

Program Transition Plan Template

Program(s): Fall Chinook

Affected Recovery Population(s) and Recovery Designation(s):

Population Name	Population Recovery Designation
Lower Cowlitz	Contributing
Upper Cowlitz (Upper Cowlitz/Tilton combined)	Stabilizing

Synopsis of how this Transition Plan is expected to change the current hatchery program and advance population(s) to the next Recovery Phase as characterized in 2020 FHMP:

The overall hatchery program size will remain the same (contingent on bioprogramming). Transition from the current lower Cowlitz segregated and integrated programs to a single Upper Cowlitz integrated hatchery program (Utilizing only the Tilton River population segment) for all or the vast majority of the 3.5 million smolts. Begin CWT marking of Chinook smolts handled at the Mayfield Dam Juvenile facility in 2022. Continue improvements to lower Cowlitz spawner abundance monitoring. This will promote continued abundance building of Upper Cowlitz Fall Chinook while improving understanding of the population and origin of returning natural- origin fall Chinook in the Lower Cowlitz and Tilton Rivers to advance recovery, including progression through additional recovery phases.

Recovery Phase(s) as Described in FHMP: Lower Cowlitz/Local Adaptation and Upper Cowlitz/Local Adaptation

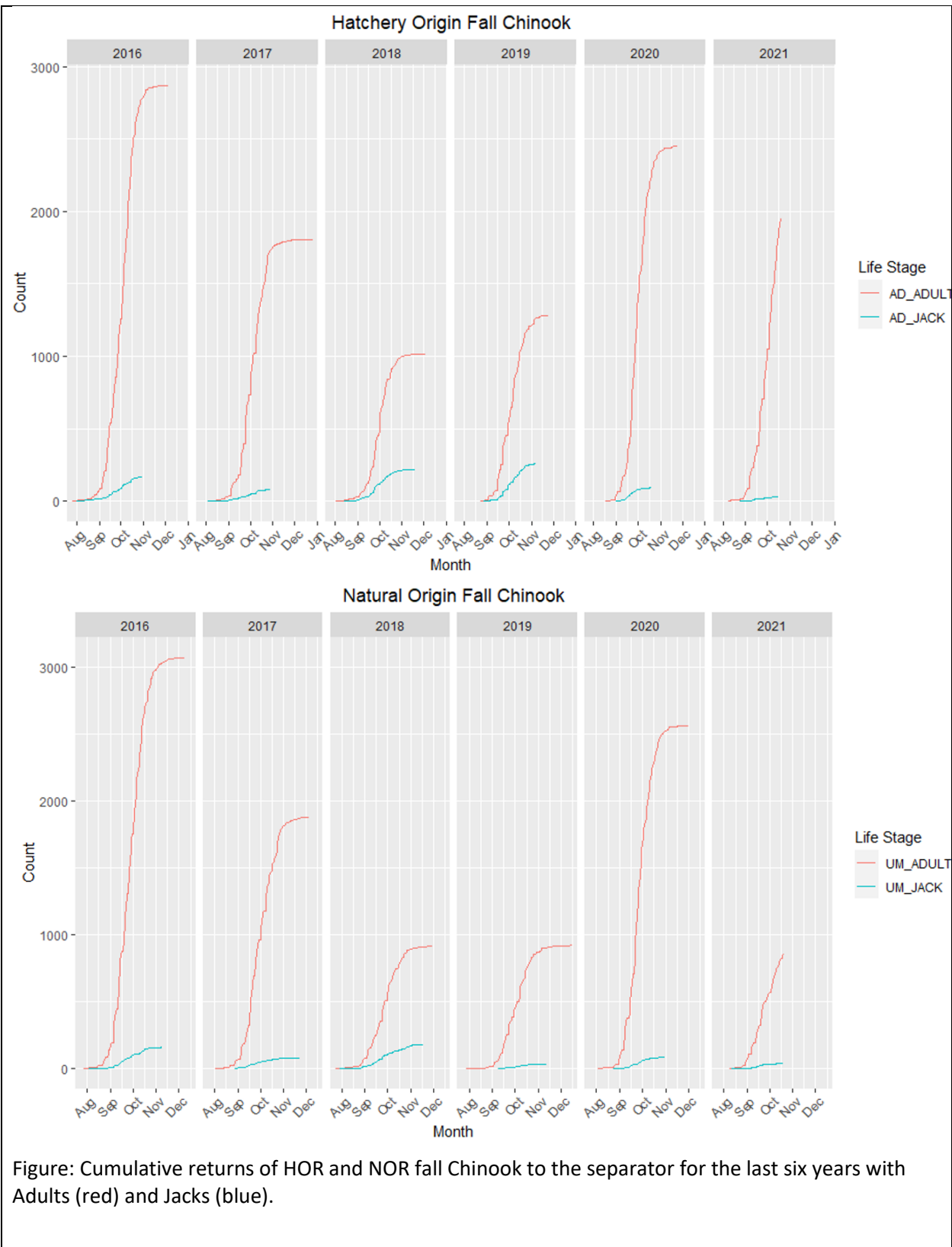
Goal of new program by recovery phase (i.e. conservation/harvest, etc):

Recovery Phase	Goal of program	Thresholds/Triggers/Decision Rules required to transition from one phase to next
Preservation	Conservation (promote recovery) and harvest	<p>Natural origin population at risk of extirpation</p> <p><i>Not applicable – as populations are already past this phase</i></p> <ul style="list-style-type: none"> • 5 yr geomean total abundance (when counting NOR adults plus HOR adults up to the number which would cause pHOS to equal the pHOS goal for Local Adaptation) is LESS than the quasi-extinction threshold • Vast majority/all of historical habitat is unusable/heavily impacted/inaccessible currently (e.g., blocked by dams with no passage)
Recolonization	Conservation (promote recovery) and harvest	Natural origin population at low abundance; habitat underutilized

		<p>Assuming populations are currently past this phase. Revisit criteria if population assessment indicates Upper (Tilton) or Lower Cowlitz population is NOT in local adaptation phase or if either population's status declines.</p> <ul style="list-style-type: none"> • 5 yr geomean total abundance (when counting NOR adults plus HOR adults up to the number which would cause pHOS to equal the pHOS goal for Local Adaptation) is MORE than quasi-extinction threshold but LESS than the number needed to meet the interim viability goal (NOAA VSP criteria or alternative). • Interim viability goal can be expressed as seeding a percentage (e.g., 50%) of the freshwater habitat, and can be estimated by stock recruit analysis (e.g., estimate spawner abundance required to produce 50% of R_{max}). • Enough historical habitat is currently accessible (including by trap and haul) for maintenance of an equilibrium population size greater than QET
Local Adaptation	Conservation (promote recovery) and harvest	<p>Natural origin population nearing full-seeding of available habitat</p> <p>Assuming current populations are in this phase now.</p> <p>Tilton</p> <ul style="list-style-type: none"> • Develop assessment criteria for trigger(s) during next 1 year <ul style="list-style-type: none"> ○ Such as integrating R_{max}, SAR and/or adult to adult productivity into phase triggers • Assess if Local Adaptation Phase is appropriate at this time <p>Lower</p> <ul style="list-style-type: none"> • Develop/Confirm assessment criteria for trigger(s) during next 1 year of: <ul style="list-style-type: none"> ○ Escapement

		<ul style="list-style-type: none"> ○ R_{max} ○ Adult to adult productivity ● Maintain pHOS goal of 30% while new Tilton Integrated Program is established and reassess as program matures and data becomes available post 2025.
Full Recovery	Maintain Recovery and provide Harvest	<p>Natural origin population is both above full-seeding of available habitat AND meeting its recovery goal</p> <p>Assuming current populations are not yet in this phase. Revisit criteria if population assessment confirms populations are currently in Local Adaptation phase.</p> <ul style="list-style-type: none"> ● 5 yr geomean of spawner NOR abundance (not counting HORs) is MORE than minimum interim viability objective when only counting NOR spawners and is also MORE than its recovery goal.
Current Program: This describes the fall Chinook program prior to interim management implemented in 2021.		
Program Name:	Lower Cowlitz Fall Chinook	
Program Type:	Segregated/Integrated	
Recovery Phase:	Local Adaptation	
Goal of Program(s):	Conservation/Harvest	
Adult Broodstock Collection		
Broodstock Source	Cowlitz HOR adults/Lower Cowlitz NOR adults	
Broodstock Collection location/methods	HOR returns to separator/ NORs collected from lower river via selective angling.	
Integration Rate ¹	Segregated: 0.0 /Integrated: ~0.5	
Collection timing curves:		

¹ fixed, sliding scale, etc.



Secondary sources/plans for lack of adults		NOR returns to separator were used for several (i.e. 2017 – 2021) years as a secondary source of broodstock.		
Adult Transportation & Disposition				
<i>Target</i>	<i>Rank</i>	<i>Quantity (range)</i>	<i>Location</i>	<i>Dates</i>
Tilton River	1	Up to 1,600	Gus Backstrom & Bremer Bridge <i>See Tilton River Salmon and Steelhead Transport Plan</i>	Sept-Dec
Surplus	2	Above transport and hatchery needs	Food Bank	Sept-Dec
Nutrient Enhancement	3	Spawmed carcasses, non-food grade fish above transport and hatchery needs	Upper Basin	Sept-Dec
Juvenile Release(s)				
Release Strategy		Volitional followed by force out. Net pen fish are trucked		
Quantity (range)		2.4 Million Segregated/ 1.1Million integrated 1.1 Million integrated (CSH) 0.4 Million Segregated (CSH) 2.0 Million Segregated Net Pen Project		
Release Age/size		Released at 80fpp subyearlings		
Release Location/Timing		Cowlitz Salmon – May - June Mayfield Net Pens to lower river		
Marking/Tagging strategy ²		Segregated- AD clip Integrated – AD clip/CWT		
Fish Management needs		Adipose clip required to allow harvest in mark-selective fisheries CWT in integrated program allows for identification of segregated vs. integrated returns		

² Identify how do these strategies address fish Management/evaluation, monitoring data, and adaptive management trigger points.

	<p>CWT allows for evaluation of stock composition to fisheries</p> <p>CWT allows for evaluation of Mayfield net pen rearing</p>
Evaluation Needs	<p>Adipose clip allows for evaluation of pHOS/pHOB and PNI.</p> <p>CWT allows for evaluation of stock composition on spawning grounds</p>
<p>Summary of Hatchery Configuration/Infrastructure:</p> <ul style="list-style-type: none"> • Adult collection for this program occurs at the Cowlitz Barrier Dam Separator. Broodstock is held at the Cowlitz Salmon Hatchery. • Spawning and egg incubation occur at the Cowlitz Salmon Hatchery. • Juvenile rearing occurs at the Cowlitz Salmon Hatchery in 9 raceways. 	
<p>Harvest Management Strategy³</p>	
Upper river opportunity/harvest	<p>Tilton River: Mark/Selective</p> <p>Harvest rate ranging from 3% to 22%</p> <p>Seasons/bag limits are set pre-season via NOF based on forecasted returns and expected available surplus for the Tilton.</p>
Lower river opportunity/harvest	<p>Lower Cowlitz Mark/Selective</p> <p>Harvest rate ranging from 39% to 84%</p> <p>Seasons/bag limits are set pre-season via NOF based on forecasted returns and managed in-season based on separator returns.</p>
Ocean/ Columbia R. opportunity/harvest	<p>Ocean: non-mark-selective</p> <p>Columbia R. – non mark-selective with small mark-selective period in late August</p> <p>LCR Tules managed as an aggregate with exploitation rate maximum of 28%. Seasons are set via NOF.</p>
<p>Program Performance Metrics</p>	
Proportionate Natural Influence (PNI)	
pHOS level	<p>Target: <30%:</p> <p>Recent performance: Average 17% (8-26%):</p>
pNOB levels	Target: 30%

³ %harvest or # harvest x transported; fishery type (e.g., adult/jacks?; HOR/NOR, selective/non-selective, etc.)

	Recent Performance: Utilized Tilton NORs for brood:
Brood stock mining rate	Target: <30% Recent Performance Utilized Tilton NORs for brood
Overall Performance Relative to Goals ⁴	pHOS has been within allowable standards as described by HSRG. Low collection of NORs has resulted in integration rates below target
Current Monitoring Program:	
<p>Total fall Chinook redd counts are made by helicopter surveys every other week through the season as conditions allow. The current estimate of total spawners is generated by peak redd count expansion. Flights were extended in 2018 and 2019 into the Tilton River during peak weeks, however these flights were discontinued due to budget issues and overhead cover reducing effectiveness in parts of the basin. Some exploratory foot surveys have been completed in the Tilton between 2018 and 2021. Weekly carcass surveys in the lower Cowlitz River by boat are used to generate pHOS estimates and generate age and stock composition. In 2021, a lower Cowlitz carcass tagging project was initiated to improve abundance estimates, evaluate carcass recovery efficiency and evaluate the accuracy of the aerial flight count expansion. If needed, a modification to the total spawner estimate generated by the aerial surveys will be applied to the natural spawn escapement. A spot creel operates by interviewing anglers in the lower Cowlitz River to collect in season biological data. The ratio of the number of HOR fish kept by age to the number of NOR fish reported as released can then be compared to catch record card harvest reported to estimate the total number of NOR fall Chinook released. Further, an assumed mortality rate can be applied to estimate fishery mortality. Periodic stranding surveys, as per Settlement Agreement Article 15, are conducted in the lower Cowlitz River to assess the mortality associated with river level changed due to hydropower operations.</p> <p>A spot creel operates by interviewing anglers in the lower Cowlitz River to collect in-season biological data. The ratio of the number of HOR fish kept to the number of NOR fish reported as released can then be compared to catch record card harvest reported to estimate the total number of NOR fall Chinook released. Further, an assumed mortality rate can be applied to estimate fishery mortality in the future.</p>	

⁴ outline the main reasons why a transition is needed

Proposed Program:

Proposed Pathway #1	
Program Name:	Fall Chinook
Program Type:	Integrated
Recovery Phase:	Local Adaptation
Goal of Program:	Promote continued abundance building of Cowlitz Fall Chinook while increasing understanding of the population origin of returning NOR fall Chinook in the Lower Cowlitz and Tilton Rivers to advance towards the full recovery phase.
Timing for Transition ⁵	Begin CWT application at Mayfield in 2022 and implement Brood Source, Adult Collection and Disposition strategies between 2022-2026 pending at least 5 years of adult return data. Adjust strategies as data regarding NOR population origin assignment (i.e., Tilton vs. Lower Cowlitz) becomes available.
Adult Broodstock Collection	
Broodstock Source	Primary brood source is Tilton River NOR fish collected at the separator as described in the table below. Lower Cowlitz NORs may provide a secondary source for broodstock; during interim years Upper and Lower populations can be managed as an aggregate.
Broodstock Collection location/methods	Primary broodstock collection location is at the Cowlitz Barrier Dam Separator; however, in low return years broodstock collection may occur at weirs (for HORS only) and in Mill Creek (both HOR & NOR) to supplement the program when Lower Cowlitz NOR returns are normal or above normal, as described in the table below.
Integration Rate ⁶	Targets for integration are described in table below but may be variable as program is implemented. Maintaining a single integrated program using a lower

⁵ immediate, steppingstone, specific timeframe/ milestone targets

⁶ fixed, sliding scale

integration rate if necessary is prioritized over integration rate that would require two programs (an integrated program at the integration rate and additional segregated program to meet production goals).

Priority	Collection Strategy	pNOB goal	Brood Source	Spawning Strategy	
1	Normal HOR/NOR return, no shortage	at separator	30-50%	Tilton NORs and Hatchery returns	a. Hatchery x NOR when possible, hatchery x hatchery when necessary to backfill; b. re-use NOR males once;
2	Low NOR, Normal HOR	a. at separator; b. separator/lower river (Mill Creek) if lower river escapement is in normal range or higher	30% or lower if necessary	a. Tilton NORs and Hatchery Returns; b. lower river NORs	a. Hatchery x NOR when possible, hatchery x hatchery when necessary to backfill; b. re-use NOR males once; c. accept a lower pNOB/integration rate d. plan (a) plus lower NORs
3	Low HOR return, normal NOR	a. collect from separator above 50% seeding target dependent on number of adults in hand; b. collect at separator, and also NORs and HORs from lower river areas, i.e. Mill Creek (HOR &	30-50% but could go higher if necessary	a. retain all HORs; b. retain up to 30% NOR	a. hatchery x NOR; b. exceed pNOB limit but not mining rate (unless seeding target is established)

		NOR) and Weirs (HOR only)				
4	Shortages across board	a. at separator; b. separator/lower river (Mill Creek and Weirs)	as high as possible within population limits (i.e., achieving seeding targets)	retain all HORs and 1/3 NORs but replace NORs to meet seeding target at least 1:1 rate with HORs and restrict harvest; b. reduce NOR rate to less than 1/3	a. accept we may be below program goal; b. accept a lower pNOB/integration rate as part of a stepping stone strategy.	

Definitions: - The following are interim thresholds for implementing broodstock collection as described in the table above (based on most recent 9 years of data since mass marking collected at separator).

Normal HOR (Tilton) – 1,000 - 3,000

Low HOR (Tilton) - <1,000 including brood

Normal NOR (Tilton) – 1,001 - 2,000

Low NOR (Tilton) – <1,000 including brood

Minimum Integration Target – 30%

Maximum Integration until CWT adult assessment – 50%

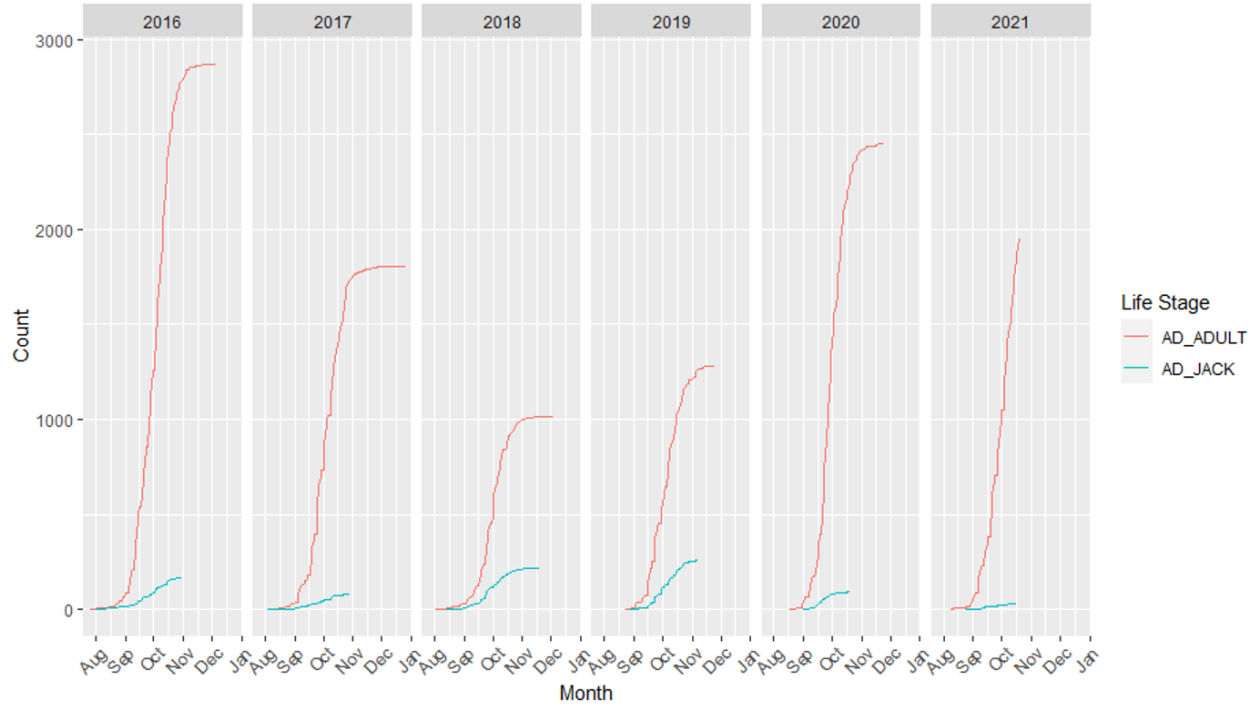
Maximum NOR brood stock mining rate – 30%

Low NOR (Lower River) – 500 Redds (1,500 fish) by second flight - escapement estimate to be improved with new methods

Collection timing curves:

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Hatchery Origin Fall Chinook



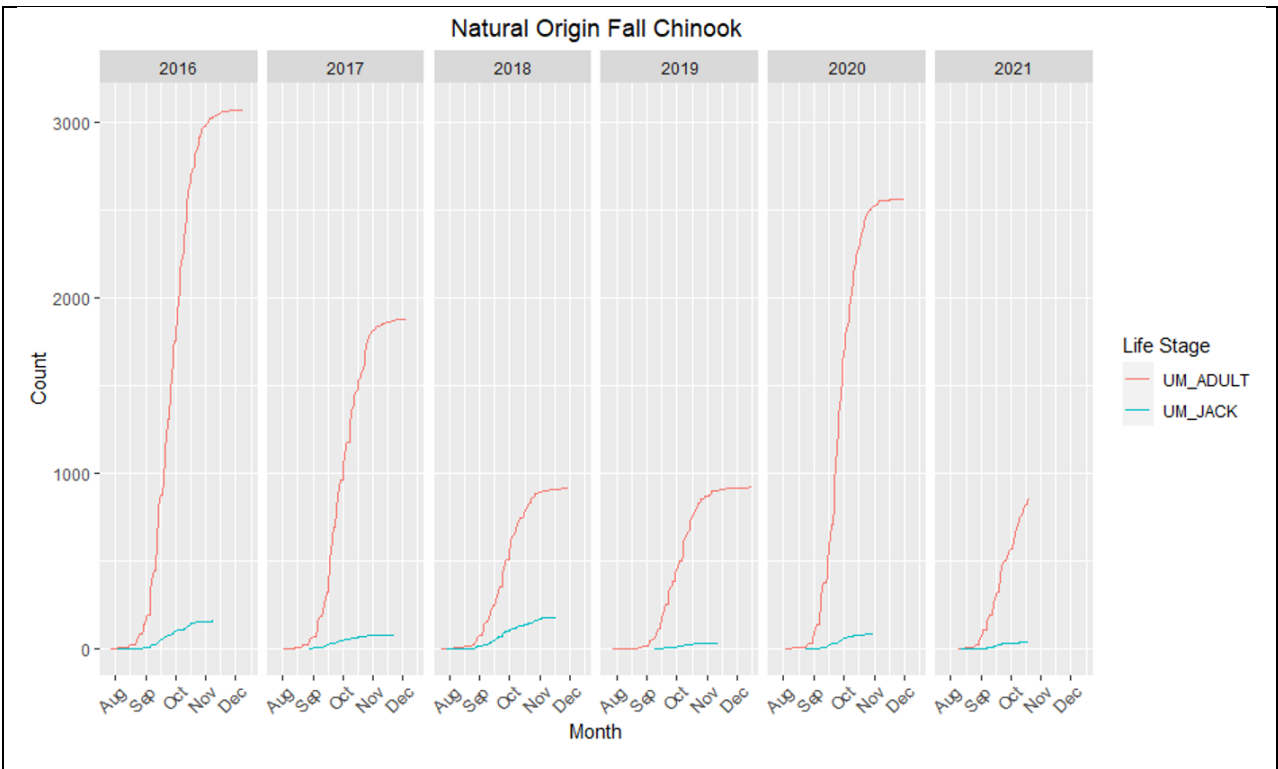


Figure: Cumulative returns of HOR and NOR fall Chinook to the separator for the last six years with Adults (red) and Jacks (blue).

Fall Chinook -

Recent, 5 year average return per program by week and respective broodstock collection goals. Example only, actual collection goals will be set via Annual Operating Plan.

Table reflects HOR and NOR collection/return *example (will be updated via AOP annually) however, when collection goals exceed actual returns use guiding principles such as backfilling and protecting the NOR mining rate*

5 yr ave (2017-2021)

		Tilton Fall Chinook		
		HOR (AD)	HOR (AD+CWT)	NOR (UM)

Week	Week	Return	Brood	Return	Brood	Return	Brood
Number	Ending	Average	Goal	Average	Goal	Average	Goal
Week 30	July 30	0		0		0	
Week 31	August 6	1		0		1	
Week 32	August 13	2		0		3	
Week 33	August 20	2		0		5	
Week 34	August 27	7		1	3	12	4
Week 35	September 3	14		3	10	42	15
Week 36	September 10	50		6	24	102	37
Week 37	September 17	92		9	35	205	74
Week 38	September 24	159	Backfill	32	123	245	89
Week 39	October 1	284	AD+CWT	74	285	349	126
Week 40	October 8	262	Brood as	75	290	273	99
Week 41	October 15	240	needed	86	330	237	86
Week 42	October 22	176	weekly	54	208	177	64
Week 43	October 29	111		40	153	129	47
Week 44	November 5	39		17	66	54	19
Week 45	November 12	22		10	37	27	10
Week 46	November 19	6		3	13	13	5
Week 47	November 26	4		2		7	
Week 48	December 3	2		0		3	
Week 49	December 10	1		0		1	
Week 50	December 17	0		0		1	
Week 51	December 24	0		0		0	
Week 52	December 31	0		0		0	
Totals		1473	0	413	1577	1888	676
Total Return Size		1473		413		1888	
Total Brood Collected		TBD		1577		676	
Brood %		0.0%		70.0%		30.0%	
Assumed Fecundity		4,057		4,057		4,057	
pNOB		0		0.5 Goal / 0.3 Target		0.5 Goal / 0.3 Target	

Mining Rate	0	n/a	30% max
Demographic Replacement (RRS=0.75)		901	
Demographic Replacement (RRSHarv=0.5)		1352	
Total Egg Take		4,211,240	
Total Release Goal		3,500,000	

Adult Transportation & Disposition

		Notes	Low	Normal	
Interim (Current through 2022 or 2023) This period accounts for unknown source of NORs (pre-Mayfield NOR CWTs returning) and; Two separate HOR return groups; Integrated and Segregated.	NOR	All returns UM	1) At least 70% of run to Tilton (Bremer Br) ¹ 2) Max of 30% to brood unless seeding target is met AND replace all mined NOR's with integrated HOR's to Tilton	1) At least 70% of run to Tilton (Bremer Bridge) ¹ 2) Max of 30% to brood <u>AND</u> replace all mined NOR's with integrated HOR's to Tilton	
	HOR (Ad Only)	Segregated	1) Retain for brood	1) Retain for Brood 2) Ship for Tilton harvest: (1600 cap) 3) Nutrient enhancement / Surplus (plan TBD)	

	HOR (Ad+CWT)	Integrated	1) Retain for brood 2) Replace NOR's mined for brood until seeding target met; send to Tilton (Bremer or Gus Backstrom) ¹	1) Retain for Brood 2) Replace NOR's mined for brood to Tilton (Gus Backstrom) 3) Ship for Tilton harvest: (1600 cap) (Gus Backstrom) ¹ 4) Nutrient enhancement / Surplus (plan TBD)	
		Notes	Low	Normal	
2023 or 2024 and beyond (Long Term FHMP Goal) - until CWT data for returning adults has been evaluated (see Marking/Tagging strategy) Period reflects all HOR adults part of single integrated program. Now, CWT's in HOR's represent index group only.	NOR (CWT)	Mayfield 5 yo's arrive in 2025	Retain for brood on collection schedule (<30% of NOR run) and ship remainder to Tilton	1) Retain TBD% for brood, not to exceed 30% 2) Ship remainder to Tilton	
	NOR (UM)	Mix of Tilton and Lower River		1) Retain for brood on collection schedule (<30% of NOR run) and ship remainder to Tilton	

3 and 4 yo NOR's with CWT's returning from Mayfield by 2023 or 2024.	HOR (Ad Only)	Integrated	1) Retain for brood (See Brood detail) 2) Demographic Replacement -Replace NOR's mined for brood until seeding target met: send to Tilton	1) Retain for brood (See Brood detail) 2) Demographic Replacement Replace NOR's mined for brood until seeding target met; send to Tilton 3) Ship for Tilton (1600 cap)4) Nutrient enhancement / Surplus (TBD)	
	HOR (Ad+CWT)		1) Retain for brood and CWT retrieval (data)	1) Retain for brood and CWT retrieval (data) 2) Nutrient enhancement / Surplus (TBD)	

Notes:

See Adult Broodstock Collection Table for additional brood details

¹ Current strategy, but proportion is subject to change per annual review per Tilton River Salmon and Steelhead Transport Plan

AHN = Above Hatchery Needs

Assumptions:

- CWT tagging at Mayfield begins with the 2021 or 2022 collection seasons
- HOR single integrated program started with BY 2018 but practically started in 2017 (See Current Program – Adult Broodstock Collection).
- All UM NOR's returning to separator may contribute to Tilton HOR program (See Adult Broodstock Collection)
- % Mayfield outmigrants thru each route is estimated sufficiently following 5 years of adult returns (see Marking Tagging Strategy)
- We will decide what to do with those UM fish when the data comes in (See Marking Tagging Strategy).

Juvenile Releases	
Release Strategy	One Group - Volitional followed by force out
Quantity	3.5 million
Release Age/size	Sub-yearling / 80 ffp
Release Location/Timing	May – June from the Cowlitz Salmon Hatchery
Note: Juvenile Release strategies will be revisited following further Bioprogramming (See Bioprogramming Section)	
Marking/Tagging strategy ⁷	<p>HORs - All fish will be adipose fin clipped and a portion of fish from each raceway will be Ad+CWTas determined by M&E needs.</p> <p>NORs</p> <ul style="list-style-type: none"> • Coded Wire Tag outmigrating NOR Fall Chinook at Mayfield with adipose fin intact <ul style="list-style-type: none"> ○ All captured and practical to mark for at least 5 years of adult returns ○ Possibly CWT subsample captured fish after 5 years of adult returns if: <ul style="list-style-type: none"> ▪ Collect and store genetic samples until at least 5 years of adult returns ▪ Potentially run genetic samples to test if rate of Tilton vs Lower River returns matches CWT predictions ▪ Survival by route and route use is estimated at Mayfield Dam (unbiased and sufficiently low variance) ○ Adaptive Management – associated with adult returns <ul style="list-style-type: none"> ▪ Predict 51 – 60% of returning adults returning will have a CWT assuming a 50 – 75% survival through the juvenile bypass:

⁷ Identify how do these strategies address fish Management/evaluation, monitoring data, and adaptive management trigger points.

	<ul style="list-style-type: none"> • FTC will revisit this marking strategy and its associated assumptions as necessary • Pros: <ul style="list-style-type: none"> ○ Contributions to outside fisheries can be characterized ○ Survival estimates are improved ○ Will be able to ID a portion of returning adults in real time ○ If Subsample of outmigrants is marked it will result in lower handling and biological impact • Cons: <ul style="list-style-type: none"> ○ Cannot mark 100%, need estimates of collection efficiency to estimate ○ If all outmigrants are CWT tagged, it will result in increased marking effects over partial marking.
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Summary of Hatchery Configuration/Infrastructure Modifications⁸:

Estimate rate of survival through the juvenile bypass route based on historic data, validate measures at Mayfield Juvenile Bypass – Secondary Separator automation frequency concurrent to the first year of CWT marking and prior to CWT adult returns to verify if rates are similar or above 2015 and 2016 test years and to predict rate of returning CWT adults. If survival rates through the juvenile bypass are lower than anticipated during the verification study season, survival estimates will be repeated for a minimum of an additional 1 to 2 years concurrent to CWT releases.

Harvest Management Strategy

INTERIM (until we have management targets for NOR populations)			
	Abundance		
Area	Low	Normal	Above Normal

⁸ Identify changes necessary to accommodate Transition (and steps necessary to achieve)

Upper Cowlitz (Tilton)	<p>Managed based on forecasted hatchery returns; Fishery on excess HORs transported to Tilton ABOVE those needed to replace NORs used for broodstock (hatchery equivalents); Seasons set via North of Falcon; Restricted Mark-Selective fishery (reduced bag limit or full closure); In-season management based on actual separator returns of HOR/NOR.</p>	<p>Managed based on forecasted hatchery returns; Fishery on excess HORs transported to Tilton ABOVE those needed to replace NORs used for broodstock (hatchery equivalents); Seasons set via North of Falcon; Full Season Mark-Selective fishery (generally 6 hatchery fish with 2 adults); In-season management based on actual separator returns of HOR/NOR.</p>	<p>Managed based on forecasted hatchery returns; Fishery on excess HORs transported to Tilton ABOVE those needed to replace NORs used for broodstock (hatchery equivalents); Seasons set via North of Falcon; Full Season Mark-Selective fishery (increased bag limits); In-season management based on actual separator returns of HOR/NOR.</p>	
Lower Cowlitz	<p>Managed based on forecasted hatchery returns; Seasons set via North of Falcon; Restricted Mark-Selective fishery (reduced bag limit or full closure); In-season management based on actual separator returns of HOR/NOR.</p>	<p>Managed based on forecasted hatchery returns; Seasons set via North of Falcon; Full Season Mark-Selective fishery (generally 6 hatchery with 2 adults); In-season management based on actual separator returns of HOR/NOR.</p>	<p>Managed based on forecasted hatchery returns; Seasons set via North of Falcon; Full Season Mark-Selective fishery (increased bag limits); In-season management based on actual separator returns of HOR/NOR.</p>	
Ocean/Columbia River	<p>Non Mark-Selective; Seasons set via North of Falcon; Cowlitz stock part of LCR Tule aggregate</p>	<p>Non Mark-Selective; Seasons set via North of Falcon; Cowlitz stock part of LCR Tule aggregate</p>	<p>Non Mark-Selective; Seasons set via North of Falcon; Cowlitz stock part of LCR Tule aggregate</p>	

LONG TERM			
	Abundance		
Area	Low	Normal	Above Normal
Upper Cowlitz (Tilton)	<p>Managed based on forecasted hatchery returns and NOR management goals; Fishery on excess HORs transported to Tilton ABOVE those needed to replace NORs used for broodstock (hatchery equivalents); Seasons set via North of Falcon; Restricted Mark-Selective fishery (reduced bag limit or full closure); In-season management based on actual separator returns of HOR/NOR.</p>	<p>Managed based on forecasted hatchery returns and NOR management goals; Fishery on both HOR/<u>NOR</u> transported to Tilton (non-mark selective fisheries) could occur consistent with management plans that assure natural origin populations will meet goals; Seasons set via North of Falcon; Full Season Non-Mark-Selective fishery (HOR/<u>NOR</u> bag limits TBD); In-season management based on actual separator returns of HOR/NOR.</p>	<p>Managed based on forecasted hatchery returns and NOR management goals; Fishery on both HOR/NOR transported to Tilton (non-mark selective fisheries) could occur consistent with management plans that assure natural origin populations will meet goals; Seasons set via North of Falcon; Full Season Non-Mark-Selective fishery (increased bag limits); In-season management based on actual separator returns of HOR/NOR.</p>

Lower Cowlitz	Managed based on forecasted hatchery returns and NOR management goals; Seasons set via North of Falcon; Restricted Mark-Selective fishery (reduced bag limit or full closure); In-season management based on actual separator returns of HOR/NOR.	Managed based on forecasted hatchery returns and NOR management goals; Fishery on both HOR/NOR (non-mark selective fisheries) could occur consistent with management plans that assure natural origin populations will meet goals; Seasons set via North of Falcon; Full Season Non-Mark-Selective fishery (HOR/NOR bag limits TBD); In-season management based on actual separator returns of HOR/NOR.	Managed based on forecasted hatchery returns and NOR management goals; Fishery on both HOR/NOR (non-mark selective fisheries) could occur consistent with management plans that assure natural origin populations will meet goals; Seasons set via North of Falcon; Full Season Non-Mark-Selective fishery (increased bag limits); In-season management based on actual separator returns of HOR/NOR.	
Ocean/Columbia River	Non-Mark Selective; Seasons set via North of Falcon; Cowlitz stock part of LCR Tule aggregate	Non-Mark Selective; Seasons set via North of Falcon; Cowlitz stock part of LCR Tule aggregate	Non-Mark Selective; Seasons set via North of Falcon; Cowlitz stock part of LCR Tule aggregate	

Harvest Management Notes:

Steps needed to achieve long term management:

- Establish R_{max} and develop escapement goal (See Goal of new program by recovery phase, and Monitoring and Analysis needs associated with Adaptive Management trigger points Sections)
- Determine hatchery equivalent value used for NOR replacement and establish general management guideline for NOR replacement (See Adult Transportation and Disposition Section)
- WDFW - update FMEP to include above strategy and consult with NMFS
- Develop techniques for forecasting by HOR/NOR instead of aggregate

- Develop earlier in-season predictors of total return for management purposes.

Ability to allow harvest on Lower River NOR Fall Chinook requires modification of the FMEP by WDFW and ESA Permitting and consultation by NMFS.

Program Performance Metrics

Proportionate Natural Influence (PNI)	Target: Lower Cowlitz- N/A Upper Cowlitz/Tilton- >50% Recent Performance:
pHOS level	Target: Lower Cowlitz- <10% or TBD Upper Cowlitz/Tilton- The lower of <30% or <pNOB Recent Performance:
pNOB levels	Target: 30-50% in normal years with lower pNOB integration rates during low NOR return years Recent Performance:
Brood stock mining rate	Target: Max of 30% for NORs and demographic replacement with HORs Recent Performance:

Anticipated Performance Relative to Goals

Monitoring and Analysis needs associated with Adaptive Management trigger points

- Estimate rate of survival through the juvenile bypass routes based on historic data. Validate measures at Mayfield Juvenile Bypass – Secondary Separator automation frequency concurrent to the first year of CWT marking and prior to CWT adult returns to verify if rates are similar or above 2015 and 2016 test years and to predict rate of returning CWT adults. If survival rates through the juvenile bypass are lower than anticipated during the verification study season, survival estimates will be repeated for a minimum of an additional 1 to 2 years concurrent to CWT releases.
- Conduct assessment of Local Adaptation Phase assumption for Tilton and Lower River Fall Chinook Populations via life cycle modeling.

Bio-programming considerations for all programs (capacity, water, how it fits with other programs):

- Problem Statement - Optimal rearing densities reach a choke point in February and the facility was not scoped to handle Fall Chinook densities prior to the Mayfield Lake net pen program with the current mix of programs within the 650,000 pound production cap. Ultimately, the Fall Chinook program is too large for the space at Cowlitz Salmon Hatchery under the current program strategies without the use of the Mayfield net pens. Bio-programming should evaluate this constraint and explore options to address this including use of net-pens for coho off-site rearing to create more space for Fall Chinook at CSH.

The following recommendations target opening up more space:
 We need to keep the final population per pond to 560k to meet rearing criteria. Initial rearing requires the ability to separate up to 12 takes (requires 10 rearing vessels for optimal separation - Brian to verify?) Prior to marking ideal Ponding/Early space required is: 6 ponds @ 583k/pond. Post marking space is: 9 ponds @ 390k/pond @ 80fpp

Potential Solutions	Pros	Cons	Timing
<p>Reduce Program Size: Because challenges in this program begin at ponding, a reduction in this program will directly benefit all stages of rearing. Sizing the program to the available space will reduce stress, improve growth profile and likely SAR's. Alternatively reduce other programs to accommodate.</p>	<p>No impact to other programs/maintains flexibility No infrastructure modifications/additions Improves water quality during rearing Lighter densities may increase survivals Net Pens could benefit other programs Requires less brood = more adults for upstream</p>	<p>May reduce adult returns (commensurate with release # & expected SAR) Program reductions are unpopular with some constituent groups and will likely be met with opposition.</p>	<p>2022</p>
<p>Send Yearling Coho to net pens: By sending the coho to the net pens, pond space would become available to accommodate the Fall program at proper densities and provide additional compartments for different growth rates/size fish.</p>	<p>Coho typically do well in net pens Lighter densities may increase survivals Improves water quality during rearing Creates space for entire FA:CK program Reduces pressure to release spring Chinook early</p>	<p>Haven't tested coho in these pens, net pens have risk (vandalism, predation, environment, disease) 24 pens (708k fish= 47klbs) is a large operation and will be a time and cost addition (Currently only have 20 pens) Still need to truck fish OUT of pens = labor and stress increase - May require additional infrastructure at Mayfield dam for release Utilizes capacity that could be used for displacing coho for springs</p>	<p>2021</p>

<p>Send Fall Chinook to net pens (existing program): Most of the challenges associated with the fall Chinook program occur prior to marking and shipping to the net pens. This strategy has little benefits.</p>	<p>Aligns with angler's original request</p>	<p>Still requires additional pond space for full program. Doesn't solve early rearing issues (water quality and BGD) Falls have had mixed in-pen survival history High stress in short period of time</p>	<p>2021</p>
<p>Adjust Fall Chinook Release Size or Timing: High growth rates are necessary to get them to size for marking/release and net pen transport. Releasing fish at various sizes, or later would reduce the impacts Consider extending volitional release period (from 4 days to weeks?).</p>	<p>May improve early rearing density and water quality a bit Size/Timing adjustment may uncertain to improve SAR Natural growth profile is healthier for fish Multiple release sizes may increase resiliency Volitional release w/tags may provide info on best release strategy Volitional release may improve survival</p>	<p>Still requires additional pond space for full program. May not provide measurable benefits as a tactic on its own. Adjusting release size/timing comes with risk as it isn't proven May be tricky for markers or require longer marking season SAR implications are unknown Logistics become challenging as you spread out marking and hold fish into warmer water seasons Volitional releases may pose logistical problems and/or increase NOR competition, residualization Volitional releases are difficult to evaluate</p>	<p>2021</p>
<p>Increase marking and trucking efforts: The ability to mark and haul fish faster means they can go to the net pens earlier, thus allowing the fish more time in the net pens to recover before being moved yet again.</p>	<p>Aligns with angler's original request Marginally (2-4 weeks increases time spent in pens (more time in between handling events))</p>	<p>Still requires additional pond space for full program. Does not solve early rearing density challenges May affect marking strategy of other programs due to limited trailer availability Marking staff/trailer availability unknown Marking costs are higher May require additional trailer purchase</p>	<p>2022+</p>

<p>Change growth strategy or feed type: Advancements in feed may provide better water quality. Recommend a feed study at a minimum! Recommend not pushing takes to merge with each other and maintaining a more natural growth profile. Lower dam boards to increase exchange rate to better flush solids and provide exercise.</p>	<p>No additional effort to change feed Improved water quality at early rearing (assumed) Natural growth profile is healthier for fish Increased velocity/exercise = improved condition</p>	<p>Still requires additional pond space for full program. May not provide measurable benefits as a tactic on its own. Adjusting release size/timing comes with risk as it isn't proven May be tricky for markers or require longer marking season</p>	<p>2021</p>
<p>Release Coho or Spring Chinook early: Freeing up pond space will have the same impact as reducing program size. Same as sending coho to net pens as well.</p>	<p>Improves water quality during rearing Lighter densities may increase survivals Net Pens could benefit other programs Lower densities improves Falls survival</p>	<p>Will reduce adult returns Program reductions are unpopular with some constituents and will likely be met with opposition. Increase residualization / predation of NOR's</p>	<p>2021</p>

<p>Infrastructure: Adding or identifying additional rearing space is another option to address rearing challenges.</p> <ol style="list-style-type: none"> 1) Additional kettles would help with the challenges of separating the early rearing portion while merging them in size and subsequently ponds. 2) Additional ponds would help accommodate both early and later rearing challenges (same benefits as releasing other stocks to net pens or early) 3) Utilizing the adult ponds may be an option to displace other programs or rear Falls in for more space. (not ideal rearing conditions as they were not designed for juvenile rearing) 4) Utilize Trout Hatchery Remodel to accommodate other options 5) Additional net pens and potential new location 	<p>Additional kettles address early rearing challenges.</p> <p>Additional ponds address some early rearing and all later rearing challenges (coho in adult ponds frees some space for falls)</p> <p>Adult Pond usage addresses some early rearing challenges but not all</p> <p>Trout Hatchery could be made to address all issues theoretically</p> <p>Additional net pens address rearing challenges</p> <p>Potential for funding partnerships (i.e. SRKW)</p> <p>Hatchery infrastructure/facilities have less risk than alternatives (net pens)</p>	<p>Add kettles: does not address later rearing challenges and cost is high</p> <p>Add ponds: Space is challenging and cost is VERY high</p> <p>Adult ponds: Poor design for juvenile rearing and would require upgrades, cost is moderate</p> <p>Trout Hatchery: may conflict with other uses/plans; cost is high; may reduce adult recruitment to CSH and increase pHOS in Blue Cr/Lower Cowlitz spawning areas.</p> <p>Additional net pens: labor intensive; risk, cost is moderate (additional pens) to high (new pens/location)</p> <p>Largest cost of alternatives</p>	<p>2023++</p>
<p>Note: Bioprogramming will be revisited as a for all programs combined following drafting of all Transition Plans and incorporation of Public Input.</p>			

List of Reference Materials from Transition Plan Workshops
Tilton River Salmon and Steelhead Transport plan

Note: This Transition Plan is intended to serve as a step toward Recovery goals. It will be Evaluated for its progress toward achieving those objectives through the Annual Program Review (APR) as described in Chapter 12 of the Fisheries and Hatchery Management Plan (FHMP 2020), and will be altered through adaptive management as described in that process as necessary. The Hatchery Scientific Review Group (HSRG) evaluation guidelines will be evaluated for applicability during each step of recovery.