The Klamath Tribes Science and Research and Perspective on Next Steps for Sucker Recovery

- The Klamath Tribes have a deeply felt responsibility to steward our Treaty resources (plants, animals, fish and the habitat they depend upon in the Upper Klamath Basin) for our members and future generations.
- The Klamath Tribes have relied on treaty resources including the C'waam (Lost River sucker) and Koptu (Shortnose sucker) for cultural, spiritual, and subsistence purposes for thousands of years.
- Without the C'waam and Koptu, we simply do not have the ability to live as Klamath People in the way Creator intended.

Tribal Significance

- Tribes historically harvested thousands of pounds of C'waam and Koptu yearly
- The "Return of the C'waam Ceremony" is held each spring

Klamath Tribes Science and Research

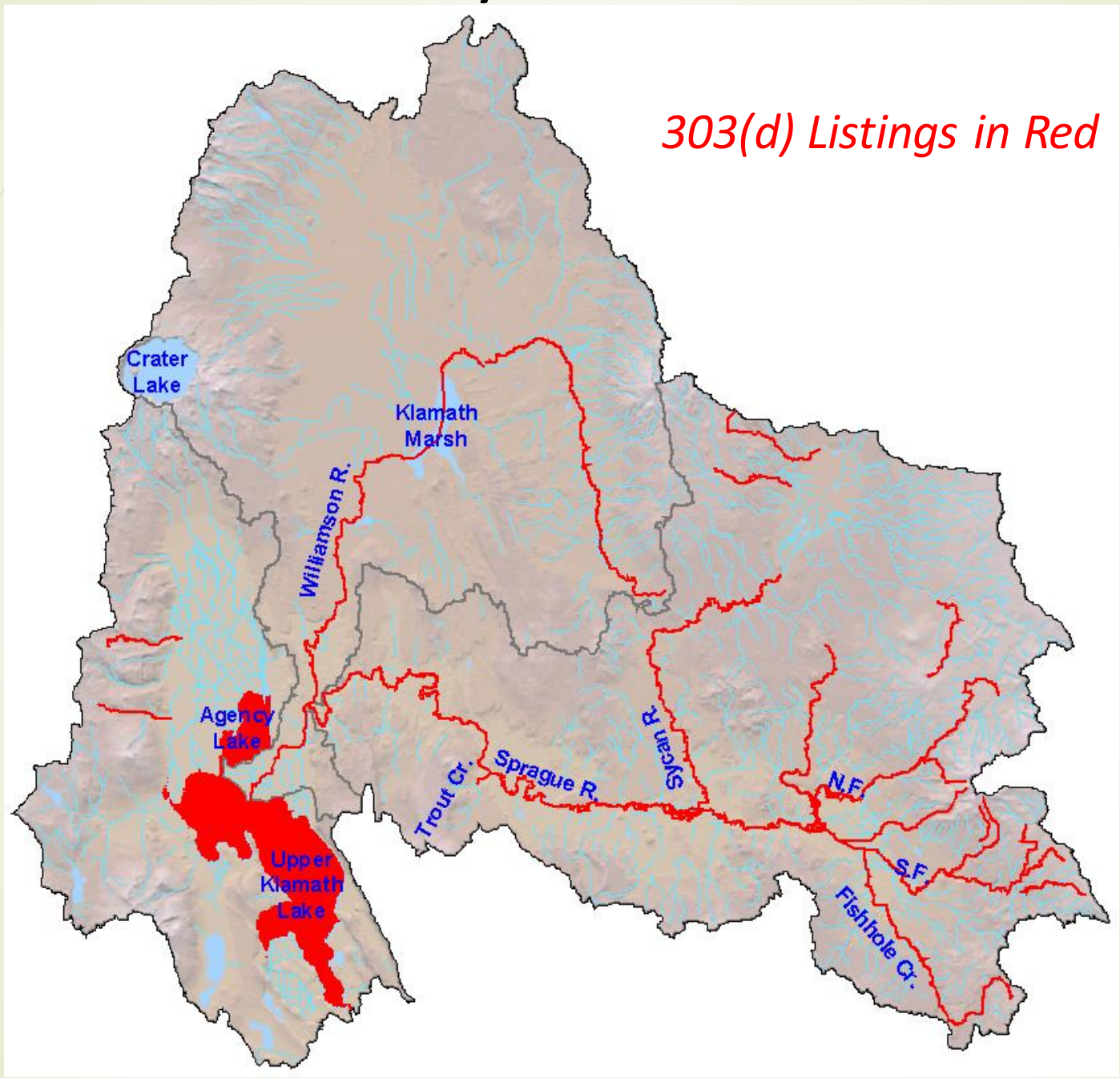
- Klamath Tribes have been conducting work since the early 1980s on endangered suckers biology and population status
- Conducting water quality trend monitoring on Upper Klamath Lake since 1990
- Conducting water quality trend monitoring on the major tributaries to Upper Klamath Lake since 2001
- Provided research facilities and support for studies by USGS on water quality tolerances of endangered suckers
- Developed rearing techniques for the endangered suckers

SPRAGUE RIVER WATER QUALITY LAB

Water Quality Monitoring Sites

Upper Klamath Lake Water Quality Monitoring

Water Quality Limited Water Bodies



Impaired water quality

Long-term Water Quality Trends

Upper Klamath Lake

- Large cyanobacteria blooms have occurred every year during the summer months
- Harmful or lethal water quality conditions affecting sucker survival including high pH, low dissolved oxygen, and high ammonia levels have occurred every summer
- TMDL targets exceeded for pH, dissolved oxygen, and chlorophll-a
- *Microcystis*, a toxin producing cyanobacteria has become more common in Upper Klamath Lake in recent years

Tributaries

- TMDL water quality standards for temperature, dissolved oxygen, and pH are exceeded every year for the Sprague River
- TMDL water quality standards for temperature are exceeded every year for the Williamson River, Sprague River, Sycan River and other tributaries

Long-term Phosphorus Loading to UKL

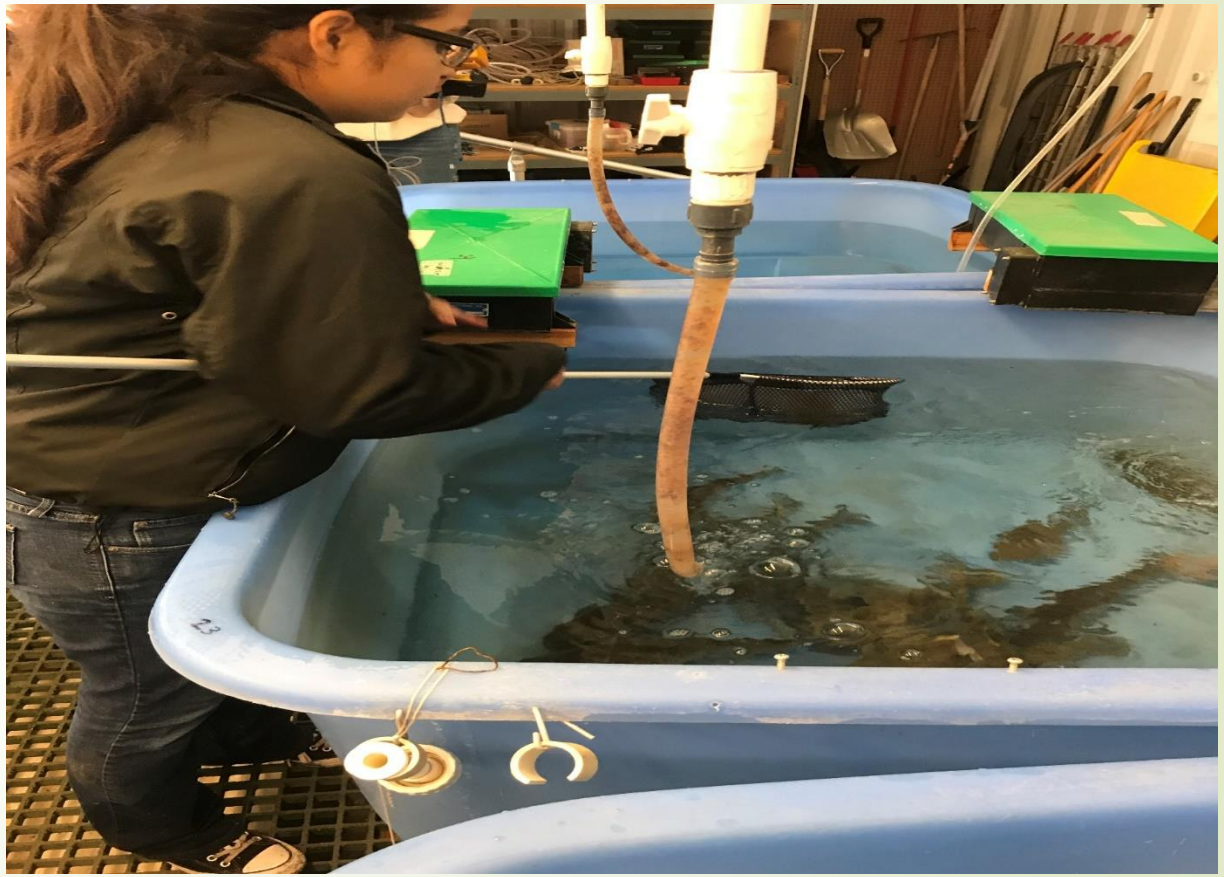
- Total phosphorus (TP) loading is the primary impairment leading to high production of cyanobacteria in UKL and corresponding poor water quality (pH, dissolved oxygen, ammonia) and lack of juvenile sucker survival
- TP loading around UKL from agricultural pumping has significantly declined over the last two decades
- External inflow TP concentrations have been reduced by about 25% towards the TMDL target of 66 ppb but still need a reduction of 27 ppb
- Despite decreasing trends in external TP concentrations and loads, there were no significant long-term trends in TP concentrations in UKL due in part to the long-term increase in evaporation on the lake

Promising Results

- USGS modeling (Wherry and Wood 2018) predicted it would take 20-30 years for the water column TP and sediment TP to reach a new equilibrium following reductions in external TP loads.
- However a 50% improvement could be achieved in 5 years and 80% in 10 years.
- Walker and Kann (2020, 2022) concluded based on their analysis of UKL inflow/outflow P dynamics, in-lake P concentrations may respond rapidly to external P load reductions because inflow loads during the winter were retained in the lake sediment, and subsequently released during the following summer, which in turn were related to the in-lake and outflow P concentrations (Legacy P probably not as important as originally suspected)
- Skinner (2022) conducted a literature review on wetland P dynamics and P removal potential and concluded that wetland restoration can play a major role in reducing P loads to UKL
- Approximately 12,000 acres of fringe wetlands are proposed for restoration in the next couple of years (Agency/Barnes)

Sucker Rearing Program

- Klamath Tribes Rearing Facility and Klamath Falls National Fish Hatchery
- Stopgap measure to prevent extinction
- Experience from other western sucker rearing programs (June Sucker, Razorback Sucker) have had some success but took years to develop
- So far monitoring has documented less than 100 reared suckers returning to spawning runs



Short-term Science Needs

- To better understand the recruitment bottleneck we need to better understand habitat use of juvenile and sub-adults through telemetry studies with reared suckers
- To ensure success of the rearing programs as a stopgap measure to prevent extinction we need to evaluate different release strategies to get the best survival (different release sizes, release locations, release timing, acclimation, net pen rearing)
- Evaluate different rearing strategies – Semi-natural rearing methods employed by the Klamath Tribes versus more controlled environments at the Klamath Falls National Fish Hatchery
- Evaluate techniques to reduce TP loading to Upper Klamath Lake (Phosphorus capture - Phoslock, Biochar, Treatment wetlands, Williamson River Delta)

Long-term Science Needs

- Sucker Recovery requires a long-term ecosystem health perspective
- Critical ecosystem functions will require large-scale restoration of the Upper Klamath Basin watersheds including streams with functioning riparian areas, rivers reconnected to their floodplains, and functioning wetlands throughout the Upper Klamath Basin
- Long-term support for habitat restoration and monitoring of sucker population status, hydrology, and water quality are needed to facilitate application of adaptive management principles