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Evaluation of a Surface Spill Operation to Return Adult Steelhead Overshoots Downstream of McNary Dam

January 10, 2022

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U.S. DEPARTMENT OF ENERGY BATTELLE

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Adult Steelhead Overshoots Must Return Downstream of McNary Dam to Spawn

- ~50% of John Day and Umatilla river steelhead overshoot those streams and pass upstream of McNary Dam (MCN)
- Fallback downstream past MCN is required to return to spawning grounds
- Telemetry studies in 2013 and 2014 found surface routes, such as the MCN TSW, to be attractive downstream routes with high survival rates for steelhead kelts
- Would limited TSW operations outside the typical spill season prove to be an effective downstream passage route for overshoots?
- An initial hydroacoustic study was conducted in Fall 2019 and Spring 2020.
- The current study covers Fall 2020 and Spring 2021

Objectives

- Estimate the effect of the timing of TSW spill treatments (12 hours of spill per week) on overshoot steelhead downstream passage at McNary Dam.
  a) Determine the influence of the timing of spill through the surface weir relative to total dam passage (guided and unguided) when spill is off.
  b) Estimate daily, weekly, seasonal, and diel timing and passage distributions.
  c) Correlate passage events to potential influential environmental and biological variables (such as river temperature and discharge) to the extent possible.

Study Design

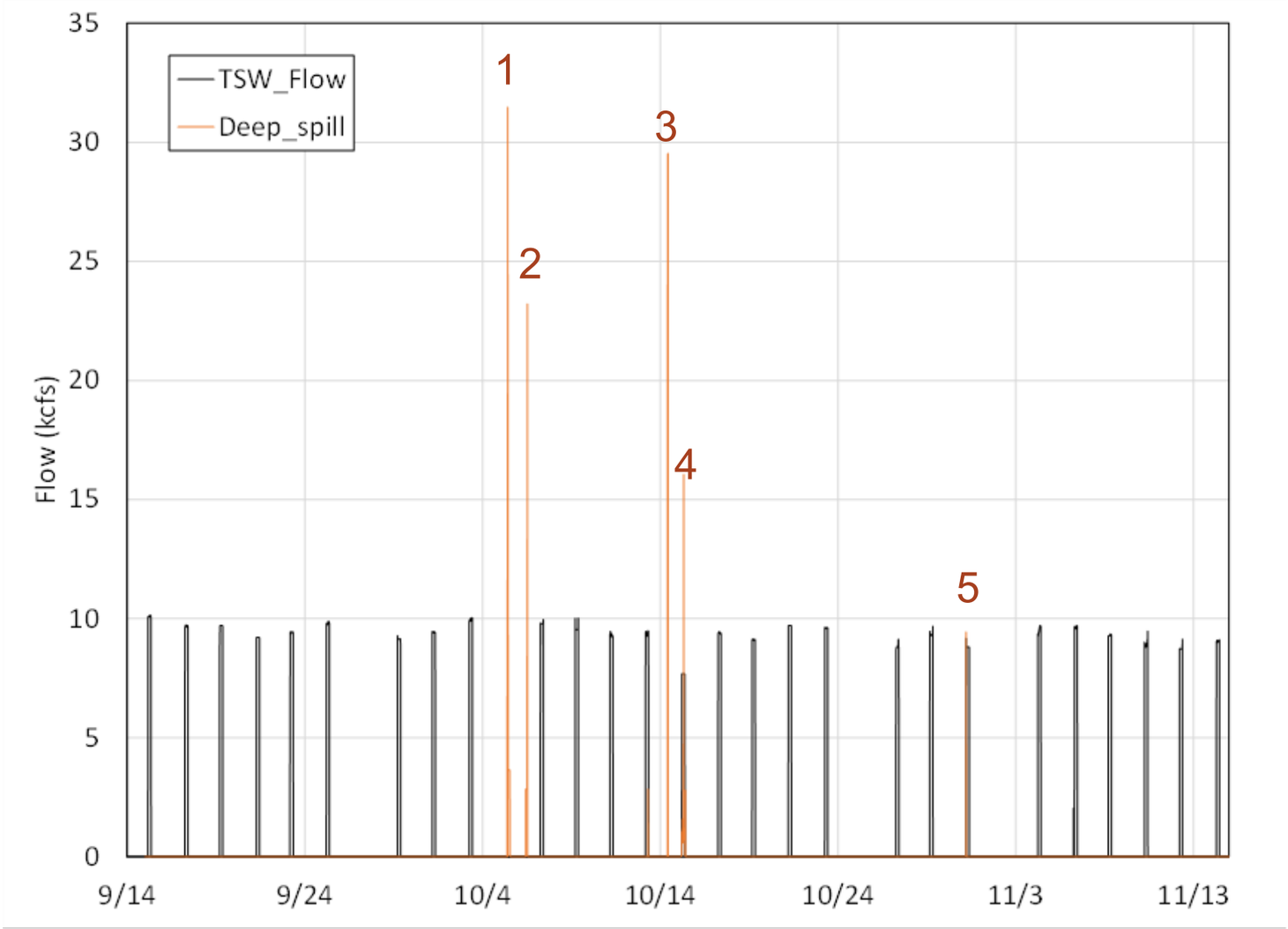
- 7-Day Blocks
  - 12 hrs TSW spill per block
    - ✓ 3 TSW_ON spill days (randomly assigned, but with a no-spill day between spill days)
      - 4-hour TSW spill periods starting at 0500h, 0600h, or 0700h (treated as replicates)
        - 2019/2020 study found that TSW spill period length was not critical and passage rates were higher for spill periods near dawn than for those beginning near dusk
    - ✓ 4 TSW_OFF no-spill days
- Fall 2020 Study Period
  - 9/14/ – 11/15
    - ✓ 9 blocks
- Spring 2021 Study Period
  - 2/15 – 4/9
    - ✓ 8 blocks

Daily Passage Estimates

- Hourly Passage Estimated using Split-beam Hydroacoustics
  - TSW – 3 transducers
  - Unit 1
    - ✓ Guided – 1 transducer per slot in 2 of 3 slots
    - ✓ Unguided – 1 transducer per slot in 2 of 3 slots
  - Unit 10
    - ✓ Guided – 1 transducer per slot in 2 of 3 slots
    - ✓ Unguided – 1 transducer per slot in 2 of 3 slots
- Expanding to Total Powerhouse Passage
  - Unit 1 and 10 Hourly passage estimates expanded to three slots.
  - Expanded by total powerhouse discharge relative to Unit 1 and Unit 10 discharge to estimate total powerhouse passage
- Daily Dam-wide Passage Estimated
  - Hourly passage estimates for TSW added to total powerhouse estimate and summed across each day

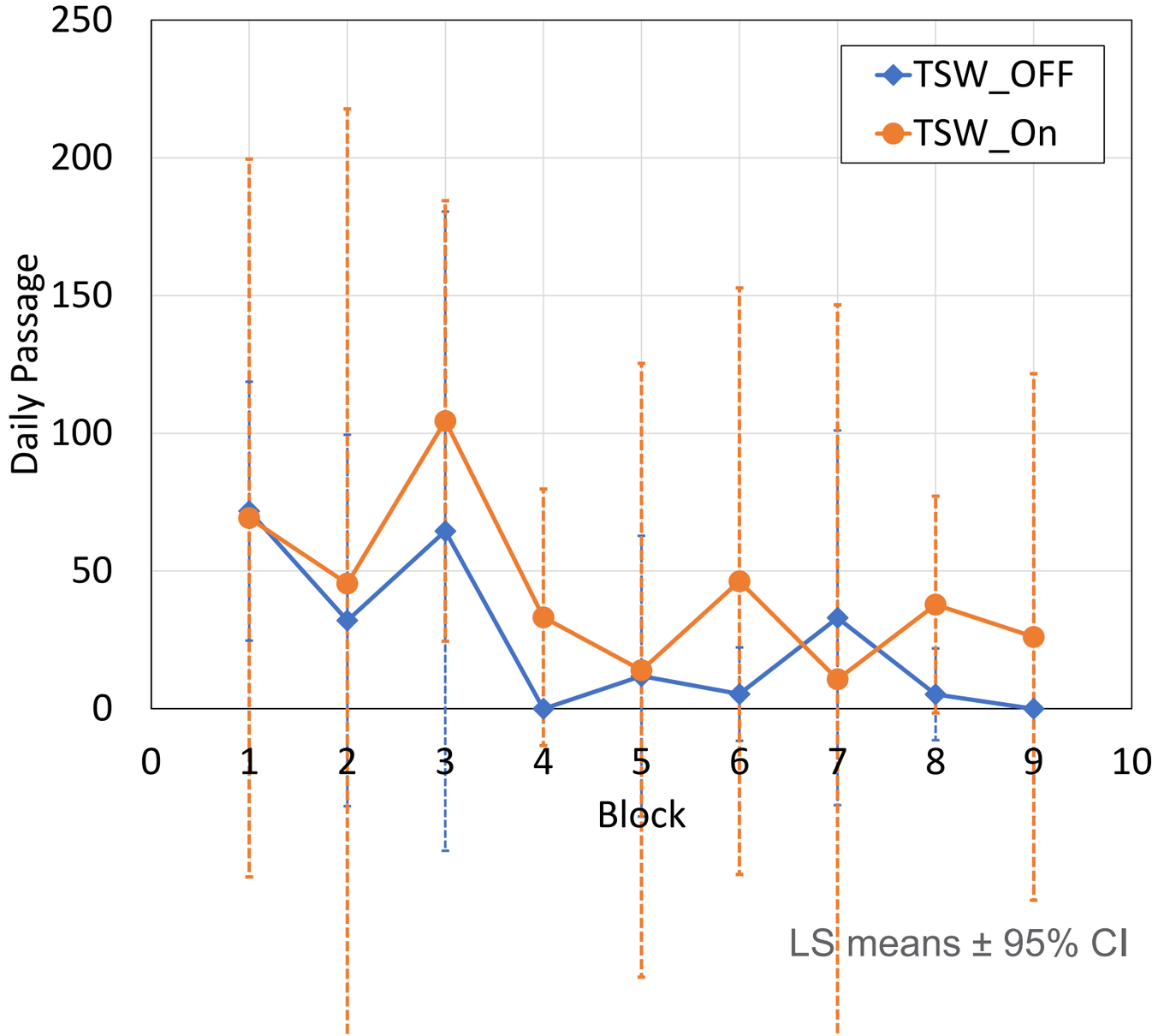
Fall 2020 Study Implementation

- 5 days censored from study due to conventional spill
  - 2 of those days included TSW spill



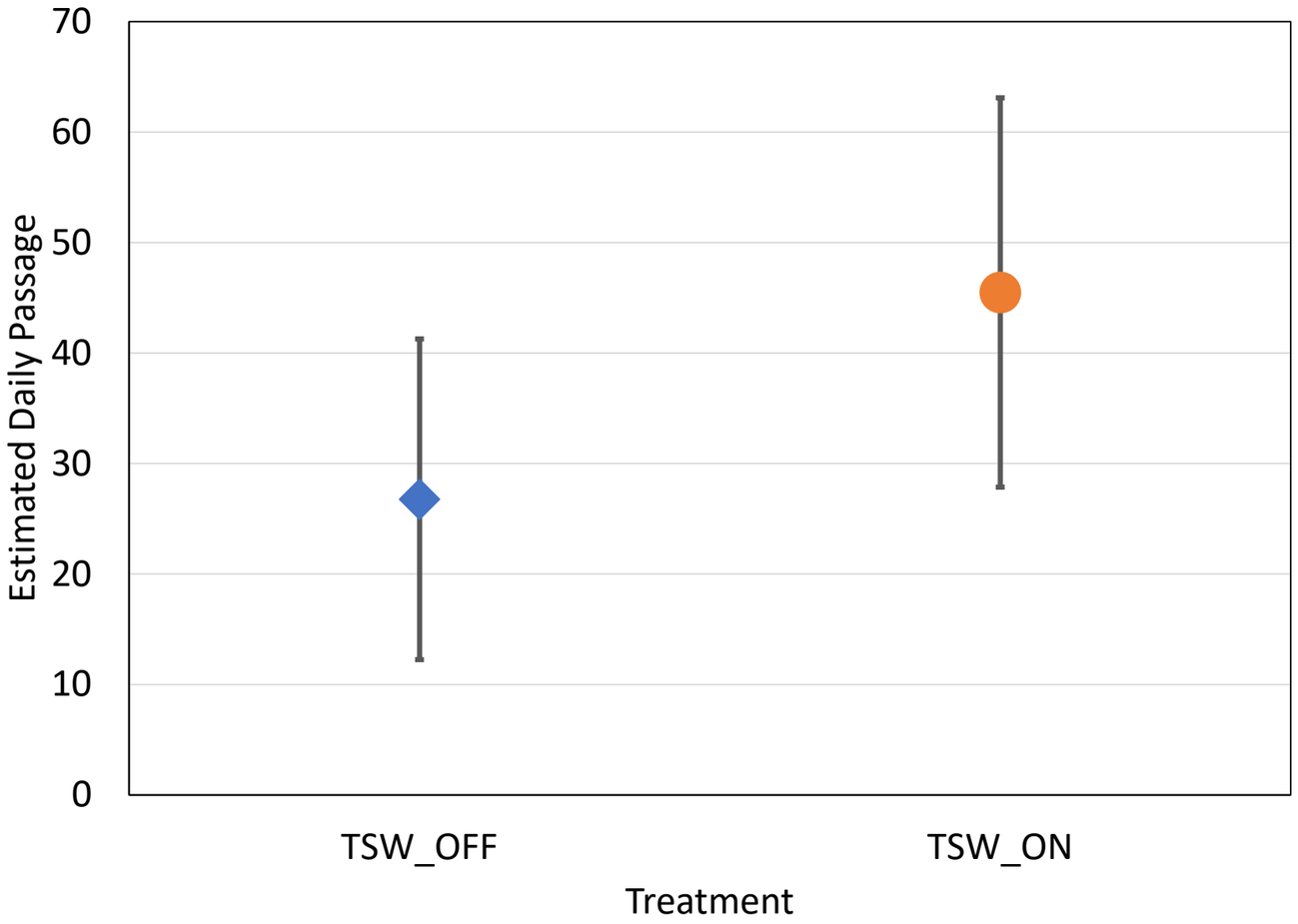
Fall 2020 Daily Passage by Block

- Variability within and among blocks
- TSW_ON ≥ TSW_OFF in 7 of 9 blocks



Fall 2020 Daily Passage by Treatment

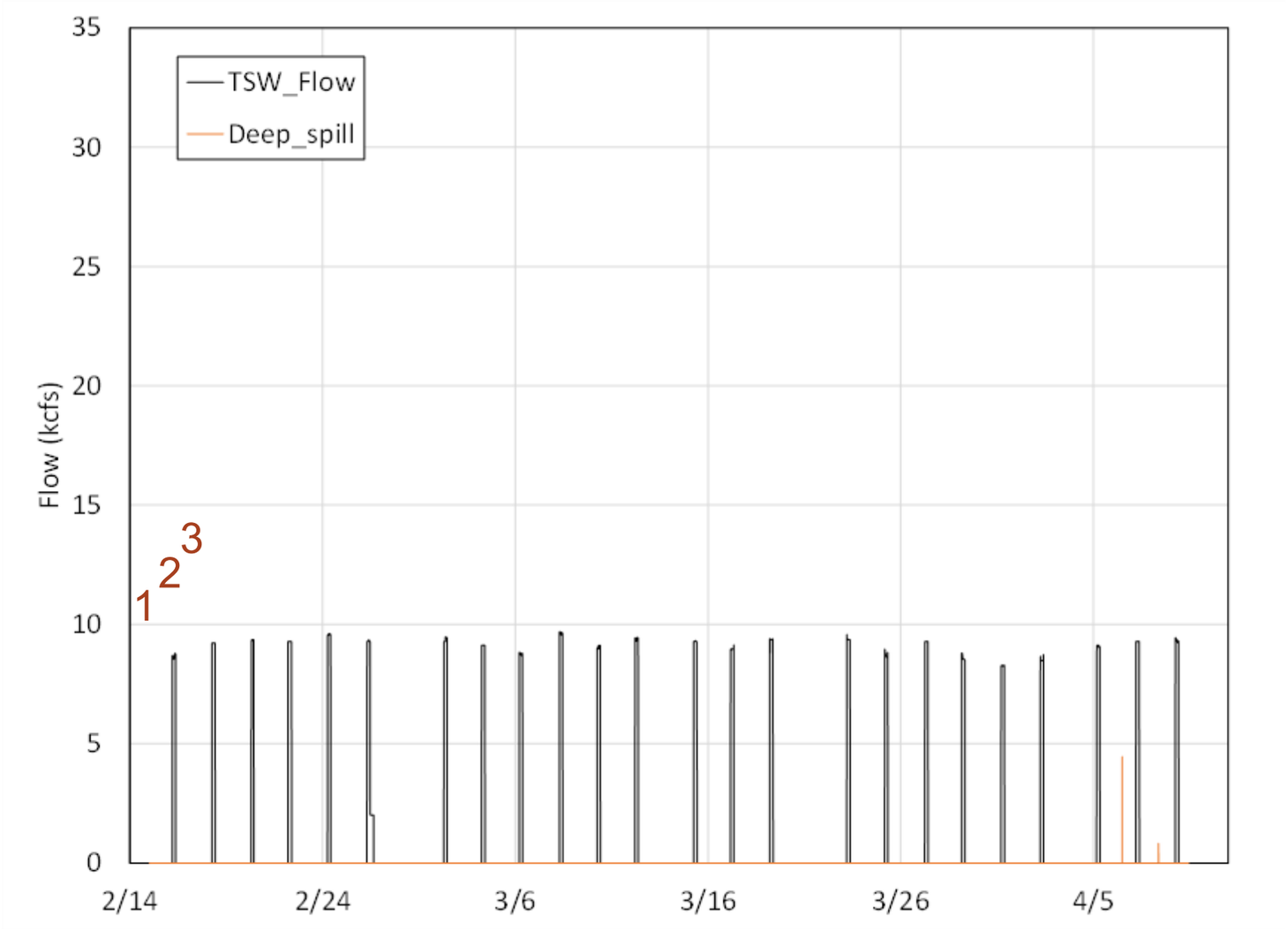
- Variable within treatments
- Dam-wide Passage Higher during TSW_On treatment Days



LS means ± 95% CI

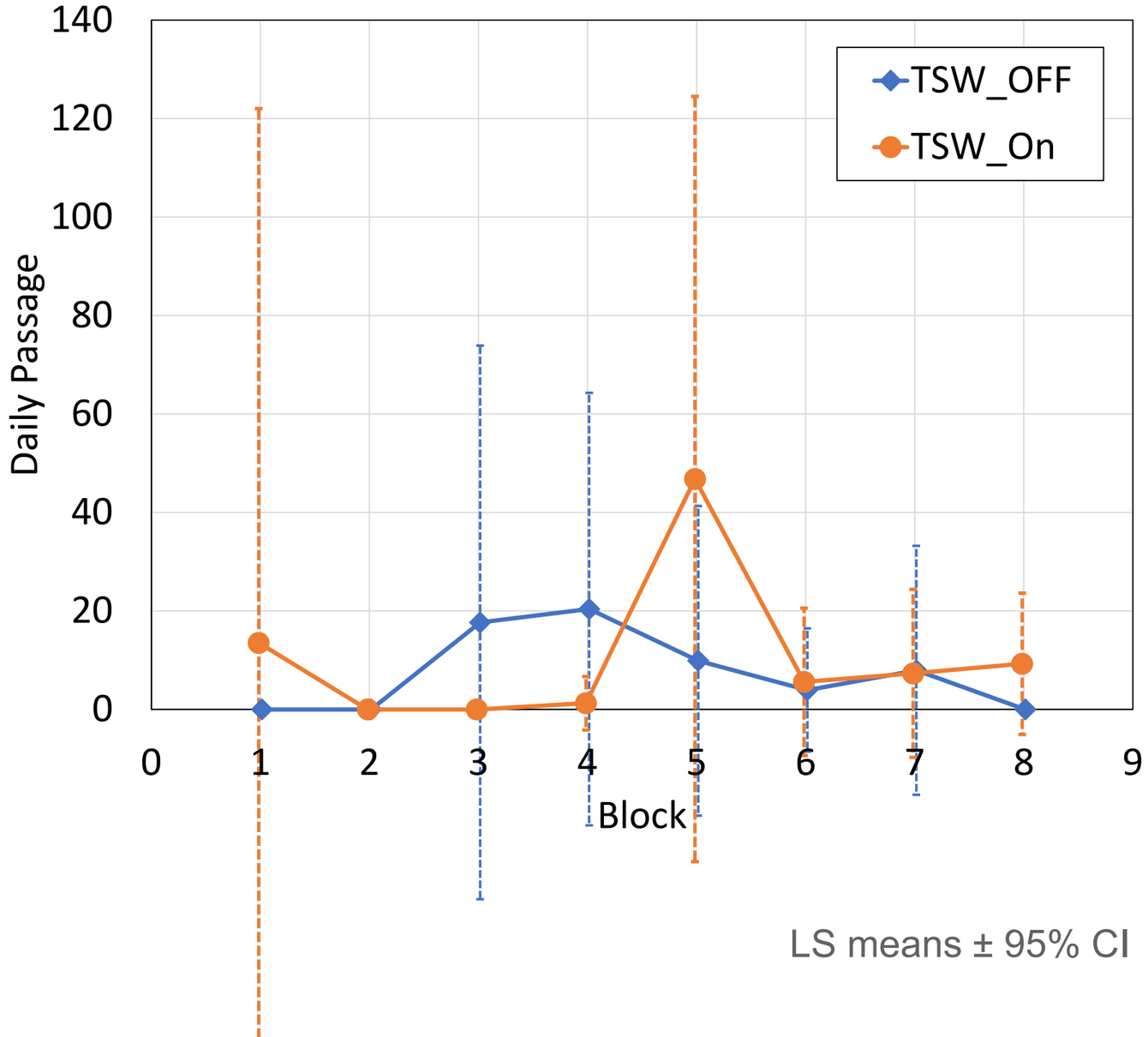
Spring 2021 Study Implementation

- 3 days censored from study due to screens not being installed
  - 1 TSW spill day
- Very brief conventional spill episodes did not cause days to be censored



Spring 2021 Daily Passage by Block

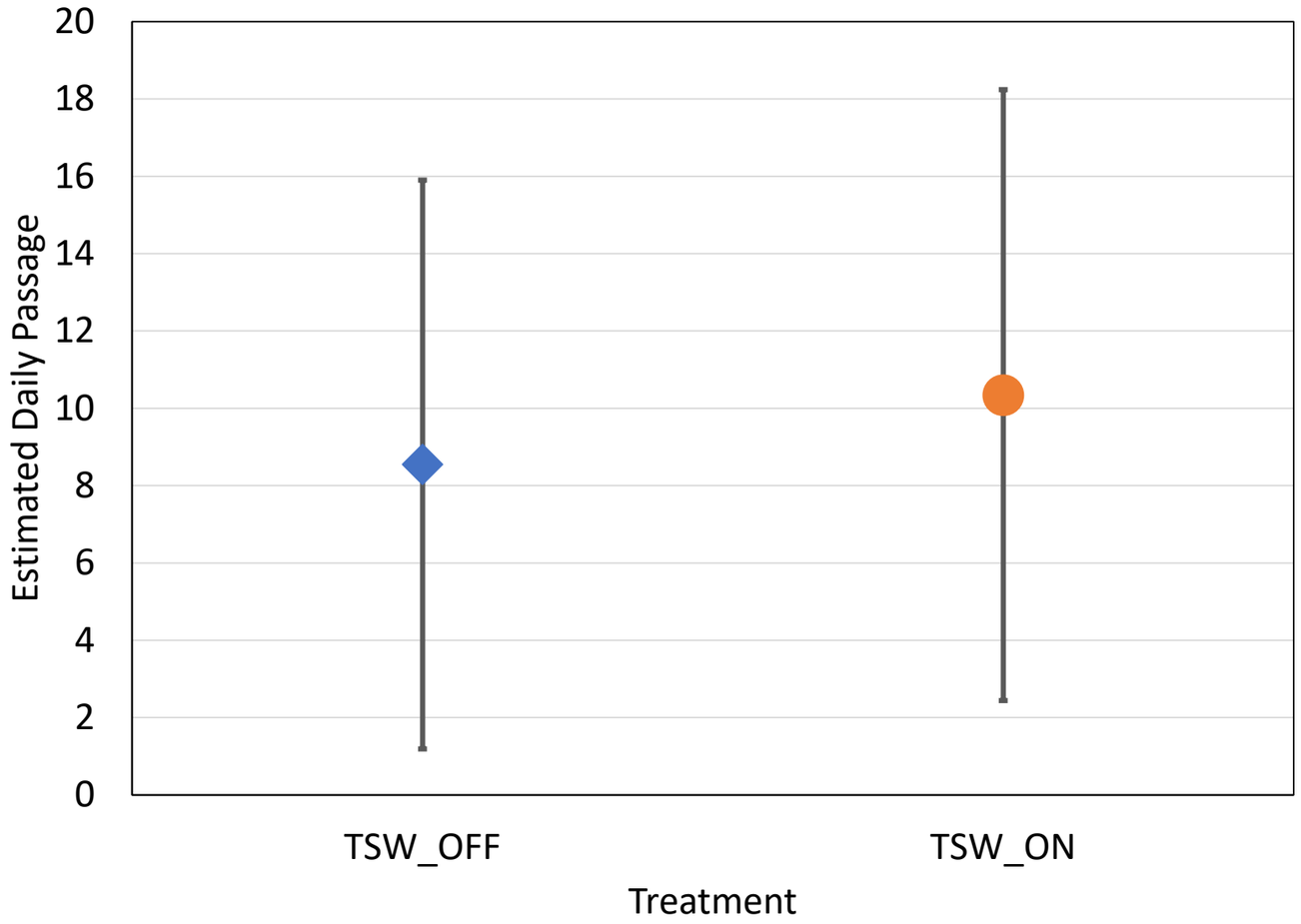
- Low numbers overall
  - No passage estimated on many days
- Variability among blocks
- TSW_ON ≥ TSW_OFF in 6 of 8 blocks



LS means ± 95% CI

Spring 2021 Daily Dam-wide Passage by Treatment

- Variable within treatments
- Variability overwhelms higher passage on TSW_ON treatment days



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Summary

- **Fall 2019 and Spring 2020**
  - Passage higher for periods beginning near dawn than for those beginning near dusk
  - TSW Spill period duration has little effect on passage rates
  - Higher passage rates during fall than spring
- **Fall 2020**
  - Dam-wide passage rate increased by ~70% on days when TSW was operated
    - ✓ Statistically significant
- **Spring 2021**
  - Dam-wide passage rate increased by ~20% on days when TSW was operated
    - ✓ Not statistically significant
    - ✓ Low passage rates inflated the variability of estimates

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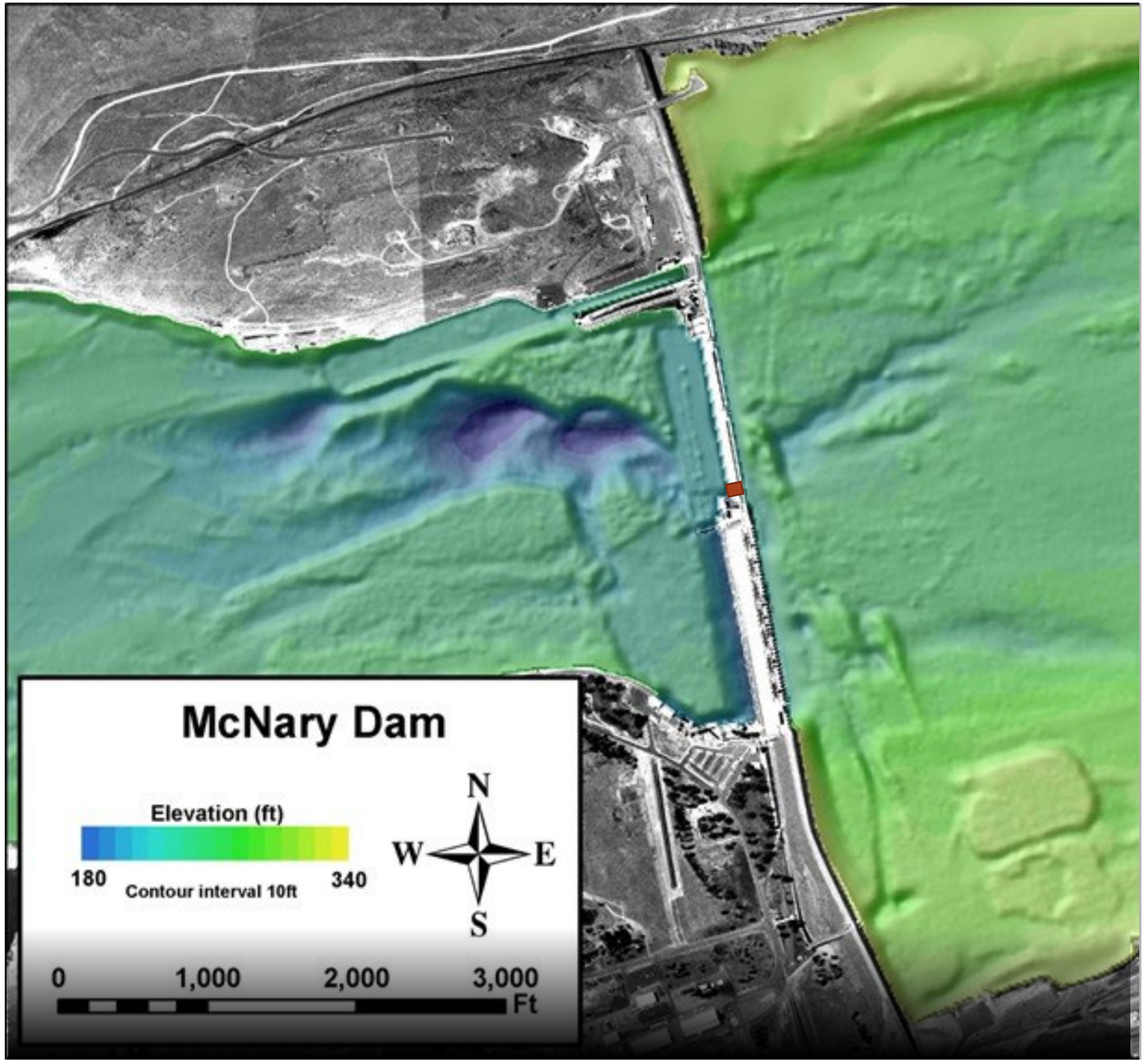
The TSW is an Effective Downstream Route for Adult Steelhead

- TSW_ON Days
  - Operated 4 of 24 hours
  - Discharged ~10kcfs
    - ✓ ~1.3 percent of total discharge
  - Dam-wide downstream passage estimates increased by 20% to 70% vs TSW_OFF days



Acknowledgements

- USACE
  - Martin Ahmann, Marvin Shutters, Karl Anderson, Joe Norton, Bobby Johnson, Charles Chamberlain, Troy Gilbert, John Oberhelman, Tim Wik, Bill Gersbach, Pete Stewart, Jim Harris, and many fisheries, maintenance, and operations staff at McNary Dam
- Associated Underwater Services
  - Mike Mars and supporting dive crew, for underwater installation and recovery of hydroacoustic equipment
- Pacific Northwest National Laboratory
  - Bob Mueller, Ryan Harnish, Kate Deters, John Stephenson, Julie Snook, Brandon Boehnke, and Jarrod Ver Steeg.

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Thank you