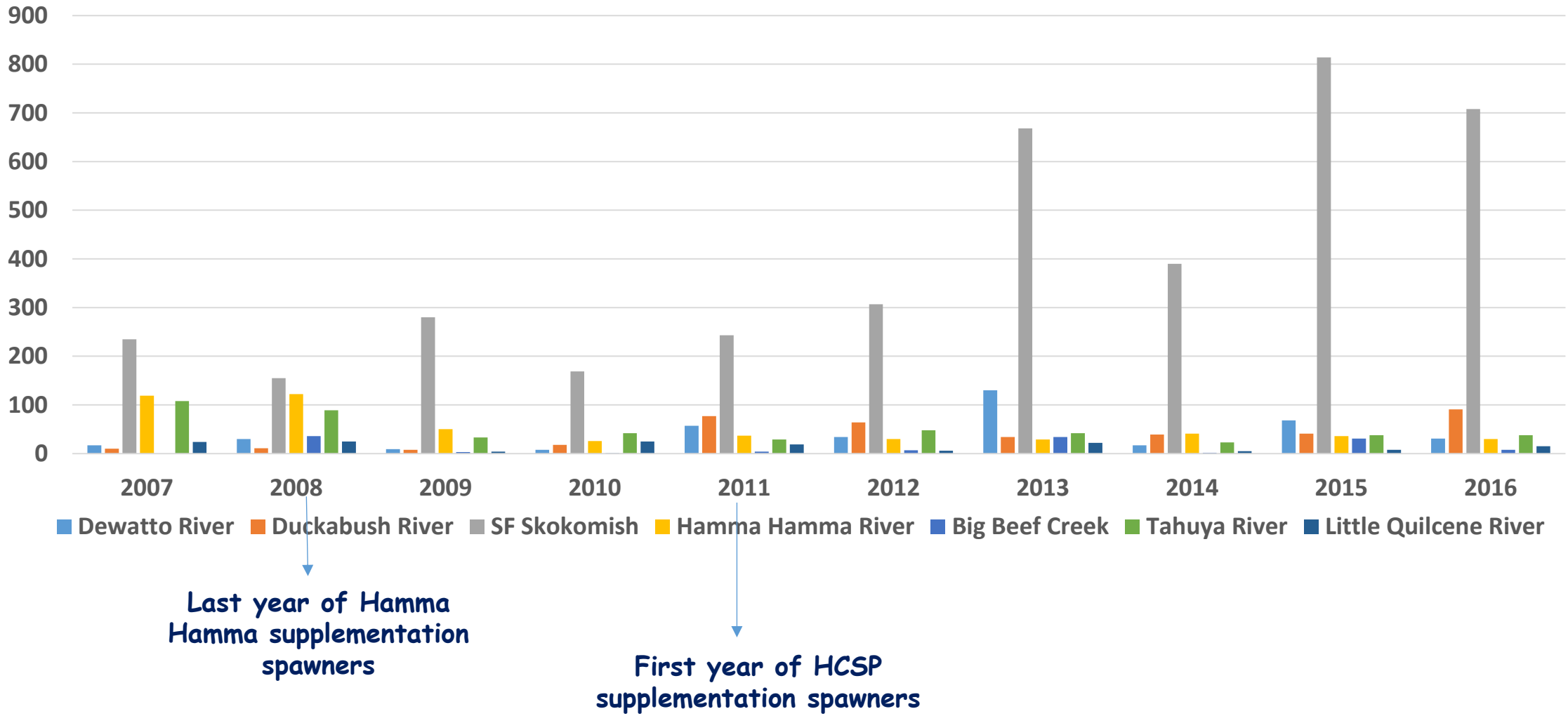


Age-at-smoltification in Hood Canal steelhead populations

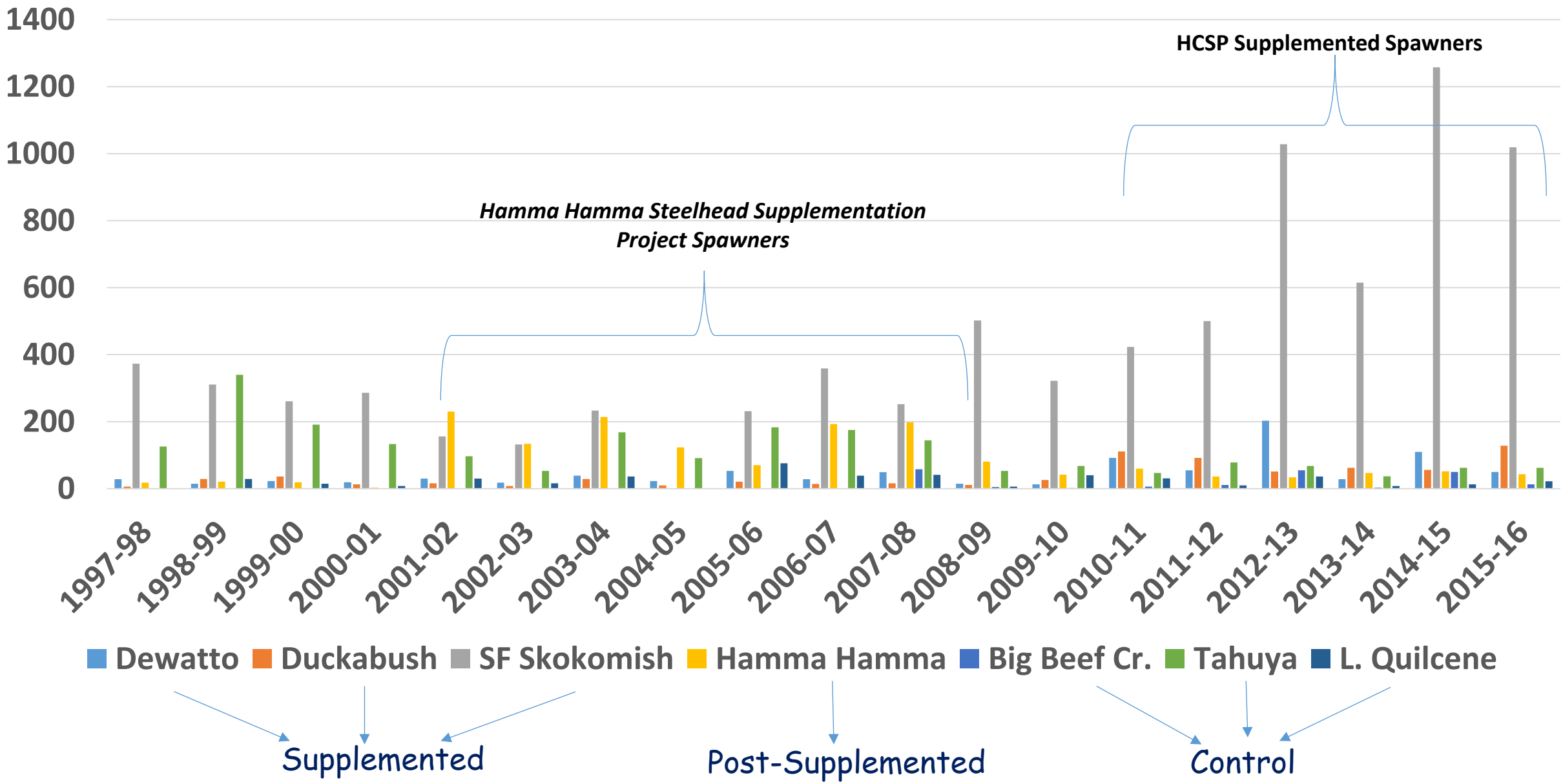


Ageing: WDFW ageing laboratory

Annual Redd Abundance



Annual Escapement



Monitoring and Evaluation Tools

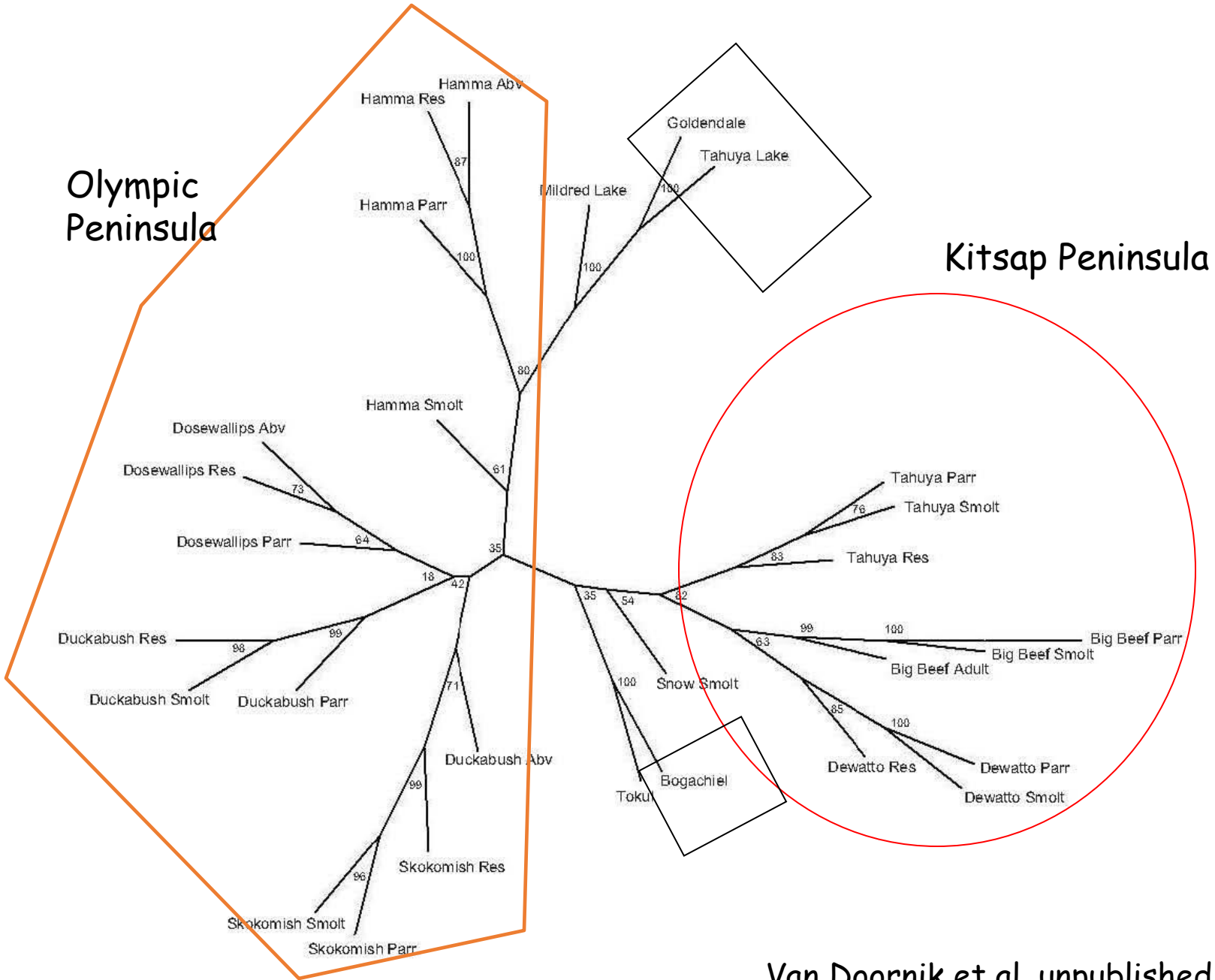
- Weekly redd surveys
- Summer parr sampling
- Smolt trapping
- Adult sampling
- Acoustic Telemetry

Hamma Hamma steelhead supplementation project: Genetic diversity

Summer parr	N	H_o	Alleles	Rare alleles	Unique alleles	A_r	Mean Nb
Wild fish before supplementation (1998-2001)	224	0.760	177	61	15	17.5	33
Wild + Hatchery offspring after Supplementation (2002-2004)	241	0.763	176	54	16	17.4	42

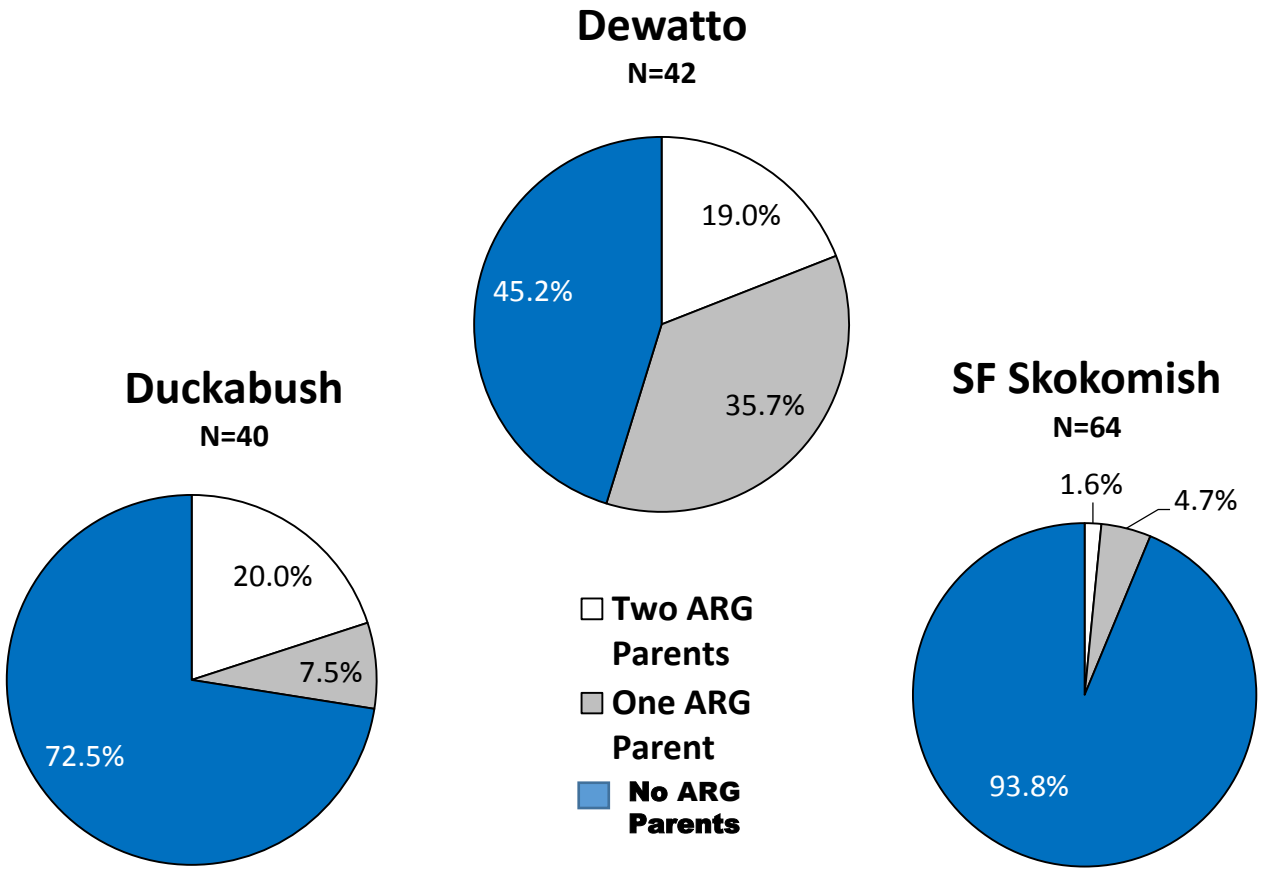
D. Van Doornik et al. 2010 CJFAS

Genetic structure of Hood Canal steelhead

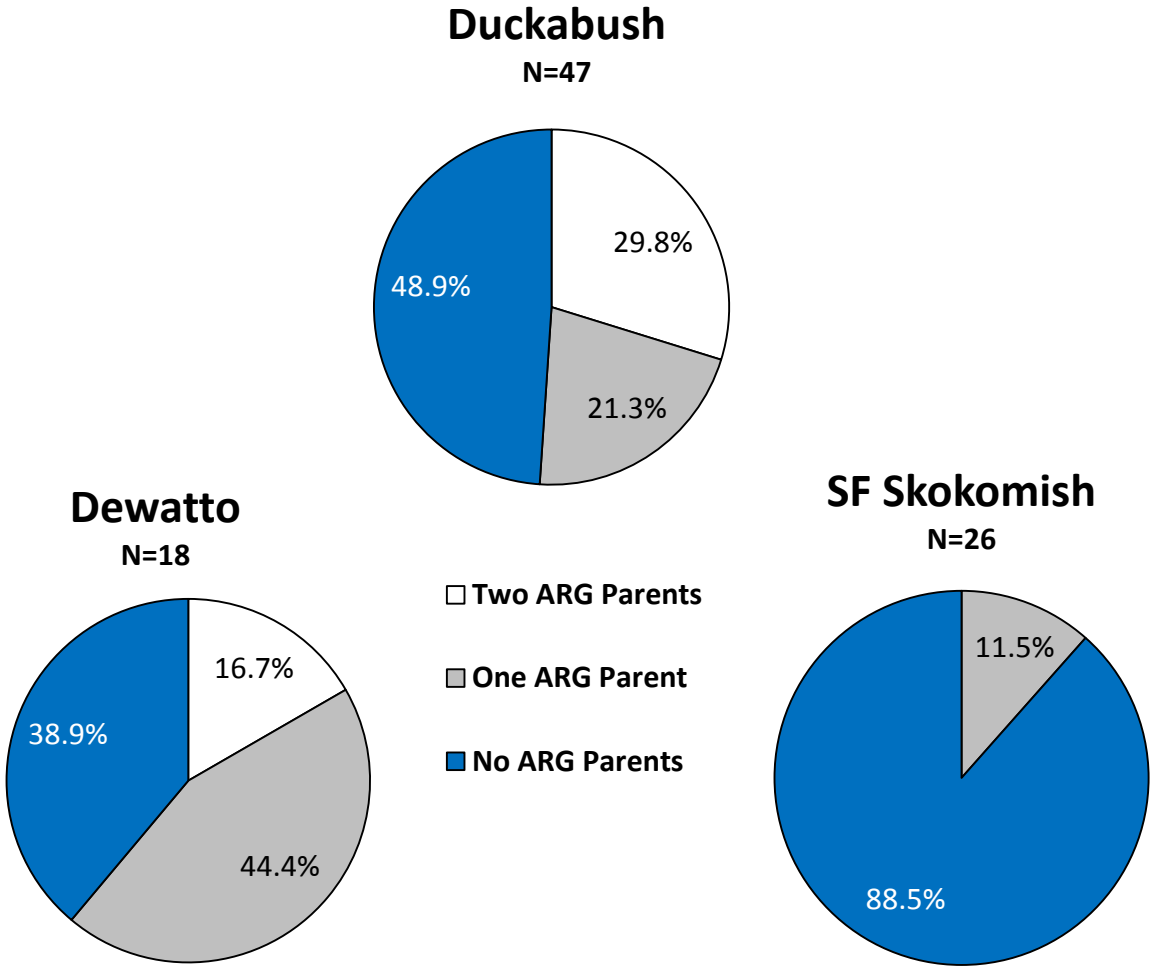


Van Doornik et al. unpublished data

Parentage of BY2011 parr by ARG



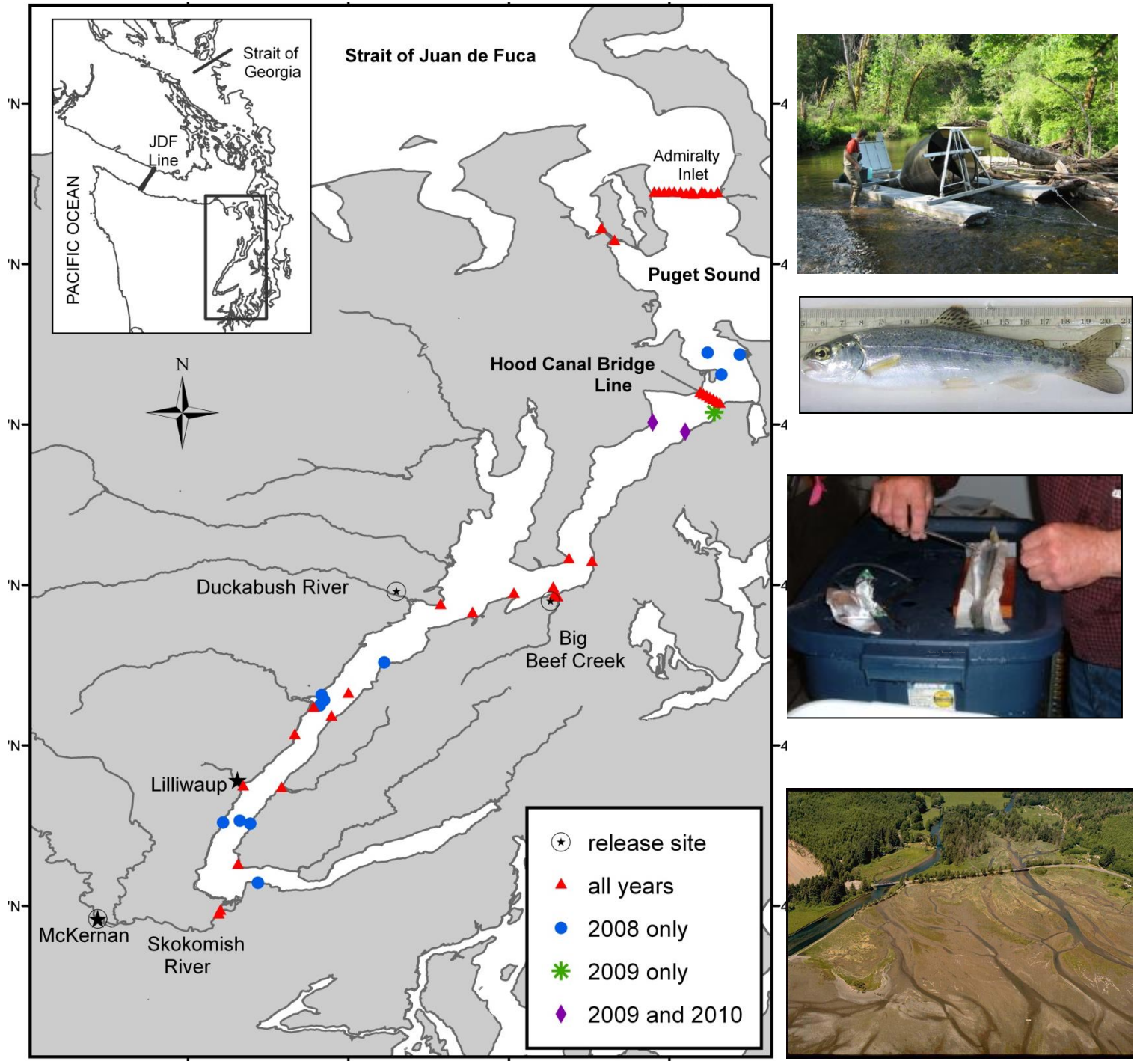
Parentage of BY2011 smolts by ARG



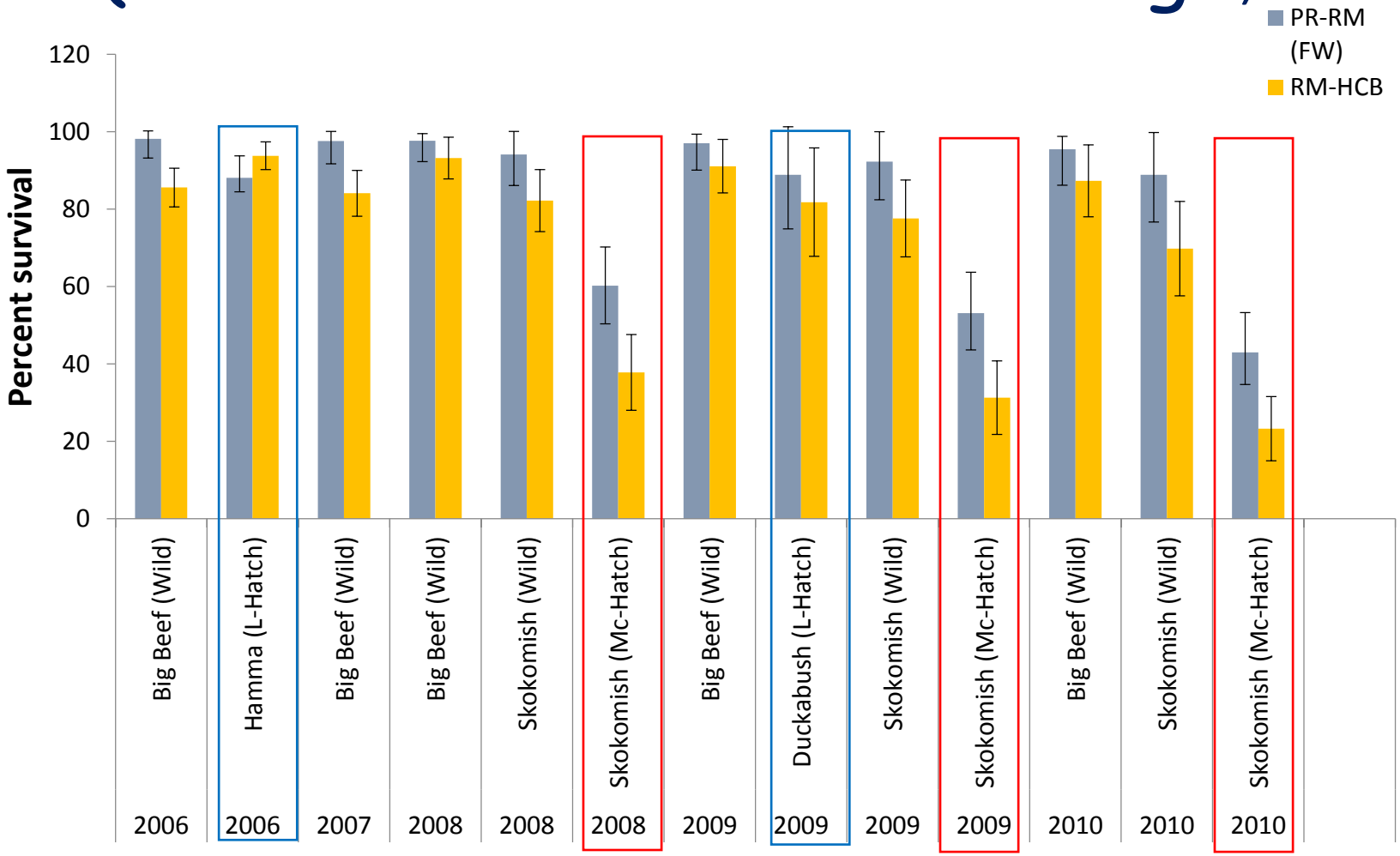
Adult offspring of ARG

River	Number of adults sampled	Number of adults with 2 ARG parents	Number of adults with 1 ARG parent
Dewatto	6	2	0
Duckabush	9	1	1
Skokomish	19	0	1

Acoustic Telemetry



Early marine survival (release to Hood Canal Bridge)



Moore et al. 2010, 2012

Summary

- Hood Canal steelhead populations are diverse and adapted to local stream conditions
- Abundance has remained low since the 1990's and has not recovered despite fishing closures
- Hatchery actions have been tailored to the local watershed and are being tested in an experimental way
- Initial results from the Hamma Hamma River suggest some improvement resulting from conservation hatchery practices

….the rest remains to be seen.


Thank you!