

An aerial photograph of a lake shoreline. The left side shows a steep, eroded bank with exposed tree roots and some green vegetation. The water is clear, revealing a dense bed of green and brown submerged plants and algae. The right side of the image shows the surface of the water with gentle ripples.

Effects of Watercraft Wakes on Shoreline Erosion and Potential Impacts for Salmon at Big Lake

Eli Wilson
Master's Student
UAF CFOS

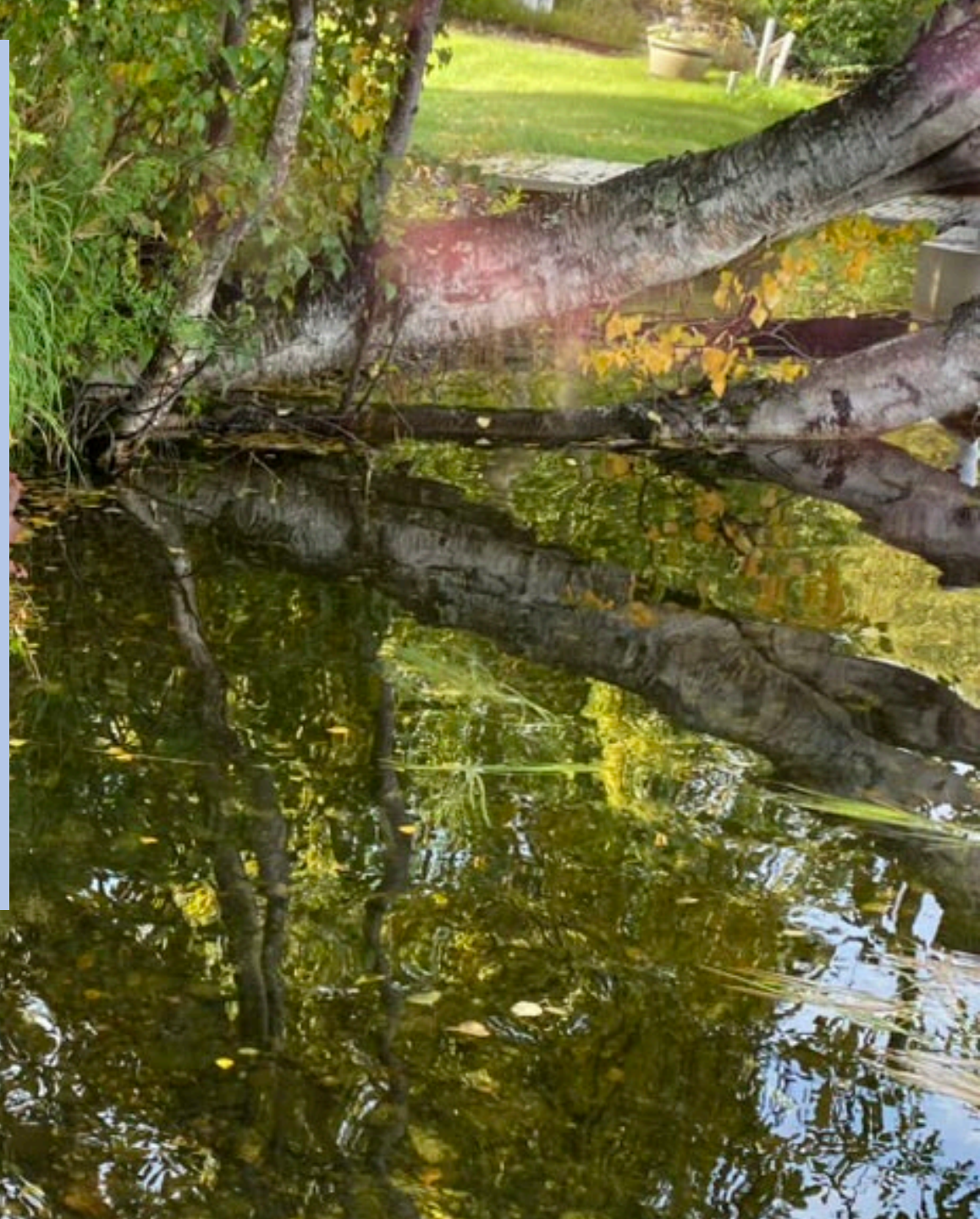
Study Area

- Big Lake
- Located ~1hr NE of Anchorage
- Popular site for recreational watercraft users
- Supports the Fish Creek PU Sockeye Fishery
- Extensive shoreline development



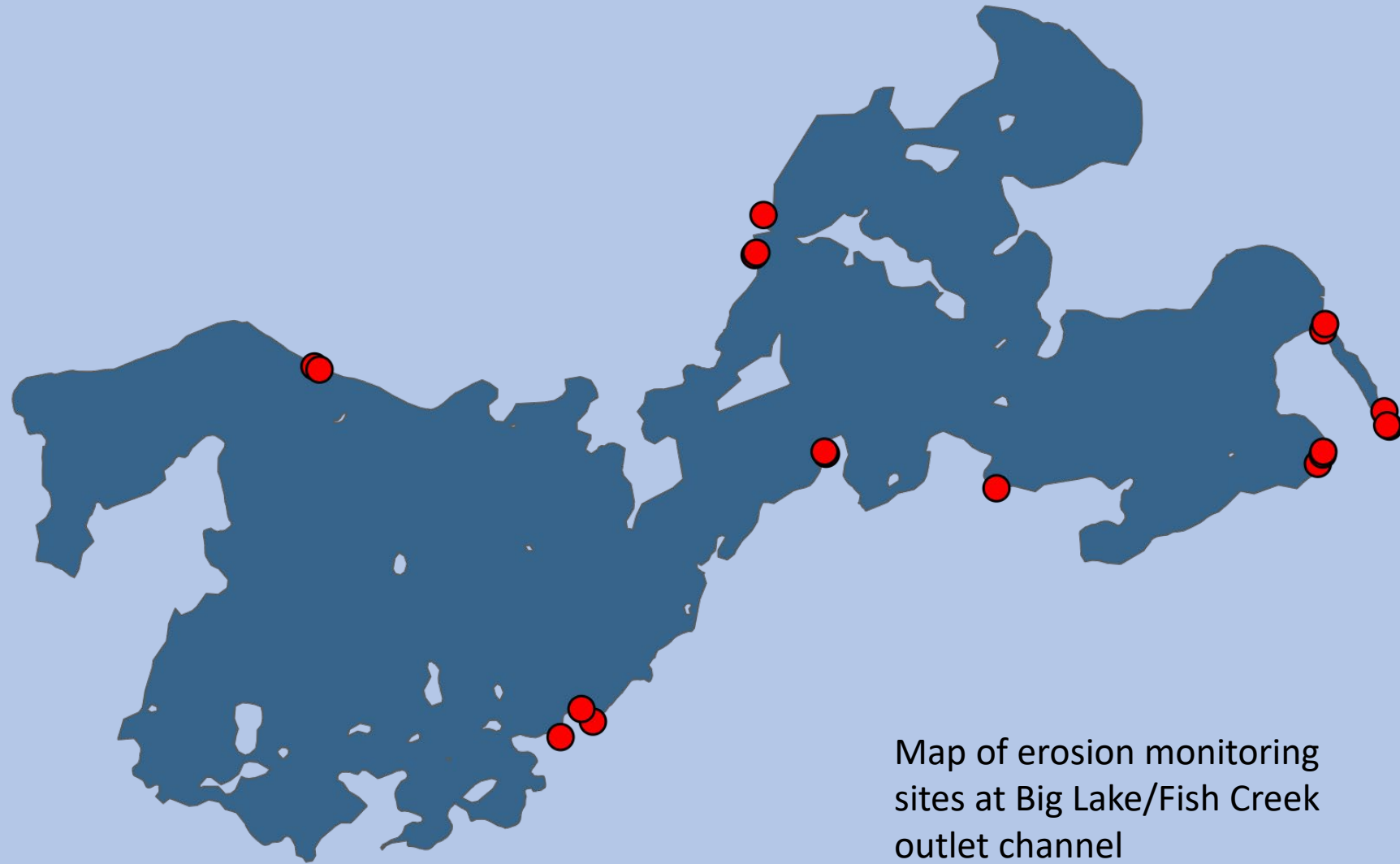
Research Questions

- What is the level of correlation between watercraft wakes and shoreline erosion at Big Lake?
- How much do shoreline erosion rates vary around the lake and how are those rates impacted by shoreline development?
- Which sections of the lakeshore are utilized by spawning Sockeye Salmon and how might this influence the response to erosional issues?



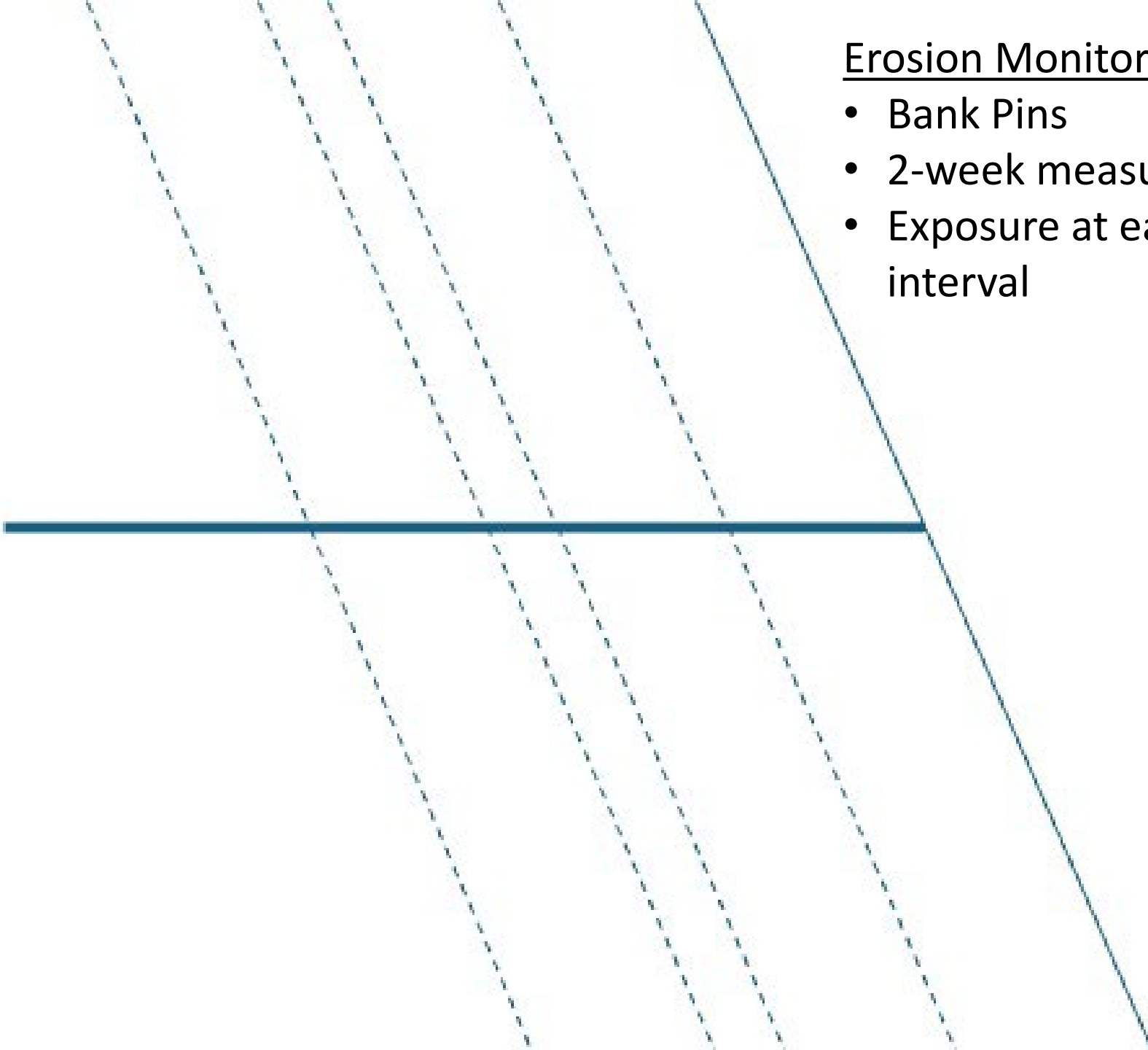
Data Collection, June-October 2024

- Erosion Rates
- Wake and wave activity
- Turbidity and substrate composition
- Sockeye spawning surveys



Erosion Monitoring

- Bank Pins
- 2-week measurement interval
- Exposure at each check → Mean erosion over interval



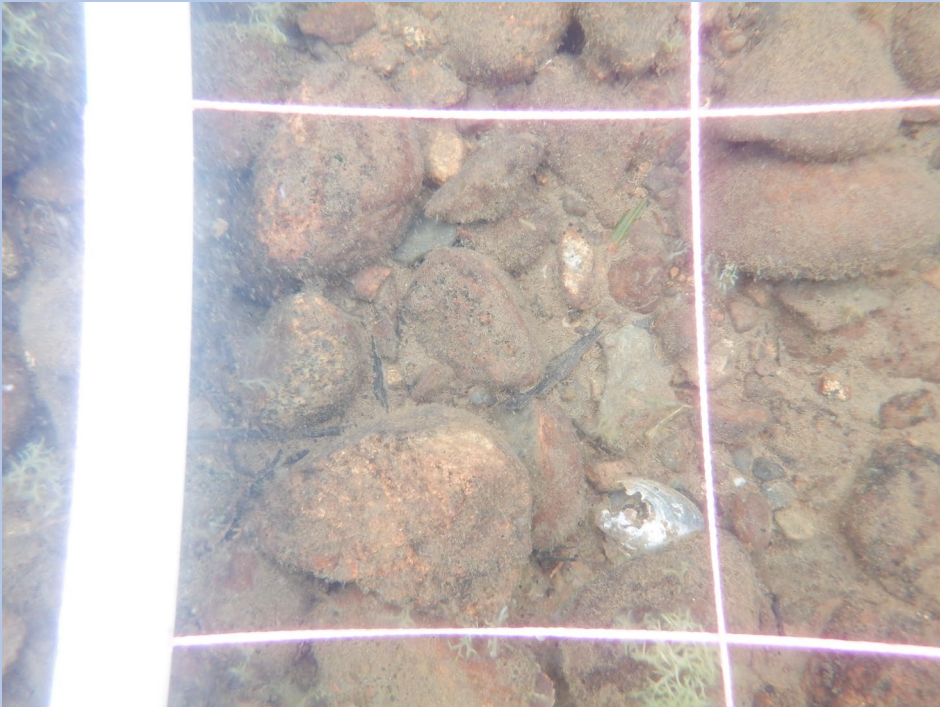
Wake and Wave Gauging

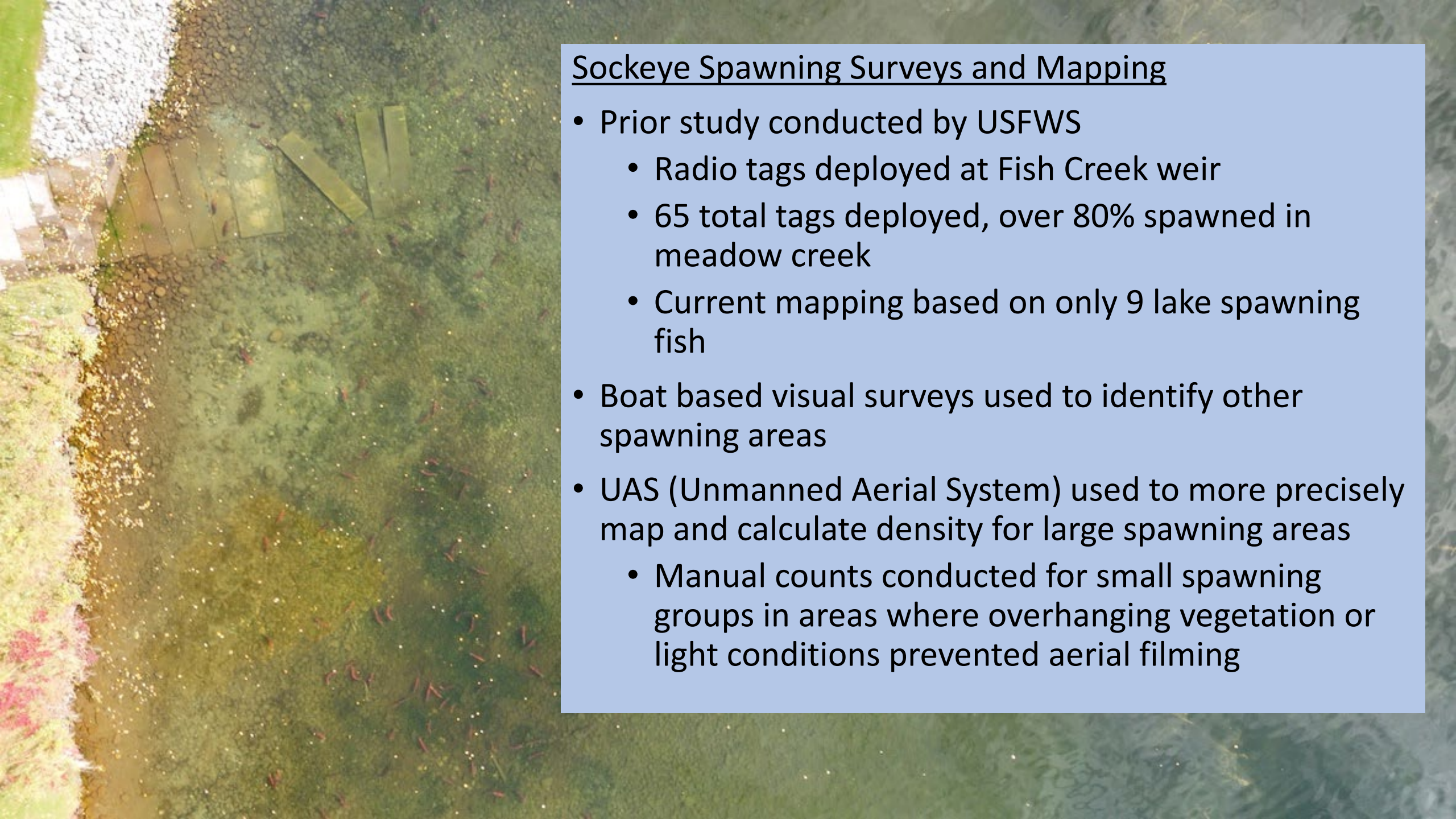
- Array of 5 (6) water presence sensors
- Detection event logged when wetted
- Bin/range approximation of magnitude value for each even based on vertical sensor placement.
- Adjustment for fluctuation in lake level



Substrate Composition and Turbidity

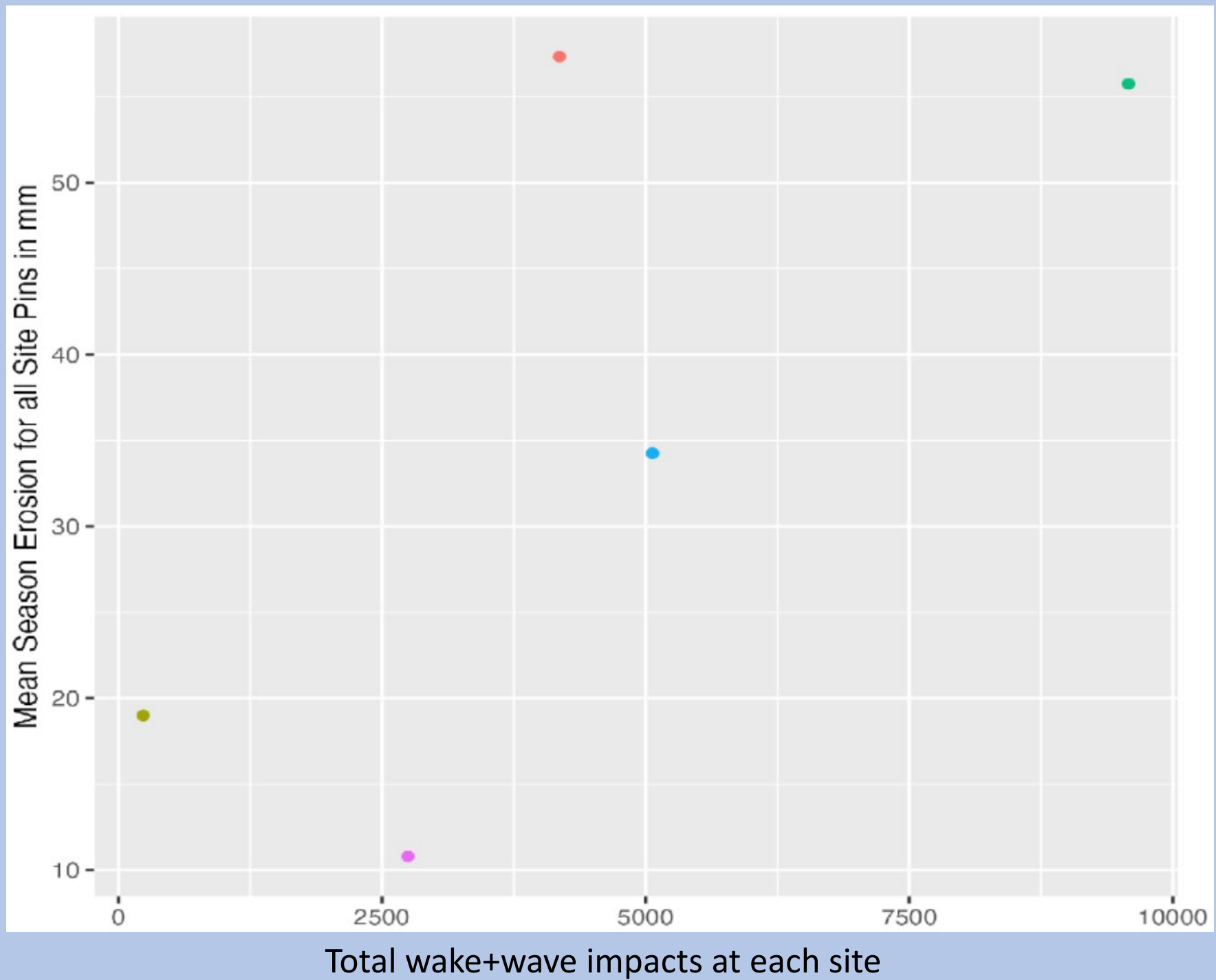
- Substrate Sampling
 - Petit Ponar dredge
 - Sampled adjacent to erosion monitoring sites, previously documented Sockeye spawning areas
 - Photographic collection of data using PVC+string grid
- Turbidity measured by multiparameter sonde



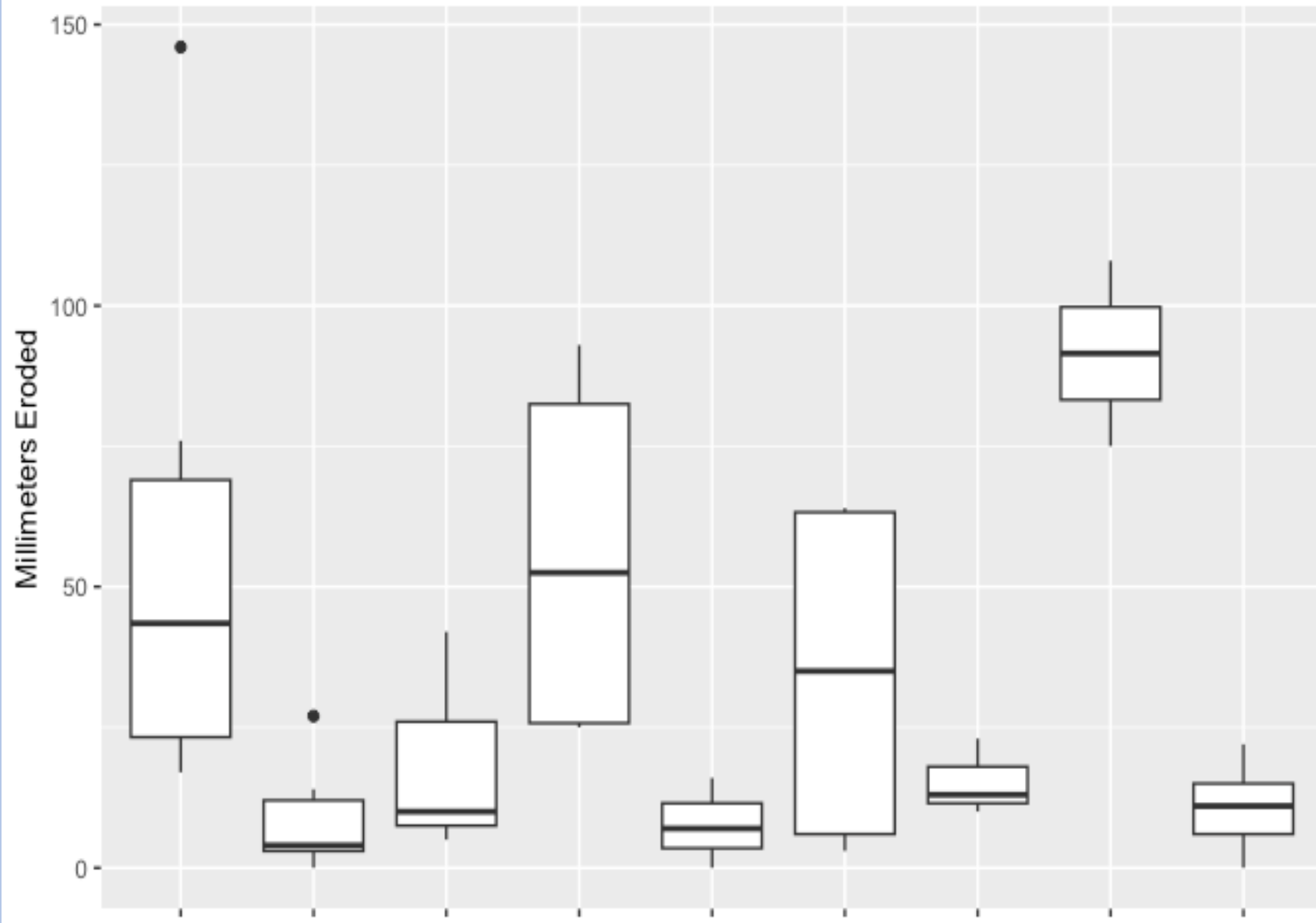
An aerial photograph showing a spawning area. In the upper left, there's a shoreline with gravel and some wooden pilings or a weir structure. The water is greenish-brown, and numerous small, reddish-brown fish are visible swimming in the water, particularly concentrated near the shoreline and the wooden structure.

Sockeye Spawning Surveys and Mapping

- Prior study conducted by USFWS
 - Radio tags deployed at Fish Creek weir
 - 65 total tags deployed, over 80% spawned in meadow creek
 - Current mapping based on only 9 lake spawning fish
- Boat based visual surveys used to identify other spawning areas
- UAS (Unmanned Aerial System) used to more precisely map and calculate density for large spawning areas
 - Manual counts conducted for small spawning groups in areas where overhanging vegetation or light conditions prevented aerial filming

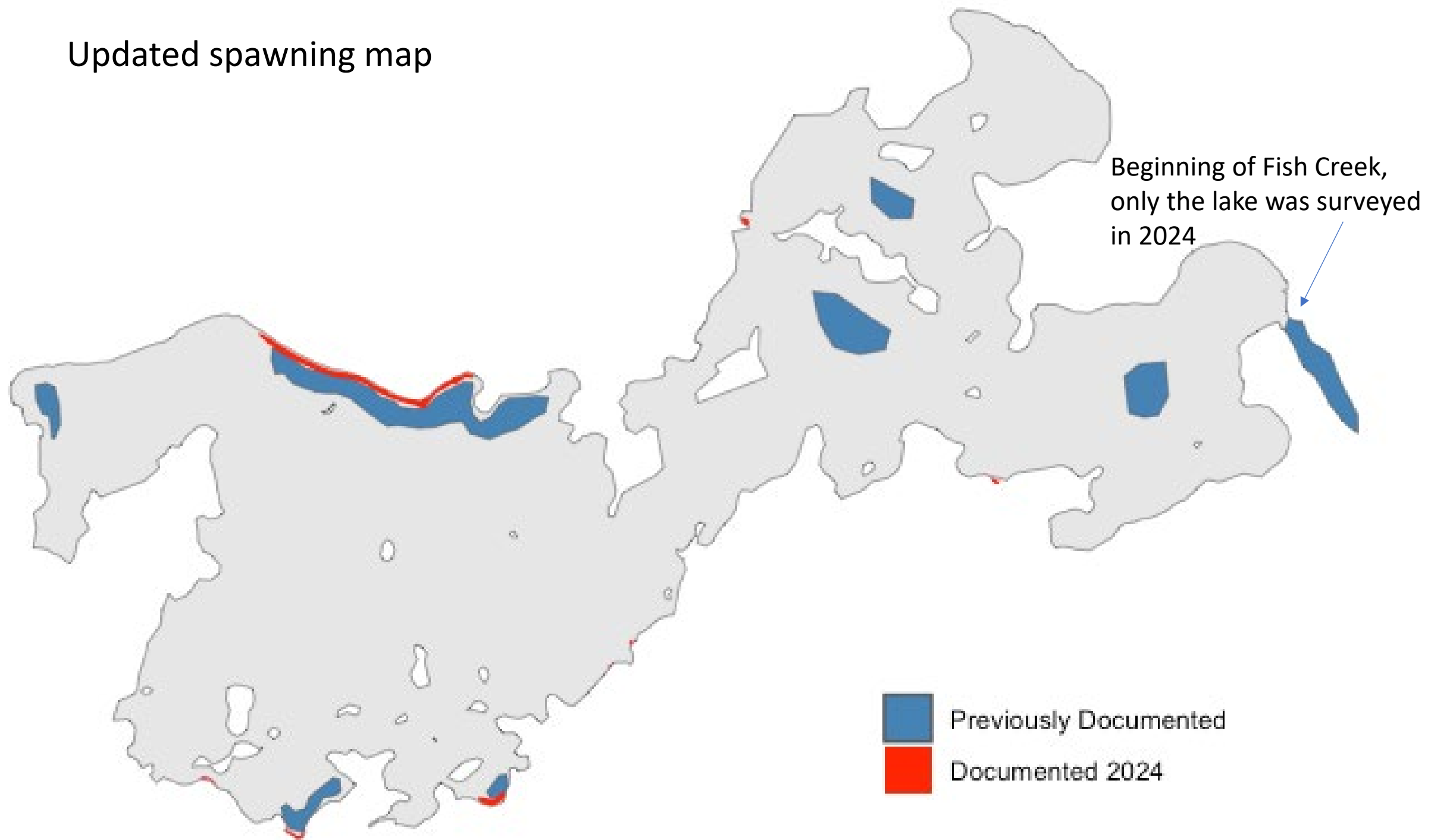


Season Long Erosion by Site



Sites (names removed for landowner anonymity)

Updated spawning map



Next Steps

More to do on all fronts

- Erosion modeling
- Sockeye spawning video analysis
- Substrate (or not?)



Thank you to everyone who has helped with
fieldwork, field equipment, planning, and
study design!

