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ALASKA

ENVIRONMENTAL CONSERVATION PROGRAM

EAGLE RIVER ADULT SALMON MONITORING ON JOINT BASE ELMENDORF-RICHARDSON, ALASKA, 2013

FINAL

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Eagle River Adult Salmon Monitoring on Joint Base Elmendorf-Richardson, Alaska, 2013

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Introduction

Establishing a baseline for salmon escapement and run timing in Eagle River is an important component in understanding the presence and abundance of beluga whales (*Delphinapterus leucas*) at the mouth of Eagle River. In 2008, National Marine Fisheries Service (NMFS) listed the Cook Inlet beluga whale (CIBW) as endangered (73 FR 62919, Oct 22, 2008). Beluga whales are predatory in nature and follow eulachon (*Thaleichtys pacificus*) into the Upper Cook Inlet during the spring then switch to consuming salmon (*Oncorhynchus* spp.) as the eulachon numbers decline (NMFS 2009). When the CIBW was listed as endangered, four out of the five species of Pacific salmon–Chinook (*Oncorhynchus tshawytscha*), sockeye (*Oncorhynchus nerka*), chum (*Oncorhynchus keta*), and coho (*Oncorhynchus kisutch*)– were considered as primary constituent elements (PCEs) (U. S. Army Engineer District, Alaska 2013). As PCEs, these fish are considered necessary for the recovery of the CIBW (U. S. Army Engineer District, Alaska 2013).

On April 11, 2011, the final ruling to designate critical habitat for the CIBW was announced (76 FR 20180, April 11, 2011). All of the upper Cook Inlet, including the Knik Arm, was designated as critical habitat (NMFS). Joint Base Elmendorf-Richardson (JBER) property is adjacent to the Knik Arm, but no portion of JBER property was listed as critical habitat. The Endangered Species Act (ESA) section 4(a)(3)(B)(i) states "…Secretary shall not designate as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan prepared under section 670a of this title…". JBER's Integrated Natural Resources Management Plan (INRMP) outlines monitoring of anadromous waterways on JBER.

HDR Inc. was awarded a contract in 2011 to design and implement a salmon monitoring project in Eagle River (U. S. Army Engineer District, Alaska 2013). The pilot season was conducted during the summer of 2012 when a Dual Frequency Identification Sonar (DIDSON) and a fish wheel with videography were deployed in Eagle River.

Objectives

The goal for this project was to establish a baseline species composition, run timing, and relative run strength of Pacific salmon in Eagle River.

Study Site

Eagle River is a glacially fed river approximately 15 miles north of Anchorage, Alaska, with the lower nine river miles flowing within JBER property. The first four river miles are located with the Eagle River Flats Impact Area (Figure 1). The fish wheel and DIDSON site location is approximately four and a quarter river miles up from the mouth of Eagle River (Figure 2). This site was selected because it was a single channel, wedged-shaped river cross section that matched the shape of the sonar beam, had a uniform slope without deep depressions or boulders that could create blind spots, had ease of access, and was within a reasonable distance of a suitable site for the operation of the fish wheel (U. S. Army Engineer District, Alaska 2013).

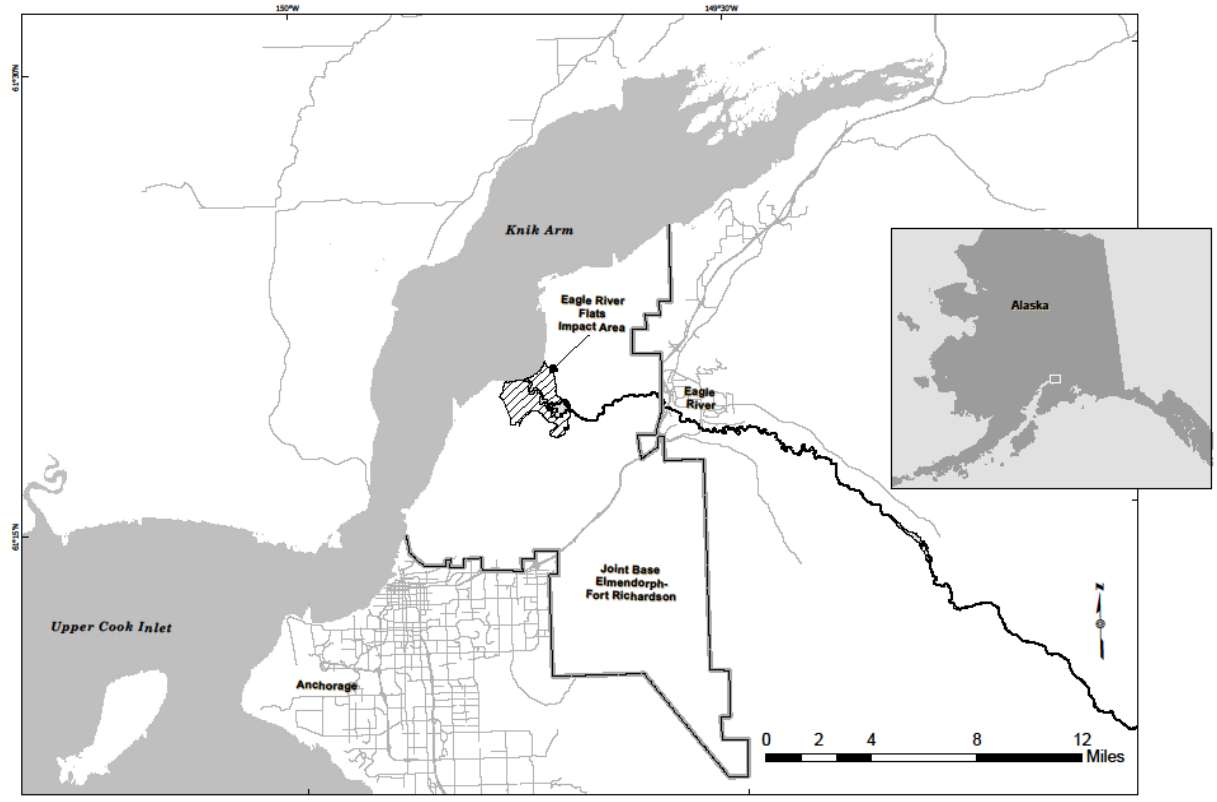

Figure 1. Location of Eagle River and JBER relative to Anchorage, AK (U. S. Army Engineer District, Alaska 2013).

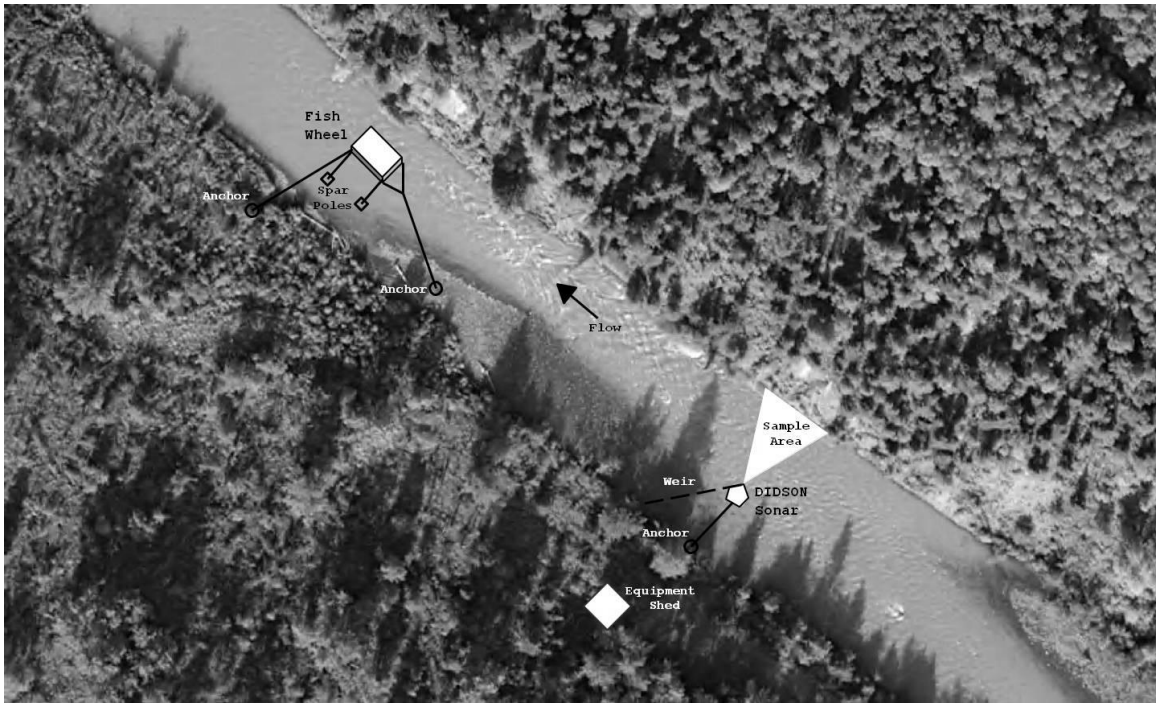

Figure 2. Approximate location of the 2013 fish wheel and DIDSON (U. S. Army Engineer District, Alaska 2013).

Methods

DIDSON Deployment

A long range model 300 DIDSON was used to passively sample the salmon. A DIDSON is an acoustic camera that uses acoustic beams and sends out short pulses of 48 beams. These 48 beams form a field of view 29° wide by 14° tall that can approximately reach 60 meters (m) (Sound Metrics Corp. 2008).

The DIDSON was installed on 4 June 2013 at 1445, and the first full day of operation began on 5 June 2013. The DIDSON was deployed on the left bank. A partial modular A-frame type picket weir was installed approximately 1 m downriver and extended approximately 1 m past the DIDSON. This was to insure that the fish passed through the sonar beams and were detectable.

The DIDSON was placed in a silt exclusion box and then mounted onto a metal frame that was placed perpendicular to the river flow. This frame also allowed for manual adjustments in the horizontal and vertical view. The aim was adjusted so that the river's bottom and surface could be seen in the display. A 3° concentrator lens was used to help optimize the DIDSON's beams to the river's profile (U. S. Army Engineer District, Alaska 2013).

DIDSON Data Collection and Analysis

On site, there was a shed that housed two computers and a two terabyte external hard drive. On the first computer, DIDSON viewer software version 5.23 was installed and used to solely manipulate the DIDSON's window length, frame rate, file duration, and send the data to the external two terabyte solid state hard drive. Every 15 minutes, the DIDSON would change the window length to ensure the whole river was being sampled. The near window length was from 0.4 to 10.4 m and the far window length was from 9.6 to 19.6 m. The DIDSON's sustained frame rate was 8 frames per second.

The second computer also had DIDSON viewer software version 5.23 installed and was used to process the raw data files into Convolved Samples Over Threshold (CSOT) that had been stored on the external hard drive. The CSOT program takes the raw data files and writes a new file that contains only files that show motion (U. S. Army Engineer District, Alaska 2013). Once the raw data had been processed into CSOT files, the files were then reviewed.

All CSOT files were reviewed in video mode, and each fish that was seen was marked and manually measured using the software. By marking and measuring fish, a Fish Count file was generated with information such as date, time, range, length, and direction of travel (upstream or downstream). Once the file reviewing was completed, the Fish Count files were merged into a Microsoft Excel worksheet (U. S. Army Engineer District, Alaska 2013).

Direction of travel of each fish was noted in the Excel worksheet; one designating a fish traveling upstream and one a fish traveling downstream. This Excel worksheet was also used to extrapolate and expand the fish counts. There was overlap in the two window lengths, which left a portion of the river being sampled 100% of the time and the other sections only 50% of the time. Fish that were seen in the overlapping sections were not expanded, while the fish in the other two sections were multiplied by two to compensate for being sampled only 50% of the time (U. S. Army Engineer District, Alaska 2013).

Fish Wheel Deployment

DIDSONs are unable to distinguish between fish species; therefore, a fish wheel was used in conjunction with the DIDSON to understand the species apportionment. Fish wheels are another passive sampling technique that captures living fish by scooping the fish out of the

water and sliding them into a live box (Hubert et al. 2012). The force of the river against the baskets causes the baskets to rotate. The fish wheel was located approximately 110 m down river from the DIDSON on the left bank. This site did not have any trees that could be used to secure the fish wheel so a 4 ft by 4 ft gabion was constructed above the ordinary high water mark (U. S. Army Engineer District, Alaska 2013).

The fish wheel consisted of two aluminum pontoons, three baskets that each measured 6 ft by 6 ft to the axle, railings, video chute, camera, motion-sensing digital video recorder, batteries, live box, spar poles, and various ropes and cables. The attached live box was only operating while personnel were on site. The live box was used to verify the motion sensing video recorder. The motion-sensing video recorder and camera were used in hope of eliminating the handling and holding of the fish (U. S. Army Engineer District, Alaska 2013). Once a video is taken of the fish, as it slides through the primary chute, it is immediately released back into the river. A secondary chute, consisting of ½ inch rubber, is used to extend the primary chute, thus allowing the fish to bypass the live box. The fish wheel began operating on 16 July 2013 after assembly was completed.

Fish Wheel Data Collection and Analysis

The fish wheel was checked twice daily for fish while personnel were on site and the live box was in operation. Fish were identified by species, and, when possible, the sex of the fish was recorded. The fish were then released promptly back into the river.

The motion-sensing video recorder was also checked twice daily to insure that it was sensing and recording captured fish properly. Personnel also reviewed the video recording daily to identify fish that were captured and released while personnel were not on site. Fish that were easily identifiable were recorded and fish less easily distinguished were recorded as unknown.

Results

DIDSON

The DIDSON started operation on 4 June 2013 and ended operations on 12 June 2013 due to a high water event that swept the weir and DIDSON stand downriver, resulting in the DIDSON stand being damaged beyond repair. A total of 42 fish were observed during the 8

days that the DIDSON was operating. The highest passage of fish was seen on June 6, with 12 fish passing the DIDSON (Table 1).

Table 1. Eagle River DIDSON Expanded Counts 2013.

	Near Range (R1)		Far Range (R2)		R1+R2			
Date	Fish Observed	Expanded Net Count	Fish Observed	Expanded Net Count	Total Fish Observed	Total Expanded Net Count	Cumulative	Cumulstive Expanded
6/4/2013	0	0	0	0	0	0	0	0
6/5/2013	0	0	1	2	1	2	1	2
6/6/2013	0	0	6	12	6	12	7	14
6/7/2013	0	0	4	8	4	8	11	22
6/8/2013	0	0	4	8	4	8	15	30
6/9/2013	2	4	1	2	3	6	18	36
6/10/2013	3	6	0	0	3	6	21	42
6/11/2013	0	0	0	0	0	0	21	42
6/12/2013	0	0	0	0	0	0	21	42

Fish Wheel

The assembly and installation of the fish wheel was completed on 18 July 2013, and sampling began the same day, catching one sockeye. The fish wheel was removed 2 September 2013, and, in total, the fish wheel caught 115 salmon (Appendix 1). The run timing of the adult Chinook salmon run is largely unknown due to only two Chinook salmon being caught, one on 30 July, and the other Chinook caught had already spawned when caught on 14 August.

The first sockeye was caught on 18 July with the last one being caught on 27 August. A total of 17 sockeye were caught in the fish wheel, with the largest number of fish being caught on 26 July 2013 (Figure 3).

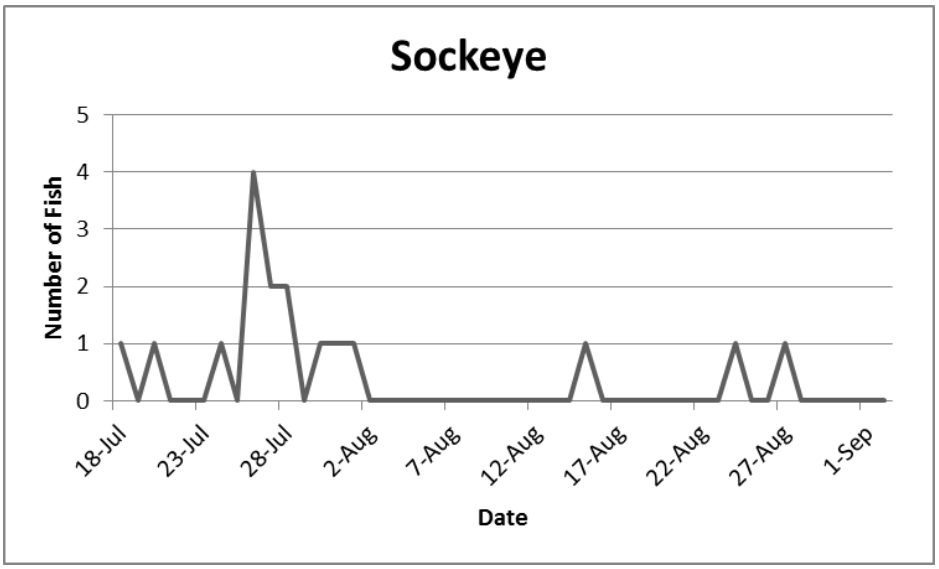

Figure 3. Daily number of sockeye salmon caught in the fish wheel.

The first chum salmon was caught on 26 July, while the last chum was caught on 31 August. A total of 21 chum were caught in the fish wheel, with the highest catch rate of 4 occurring on 25 August (Figure 4).

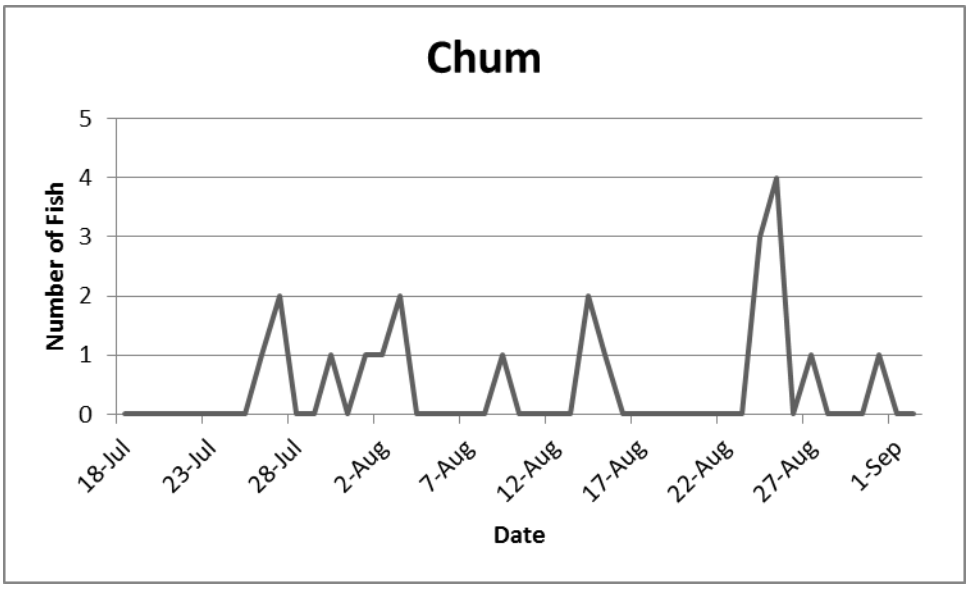

Figure 4. Daily number of chum salmon caught in the fish wheel.

The first pink salmon was caught on 26 July while the last pink salmon was caught on 28 August. A total of 25 pink salmon were caught in the fish wheel, with the highest catch rate of 4 fish in one day occurring on 9 August (Figure 5).

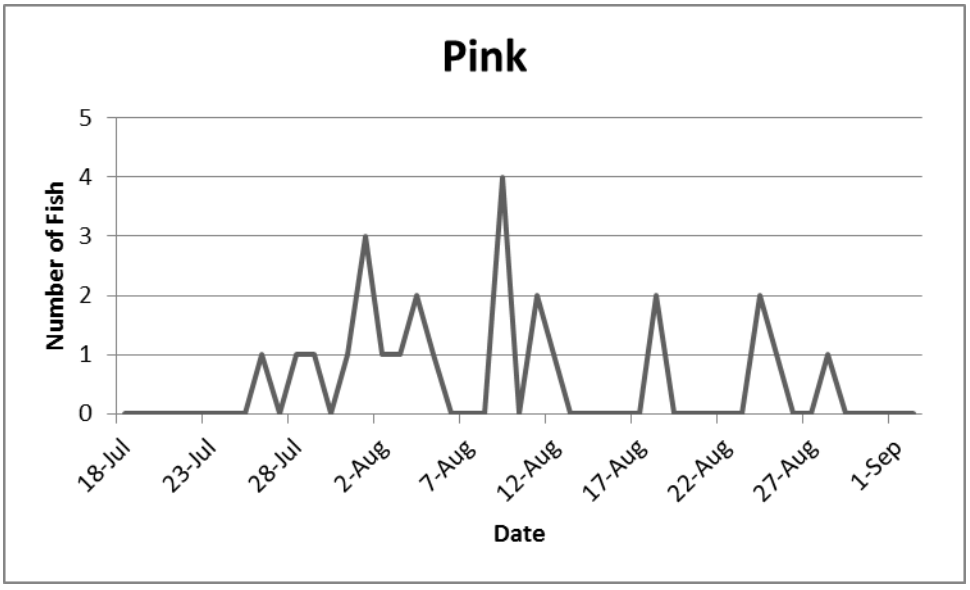

Figure 5. Daily number of pink salmon caught in the fish wheel.

The number of coho salmon caught in the fish wheel was double the number of any other Pacific salmon caught. A total of 45 coho were caught in the fish wheel during the operation. The first coho was caught on the 26 July while the last one was caught on 2 September. The highest number of coho caught in one day was five and occurred on 25 August (Figure 6).

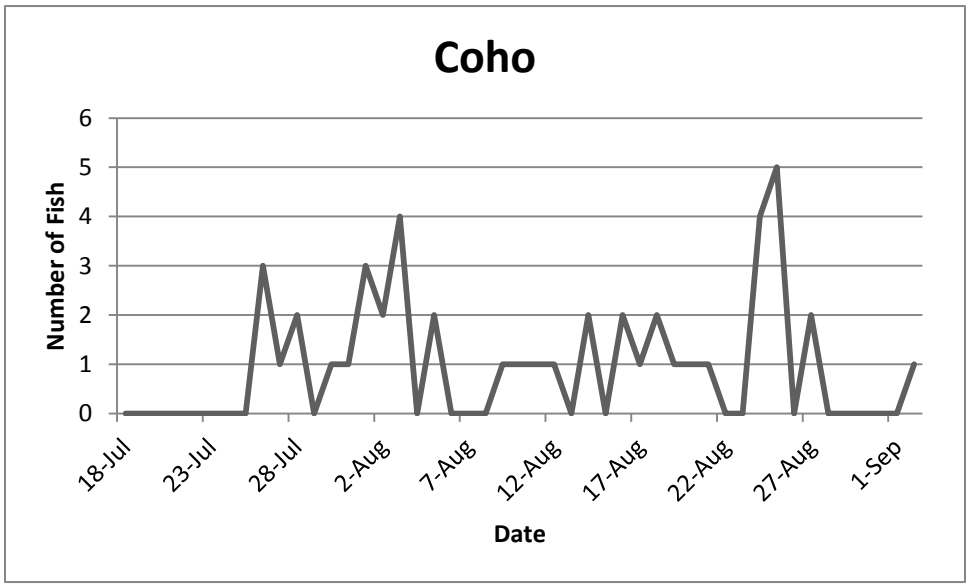

Figure 6. Daily number of coho salmon caught in the fish wheel.

Discussion and Conclusion

Eagle River Conditions

South-central Alaska experienced an abnormally late thaw in spring due to May 2013 being colder than average (National Weather Service 2013). These colder days delayed the installation of the DIDSON and fish wheel. Typically once the snow and shelf ice has melted from the river bank, the DIDSON and weir are installed. When Eagle River was determined safe for the crew to install the sonar, we observed an immediate rise in water over a two-day period. This made the sonar and weir unobtainable by the crew. The crew was able to retrieve the DIDSON; however, the DIDSON stand and weir were washed downstream, and the DIDSON stand was damaged beyond repair. Since the DIDSON stand was damaged in this high water event, the DIDSON was not used for the remainder of the 2013 field season.

DIDSON

The 42 salmon recorded during the 8-day period in June were likely Chinook salmon. From the previous 2012 season, very little species overlap occurred early in the salmon returning in mid-May to early June. The DIDSON requires constant attention to varying water levels, and the operating threshold is assumed to be near the 1,500 cubic feet per second (cfs) mark. This cfs threshold is based on the National Weather Service's Advanced Hydrologic Prediction Service located on Eagle River at the Glenn Highway Bridge. As the water starts to reach the 1,500 cfs mark, the DIDSON will need to be moved closer to shore in order for the crew to safely access it. Also, this could mean that the DIDSON and the weir are completely removed from the river to insure that no damage occurs to the DIDSON and the weir. Any time the DIDSON is moved within the river, or fully removed from the river, it is turned off. Turning off the DIDSON causes data gaps, which in turn means we could be missing fish migrating upstream. Site placement will be a critical aspect to safely continue to gather data.

Future work to be considered includes understanding bank preference, particularly for Chinook salmon and determining a correction factor for the two different fields of views. Understanding which bank the Chinook salmon use will help us gain a better feel for their abundance. However, several years of complete data sets will be needed before we have a full understanding of bank preference. In order to determine the correction factor, several years of complete data sets will be needed.

Fish Wheel

The fish wheel was operated on July 18, 2013 to September 2, 2013. Due to the fish wheel being installed later in the season, a lower catch of Chinook salmon was expected. In previous years, the Chinook salmon run timing began in mid-June and lasted into the first week of July. A reoccurring issue was operating the video camera. The battery for the video camera would not last through the night. Also, the motion sensor had difficulty running in low light. A new battery for the 2014 field season should help the camera run through the night. Likewise, adjusting the video settings should help with the low light issue.

Literature Cited

"Endangered and Threatened Species; Designation of Critical Habitat for Cook Inlet Beluga Whale: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce (Final Rule)." Federal Register 76:69 (April 11, 2011) p. 20180. Available from: National Marine Fisheries Service. <www.nmfs.noaa.gov/pr/pdfs/fr/fr73-62919.pdf >. Accessed 1/21/14.

"Endangered and Threatened Species; Endangered Status for the Cook Inlet Beluga Whale: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce (Final Rule)." Federal Register 73:205 (October 22, 2008) p. 62919. Available from: National Marine Fisheries Service. <www.nmfs.noaa.gov/pr/pdfs/fr/fr73-62919.pdf >. Accessed 1/10/14.

Endangered Species Act as amended. Available from: Cornell University Law School, Legal Information Institute. <http://www.law.cornell.edu/uscode/text/16/1533>. Accessed 1/22/14.

Hubert, W. A., K. L. Pope, and J. M. Dettmers. 2012. "Passive Capture Techniques." Page 249 in A. V. Zale, D. L Parrish, and T. M. Sutton, editors. *Fisheries Techniques*, 3rd edition. American Fisheries Society, Bethesda, Maryland.

National Marine Fisheries Service, Alaska Regional Office. Cook Inlet Beluga Whales. 2009. Available from: National Marine Fisheries Service, Alaska Regional Office. <http://www.fakr.noaa.gov/protectedresources/whales/beluga/cibrochure09.pdf>. Accessed 1/14/14.

National Marine Fisheries Service, Alaska Regional Office. Cook Inlet Beluga Whales, Critical Habitat. Available from: National Marine Fisheries Service, Alaska Regional Office. <http://alaskafisheries.noaa.gov/protectedresources/whales/beluga/management.htm#habitat>. Accessed 1/22/14.

National Weather Service, Anchorage Forecast Office. 2013. 2013 Anchorage Annual Temperatures. Accessed 18 Dec. 2013. < http://pafc.arh.noaa.gov/panctemps.php>

Sound Metrics Corp. 2008. Dual-frequency identification sonar DIDSON operation manual V5.23. Sound Metrics Corporation, Lake Forest Park, Washington.

U. S. Army Engineer District, Alaska. 2013. Eagle River Adult Salmon Monitoring, Final Report. Contract W911KB-10-D-0011 Task Order 0007.

Appendix

Appendix 1. Total number of salmon caught in the fish wheel.

Date	Chinook	Sockeye	Chum	Pink	Coho
18-Jul	0	1	0	0	0
19-Jul	0	0	0	0	0
20-Jul	0	1	0	0	0
21-Jul	0	0	0	0	0
22-Jul	0	0	0	0	0
23-Jul	0	0	0	0	0
24-Jul	0	1	0	0	0
25-Jul	0	0	0	0	0
26-Jul	0	4	1	1	3
27-Jul	0	2	2	0	1
28-Jul	0	2	0	1	2
29-Jul	0	0	0	1	0
30-Jul	1	1	1	0	1
31-Jul	0	1	0	1	1
1-Aug	0	1	1	3	3
2-Aug	0	0	1	1	2
3-Aug	0	0	2	1	4
4-Aug	0	0	0	2	0
5-Aug	0	0	0	1	2
6-Aug	0	0	0	0	0
7-Aug	0	0	0	0	0
8-Aug	0	0	0	0	0
9-Aug	0	0	1	4	1
10-Aug	0	0	0	0	1
11-Aug	0	0	0	2	1
12-Aug	0	0	0	1	1
13-Aug	0	0	0	0	0
14-Aug	1	0	2	0	2
15-Aug	0	1	1	0	0
16-Aug	0	0	0	0	2

Date	Chinook	Sockeye	Chum	Pink	Coho
17-Aug	0	0	0	0	1
18-Aug	0	0	0	2	2
19-Aug	0	0	0	0	1
20-Aug	0	0	0	0	1
21-Aug	0	0	0	0	1
22-Aug	0	0	0	0	0
23-Aug	0	0	0	0	0
24-Aug	0	1	3	2	4
25-Aug	0	0	4	1	5
26-Aug	0	0	0	0	0
27-Aug	0	1	1	0	2
28-Aug	0	0	0	1	0
29-Aug	0	0	0	0	0
30-Aug	0	0	0	0	0
31-Aug	0	0	1	0	0
1-Sep	0	0	0	0	0
2-Sep	0	0	0	0	1
Cumulative	**2**	**17**	**21**	**25**	**45**