



# United States Department of the Interior



## FISH AND WILDLIFE SERVICE

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Memorandum

DATE: August 30, 2019

TO: Nicholas Hetrick, FAC Program Lead – Arcata Fish and Wildlife Office

FROM: Anne Voss, Fish Biologist – CA-NV Fish Health Center

The California-Nevada Fish Health Center (Center) works collaboratively with the Service's Arcata Fish and Wildlife Office (AFWO) and the Karuk and Yurok tribes to monitor the prevalence of *Ceratonova shasta* and *Parvicapsula minibicornis* infections in juvenile salmon in the Klamath River. The Center coordinates this annual monitoring project, provides laboratory support, and generates an annual summary report for the study. AFWO and tribal biologists are responsible for collecting fish samples for the Center.

Prevalence of infection is the measure used in medicine and epidemiology to define individuals affected by a disease at a particular point in time, within a given sample set. Also known as Point Prevalence, it describes the proportion (percentage) of a group that has the condition (infection) at a specific point in time. The quantity of parasite DNA (DNA copy number) is provided, when applicable, to evaluate the parasite load within the fish. *Ceratonova shasta* DNA copy number in the 2-4 log range has been associated with unrecoverable infection levels by histology and observations of fish in a clinical state of disease. Other important factors including exposure dose, impact on fish tissues, and the rate of disease progression have to be evaluated to assess the overall disease impacts to the group of fish that are sampled.

To date, QPCR testing has been performed for fish collected from March 26 through June 19 in the upper Shasta River to Scott River (K4) reach, April 8 through June 11 in the Scott River to Salmon River (K3) reach, June 4 through June 20 and July 15 through July 25 in the Salmon River to Trinity River reach (K2), and June 21 through July 24 in the Trinity River to Estuary reach (K1). Natural fish collected in K4 were monitored in real time for the first nine weeks of monitoring, and the first *C. shasta* detection occurred the week of April 28. *Parvicapsula minibicornis* was first detected the week of April 7. Iron Gate Hatchery released fish starting on June 5, and sampling shifted towards collection of hatchery fish.

Overall, *Ceratonova shasta* has been detected in 49% (401/812) of fish tested. *Parvicapsula minibicornis* has been detected in 71% (579/812) of fish tested. All data is preliminary and subject to revision prior to final review and annual report.

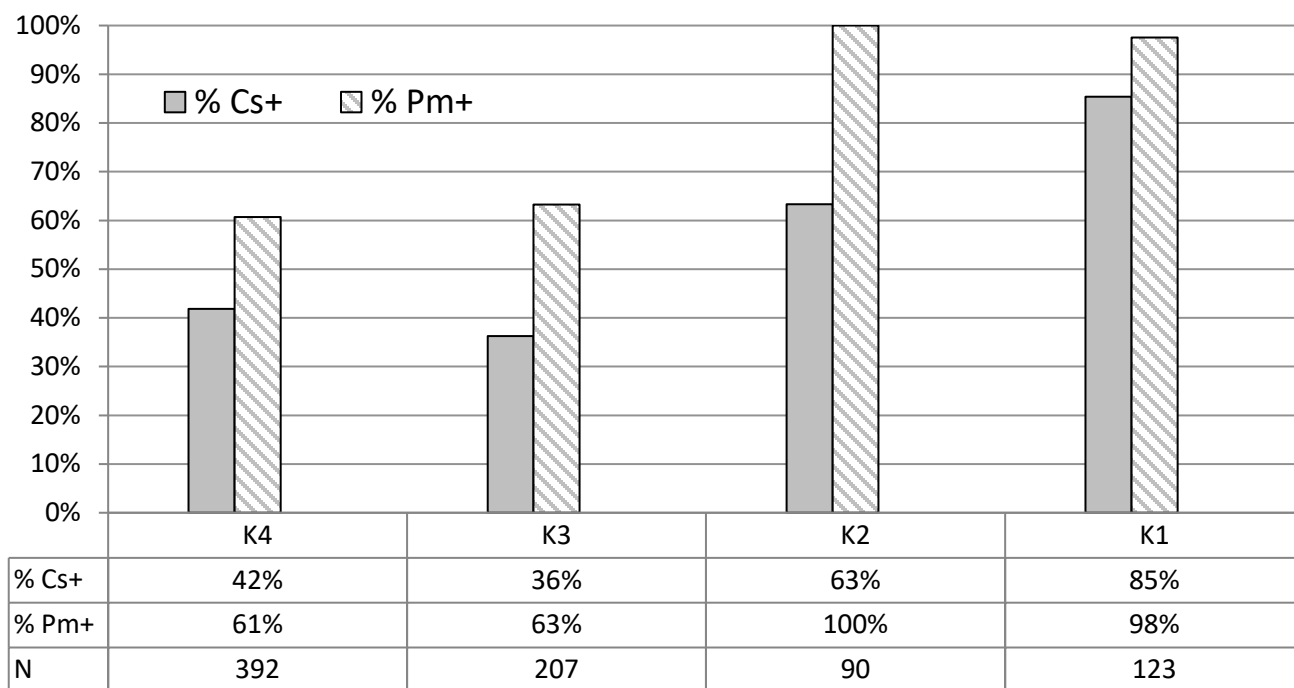


Figure 1. *Ceratonova shasta* and *Parvicapsula minibicornis* prevalence of infection (POI) by sampling reach. Percent positive by Quantitative Polymerase Chain Reaction (QPCR) testing.

Table 1. Weekly-stratified prevalence of infection (POI) of *Ceratonova shasta* in juvenile Chinook salmon captured in the Shasta River to Scott River reach (K4) and the Scott River to Salmon River reach (K3) of the Klamath River.

Sample Week	Shasta to Scott - K4 Reach					Scott to Salmon - K3 Reach				
	Date Collected	Number Sampled	Number Cs Positive	Cs POI	DNA copy number over 3 logs	Date Collected	Number Sampled	Number Cs Positive	Cs POI	DNA copy number over 3 logs
1	3/26/19	30	0	0%	n/a	Not Sampled				
2	4/2/19	30	0	0%	n/a	Not Sampled				
3	4/9/19	30	0	0%	n/a	4/8/19	22	0	0%	n/a
4	4/16/19	30	0	0%	n/a	4/15/19	21	0	0%	n/a
5	4/23/19	30	0	0%	n/a	4/22/19	21	0	0%	n/a
6	4/30/19 5/02/19	30	18	60%	0%	4/30/19	20	3	15%	0%
7	5/7/19	30	25	83%	13%	5/7/19	20	4	20%	0%
8	5/13/19	30	26	87%	13%	5/13/19	20	18	90%	15%
9	5/20/19	30	26	87%	20%	5/21/19	21	21	100%	38%
10	5/28/19 5/29/19	31	25	81%	0%	5/30/19	22	18	82%	14%
11	6/5/2019	30	16	53%	0%	6/4/19	20	11	55%	0%
12	6/11/19 6/12/19	31	7	23%	3%	6/11/19	20	0	0%	n/a
13	6/18/19 6/19/19	30	21	70%	27%	<i>test results pending</i>				

\* K4 week 12 includes thirteen hatchery fish. K4 week 13 includes seven hatchery fish

\*\* All twenty fish collected in K3 week 12 are hatchery fish

Table 2. Weekly-stratified prevalence of infection (POI) of *Ceratonova shasta* in juvenile Chinook salmon captured in the Salmon River to Trinity River reach (K2) and the Trinity River to Estuary reach (K1) of the Klamath River.

Sample Week	Salmon to Trinity – K2 Reach					Trinity to Estuary – K1 Reach				
	Date Collected	Number Sampled	Number Cs Positive	Cs POI	DNA copy number over 3 logs	Date Collected	Number Sampled	Number Cs Positive	Cs POI	DNA copy number over 3 logs
11	6/4/19	19	8	42%	0%	Not Sampled				
12	6/11/19	20	10	50%	0%	Not Sampled				
13	6/20/19	11	9	82%	0%	6/21/19	14	14	100%	71%
14	<i>test results pending</i>					6/24/19 6/27/19	25	20	80%	20%
15	<i>test results pending</i>					7/2/19	20	14	70%	5%
16	<i>test results pending</i>					7/11/19	22	18	82%	5%
17	7/15/19 7/17/19	20	18	90%	10%	7/16/19	22	21	95%	0%
18	7/22/19 7/25/19	20	12	60%	0%	7/24/19	20	18	90%	25%

\* K2 week 17 includes seven hatchery fish. K3 week 18 includes three hatchery fish

\*\* K1 week 13 includes two hatchery fish, K1 week 14 includes five hatchery fish, K1 week 15 includes nine hatchery fish, K1 week 16 includes six hatchery fish, K1 week 17 includes three hatchery fish, and K1 week 18 includes four hatchery fish.

Table 3. Weekly-stratified prevalence of infection (POI) of *Parvicapsula minibicornis* in juvenile Chinook salmon captured in the Shasta River to Scott River reach (K4) and the Scott River to Salmon River reach (K3) of the Klamath River.

Sample Week	Shasta to Scott - K4 Reach				Scott to Salmon - K3 Reach			
	Date Collected	Number Sampled	Number Pm Positive	Pm POI	Date Collected	Number Sampled	Number Pm Positive	Pm POI
1	3/26/19	30	0	0%	Not Sampled			
2	4/2/19	30	0	0%	Not Sampled			
3	4/9/19	30	2	7%	4/8/19	22	1	5%
4	4/16/19	30	1	3%	4/15/19	21	0	0%
5	4/23/19	30	11	37%	4/22/19	21	4	19%
6	4/30/19 5/02/19	30	29	97%	4/30/19	20	12	60%
7	5/7/19	30	26	87%	5/7/19	20	18	90%
8	5/13/19	30	30	100%	5/13/19	20	20	100%
9	5/20/19	30	30	100%	5/21/19	21	21	100%
10	5/28/19 5/29/19	31	31	100%	5/30/19	22	22	100%
11	6/5/19	30	30	100%	6/4/19	20	20	100%
12	6/11/19 6/12/19	31	18	58%	6/11/19	20	13	65%
13	6/18/19 6/19/19	30	30	100%	<i>test results pending</i>			

\* K4 week 12 includes thirteen hatchery fish. K4 week 13 includes seven hatchery fish

\*\* All twenty fish collected in K3 week 12 are hatchery fish

Table 4. Weekly-stratified prevalence of infection (POI) of *Parvicapsula minibicornis* in juvenile Chinook salmon captured in the Salmon River to Trinity River reach (K2) and the Trinity River to Estuary reach (K1) of the Klamath River.

Sample Week	Salmon to Trinity – K2 Reach				Trinity to Estuary – K1 Reach			
	Date Collected	Number Sampled	Number Pm Positive	Pm POI	Date Collected	Number Sampled	Number Pm Positive	Pm POI
11	6/4/19	19	19	100%	Not Sampled			
12	6/11/19	20	20	100%	Not Sampled			
13	6/20/19	11	11	100%	6/21/19	14	14	100%
14	<i>test results pending</i>				6/24/19 6/27/19	25	25	100%
15	<i>test results pending</i>				7/2/19	20	18	90%
16	<i>test results pending</i>				7/11/19	22	22	100%
17	7/15/19 7/17/19	20	20	100%	7/16/19	22	22	100%
18	7/22/19 7/25/19	20	20	100%	7/24/19	20	19	95%

\* K2 week 17 includes seven hatchery fish. K3 week 18 includes three hatchery fish

\*\* K1 week 13 includes two hatchery fish, K1 week 14 includes five hatchery fish, K1 week 15 includes nine hatchery fish, K1 week 16 includes six hatchery fish, K1 week 17 includes three hatchery fish, and K1 week 18 includes four hatchery fish.