

# Assessing superimposition of listed tule fall Chinook salmon redds using aerial and ground surveys on the White Salmon River, WA

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## Background

- Hatchery upriver bright (URB) fall Chinook salmon are straying into the White Salmon River (Figure 1).
- ESA-listed tule fall Chinook population in the White Salmon River spawns earlier (Sept – Oct) than URBs (late Oct – Nov).
- Tule redds at risk to superimposition which may displace eggs and reduce egg-to-fry survival.

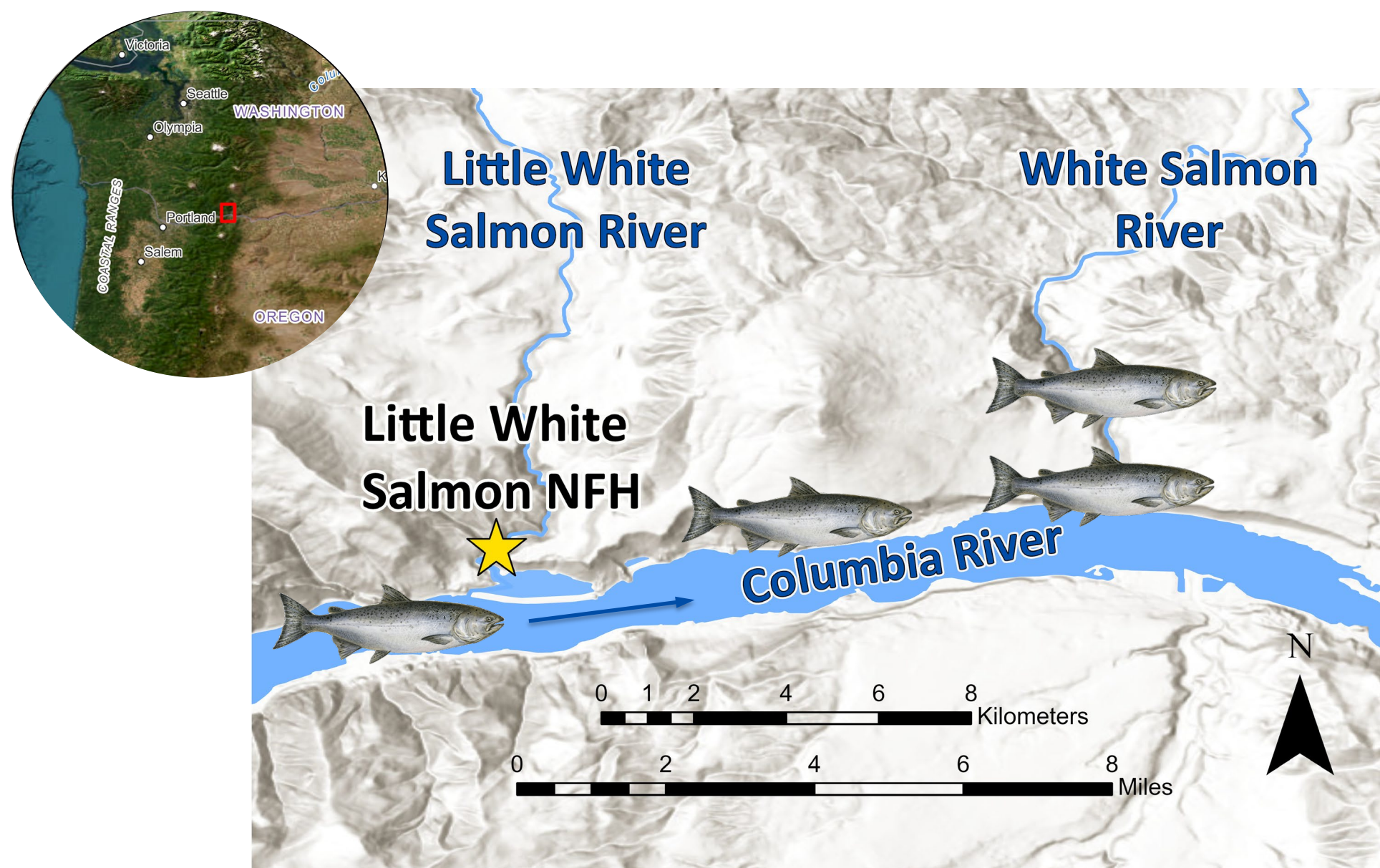


Figure 1. Location of Little White Salmon National Fish Hatchery (NFH) and White Salmon River.

## Survey methods

- Redd locations were mapped during weekly ground surveys from Sept – Nov.
- Degree of overlap and level of disturbance to tule redds was evaluated during ground surveys (Figure 2).
- Weekly aerial drone surveys provided high-resolution imagery for comparison to ground surveys (Figures 3 and 4).



Figure 2. Ground surveyors mapping redds with ArcGIS Field Maps and an Arrow RTK GNSS Receiver (cm level accuracy).

## Aerial survey imagery

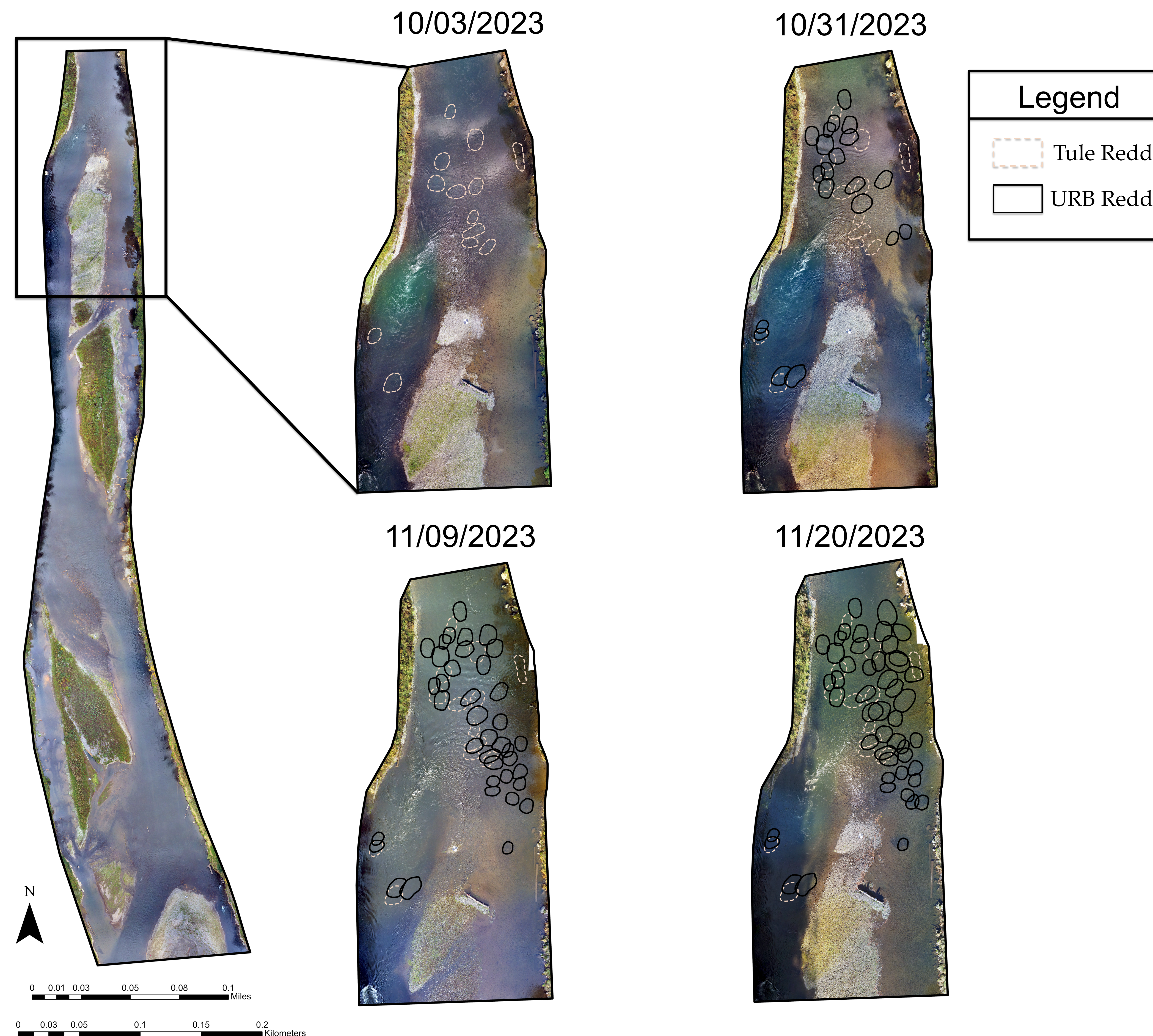


Figure 3. Aerial imagery of study area on the White Salmon River with a portion of the most upstream section magnified for four survey dates to show the location of ESA-listed tule fall Chinook salmon redds (dashed) and upriver bright (URB) fall Chinook salmon redds (solid).

## Acknowledgments

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## Lessons Learned

- A surprisingly high incidence of tule redds monitored were superimposed by URBs in 2022 and 2023.
- Counts of redds superimposed from aerial surveys can be especially valuable for high-density spawning areas.
- Efficient processing of aerial imagery requires high performance computing environment.
- Aerial drone surveys can provide high-resolution georeferenced imagery of a more expansive area of spawning grounds.

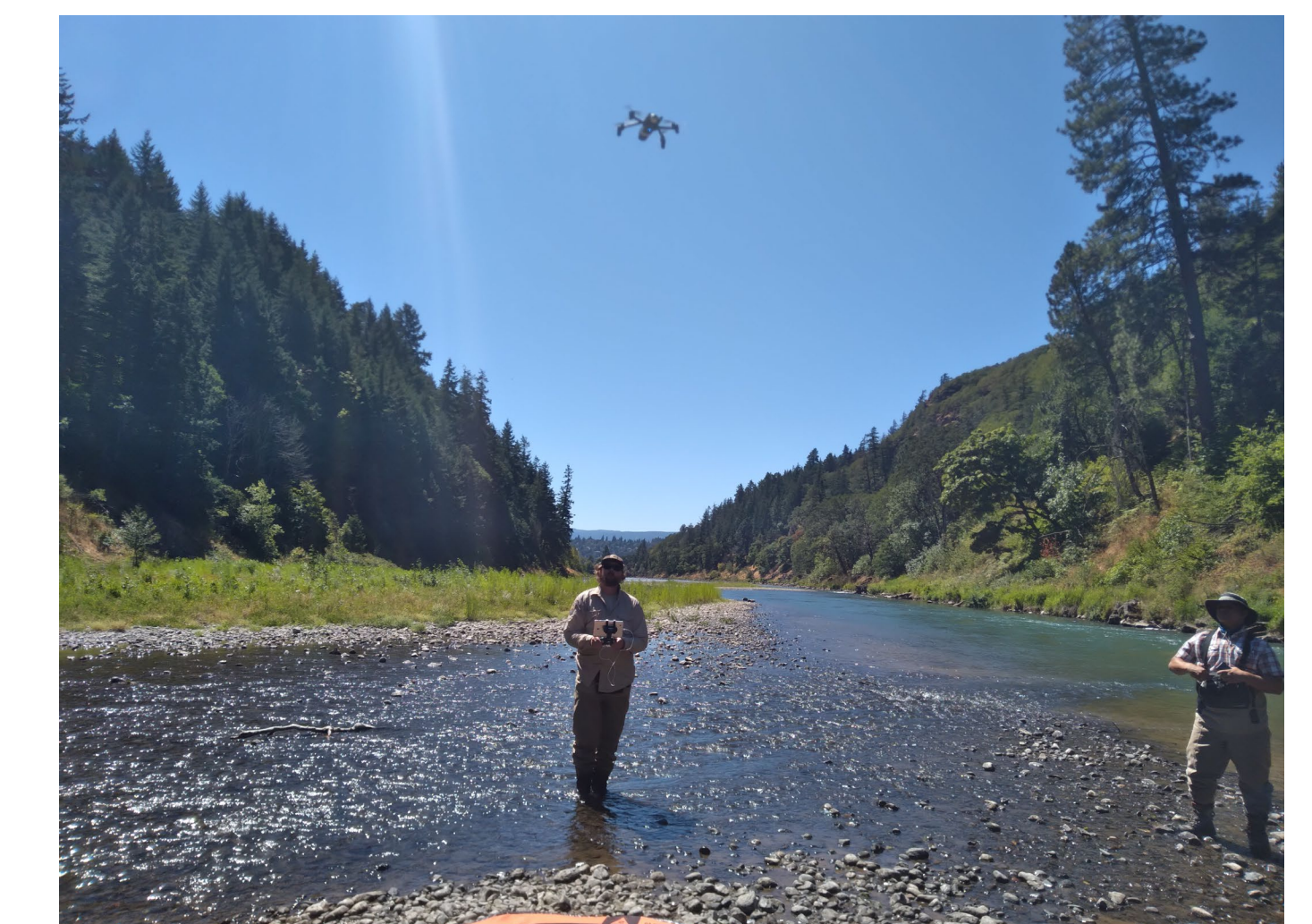


Figure 4. A Parrot Anafi quadcopter was used for aerial missions with a 4K HDR 21 MP camera

## Next steps

- Compare count estimates of redds superimposed from ground surveys with aerial surveys.
- Estimate aerial observer error among four independent observers.
- Prepare for 2024 aerial surveys using a Skydio X10 drone with onboard AI for obstacle avoidance.

## Further information

Please see <https://www.fws.gov/office/columbia-river-fish-and-wildlife-conservation> for more information about what we do. Reach out to [justin\\_baker@fws.gov](mailto:justin_baker@fws.gov) if you have a question or comment.