Ceratomyxa Shasta Fact Sheet - 2002

GENERAL

- *Ceratomyxa shasta* is a microscopic myxosporean protozoan parasite that afflicts salmonid fish of the Pacific northwest (Bartholomew et al. 1989)
- First observed in Crystal Lake Hatchery, Shasta County, California (1948)
- Distribution in Pacific Northwest (Idaho, Oregon, Washington, Northern California, British Columbia, Alaska)
- The reported distribution of *C. shasta* in the PNW has expanded. This may not be a true increase in distribution since the parasite does not colonize readily - expanded occurrences may be the result of more sensitive detection techniques.

LIFE HISTORY

- Intermediate host is a freshwater polychaete (first identified from periphyton samples attached to fresh water mussel - *no direct link to the freshwater mussel or the periphyton has been determined* (Bartholomew et al. 1997)
- Infection through contact with infectious stage (actinospore) found in water column
- Neither horizontal (fish to fish), or vertical (fish to egg) transmissions have been documented in laboratory testing
- Spore size 14-23μm long 6-8μm wide
- Spores released back into freshwater system following salmonid mortality
- Complete life cycle, host and vector interaction, not fully understood (especially the ecology of the polychaete host) (Bartholomew pers com. 2002)

INFECTION

- Clinical indications of infection include lethargy, loss of body mass, darkening, ascites, exopthalmia, kidney pustules (vary by salmonid species and life stage)
- Internally affects entire digestive tract, liver, gall bladder, spleen, gonads, kidney, heart, gills, and muscle (vary by salmonid species and life stage)
- Adult chinook salmon (*O. tshawytscha)* mortality caused by intestinal perforations and co-occurring bacterial infections

- Research indicates infection potential is enhanced when water temperatures are high, water flow are low, and/or numbers of infectious *C. shasta* are relatively high
- Infection rates appear to be higher in or below reservoir environments than riverine(Variable) See Table Below

System	Occurrence Upstream of Reservoirs	Occurrence in Reservoir	Occurrence Downstream of Reservoirs
Cowlitz	NA	Low	High
Willamette	None	None	High (downstream of Corvallis)
Deschutes	High	Low (increase in Simtustus)	High

DIAGNOSIS / TREATMENT

- Detection of infection is achieved either microscopically, by visual detection of parasite spores in intestinal scrapings, by detection of parasite DNA using a specific polymerase chain reaction assay, or by examination of histological sections using monoclonal antibodies and fluorescein or enzyme conjugated secondary antibodies (Palenzuela et al. 1999; Fox et al. 2000; Bartholomew 2001).
- Treatment of incoming hatchery water supplies using a combination of ultraviolet irradiation, chlorination, and sand filtration or by ozonation, has been successful in decreasing infections in these facilities

TEMPERATURE DEPENDENCE

- Cold temperatures and salinity may reduce progress of disease, but not eliminate infection
- Progression of infection and mortality is temperature dependent (higher temperature yields increased disease progression / quicker mortality)

Rainbow trout temperature related mortality (Udey et al. 1975)

Temperature (Celsius)	Mortality in Days
6.7	155
23.3	14

DISEASE RESISTANCE

- Salmonid stocks exhibit varied resistance to *C. shasta* (co-evolutionary resistance)(reviewed by Bartholomew 1998)
- Resistance is variable and may be compromised by high levels of exposure to *C. shasta* and increased water temperatures
- Salmonid stocks resistant to *C. shasta* not necessarily myxosporean resistant & capable of infection by *M. cerebralis* (whirling disease)

KLAMATH BASIN

- *C. shasta* is most significant disease issue for outmigrating juvenile chinook and steelhead (O. mykiss) in the Klamath Basin (Foott pers com. 2002, Hemmingsen pers com. 2002)
- Surveys for *C. shasta* have been performed since late 1980's
- Live box studies have shown *C. shasta* to inhabit the entire length of the Klamath River (live box studies) (Foott pers com. 2002)

- Concentrations of *C. shasta* appear to decrease from the headwaters to the mouth of the Klamath River (Foott pers com. 2002)
- Lower reaches of Williamson & Sprague Rivers contain *C. shasta*
  Sprague River up to Trout Creek
  Williamson River up to Kirk Springs
- Redband rainbows *(O. m. newberrii)* in Williamson found to be variably resistant
- Two populations of rainbow trout are found in Williamson (Hemminson pers com. 2002)
  Population #1 above Kirk Springs – susceptible to *C. shasta*
  Population #2 below Kirk Springs – resistant to *C. shasta*
- Endemic chinook salmon do not appear to be affected by *C. shasta* when water temperatures remain below 60 °F (Foott pers com. 2002)
- Highest mortalities have occurred in outmigrating juvenile chinook salmon

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