

Predicted Hydrology for 2019 Irrigation Season

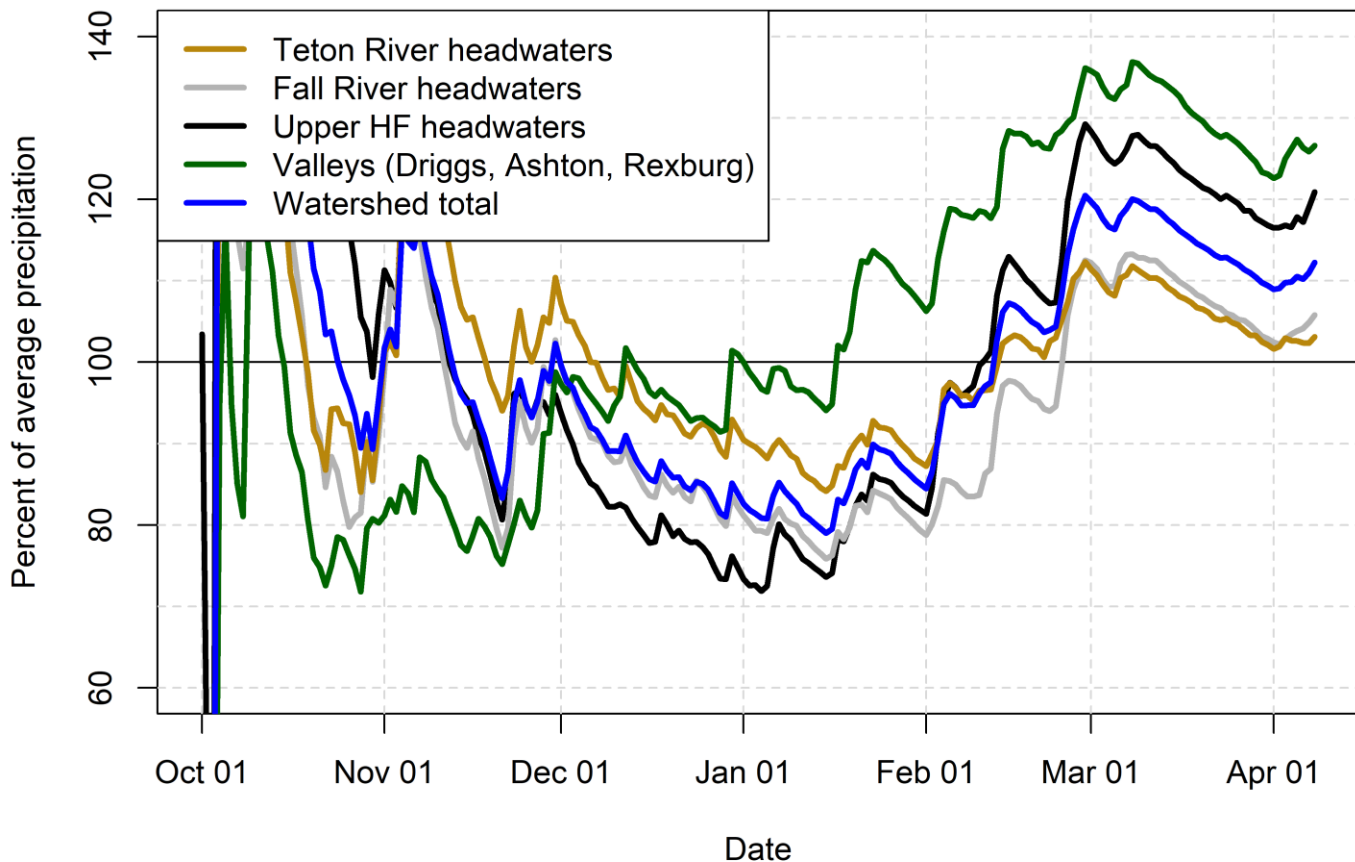


Henry's Fork Watershed Council, May 8, 2019

Outline

- Summary of current hydrologic conditions
- Predictive model objectives and description
- Predictions for 2019 irrigation season
- System constraints: Island Park Reservoir volume vs. streamflow at St. Anthony
- What we know about IP Reservoir and the fishery
- What we need to know next:
 - Ecology of upper HF/IP Reservoir system (Big Springs to IP Res.)
 - Hydrology-habitat relationships in lower HF (Below St. Anthony)

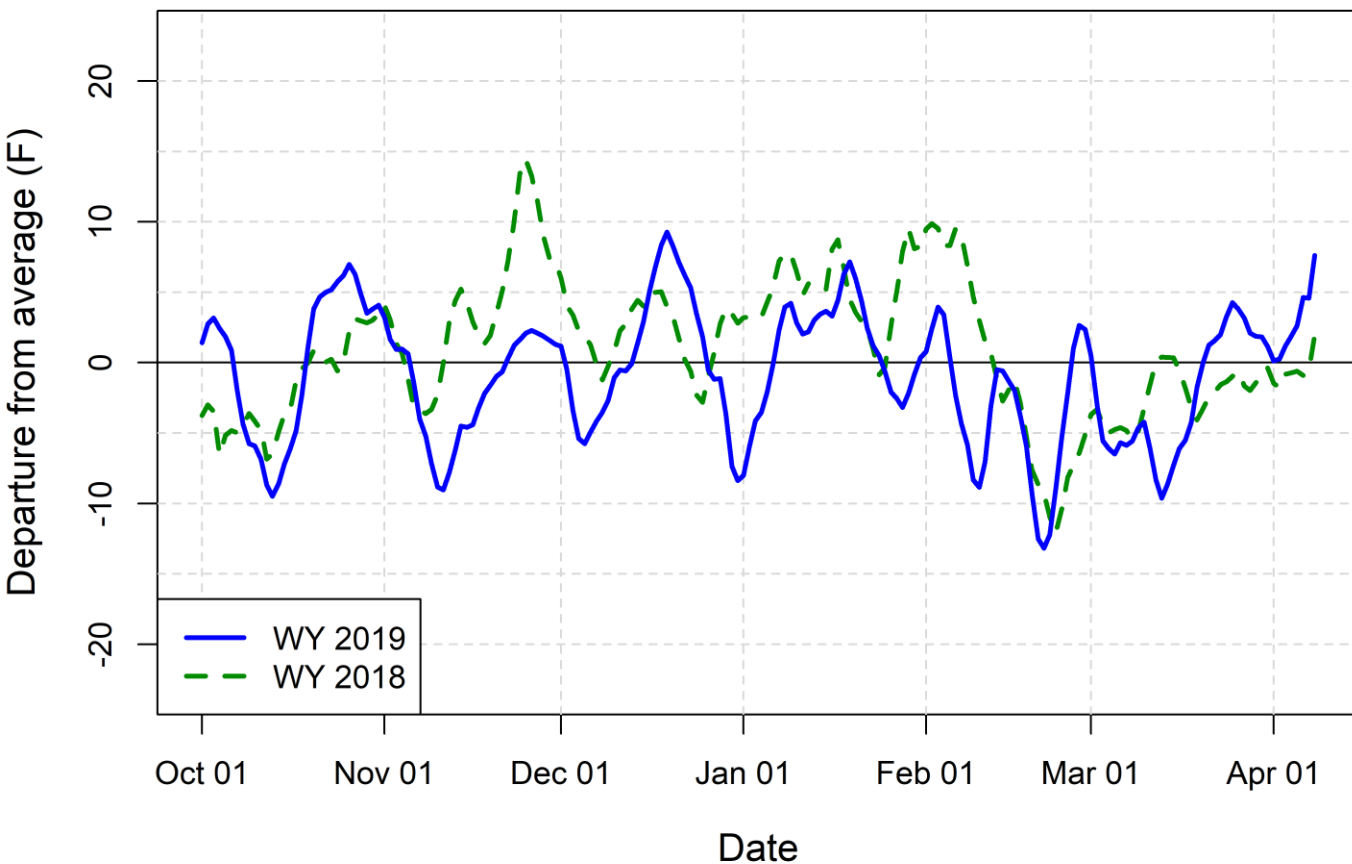
Henry's Fork Watershed Water-year Precipitation, Tue Apr 09 2019



February 2 – March 10 was extremely wet.

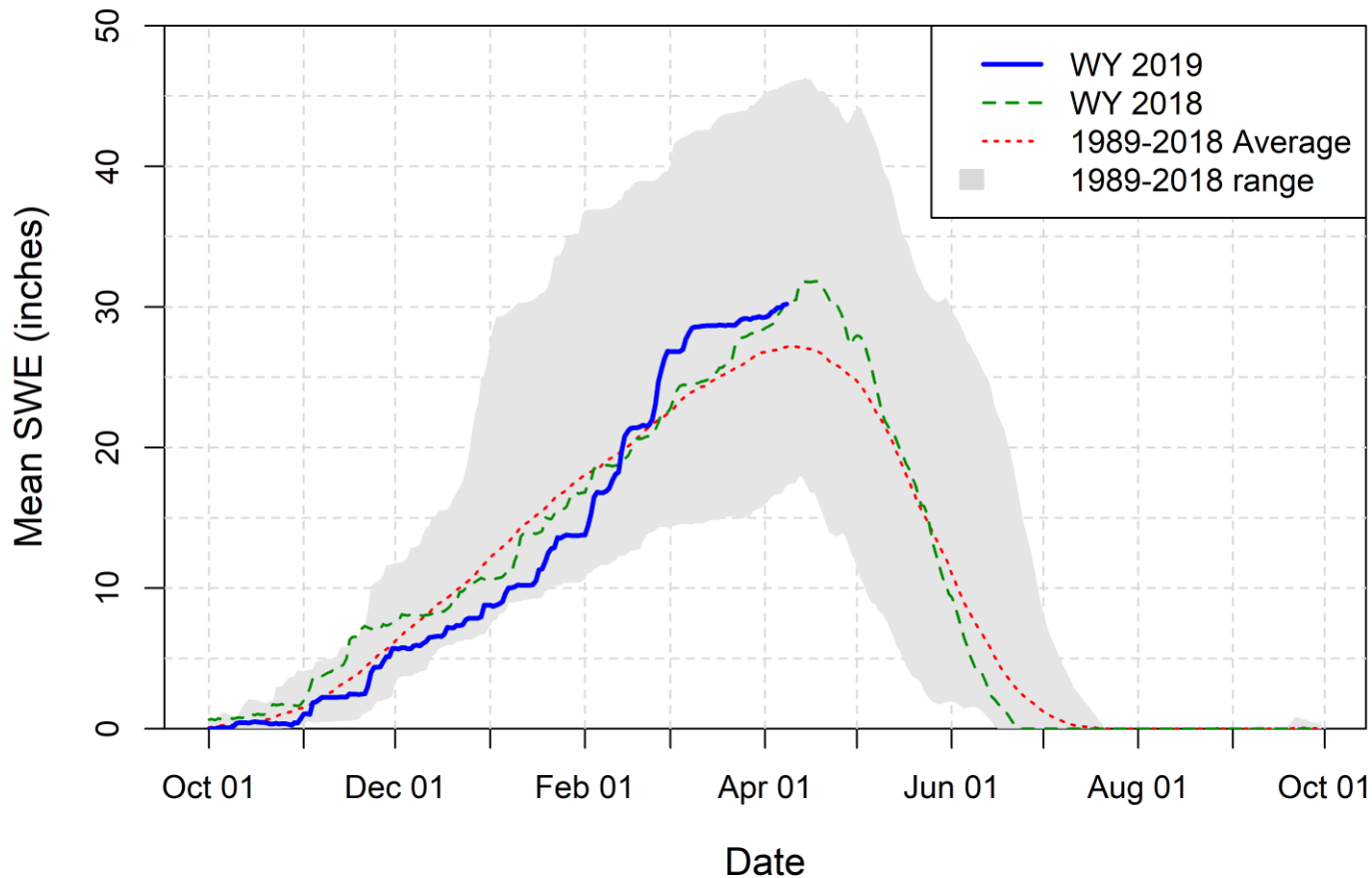
Note that valleys and upper HF headwaters are far above average; Fall River and Teton River are near average.

HF Watershed 7-day Temperature, Departure from 1989-2018 Average



Temperatures were below average from late January until late March.

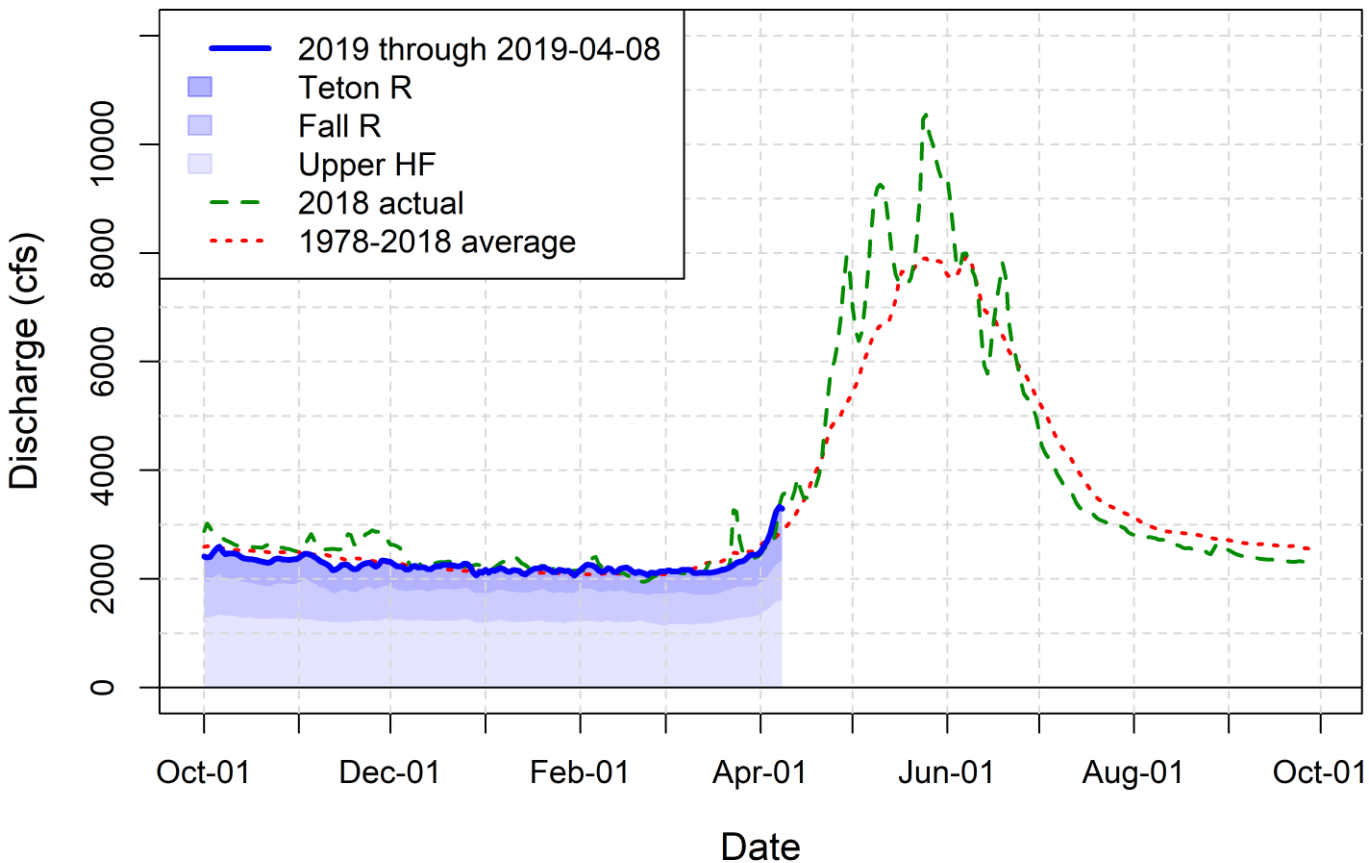
Henry's Fork Watershed Mean SWE Accumulation Apr 09 2019



Watershed SWE:

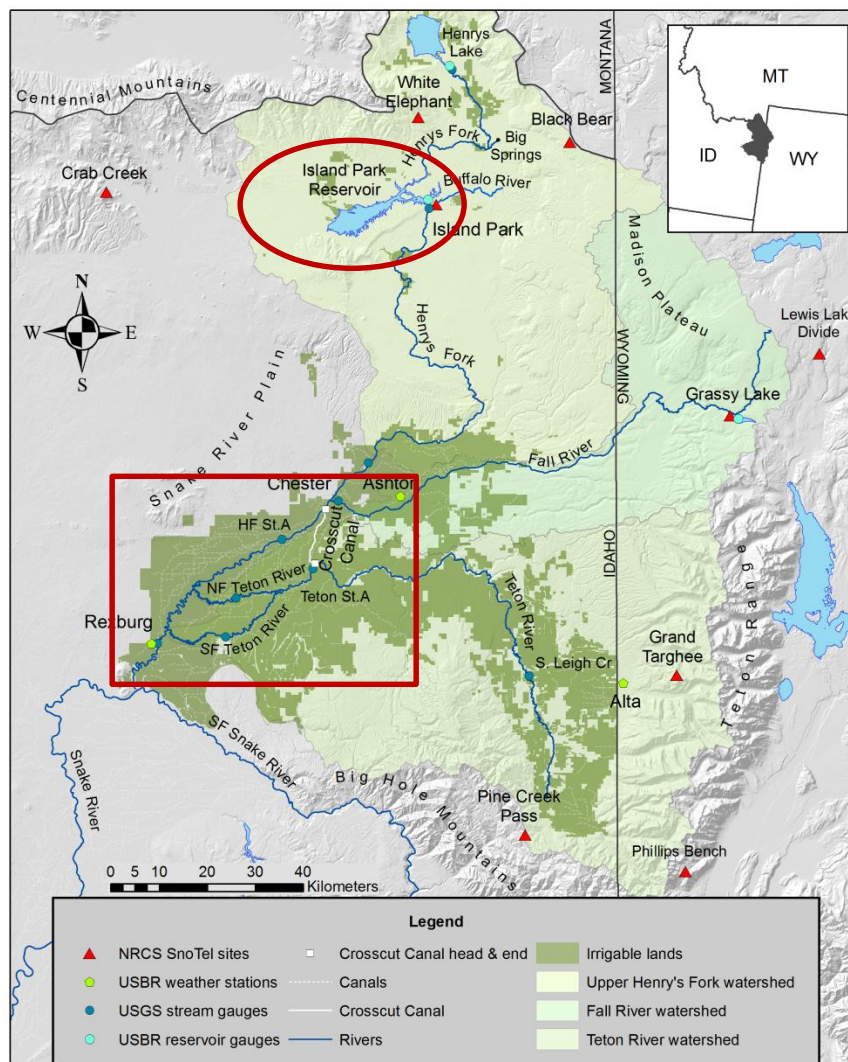
- Still accumulating
- Currently 111% of average

Henry's Fork Total Natural Flow (Water Supply)



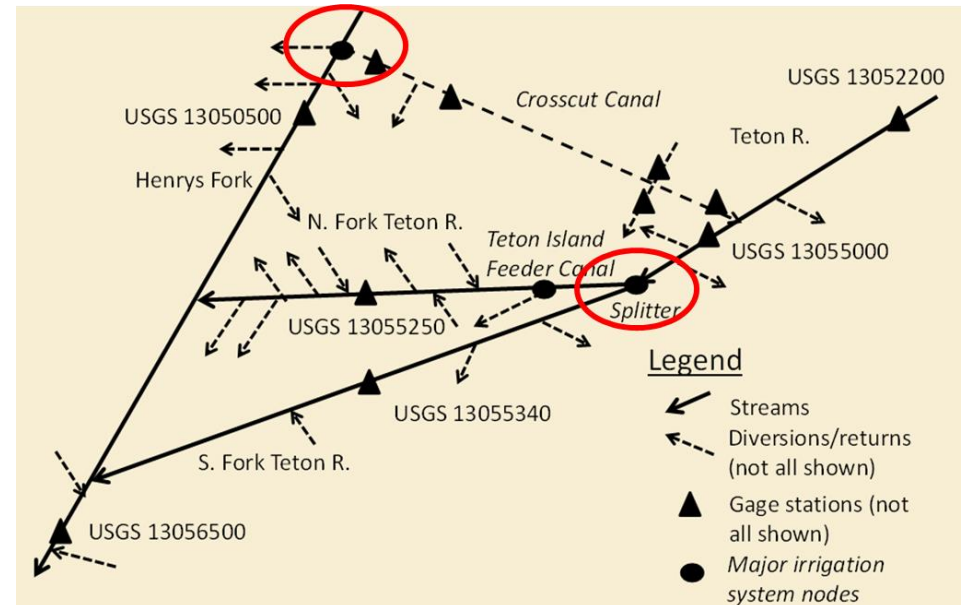
No early runoff
this year.

Streamflow
responded to
snowmelt only in
past few days.



Henry's Fork Irrigation System

- Island Park is primary storage reservoir
- Most need for storage water is delivery to Teton River through Crosscut Canal
- Streamflow in HF at St. Anthony (downstream of Crosscut) is used to determine need for IP storage delivery.



April-September Streamflow and Reservoir Simulation

Objectives:

- Simulate irrigation season hydrology, based on April 1 conditions.
- Predict September 30 content of Island Park Reservoir.
- Quantify relationship between Island Park Reservoir content and streamflow at St. Anthony.

At daily time scale, model tracks:

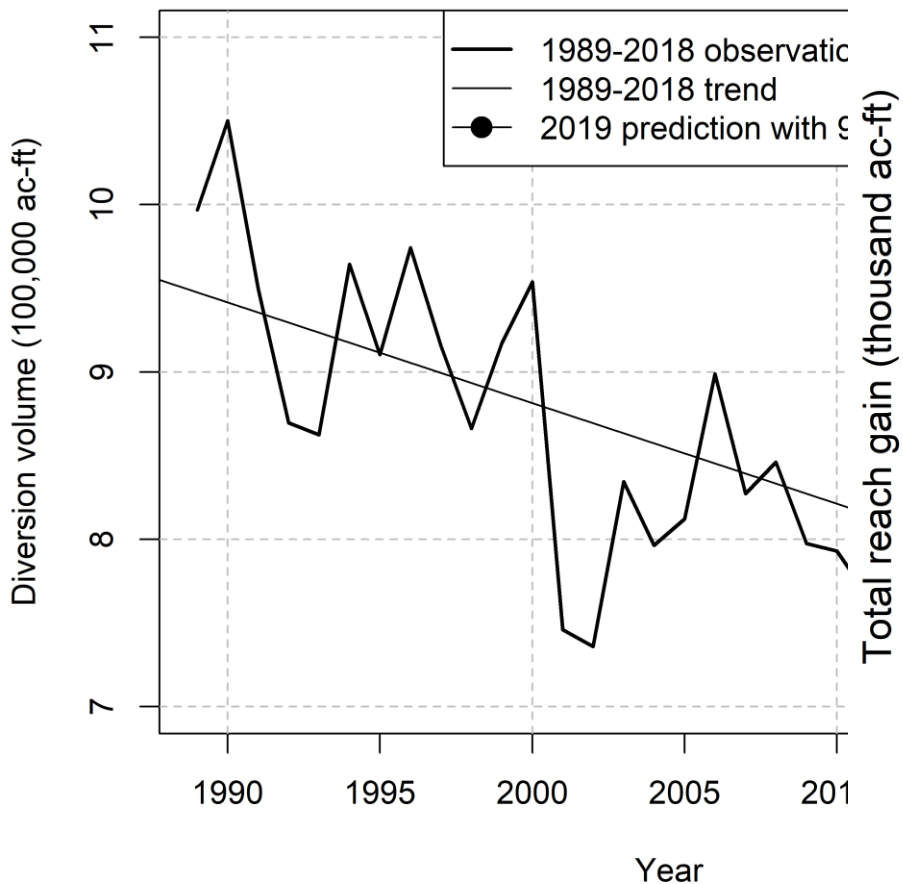
- Natural streamflow (upper HF, Fall River, Teton River)
- Irrigation diversion
- Lower-watershed reach gains/losses
- Reservoir storage/delivery
- Resulting regulated streamflow

April-September Streamflow and Reservoir Simulation

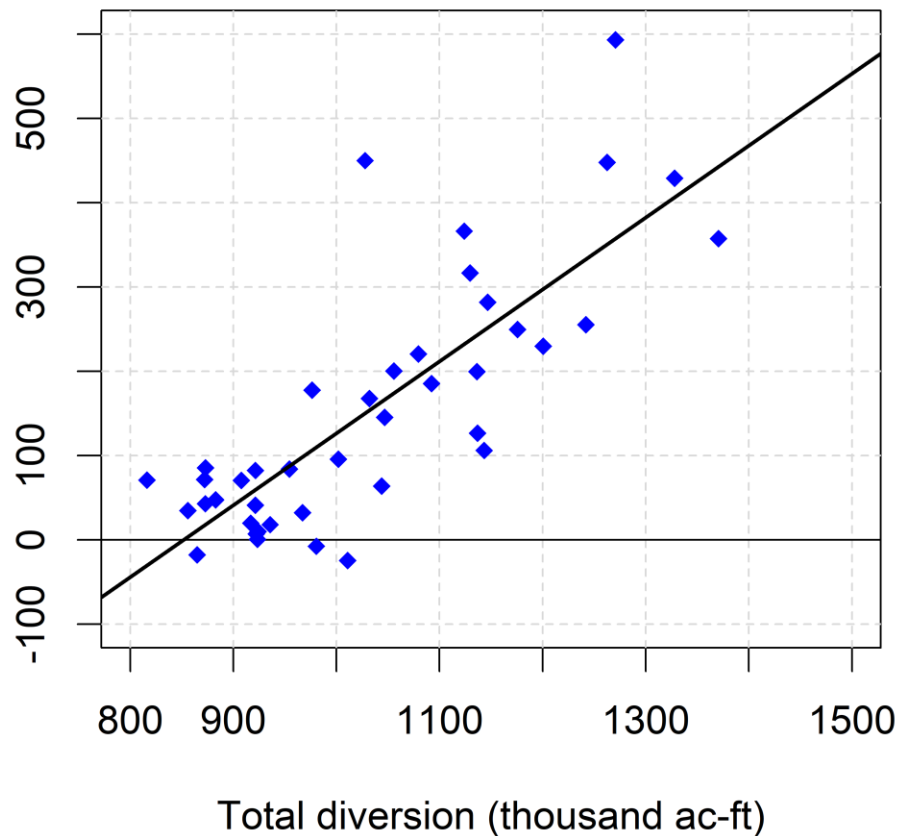
Probability distributions predicted by statistical models:

- Natural streamflow volume (predicted from winter flow and April-1 SWE)
 - Streamflow timing (predicted from Apr-Jun temperature and April-1 SWE)
 - April-June watershed-averaged temperature (predicted from 30-year trend)
 - Correlation in volume and timing among subwatersheds
 - Diversion (predicted from trend and April-1 SWE)
 - Reach gains (predicted from trend; correlated with diversion)
 - “Analog year” hydrographs selected based on probabilities.
-
- 5,000 simulations are performed with different randomly selected values of the above components.
 - Mean of the 5,000 simulations is the expected (“predicted”) value.

April-September Diversion



Lower HF Reach Gain vs. Diversion



Operational assumptions

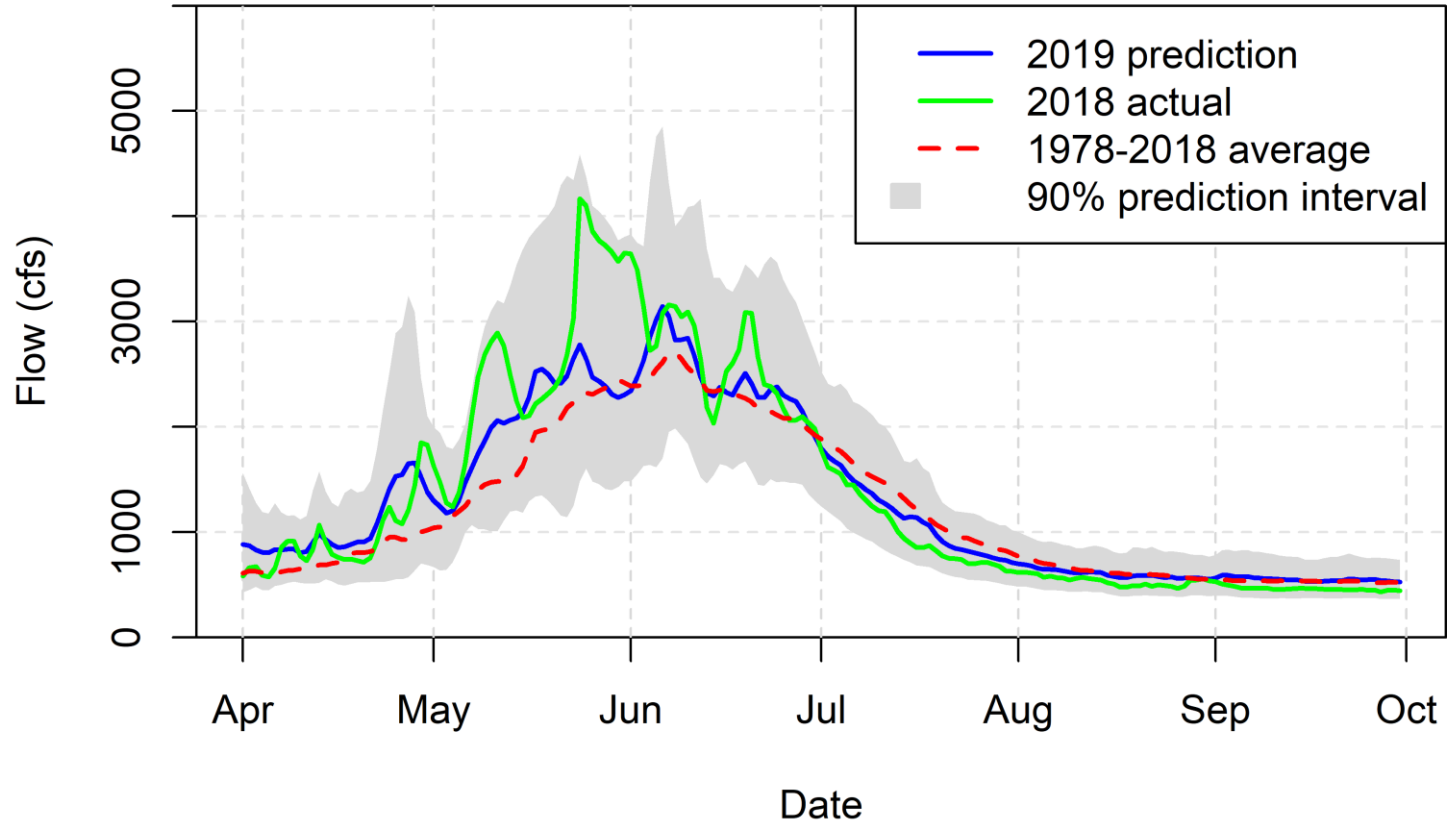
- Fill reservoirs (Henry's, Island Park, Grassy) as soon as possible
- After fill but before delivery needed, reservoir outflow = inflow
- After that, Henry's Lake outflow = 70 cfs
- Set flow target in HF at St. Anthony
- Set Crosscut Canal delivery to 0 except when Teton natural flow does not meet demand (adjust for reach gains/losses in canal and river)
- On first day storage is needed (or July 15, whichever is later), set Grassy Lake outflow to 50 cfs
- Deliver 3,000 ac-ft from Grassy Lake (30 days at 50 cfs)
- Last, set IP outflow to keep flow at St. Anthony no lower than target

Results

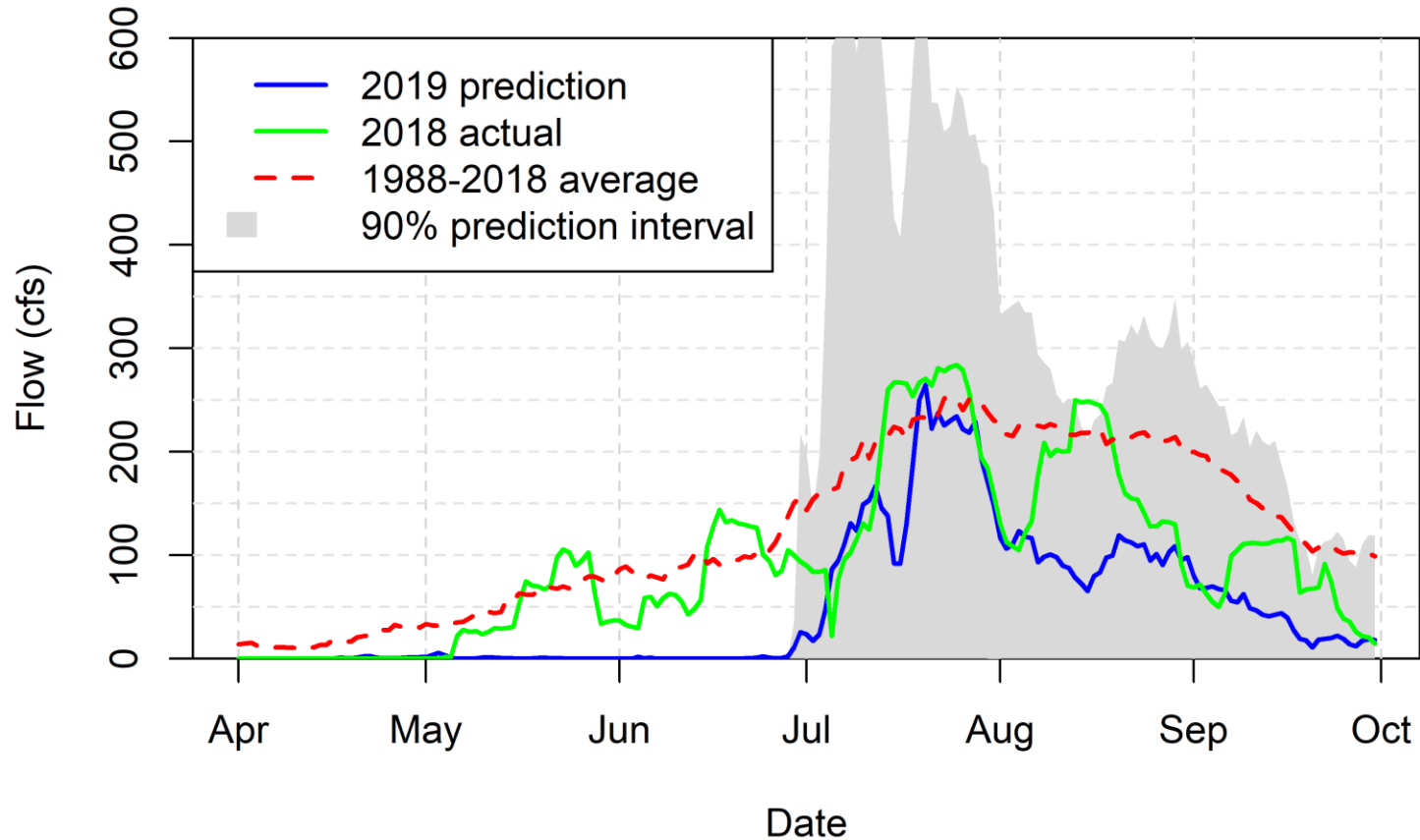
Subwatershed	Predictors (% of ave.)		Mean April 1 – September 30 natural flow					
			2019 prediction		90% exceedance		2018 observed	
	Baseflow	SWE	cfs	% of ave.	cfs	% of ave.	cfs	% of ave.
Upper Henry's Fork	95%	116%	2026	105%	1766	91%	1787	93%
Fall River	103%	102%	1446	103%	1181	84%	1518	108%
Teton River	94%	112%	1319	108%	1025	84%	1371	113%
WATERSHED TOTAL			4,791	105%	3,982	87%	4,676	104%

- Predicted natural flow is just a little above average, and about like last year.
- BUT, a much greater percentage of natural flow will come from upper Henry's Fork, and less from Fall River and Teton River.

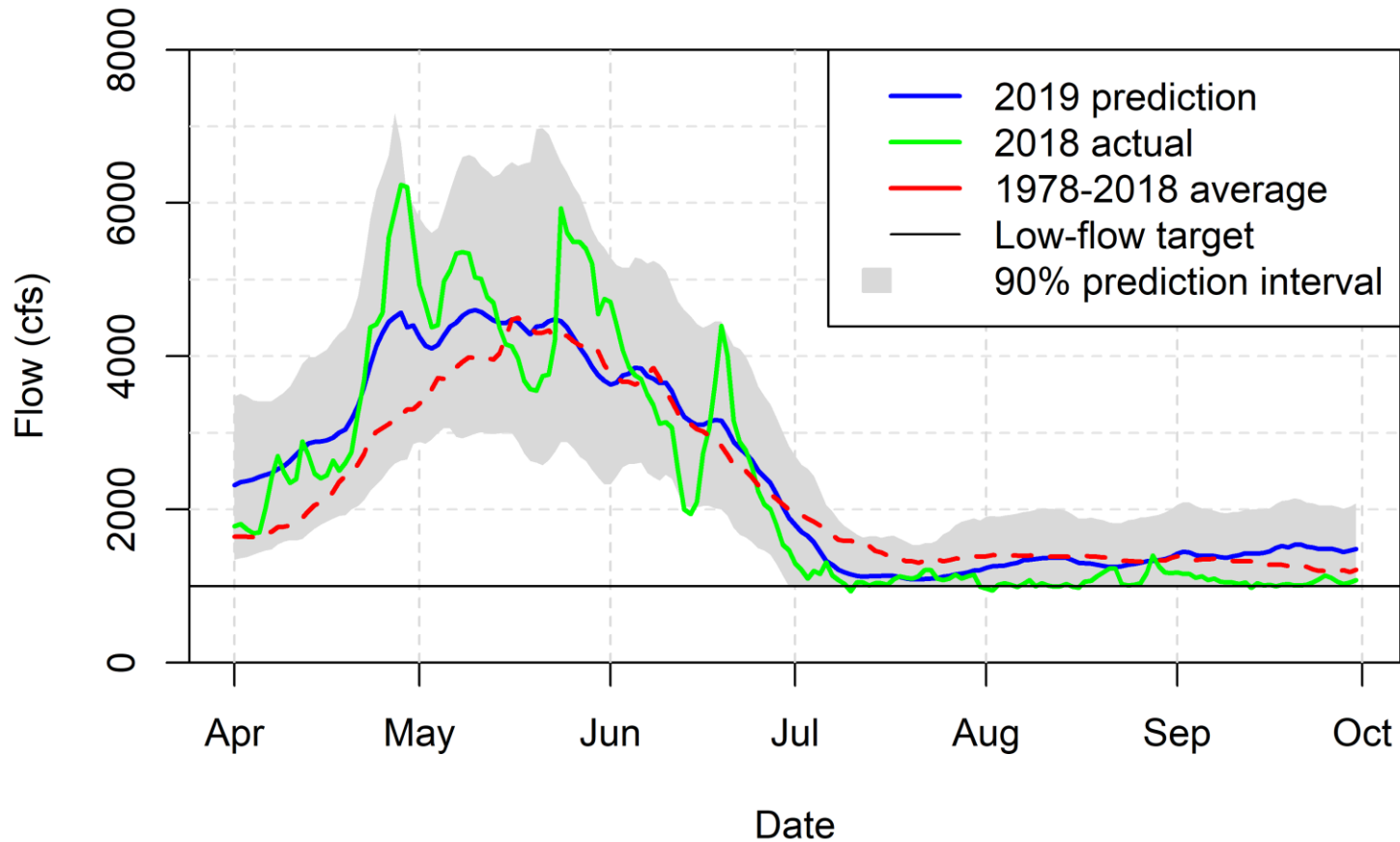
Streamflow in Teton R. above Crosscut Canal



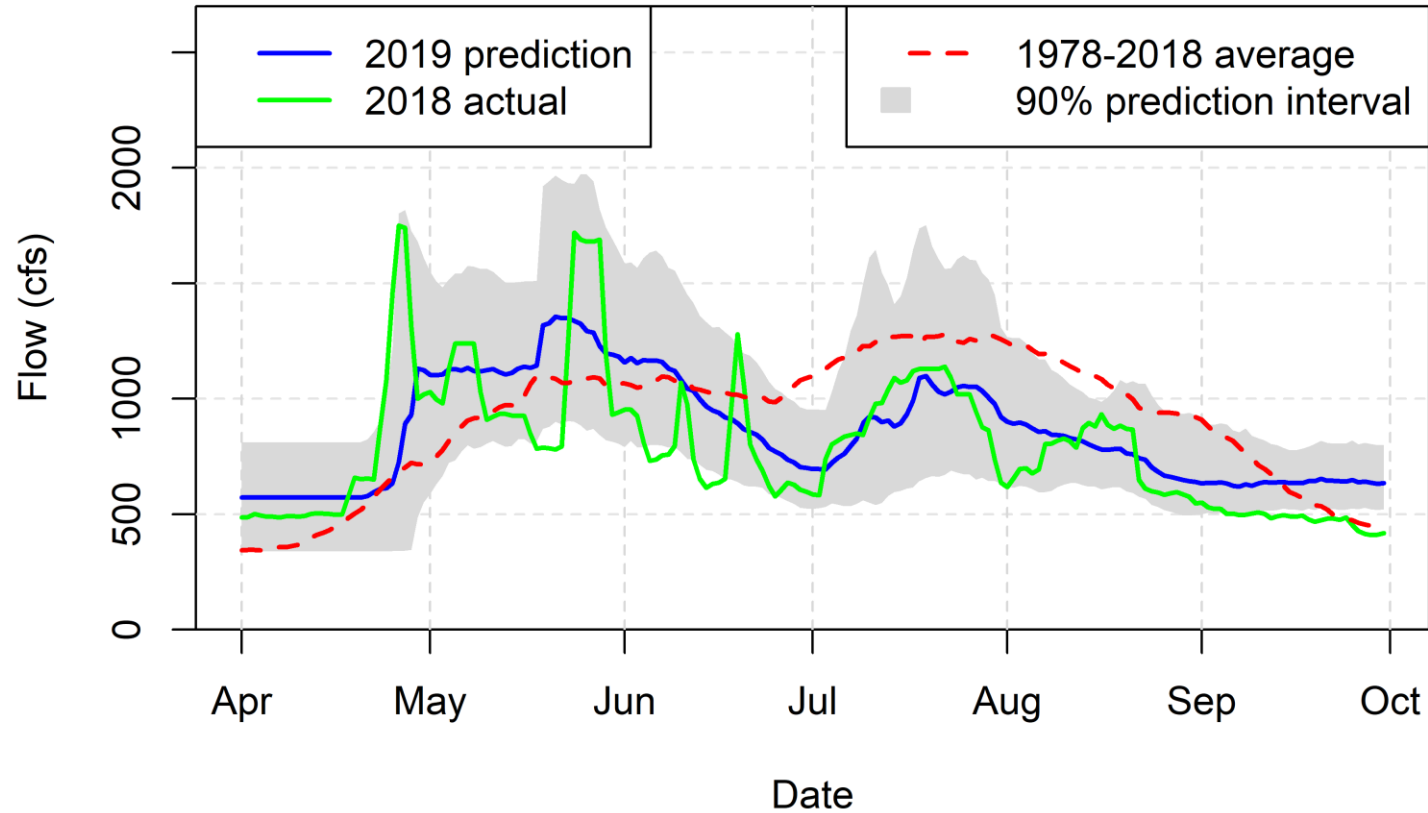
Delivery in Crosscut Canal to Teton R.



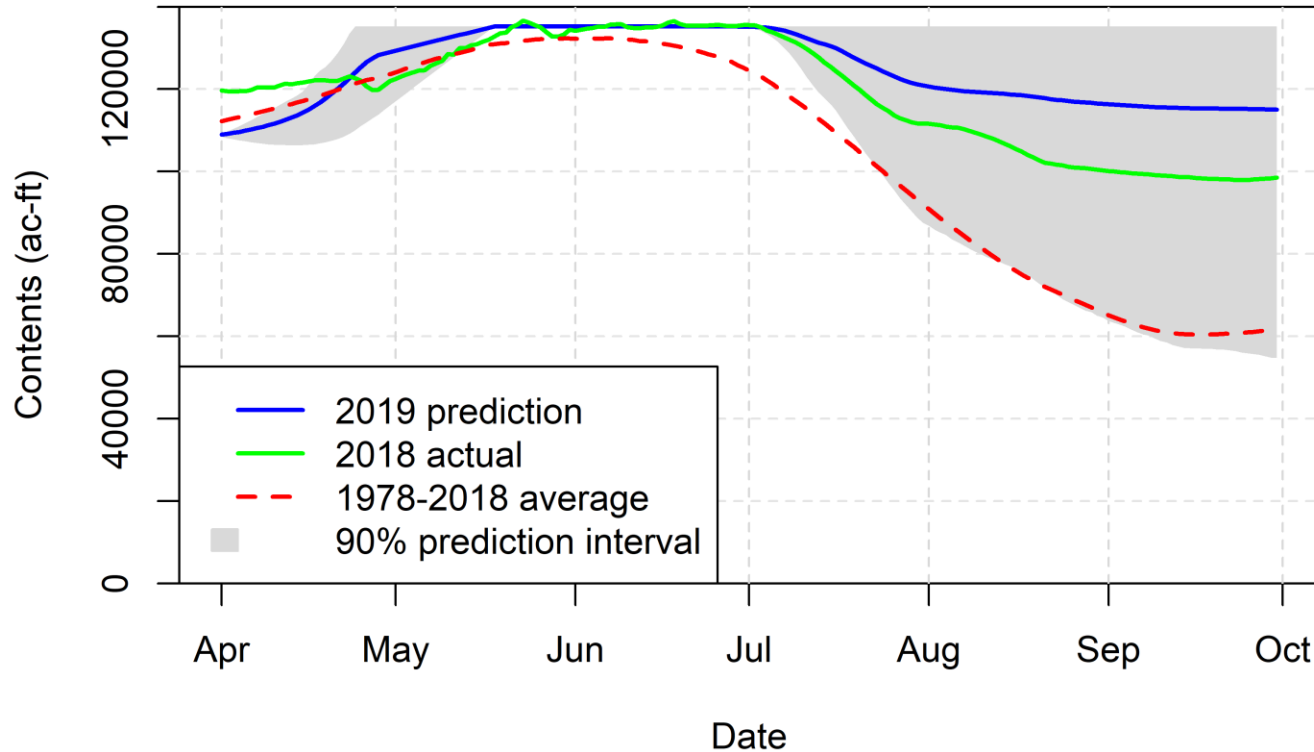
Streamflow in Henry's Fork at St. Anthony



Streamflow in Henry's Fork at Island Park



Island Park Reservoir Contents

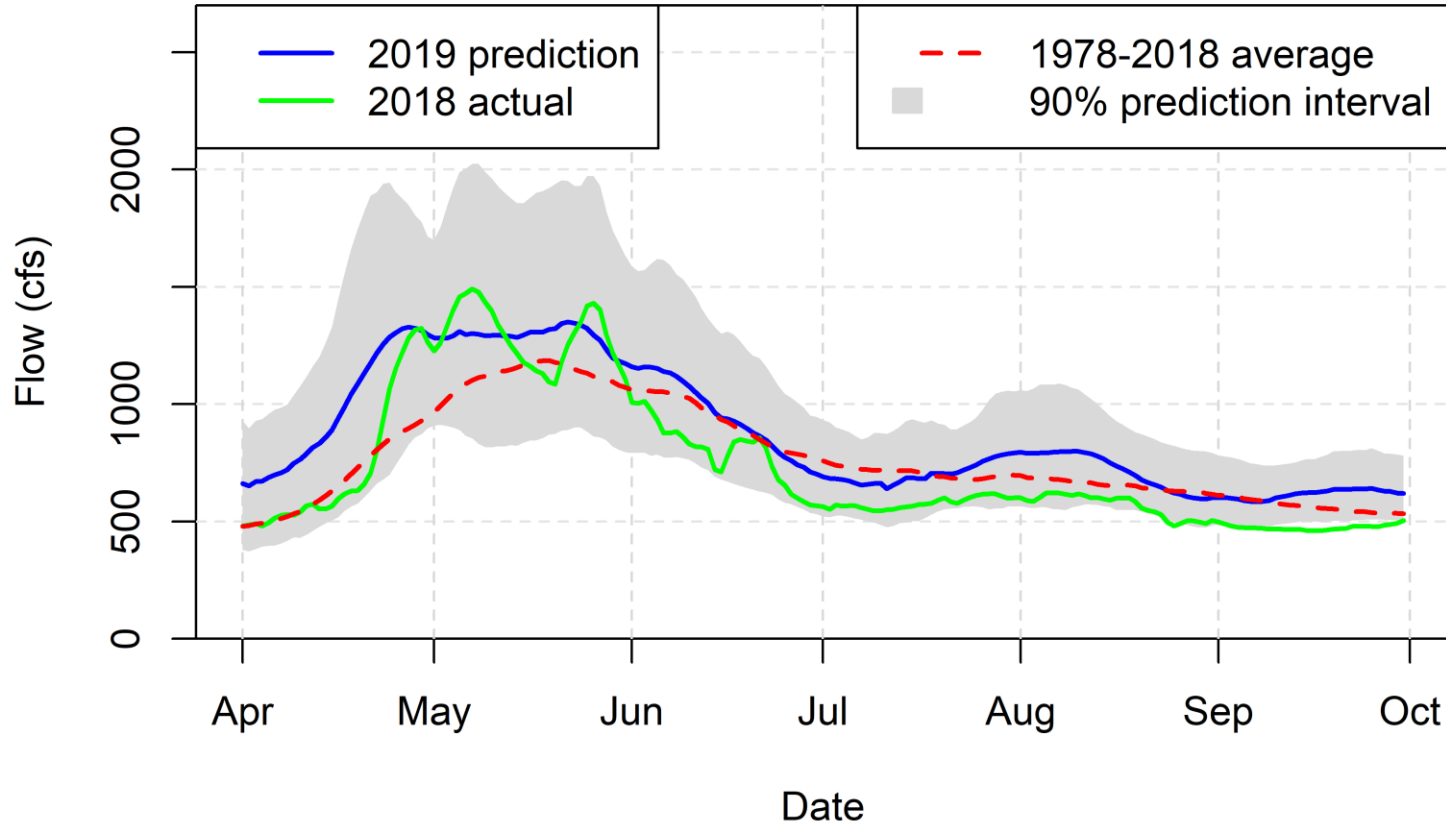


If IP outflow is about like last year, why is expected September 30 reservoir volume higher than last year?

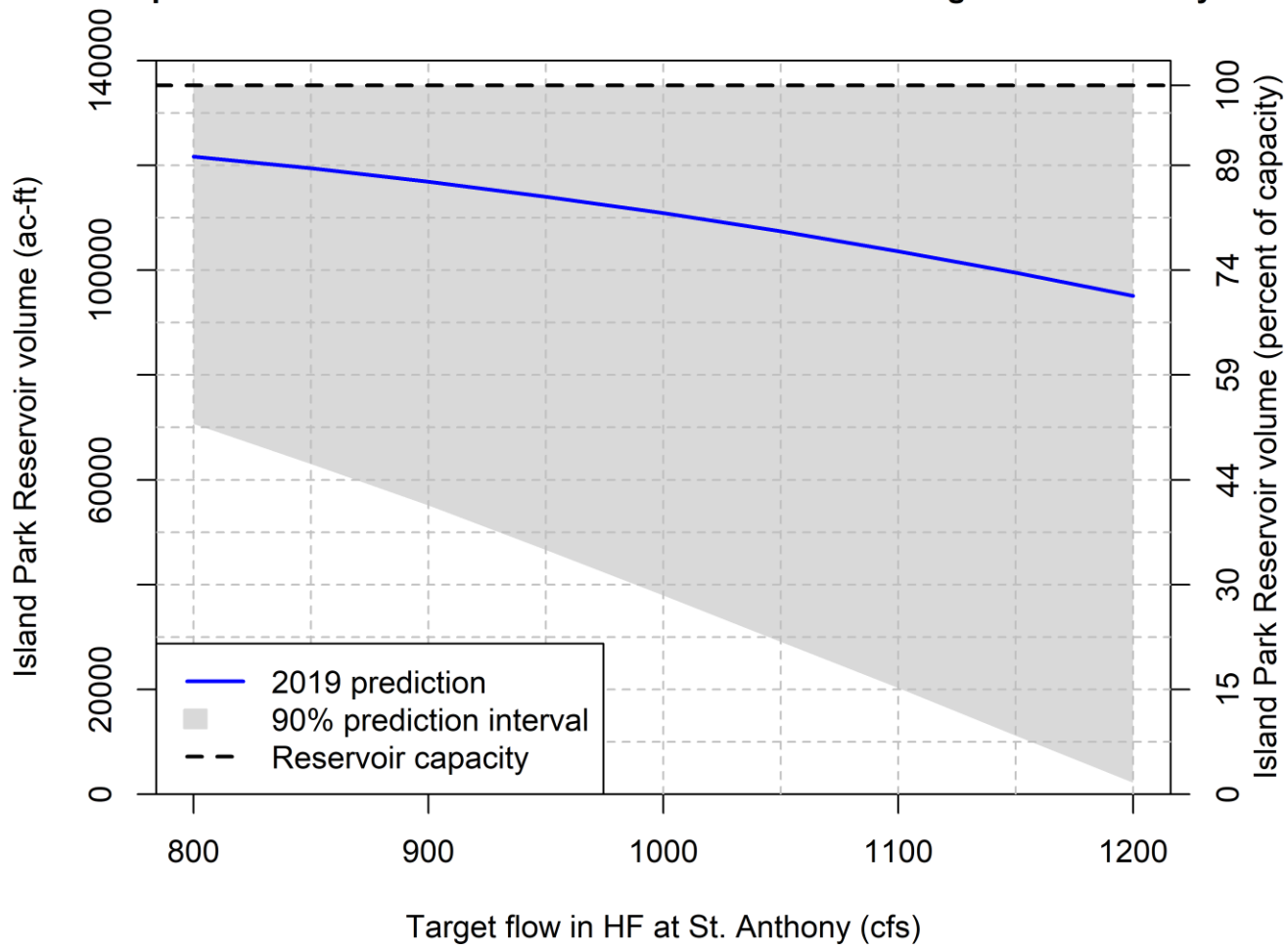
Crosscut need = St. Anthony low-flow = IP delivery = July 1

Inflow is much higher!

Inflow to Island Park Reservoir



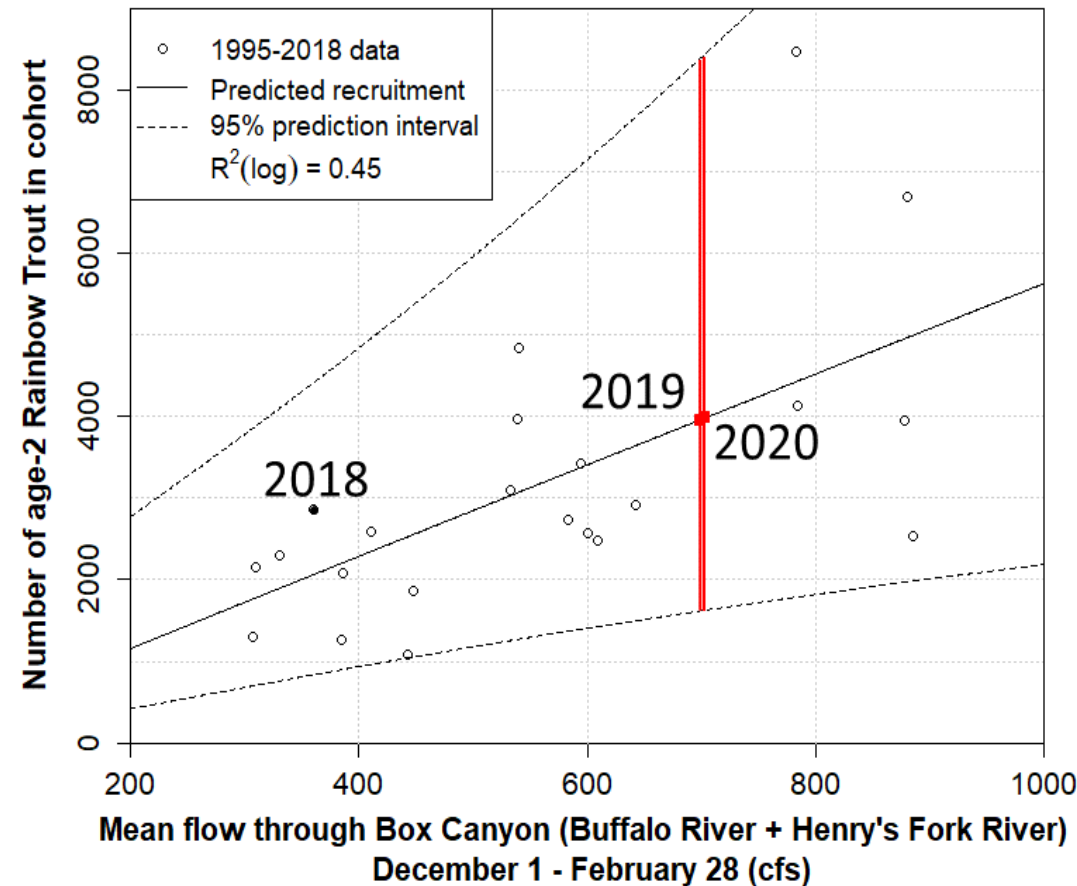
Sept. 30 IP Reservoir Volume vs. Summer-time Flow Target at St. Anthony



Summary of Model Predictions

- Natural flow in all subwatersheds 103-108% of average.
- 42% of natural flow will come from upper HF vs. 38% in 2019.
- Teton River, Fall River, Crosscut delivery, and lower HF flow all about the same as in 2018.
- Island Park storage delivery will start around average timing: July 1-3.
- Delivery will be modest: 800-1200 cfs, much like 2018.
- BUT, much higher inflow will keep reservoir higher all summer, ending up at around 110,000 ac-ft (81% full) vs. 72% full in 2018.

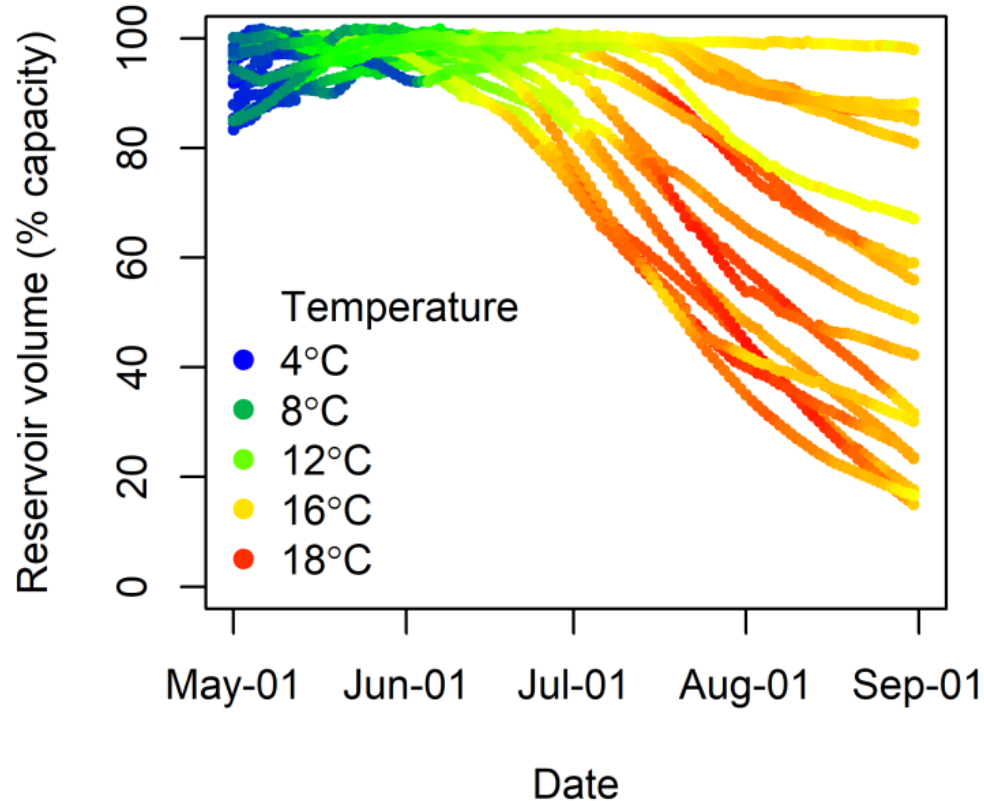
What we know about Island Park Reservoir and fishery:



Higher reservoir carryover = less to store in winter = higher winter outflow = higher trout recruitment downstream of dam (Box Canyon, Harriman State Park, etc.)

Until 2016, this was ALL WE KNEW!

What we know about Island Park Reservoir and fishery:



Higher reservoir volume during summer = lower water temperature.

Other things we have learned:

Excessive drawdown of reservoir:

INCREASES

- Algae and cyanobacteria in reservoir
- Suspended sediment delivery
- Turbidity

DECREASES

- Trout and kokanee habitat in reservoir
- Quality of angling experience in river



What next?

Excessive drawdown of reservoir:

INCREASES

- Algae and cyanobacteria in reservoir
- Suspended sediment delivery
- Turbidity

DECREASES

- Trout and kokanee habitat in reservoir
- Quality of angling experience in river

Algae and cyanobacteria in reservoir depend on nutrient influx from upstream; fishery upstream depends on reservoir habitat. HOW?



What next?

- We know we can keep more water in IP by lowering flow at St. Anthony. But at what cost to fishery there? What is optimal St. Anthony flow target?
- HFF is linking IP Reservoir management to fisheries at top and bottom of watershed through a four-year, \$300,000+ project at Utah State University.



Upper River component: Jack McLaren



Lower River component: Christina Morrisett