



U.S. Fish & Wildlife Service

Arcata Fish & Wildlife Office Fish and Aquatic Conservation Program

Klamath River Outmigrant Monitoring Update — March 22, 2021

Synopsis: The outmigration of juvenile salmonids is monitored annually on the mainstem Klamath River by the USFWS Arcata Fish and Wildlife Office (AFWO) and the Karuk Tribe of California. The objectives of this collaborative project are to:

1. Estimate the weekly abundance of juvenile Chinook Salmon and collect pertinent biological data such as fork lengths and presence of clinical signs of disease at three selected locations on the mainstem Klamath River.
2. Examine subsamples of Chinook Salmon, Coho Salmon, and steelhead for external disease indicators and collect, preserve, and deliver weekly-stratified, random samples of young-of-the-year (YOY) Chinook Salmon to the Service's California–Nevada Fish Health Center (CA–NV FHC) for conducting qPCR assays to estimate *Ceratonova shasta* and *Parvicapsula minibicornis* infection rates in the outmigrant population.
3. Collect relative abundance and biological data on Coho Salmon and steelhead at the three locations on the mainstem Klamath River.
4. Collect and process water samples from the Klamath River near the Kinsman trap site for partners at Humboldt State University (HSU) conducting a study on the quantitative relationship between environmental DNA (eDNA) and juvenile Chinook Salmon abundance.

Information generated by this study are used for a variety of purposes, including stock-recruitment analyses, to inform flow management decisions, to further refine a fish disease model, and to validate and calibrate the S³ (Stream Salmonid Simulator) Chinook Salmon production model, among others.

Monitoring is conducted at three sites on the mainstem Klamath River between Iron Gate Dam (IGD; rkm 309.65) and the Scott River confluence (rkm 232.95). The upstream-most site (rkm 307.75), referred to as the 'Bogus Trap Site' is located on the right bank downstream of the Bogus Creek confluence on Blue Heron RV Park property. The second location is the 'I-5 Trap Site' (rkm 293.55), which is positioned on the left bank downstream of the Carson Creek confluence and upstream of the I-5 bridge river crossing. The site located furthest downriver is the 'Kinsman Trap Site' (rkm 237.55) and is positioned in a side channel on the left bank just upstream of the Kinsman Creek confluence. Trapping at the Bogus Trap Site is conducted using a single 3.1-m wide and 1.6-m tall frame net. Sampling at the I-5 Trap Site is conducted using two in-line 8-ft diameter rotary screw traps (RST) and one 3.1-m by 1.6-m frame net. One 5-ft diameter RST is used to capture fish at the Kinsman Trap Site. Traps are typically operated four nights per week (Monday through Thursday) and checked once daily while in operation. Trapping began March 1 [Calendar Week (CW) 10] at all sites in 2021.

This project update provides an in-season summary of the total catch (Table 1) and mean catch per day by week (Table 2) of Chinook Salmon, Coho Salmon, and steelhead at each trap site. In addition, we provide weekly estimates of the mean fork length of YOY Chinook and Coho salmon from the each of the three trap sites (Table 3). Expansions to generate weekly-stratified abundance estimates are calculated after the end of the season and are not presented here. Trap efficiency, a measure of the proportion of fish moving past a trap site that are caught, varies weekly. *Therefore raw catch numbers are not representative of actual abundance and we advise against using weekly raw catch numbers to make inferences on temporal abundance.*

Included in this project update is a weekly-stratified summary of clinical signs of disease observed in the catch for the trap and seine sites (Table 4). Note that these data are based on the visual presence of external symptoms of disease, which may not always be revealed by infected fish. The percentage of live YOY Chinook Salmon in the trap and seine catches that exhibit distended bellies, gill fungus, and pale gills are presented separately for each site on a weekly basis (Table 4). Distended bellies may be a clinical sign of infection by the myxosporean parasites, *Ceratonova shasta* and *Parvicapsula minibicornis*. Gills of juvenile salmonids ≥ 45 mm FL are evaluated for color (red, pale/pink, white, or tan) and condition (normal, eroded, or fungal). Pale gills may be due to anemia associated with *P. minibicornis* infection. Gill fungus is likely *Saprolegnia* growing upon a columnaris (*Flavobacterium columnare*) infection.

To more accurately determine infection rates for the outmigrant juvenile Chinook Salmon population passing the Kinsman Trap Site, weekly-stratified random samples are collected, preserved, and delivered to the CA–NV FHC to process using qPCR assays. This season's sampling will begin the week of March 24. The CA–NV FHC investigates infection rates of *C. shasta*, *P. minibicornis* and other pathogens in juvenile salmonids in the Klamath River annually. The CA–NV FHC releases regular updates (which are posted on the AFWO website) and a final report for each season.

We also present daily mean discharge below IGD (Figure 1) and at the Kinsman Trap Site (Figure 2) from late February to July to help portray pertinent flow conditions. Discharge at the Bogus and I-5 trap sites are represented by USGS Gauging Station 11516530 (Klamath River below IGD, California). Discharge at USGS 11520500 (Klamath River near Seiad Valley, California) minus discharge at USGS 11519500 (Scott River near Fort Jones, California) is used as a surrogate flow for the Kinsman Trap Site.

If you have any questions regarding this summary, please contact Bill Pinnix (bill_pinnix@fws.gov) or Tyler Wallin (tyler_wallin@fws.gov).

Table 1. In-season summary of the total catch by week of adipose fin-clipped (AD Clip) and non-adipose fin-clipped (No Clip) Chinook Salmon and steelhead and left maxillary-clipped (LM Clip) and non-maxillary clipped (No Clip) Coho Salmon by trap at the Bogus, I-5, and Kinsman trap sites on the mainstem Klamath River, 2021. Note that RST = rotary screw trap, UPS = upstream, DNS = downstream, and YOY = young-of-the-year.

Preliminary Data - Subject to Revision

Trap	Survey week	Sample dates	Q (cfs) ^a		Water temp. (F) ^b		Trapping days	Chinook (<i>O. tshawytscha</i>)			Coho (<i>O. kisutch</i>)			Steelhead (<i>O. mykiss</i>)			
			Min	Max	Min	Max		YOY			YOY	Age 1 +		YOY	Age 1 +		
								No clip	AD clip	Age 1+		No clip	LM clip		No clip	AD clip	
Bogus Frame Net	1	3/3-3/5	998	1000	42.4	44.1	3	54	0	0	0	0	0	0	0	0	0
	2	3/9-3/12	997	1000	44.1	44.9	4	59	0	0	0	0	0	0	0	0	0
	3	3/16-3/19	997	1000	42.6	44.6	3	69	0	0	0	0	0	0	0	0	0
I-5 UPS RST	1	3/2-3/5	998	1030	40.6	42.6	4	57	1	0	0	0	0	0	0	0	0
	2	3/9-3/12	997	1000	42.9	44.2	4	78	0	0	0	0	0	0	0	0	0
	3	3/16-3/19	997	1000	42.6	44.9	4	122	0	1	0	0	0	19	0	1	0
I-5 DNS RST	1	3/2-3/5	997	1030	40.6	42.6	4	34	2	0	0	0	0	0	1	0	0
	2	3/9-3/12	998	1000	42.9	44.2	4	72	0	1	0	0	0	0	1	0	0
	3	3/16-3/19	997	1000	42.6	44.9	3	86	0	0	0	0	11	0	0	0	0
I-5 Frame Net	1	3/2-3/5	998	1030	40.6	42.6	4	21	0	0	0	0	0	0	0	0	0
	2	3/9-3/12	997	1000	42.9	44.2	4	29	0	0	0	0	0	0	0	0	0
	3	3/16-3/19	997	1000	42.6	44.9	4	40	0	0	0	0	9	0	0	0	0
Kinsman RST	1	3/2-3/5	1594	1630	39.9	46.2	4	90	0	0	2	3	0	2	1	0	0
	2	3/9-3/12	1534	1584	44.2	45.7	4	206	0	0	1	0	0	2	2	0	0
	3	3/16-3/19	1526	1541	43.3	47.8	4	134	1	0	7	0	9	1	7	0	0

^a mean discharge from day of sampling (discharge below IGD used for Bogus and I-5 sites; flow at Kinsman Site is Klamath River flow at Seiad minus Scott River flow)

^b temperature recorded at time of trap check (true daily ranges from temperature loggers will become available at the end of the season)

^c trap not set this week because trapping operations were limited due to reduced efforts in response to the Covid-19 pandemic

Table 2. In-season summary of the average catch-per-day by week of non adipose fin-clipped (No Clip) and adipose fin-clipped (AD Clip) Chinook Salmon and steelhead and non-maxillary clipped (No Clip) and left maxillary-clipped (LM Clip) Coho Salmon by trap at the Bogus, I-5, and Kinsman trap sites on the mainstem Klamath River, 2021. Note that RST = rotary screw trap, UPS = upstream, DNS = downstream, and YOY = young-of-the-year.

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Trap	Survey week	Sample dates	Q (cfs) ^a		Water temp. (F) ^b		Trapping days	Chinook (<i>O. tshawytscha</i>)			Coho (<i>O. kisutch</i>)			Steelhead (<i>O. mykiss</i>)			
			Min	Max	Min	Max		YOY			YOY	Age 1 +		YOY	Age 1 +		
								No clip	AD clip	Age 1+		No clip	LM clip		No clip	AD clip	
Bogus Frame Net	1	3/3-3/5	998	1000	42.4	44.1	3	18.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	3/9-3/12	997	1000	44.1	44.9	4	14.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3	3/16-3/19	997	1000	42.6	44.6	3	23.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-5 UPS RST	1	3/2-3/5	998	1030	40.6	42.6	4	14.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	3/9-3/12	997	1000	42.9	44.2	4	19.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3	3/16-3/19	997	1000	42.6	44.9	4	30.50	0.00	0.25	0.00	0.00	4.75	0.00	0.25	0.00	
I-5 DNS RST	1	3/2-3/5	998	1030	40.6	42.6	4	8.50	0.50	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00
	2	3/9-3/12	997	1000	42.9	44.2	4	18.00	0.00	0.25	0.00	0.00	0.00	0.00	0.25	0.00	0.00
	3	3/16-3/19	997	1000	42.6	44.9	3	28.67	0.00	0.00	0.00	0.00	3.67	0.00	0.00	0.00	
I-5 Frame Net	1	3/2-3/5	998	1030	40.6	42.6	4	5.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	3/9-3/12	997	1000	42.9	44.2	4	7.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3	3/16-3/19	997	1000	42.6	44.9	4	10.00	0.00	0.00	0.00	0.00	2.25	0.00	0.00	0.00	
Kinsman RST	1	3/2-3/5	1594	1630	39.9	46.2	4	22.50	0.00	0.00	0.50	0.75	0.00	0.50	0.25	0.00	
	2	3/9-3/12	1410	1584	44.2	45.7	4	51.50	0.00	0.00	0.25	0.00	0.00	0.50	0.50	0.00	
	3	3/16-3/19	1526	1541	43.3	47.8	4	33.50	0.25	0.00	1.75	0.00	2.25	0.25	1.75	0.00	

^a mean daily discharge range during sampling dates (discharge below IGD used for Bogus and I-5 sites; flow at Kinsman Site is Klamath River flow at Seiad minus Scott River flow)

^b temperature recorded at time of trap check (true daily ranges from temperature loggers will become available at the end of the season)

^c trap not set this week because trapping operations were limited due to reduced efforts in response to the Covid-19 pandemic

Table 3. In-season summary of fork lengths, compared with the last ten years, of naturally produced Chinook and Coho salmon by trap type at the Bogus, I-5, and Kinsman sites on the mainstem Klamath River, 2021. RST = rotary screw trap and YOY = young-of-the-year. Note: these data only include naturally produced fish and end at the date of the release of hatchery fish.

Preliminary data - Subject to revision

Site	Calendar Week	2021 sampling dates	YOY Chinook (natural) - fork length data							YOY Coho - fork length data								
			2021				Previous 10 years			2021				Previous 10 years				
			n	Mean (mm)	Min. (mm)	Max. (mm)	% > 55 mm	n	Years of data	Mean (mm)	n	Mean (mm)	Min. (mm)	Max. (mm)	% > 55 mm	n	Years of data	Mean (mm)
Bogus Frame	10	Mar 2-5	36	37	32	41	0	588	9	36.6	0	-	-	-	0	0	-	
	11	Mar 9-11	47	36	32	41	0	716	9	36.9	0	-	-	-	2	1	34.0	
I-5 RST's	12	Mar 16-18	45	36	30	40	0	748	9	36.8	0	-	-	-	28	3	35.2	
	10	Mar 2-5	68	38	35	41	0	536	8	37.5	0	-	-	-	0	0	-	
I-5 Frame	11	Mar 9-11	87	37	30	43	0	554	10	37.8	0	-	-	-	1	1	35.0	
	12	Mar 16-18	90	37	33	47	0	571	9	37.2	0	-	-	-	0	0	-	
	10	Mar 2-5	19	38	36	41	0	196	5	38.0	0	-	-	-	0	0	-	
Kinsman RST	11	Mar 9-11	18	37	33	41	0	208	5	37.1	0	-	-	-	1	1	35.0	
	12	Mar 16-18	33	37	37	46	0	265	6	37.3	0	-	-	-	14	2	35.4	
	10	Mar 2-5	58	38	33	48	0	376	7	37.8	2	33.0	32	34	0.0%	0	0	-
	11	Mar 9-11	89	39	34	41	0	439	8	39.5	1	78.0	78	78	100.0%	12	1	33.4
	12	Mar 16-18	88	40	33	64	0	464	8	42.8	1	33.0	33	33	0.0%	33	2	35.0

^a trap not set this week because trapping operations were limited due to reduced efforts in response to the Covid-19 pandemic

^b sample size too low for a reportable calculation

Table 4. In-season summary of clinical signs of disease in young-of-the-year Chinook Salmon by site at the Bogus, I-5, and Kinsman sites on the mainstem Klamath River, 2021. *Note: Although only Chinook Salmon are reported in this table, we also monitor clinical signs of diseases in Coho Salmon and other species.*

Preliminary Data - Subject to Revision

Site	Calendar week	Sampling dates	Weekly mean flow (cfs) ^a	Water temp. (F) ^b		Belly condition			Gills			Condition	
				Min	Max	Sample size	Distended		Sample size	Color		Eroded or fungal	
							# positive	%		# positive	%	# positive	%
Bogus	10	Mar 3-4	992	42.4	44.1	36	0	0.0%	0	-	-	-	-
	11	Mar 9-10	1,000	46.0	47.3	47	0	0.0%	0	-	-	-	-
	12	Mar 16-18	999			45	0	0.0%	0	-	-	-	-
I-5	10	Mar 2-4	992	42.8	42.8	91	0	0.0%	1 ^c	0	-	0	-
	11	Mar 9-10	1,000	44.0	45.3	122	0	0.0%	0	-	-	-	-
	12	Mar 16-18	999			123	0	0.0%	2 ^c	0	-	0	-
Kinsman	10	2-4	1,612	40.1	45.6	90	0	0.0%	0	-	-	-	-
	11	9-11	1,564	46.2	54.1	90	0	0.0%	11 ^c	0	-	0	-
	12	Mar 16-18	1,537			88	0	0.0%	14 ^c	0	-	0	-

^a discharge below IGD used for Bogus and I-5 sites; discharge at Kinsman Site is Klamath River discharge near Seiad Valley minus discharge in the Scott River near Fort Jones

^b temperature recorded at time of trap check/seine (true daily ranges from temperature loggers will become available at the end of the season)

^c sample size too low for a reportable calculation

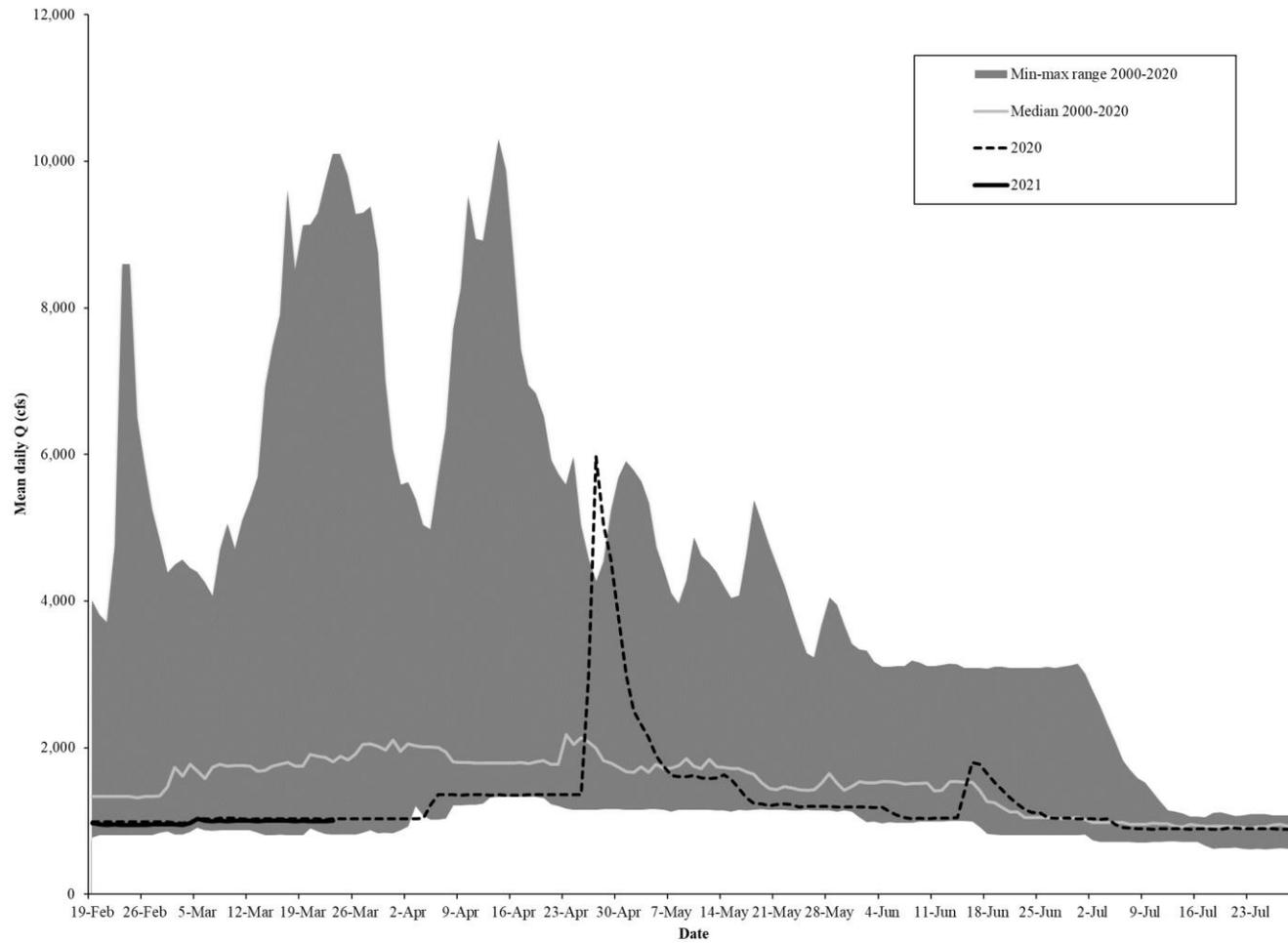


Figure 1. Daily mean discharge below Iron Gate Dam, Klamath River (USGS Gaging Station 11516530) from late February through July, 2000–2021.

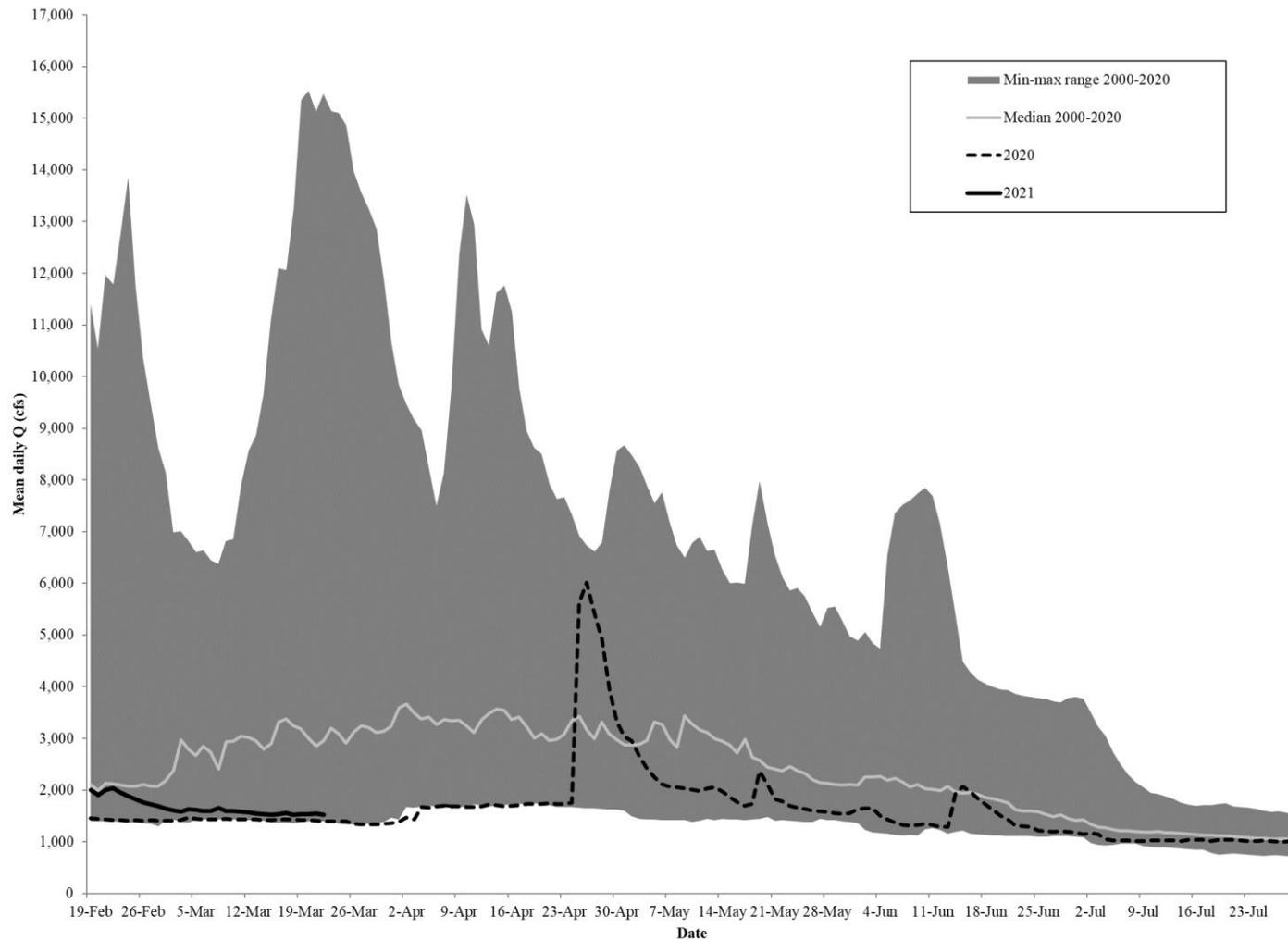


Figure 2. Klamath River daily mean discharge at the Kinsman Trap Site from late February through July, 2000–2021. Flow measurements are not available at this location. Therefore Klamath River flow near Seiad Valley, California (USGS Gaging Station 11520500) minus flow from the Scott River near Fort Jones, California (USGS 11519500) is used as a surrogate.