

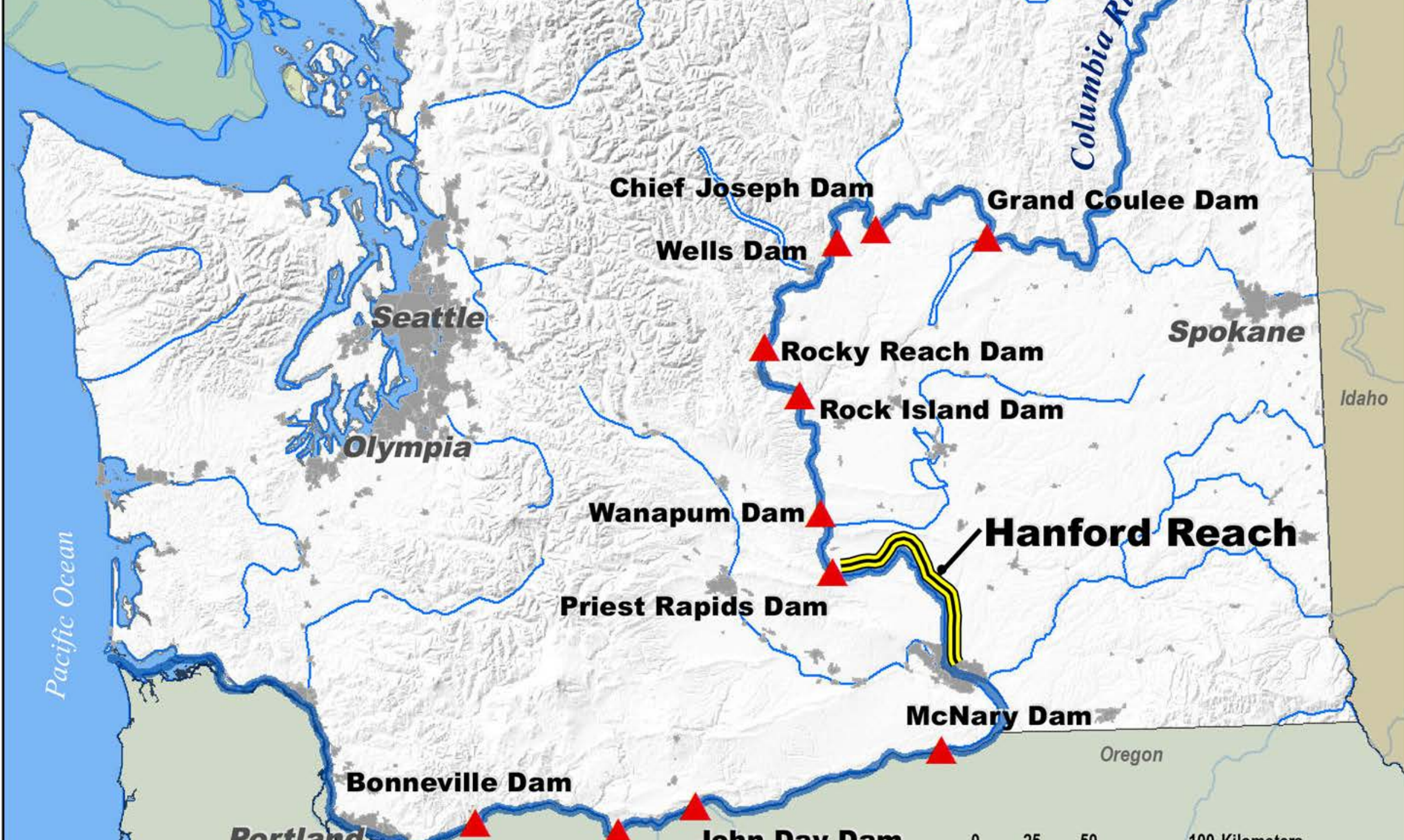
An underwater photograph of several salmon swimming in a river. The water is clear and greenish, and the riverbed is visible at the bottom. The salmon are in various positions, some swimming towards the camera and others away from it.

Teaming to achieve hatchery reform in a Columbia River Hatchery

Todd N. Pearsons¹, Alf H. Haukenes², Paul Hoffarth², and Steven Richards²

¹ Grant County Public Utility District,

² Washington Department of Fish and Wildlife



Hatchery Programs

A large group of salmon swimming in clear water, likely in a hatchery tank. The fish are densely packed, and the water is a vibrant greenish-blue. The salmon have a silvery-grey color with dark spots on their sides. They are all facing in various directions, some towards the camera and others away.

- 5 million to 5.6 million subyearlings for GPUD at PRH
- 1.7 million subyearlings for ACOE at PRH
- 3.5 million subyearlings for ACOE at Ringold
- About 5,500 adult brood needed

Massive harvest of PRH fish

- Ocean and river harvest
- 23,256 mean annual harvest BY 1997-2010
- 107,044 in BY 2010



New definition of success (HSRGG)

1. Meet mitigation requirements
2. Continue to contribute to high harvest
3. Limit risks of domestication selection ($PNI > 0.67$)



PNI and definitions ($E=mc^2$)

- **Single population proportionate natural influence (PNI)**
- $PNI = pNOB / (pNOB + pHOS)$
- pNOB is the proportion of natural origin brood in the hatchery
- pHOS is the proportion of hatchery origin spawners in nature

Challenge: achieve $PNI > 0.67$

- Estimates of PNI were about 0.4
- Maintain program size (large)
- Marking controversy (constraint)
- Other hatchery programs (limited control, PNI estimation)
- New hatchery
- Record returns
- Difficulty obtaining NOB (options)
- This talk is about how we overcame obstacles to achieve a PNI goal

Strategies for achieving goal

1. Marking and tagging
2. Hatchery rebuild
3. pHOS management
4. pNOB for spawning
5. Spawning strategy
6. Multiple program PNI estimation



Improve marking and tagging (compromise)

- Increase Ad clip proportion (about 50%, 2010 release)
- Increase CWT proportion (1.2 million DIT, 2010 release)
- Increase in PIT tags from 3,000 to 43,000 (2012 release)
- 100% otolith mark (2008 release)

Priest Rapids Hatchery otolith mark



“Don't fix what isn't broken”



PHOS management at volunteer trap (24/5,7)

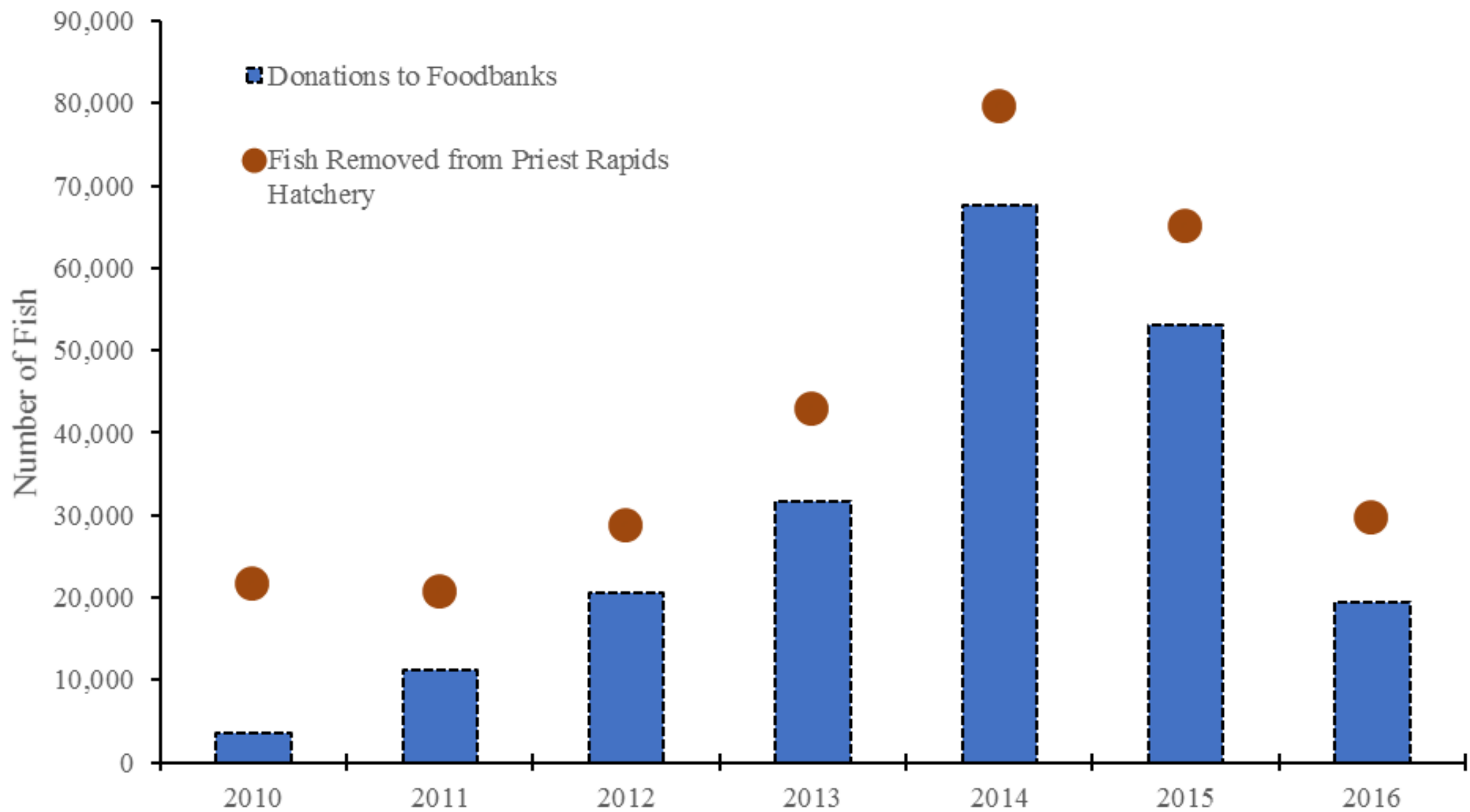


Over 75% of PRH fish returning to the Reach can be removed at the trap



About 80,000 removed in 2014





Prioritizing collection of naked fish at the hatchery trap (>95% HO, insufficient)



Collecting fish from a mainstem river trap

- Goal of 1,000 fish,
- Doubled pNOB from 0.05 to 0.11 (insufficient)



Teaming with anglers to collect fish in the natural environment (goal = 400 fish)

Year	Number of Anglers	Number of Boats	<u>Broodstock Collected</u>	
			Male	Female
2012	81	31	43	25
2013	169	67	293	104
2014	115	45	174	128
2015	165	65	205	305
2016	245	85	130	150
2017	374	136	178	307

Coastal Conservation Association



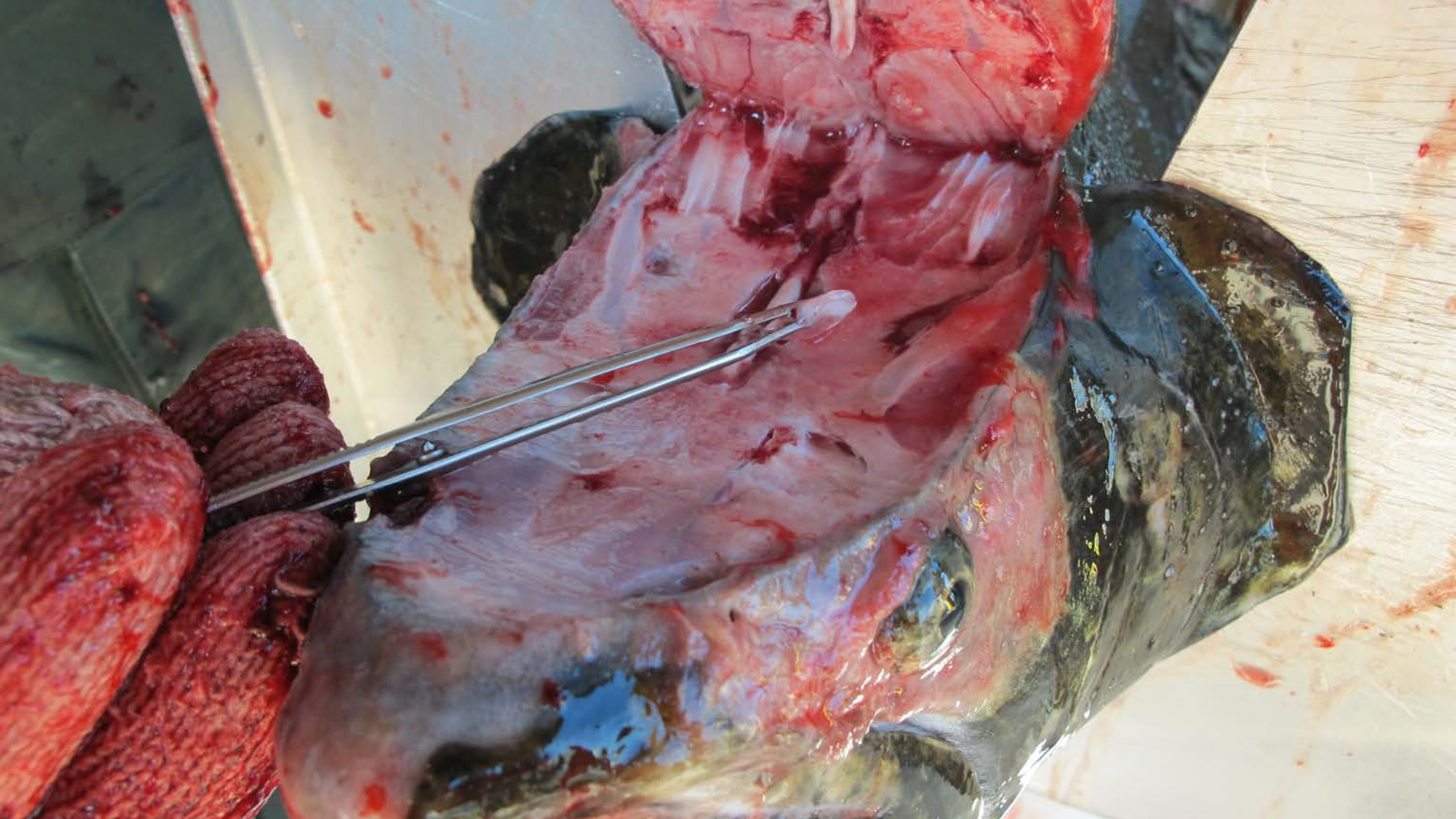


Increase of pNOB by 37% at PRH



Real time otolith reading and spawning
protocol adjustments









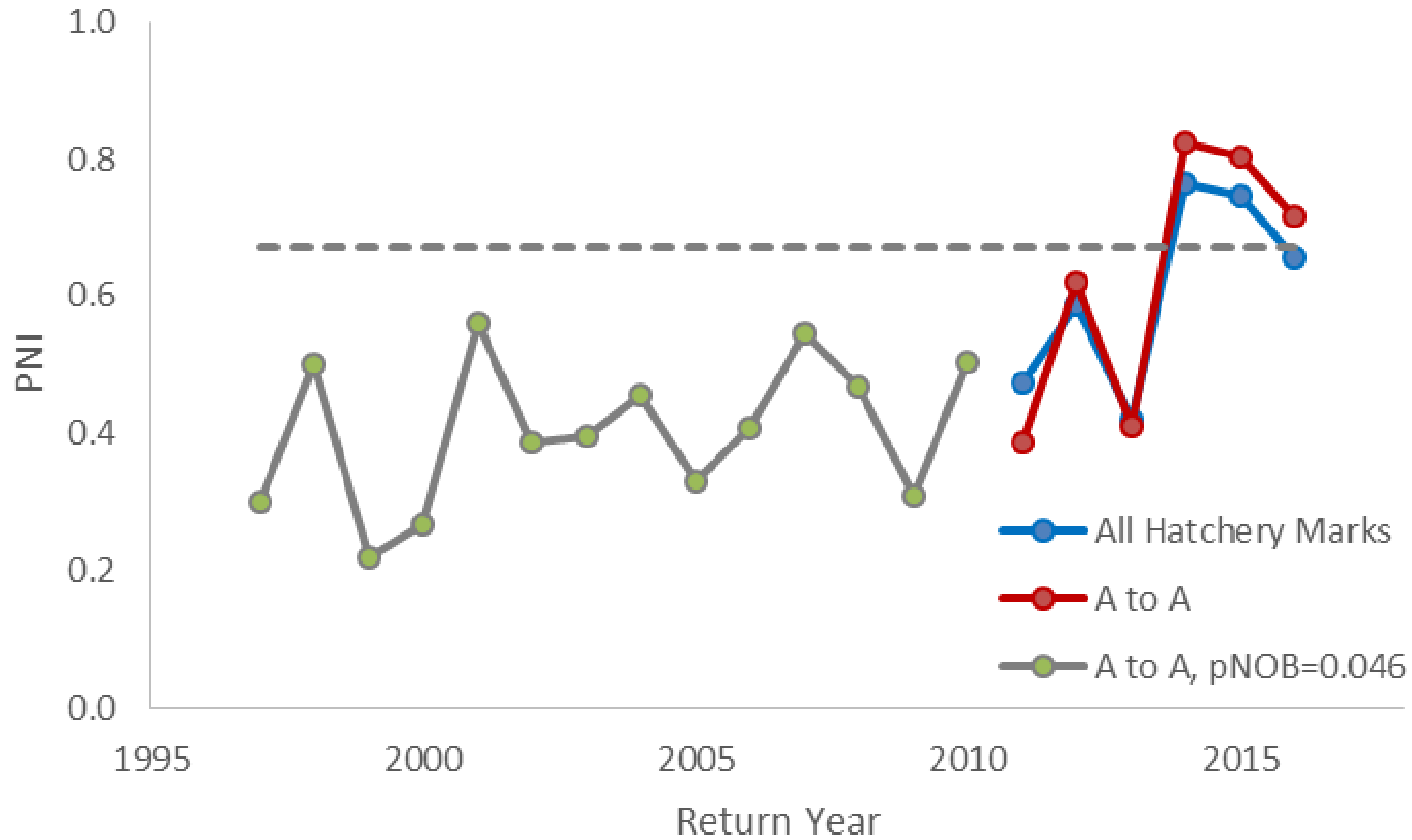


38% increase in pNOB



Multi-population PNI (Busack)

	Spawners/Broodstock		
Sources	Natural Population	PRH	RSH*
Natural Population	0.8904	0.066	0.066
PRH	0.058	0.934	0.934
RSH*	0.0514	0	0
Total (each column must add to 1.0)	1.0	1.0	1.0
RSH* Includes out of basin strays which likely have very low pNOB... similar to RSH for most years			



Lessons learned

- Many years, many partners (CCA), and many approaches to achieve our harvest, mitigation, and PNI goals
- Marking/tagging, 3 locations of broodstock collection, alternative mating strategies, multi-pop PNI estimator
- Balancing genetic risks
- It hasn't been easy (politically, scientifically, or financially)
- Creativity, collaboration, and cash were keys to success

Thanks

- PRH hatchery and M&E staff
- Eric Lauver
- HSRG
- Coastal Conservation Association
- Priest Rapids Coordinating Committee's Hatchery Sub-committee

