1 Maf of Canadian Treaty Storage and Impact on Water Travel Time and Survival

By
FPC Staff

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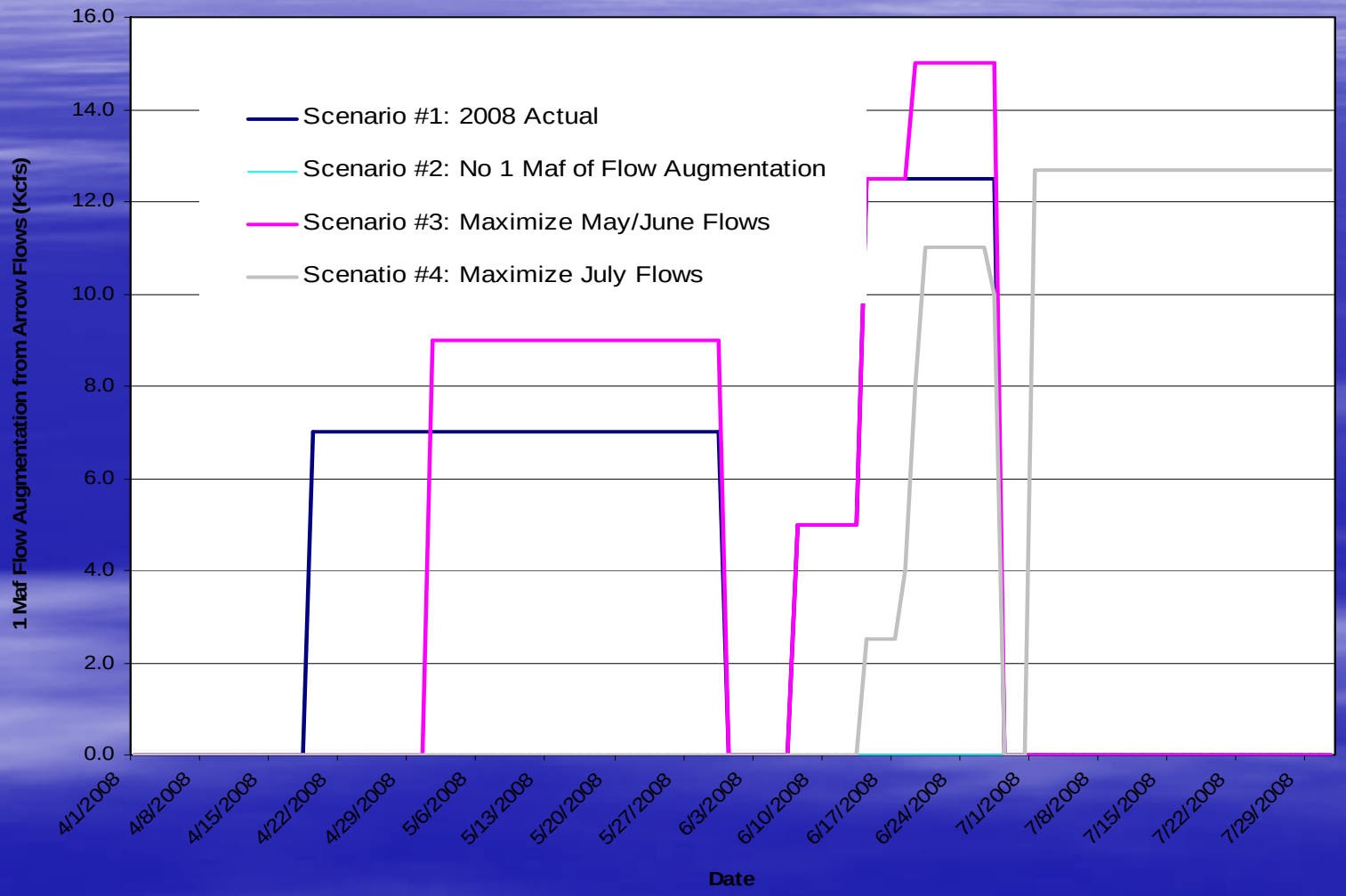
Goal:

To estimate Water Travel Times and survival of juvenile anadromous fish under four scenarios in 2008 and 2009:

2008 Scenarios

- 1. Actual 2008 1 Maf Release
- 2. Estimations of Columbia River flows had the 1 Maf not been provided in 2008
- 3. Reshaping the 1 Maf to maximize releases in May and June
- 4. Reshaping the 1 Maf to maximize releases in July

2008 Scenarios



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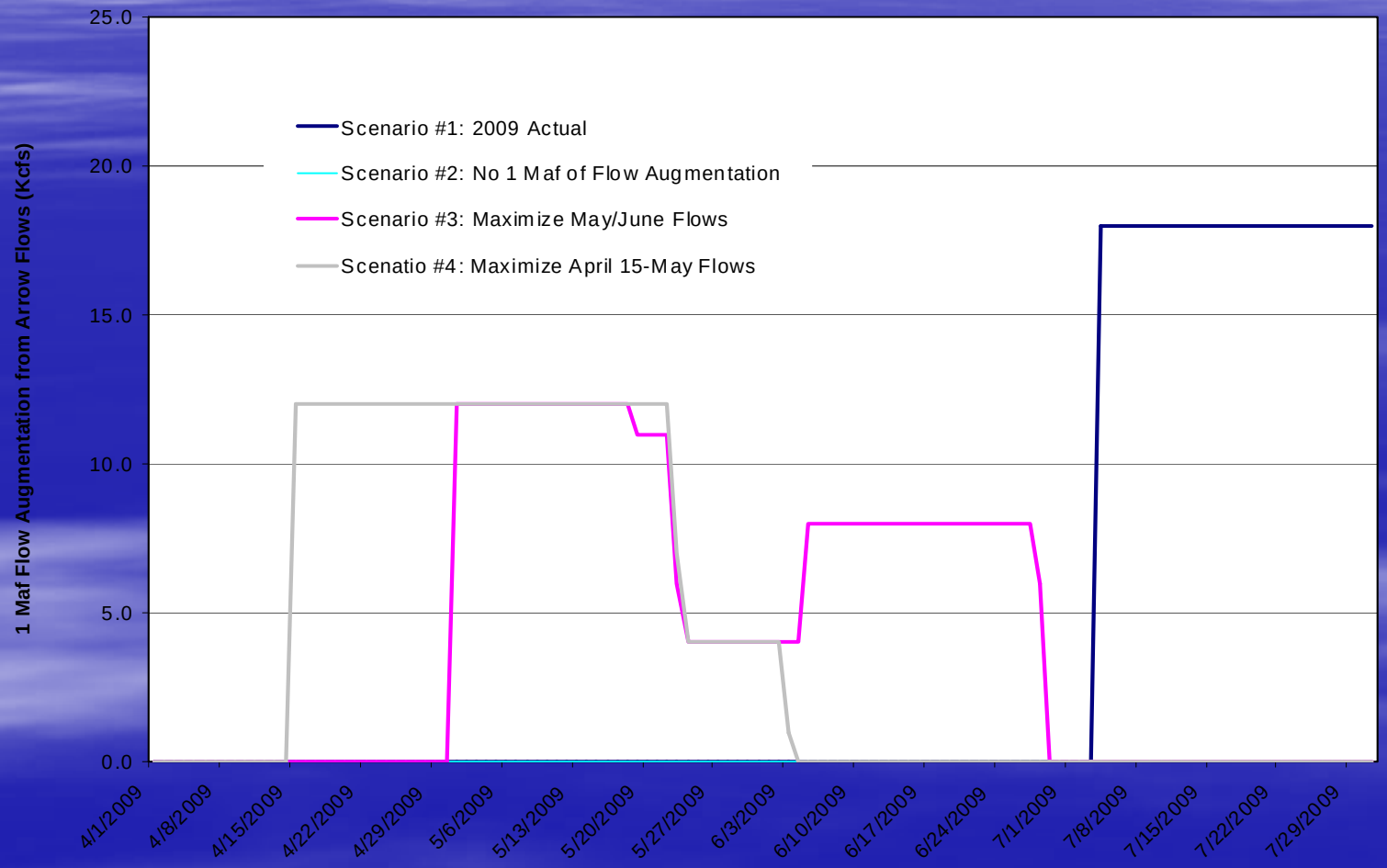
2009 Scenarios

2009

- 1. Actual 2009 1 Maf Release
- 2. Estimations of Columbia River flows had the 1 Maf not been provided in 2009
- 3. Reshaping the 1 Maf to maximize releases in May and June
- 4. Reshaping the 1 Maf to maximize releases April 15 to end of May

2009 Scenarios



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Assumptions Developing Scenarios

- 1. 1 Maf must be released April 15-July31
- 2. Arrow total outflows could not to exceed 30 Kcfs April-June
- 3. Modifications to the 1 Maf of flow augmentation would have immediate impacts at projects downstream.

Calculation of WTT (Water Transit Time)

Reservoir Replacement Method used for all Calculations of WTT- with exception of the Hanford Reach

- Suggested for use by COE
- Validated by COE using HEC-2 model

An "average" particle of water starting at the upstream end of the pool will "theoretically" exit at the downstream end when the volume of water that was in the pool has exited from the downstream end of the pool

WTT (s) = Reservoir Volume (ft3) / Flow (ft3/s)

Simple method if the following are known: flow rate exiting the pool, pool elevation, and pool storage/elevation rating curve

Forebay Elevations used in Water Transit Time estimations under all scenarios

	Forebay Elevation (ft)	Storage at Forebay Elevation (ft^3)
Rocky Reach	706.0	16,473,311,712
Rock Island	612.6	5,617,860,019
Wanapum	569.8	24,504,123,917
Priest Rapids	486.9	8,309,265,846
McNary	338.7	56,710,764,000
John Day (MIP)	262.0	96,642,216,000

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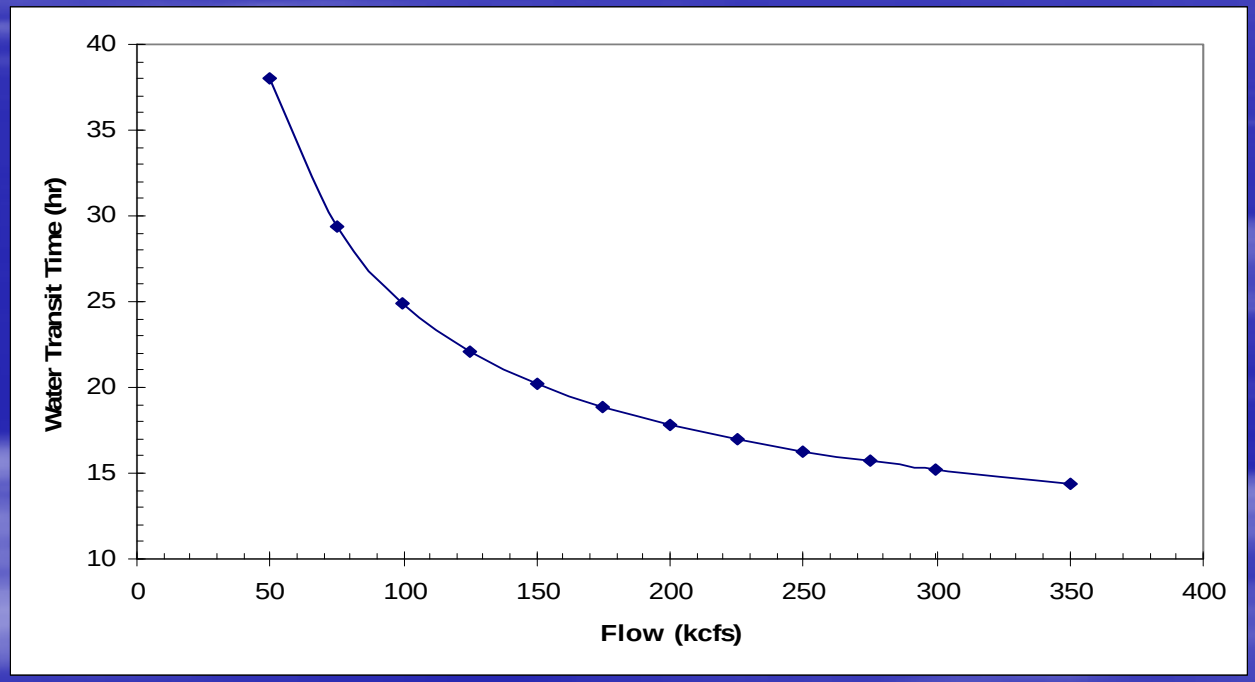
Water Travel Time through Hanford Reach of Columbia River

- The Hanford Reach (Priest Rapids to the Yakima River) is a free-flowing section and therefore transit times were estimated using a different method.



- Water Transit Time from Priest Rapids Dam to the confluence with the Yakima River (Hanford Reach) versus flow through the reach estimated using MASS1 models provided by the PNNL.

Estimating Survival-WTT Relationship

Relationships between fish survival and Water Travel Time were developed for this analysis- methodology same as previous FPC analyses (see past FPC Annual Reports for more details)

Three groups of fish were utilized:

1. Steelhead, Pit-Tags marked and released from RIS (Rock Island Dam)- WTT reach RIS to McNary Dam
2. Yearling Chinook, Pit-Tags marked and released from RIS- WTT reach RIS to McNary Dam
3. Sub-Yearling Summer Chinook, Pit-Tags marked and released from Wells Hatchery- WTT reach Wells Hatchery to John Day Dam

Estimates of Survival

For 2008 Scenarios:

Utilized 1998 to 2007 yearling chinook and steelhead PIT-Tag releases and 1998 to 2004 subyearling Pit-Tag releases from Wells NFH.

For 2009 Scenarios:

Utilized 1998 to 2009 yearling chinook and steelhead PIT-Tag releases and 1998-2009 (not including 2005 and 2007) subyearling Pit-Tag releases from Wells NFH.

Three distinct detection groups were created for each year (except for subyearling Chinook) and survival estimates were generated for each group when sample sizes were adequate within the time periods to estimate survival through the reach.

2008 WTT Results

Species	Release Site	WTT Reach	Release Date(s)	WTT Scenario (days)			
				1	2	3	4
ST	RIS	RIS - MCN	4/21-5/4	7.3	7.7	7.4	7.7
			5/5-5/18	5.4	5.6	5.4	5.6
			5/19-6/1	4.1	4.1	4.0	4.1
CH1	RIS	RIS – MCN	4/21-5/4	6.8	7.1	6.8	7.1
			5/5-5/18	5.1	5.3	5.1	5.3
			5/19-6/1	4.1	4.1	4.0	4.1
CH0	WELH	WELH - JDA	6/16	14.0	14.2	14.1	13.4

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2008 Survival Results

Species	Release Site	WTT Reach	Release Date(s)	Survival Scenario 1	2	3	4
ST	RIS	RIS - MCN	4/21-5/4	0.47	0.45	0.47	0.45
			5/5-5/18	0.61	0.59	0.61	0.59
			5/19-6/1	0.69	0.69	0.69	0.69
CH1	RIS	RIS – MCN	4/21-5/4	0.66	0.66	0.66	0.66
			5/5-5/18	0.71	0.70	0.71	0.70
			5/19-6/1	0.73	0.73	0.73	0.73
CH0	WELH	WELH - JDA	6/16	0.34	0.34	0.34	0.36

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2009 WTT Results

Species	Release Site	WTT Reach	Release Date(s)	WTT Scenario (days) 1	2	3	4
ST	RIS	RIS - MCN	4/21-5/4	6.8	6.8	6.5	6.3
			5/5-5/18	6.3	6.3	5.9	5.9
			5/19-6/1	5.1	5.1	5.0	5.0
CH1	RIS	RIS – MCN	4/21-5/4	6.8	6.8	6.5	6.4
			5/5-5/18	6.3	6.3	5.9	5.9
			5/19-6/1	5.2	5.2	5.1	5.1
CH0	WELH	WELH - JDA	6/16	16.4	17.6	17.4	17.1

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2009 Survival Results

Species	Release Site	WTT Reach	Release Date(s)	Survival Scenario 1	2	3	4
ST	RIS	RIS - MCN	4/21-5/4	0.51	0.51	0.53	0.54
			5/5-5/18	0.55	0.55	0.57	0.57
			5/19-6/1	0.62	0.62	0.63	0.63
CH1	RIS	RIS – MCN	4/21-5/4	0.65	0.65	0.66	0.66
			5/5-5/18	0.66	0.66	0.67	0.67
			5/19-6/1	0.68	0.68	0.69	0.69
CH0	WELH	WELH - JDA	6/16	0.29	0.27	0.27	0.28

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Conclusions

- Overall, the four scenarios that modeled different release scenarios for the 1 Maf of Supplemental Storage from Canadian releases did show small differences in survival between groups of migrating fish
- This analysis does indicate that small survival benefits can be accomplished for steelhead and yearling chinook if releases are primarily focused on the late April-June time frame, where as slight survival benefits to sub-yearling chinook can be had if releases are focused primary in July.
- These survival benefits would be especially noticeable when coupled with other actions that benefit survival.
- The balance of releases is important, as focusing releases during one period may benefit one species but lead to decreases in survival to another species that tends to migrate at a different time.