

Repeat Homing of Artificially Reconditioned Steelhead Kelt in the Yakima Basin, WA

Jeremiah Newell¹, John Whiteaker¹, Doug Hatch¹, Ryan Branstetter¹, Jeff Stephenson¹, Andrew Pierce¹, Chris Fredericksen², William Bosch², Joe Blodgett², Michael Fiander²

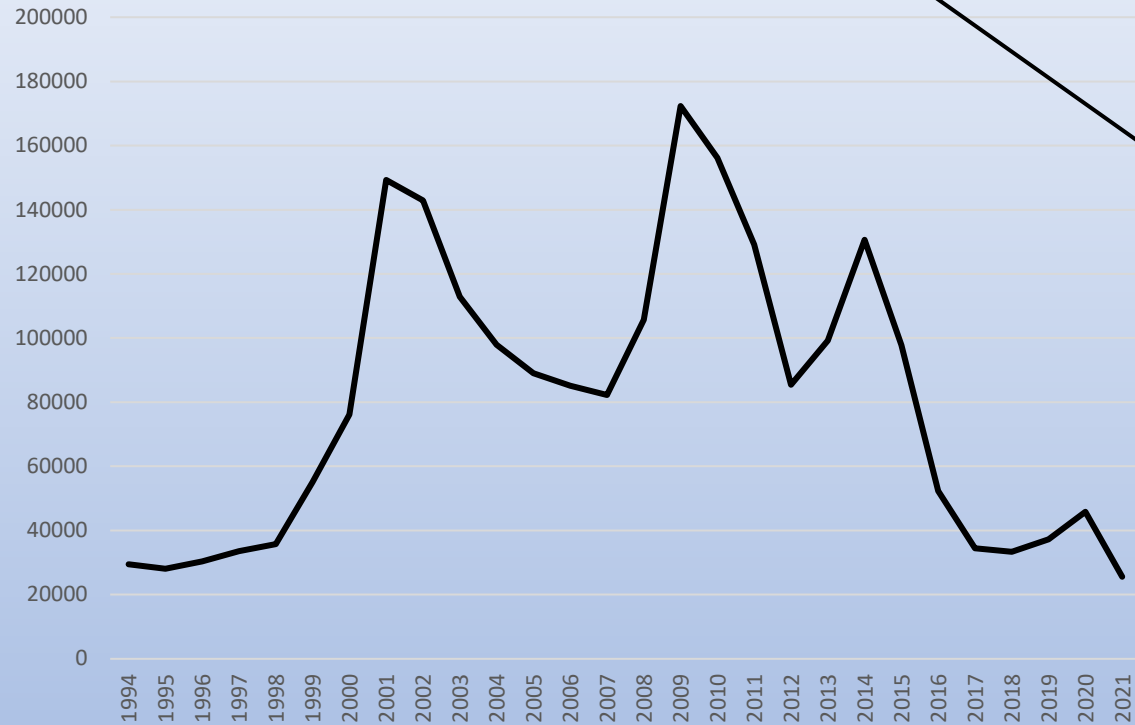
¹Columbia River Inter-Tribal Fish Commission

²Yakama Nation Fisheries



Columbia Basin Steelhead

Wild Steelhead Count (Bonneville Dam)



- All steelhead above Bonneville Dam are listed under the ESA
- Average escapement for the entire basin is only 80,000

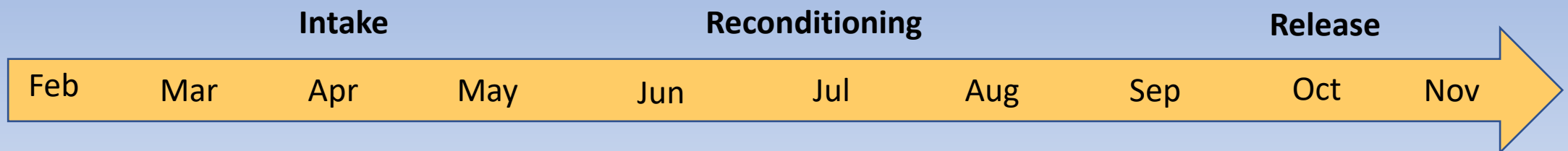
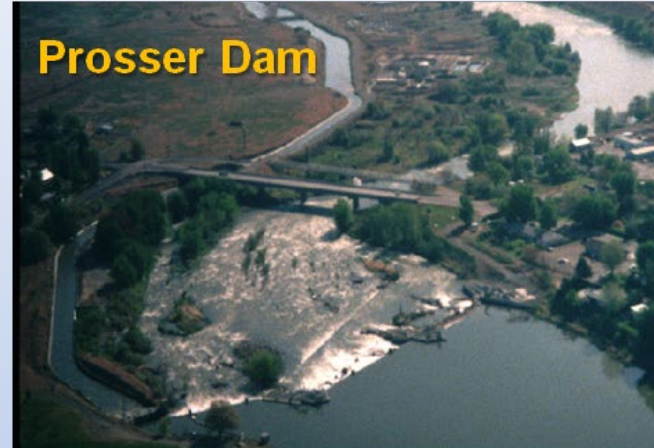
Life History

- Steelhead are the anadromous form of rainbow trout and are capable of repeat spawning (iteroparity)
- Post-spawn steelhead migrating downstream to the ocean are called kelts
- Kelt steelhead are relatively abundant in the basin
- Repeat spawner rates are extremely low



Kelt Reconditioning- The Process

- Collect downstream migrating kelts at weirs or juvenile bypass systems in the spring
- Transport kelts to large circular tanks. Utilize specialized fish culture practices.
- Release reconditioned kelts in the fall to overwinter with the natural run and spawn the following spring.
- Reconditioned kelts can choose two alternative pathways to rematuration and repeat spawning
 - Consecutive spawning
 - Skip spawning

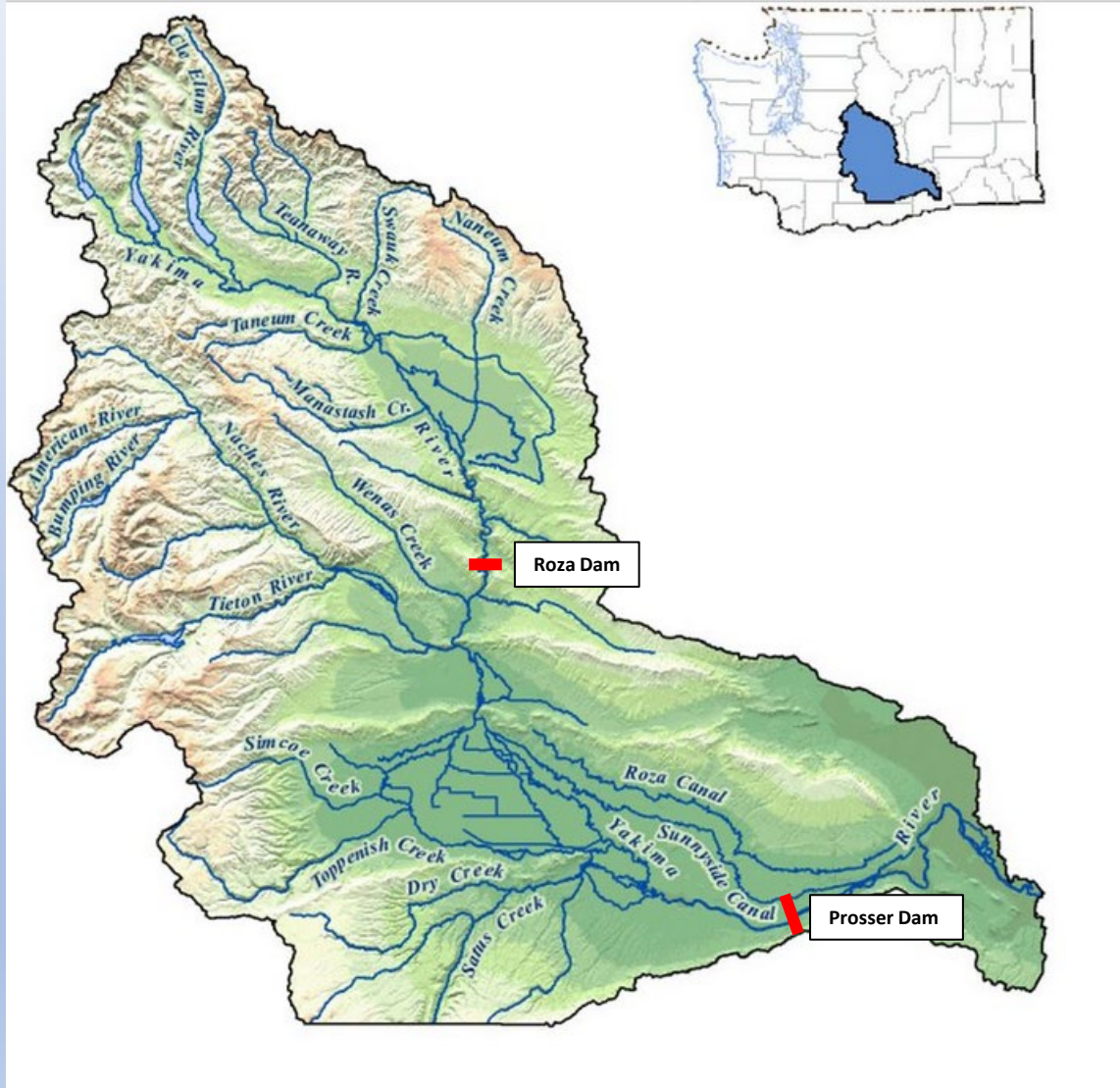


Key Questions

1. Establish methods to assess how kelt conditioning may benefit population growth, abundance, spatial structure, and diversity.
2. Quantify the breeding and reproductive success of hatchery-origin, natural-origin, and reconditioned natural-origin females.
3. Develop methods to assess the fat levels, maturation timing, fecundity, egg size, and gamete viability of the project's reconditioned kelts.
4. Evaluate the homing and straying rates of reconditioned kelts released by the project.
5. Determine the best geographic locations and times of the year to release reconditioned kelts.



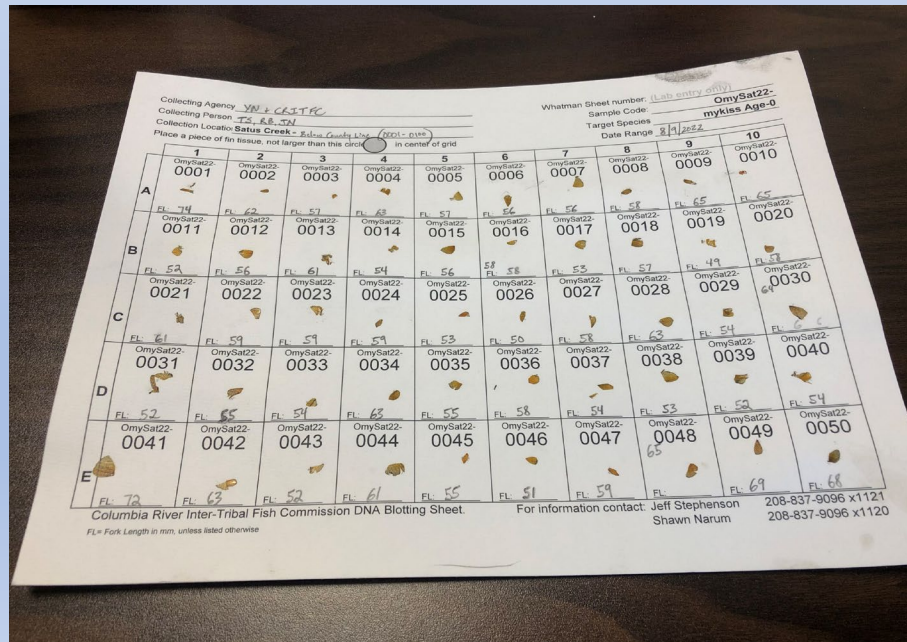
The Yakima Basin



- The Yakima River is approximately 344 km in length and the entire basin is 15,928 km²
- Historically, the Yakima Basin was one of the major producers of salmon and steelhead in the Columbia River Basin
- Estimated to have historical returns of salmon/steelhead numbering 500,000-900,000 (prior to 1850)
- The steelhead population consists of three genetically unique major population groups (MPG)
- Post spawn steelhead migrating downriver are entrained in an irrigation canal and collected at the Chandler Juvenile Monitoring Facility (CJMF)
- Kelt steelhead are reconditioned at the adjacent Prosser Hatchery

Homing of Artificially Reconditioned Kelt Steelhead

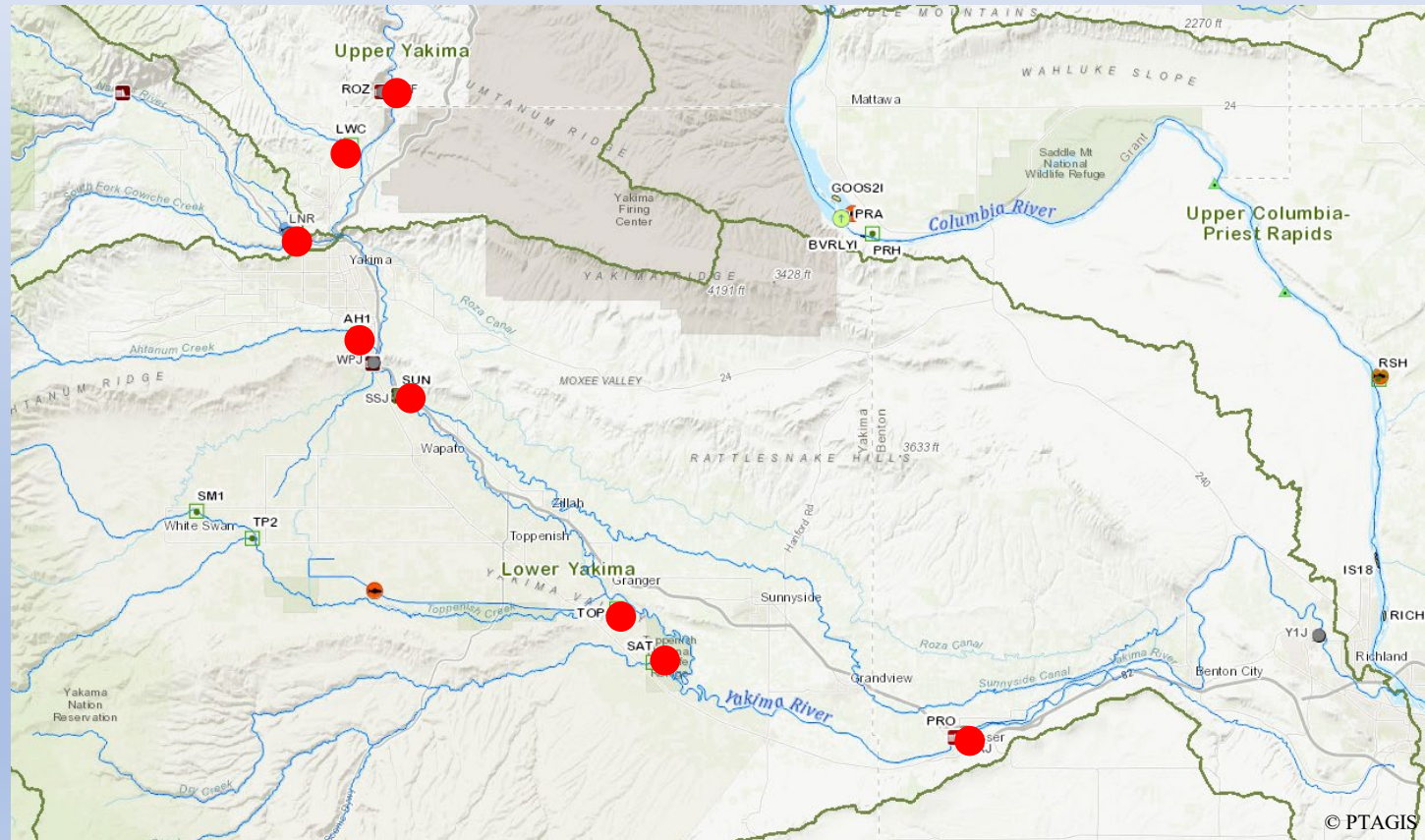
- Used PIT tag data and parentage analysis to evaluate the homing and straying rates of reconditioned kelts in the Yakima River Basin
- We examined homing/straying at two different spatial scales
 1. Sub-Basin
 2. Sub-Population



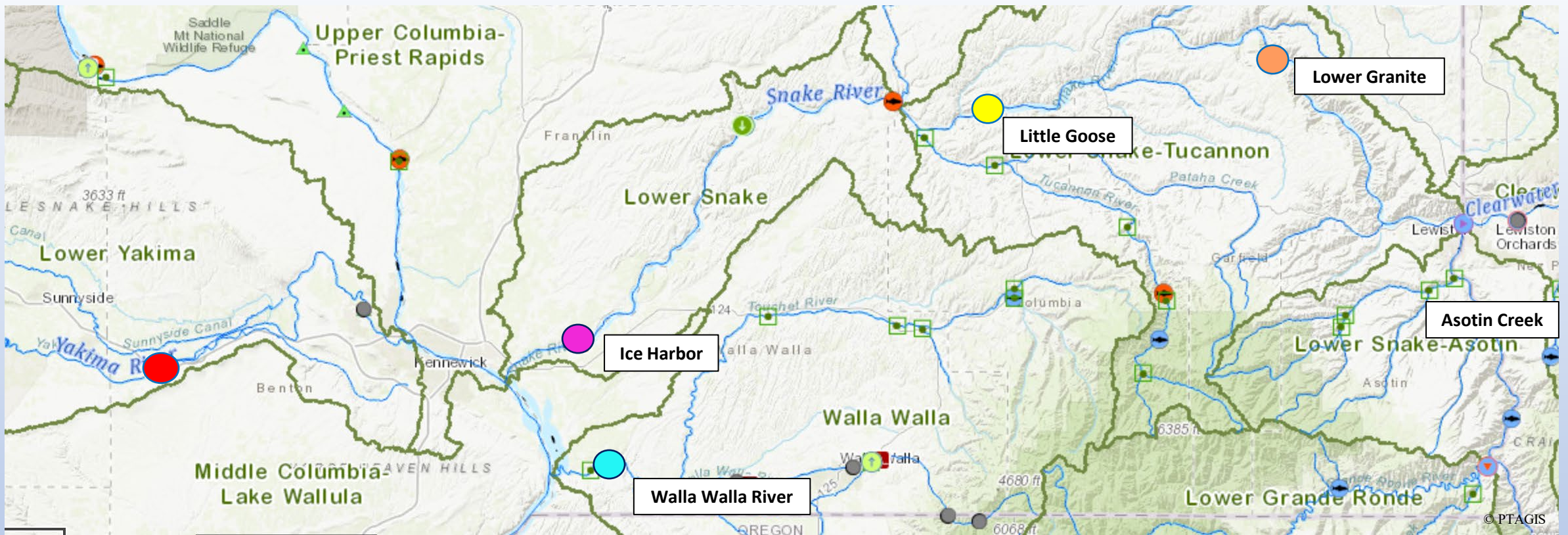
Sub-Basin Homing

- All long-term reconditioned kelts for this study were released below Prosser Dam in the lower Yakima River with a PIT tag for individual identification
- Final spawning destination of these individuals was assigned through tributary, in-river, or dam PIT tag detection, or recollection as post spawn kelts the following emigration season
- Fish that had no detections post release were excluded from our analysis
- The PTAGIS database is queried on an annual basis to collect the complete tag history for all kelts released from the reconditioning program
- Final detections were assigned using the last uppermost detection location

Reconditioned Kelts Detected at or Above Prosser Dam (2012-2022)



- Prosser Dam (2008): 682
- Satus Creek (2012): 235
- Toppenish Creek (2012): 157
- Sunnyside Dam (2015): 112
- Ahtanum Creek (2019): 38
- Naches River (2016-2020): 40
- Wenas Cr (2018): 3
- Roza Dam (1992): 29



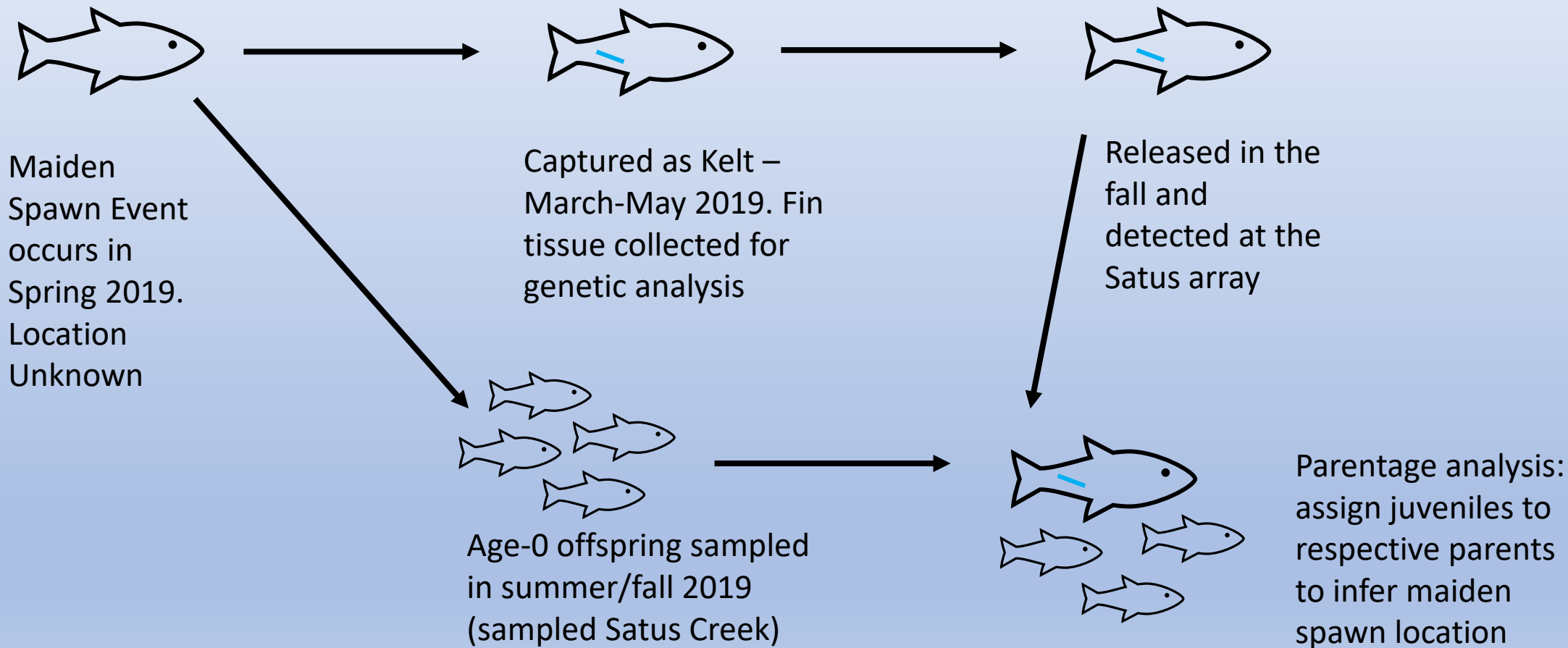
Sub-Basin Strays

- A total of five potential strays from the 2012-2021 Prosser kelt releases
- One fish detected in Asotin Creek on 4/9/20
- Three fish with final detections at Ice Harbor (3/5/16), Little Goose (3/23/18), and Lower Granite (4/1/16)
- One fish detected in the Walla Walla River on 4/16/14
- Stray rate of less than 0.5%

Sub-Population Homing

- Limited to maiden steelhead with detections at the sub-population level and subsequent detections post reconditioning
 - PIT to PIT group
- PIT tag arrays installed in 2012 (Satus & Toppenish Creek)
- Only a small number of maiden spawners are PIT tagged
- To increase sample size we used parentage results as a proxy for PIT tag detections of the maiden spawning event
 - Reproductive success study
 - Progeny to PIT group

Progeny to PIT Group



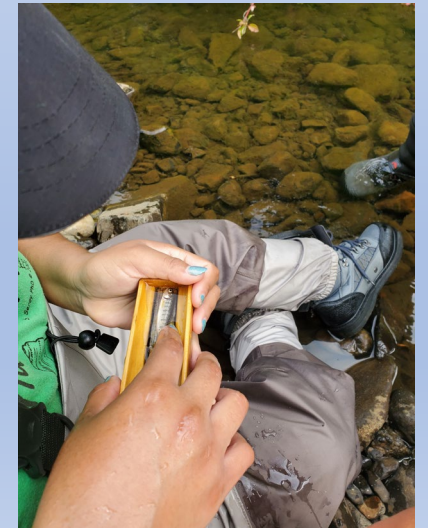
Results

PIT to PIT group (2012-2022)

Detection Event	Satus Creek	Toppenish Creek	Ahtanum Creek	Roza Dam	Taneum Creek	Teanaway River	Totals
<i>Maiden PIT Detection</i>	17	24	3	20	2	1	65
<i>Kelt PIT Detection</i>	17	24	3	20	2	1	65
<i>Homing %</i>	100	100	100	100	100	100	100

Progeny to PIT group (2013-2021)

Detection Event	Satus Creek	Toppenish Creek	Totals
<i>Age-0 Juveniles</i>	41	44	85
<i>Kelt PIT Detection</i>	41	44	85
<i>Homing %</i>	100	100	100



Prosser Kelt Releases (Sub-Basin & Sub-Population)

Run Year	Release Date	Release Total	Upstream Detections	Upstream migration %
2012-13	10/10/2012	337	234	69.4%
2013-14	10/23/2013	224	114	50.9%
2014-15	11/6/2014	153	112	73.2%
2015-16	11/5/2015	322	207	64.3%
2016-17	10/27/2016	192	157	81.8%
2017-18	10/24/2017	70	58	82.8%
2018-19	11/1/2018	106	95	89.6%
2019-20	10/31/2019	154	116	75.3%
2020-21	10/20/2020	258	164	63.6%
2021-22	10/28/2021	149	104	69.8%
2012-2022 Totals	-	1965	1361	72.1%

Conclusions

- Artificially reconditioned kelts in the Yakima Basin demonstrate extremely high levels of homing fidelity
 - 99.5% homing rate (Sub-Basin)
 - 100% homing rate (Sub-Population)
- The reestablishment or enhancement of repeat spawning in listed steelhead populations can improve productivity, diversity, and demographic stability
- Kelt reconditioning is a conservation tool: the goal is to convert the abundance of kelt steelhead into increased numbers of repeat spawners
- During years of low abundance, kelt reconditioning becomes increasingly valuable



Reconditioned Kelts (Snake River)

- 3DD.0077597DB2: maiden det. TAY on 4/26/20, kelt det. TAY on 4/25/22
- 3DD.0077599884: maiden det. WR2 on 4/29/20, kelt det. WR2 on 4/29/22
- 3DD.007759BE1C: maiden det. HYC on 4/28/20, kelt det. HYC on 5/2/22
- 3DD.007759BFDB: maiden det. TAY on 4/22/20, kelt det. TAY on 4/24/22
- 3DD.00775FA9B3: maiden det. JOC on 2/11/20, kelt det. JOC on 3/4/22
- 3DD.007761DBD6: maiden det. IR2 on 4/8/20, kelt det. IR2 on 3/23/22
- 3DD.007761F106: maiden det. IR2 on 4/22/20, kelt det. IR2 on 4/24/22