Lower Klamath River
Adult Chinook Salmon Pathology Monitoring, 2005

Klamath River Division
Yurok Tribal Fisheries Program
Hwy. 96, Route Box 196
Hoopa, CA 95546

Ryan Benson

Technical Memorandum KR-05-01
December 2005

INTRODUCTION

The primary cause of the 2002 lower Klamath River fish kill, which resulted in a minimum of 32,553 dead Chinook salmon, was an epizootic caused by the protozoan parasite *Ichthyophthirius multifiliis* (Ich) and the bacterium *Flavobacterium columnare* (Columnaris) (Foott 2002, CDFG 2003a). Factors such as low flows, high water temperatures, high fish density, and long residence time contributed to the epizootic outbreak (CDFG 2003a, YTFP 2004a). In 2003 and 2004 the Yurok Tribal Fisheries Program (YTFP), the USFWS Arcata Fish and Wildlife Office (AFWO), and the Karuk Department of Natural Resources (KDNR) quantified the incidence and severity of Ich infection in fall-run Chinook salmon during the late summer and early fall. The purpose was to detect significant increases in severity of Ich or Columnaris infection to determine if an Emergency Response Release from Lewiston Dam would mitigate the effects of a potential fish kill (YTFP 2004b, 2005).

Ich is a protozoan parasite found throughout the world and is endemic to the Klamath River. Although in-river temperatures were favorable to the Ich reproductive cycle in past years, 2002 was the only year on record to experience an epidemic (YTFP 2004a). The purpose of the current pathology monitoring effort was to collect baseline data on background levels of Ich. Ultimately, we intend to collect a long-term data set, inclusive of different water year types and Chinook salmon run sizes, in order to monitor conditions leading to potential future epizootic outbreaks in the Klamath River.

METHODS

Beginning 6 September, 2005, field personnel began sampling adult Chinook salmon for levels of disease. Sampling was conducted on the mainstem Klamath River from upstream of the Blue Creek confluence (rkm 26.5) upstream as far as Weitchpec, below the Trinity River confluence (rkm 69.5). The lower sites were sampled early in the season, and upstream sites were sampled later as the fall run migrated upriver and down-river captures declined.

We employed stationary gillnet sets and drifts, using 50'-75' monofilament gill nets, 12' deep, with 7 ¼" mesh size. Drift sets were conducted by setting a net perpendicular to the thalweg of the river, which was then allowed to float downstream with the current. Samplers drifted next to the net in a jet boat to ensure it was positioned correctly or did not get tangled. Drifts were 300'- 600' in length. Stationary sets were typically deployed in back eddies. The float line was secured to the bank and the net was stretched perpendicular to the river flow. Stationary sets were left for two to seven hours per night. Field crews attended nets for the entire duration, checking them every 30 to 60 minutes, or whenever a salmon appeared to be entangled or captured. Generally, drift sets were conducted in the late afternoon and early evening when daylight was available. Stationary sets were deployed near dusk.

Upon capture, live or recently expired adult Chinook salmon were examined externally for evidence of Columnaris infection and general body condition. Samplers then removed the outside gill arch from the left and right sides and stored them in plastic bags for examination. Gill arch samples were examined immediately or stored on ice for analysis within one hour of removal. Each gill arch was examined using a 40X dissecting scope. Any Ich trophozoites observed on the gill tissue samples were enumerated and recorded.

We estimated the mean monthly discharge for September based on records from the U.S. Geological Survey (USGS). Records were obtained from gauges on the Klamath River near Klamath, CA (KNK, USGS 11530500), below Iron Gate Dam (KIG, USGS 11516530), and on the Trinity River below Lewiston Dam (LWS, USGS 11525500). These records are provisional and subject to change, however, they provide an adequate estimate of Klamath River discharge.

RESULTS

From 6 September to 7 October, 2005, YTFP personnel sampled a total of 112.25 set net hours and 13 drifts. The number of adult Chinook salmon sampled was 85. Weekly samples ranged from 9 to 25 adults per week. For the duration of the monitoring period, not a single incidence of Ich or Columnaris was documented (Table 1). Generally, adult Chinook salmon appeared very healthy. Mean daily flows in the lower Klamath River and discharge from upriver dams is presented in Figure 1.

Table 1. Results of the adult fall Chinook salmon pathology monitoring effort on the lower Klamath River, California, in 2005.

Sample Week	Sample size	Number of Ich	Number of Columnaris	Effort	
				net hours	drifts
4 Sept - 10 Sept	13	0	0	6	6
11 Sept - 17 Sept	9	0	0	17.25	0
18 Sept - 24 Sept	20	0	0	37.25	7
25 Sept - 1 Oct	18	0	0	22.75	0
2 Oct - 8 Oct	25	0	0	29	0

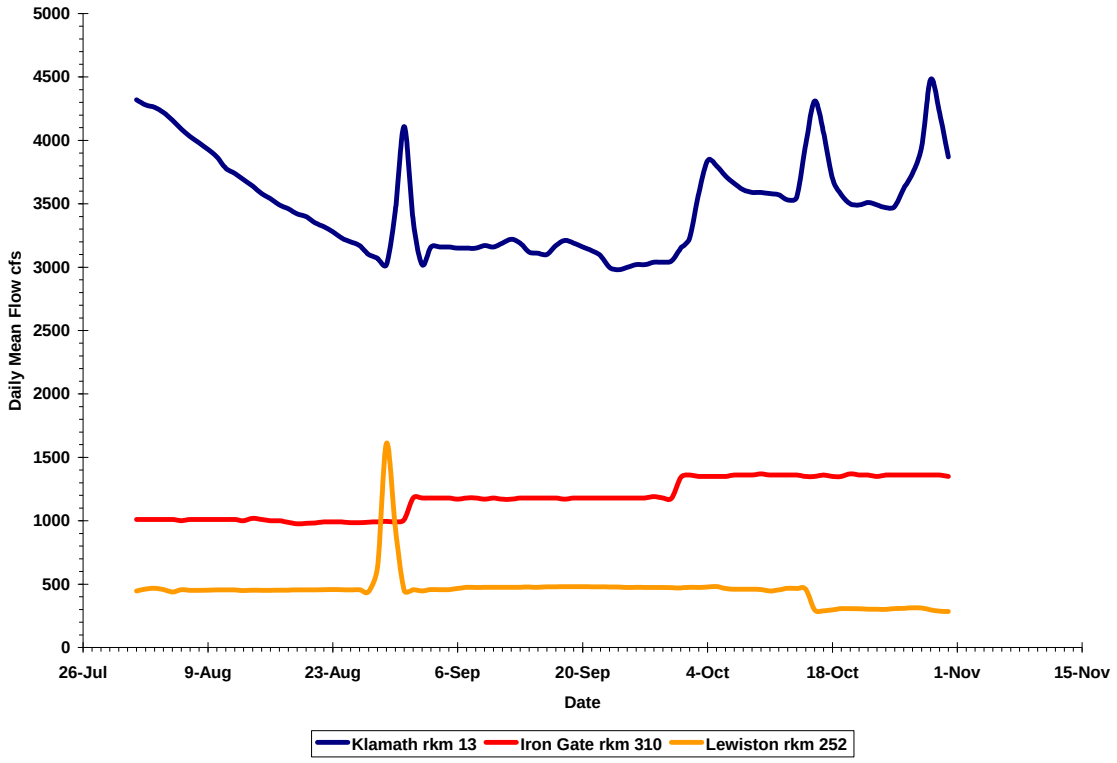

Figure 1. Mean daily discharge (cfs) of the Klamath and Trinity rivers during the adult Chinook salmon pathology monitoring sampling period, 2005. Discharge was measured on the Klamath River near Iron Gate Dam (KIG), near Klamath (KNK), and on the Trinity River near Lewiston (LWS) (USGS final data).

DISCUSSION

A combination of factors came together in a synergistic manner, resulting in the Klamath River fish kill of 2002. Lower than average flow releases from IGD, above average adult Chinook salmon escapement, early run timing, delayed migration, and potential restricted fish passage contributed to overcrowded conditions which resulted in an epizootic outbreak (CDFG 2003a, YTFP 2004a). River conditions and fall Chinook in 2005 were different than in 2002, and many of the critical factors resulting in the 2002 fish kill were not present.

Ocean escapement in 2002 was approximately 160,800 (CDFG 2003b). Predicted ocean escapement for 2005 was 67,841 (KRTAT 2005), far below the average ocean escapement since 1981 (109,200); however, the actual estimated run size will not be available until the latter part of January, 2006. Average September flow below IGD in 2002 was 760 cfs (CDFG 2003a, YTFP 2004a), whereas average provisional September flow in 2005 was 1,180 cfs. Finally, average September flow near Klamath in 2002 was

2,129 cfs (CDFG 2003a), significantly lower than 2005 average September flow, which was 2,489 cfs.

In 2002, the interaction of critical factors contributed to overcrowded conditions, which provided the necessary conditions for an Ich outbreak. Considering that these contributing factors were not present in 2005, it seems logical that the incidence of the Ich parasite in the adult Chinook salmon population was extremely low. Long term disease monitoring on the Klamath River should take into account IGD flows and run-size for that sampling year. In future monitoring efforts, these factors may correlate to the incidence and severity of Ich in the population.

ACKNOWLEDGEMENTS

The YTFP would like to thank our hard working staff for the long and late hours necessary to make this annual project a success. This study was funded by the Bureau of Reclamation's Trinity River Restoration Program and the Pacific Coastal Salmon Recovery Fund.

REFERENCES

CDFG (California Department of Fish and Game). 2003a. September 2002 Klamath River fish kill: Preliminary analysis of contributing factors. CDFG Northern California-North Coast Region. Arcata, California.

CDFG. 2003b. Klamath River Basin Fall Chinook Salmon Spawner Escapement, In-river Harvest and Run-size Estimates, 1978-2002. CDFG Northern California-North Coast Region, Redding, CA.

Foott, J.S. 2002. Pathology report. FHC Case No. 2002-139. USFWS. Anderson, California.

KRTAT. 2005. Ocean abundance projections and prospective harvest levels for Klamath River fall Chinook, 2005 season.

YTFP (Yurok Tribal Fisheries Program). 2004a. The Klamath River fish fill of 2002; analysis of contributing factors. Final Report. Yurok Tribal Fisheries Program. Klamath, California.

YTFP. 2004b. Lower Klamath River adult Chinook salmon Pathology monitoring, 2003. Technical Memorandum TR-04-02. Yurok Tribal Fisheries Program, Trinity River Division. Hoopa, California.

YTFP. 2005. Lower Klamath River adult Chinook salmon Pathology monitoring, 2003. Technical Memorandum TR-05-04. Yurok Tribal Fisheries Program, Trinity River Division. Hoopa, California.