



Overview

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) have implemented a reintroduction program for Pacific Lamprey (*Entosphenus tridentatus*) in the Columbia River Basin due to population declines of this species throughout its historic range (Fig. 1). Artificial propagation, a new frontier in restoration research for Pacific Lamprey, is one method that is supporting CTUIR reintroduction efforts in the Tucannon River, WA (Fig. 2). In 2021 and 2022, CTUIR released approximately 850,000 artificially-propagated Pacific Lamprey prolarvae into the Tucannon River and tracked them in the wild using genetics. Objectives were to confirm the following:

- 1) Artificially-propagated (AP) larval lamprey can survive in the wild.
- 2) AP survivors can grow continuously across years and distribute downstream of release locations.
- 3) Genetic parentage assignments would match known cross records, and offspring locations would be observed nearest to their release group location.

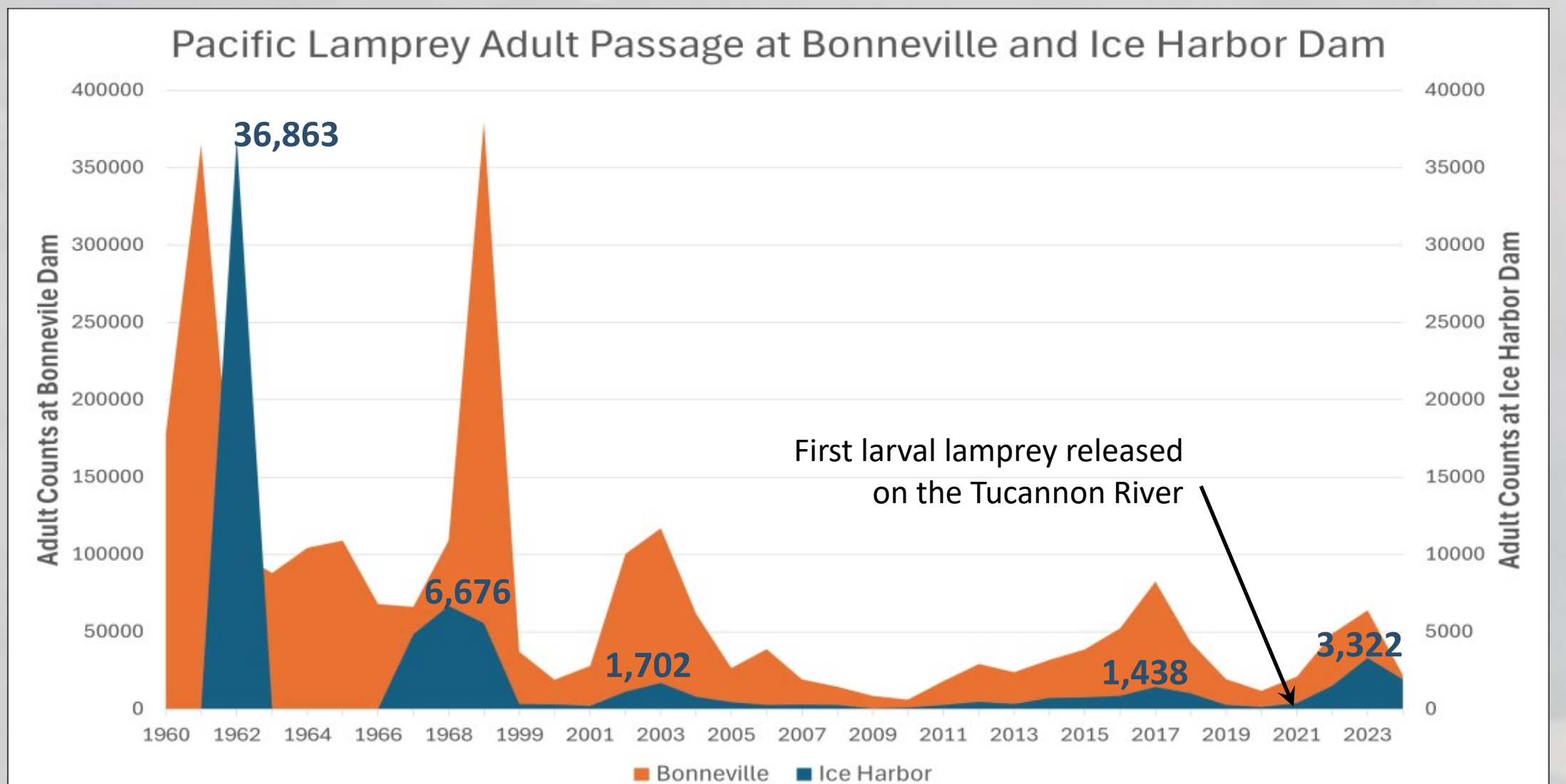


Figure 1. The number of adult lamprey passing Bonneville and Ice Harbor Dams has significantly diminished from the first count at Ice Harbor Dam in 1962. Ice Harbor Dam is the most downstream dam on the Snake River. No passage data is available for either dam during the 1969-99 timeframe. Source: Fish Passage Center.

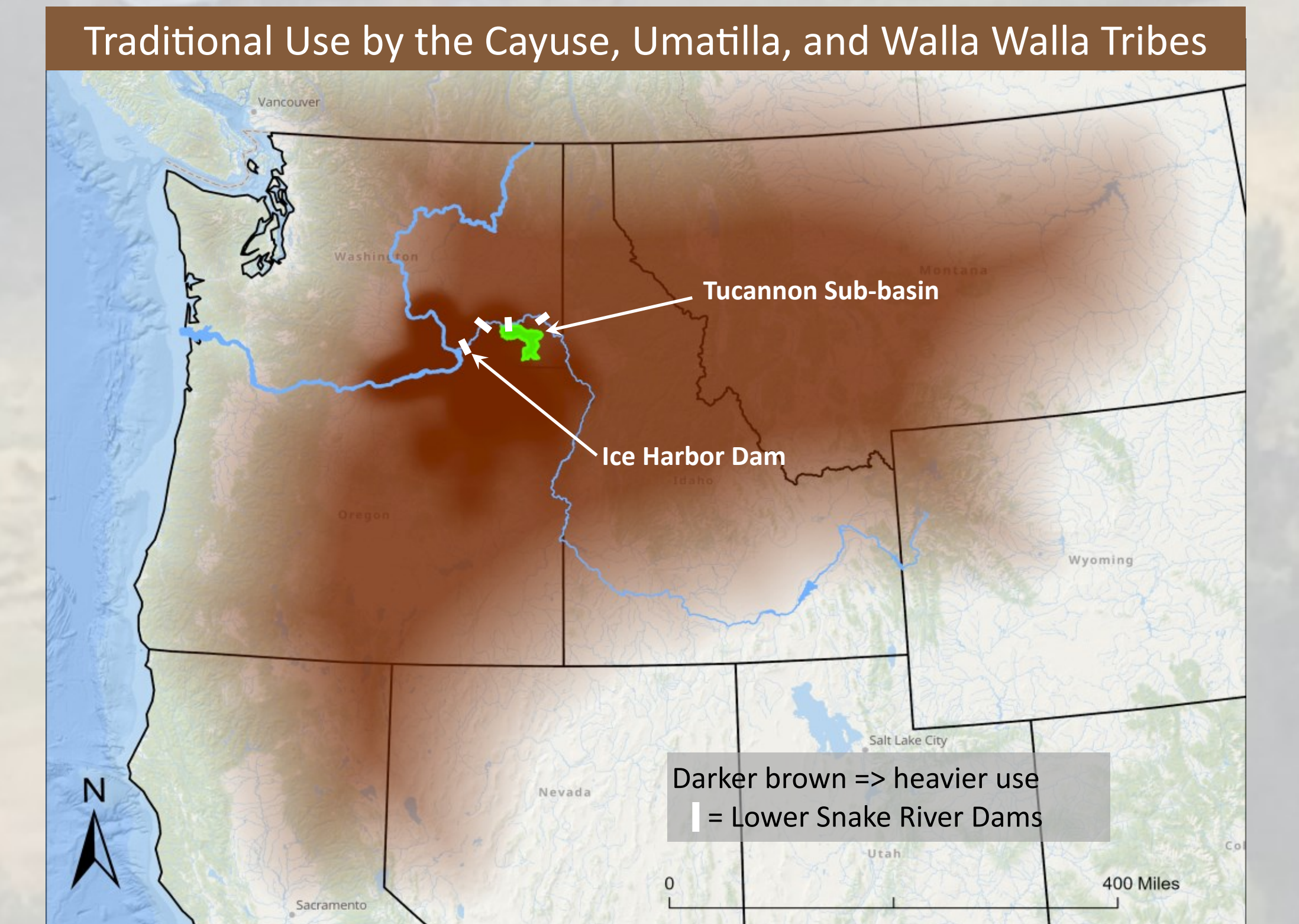


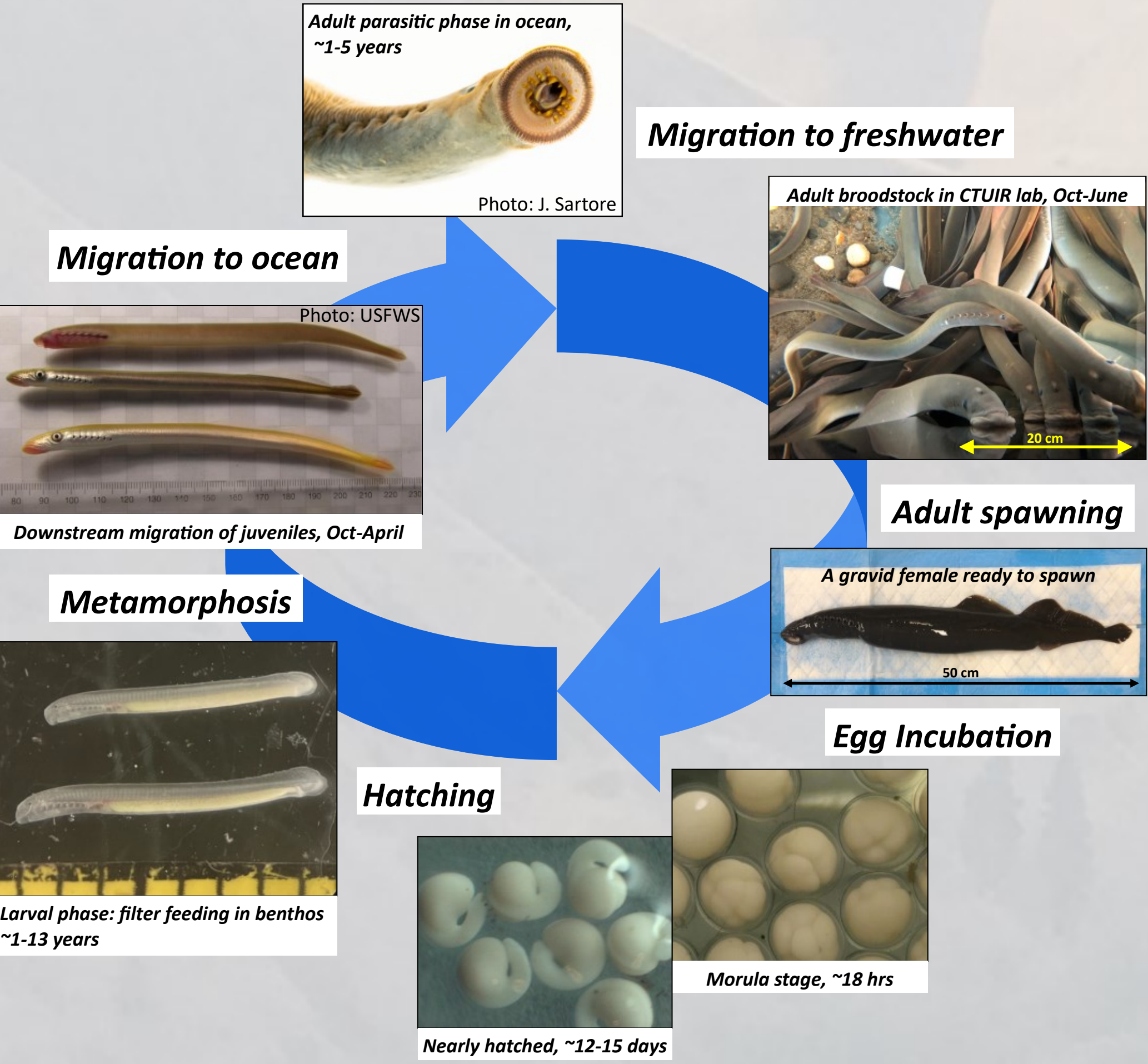
Figure 2. The Tucannon River, located between Lower Monumental and Little Goose Dams, is the lowest tributary to the Snake River that sustains several anadromous fish populations. The Tucannon River occurs in an area where CTUIR exercises fisheries co-management authority with States.

In 2021 and 2022, twelve female and eighteen male lampreys were tissue sampled and cross-fertilized in the lab (Fig. 3). The resulting larvae were reared to a minimum of 30 days post-fertilization. AP larvae were released into the Tucannon River in 2021 (n = 471K) and 2022 (n = 387K). Crosses were isolated for the identification of two treatments (staggered and direct release) at two release sites (Index 10 and 11; Fig. 4). Prior to the first release of AP lamprey, no Pacific Lamprey were detected in the Tucannon River upstream of river kilometer 14 (Index 4) during electrofishing and eDNA surveys. Post-release electrofishing at multiple index sites in 2023 provided data on presence and distribution of AP survivors. Genetic analysis was conducted on all sampled larvae to determine whether they were AP offspring.

AlaKaZam: Bringing Pacific Lamprey back to the Tucannon River with Artificially-Propagated Larvae

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Pacific Lamprey Life Cycle



Artificial Propagation



Figure 3a. Tissue samples are collected from the dorsal fins of all adult lamprey broodstock and used for future parentage and sibship analysis.

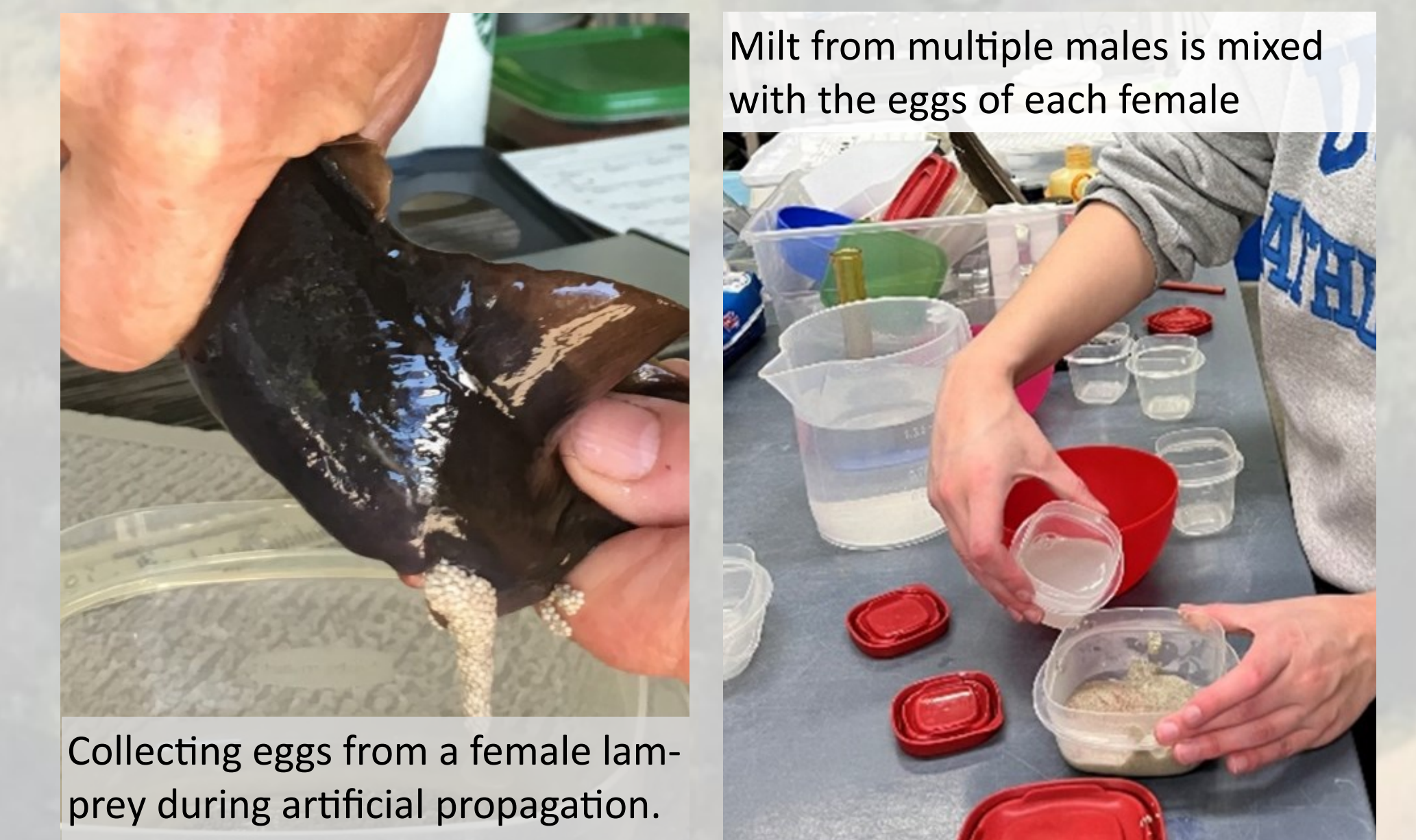
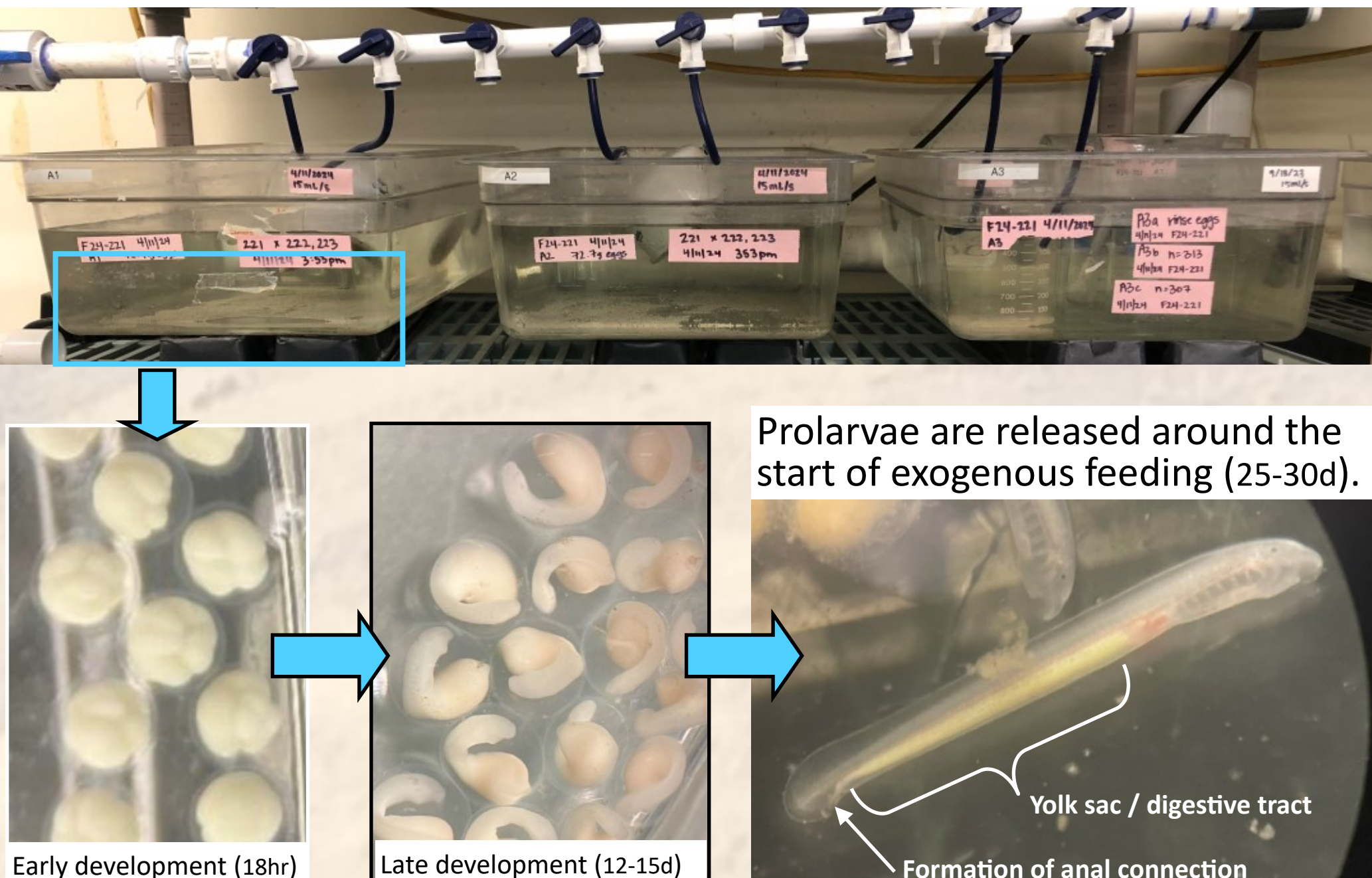
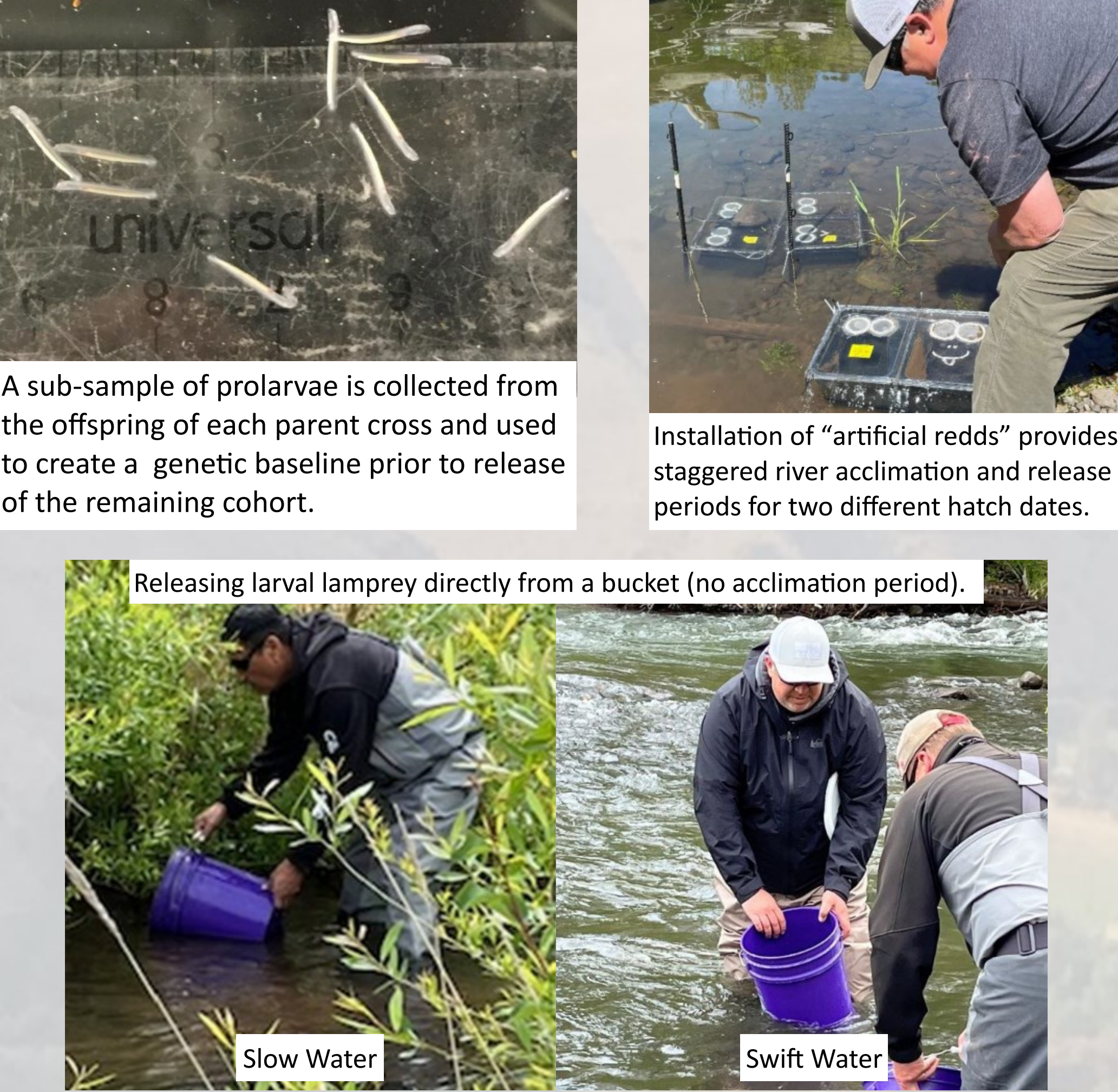


Figure 3b. Fertilized eggs are separated into matrilineal families and incubated in a recirculating system where flow and temperature are held constant.

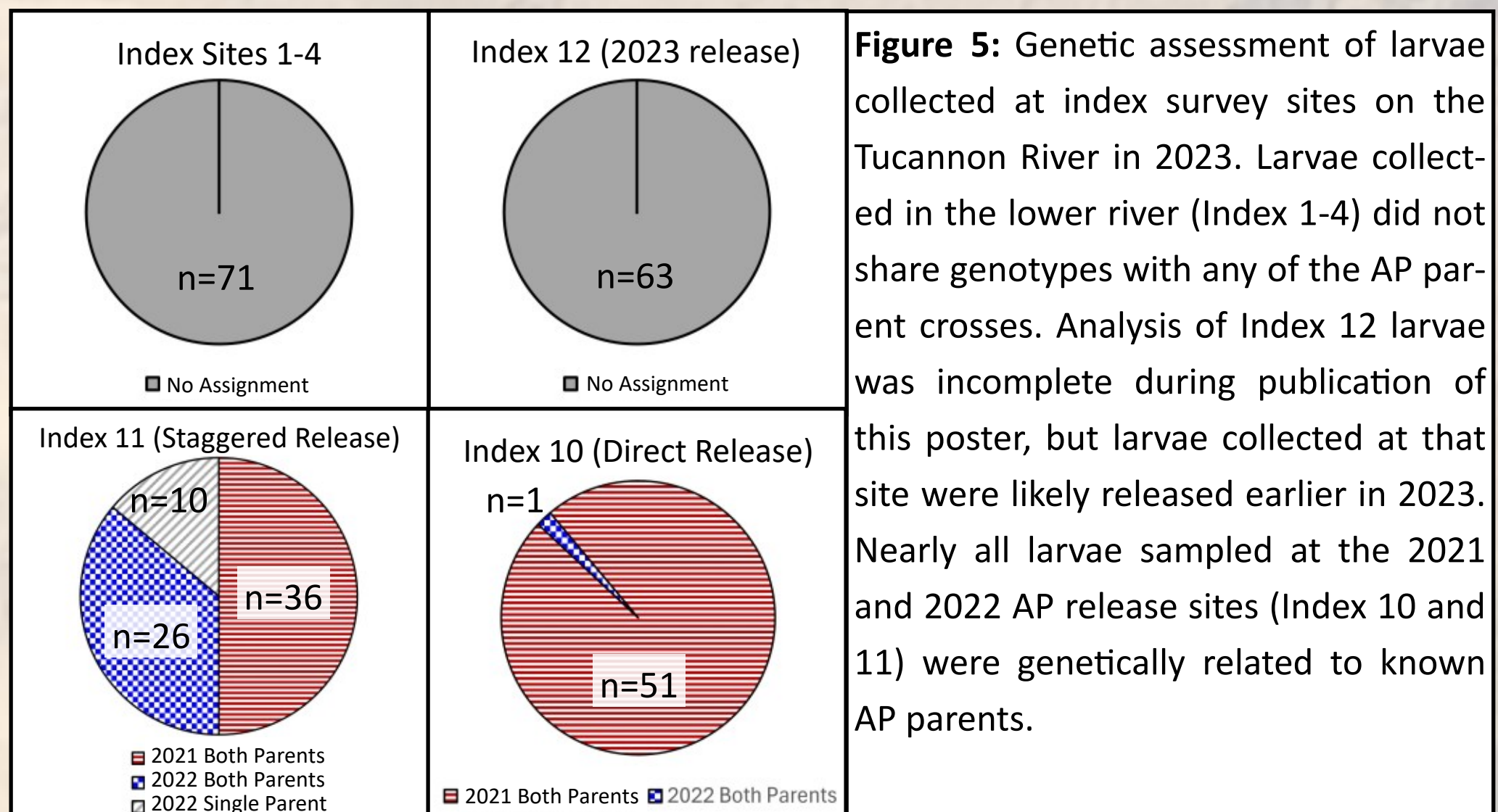
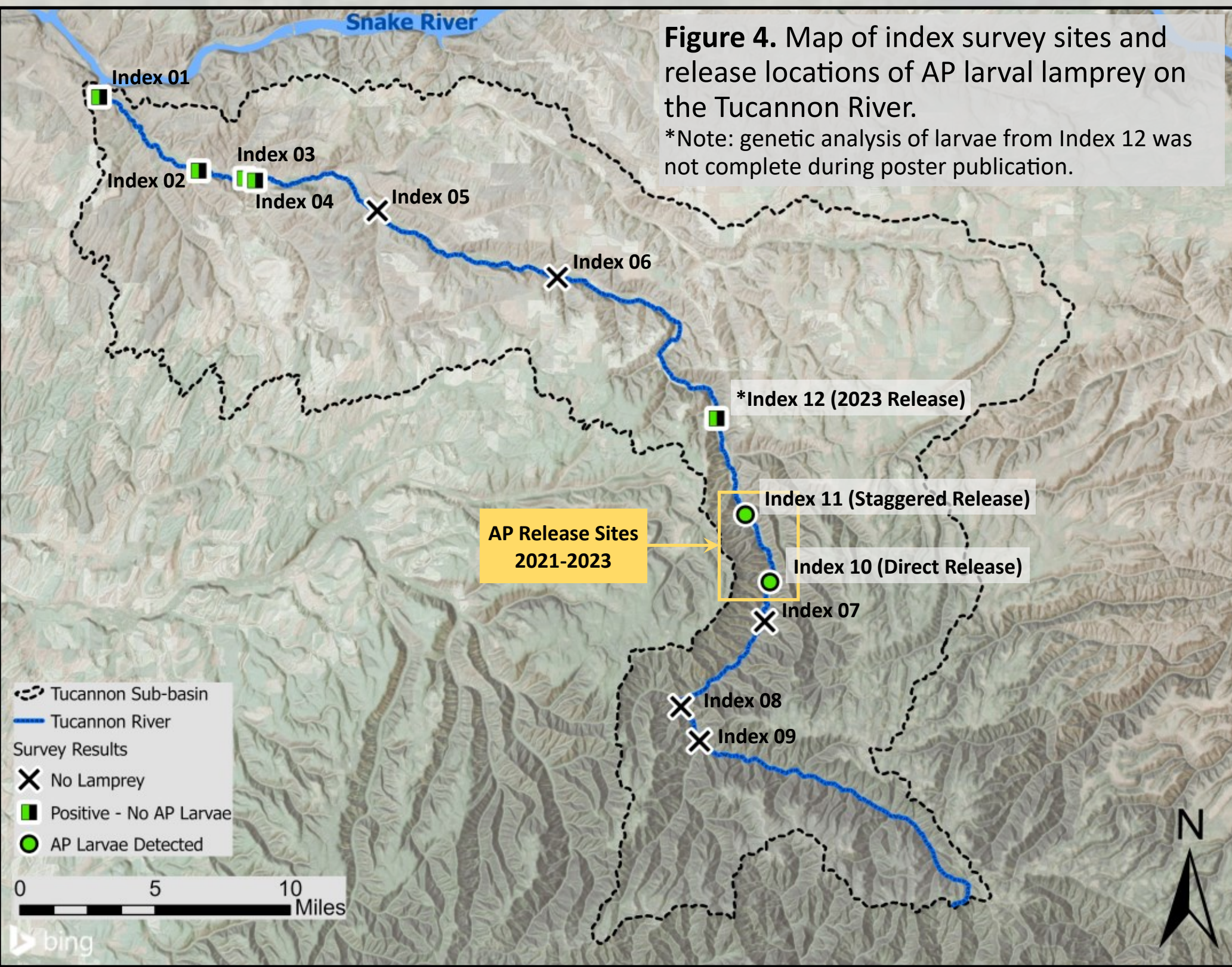


Outplanting Larval Lamprey



Results

Of the 262 larval lampreys collected in 2023, only four “failed” to genotype (Table 1). While larvae occurred at seven index sites, no AP fish were identified in the lower river (Index 1-4). AP larvae were collected from the upper Tucannon River near larval release locations. Of the larvae successfully genotyped in survey samples from the AP release sites (Index 10 and 11), 100% were assigned to one or two AP parents. Moreover, most of the fish were assigned to both parents, increasing the credibility of assignments (Fig. 5).



Summary

Genetic parentage assignment indicated that AP Pacific Lamprey released into the Tucannon River survived and grew at rates of approximately 30 mm/yr for up to two years in the wild (SY21 average length = 102mm; SY22 avg length = 61mm, **Fig. 6**). The crosses conducted in the laboratory were consistent with crosses identified from field collections and revealed that both direct and staggered release methods worked. However, contrary to expectation, AP larvae did not disperse far downstream in their first few years of life. Future years of results from genetic marking experiments will hopefully help to refine release methodology and specifically: 1) confirm AP survive to advanced life stages, 2) understand effects of density on emigration and transformation, and 3) provide information on Tucannon River carrying capacity for this species.

Table 1. Parentage assignments of the larvae to AP candidate parents.						
Year	Ma	Pa	Method Failed	GSI	Both Parents	Single Parent
2021	---	---		134		10
	SY21-0365	SY21-0371			20	20
	SY21-0393	SY21-0381			4	4
		SY21-0391			1	1
	SY21-0397	SY21-0371			2	2
		SY21-0381			29	29
		SY21-0391			29	29
2022	SY21-0241	SY21-0395			1	1
	SY21-0397	SY21-0395			1	1
	SY22-0024	SY22-0038			12	12
	SY22-0036	SY22-0038			6	6
	SY22-0040	SY22-0038			8	8
	SY22-0213	SY22-0038			1	1
	NA	NA	4			4
Total			4	134	114	10

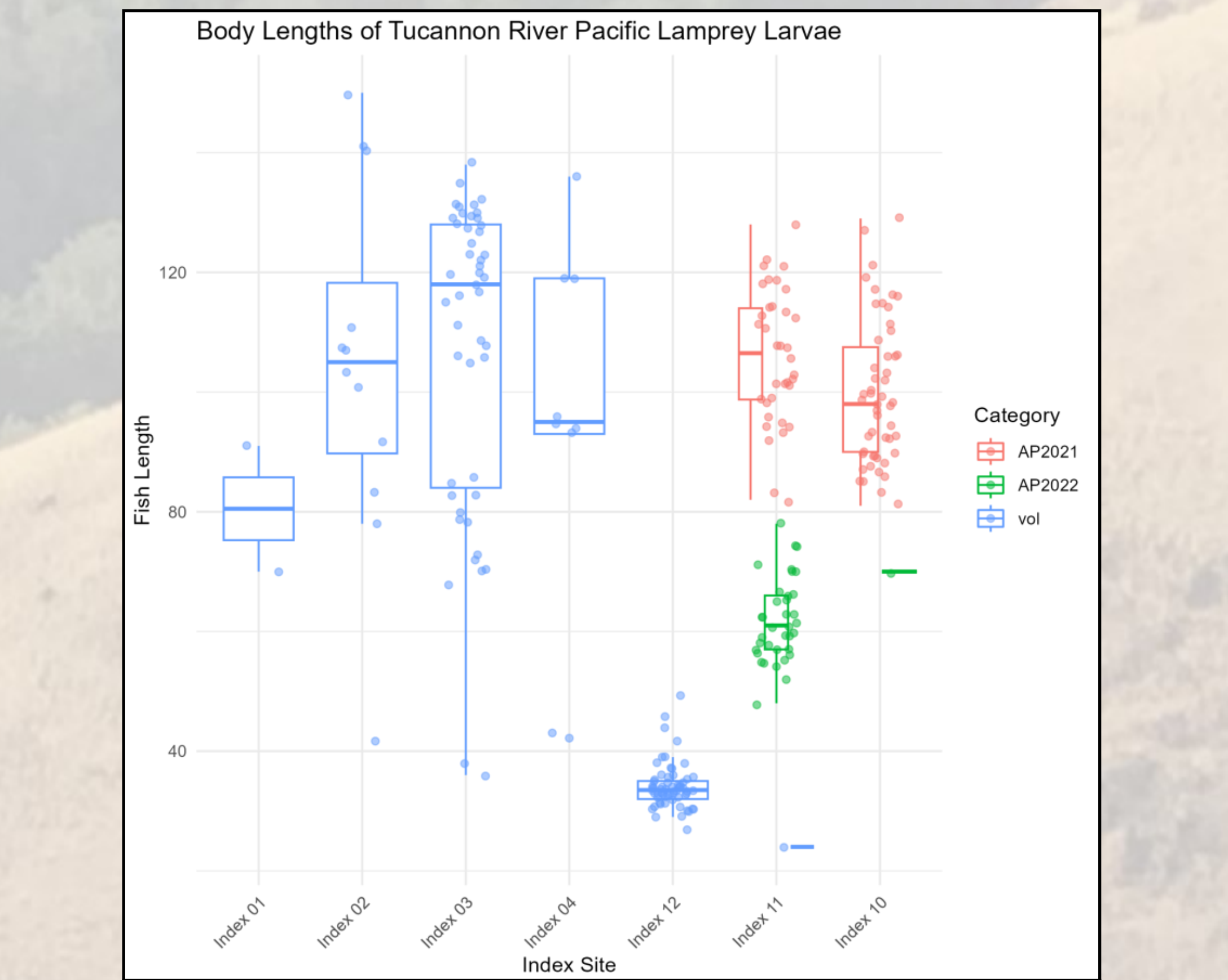


Figure 6. Box and whisker plot of body lengths of Tucannon River Pacific Lamprey larvae. Parentage analysis indicated whether larvae were either from AP brood years 2021 or 2022, or represented volitional (vol) production.



Acknowledgements
The Portland Zoo, High Desert Museum, Walla Walla Community College, and Imtwha Hatchery (CTUIR) provided support for housing broodstock during the winter. Whitman College students provided support in both broodstock maintenance, larval rearing and artificial propagation operations. Sally Gee (Oregon Department of Fish and Wildlife) provided timely health screening for larval outplants. Thanks all!