



United States Department of the Interior



FISH AND WILDLIFE SERVICE

CA-NV Fish Health Center
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Memorandum

DATE: August 2, 2021

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.

For the 2021 outmigration season, the Center will strive to provide Quantitative Polymerase Chain Reaction (QPCR) testing of juvenile Chinook salmon collected from the Shasta to Scott (K4 or "Kinsman") reach in a time-sensitive manner. The goal is to provide weekly-stratified estimates of *C. shasta* prevalence of infection (POI) and DNA copy number to managers on a weekly basis during the early outmigration season.

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.

To date, QPCR testing has been performed for fish collected from March 23 through June 2 in the upper Shasta River to Scott River (K4) reach, April 5 through May 25 in the Scott River to Salmon River (K3) reach, April 9 through June 28 in the Salmon River to Trinity River reach (K2), and July 2 through July 8 in the Trinity River to Estuary (K1) reach. Natural fish collected in K4 were monitored in real time for nine weeks, and the first *C. shasta* detection occurred on March 30. To date, nine CWTs have been tested in the Trinity River to Estuary (K1) reach. An additional 259 fish have been tested since our June 2021 update.

Overall, *Ceratonova shasta* has been detected in 57% (515/911) of fish tested. *Parvicapsula minibicornis* has been detected in 64% (583/911) of fish tested. All data is preliminary and subject to revision prior to final review and annual report.

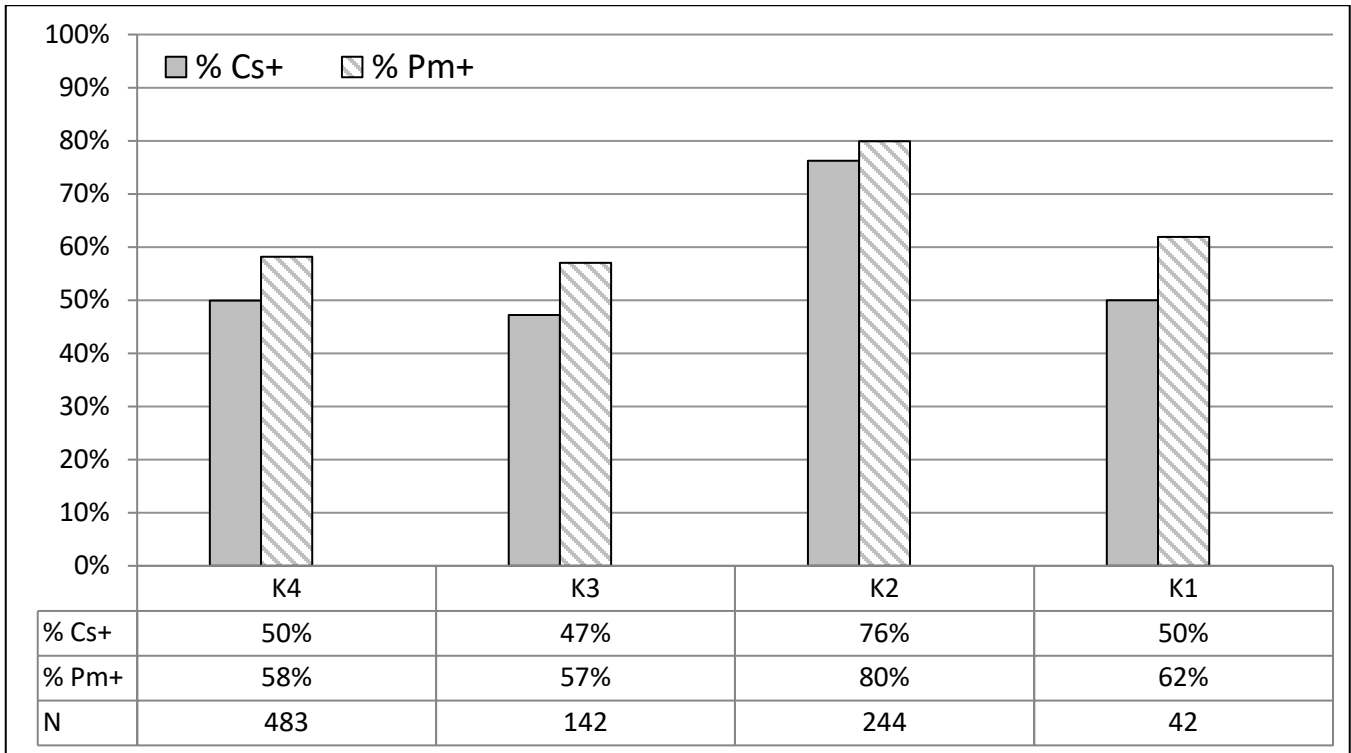


Figure 1. *Ceratonova shasta* and *Parvicapsula minibicornis* prevalence of infection (POI) by sampling reach. Percent positive by Quantitative Polymerase Chain Reaction (QPCR) testing.

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	3/23/2021 3/24/2021	30	0	0%	n/a	Not Sampled				
2	3/30/2021	30	1	3%	0%	Not Sampled				
3	4/06/2021	60	0	0%	n/a	4/05/2021	20	2	10%	0%
4	4/13/2021	60	9	15%	0%	4/12/2021	21	0	0%	n/a
5	4/20/2021	60	26	43%	0%	4/19/2021	20	5	25%	0%
6	4/27/2021	60	47	78%	15%	4/26/2021	21	15	71%	0%
7	5/04/2021	60	58	97%	63%	5/03/2021	21	17	81%	10%
8	5/11/2021	41	40	98%	59%	5/10/2021	samples not tested due to poor tissue quality			
9	5/20/2021	51	34	67%	14%	5/17/2021	20	15	75%	15%
10	5/25/2021 5/26/2021	27	22	81%	15%	5/24/2021 5/25/2021	19	13	68%	5%
11	6/01/2021 6/02/2021	4	4	100%	50%	Not Sampled				

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) of the Klamath River. Sampling in K2 started the week of April 4 (week 3). Fish tested to date were captured at the Weitchpec rotary screw trap, as well as seined upstream at Big Bar and Camp Creek.

Salmon to Trinity – K2 Reach					
Sample Week	Date Collected	Number Sampled	Number Cs Positive	Cs POI	DNA copy number over 3 logs
3	4/09/2021	9	5	56%	0%
4	4/15/2021	20	12	60%	0%
5	4/22/2021 4/23/2021	2	0	0%	n/a
6	4/28/2021 4/29/2021	11	5	45%	9%
7	5/05/2021 5/06/2021	8	6	75%	25%
8	5/11/2021 5/12/2021	24	20	83%	38%
9	5/18/2021	20	19	95%	50%
10	5/26/2021 5/27/2021	21	21	100%	33%
11	6/02/2021	20	17	85%	5%
12	6/07/2021 6/08/2021	29	22	76%	3%
13	6/15/2021 6/16/2021	41	32	78%	0%
14	6/20/2021	20	15	75%	15%
15	6/28/2021	19	12	63%	16%

Table 3. Weekly-stratified prevalence of infection (POI) of *Ceratonova shasta* in juvenile Chinook salmon captured in the Trinity River to Estuary reach (K1) of the Klamath River. Sampling in K1 started the week of June 27 (week 15).

Trinity to Estuary – K1 Reach					
<i>Sample Week</i>	<i>Date Collected</i>	<i>Number Sampled</i>	<i>Number Cs Positive</i>	<i>Cs POI</i>	<i>DNA copy number over 3 logs</i>
15	7/02/2021	20	7	35%	5%
16	7/08/2021	22	14	64%	27%

* Number of fish sampled in Week 15 includes 3 CWTs, all of which tested negative for *C. shasta*.
 Number of fish sampled in Week 16 includes of 6 CWTs, 3 of which tested positive for *C. shasta*.

Table 4. 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	3/23/2021 3/24/2021	30	0	0%	Not Sampled			
2	3/30/2021	30	0	0%	Not Sampled			
3	4/06/2021	60	0	0%	4/05/2021	20	0	0%
4	4/13/2021	60	10	17%	4/12/2021	21	0	0%
5	4/20/2021	60	35	58%	4/19/2021	20	7	35%
6	4/27/2021	60	53	88%	4/26/2021	21	20	95%
7	5/04/2021	60	60	100%	5/03/2021	21	15	71%
8	5/11/2021	41	41	100%	5/10/2021	samples not tested due to poor tissue quality		
9	5/20/2021	51	51	100%	5/17/2021	20	20	100%
10	5/25/2021 5/26/2021	27	27	100%	5/24/2021 5/25/2021	19	19	100%
11	6/01/2021 6/02/2021	4	4	100%	Not sampled			

Table 5. Weekly-stratified prevalence of infection (POI) of *Parvicapsula minibicornis* in juvenile Chinook salmon captured in the Salmon River to Trinity River reach (K2) of the Klamath River. Sampling in K2 started the week of April 4 (week 3). Fish tested to date were captured at the Weitchpec rotary screw trap, as well as seined upstream at Big Bar and Camp Creek.

Salmon to Trinity – K2 Reach				
Sample Week	Date Collected	Number Sampled	Number Pm Positive	Pm POI
3	4/09/2021	9	3	33%
4	4/15/2021	20	5	25%
5	4/22/2021 4/23/2021	2	0	0%
6	4/28/2021 4/29/2021	11	4	36%
7	5/05/2021 5/06/2021	8	3	38%
8	5/11/2021 5/12/2021	24	21	88%
9	5/18/2021	20	20	100%
10	5/26/2021 5/27/2021	21	19	90%
11	6/02/2021	20	20	100%
12	6/07/2021 6/08/2021	29	26	90%
13	6/15/2021 6/16/2021	41	40	80%
14	6/20/2021	20	19	75%
15	6/28/2021	19	15	58%

Table 6. Weekly-stratified prevalence of infection (POI) of *Parvicapsula minibicornis* in juvenile Chinook salmon captured in the Trinity River to Estuary reach (K1) of the Klamath River. Sampling in K1 started the week of June 27 (week 15).

Trinity to Estuary – K1 Reach				
<i>Sample Week</i>	<i>Date Collected</i>	<i>Number Sampled</i>	<i>Number Pm Positive</i>	<i>Pm POI</i>
15	7/02/2021	20	12	60%
16	7/08/2021	22	14	64%

* Number of fish sampled in Week 15 includes 3 CWTs, 1 of which tested positive for *P. minibicornis*.
 Number of fish sampled in Week 16 includes of 6 CWTs, 4 of which tested positive for *P. minibicornis*.