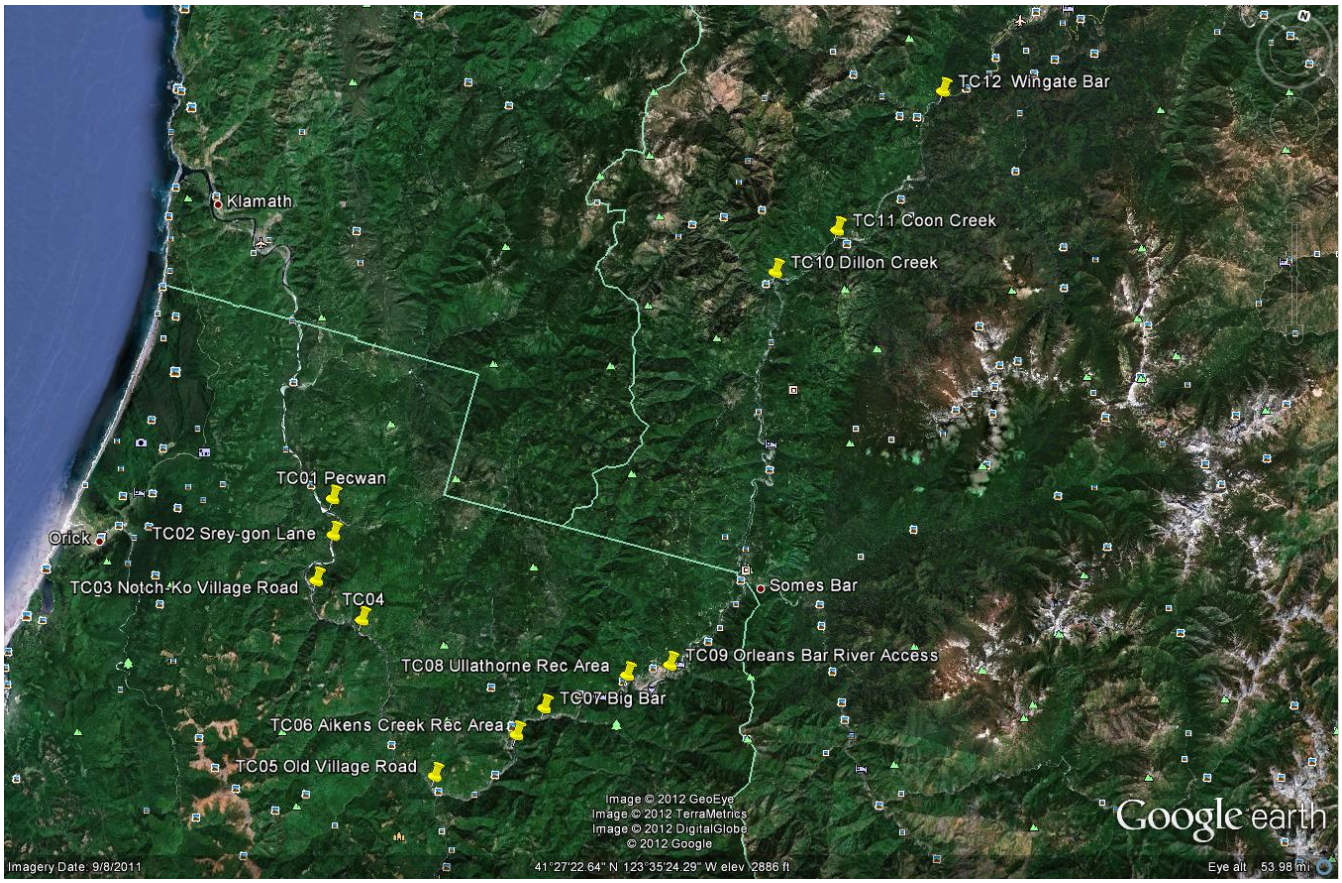
'Tully Creek' Longitudinal Water Sampling

July 2012

There are five monitoring sites in the lower Klamath River at which river water is collected weekly by an automated sampler. The water samples are filtered and the density of *Ceratomyxa shasta* is measured by quantitative PCR. Parasite levels at the lowermost site (at ~60 Rkm), Tully Creek, have increased over the past several years to surpass those detected at previously high sites, such as Beaver Creek (KBC).

To investigate the extent of the high parasite densities at the Tully Creek site, we conducted longitudinal water sampling, starting at the lowermost road-accessible location downstream of Tully Creek (~38.4Rkm) and finishing upstream of the index site at Orleans (~90Rkm). Water was collected from four sites downstream of Tully Creek and from four sites upstream of Tully Creek (between Tully Creek and Orleans). We also sampled at Orleans and included two sites upstream of Orleans that overlapped with the Infectious Zone study conducted in 2009-2011 (Coon Creek and Wingate Bar; see map below). All sites were accessible by vehicle and foot. On July 19, three 1L samples were collected from 12 sites (including one tributary, Dillon Creek), kept cool on ice and filtered within 24 hours of collection, then frozen. The filter papers were dissolved in acetone and any DNA present was extracted using a kit (Hallett et al. 2012). Samples were tested for *C. shasta* DNA using qPCR (Hallett and Bartholomew 2006).



Ceratomyxa shasta was detected in water samples collected from all mainstem sites; levels ranged between 1 and 10 spores/L (Figure 1). This was in contrast to the tributary, Dillon Creek (site 10), where less than 1 spore/L was measured. Data from our index sites is included for comparison; Tully Creek ~1 spore/L, KBC <1 spore/L (Figure 2). Index samples are collected with an automated sampler (ISCO) and parasite levels are typically lower in these 24-hour composites than in the single timepoint manual samples.

The parasite was present throughout the lower Klamath River and there was no obvious focal point. Polychaete surveys, sentinel fish studies and wild fish surveys would need to be conducted to determine the source of the parasites and whether the stages are actinospores or myxospores, or a combination of both.

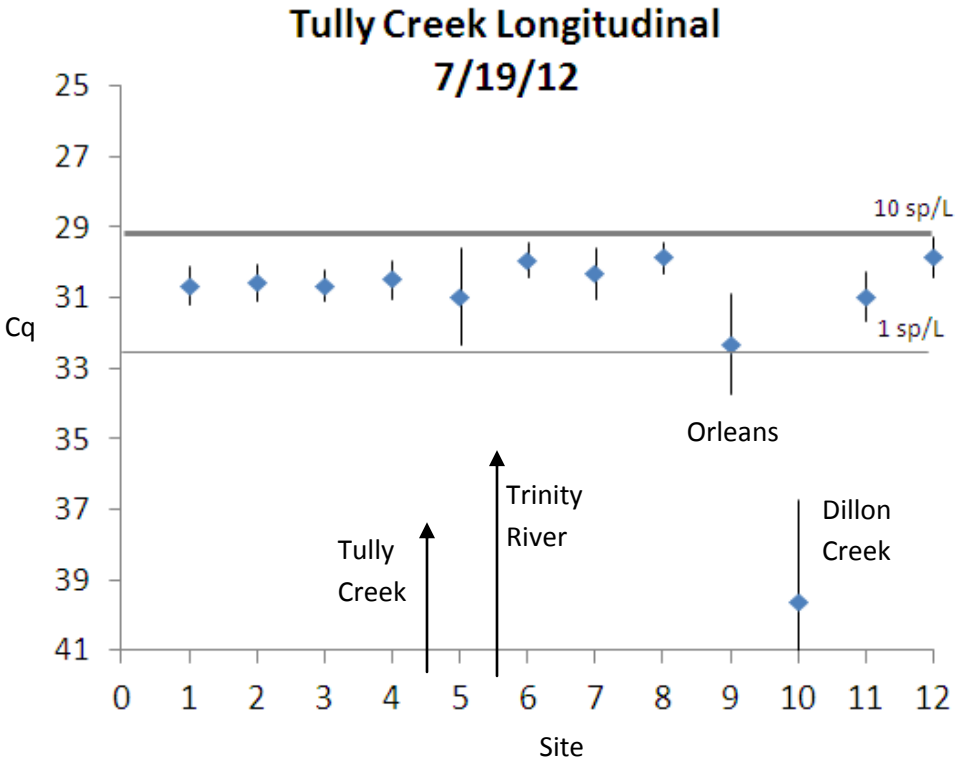


FIGURE 1. Density of *Ceratomyxa shasta* in lower Klamath River water samples collected July 19. Each data point is the average of three 1L replicate samples collected manually.

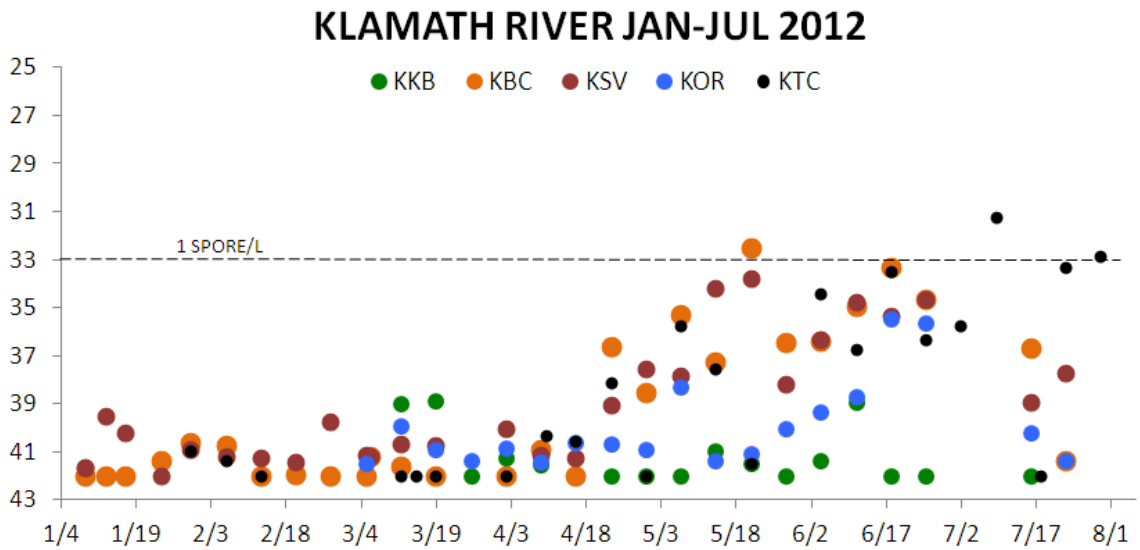


FIGURE 2. Density of *Ceratomyxa shasta* in river water samples collected by an automated sampler at five index sites. Each data point is the average of three 1L replicates.

Site Descriptions

SITE 1: TC01A-C Pecwan 41°20.921N 123°52.102W
=Upstream of 'The End of The Road' and downstream of the confluence with Pecwan Creek, from 169 (Martin's Ferry Road) park at pullout at mile marker 13.58 and follow stock paths down to river, sample sand/cobble area upstream of algae and large bar. 1:10pm

SITE 2: TC02 Srey-gon Lane 41°19.533N 123°51.512W
=upstream of Pecwan confluence, at mile marker 15.50 drive down Srey-gon Lane to river, turn left on boat ramp, sand/pebble bar, 1:35pm.

SITE 3: TC03 Notch-Ko Village Road 41°17.558N 123°51.757W
=at mile marker 19.80 follow Notch-Ko Village Road to river, then turn right and park at about 100 yards. 2pm.

SITE 4: TC04 41°16.526N 123°48.813W
=about 200 yards downstream of mile marker 23.48, opposite 'cow sign', follow unmarked steep gravel road down to river; sand on rock, deep, smooth, green algae on rocks, fish swimming. 2:35pm

SITE 5: TC05 Old Village Road 41°11.278N 123°42.768W
=downstream of Weichpec and Hwy 96 bridge, follow Old Village Road down to coarse sand bar, sample water downstream of confluence with Trinity River (ie mixed water). 3:45pm.

SITE 6: TC06 Aikens Creek Rec Area 41°13.786N 123°39.130W
=off Hwy 96, about 28.3 mile marker, drive down dirt path to campsite then walk about 300 ft across rocks/boulders to water; water sampled downstream of large eddy; large rocks, sand in between, brown algae. 4:10pm

SITE 7: TC07 Big Bar 41°15.111N 123°38.089W
=off Hwy 96 at mile post 30.50, easy access, drive down to rocky/cobbled bar

SITE 8: TC08 Ullathorne Rec Area 41°17.270N 123°34.259W
=off Hwy 96 at mile post 36.35, easy access, drive down to sandy shore at bottom of boat ramp, broad eddy

SITE 9: TC09 Orleans Bar River Access 41°18.133N 123°32.189W
=off Hwy 96 in town, short drive but had to back out due to washout/no turn around at bottom; broad, calm sand. 5:15pm

SITE 10: TC10 Dillon Creek 41°34.521N 123°32.355W
=off Hwy 96, park off main road, scramble down bank and cross rocky outcrops then rocks/boulders to water; couldn't safely access Klamath River without crossing deep/swift Dillon Creek, the Klamath was low and the bar was dominated by Dillon Creek water; sampled Dillon Creek water. 6:15pm

SITE 11: TC11 Coon Creek 41°36.818N 123°29.743W
=off Hwy 96, easy access (better than Dillon Creek), drive down to river. 6:35pm

SITE 12: TC12 Wingate Bar 41°43.357N 123°26.230W
=off Hwy 96 at mile post 33.88, easy access, drive down to river, sandy/cobbley, good mixing. 7pm

Collecting river water at site 1 in the lower Klamath River, downstream of Pecwan confluence.
View is upstream.

Acknowledgements

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References

Hallett, S. L., and Bartholomew, J. L. 2006. Application of a real-time PCR assay to detect and quantify the myxozaon parasite *Ceratomyxa shasta* in river water samples. *Diseases of Aquatic Organisms* 71:109-118.

Hallett, S. L., Ray, R. A., Hurst, C. N., Holt, R. A., Buckles, G. R., Atkinson, S. D., and Bartholomew, J. L. 2012. Density of the Waterborne Parasite, *Ceratomyxa shasta*, and Its Biological Effects on Salmon. *Applied and Environmental Microbiology* 78:3724-3731.