APR Part 3

Management Framework
For Summer/Fall Chinook

- Review Logic Path for the Adaptive Management Process
- Review Key Assumptions
- 2021 Outcomes and 2022 Forecasts

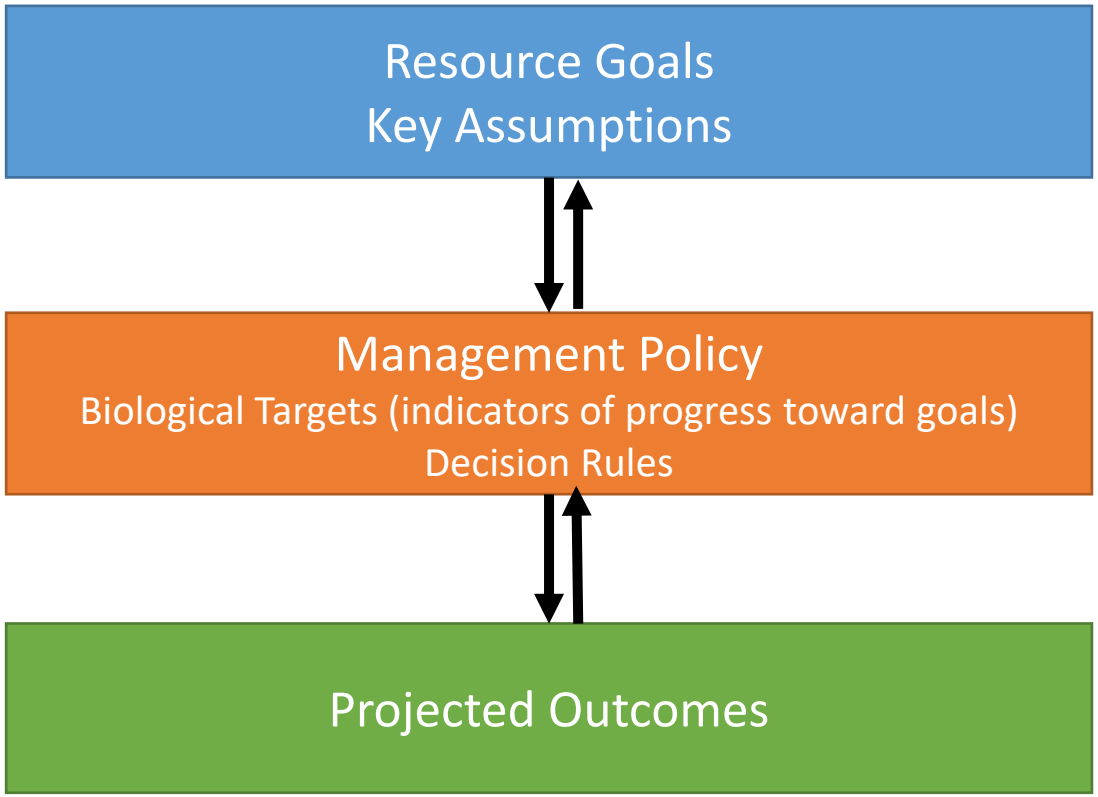
Components of Adaptive Management

I. Annual Program Review
   a. Program Goals (harvest and conservation)
   b. Key Assumptions
   c. Management Policy

Purpose of the APR: Confirm/adjust Key Assumptions and Management Policy to ensure that Program Goals are met over time

II. In-Season Management
   a. Run Forecasts
   b. Management Targets (escapement, harvest, hatchery)

Components of Adaptive Management



Program Goals

- **Conservation or Natural Production Goals:**
  - 7,500 total spawners—5,250 natural origin spawners (NOS)
  - Increase temporal and spatial diversity of spawning/rearing
  - High PNI, low pHOS so that the natural environment is driving adaptation
- **Harvest Goals:**
  - Increase harvest for all fishers
  - Harvest full tribal allocation (2022 pre-season ~ 3,100)
  - Increase % of individual tribal member harvest

Key Assumptions – Natural Production

HABITAT PARAMETERS	2011	2012	2013	2014	2015	2016	2017	2018	5-year average	Current Conditions
Habitat Productivity	7.5			8.9		5.8			NA	5.8
Habitat Capacity	12,499			7,442		16,296			NA	16,296
OCEAN AND PASSAGE SURVIVAL (SAR)										
Juvenile Outmigration										27.0%
Ocean Survival (BON to BON)										1.98%
Adult Migration										83.0%
Smolt-to-Adult Survival (SAR) (OK to OK)									0.63%	0.44%

- Habitat productivity and capacity assumptions based on EDT (last updated in 2016)
- Juvenile outmigration and adult migration assumptions are based on the BiOp
- Ocean survival (BON to BON) assumption is based on 2016 EDT analysis. Empirical data for NORs (based on PIT tag returns) suggests much higher SARs than average for BYs 2011-2013 and much lower SARs for BY 2014-2016.

Key Assumptions - Harvest

HARVEST RATES-NORs	2018	2019	2020	2021	5-year average
Ocean (unmarked)	23.9%	22.2%	14.4%	18.9%	20.5%
Lower Col. Zones 1-5 (unmarked)	0.8%	0.4%	0.8%	0.8%	0.7%
Upper Col. Bonneville to Wells (unmarked)	26.8%	18.0%	14.7%	23.0%	21.7%
NOR Terminal Induced Mortality Rate	3.0%	3.3%	1.2%	2.9%	3.1%
HARVEST RATES-HORs					
Ocean (marked)	23.9%	22.2%	14.4%	18.9%	20.5%
Lower Col. Zones 1-5 (marked)	4.4%	0.4%	2.9%	5.5%	2.8%
Upper Col. Bonneville to Wells (marked)	30.6%	30.8%	23.4%	37.4%	30.1%
Terminal Above Wells - Integrated	39.7%	35.7%	18.0%	-	29.2%
Terminal above Wells - Segregated	49.1%	58.6%	12.5%	-	21.6%

- TAC harvest rates used for ocean, Zones 1-5, and Upper Columbia to Wells fisheries
- RMIS (based on CWTs) data for terminal harvest of HORs
- NOR terminal harvest rate is estimated using CJHP program data
- Total exploitation rate is 40% for NORs and 62% for Integrated HORs
- Low NOR terminal harvest rate by MSF is critical for brood and escapement
- MSF sport fisheries in Columbia River Zones 1-6 also help NOR returns

Key Assumptions - Hatchery

Integrated Program In-Hatchery Assumptions	5-year average	Planning Assumptions
In-Hatchery Pre-spawning survival - NORs	77.1% (+)	77.1%
Eggs/Female - NORs	4,031 (-)	4,600
Egg to smolt survival-yearlings	77.7% (-)	86.0%
Egg to smolt survival-subyearlings	78.4% (-)	84.0%
Segregated Program In-Hatchery Assumptions	**5-year average**	**Planning Assumptions**
In-Hatchery Pre-spawning survival - HORs	77.6% (+)	77.6%
Eggs/Female - HORs	3,845 (-)	4,600
Egg to smolt survival-yearlings	82.1% (-)	86.0%
Egg to smolt survival-subyearlings	77.5% (-)	84.0%

- 6 of 8 metrics are not meeting expectations (pre-spawning survival assumption was 90%, now based on 5-year average)
- Options: 1) Collect more brood (not without more space or cooler water)

  2) Change management practices (CJH has been doing this, but not the big stuff (i.e. water and space))

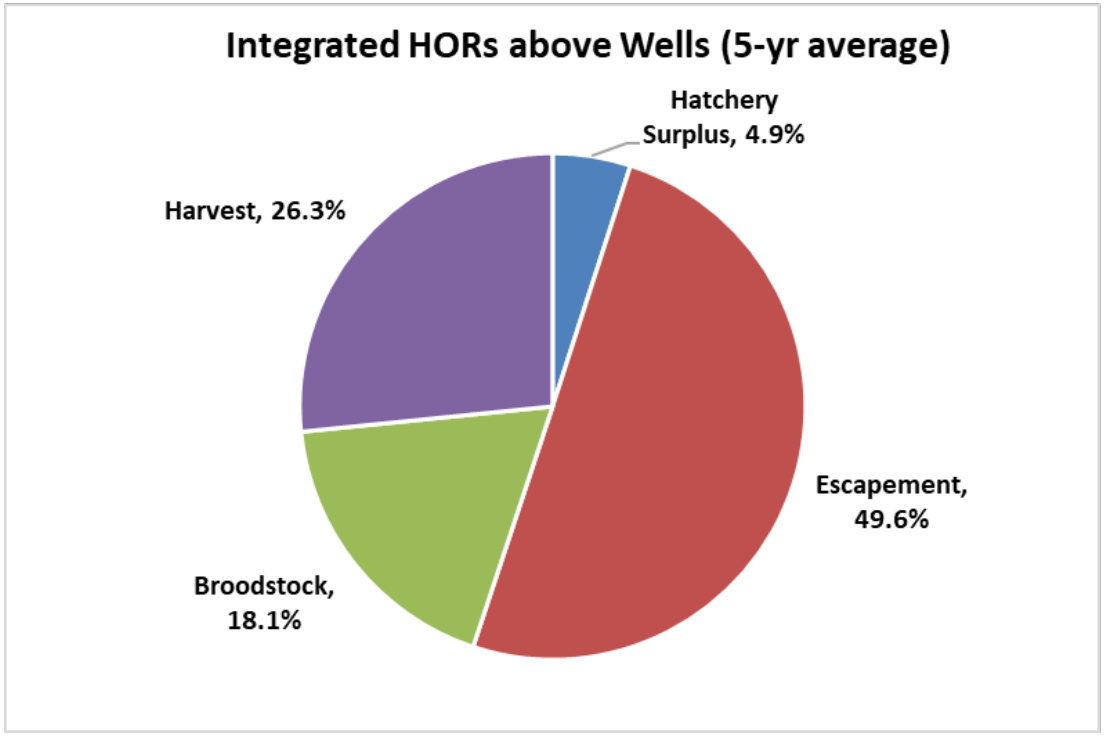
  3) Accept the lower biological targets and reduce the program goals for smolts released

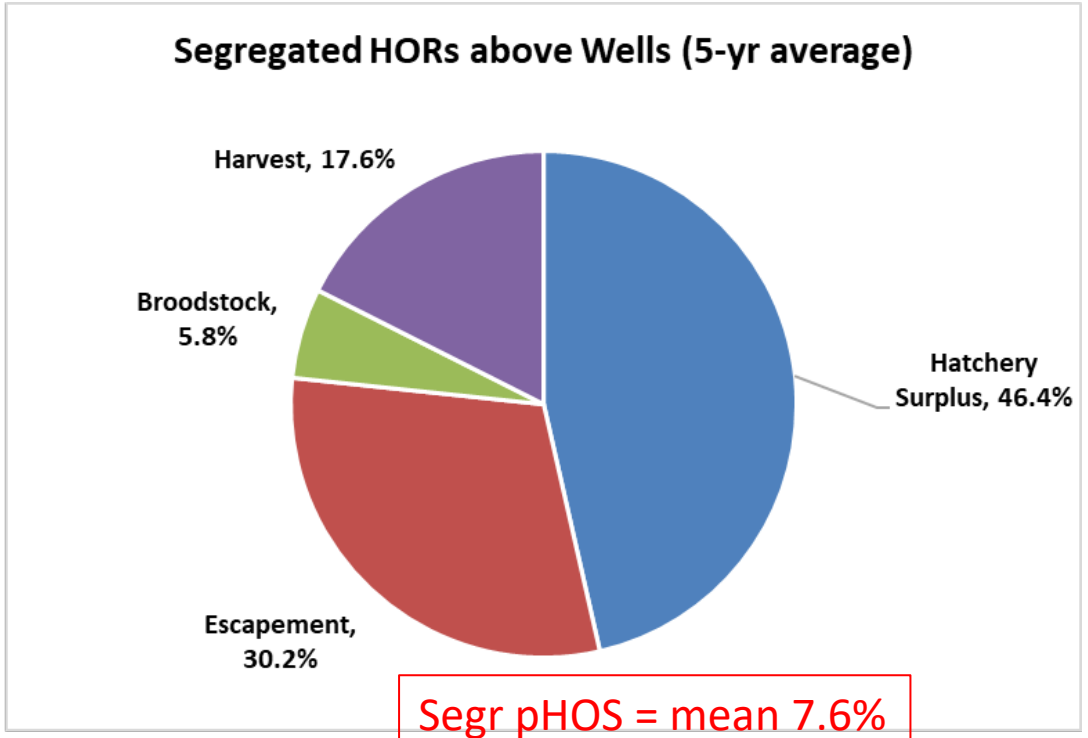
Key Assumptions - Hatchery

HATCHERY	5-year average	Planning Assumptions
SAR- integrated yearlings - BY	1.72%	0.90%
SAR- integrated subyearlings - BY	0.32%	0.27%
SAR- segregated yearlings - BY	0.95%	0.90%
SAR- segregated subyearlings - BY	0.07%	0.27%
Stray Rate from Integr. Prog (to other basins)	0.70%	??
Stray Rate from Segr. Prog (to other basins)	0.72%	??

- Yearling SARs have consistently exceeded original program assumption of 0.8-0.9%.
- Integrated subyearling SAR similar to planning assumptions; lower for segr. subyearlings
- Stray rate of CJ HORs (Int and Seg) to other streams and hatcheries is very low.

Key Assumptions - Hatchery





Segr pHOS = mean 7.6%
max 17%

- ~5% of Integrated HORs returning to the CJ Hatchery helps the program meet pHOS target
- Segregated HOR escapement has been higher than expected (~30% of total returns to Wells); goal is for majority of seg HORs to be harvested or return to the hatchery ladder

Many segr. summer Chinook are left in the river:

-early on, it's to provide fish for the fishery

-later, it's to avoid steelhead 'take' and rendering at the dump

October 6, 2020

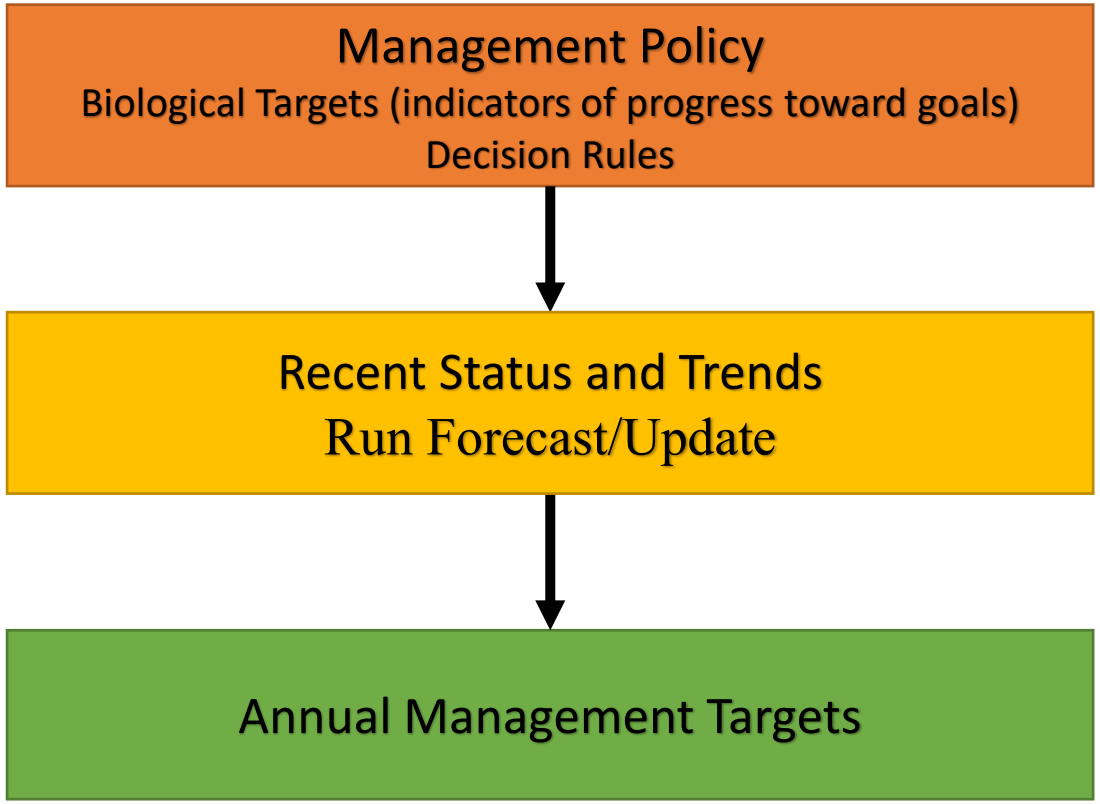
Components of Adaptive Management

I. Annual Program Review

II. In-Season Management Decision Making

II. In-Season Management Decisions

What is the “right thing to do” the coming season to meet Biological Objectives



Biological Targets are indicators of annual progress toward meeting program goals.

- Total pHOS (all programs) < 30%
- Segregated program pHOS <5%
- PNI > 0.67
- Minimum NOS target of 800 to collect brood for the integrated program
- pNOB between 30% and 100%
- Smolt release targets

Management Targets are annual targets for broodstock collection, harvest, weir removals, etc.

- They are driven by the Run Forecast, Biological Targets and Decision Rules.
- They ensure the best actions are taken given the current run forecast and assumptions about the population.

Run Forecast Methods

1) Preseason forecast (prior to July 15)

1) Columbia River Preseason TAC forecast used to predict Okanogan HORs and NORs
2) 2022 pre-season TAC forecast is 57,500
3) TAC will revise in-season and we will adjust

2) In-season run forecast (July 15)

- Wells Dam counts used to predict Okanogan HORs and NORs

3) Life Cycle Model Forecast

- Forecast returns of Okanogan HORs and NORs using ISIT tool: using empirical data on escapement, hatchery releases, age composition data, and key assumptions (habitat, hatchery, harvest)

4) Predicted HOR returns based on PIT tag expansions

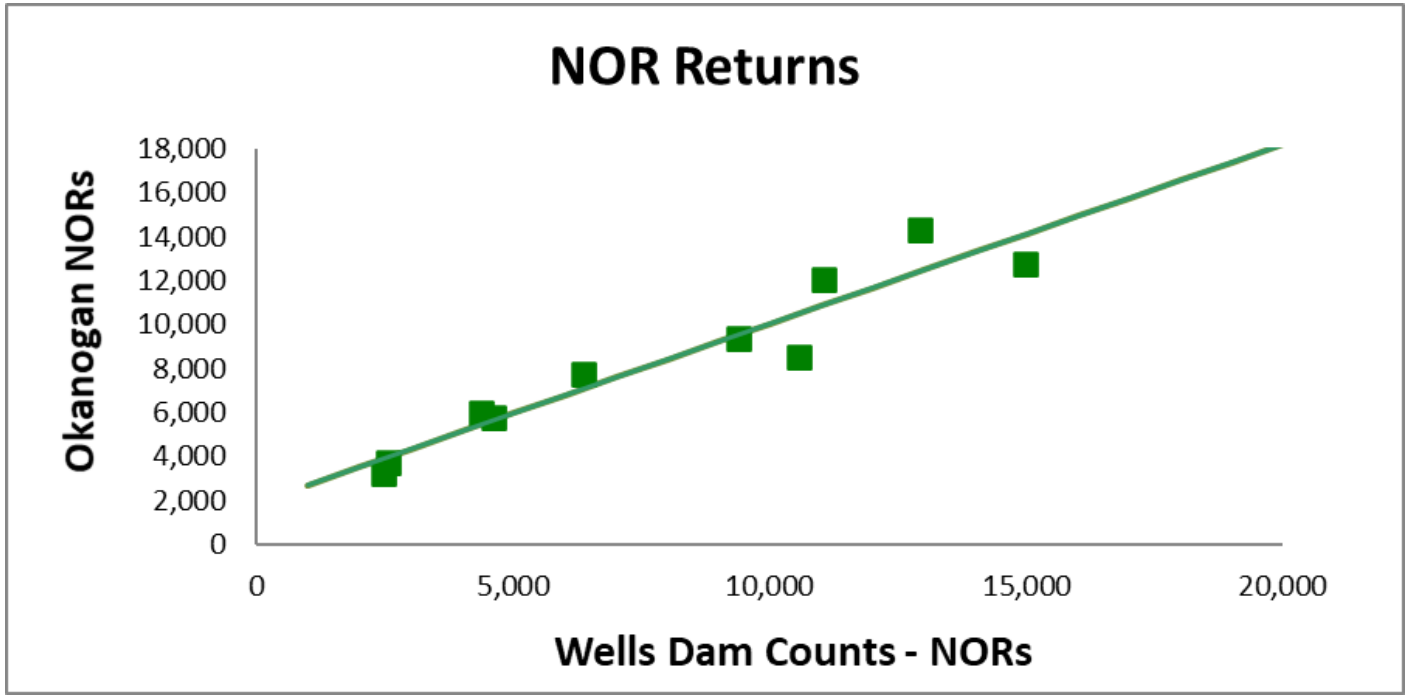
- In-season updates as PITs return to BON and Wells Dam

Wells Dam Run Forecast and Returns – 2021

2021 Forecasts and Returns	Preseason TAC Run Forecast (77,600 to BON)	Life Cycle Model Forecast	Inseason TAC Run Forecast (59,600 to BON)	Forecast Based on 7/15 Wells Dam Counts	PIT Tag Forecast as of 7/15	Final PIT tag forecast	Actual Returns
Okanogan NOR Forecast	5,988	5,751	4,871	5,545	NA	NA	5,773
Okanogan HOR Forecast	3,496	4,602	2,844	2,952	3,434	2,448	3,509
CJH HOR Forecast	2,250	3,451	1,831	2,055	3,980	2,949	1,841
Total Return Forecast	11,734	13,804	9,546	10,552	7414 HORs	5397 HORs	11,123

- TAC and LCM pre-season NOR forecast was very similar to the in-season forecast based on July 15 Wells Dam counts; they all did a good job of predicting NORs.
- TAC pre-season forecast and 7/15 PIT tag forecast did a great job of predicting integrated HORs
- TAC pre-season forecast and 7/15 Wells counts did a pretty good job of predicting segregated HORs (having ~5 years of data on segreg. returns helps these forecasts); PIT forecast overestimated segreg. returns
- LCM overestimated HORs; uses actual releases and average SAR for past 5 years; also, we may not be accounting for all seg HORs (ladder closed/remain in the river)
- 'Actual Returns' are also estimates, with unknown error (creel, redd counts, etc.)

NOR Forecast based on July 15 Wells Dam Counts



Management Targets and Outcomes – 2021

Actuals are based on final Wells Dam run sizes of:
5,773 NORs
3,509 Integrated HORs
1,841 Segregated HORs

Targets are based on final run forecasts of:
5,545 NORs
3,434 Integrated HORs
3,980 Segregated HORs

	Management Targets	2021 Performance Review Final Targets	2021 Actuals
Harvest*	Okan. HORs retained in Terminal Fisheries	1,232	850
	CJH HORs retained in Terminal Fisheries	964	472
	Incidental Loss of NORs	205	169
Hatchery and Weir*	Return of Okan. HORs to Hatchery	248	86
	Return of CJH HORs to Hatchery	2,412	923
	Okan. HORs retained at Weir	63	9
	CJH HORs retained at Weir	19	0
Integrated Hatchery Program	Natural Origin Brood (NOB)-Okan (collected)	702	705
	Hatch. Origin Brood (HOB)-Okan (collected)	-	-
	Projected Annual pNOB-Okan	100%	87%
		800,000 Yearl.	707,988 Yearl.
	Smolt Release-Okanogan	300,000 Subs	88,474 Subs
Segregated Hatchery Program	Hatch. Origin Brood (HOB) - Int	571	487
	Hatch. Origin Brood (HOB) - Seg (purse seine and ladder)	-	100
		500,000 Yearl.	568,675 Yearl.
	Smolt Release-CJH	400,000 Subs	177,932 Subs
Natural Spawning Escapement	Nat. Origin Spawners (NOS)	4,175	4,344
	Hat. Origin Spawners (HOS) - Int	1,187	1,870
	Hat. Origin Spawners (HOS) - Seg	525	312
	Hat. Origin Spawners (HOS) - out-of-basin	NA	184
	Total Number of Spawners (excludes jacks)	5,888	6,710
	Effective pHOS	25%	30%
	PNI	0.80	0.74

Wells Dam Run Forecast – 2022

2022 Forecasts	Preseason TAC Run Forecast (57,500 to BON)	Life Cycle Model Forecast
Okanogan NOR Forecast	5,205	5,827
Okanogan HOR Forecast	3,222	1,991
CJH HOR Forecast	1,913	1,576
Total Return Forecast	10,340	9,395

- 2022 Preseason TAC estimate for summer Chinook at Bonneville is 57,500 (last year's was 77,600)
- Life Cycle model estimates for 2022 are based on SAR of 2% (NOR) and 1.7% (HOR)
- Life Cycle model HOR forecasts account for actual hatchery release levels in previous years. Releases were well below average in 2019-2020.

Management Targets for 2022

Based on 2022 preseason TAC forecast, with adjustments to extend to Wells Dam:

5,205 Okanogan NORs
3,222 Integrated HORs
1,913 Segregated HORs

	Management Targets	2022 Targets
Harvest*	Okan. HORs retained in Terminal Fisheries	940
	CJH HORs retained in Terminal Fisheries	412
	Incidental Loss of NORs	178
Hatchery and Weir*	Return of Okan. HORs to Hatchery	227
	Return of CJH HORs to Hatchery	1,201
	Okan. HORs retained at Weir	63
	CJH HORs retained at Weir	9
Integrated Hatchery Program	Natural Origin Brood (NOB)-Okan (collected)	726
	Hatch. Origin Brood (HOB)-Okan (collected)	-
	Projected Annual pNOB-Okan	100%
	Smolt Release-Okanogan	800,000 Yearl. 300,000 Subs
Segregated Hatchery Program	Hatch. Origin Brood (HOB) - Int	592
	n Brood (HOB) - Seg (purse seine and ladder)	-
	Smolt Release-CJH	500,000 Yearl. 400,000 Subs
Natural Spawning Escapement	Nat. Origin Spawners (NOS)	3,872
	Hat. Origin Spawners (HOS) - Int	1,260
	Hat. Origin Spawners (HOS) - Seg	262
	Hat. Origin Spawners (HOS) - out-of-basin	NA
	Total Number of Spawners (excludes jacks)	5,393
	Effective pHOS	24%
	PNI	0.81

Expected outcomes if 2022 preseason run forecast is correct and management targets are met

STATUS OF BIOLOGICAL INDICATORS (5-year Running Averages)

	Program Biological Targets	Status in 2021 (5-year average)	Projected status in 2022 (based on pre-season TAC forecast)	Projected status in 2022 (5-year average)
NOS	5,250	4,523	3,872	4,250
pHOS	30%	27%	24%	29%
PNI	0.67	0.73	0.81	0.73

Conclusions

- **2021 returns were about average, in line with the preseason TAC forecast**
  - Harvest rates for HORs were above average, especially in Zone 6
  - Narrowly missed spawn escapement targets
  - Achieved PNI target
  - Achieved pHOS target
  - Made brood collection # for both integrated and segregated programs
  - ~90% smolt release target (integrated yearling program); >100% for segregated yearling program
  - ~30% smolt release target (integrated subyearling program); ~45% for segregated subyearling program
  - Ocean conditions very good for the 2021 outmigrating smolts (*2nd best since 1998 www.fisheries.noaa.gov/content/ocean-conditions-indicators-trends)*

- **2022 preseason TAC forecast is slightly below average and consistent with LCM for NORs**
  - Aggressive HOR terminal harvest
  - Full brood collection (100% pNOB for integrated program, integr. HORs for segr. program)
  - Expect to meet pHOS and PNI targets; NOR escapement ~3,800 (below goal)