

P5. Stage-Flow Relationship and Seasonal Fluctuations in Flow of the Lower Bear River

Abstract

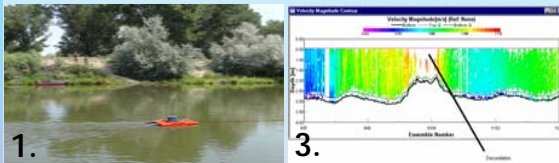
Through the Bear River Fellows program, we collected river stage, flow, and water pressure measurements at three different sites within the Lower Bear River Basin between the Idaho-Utah Stateline and Cutler Reservoir on two separate occasions in August 13-16, 2013 and November 16, 2013. Our objective with each trip was to extend the analysis from the previous year (2012) and fill out the relationship between stage and flow at each site, as well as see how the pressure, temperature, and flow changed over time. Using this data, we developed a stage-flow relationship for each site which we found was positive and linear. We used the pressure transducer data to calculate a time-series of water stage and then used the developed stage-flow relationship to convert the calculated stage into a time-series of flow at each location. With the additional sites located south of the Idaho-Utah Stateline USGS monitoring site (#10092700) is located, we were able to more accurately locate where water was lost/gained within the Lower Bear River. This stage-flow relationship and time-series of flows derived from pressure transducer readings provide details into how mass is balanced within the Lower Bear River basin. This balance includes effects of human and natural inputs/outputs as well as changing weather patterns on the flow.

Objectives

After canoeing the Bear River for four days in August, 2013, we wanted to use our Bear River Fellowship to learn:

- How will our stage and flow measurements change over time?
- How does seasonality affect Bear River flow?

Methods



1. Measured flows using an Acoustic Doppler Current Profiler.
2. Measured pressures using a pressure transducer at each site.
3. Processed flow data using WinRiver 2 Software.
4. Constructed a stream rating curve in Excel for each site.
5. Processed pressure data from transducer using HOB0ware.
6. Obtained air pressure data from MesoWest Weather Database to calculate river stage.

Site Locations

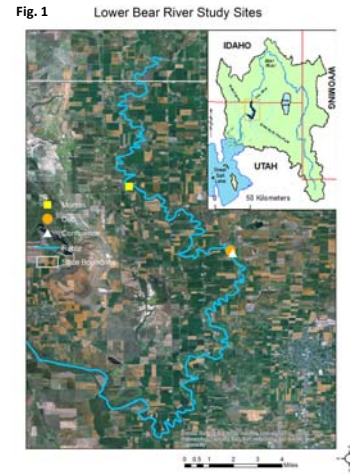
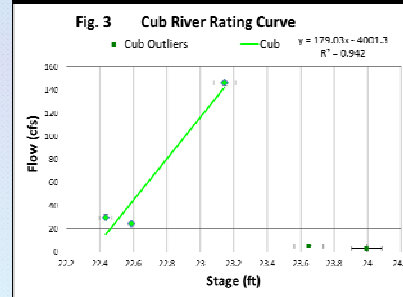
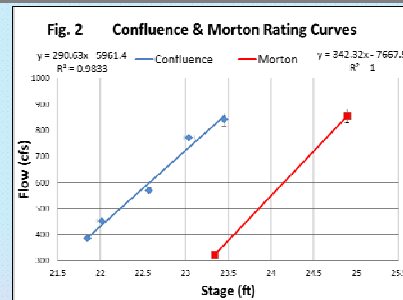


Fig 1: A map of the route taken along the Lower Bear River (blue) and each of our site locations.

Stream Rating Curves



Figs 2 & 3: Stream rating curves representing the stage-flow relationships.

Hydrograph

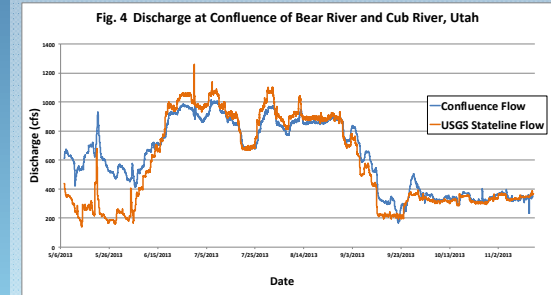


Fig 4: A hydrograph of seasonal changes in flow for measurements at the Confluence and the Stateline USGS gage.

Discussion

- The hydrograph shows seasonal changes in flow at the Confluence site (Fig. 4).
- Flow at the Confluence peaked on July 6th, 2013 at 1,013 cfs during spring runoff (Fig. 4).
- When Confluence flows were high, there was a significant backflow at the Cub River site. (Two red, outlying data points on the stream rating curve in Fig. 3)
- In May, flow at the upstream Stateline gage is much less than at the downstream Confluence sites, indicating more inputs than outputs.
- During summer months, flow at the Stateline is greater than at the Confluence, indicating a withdrawal of water in the system.
- Overall, the flow at the Stateline closely resembles the flow at the Confluence, suggesting few outputs from the river.

Next Steps

- Add more data points to the stream rating curves, especially for the Morton and Cub River sites.
- Extend the stream rating curves to include lower and higher flow measurements.
- Create hydrographs for the Morton and Cub River sites.
- Further analyze the mass balance of human inputs/outputs between the Stateline and Confluence site.

Conclusions

- We found positive, linear relationships between stage and flow at each site.
- There is a significant seasonal influence on the flows at each of our sites.
- In the spring, the river had more inputs than outputs; in the summer, the river had more outputs than inputs.