Hatchery-Wild Interactions Study: Sitka Sound Science Center 2020 Field Summary

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Abstract:

The scale of Alaska salmon hatchery programs has raised concerns that hatchery salmon may impact the productivity and sustainability of wild stocks. The need for research studies that address concerns around straying and the genetic and ecological interactions between hatchery and wild salmon was thus developed. The Sitka Sound Science Center (SSSC) was contracted by the Alaska Department of Fish and Game (ADF&G) to collect genetic and life history samples from post-spawned summer chum salmon in three streams in Northern Southeast Alaska.

For the 2020 field season, crews collected a total of 191 samples between 7/22/2020 and 8/27/2020. A total of 60 surveys were completed or partially completed during that time. For Fish Creek, crews collected 134 samples, observed 877 live fish, 78 dead fish, and 90 previously sampled during the entirety of the field season. For Sawmill Creek, crews collected 6 samples, observed 150 live fish, 2 dead fish, and 1 previously sampled for the entirety of the field season. Lastly, the vessel crew on Prospect Creek collected 51 samples, observed 718 live, 15 dead fish, and 0 previously sampled were observed. The number of samples collected in 2020 (191) was lower than the average number of samples collected between 2017-2019; 3,206 samples. This suggests that high water and a small chum salmon return significantly impacted field crew's ability to collect samples. Heavy rain caused field crews to cancel and partially complete 20 surveys. Despite significant impairments to sampling, crews reached targeted percentages (60-80%) for Prospect and Fish Creek, but not Sawmill.

In preparation for the field season we conducted 10 days of training with extensive COVID-19 precautions in place- severely impacting safety procedures, travel, and project structure. Overall, high stream levels and a reduced chum return significantly impacted the number of samples collected in 2020.

Introduction:

Due to the value of both hatchery-origin and wild stocks of Alaska salmon, ADF&G, along with hatchery corporations, have recognized the need for research studies that address concerns about straying and the genetic and ecological interactions between hatchery and wild salmon. In addition, the state mandate that hatchery production be compatible with sustainable productivity of wild stocks also influenced the initiation of this long-term assessment. In response to a growing body of concern regarding the scale of the Alaska salmon hatchery programs and the potential impacts of hatchery salmon on the productivity and sustainability of wild stocks, the Hatchery-Wild Interactions Project was developed. In 2011, ADF&G convened a science panel that prioritized three major questions in Southeast Alaska and Prince William Sound:

1) What is the genetic stock structure of chum salmon in Southeast Alaska (SEAK)?
2) What is the extent and annual variability in straying of hatchery chum salmon in SEAK?

3) What is the impact on fitness (productivity) of wild chum salmon due to straying of hatchery chum salmon?

The Sitka Sound Science Center was contracted by the ADF&G to collect genetic and life history samples from post-spawned summer chum salmon in three streams in Northern Southeast region of Alaska beginning in 2017. This report details the field summary and survey findings of those streams in the 2020 field season. The raw data are available and were submitted via the Hatchery Wild Application.

Methods:

SSSC was contracted to sample three streams (Figure 1) for post-spawned summer chum salmon in Northern Southeast Alaska in 2020. The land-based field crew conducted surveys on Fish Creek (Douglas Island) and Sawmill Creek (Berner's Bay) while the vessel-based crew focused on Prospect Creek (Port Snettisham). The land-based crew was tasked with conducting surveys on Fish Creek (AWC 111-50-10690) on Douglas Island and Sawmill Creek (AWC 115-20-10520) in Berner's Bay. Fish Creek is accessed by the road system on Douglas Island and the crew traveled by skiff to Sawmill Creek. The *M/V Surveyor* was contracted again in 2020 to provide transport, housing for the vessel-based crew, and to provide access to Prospect Creek (AWC 111-33-10100).

SSSC crews are contracted to collect otolith and tissue samples and morphological information from post-spawned chum salmon. In addition, crews record a daily live, dead, and previously sampled count for all chum salmon observed in each stream. Crews also take weekly live counts of pink salmon in each stream.

Figure 1. Locations of streams sampled by SSSC field crews in 2020.

1. Training and Field Preparation:

SSSC field crews spent 10 days of training prior to conducting field work. Training consisted of field safety, sampling protocols and quality control. Extensive measures were taken to protect crew members, SSSC staff, and the Sitka and Juneau communities from COVID-19. Due to COVID-19, traditional access to the University of Alaska Southeast was not available for the Juneau-based crew and alternative housing near Auke Bay was obtained. In response to the pandemic, we avoided commercial flights to minimize potential exposure and increase safety. Instead we relied on the *M/V Surveyor* to transport our field crews and supplies from Sitka to Juneau.

Numerous policies and procedures were developed to minimize contact and ensure data was collected effectively and safely. Major alterations to training and field preparation included: conducting training virtually and outside in groups of <5 with masks; quarantining out-of-state hires for two weeks in addition to requiring two negative tests to begin work; supplementing field crews with SSSC staff to reduce the number of travel hires; and a Juneau based support person to conduct grocery shopping to further minimize community interactions. To see the full extent of our COVID-19 policies and procedures please reference Appendix A.

2. Data Collection & Reporting:

Through updates to the field technician training, the quality and integrity of the data was further enhanced in 2020. To obtain more samples crews focused survey efforts on live post-spawned chum salmon, in the absence of more readily available carcasses. Crews used snagging equipment and nets to target post-spawned live individuals. This significantly aided crews in collecting more samples. However, special care had to be taken to not unnecessary capture pre-spawned individuals. Consistently low numbers out of Sawmill Creek, caused the Juneau based crew to shift data collection to focus on Fish Creek for the last four surveys.

Additional updates were made to the computer application to increase quality assurance of samples. This included adding a check to catch duplicate scale card row numbers and rearranging the stream specimens display so that otolith, DNA, scale, length, height, and sex were grouped together for ease-of-use. Adding a previously sampled count (as part of the overall dead count) provided more detailed information about dead count proportions and insight on carcass accumulation patterns on the stream. The laptop application allows for easy review of all field data and data were submitted after returning to base camp. Prior to data transmission, the laptop application prompts a complete review of the samples collected and requires the identification of milestone cells (missing otolith, last specimen, etc.). Once these checks are complete, the survey is transmitted to the Hatchery-Wild Database via the internet. Data were backed up on multiple storage devices daily by both field crews. The vessel-based crew had limited internet access and transmitted surveys as service was available, typically occurring each week.

The Hatchery-Wild Database is critical to acquisition of error-free data and is used by project personnel throughout the season to produce reports, conduct data checks, and confirm survey transmission. The database is also used during the season to conduct final quality assurance checks prior to delivering otolith and DNA samples to the ADF&G MTA Lab and scales to the Douglas Island Pink & Chum lab in Juneau.

3. Sampling Equipment Summary

Most sampling equipment worked well in 2020. We had some issues with finding supportive and waterproof backpacks and had issues with a few clickers stalling out. Primary sampling equipment included:

1. Knives
2. Forceps
3. Surgical scissors
4. 48 deep-well plates
5. Impermamats
6. Tray labels
7. Tray jigs
8. Calipers
9. Ethanol
10. Scale cards

Several pieces of equipment were replaced with updated versions, including a new laptop for the vessel-based crew. Overall, crew members felt well prepared and satisfied with the equipment used in the field.

Communication between field crews and project coordinators was effective and frequent. The use of both cell phones and Garmin InReach SE Satellite texting devices allowed crews to remain in contact with the SSSC project coordinator and field support staff throughout the season. Sample numbers, field logistics, schedule revisions, field crew requests, and other challenges were discussed throughout the season. The project coordinators also maintained communication with ADF&G Area Management Biologists in Juneau and Haines with updates on fish numbers, as well as stream and sampling conditions. Weekly updates were also communicated to ADF&G project supervisors and the HWI science panel.

Results:

During the 2020 field season crews collected a total of 191 samples between 7/22/2020 and 8/27/2020. A total of 60 surveys were completed during that time- 30 surveys on Prospect Creek, 15 surveys on both Sawmill Creek and Fish Creek. For Fish Creek, crews collected 134 samples, observed 877 live fish, 78 dead fish, and 90 previously sampled during the entirety of the field season (Figure 2). The vessel crew on Prospect Creek collected 51 samples, observed 718 live, 15 dead fish, and 0 previously sampled were observed (Figure 3). For Sawmill Creek, crews collected 6 samples, observed 150 live fish, 2 dead fish, and 1 previously sampled for the entirety of the field season (Figure 4).

Weather and reduced run sizes constrained the number of samples collected in 2020. Field crews had to cancel 10 and partially complete 10 surveys due to flooding conditions (Table 1a-c). Prospect Creek was hit particularly hard by flooding conditions- the remote terrain and nature of

stream made conducting abbreviated surveys more challenging than other streams. Even when conditions were amenable to surveying few fish were observed.

Recorded live and dead counts were lower in 2020 than in previous years (Table 2-a). Run timing appeared to be later than previous years, especially for Prospect and Sawmill Creek. For all creeks, a small range of observed live counts and small sampling sizes made pin-pointing a peak live count less substantial than in previous years. For example, 18 fish were observed on 7/27 and 23 fish were observed on 8/13 (the peak live count observed) in Sawmill Creek (Table 2-2a). Despite reduced live and dead counts, field crews reached targeted percentages for sampling peak live counts for Prospect and Fish Creek (Table 3). Daily proportions of samples collected fluctuated throughout the season but corresponded with peak dead counts observed for all three streams (Figure 5-7). Daily sample proportions were higher when more dead fish were observed in the stream. Fish Creek observed the highest proportion of daily samples on August 12th and August 18th. Sawmill Creek observed the highest proportion of daily samples on August 9th. The highest proportion of daily samples for Prospect Creek occurred slightly later in the season on August 24th.

Tables and Figures:

Table 1: Survey schedule and collected samples by stream

	Indicates a cancelled survey- weather
	Indicates a partial survey-weather

A. Fish Creek (111-50-10690)

Date	Live	Dead	Samples	Prev. Sampled
7/20/2020	0	0	0	0
7/22/2020	15	1	1	0
7/24/2020	63	0	0	0
7/26/2020	0	0	0	0
7/28/2020	114	1	1	0
7/30/2020	52	3	3	0
8/1/2020	70	2	2	0
8/3/2020	0	0	0	0
8/5/2020	62	7	9	1
8/7/2020	67	7	7	1
8/10/2020	0	0	0	0
8/12/2020	109	9	16	0
8/14/2020	35	8	10	6
8/16/2020	34	3	11	7
8/18/2020	56	7	16	6
8/20/2020	42	8	15	7

8/22/2020	56	11	14	25
8/24/2020	50	6	12	15
8/25/2020	33	3	11	22
8/26/2020	19	2	6	?
Totals	**877**	**78**	**134**	**90**

B. Sawmill Creek (115-20-10520)

Date	**Live**	**Dead**	**Samples**	**Prev. Sampled**
7/21/2020	7	0	0	0
7/23/2020	9	0	0	0
7/25/2020	6	0	0	0
7/27/2020	18	0	0	0
7/29/2020	15	0	0	0
7/31/2020	9	0	0	0
8/2/2020	14	0	0	0
8/4/2020	0	0	0	0
8/6/2020	9	0	1	0
8/9/2020	14	1	3	0
8/11/2020	17	0	0	1
8/13/2020	23	0	0	0
8/15/2020	5	1	2	0
8/17/2020	2	0	0	0
8/19/2020	2	0	0	0
8/21/2020	0	0	0	0
8/23/2020	0	0	0	0
Totals	**150**	**2**	**6**	**1**

C. Prospect Creek (111-33-10100)

Date	Live	Dead	Samples	Prev. Sampled
7/22/2020	22	0	0	0
7/23/2020	0	0	0	0
7/24/2020	8	0	0	0
7/25/2020	0	0	0	0
7/26/2020	0	0	0	0
7/27/2020	12	0	0	0
7/28/2020	16	0	0	0
7/29/2020	26	0	0	0
7/31/2020	13	0	0	0

8/1/2020	17	1	1	0
8/2/2020	23	0	0	0
8/3/2020	42	0	0	0
8/4/2020	19	0	0	0
8/5/2020	48	0	1	0
8/6/2020	41	2	2	0
8/7/2020	5	0	0	0
8/11/2020	13	0	0	0
8/12/2020	28	0	1	0
8/13/2020	52	0	3	0
8/14/2020	38	2	4	0
8/15/2020	1	0	0	0
8/16/2020	6	0	1	0
8/17/2020	2	0	0	0
8/18/2020	28	1	4	0
8/19/2020	31	1	2	0
8/20/2020	59	0	4	0
8/21/2020	45	0	0	0
8/23/2020	9	2	2	0
8/24/2020	40	3	13	0
8/25/2020	36	1	8	0
8/26/2020	11	0	1	0
8/27/2020	27	2	4	0
Totals	**718**	**15**	**51**	**0**

Table 2: Chum salmon peak live counts by stream in 2017-2020.

Stream Name	**AWC Number**	**2017 Live Chum Salmon**		**2018 Live Chum Salmon**		**2019 Live Chum Salmon**		**2020 Live Chum Salmon**	
		Date	Peak Count	Date	Peak Count	Date	Peak Count	Date	Peak Count
Fish	111-50-10690	7/30/17	1,591	7/22/18	370	8/2/19	945	7/28/20	114
Prospect	111-33-10100	8/5/17	1,300	8/6/18	569	8/8/19	588	8/20/20	59
Sawmill	115-20-10520	7/29/17	1,174	7/27/18	497	8/1/19	145	8/13/20	23

Table 2a: Chum salmon peak dead counts by stream in 2017- 2020.

Stream Name	**AWC Number**	**2017 Dead Chum Salmon**		**2018 Dead Chum Salmon**		**2019 Dead Chum Salmon**		**2020 Dead Chum Salmon**	
		Date	Peak Count	Date	Peak Count	Date	Peak Count	Date	Peak Count
Fish	111-50-10690	8/12/17	496	8/6/18	272	8/15/19	854	8/22/20	11
Prospect	111-33-10100	8/13/17	534	8/10/18	40	8/21/19	441	8/24/20	3
Sawmill	115-20-10520	8/13/17	855	8/5/18	31	8/14/19	169	8/9/20	--*

**Too small of sample size to accurately estimate*

Table 3: 2020 Sample collection information

Stream Name	AWC Number	Target Sample Size	Stream Surveys	Total Samples Collected	Peak Live Count	% of Peak Live Count Sampled
Fish	111-50-10690	500	15	134	114	118%
Prospect	111-33-10100	500	30	51	59	86%
Sawmill	115-20-10520	500	15	6	23	26%

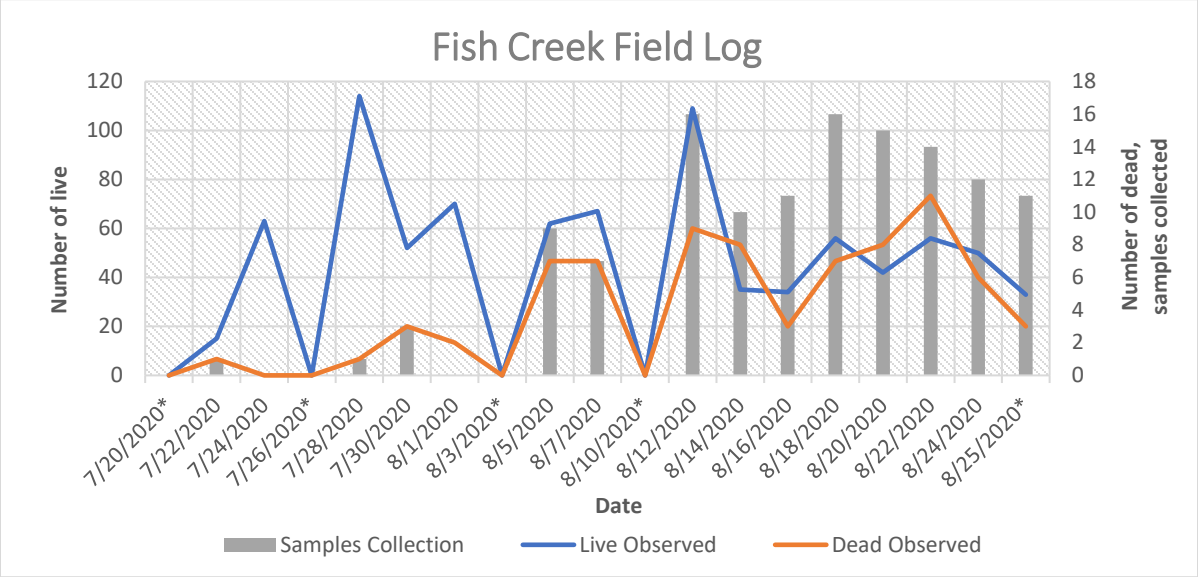

Figure 2: Summary of field observations for the 2020 field season for Fish Creek. Includes observed live and dead counts, and samples collected. Asterisk indicates a modified or cancelled survey.

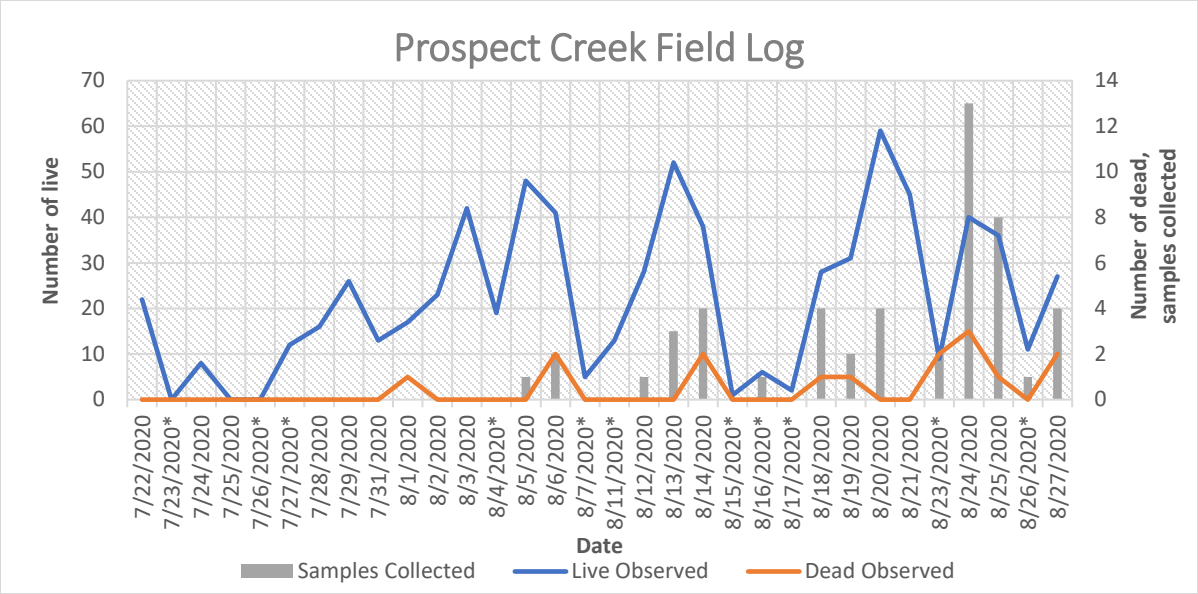

Figure 3: Summary of field observations for the 2020 field season for Prospect Creek. Includes live, dead, and sample counts. Asterisk indicates a modified or cancelled survey.

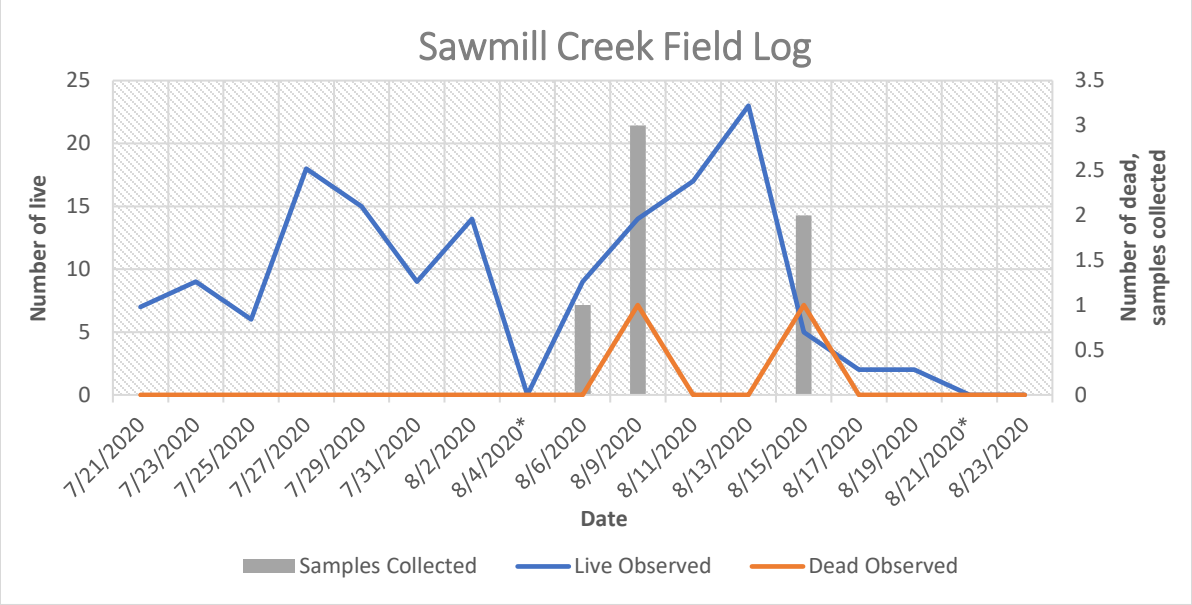

Figure 4: Summary of field observations for the 2020 field season for Sawmill Creek. Includes live, dead, and sample counts. Asterisk indicates a modified or cancelled survey.

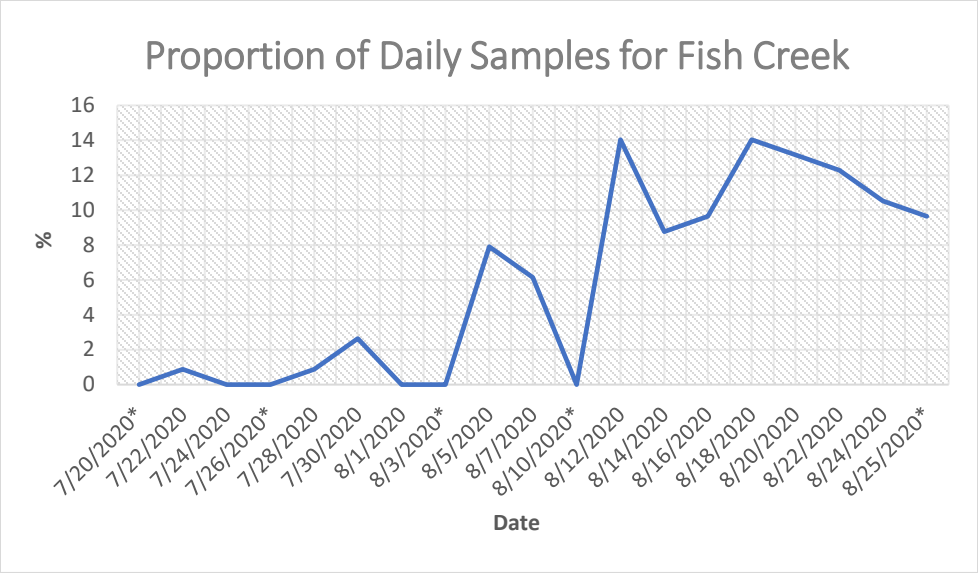

Figure 5: The proportion of the total samples collected for Fish Creek in 2020.

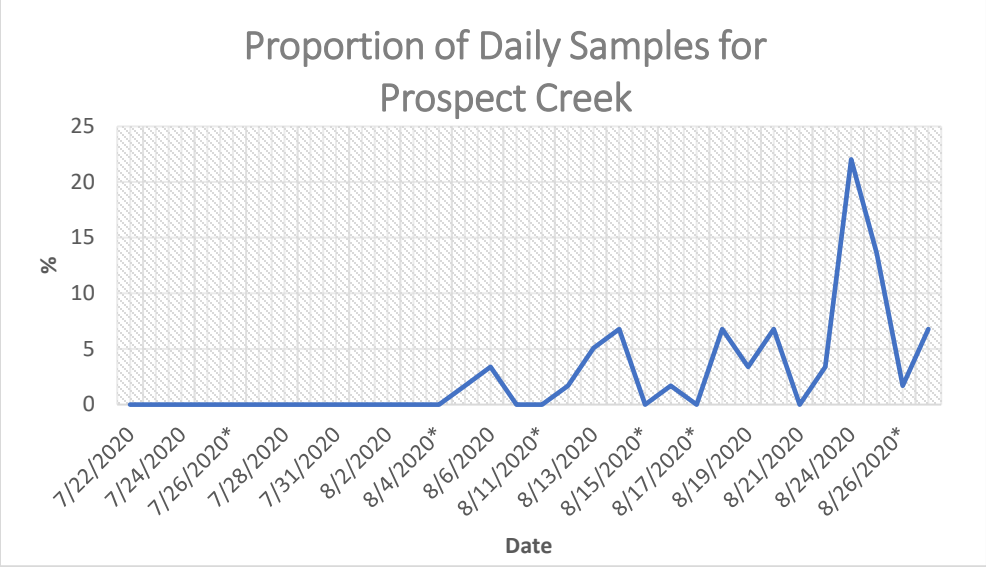

Figure 6: The proportion of the total samples collected for Prospect Creek in 2020.

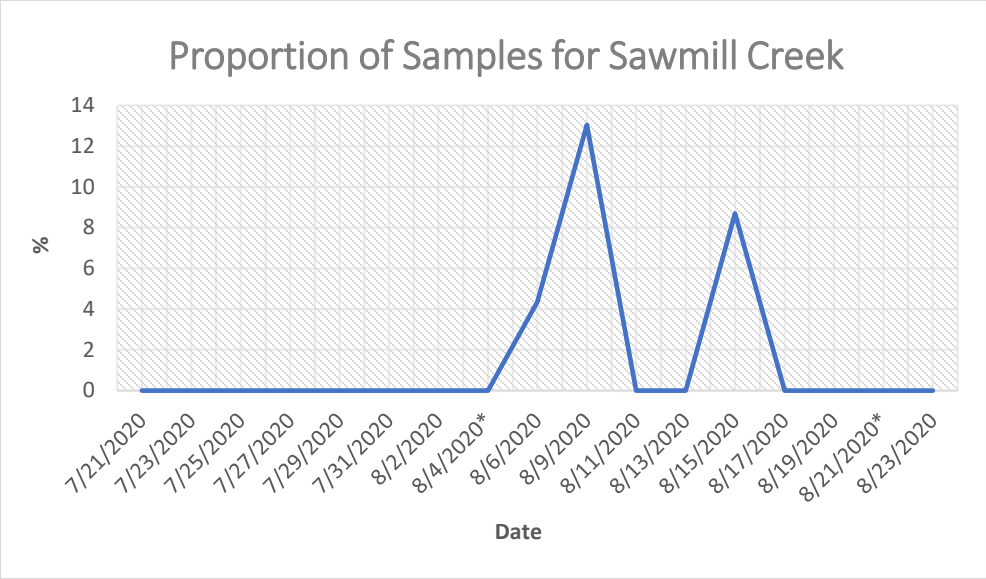

Figure 7: The proportion of the total samples collected for Sawmill Creel in 2020.

Discussion:

Field crews were plagued by a difficult combination of flooding and a small chum salmon return in Southeast, observations that were observed throughout the region. In 2020 Port Snettisham saw an average of 19.81mm of daily precipitation during sampling. Daily accumulation for Port Snettisham between 2017 and 2019 during sampling was 10.922mm on average. For Sawmill and Fish Creek, Lena Point weather station recorded an average of 6.98mm in 2020 of accumulated daily precipitation during sampling. Between 2017 and 2019 daily accumulated precipitation was 5.01mm, on average (Alaska Climate Research Center). Flooding caused crews to cancel an unprecedented number of surveys, impacting the number of fish crews were able to sample.

On days crews were able to sample, high flows impacted the turbidity and debris composition within each stream, which had potential ramifications for live and dead counts crews were able to physically observe. Preliminary discharge data from Lemon Creek, a nearby stream to sample surveys, recorded an average flow of 758.10 ft^3/s during the sampling period. Between 2017 and 2019 average discharge for Lemon Creek was 505.45 ft^3/s (USGS). High and fast-moving water could also be responsible for the low amount of dead chum salmon observed. Flood conditions appeared to flush carcasses out and made it difficult for carcasses to pool-up in traditionally low-flow areas. The low amount of previously sampled salmon observed also suggests that carcasses were being moved beyond survey extents or collecting in areas unsafe to sample due to high flows.

Douglas Island Pink and Chum, Inc. (DIPAC) observed significantly reduced chum returns in 2020, with approximately 758,543 fish returning. The average chum return recorded by DIPAC, between 1994 and 2019, was 2,652,628 fish (DIPAC, 2020). In addition, the projected total

return of chum salmon to the Macaulay Hatchery and other release sites for DIPAC was 1.98 million for 2020 (Hagerman, 2020). Cost recovery efforts for DIPAC were halted to transport live fish to the Macaulay Hatchery site to assist in broodstock needs. Even with these recovery efforts, DIPAC still fell sort of egg collection goals (DIPAC, 2020). Similarly, the Alaska Department of Fish and Game projected a chum harvest of 9 million fish in Southeast Alaska, and preliminary post-season summaries estimate a Southeast chum harvest of 4.7 million (ADF&G, 2020).

Environmental conditions and a small chum salmon return resulted in reduced samples rather than crew efficacy and methodology. Flooding made sampling in a reduced run year challenging. Crews were able to increase sampling numbers by adapting and utilizing alternative sampling techniques to target live-post spawned individuals. Regardless, 2020 field crews pivoted to adjust to an already challenging season and collected the targeted percentages of peak live count samples despite significant obstacles to sampling.

Appendix A:

SSSC Shared Field Housing Statement:

The Sitka Sound Science Center is dedicated to maintaining a safe and healthy workplace and living space for all staff. The communities we conduct field research in generally have very limited medical support, and because the spread of viruses occurs quickly in a closed system, Sitka Sound Science Center has developed this agreement to protect our staff and community from COVID-19.

1. Please limit your interactions with the community as much as possible during non-work hours. This includes visiting restaurants, bars, and other public spaces. All SSSC staff members are encouraged to maintain social distancing and wear face masks to ensure the safety of all housemates when in public.

2. If you do need to head into town, minimize your impact. Operate with a plan, consider (1) what you need, (2) where those things are, (3) how to accomplish your errands as efficiently as possible.

3. Only SSSC staff are permitted in SSSC shared housing- no overnight guests are permitted.

4. Frequent hand-washing and general personal hygiene is of special importance during a global pandemic. Hands should be washed upon entering and departing shared housing. Common areas and frequently touched surfaces should be wiped down daily- materials to be provided by SSSC.

5. Daily health screenings are required of all SSSC staff members in shared housing. If a crew member starts exhibiting COVID-19 symptoms that crew member must stop working and project coordinators will ensure separate accommodations and testing. Please do not hide or underreport symptoms. Your safety and the safety of the crew is more pressing than the need to collect samples.

6. We recognize that this isn't an all-encompassing document- if a crew member, staff member, etc. in shared housing is exhibiting behaviors that you feel are risky or unsafe in relation to COVID-19 please bring to the attention of a project coordinator. If you feel uncomfortable approaching them, please see the attached list of possible contacts within SSSC.

References:

ADF&G, 2020. "Salmon Fishery Update- Southeast Alaska & Yakutat Commercial Fisheries." Alaska Department of Fish and Game. Sept. 18.

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Hagerman, Grant and Micheal, Vaughn. 2020. 2020 Summer Troll Fishery Management Plan. Regional Information Report No. 1J20-12. Alaska Department of Fish and Game. June.

USGS, 2020. National Water Information System.