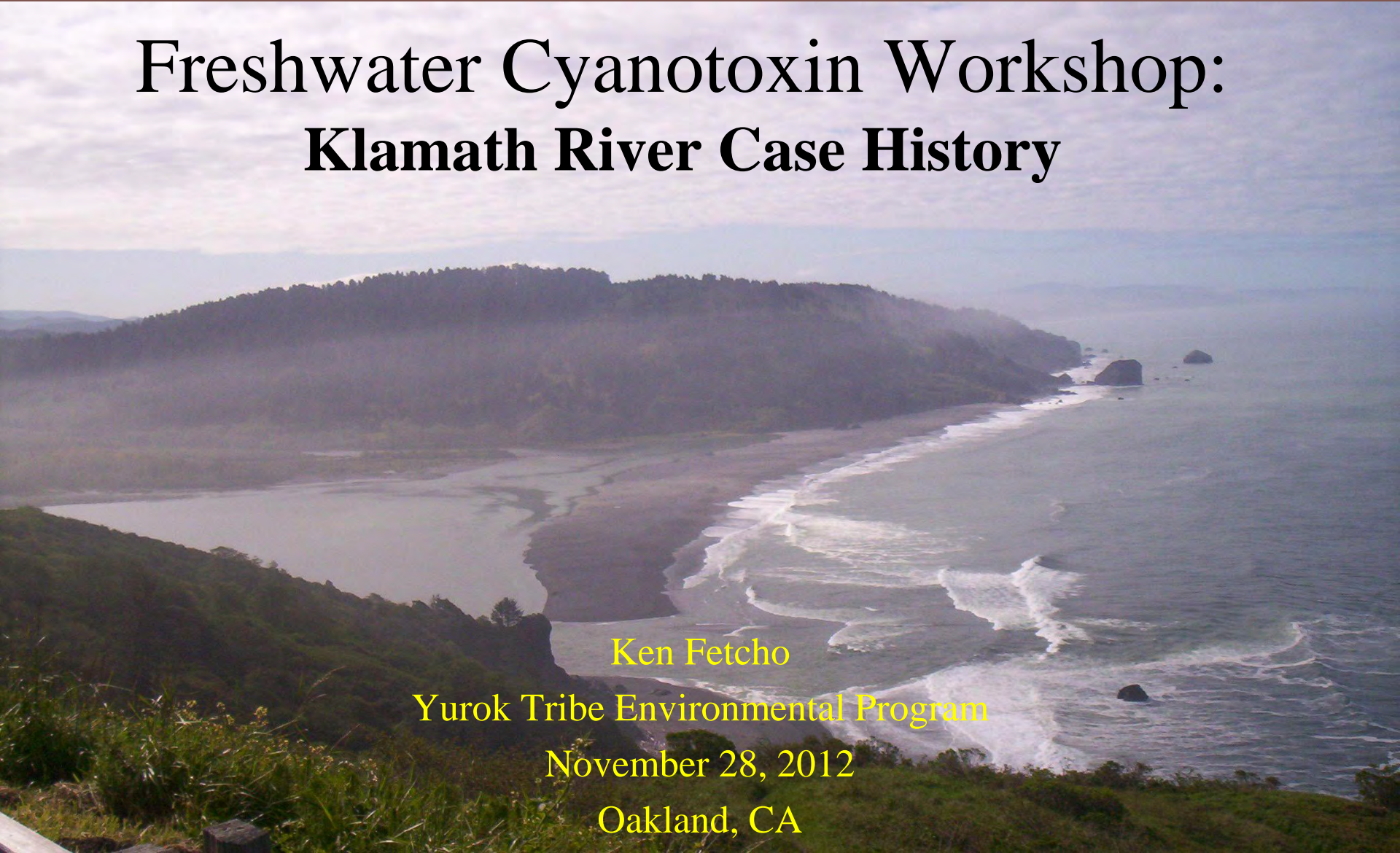


Freshwater Cyanotoxin Workshop: Klamath River Case History



Ken Fetcho

Yurok Tribe Environmental Program

November 28, 2012

Oakland, CA



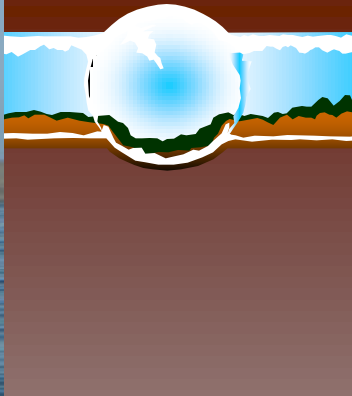


Yurok Ancestral Territory and the Yurok Indian Reservation



Yurok Culture is Strongly Linked to the Klamath River





THE KLAMATH: MAP OF A THREATENED RIVER



Dip net fishing in the early 1900s



The Karuk dip net fishery at Ishi Pishi Falls is one of the last surviving traditional fisheries in America.



Salmon cooked traditionally over a fire pit.



Karuk dip nets are made the same way today as they have been for thousands of years

Iron Gate Dam
river mile: 190
constructed: 1962

Copco Dams 1 & 2
river mile: 198.6 & 196.8
constructed: 1917 & 1925

Fall Creek Dam
river mile: 192
constructed: 1903

J.C. Boyle Dam
river mile: 225
constructed: 1958

Keno Dam
river mile: 233
constructed: 1931

Link River Dam
river mile: 254
constructed: 1921



Scene from a Klamath Tribal village in the Upper Basin after a successful day harvesting fish



Anglers search for an elusive steelhead

DAMMED TO E



Unreachable fish



Steelhead trout widespread distribution in Klamath Basin catchment. Once again thriving in the Upper Basin, even in the face of dams.



Coho salmon once thrived in the tributaries of the Klamath Basin.



Chinook salmon once thrived in the stem and tributaries of the Klamath Basin.



Extinct salmon species were once the main source of salmon in the Klamath Basin. Extinct in the present day from the entire basin.

OREGON
CALIFORNIA

SPENCER CREEK
Klamath River
HENRY CREEK
FALL CREEK
CAMP CREEK
SCOTCH CREEK
SHOVEL CREEK

Upper Klamath Lake



Copco Dam and Reservoir



Iron Gate Dam and Reservoir





Microcystis aeruginosa colony

Impacts To Tribal Members

- ❖ River posted to mouth 2007 & 2012
- ❖ YTEP has received 9 reports from Tribal Members experiencing rashes and flu like symptoms since 2005
- ❖ Perception that risk exists alters behavior = Environmental Justice Issue
- ❖ Cultural Beneficial Use documented on KR by State of CA
- ❖ Yurok Beneficial Uses & Environmental Justice Survey 2008 documented effects of BGA on cultural and subsistence practices



WQ Monitoring Detects a Problem

- ❖ In 2005 USFWS, Karuk and Yurok Tribes detected microcystis in water samples after Klamath River turns bright green





Initial Yurok Response Scientific Data Collection (2005)

Water Sampling

- ❖ Algae ID and counts (cells/ml)
- ❖ Microcystin analysis (micrograms/Liter)
- ❖ Increased sampling frequency and locations

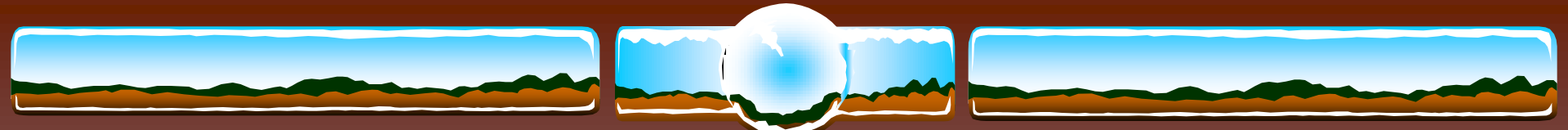
Fish Tissue Sampling

- ❖ 4 Adult Chinook salmon – livers and fillets 2 from Yurok Reservation and 2 from Iron Gate Dam Hatchery (ND)
- ❖ 2 Steelhead – Fillets ND livers one adult (trace) and one 1/2 pounder (0.54µg/g)



PUC Settlement

- ❖ Creates multi-agency Klamath River BGA Workgroup with \$450K
- ❖ Funded monitoring above, in and below Reservoirs 2006
- ❖ \$175K Funded Dr. Pia Moisander from UCSC to perform research in reservoirs to look at limiting factors
- ❖ Monthly conference calls discuss:
 - Monitoring Plans
 - Coordination of Monitoring – Temporal and Spatial
 - Current Conditions and Postings
- ❖ Discussions on methods – Lab and Field algae ID and toxin method and sample preparation guest speakers



Klamath Hydro-electric Settlement Agreement (KHSA) **2009 - Present**

- ❖ \$500K/year for public health and comprehensive
- ❖ Public health sampling for posting in reservoirs and river
- ❖ Sample in reservoirs until posted
- ❖ Sample in river weekly once MSAE is detected
- ❖ PacifiCorp, Karuk and Yurok circulate public health memos to KR BGA workgroup list serve
- ❖ <http://kbmp.net/blue-green-algae-tracker>

KHSA Interim Measure 15: Baseline Water Quality Monitoring Sites 2011





Published Studies

- ❖ *Asarian, E. and J. Kann. 2011. Phytoplankton and Nutrient Dynamics in Iron Gate and Copco Reservoirs 2005-2010. Prepared by Kier Associates and Aquatic Ecosystem Sciences for the Klamath Basin Tribal Water Quality Work Group. 60p + appendices.*
- ❖ *Technical Memorandum Summary of 2005 Toxic Microcystis aeruginosa Trends in Copco and Iron Gate Reservoirs on the Klamath River, CA. Jacob Kann, Ph.D. Aquatic Ecosystem Sciences LLC and Susan Corum Karuk Tribe*
- ❖ *Kann, J. 2006. Microcystis aeruginosa Occurrence in the Klamath River System of Southern Oregon and Northern California. Report for the Yurok Tribe Environmental Program and Fisheries Department, Klamath, CA by Aquatic Ecosystem Sciences, Ashland, OR. 26 p. (1.4 Mb)*
- ❖ *Technical Memorandum Toxigenic Microcystis aeruginosa bloom dynamics and cell density/chlorophyll a relationships with microcystin toxin in the Klamath River, 2005-2008. Jacob Kann, Ph.D. Aquatic Ecosystem Sciences LLC and Susan Corum Karuk Tribe*
- ❖ *Technical Memorandum Microcystin Bioaccumulation in Klamath River Freshwater Mussel Tissue: 2009 Results. Jacob Kann, Ph.D. Aquatic Ecosystem Sciences LLC, Susan Corum Karuk Tribe, Ken Fetcho Yurok Tribe*
- ❖ *Technical Memorandum Preliminary 2010 Microcystin Bioaccumulation Results for Klamath River Salmonids. Jacob Kann, Ph.D. and Lisa Bowater, Crystal Bowman and Grant Johnson*
- ❖ *Recreational exposure to microcystins during algal blooms in two California lakes Backer LC, McNeel SV, Barber T, Kirkpatrick B, Williams C, Irvin M, Zhou Y, Johnson TB, Nierenberg K, Aubel M, LePrell R, Chapman A, Foss A, Corum S, Hill VR, Kieszak SM, Cheng YS. Toxicon. 2010 May;55(5):909-21.*
- ❖ *Nutrient limitation of Microcystis aeruginosa in northern California Klamath River reservoirs Pia H. Moisander, Mari Ochiai, Andrew Lincoff. Harmful Algae (04 May 2009)*
- ❖ *Diversity of Microcystis aeruginosa in the Klamath River and San Francisco Bay delta, California, USA (Citations: 1)PH Moisander, PW Lehman, M Ochiai, S Corum Journal: Aquatic Microbial Ecology - AQUAT MICROB ECOL , vol. 57, pp. 19-31, 2009*
- ❖ *Population Turnover in a Microcystis Bloom Results in Predominantly Nontoxigenic Variants Late in the Season Connie S. Bozarth, I Andrew D. Schwartz, Jonathan W. Shepardson, Frederick S. Colwell, and Theo W. Dreher APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Aug. 2010, p. 5207-5213*
- ❖ *Final Report to the U.S. Environmental Protection Agency on Cyanotoxin Accumulation in Fish and Freshwater Mussels of the Klamath River Water Quality Cooperative Agreement CP 96941301 State Water Resources Control Board Division of Water Rights*



Remaining Issues

- ❖ Long term funding for monitoring and research
- ❖ Health Effect Documentation
- ❖ Past Hum Co. press release stated that no documented health effects to humans has occurred
- ❖ Humboldt County Health Officer Dr. Ann Lindsay to the Del Norte Medical Society Bulletin requesting that illnesses be reported to Humboldt County Environmental Health Specialist – vacant position
- ❖ YTEP wrapping up EPA STAR grant to look at contamination in ecosystem and organisms to determine if risks exist to Tribal Members = linkages to health of Tribal Members?
- ❖ Interim Environmental Justice Issues = dams WQ impacts affects CUL beneficial uses due to unique association with the River ongoing exposures, latest concerns over algaecide applications in Copco



Acknowledgements

- ❖ Water Boards Training Academy
- ❖ Karuk Tribe
- ❖ USEPA
- ❖ USFWS
- ❖ NCRWQCB
- ❖ SWRCB
- ❖ BOR
- ❖ Humboldt County
- ❖ Del Norte County
- ❖ Dr. Jake Kann
- ❖ Dr. Jim Sweet
- ❖ Wright State University – Dr. Carmichael
- ❖ CDFG Rancho Cordova Water Pollution Lab
- ❖ USEPA Region 9 Lab
- ❖ PacifiCorp
- ❖ KBMP
- ❖ UC Davis