CERATOMYXA SHASTA
2008 PRELIMINARY RESULTS
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Investigator: Jerri Bartholomew,
Department of Microbiology, Oregon State University

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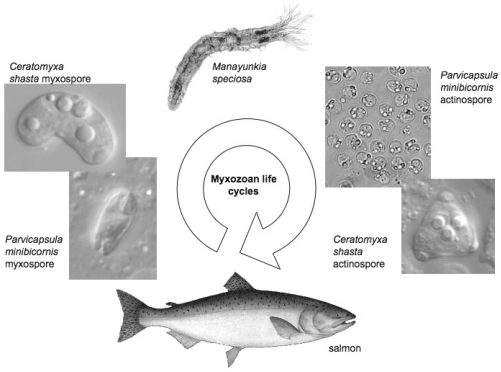


Note: Results reported here are preliminary; studies and analyses are not complete

SENTINEL FISH EXPOSURES:
Sentinel exposures in 2008 are being conducted following the same protocol used in previous years to determine:

1. How infection levels this year compare with levels in previous years.
2. If the distribution of the parasite has changed.
3. The relative susceptibility of Chinook and coho salmon
4. The effects of temperature on disease progress in Chinook, coho and steelhead
5. The relationship between parasite numbers measured in water samples and biological effects in the different fish species.

Exposures were conducted May 13-18 and June 17-20 for ~72 hrs at locations in the upper and lower river (**Figure 1**). Exposure sites were those used in previous study years with the following substitutions:

R-Ranch was replaced with Klamath River Country Estates (Klamathon)
Tully Creek was replaced with Young's Bar

Rainbow trout and fall Chinook salmon (IGH stock) were held at all sites; coho salmon (IGH stock) were held only at sites below IGD. After exposure fish were held at the Oregon State University Salmon Disease Laboratory at average Klamath River temperatures measured during exposure. In May ambient water temperatures averaged 16˚C and 18˚C in June. These temperatures were lower than in 2007 during the same period. Results are presented in **Table 1** and **Figures 2 and 3**.

Preliminary summary of June and July sentinel results:

- The hot zone for severe infections of ceratomyxosis occurred in the Klamath River below Iron Gate Dam near Beaver Creek. This is in agreement with previous year's results, showing that the infectious area is stable.
- In both May and June, fall Chinook juveniles held at Beaver Creek suffered greater than 90% loss after 72 h exposure in the river and then held at 16-18°C; this is significantly higher than in previous years.
- Mortality in coho salmon held at Beaver Creek during May and June was greater than 80%; this is significantly higher than in previous years.
- Losses in fall Chinook and coho salmon decreased downstream of Seiad Valley, as in previous years.

- Non-native rainbow trout had high loss at all sites except for Keno Eddy (above JC Boyle Dam).
- As in past years, Iron Gate Hatchery fall Chinook did not suffer loss from *Ceratomyxa* in the lower Williamson River despite the high mortality in rainbow trout.

Figure 1. Map of sites for exposures of sentinel fish and collection of water samples in 2007.

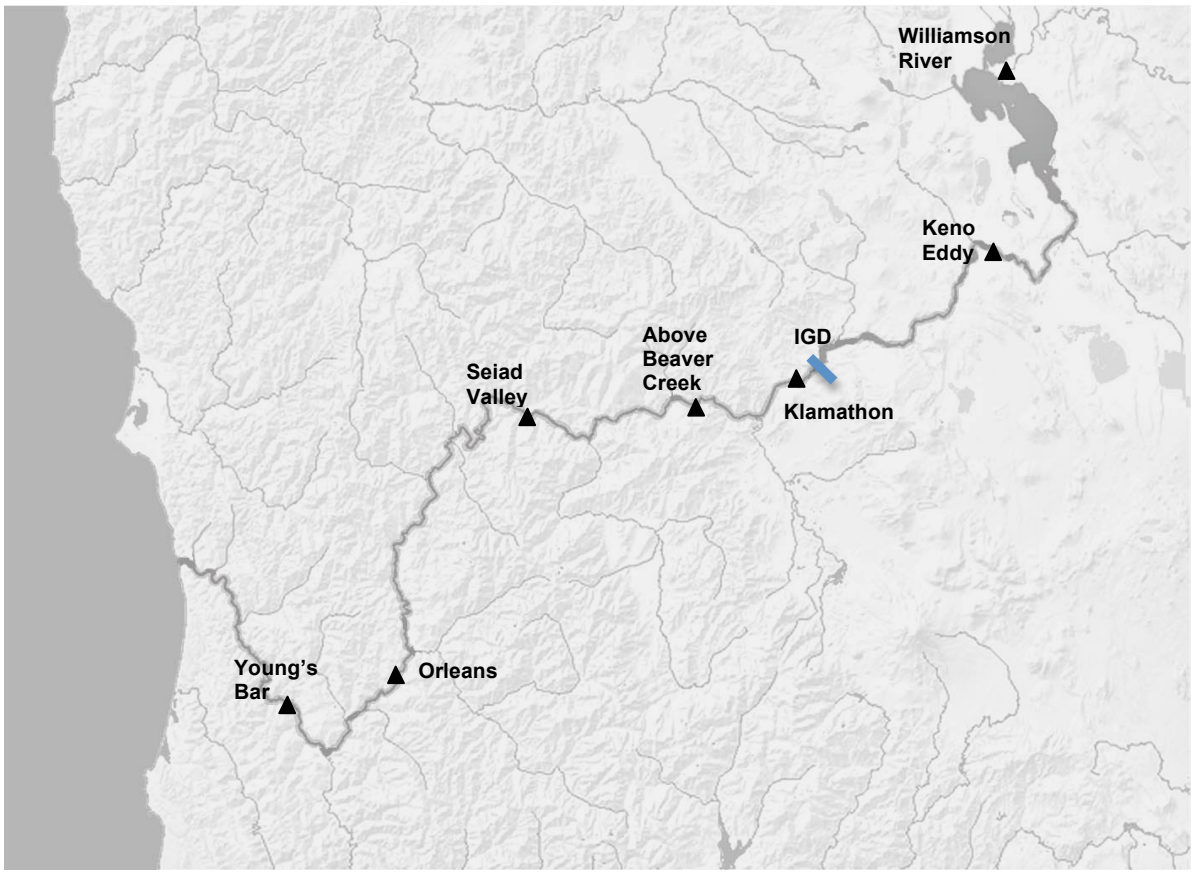


Table 1. Per cent loss of fish exposed at various Klamath River sentinel sites for 72 hours in May or June 2008 and subsequently held for 65 or more days at the Salmon Disease Laboratory in a 16-18°C water supply. ND = no fish were exposed.

Exposure sites	Rainbow May	Rainbow June	Chinook May	Chinook June	Coho May	Coho June
Williamson River Resort	100.0	100.0	2.4	0.0	ND	ND
Keno Eddy	9.3	0.0	0.0	0.0	ND	ND
Klamathon	92.8	97.4	0.0	0.0	21.4	20.0
Beaver Creek	100.0	100.0	92.3	98.6	82.9	88.6
Seiad Valley	100.0	100.0	46.8	62.5	46.0	87.5
Orleans	95.1	97.6	2.4	25.0	20.5	12.5
Young's Bar	ND	100.0	ND	0.0	ND	20.0

Figure 2. Percent mortality of susceptible rainbow trout and Iron Gate Hatchery Chinook and coho salmon held at exposures sites in the Klamath River in May 2008. Coho salmon were not held at the Williamson River and Keno sites in the upper basin and no groups were exposed at Young's bar in May

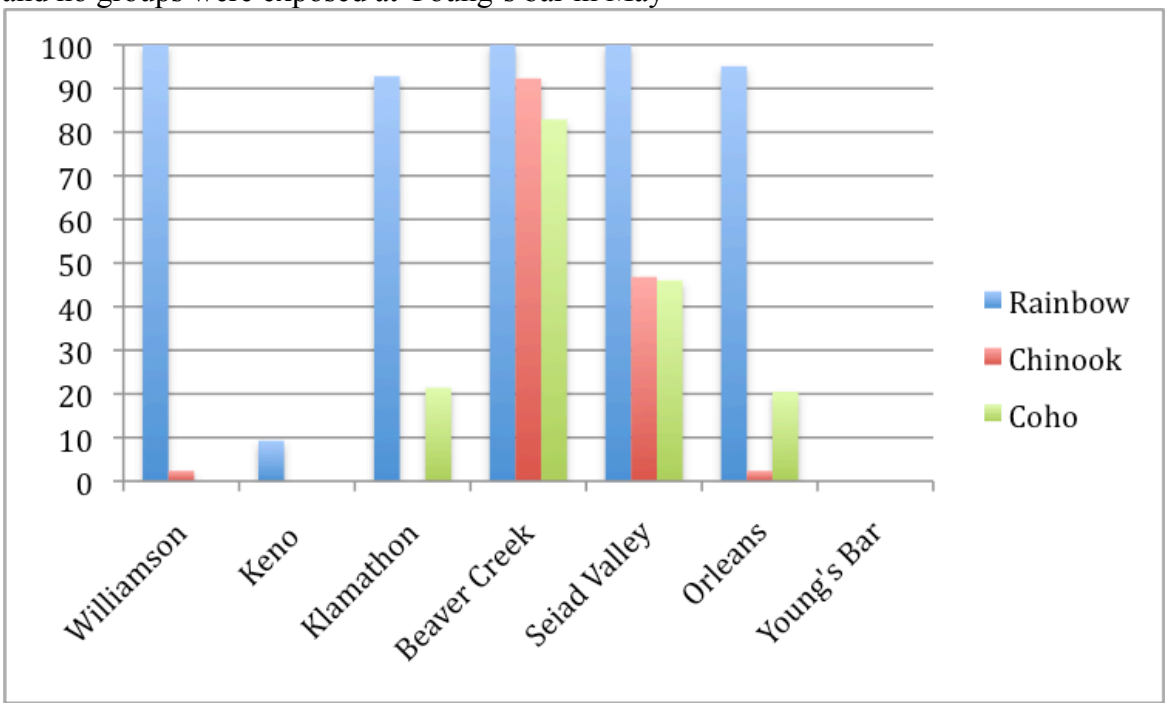
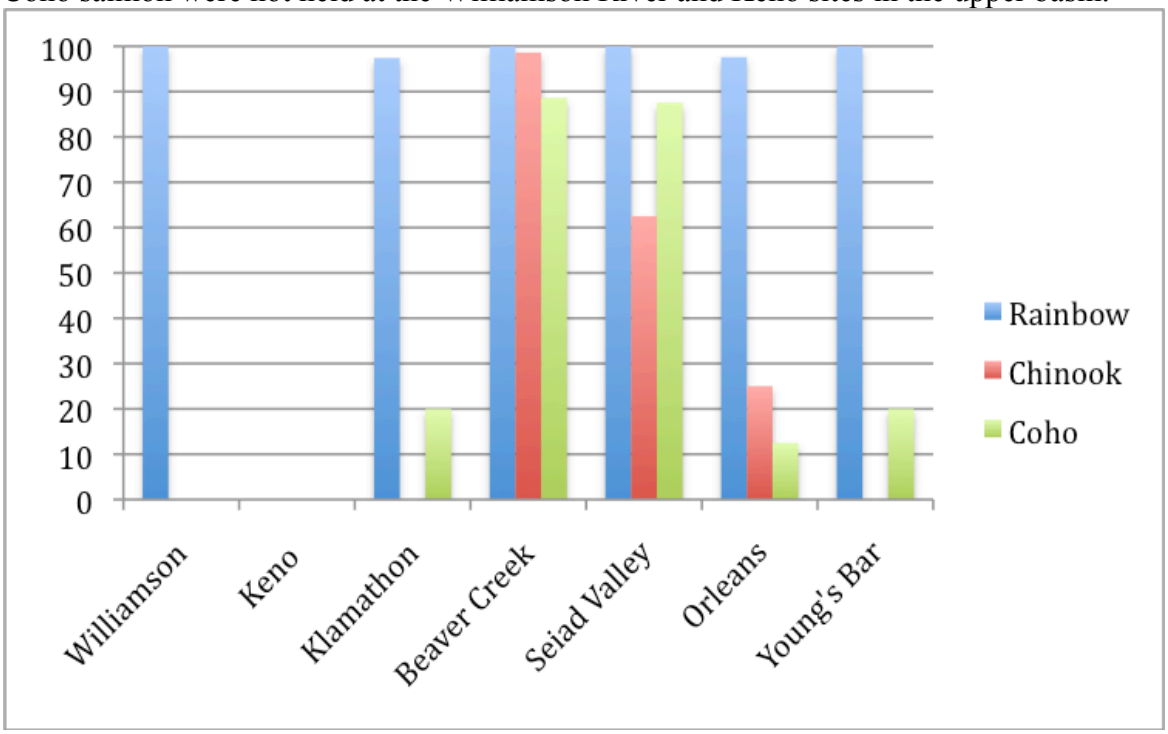


Figure 3. Percent mortality of susceptible rainbow trout and Iron Gate Hatchery Chinook and coho salmon held at exposures sites in the Klamath River in June 2008. Coho salmon were not held at the Williamson River and Keno sites in the upper basin.



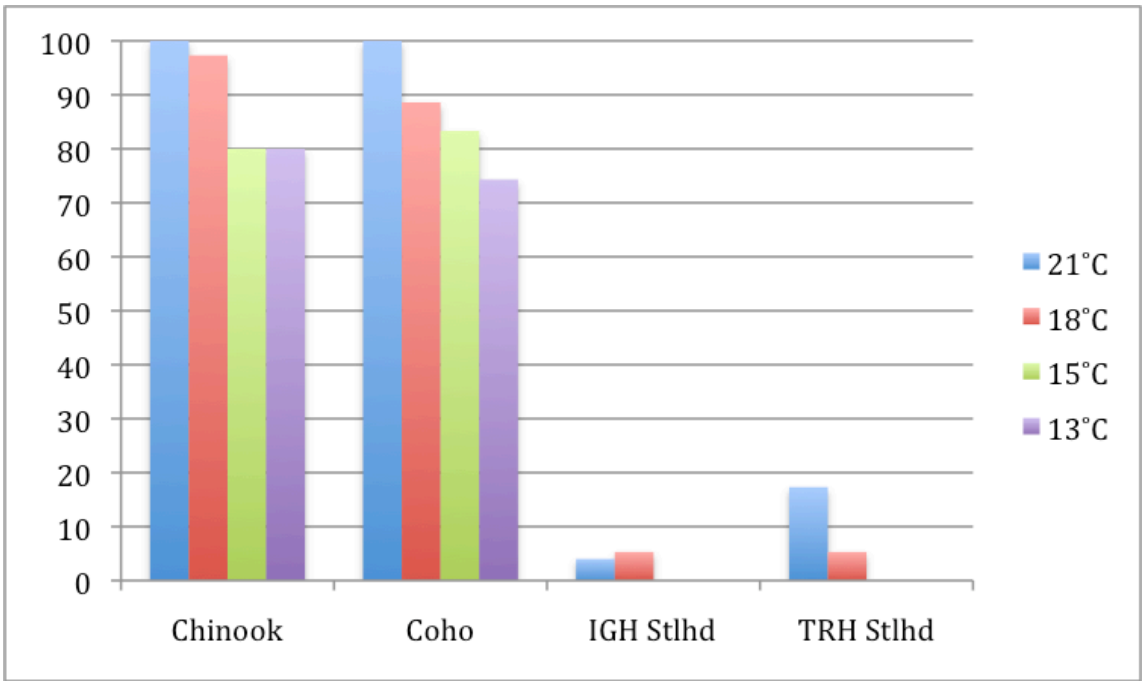
Effects of Water Temperature

At the Beaver Creek site, in June, 200 each of IGH stocks of Chinook and coho salmon and steelhead, and of Trinity River Hatchery (TRH) steelhead were exposed for 3 d then returned to the OSU-SDL. Each stock was divided randomly into 8 tanks, then after 6d at 13˚C, temperatures were increased to 15, 18 and 21˚C for 2 tanks/stock. Two tanks remained at 13˚C. Results are presented in **Figure 4.**

Preliminary summary of water temperature results:

- IGH fall Chinook and coho suffered very high loss at all four temperatures tested. The 72 h exposure in the Klamath River during June 17-20 demonstrated a severe challenge level at that time.
- The total loss for each species in the post-exposure rearing of the fish was not greatly reduced by the lower water temperature of 13°C. Also, all groups were held at 13°C for 6 days after exposure due to equipment failure but even with this cool water exposure prior to being elevated for the remaining holding at 21, 18 or 15°C, losses from *C. shasta* was severe.
- Both the IGH and TRH steelhead juveniles were more resistant to *C. shasta* infection, which may indicate a somewhat lower resistance for this stock. At 21°C loss in the TRH steelhead was 17.3 % compared to 4.0% for IGH steelhead. No difference in loss in these steelhead was observed at 18°C.

Figure 4. Mortality in Iron Gate Hatchery stocks of Chinook and coho salmon and steelhead and Trinity River Hatchery steelhead following exposure to *C. shasta* for 3 d near Beaver Creek then subject to increased water temperatures.



WATER SAMPLING:
Water samples were taken to determine:

1. How infection levels this year compare with levels in previous years.
2. If the distribution of the parasite has changed.
3. The relationship between parasite numbers measured in water samples and biological effects in the different fish species.

Continuous water samplers were placed at each of the sentinel sites and programmed to collect water every 2 h over a 24 hour period, twice weekly beginning at the end of March. This was done to provide higher resolution of parasite levels than in previous years. Samples were collected and filtered by the Karuk Tribe (Susan Corum, Water Resources Coordinator, Karuk Tribe Dept. of Natural Resources), then shipped to OSU for final processing and analysis by quantitative PCR (QPCR). In addition, samples were collected from tributaries every other week and from upriver sentinel sites during fish exposures. Preliminary results are presented in **Figures 5 and 6**.

Preliminary summary of water sampling results:

- Parasite numbers in water samples was higher in 2008 than in previous years when parasite numbers were measured: this supports the higher mortality in sentinel exposures.
- The highest abundance of parasite spores was at Beaver Creek, and levels in June were only slightly higher than in May. Estimates of actual spore numbers during this period approached 100 spores/liter.
- Parasite numbers immediately below IGD fluctuated greatly. All other sites showed a pattern of increasing spore numbers beginning in late April, peaking in mid-May and remaining stable through June.
- No spores were detected in water samples taken in May from the Scott, Shasta or Salmon Rivers.

Figure 5. *Ceratomyxa shasta* abundance in water samples collected from sentinel exposure locations in May and June 2008 and quantified using QPCR. KKB = Klamathon; KBC = Beaver Creek; KSV = Seiad Valley; KOR = Orleans. Approximate numbers of spores per liter of water measured are indicated to the right of the graph

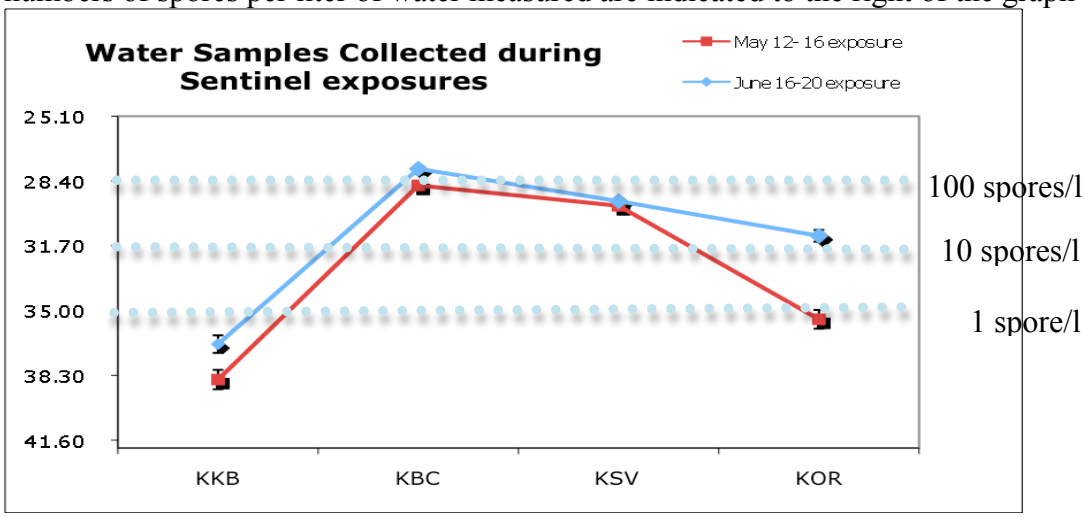
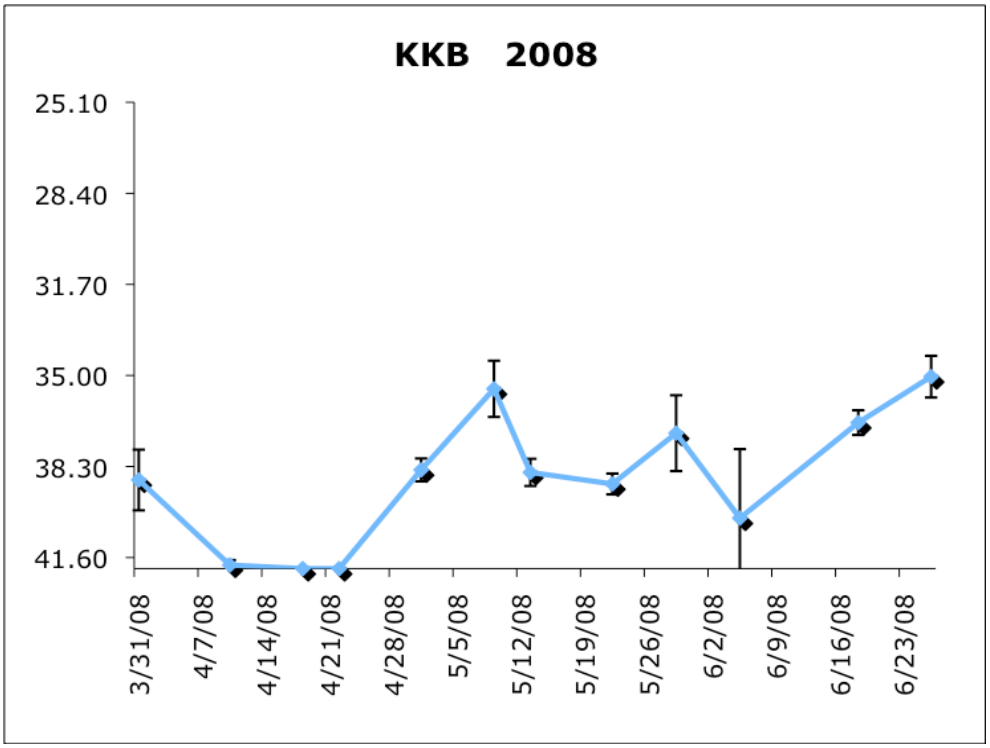
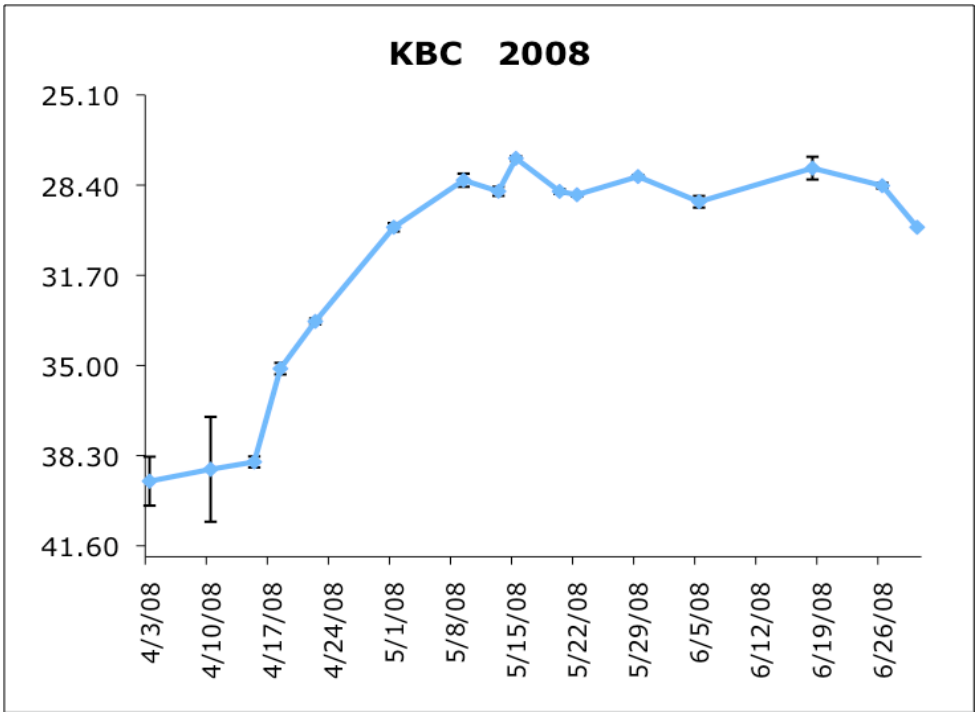
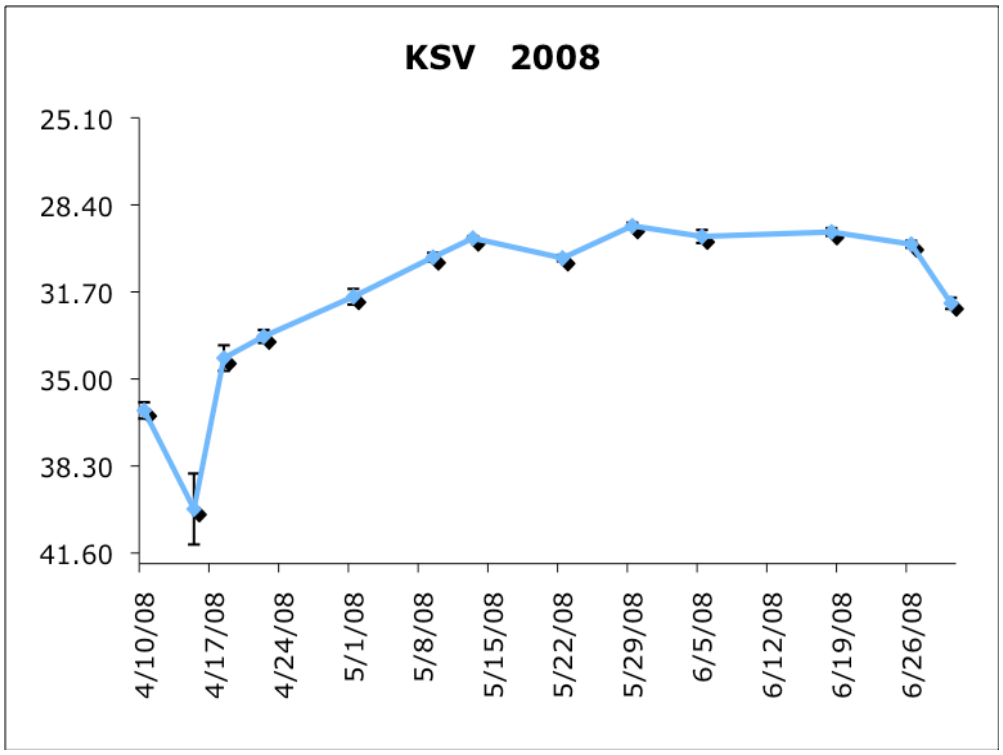
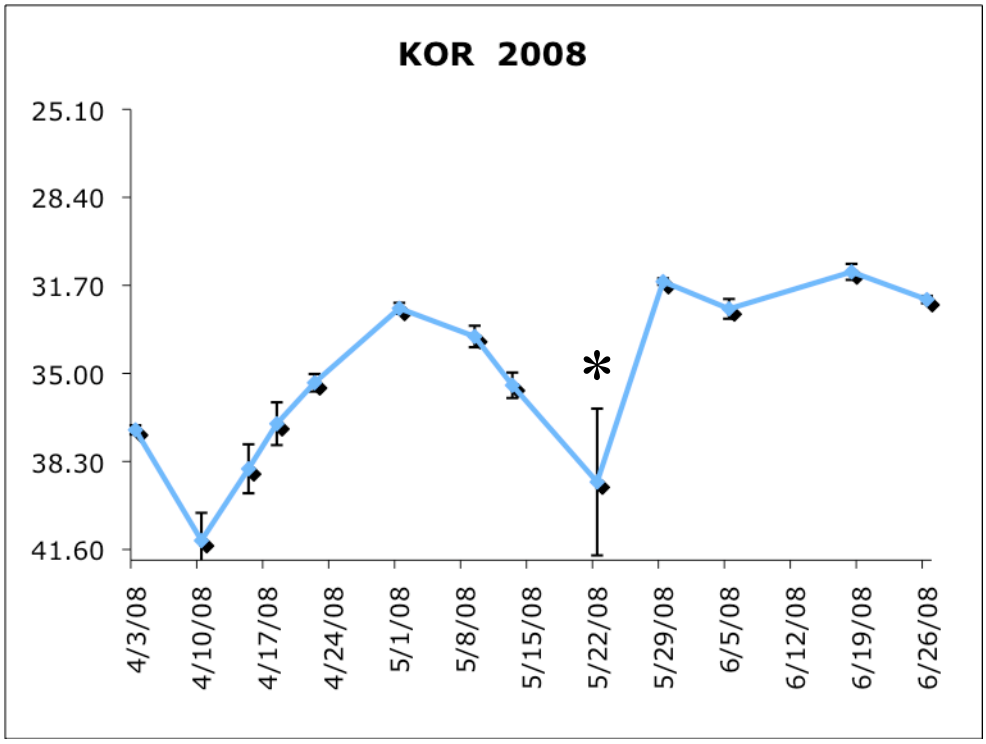


Figure 6. *Ceratomyxa shasta* abundance in water samples collected from sentinel exposure locations from April through June. Samples were collected twice weekly. A QPCR value (left axis) of 35 is roughly equal to 1 spore/l. Every 3.3 value increase equates roughly to a 10-fold increase in spore numbers. Sites are ordered from upriver downstream: KKB = Klamathon; KBC = Beaver Creek, KSV = Seiad Valley; KOR = Orleans









* This sampling period corresponds with increased discharge as measured at Somes Bar (Salmon River) and Orleans from approximately May 26-22, possibly explaining the variability and decreased parasite numbers