

Consequences for Trial Alternatives under Interim Performance Measures

Main Table Meeting

July 14, 2021



Outline

- Purpose of Sample Consequences Calculations
- Trial Alternatives and Interim Performance Measures
- PM Methods and Results



Purpose of Trial Alternatives

- Demonstrate how performance measures respond to flow management decisions
- Demonstrate some of the trade-offs that may be required in SDM process
- Provide a starting point to inform discussion of potential alternatives
- **May not represent future hydrological conditions**
 - climate change
- **Not intended as a future operational regime**



Sample Consequences Table

Performance Measure	Period	Location	Units	Preferred Direction	Scenario		
					Pre-1981	Post-1981	100% via SLS
Flooding - Number of days where flow exceeds 550 m ³ /s	All	Nechako at Vanderhoof	Days per year	Low	5.3	2.6	31.0
Flushing flows – number of days where flow exceeds 468 m ³ /s	All	Nechako at Vanderhoof	Days Per Year	High	15.2	7.7	46.8
Salmon - Average daily flow	Jul 1 - Sep 30	Nechako at Vanderhoof	m ³ /s	High	229	176	291
Caribou - Days where reservoir elevation is less than 852 m	May 1 - Jun 30	Nechako Reservoir	Days per year	Low	48.7	38.4	???
Boat access - Average reservoir elevation	Mar 1 - Oct 31	Nechako Reservoir	m	High	851.7	851.7	???
Power Generation - Average daily flow	All	Kemano Powerhouse	m ³ /s	High	86.4	118	0.00

PM values calculated as average over all years of record

Values presented use interim PMs, and are subject to change

Flow scenarios are for demonstration purposes and not intended as a future operational regime.

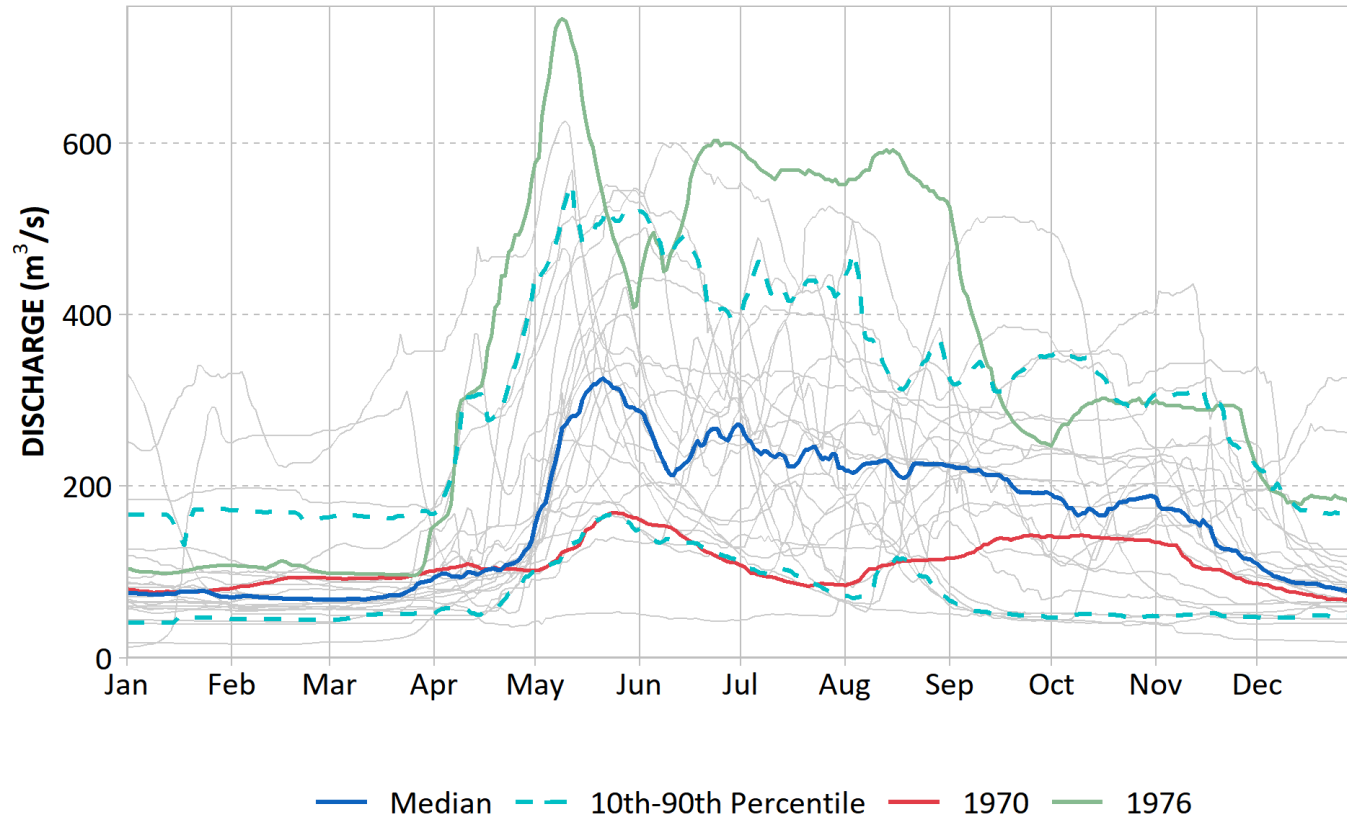
Trial Alternatives – Inputs / Methods

- Simplified calculations, based on data from:
 - Measured discharge at Nechako at Vanderhoof (pre/post 1981)
 - Modelled discharge at Nechako at Vanderhoof (100% flow to Nechako via SLS)
 - Nechako Reservoir elevation
 - Kemanu powerhouse
- Calculations are completed for individual years and summarized
 - Figures show the distribution of PM values over years
 - Tables provide average across all years



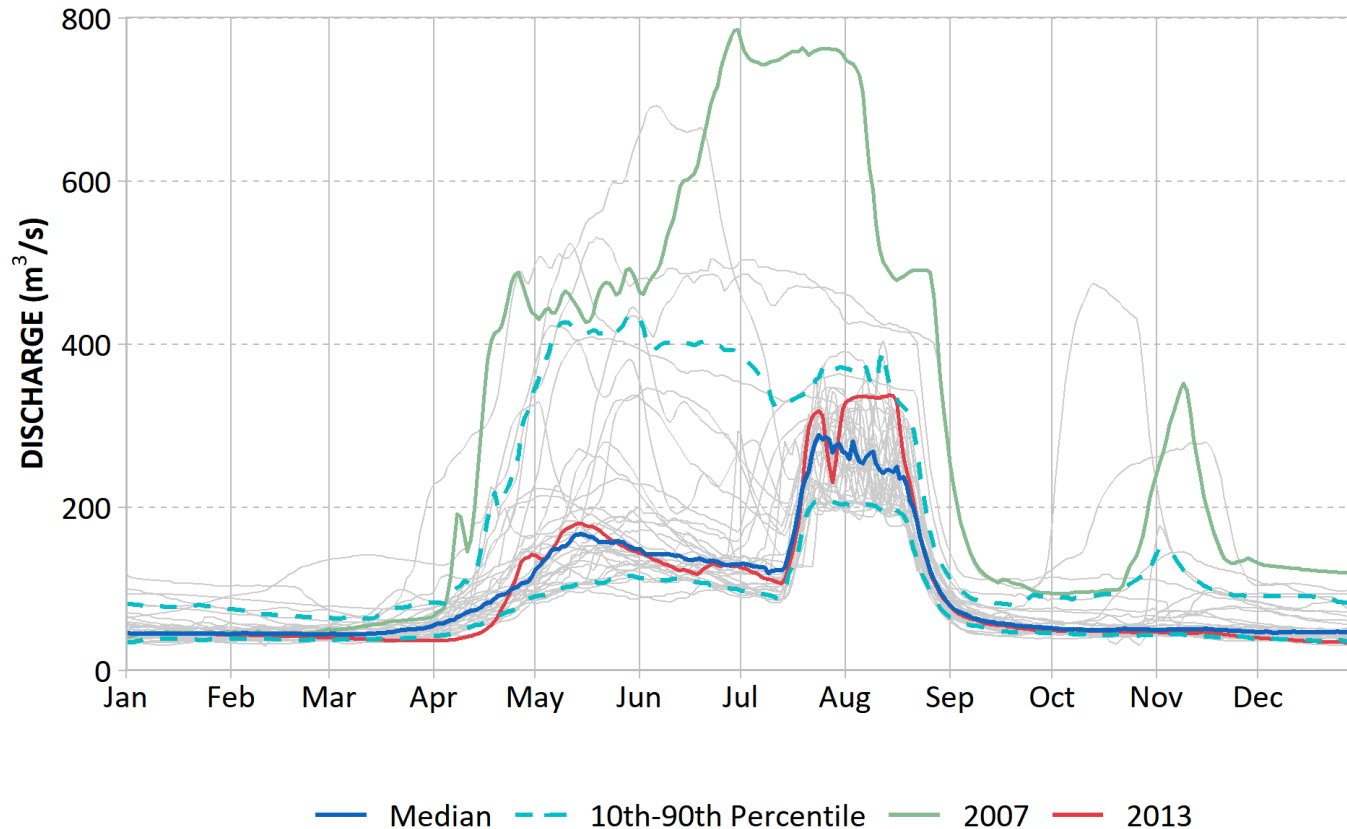
Nechako at Vanderhoof

Historic (Pre-1981)



Nechako at Vanderhoof

Historic (Post-1981)

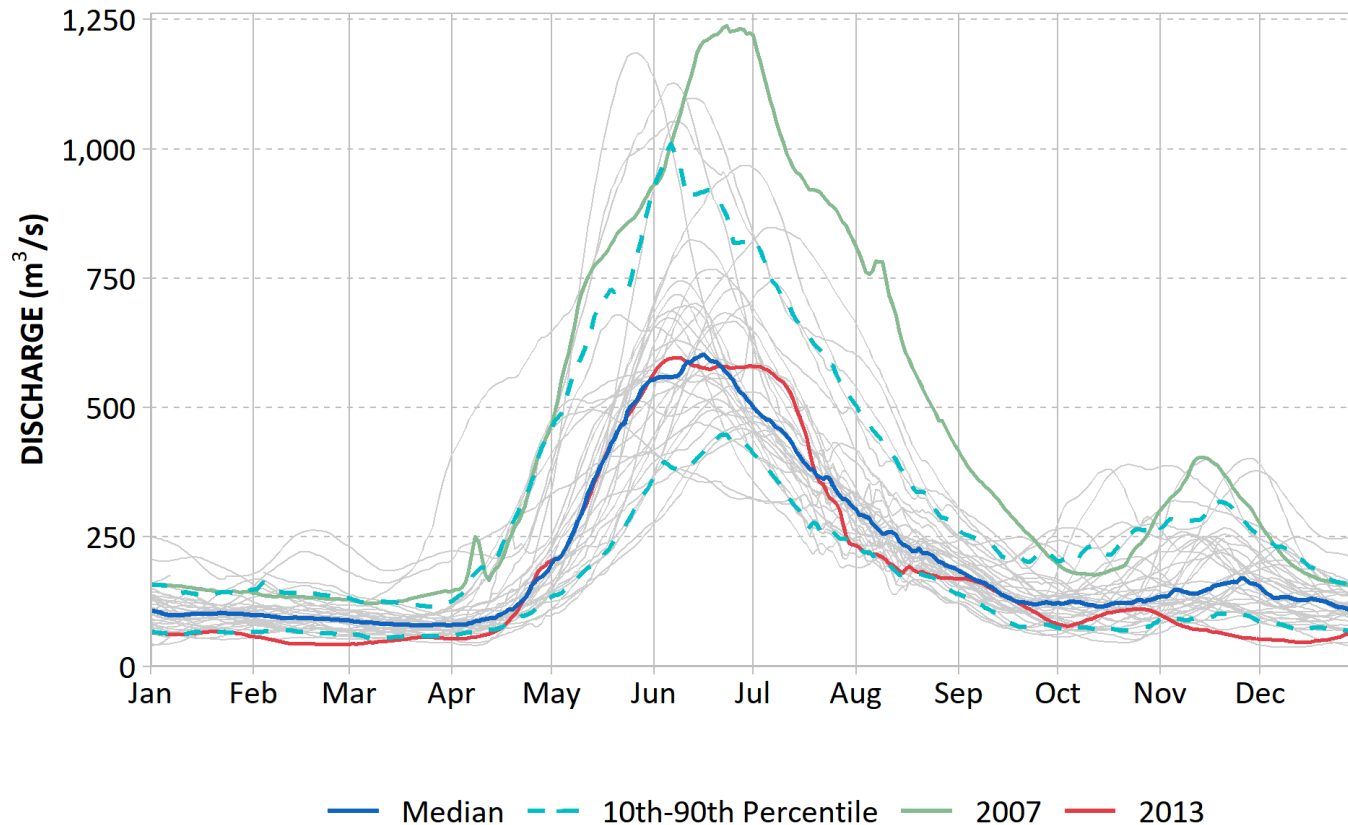


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Flow scenarios are for demonstration purposes and not intended as a future operational regime

Nechako at Vanderhoof

100% Flow to Nechako via Skins Lake Spillway

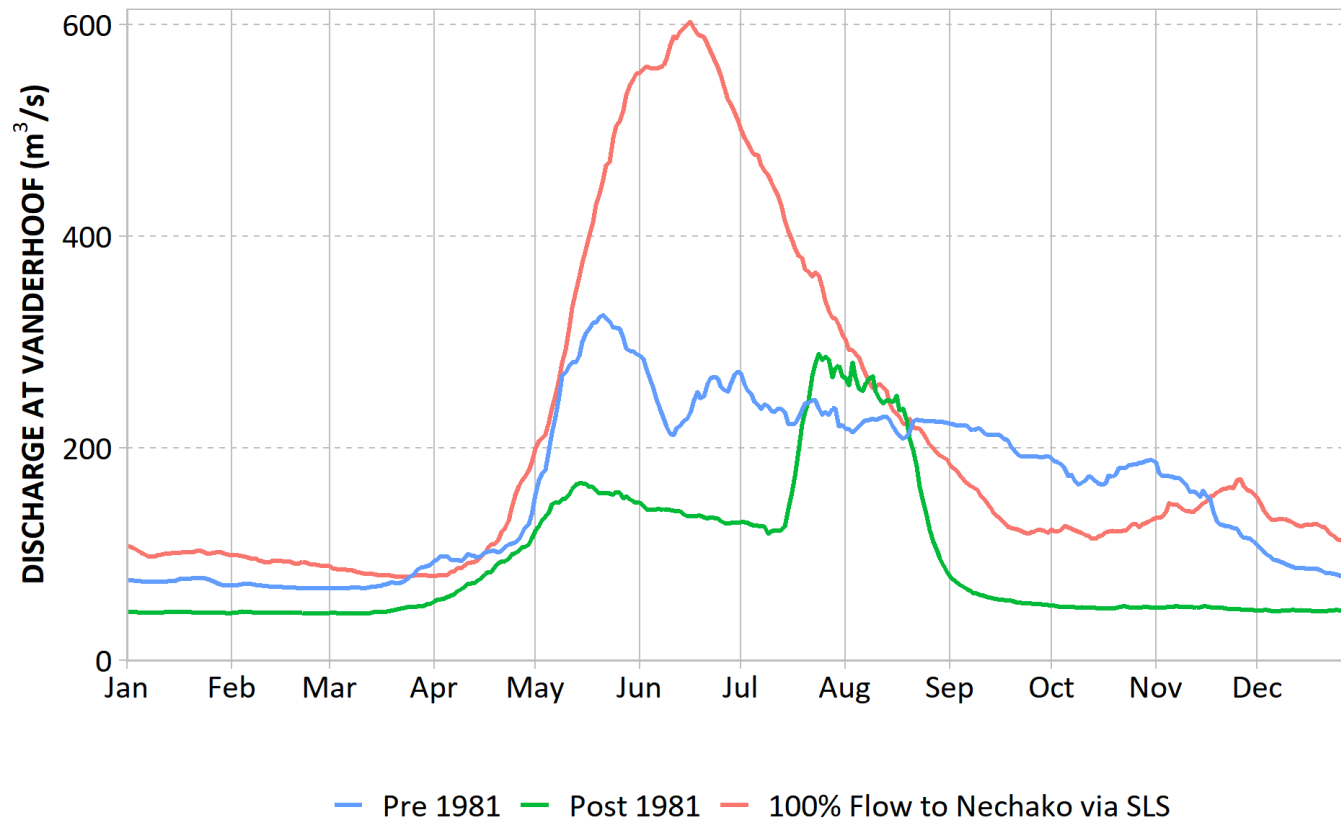


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Flow scenarios are for demonstration purposes and not intended as a future operational regime
Hydrograph is based on modelled data of hypothetical flow routing scenario

Nechako at Vanderhoof

Comparison of Median Flow



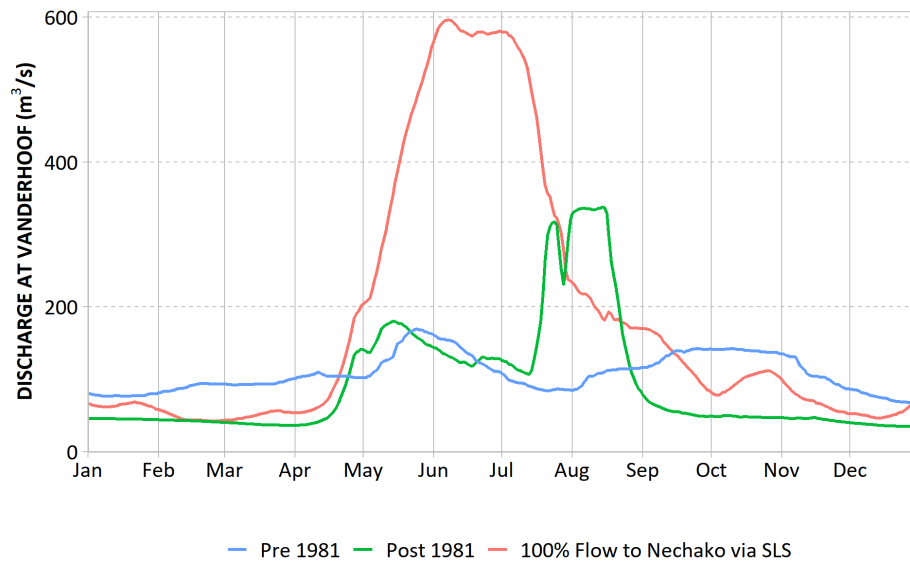
GET INVOLVED NECHAKO

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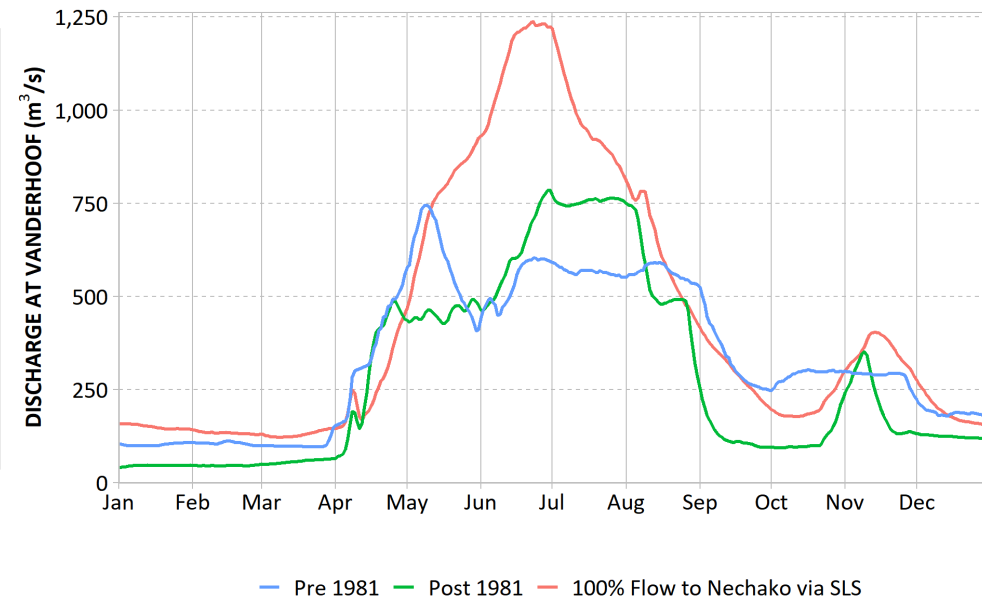
Nechako at Vanderhoof

Specific Years

Comparison of low inflow years (1970, 2013)



Comparison of high inflow years (1976, 2007)



Flow scenarios are for demonstration purposes and not intended as a future operational regime

Performance Measures for Interim Calculations

Objective	Interim Performance Measure	Preferred Direction
Minimize open-water, overbank flooding	Number of days at Vanderhoof where flow exceeds 550 m ³ /s	Low
Maximize flushing flows	Number of days at Vanderhoof where flow exceeds 200% MAD	High
Minimize temperature effects on salmon migration	Average daily flow at Vanderhoof between July 1 and Sept 30	High
Minimize land connections to caribou calving islands	Days where reservoir elevation is less than 852 m (2795 ft) between May 1 and June 30	Low
Maximize access to boat docks and launches	Average reservoir elevation between March 1 and October 31	High
Maximize RTA power generation	Average Kemano Powerhouse flow	High

Interim PMs provided for demonstration purposes, and are subject to change

**Objective: Minimize open-water,
overbank flooding**

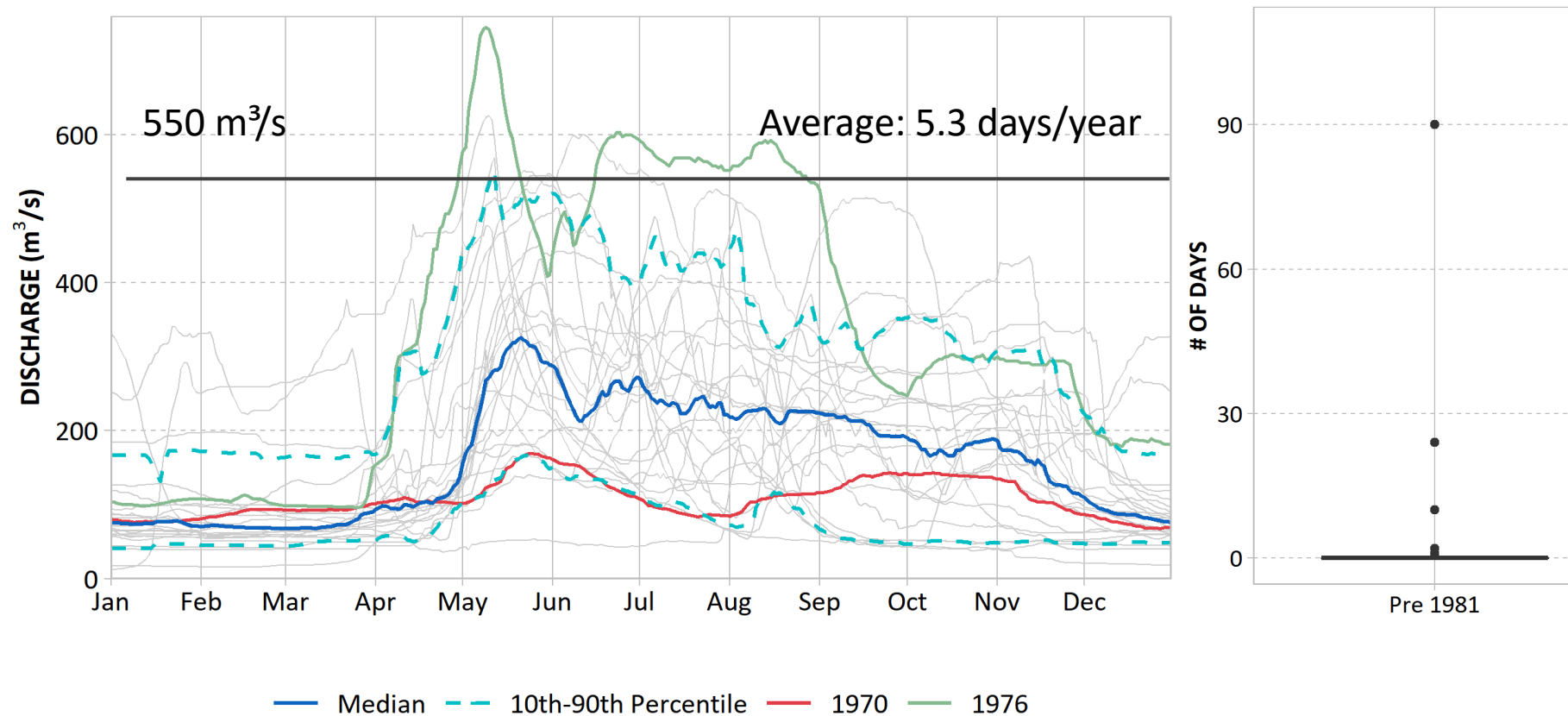
**Interim PM: Number of days where
flow exceeds 550 m³/s**



Interim PMs provided for demonstration purposes, and are subject to change

Nechako at Vanderhoof

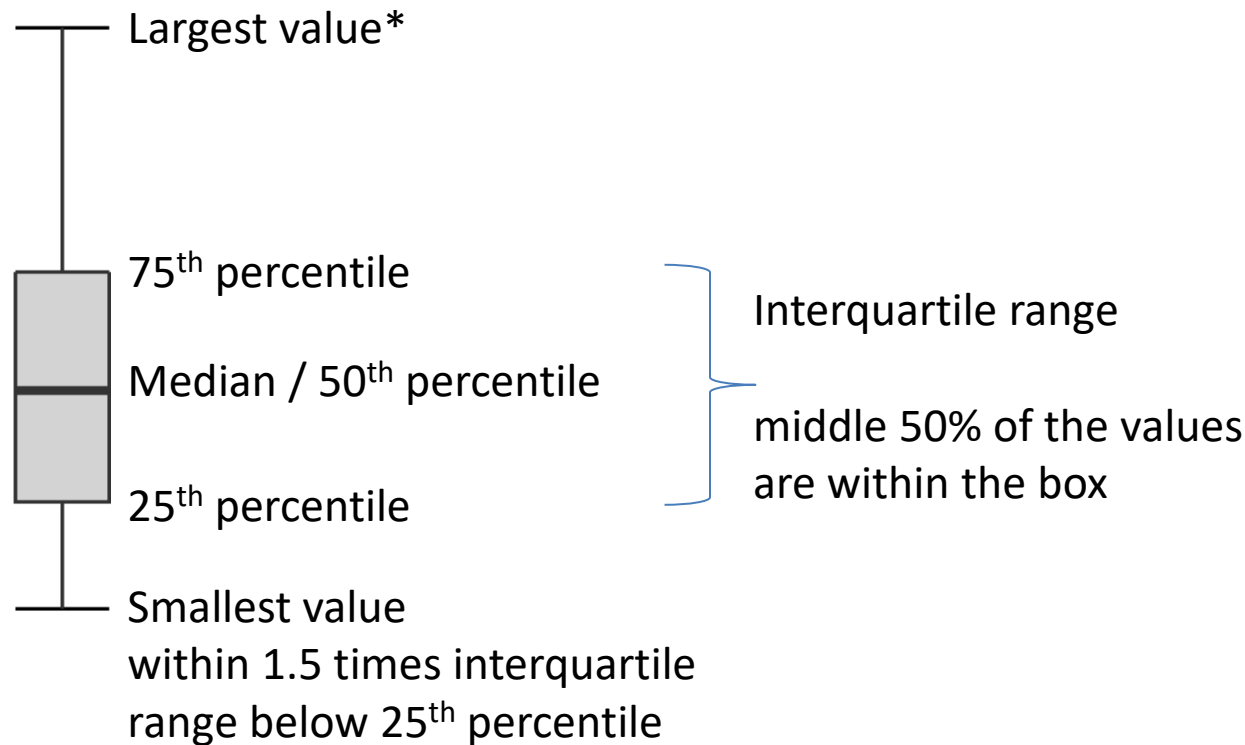
Flooding - Pre-1981



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Box Plots

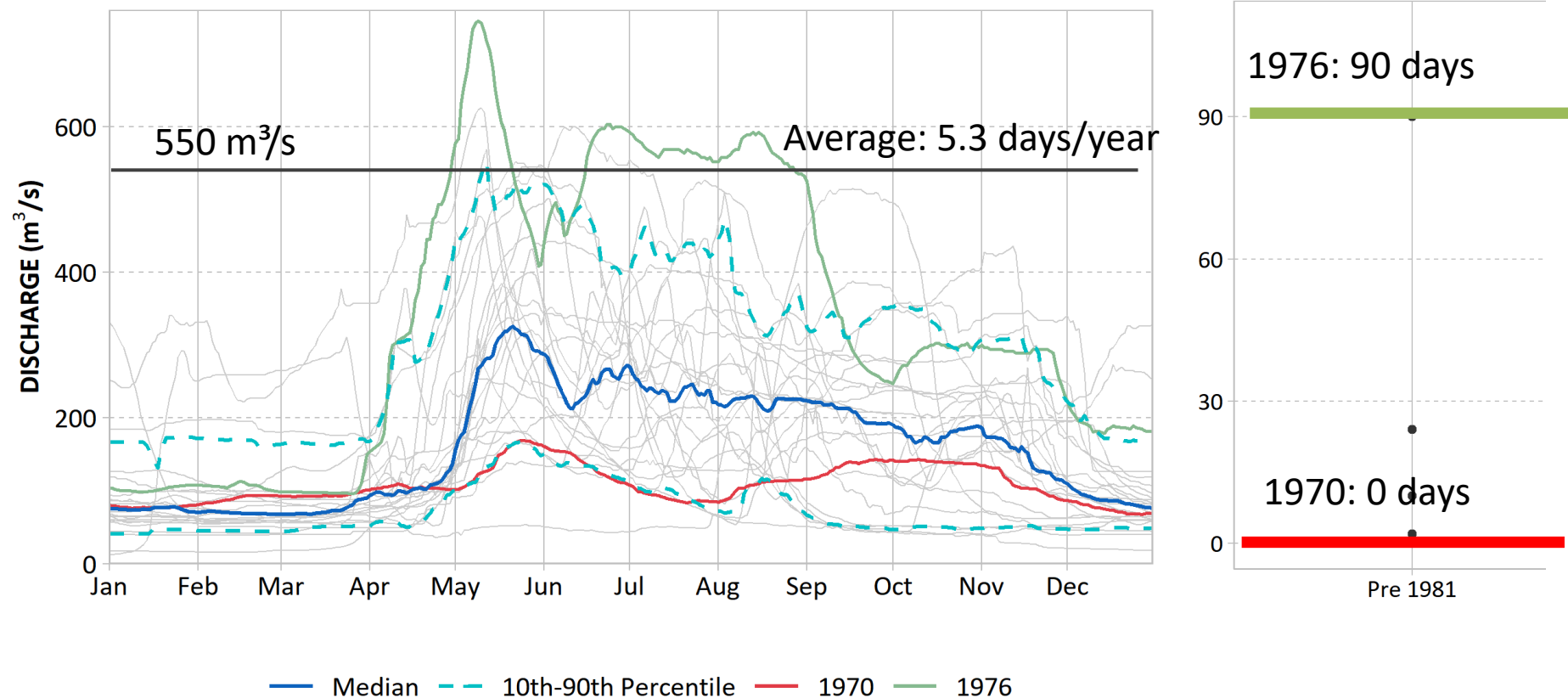


- Outlier – value is farther than 1.5 times the interquartile range below the 25th percentile



Nechako at Vanderhoof

Flooding - Pre-1981

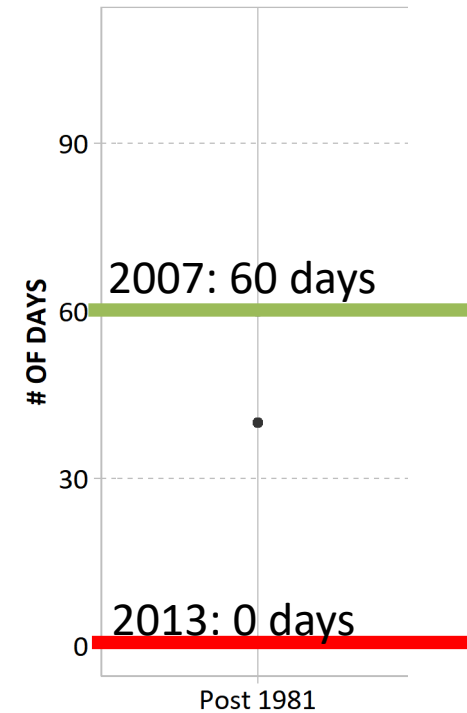
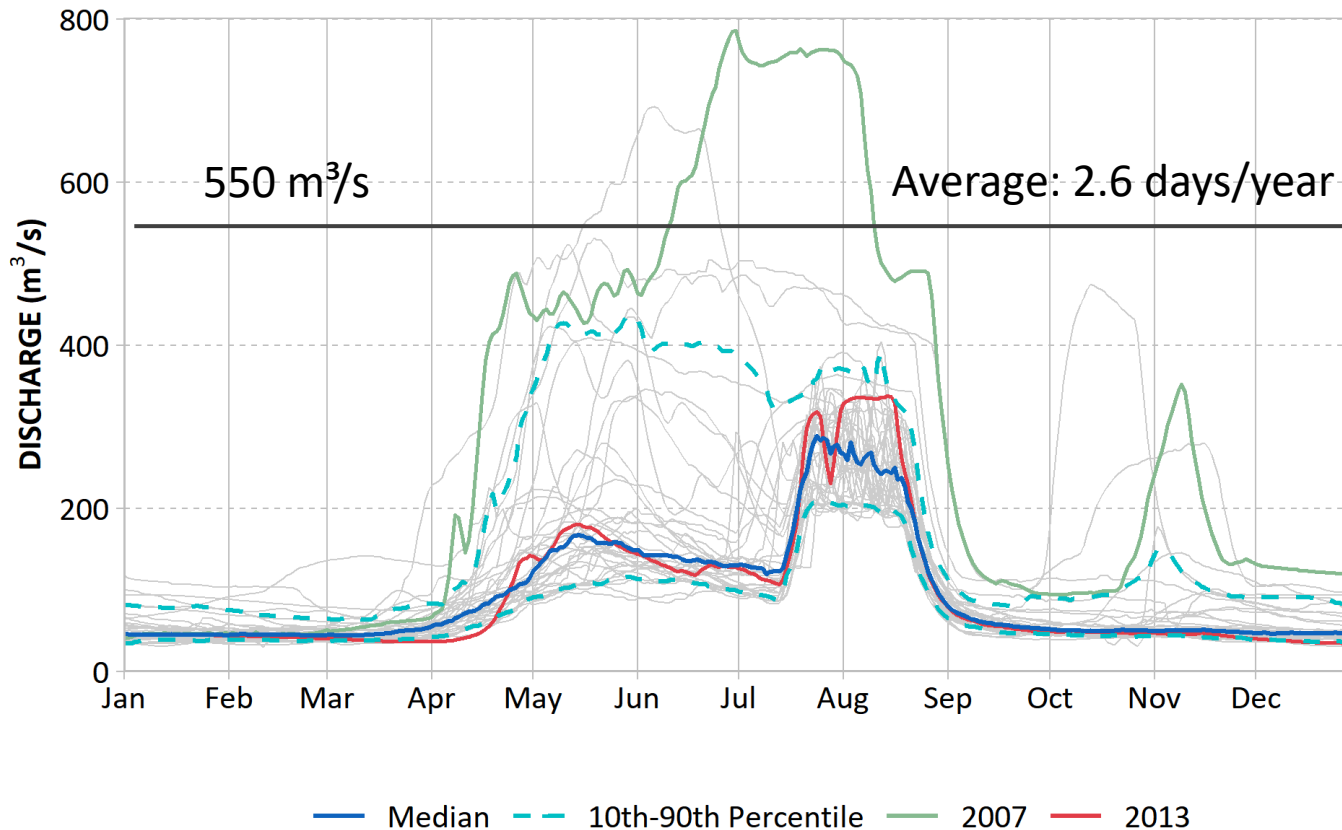


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Nechako at Vanderhoof

Flooding – Post 1981

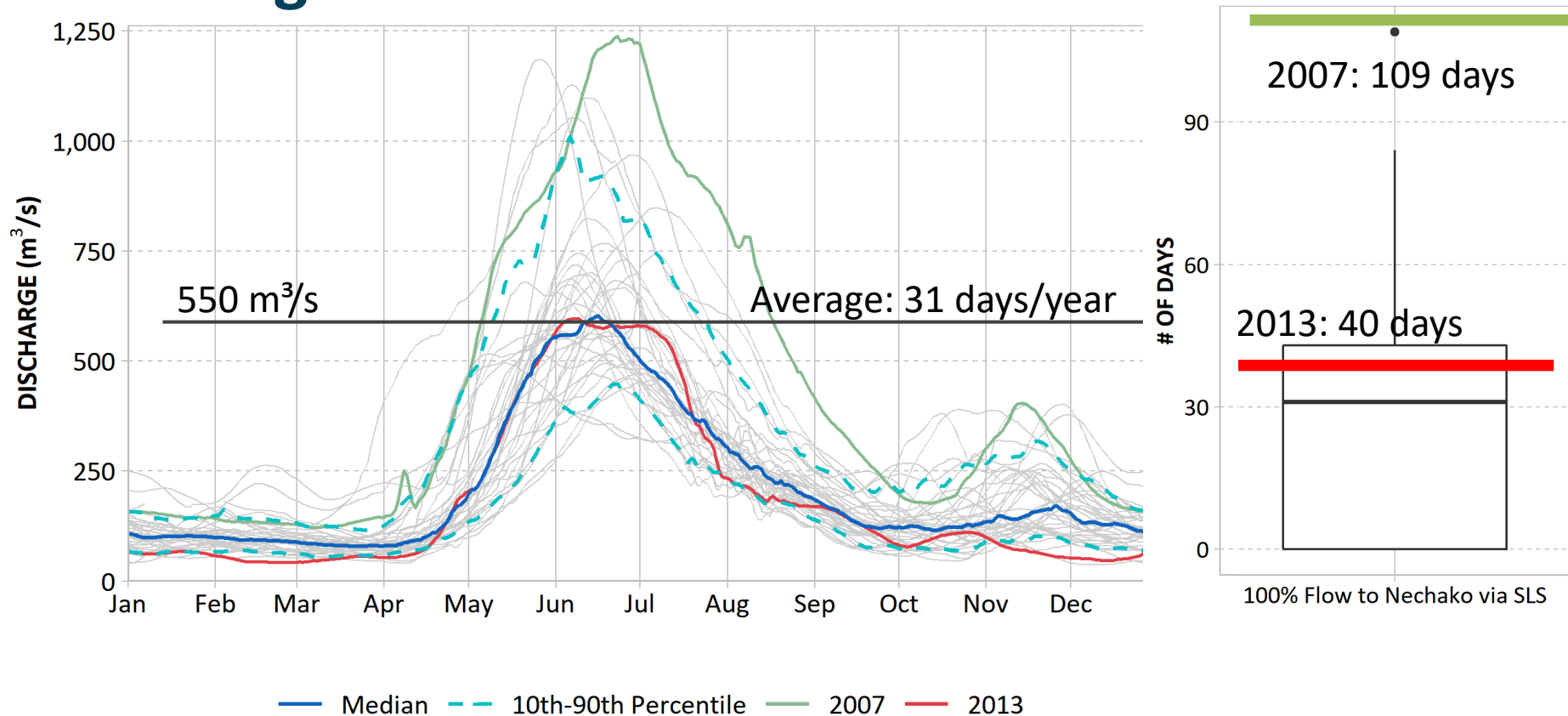


GET INVOLVED NECHAKO

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Nechako at Vanderhoof

Flooding – 100% Flow to Nechako via SLS



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Sample Consequences Table

Performance Measure	Period	Location	Units	Preferred Direction	Scenario		
					Pre-1981	Post-1981	100% via SLS
Flooding - Number of days where flow exceeds 550 m ³ /s	All	Nechako at Vanderhoof	Days per year	Low	5.3	2.6	31.0



GET INVOLVED NECHAKO

PM values calculated as average over all years of record
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Sample Consequences Table

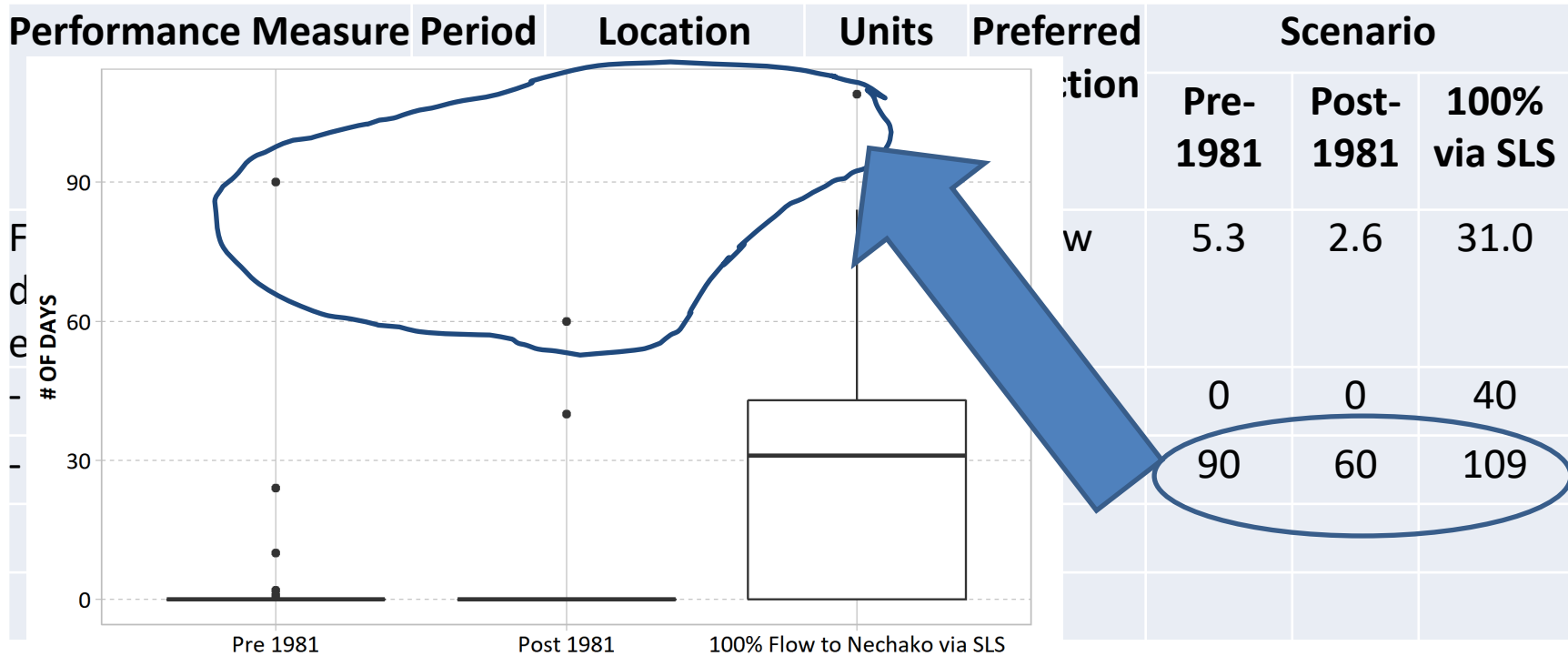
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					Pre-1981	Post-1981	100% via SLS
Flooding - Number of days where flow exceeds 550 m ³ /s	All	Nechako at Vanderhoof	Days per year	Low	5.3	2.6	31.0
- Low inflow year					0	0	40
- High inflow year					90	60	109



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Sample Consequences Table



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Objective: Maximize flushing flows

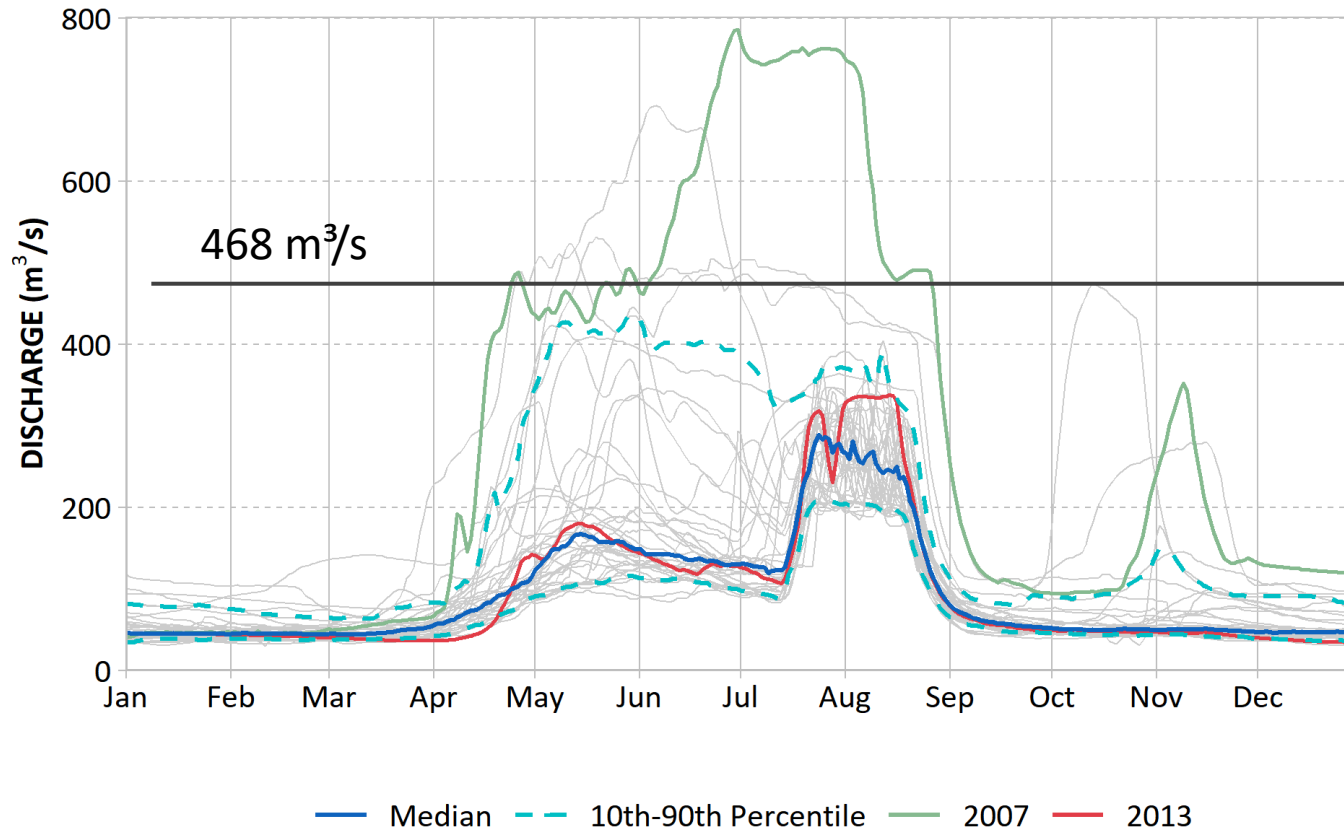
Interim PM: Number of days where flow exceeds 200% natural mean annual discharge ($\sim 468 \text{ m}^3/\text{s}$)



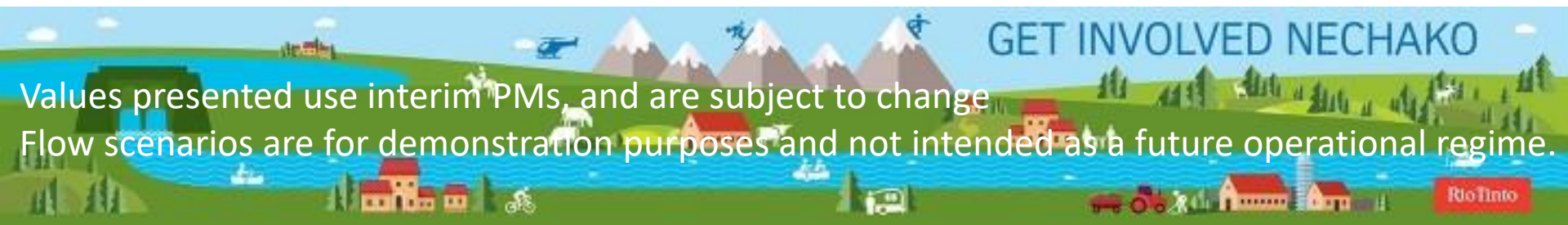
Interim PMs provided for demonstration purposes, and are subject to change

Nechako at Vanderhoof

Flushing Flows – Post-1981



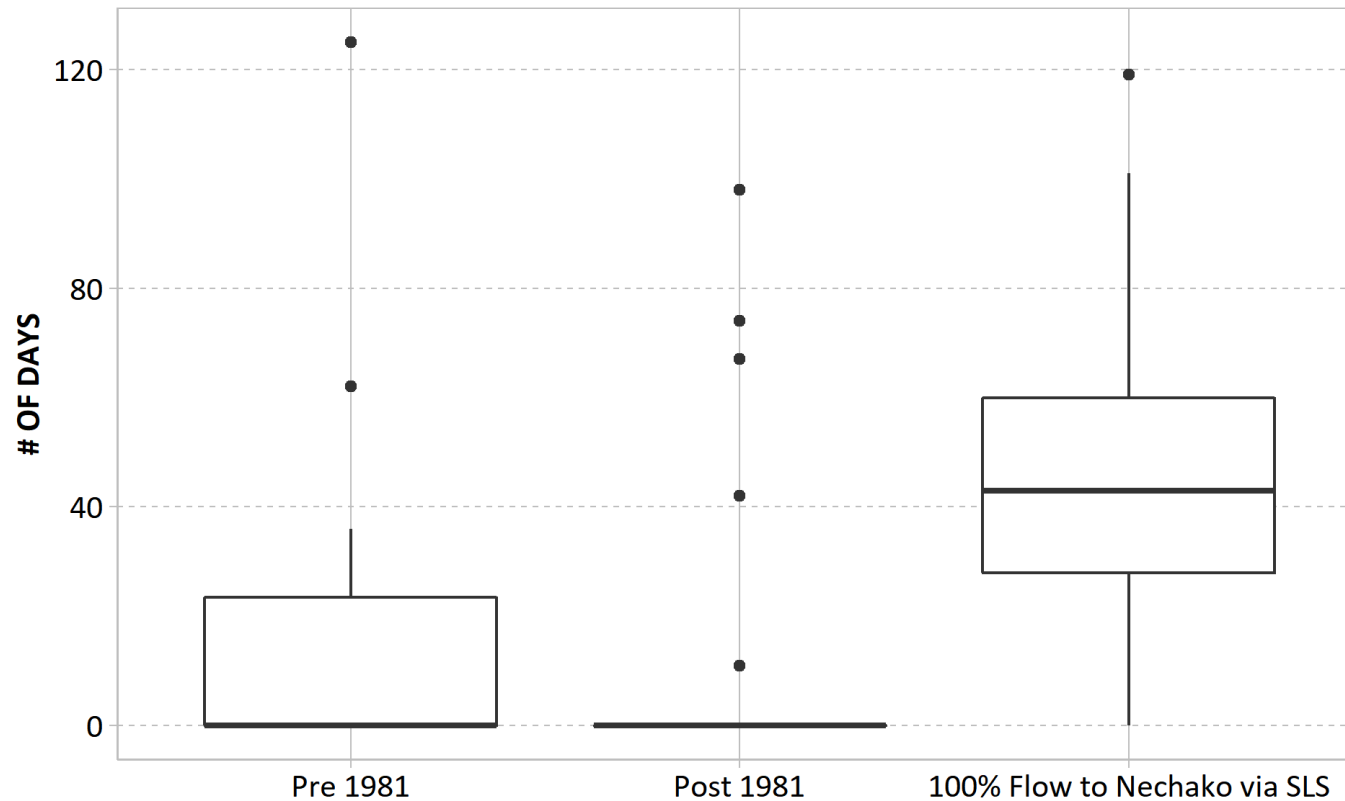
In contrast to flooding, preferred direction is high



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Nechako at Vanderhoof

Flushing Flows



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GET INVOLVED NECHAKO

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Objective: Minimize temperature effects on salmon migration

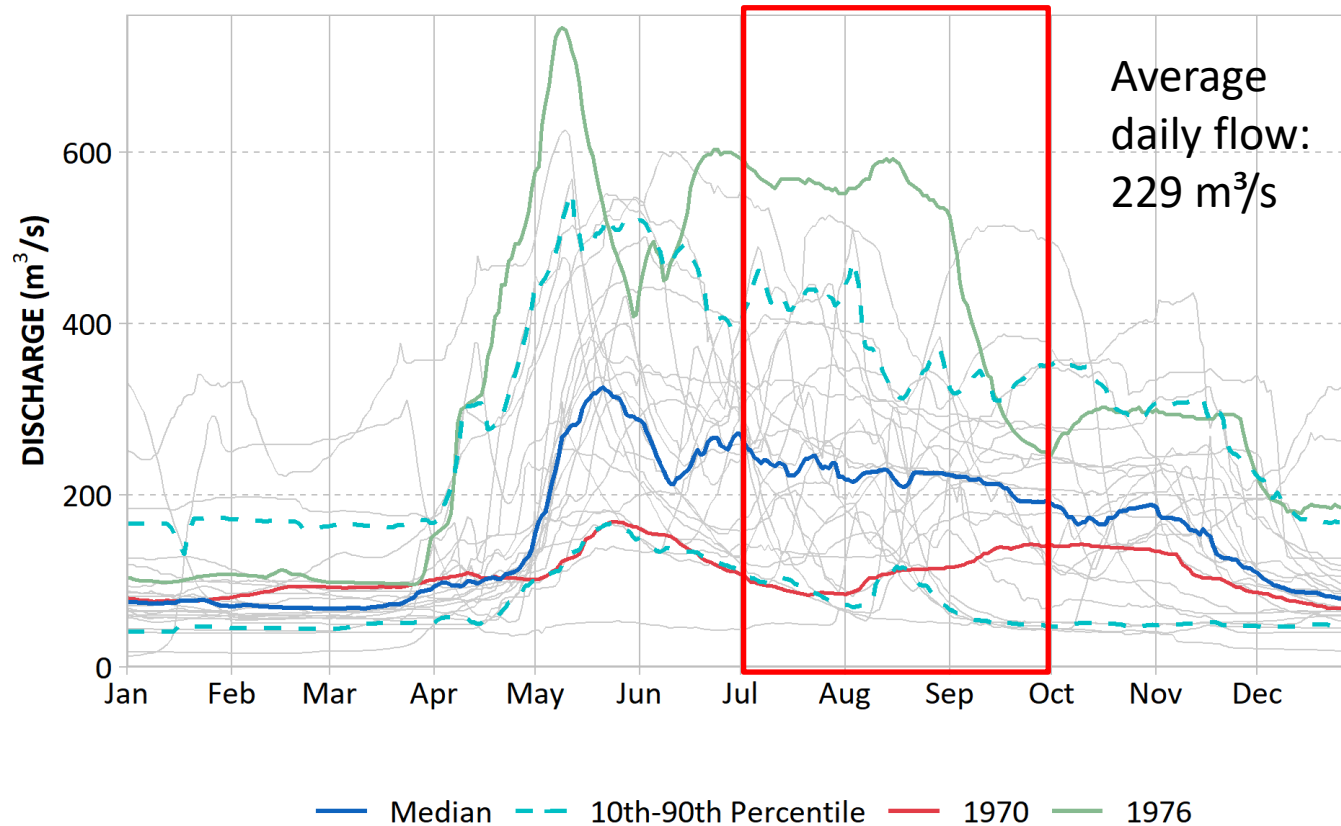
Interim PM – Average daily flow at Vanderhoof between July 1 and Sept 30 (proxy for temperature)



Interim PMs provided for demonstration purposes, and are subject to change

Nechako at Vanderhoof

Salmon Migration - Pre-1981

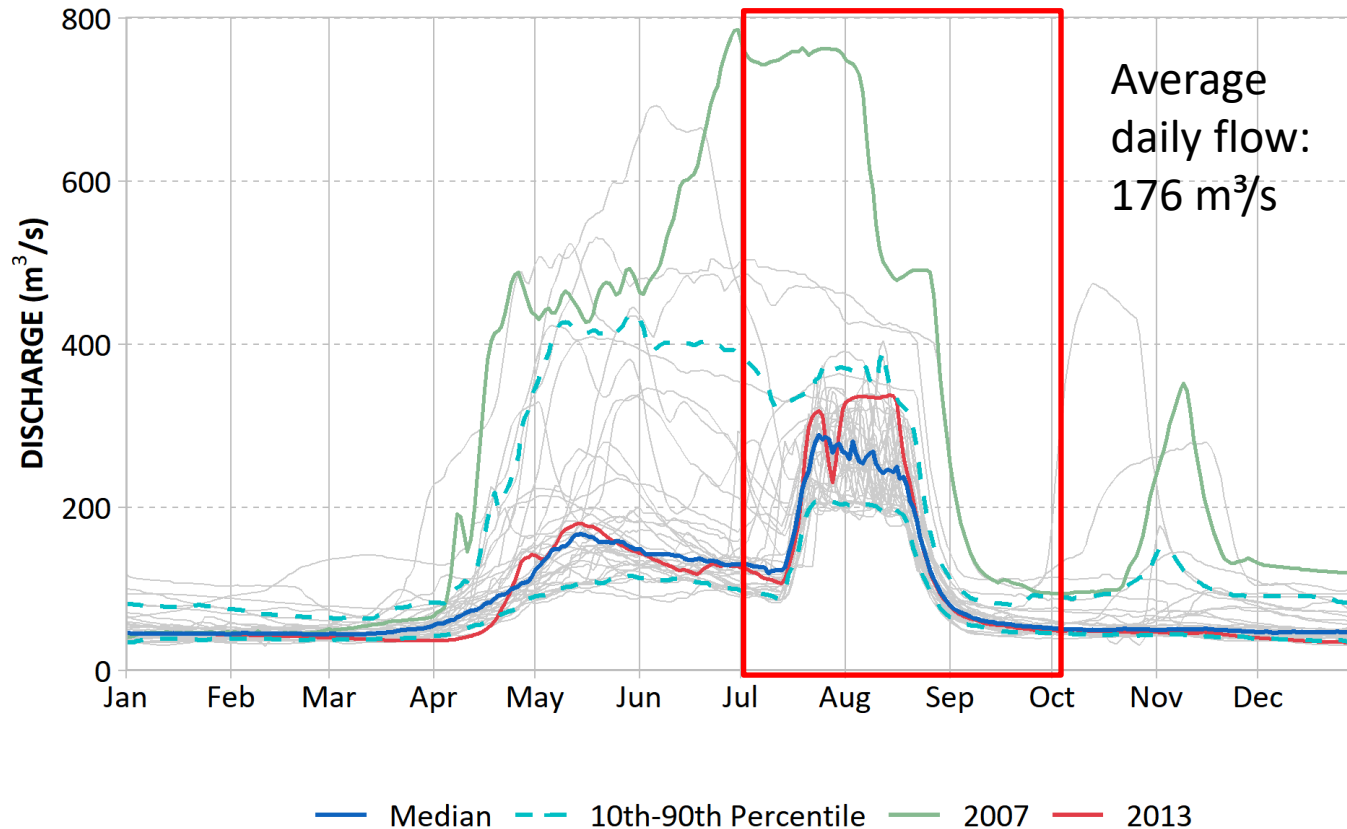


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Nechako at Vanderhoof

Salmon Migration - Post-1981

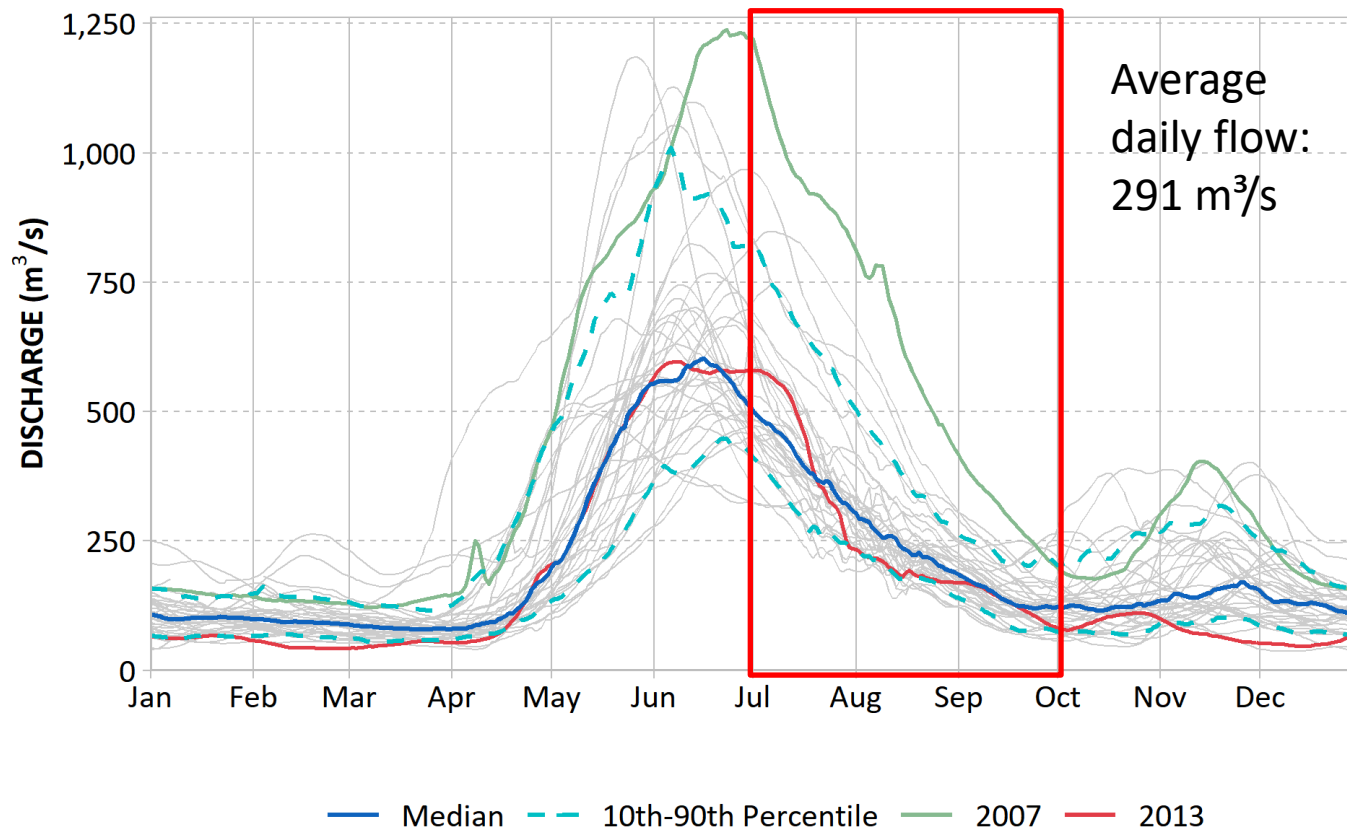


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Nechako at Vanderhoof

Salmon Migration - 100% Nechako flow via SLS

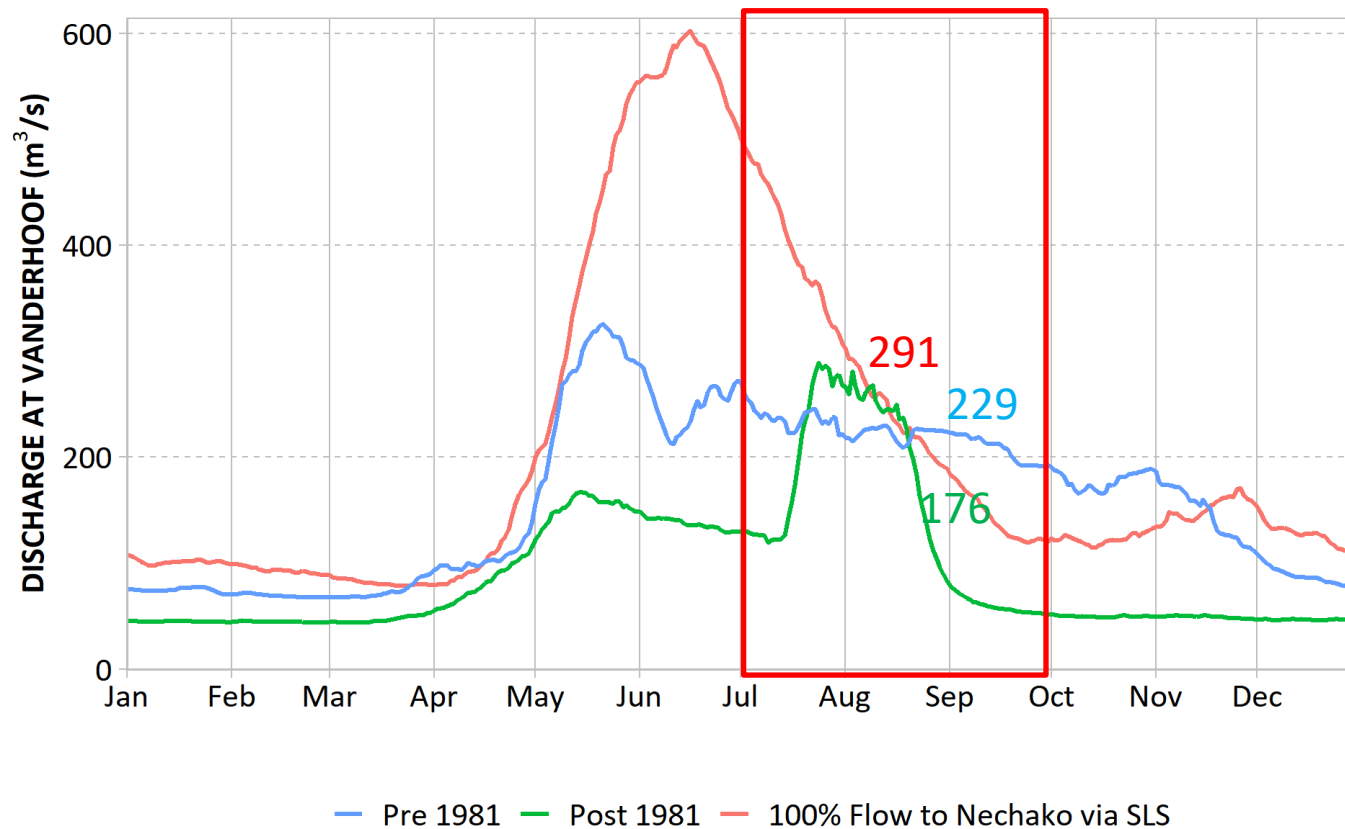


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Nechako at Vanderhoof

Comparison of Salmon Migration Flows

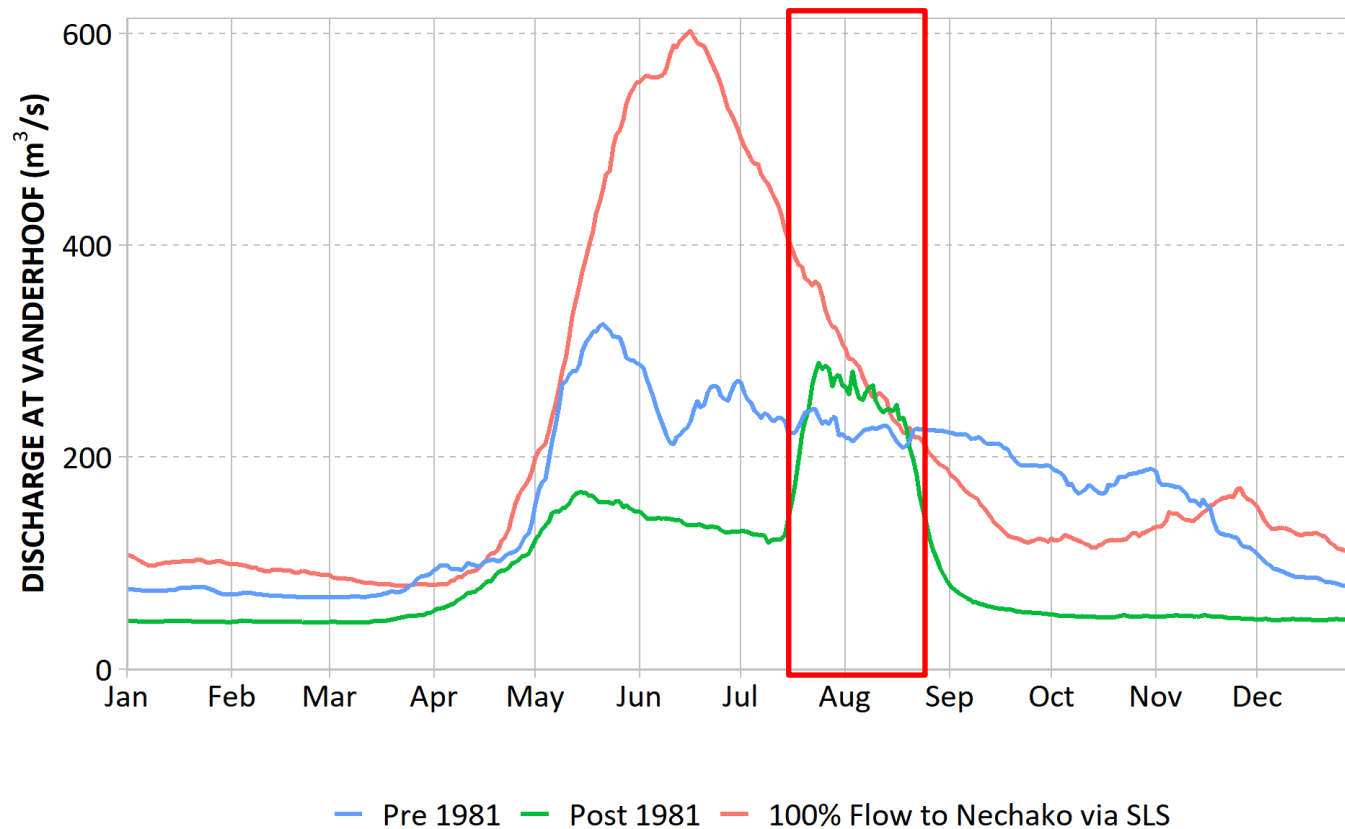


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Nechako at Vanderhoof

Critical Timing of Salmon Migration Flows?

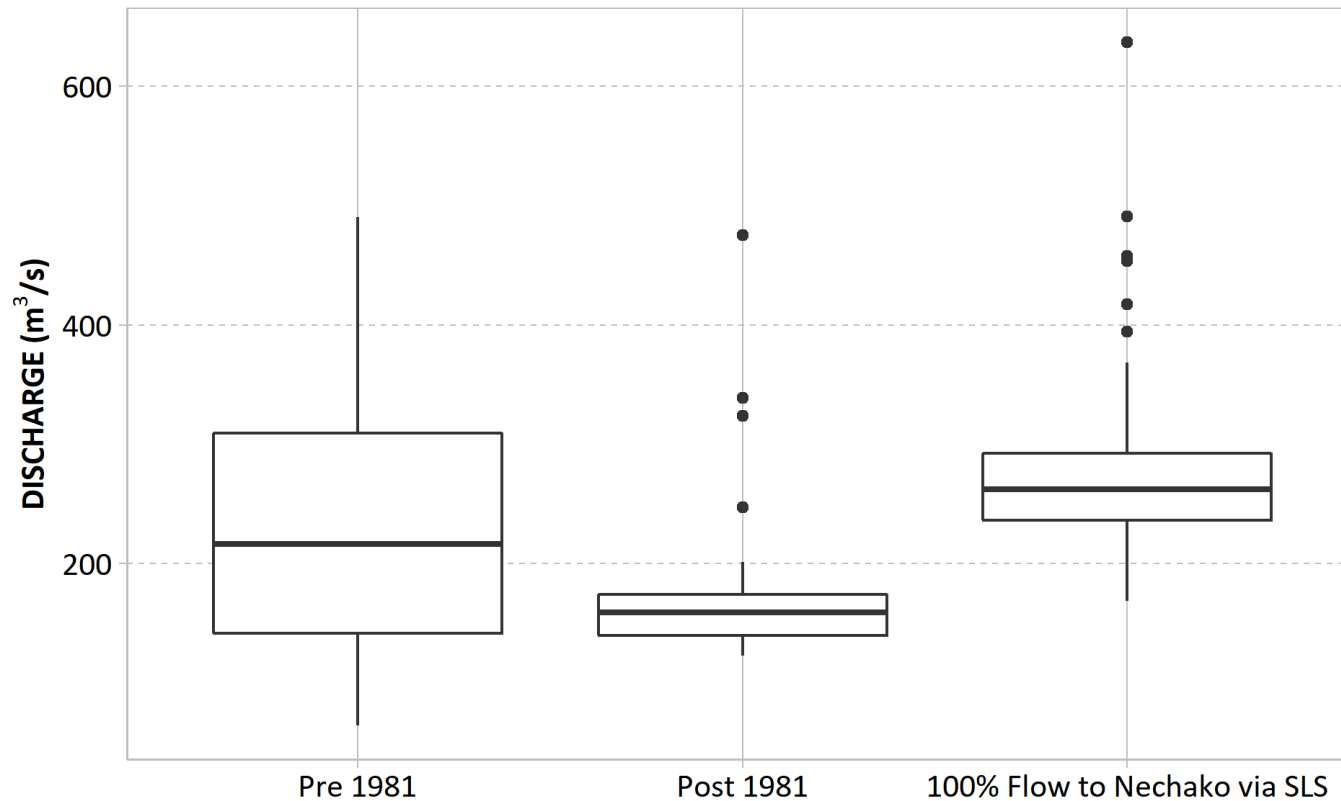


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Nechako at Vanderhoof

Salmon Migration Flows



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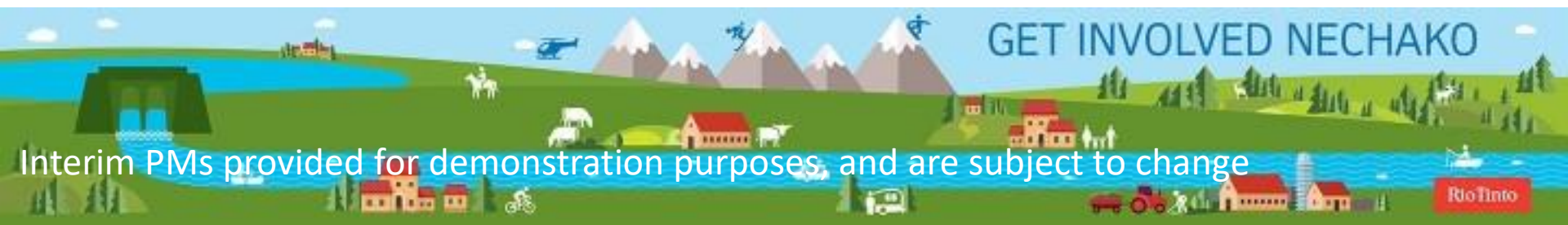


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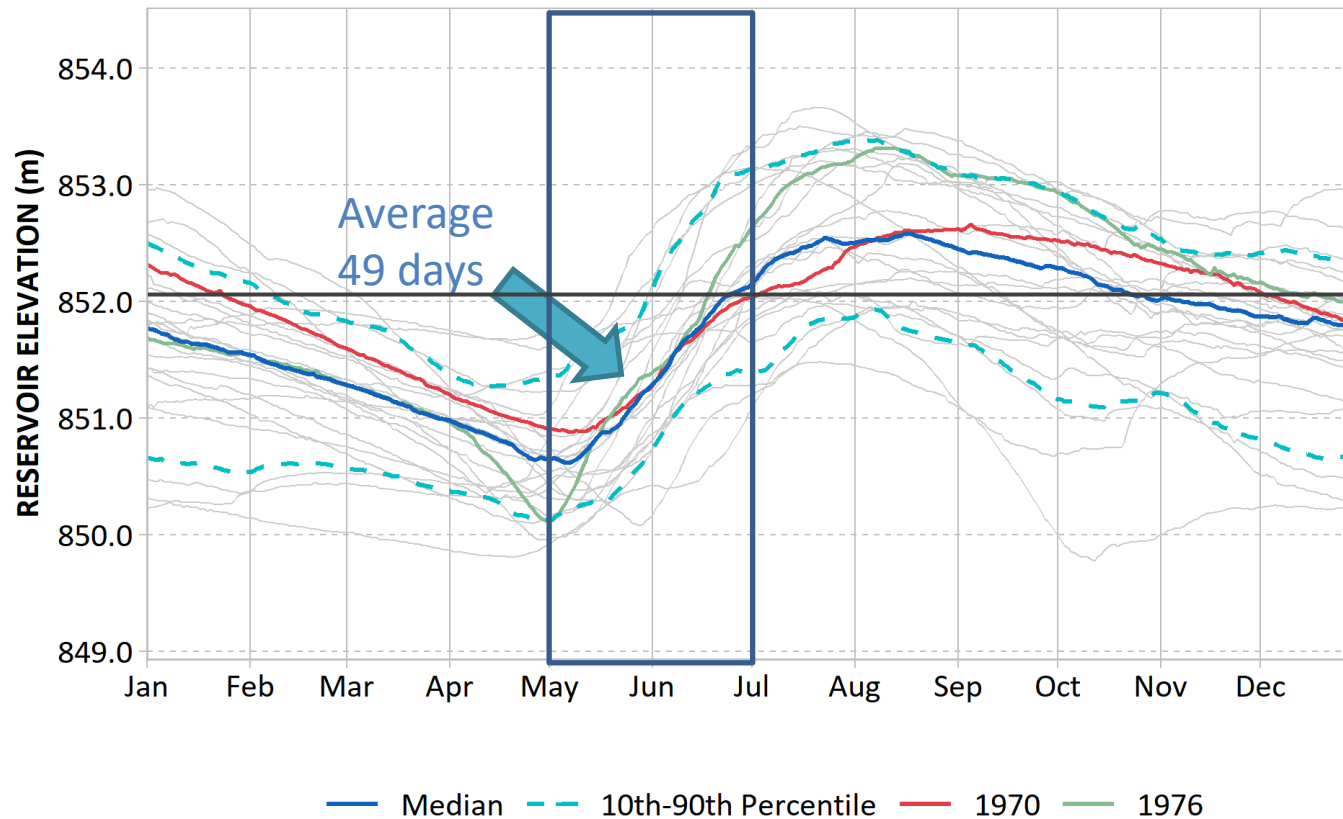
Objective: Minimize land connections to caribou calving islands

Interim PM – Days where reservoir elevation is less than 852 m (2795 ft) (May 1 – June 30)



Nechako Reservoir Elevation

Caribou Calving Island Land Links - Pre-1981

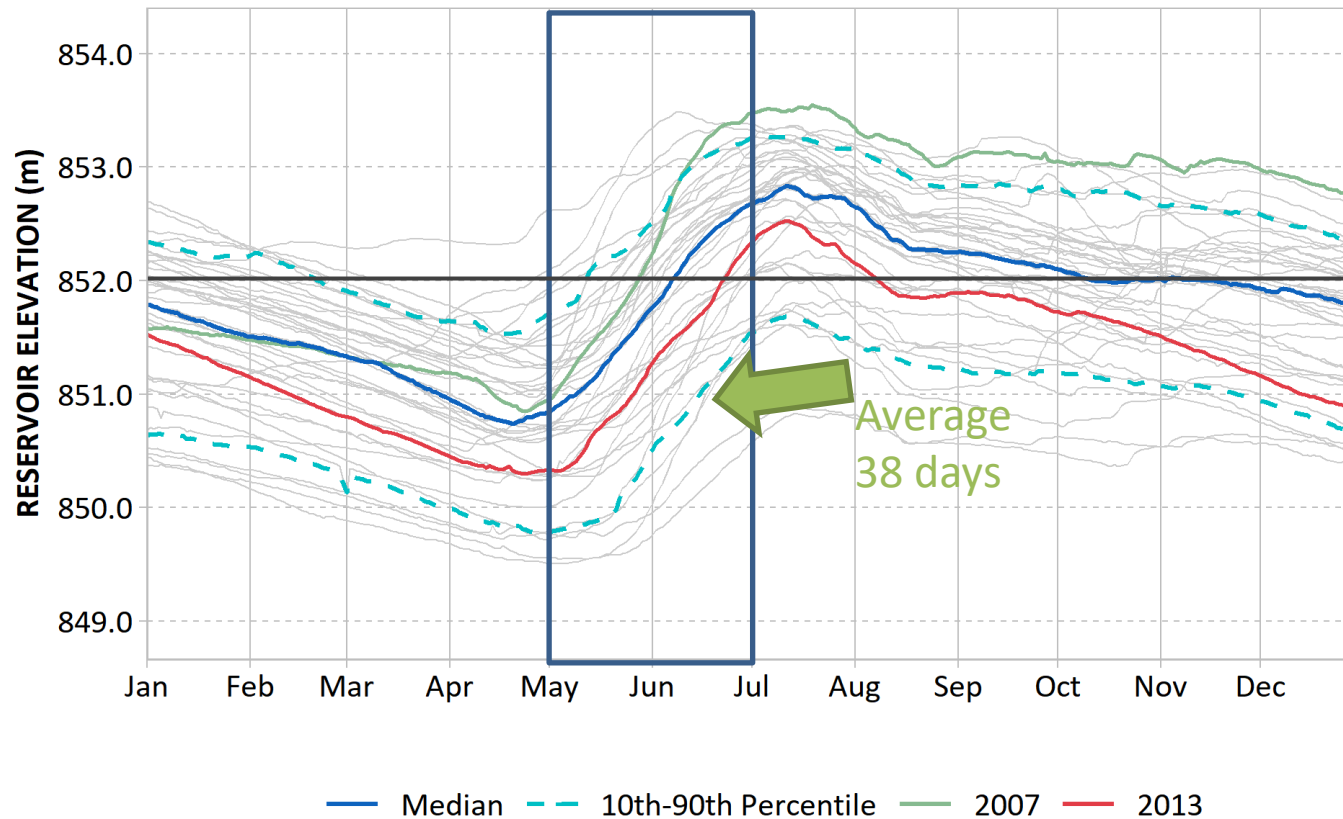


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Nechako Reservoir Elevation

Caribou Calving Island Land Links - Post-1981

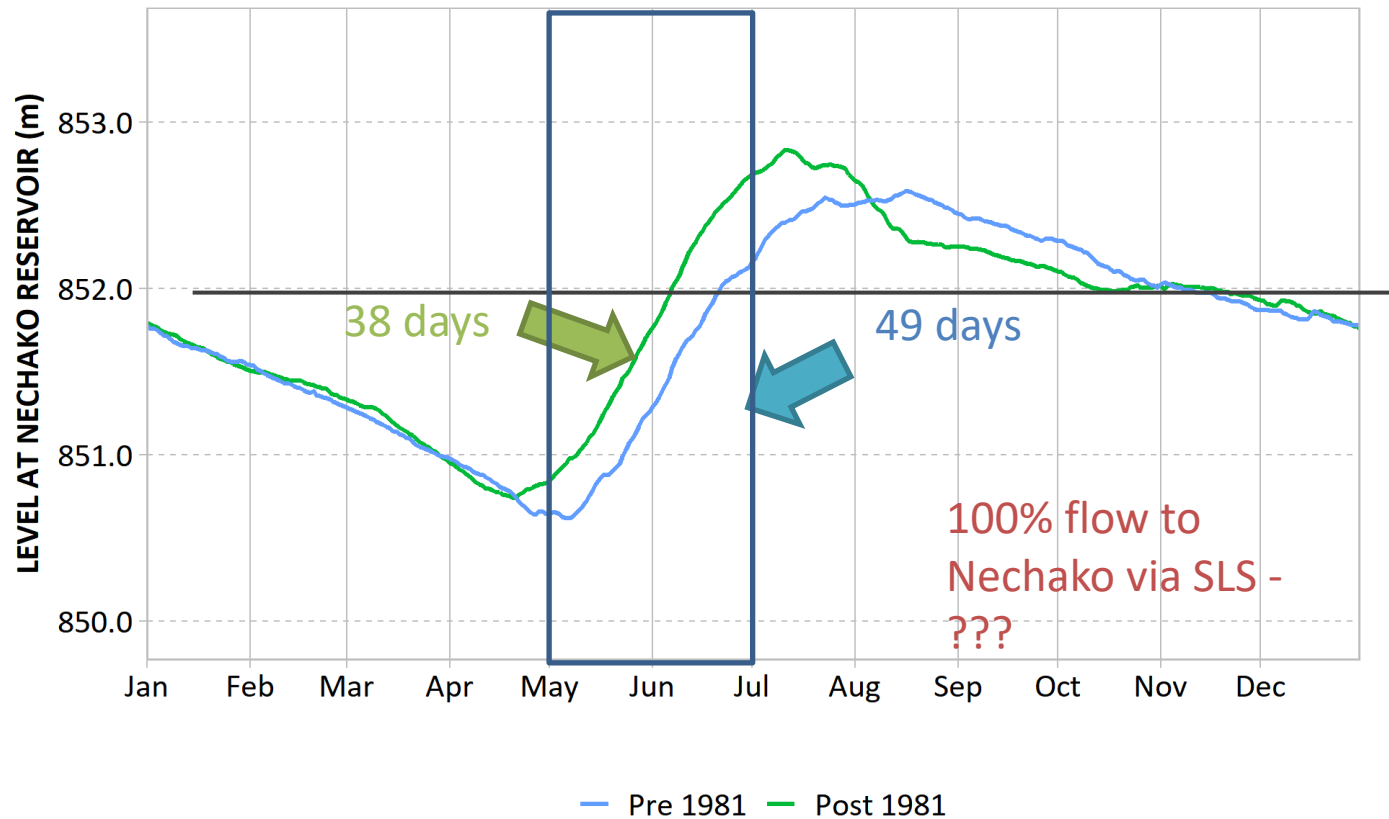


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Nechako Reservoir Elevation

Caribou Calving Island Land Links - Comparison



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Nechako Reservoir Elevation

Caribou Calving Island Land Links



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Caribou - Days where reservoir elevation is less than 852 m	May 1 - Jun 30	Nechako Reservoir	Days per year	Low	48.7	38.4	???



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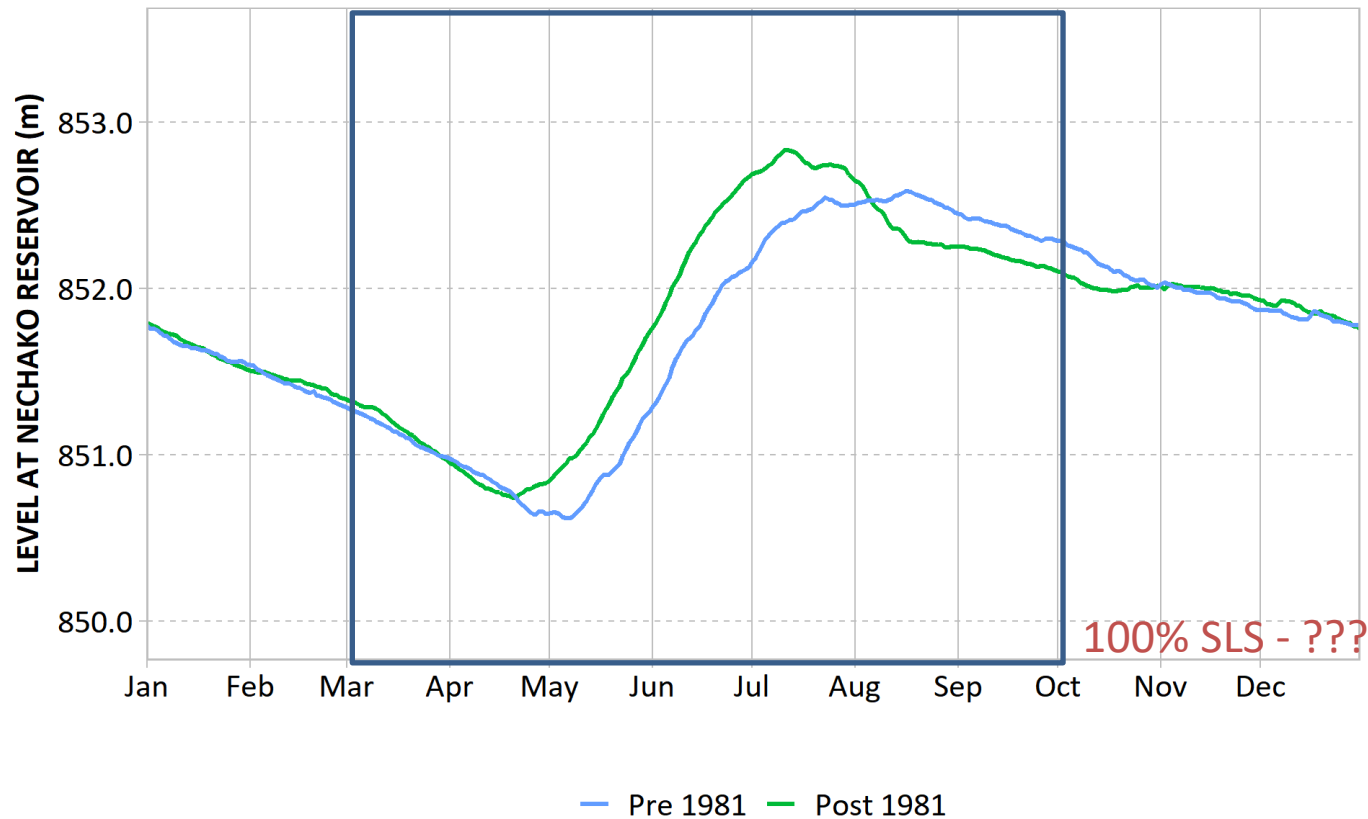
Objective: Maximize access to boat docks and launches

Interim PM – Average reservoir elevation March to October



Nechako Reservoir Elevation

Boat Docks and Launches - Comparison

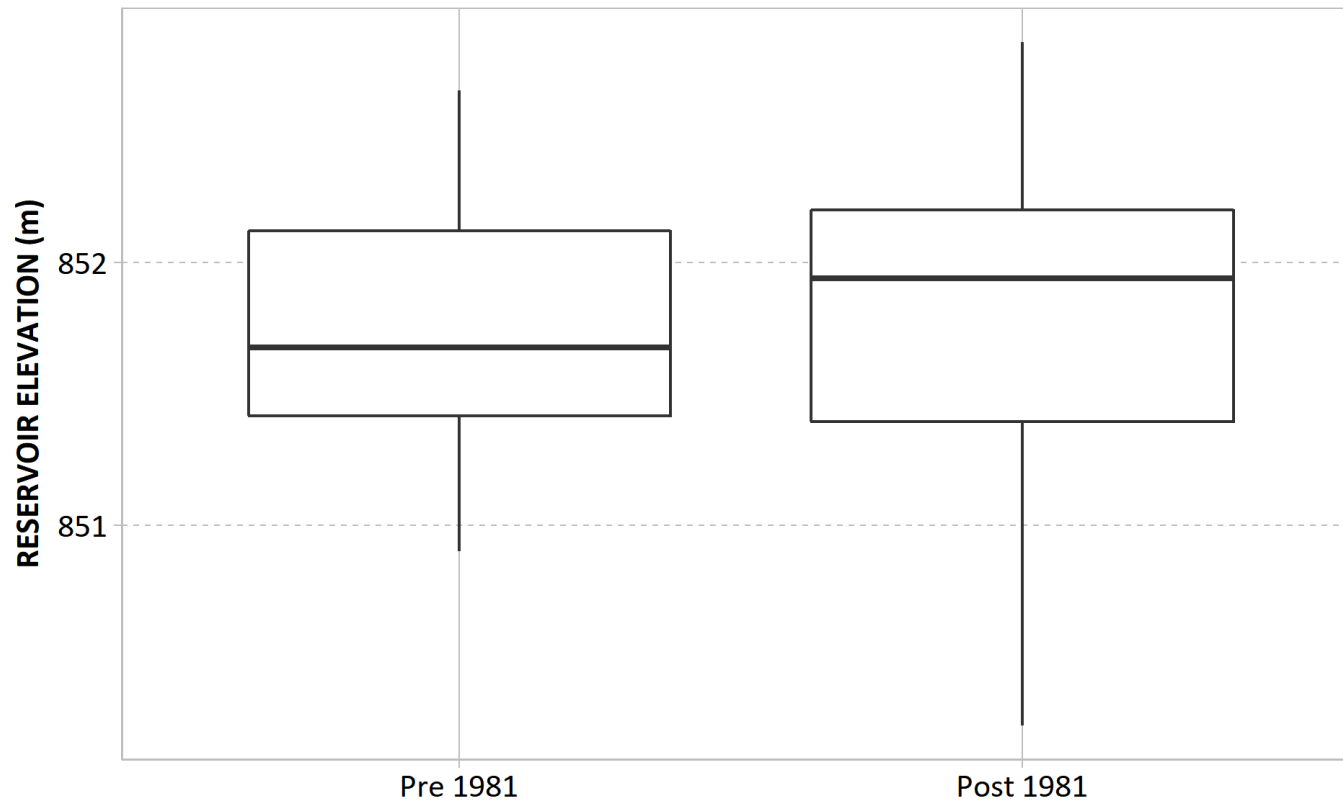


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Nechako Reservoir Elevation

Boat Docks and Launches



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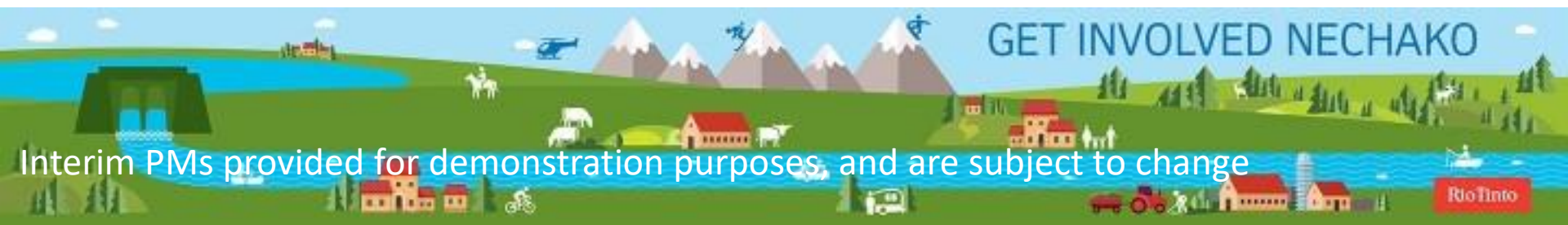
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Boat access - Average reservoir elevation	Mar 1 - Oct 31	Nechako Reservoir	m	High	851.7	851.7	???

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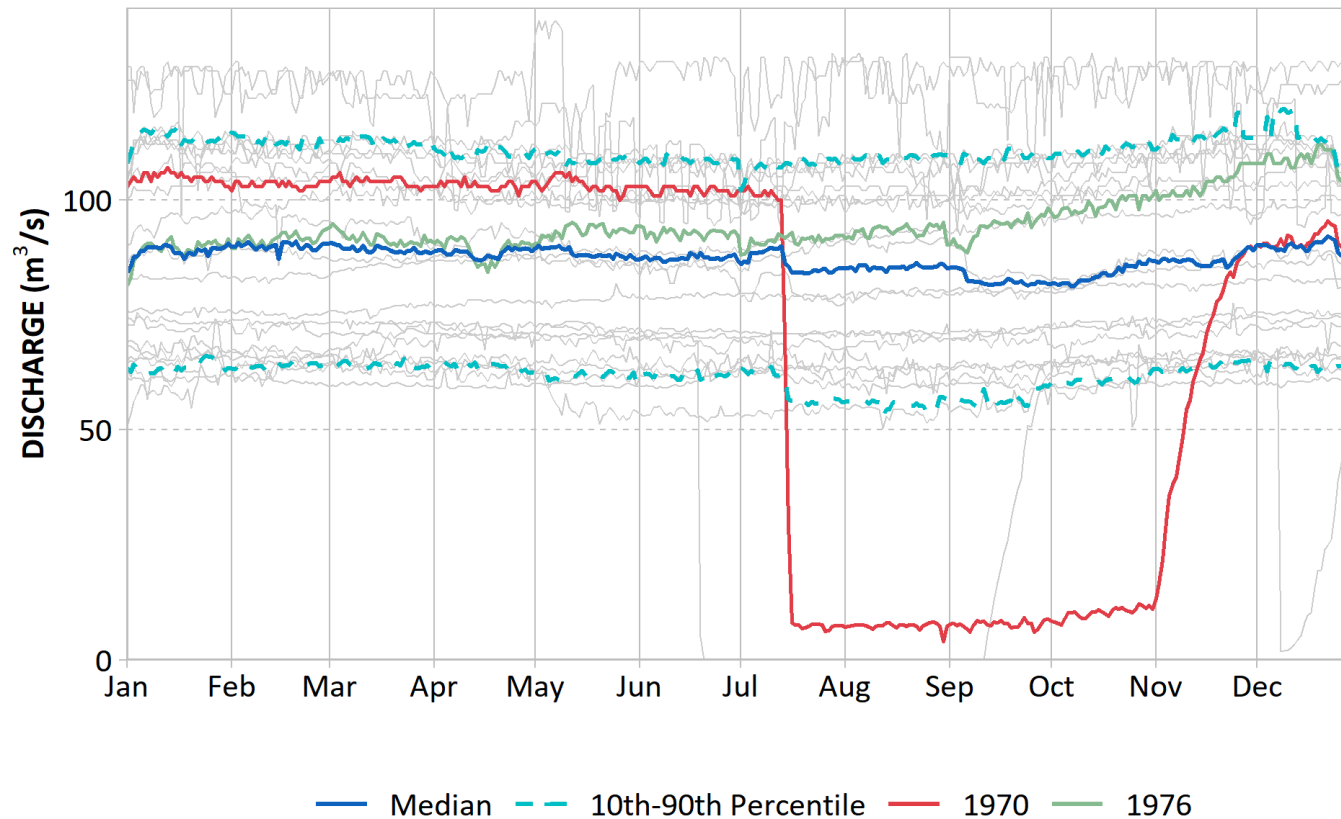
Objective: Maximize RT power generation

Interim PM – Average daily flow at Kemano Powerhouse



Kemano Powerhouse

Power Generation – Pre-1981

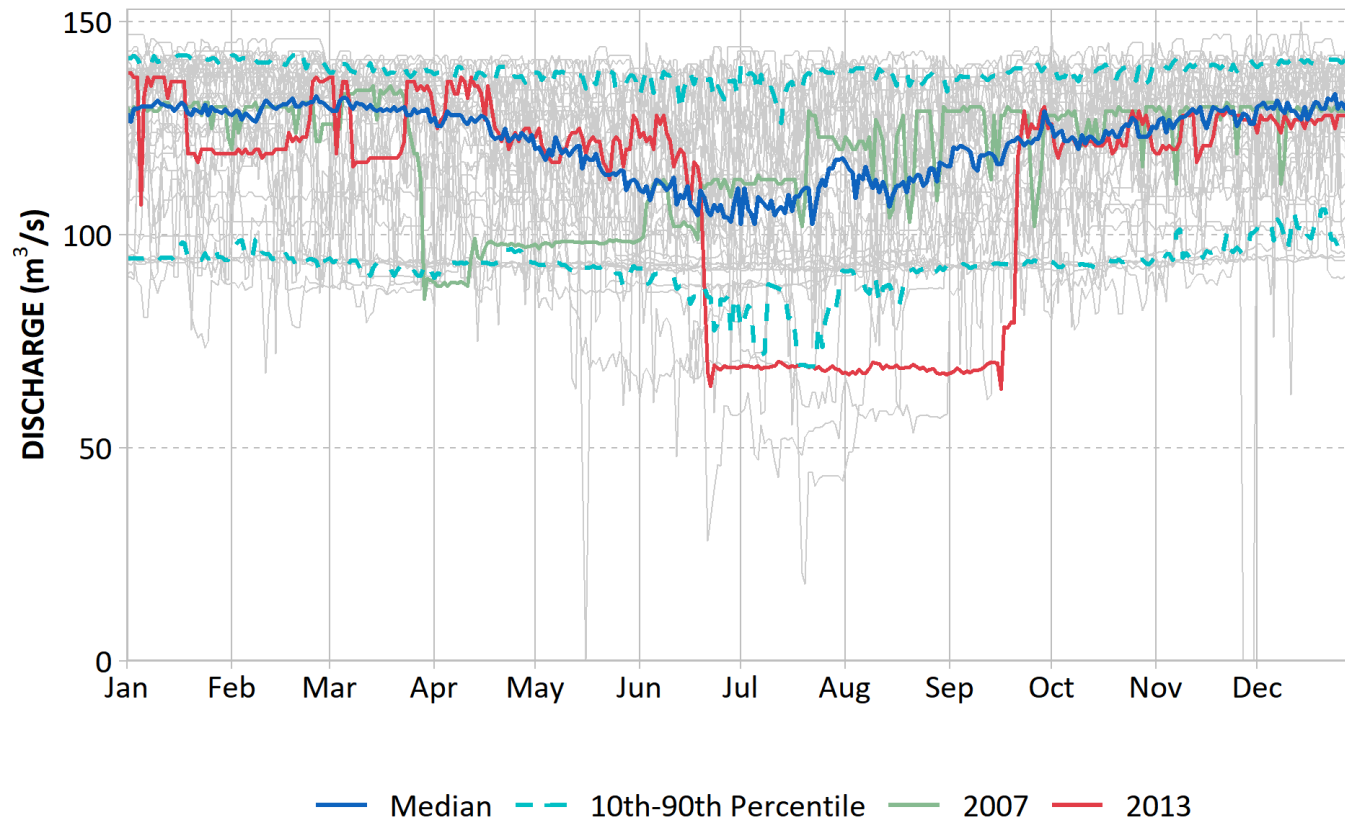


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Kemano Powerhouse

Power Generation – Post-1981

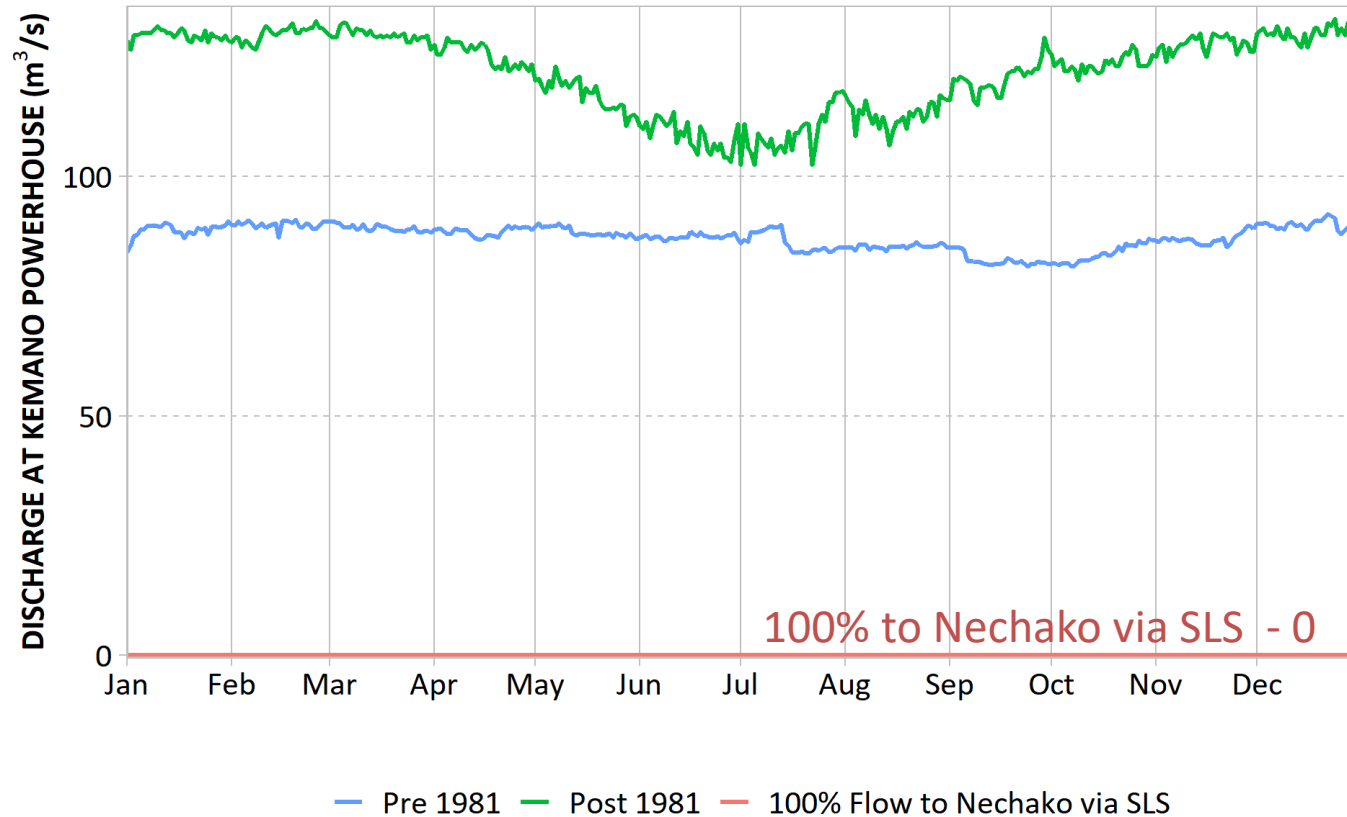


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Kemano Powerhouse

Power Generation – Comparison

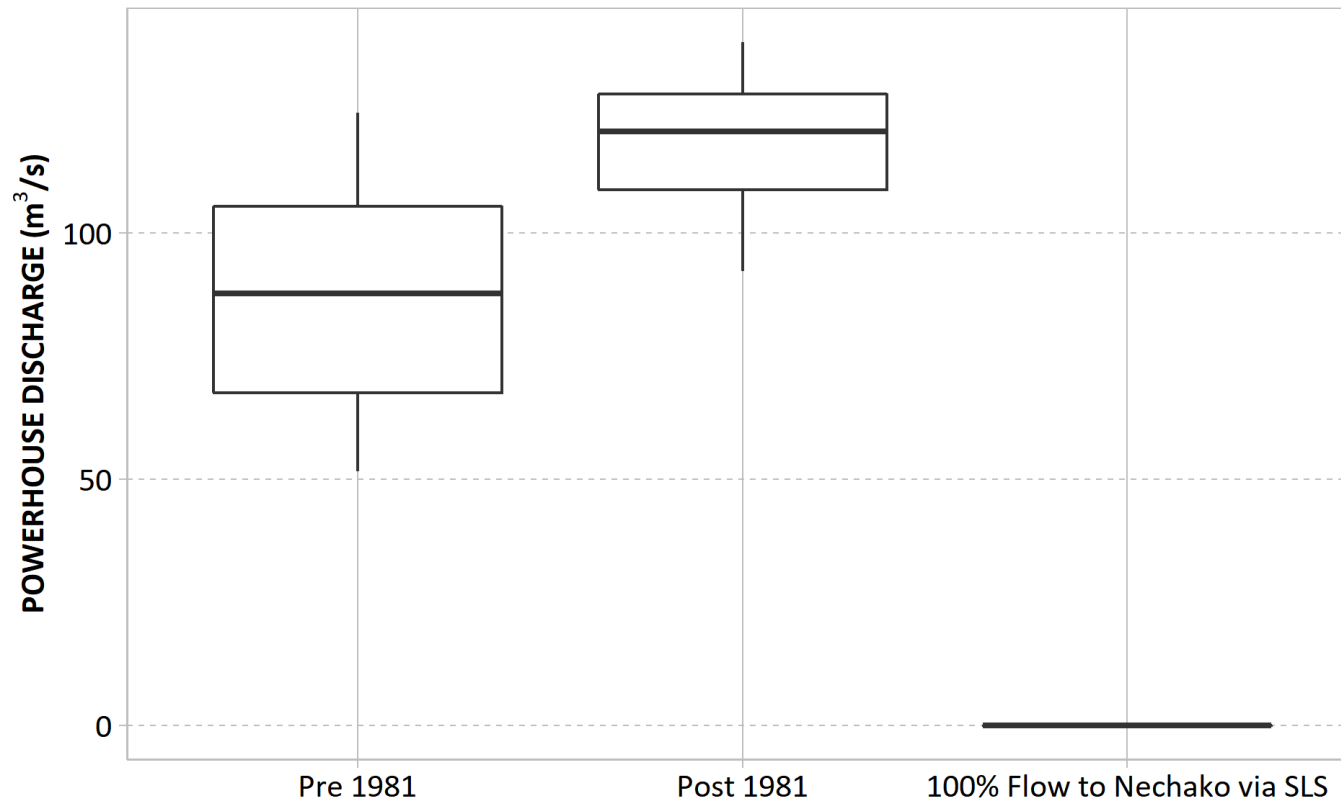


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Kemano Powerhouse

Power Generation



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Boat access - Average reservoir elevation	Mar 1 - Oct 31	Nechako Reservoir	m	High	851.7	851.7	???
Power Generation - Average daily flow	All	Kemano Powerhouse	m ³ /s	High	86.4	118	0.00

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Sample Consequences Table

Low inflow years

Performance Measure	Period	Location	Units	Preferred Direction	Scenario		
					Pre-1981	Post-1981	100% via SLS
Flooding - Number of days where flow exceeds 550 m ³ /s	All	Nechako at Vanderhoof	Days per year	Low	0	0	40
Flushing flows – number of days where flow exceeds 468 m ³ /s	All	Nechako at Vanderhoof	Days Per Year	High	0	0	54
Salmon - Average daily flow	Jul 1 - Sep 30	Nechako at Vanderhoof	m ³ /s	High	110	168	257
Caribou - Days where reservoir elevation is less than 852 m	May 1 - Jun 30	Nechako Reservoir	Days per year	Low	58	53	???
Boat access - Average reservoir elevation	Mar 1 - Oct 31	Nechako Reservoir	m	High	851.9	851.4	???
Power Generation - Average daily flow	All	Kemano Powerhouse	m ³ /s	High	71	111	0

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High inflow years

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Flushing flows – number of days where flow exceeds 468 m ³ /s	All	Nechako at Vanderhoof	Days Per Year	High	62.5	98	119
Salmon - Average daily flow	Jul 1 - Sep 30	Nechako at Vanderhoof	m ³ /s	High	300	476	637
Caribou - Days where reservoir elevation is less than 852 m	May 1 - Jun 30	Nechako Reservoir	Days per year	Low	53	27	???
Boat access - Average reservoir elevation	Mar 1 - Oct 31	Nechako Reservoir	m	High	852.0	852.5	???
Power Generation - Average daily flow	All	Kemano Powerhouse	m ³ /s	High	83	119	0

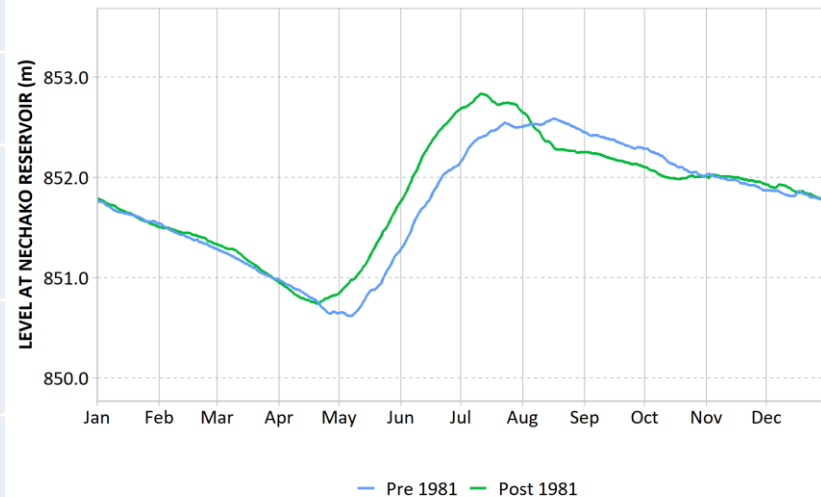
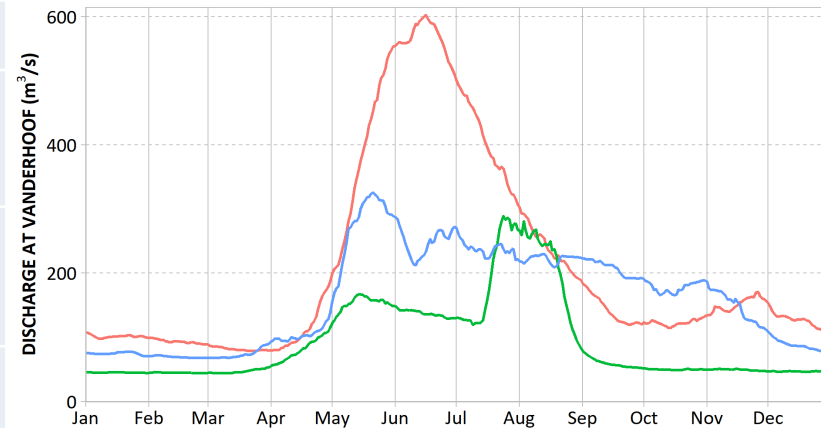
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Sample Consequences Table - Discussion

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Salmon - Average daily flow	Jul 1 - Sep 30	Nechako at Vanderhoof	m ³ /s	High	229	176	291
Caribou - Days where reservoir elevation is less than 852 m	May 1 - Jun 30	Nechako Reservoir	Days per year	Low	48.7	38.4	???
Boat access - Average reservoir elevation	Mar 1 - Oct 31	Nechako Reservoir	m	High	851.7	851.7	???
Power Generation - Average daily flow	All	Kemano Powerhouse	m ³ /s	High	86.4	118	0.00



— Pre 1981 — Post 1981

PM values calculated as average over all years of record
 Values presented use interim PMs, and are subject to change
 Flow scenarios are for demonstration purposes and not intended as a future operational regime