Incorporation of video recording technology to the existing weir project on the East Fork Andreafsky River.

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Introduction: This project addressed the priority information need of obtaining reliable estimates of Chinook Salmon and chum Salmon escapements. Management and assessment of management actions for Yukon River salmon fisheries is difficult due to the complexity of the salmon runs, mixed stock fisheries, and the limited number of escapement studies in the drainage. The East Fork Andreafsky River is a major tributary in the lower Yukon River. The East Fork Andreafsky River weir is the only lower river escapement project which provides both in-season information to assess management actions as well as a postseason estimate of escapement and Age Sex and Length data for Chinook Salmon and summer chum Salmon. The Andreafsky weir has been in operation for 21 years, yielding a long term data set of accurate escapement data. This long term data set enables analyses of trends in population status, size, length, age, and gender composition of the run, developing future run projections, and setting and evaluating harvest and escapement goals and allocations. Furthermore, these time series data will become increasingly valuable as stressors such as climate change, disease, selective harvest, and overall demand on the resources of the dynamic Yukon River system continue to increase.

Over the past decade, Yukon River Chinook Salmon and summer Chum Salmon runs have displayed wide variability, with Chinook Salmon returns below projected levels (JTC 2015). These circumstances accentuate the need to collect accurate escapement estimates from Yukon River tributaries. The incorporation of videography into the Andreafsky weir project has provided cost savings by reducing the time required to count passing fish, thus reducing crew size and personnel costs. Also, videography has reduced the impact to migrating salmon by reducing the period of time that the weir is closed and potentially interrupting salmon migration. This has been an extremely useful tool with the recent above average temperatures experienced in 2014 and 2015. Furthermore, the videography provides the opportunity to increase public awareness by sharing video through social media, and should increase accuracy of counts by allowing video to be reviewed to verify counts or species identification.

The focus of this project was to construct a video monitoring platform that could accurately identify the species of fish passing through the weir, as well as, the number of fish by species, such that in-season and long term data suffered no significant loss of accuracy. Additionally, videography may allow us to further our understanding of quality of escapement in the future.

The weir was designed using much of the pioneering work done in Southeast Alaska by the Kenai Field office, while also incorporating newer technologies and redesigning certain

components. The necessary components, supplies, and equipment to construct and install the video systems were purchased; based on information from previously successful video weir operations (Anderson et al. 2004; Gates et. al. 2010; Gates and Boersma 2011; Ken Gates, US Fish and Wildlife Service, personal communications; Ken Harper, US Fish and Wildlife Service, personal communications). Construction of the video box and chute was done by the Fairbanks Fish and Wildlife Field Office staff. All components were designed to be compatible with the existing weir structure. By combining tested designs with newer technologies the East Fork Andreafsky River weir video conversion proved to be a success and performed well even under difficult field conditions.

Objectives:

1. Construct, install, and operate an underwater video system at the existing East Fork Andreafsky River weir to improve escapement monitoring

2. Verify video system performance by validating motion capture video counts with real time counts with no disruption to the existing data collection.

Study Area: East Fork Andreafsky River.

East Fork Andreafsky River weir location- N62.24100°, W162.674717°. For a description of the East fork Andreafsky River see Mears (2015) The Weir is located approximately 40 river kilometers from the village of Saint Marys, Alaska (figure 1).

Licenses and Permits: No new licenses or permits were required to convert to a video weir system.

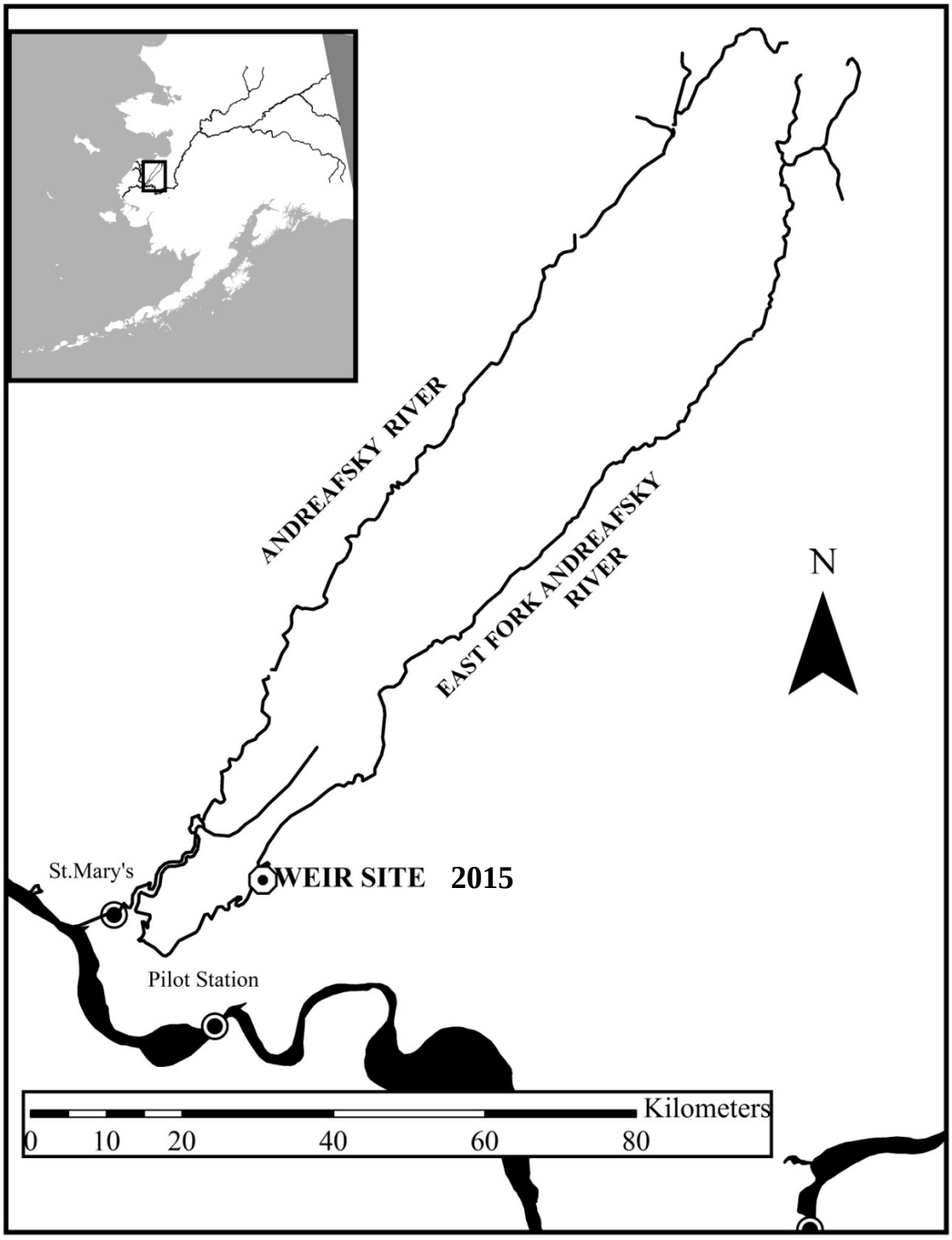

Figure 1. East Fork Andreafsky River. Alaska

Methods: Construction of the video weir components began in January of 2014, and were completed in May 2014. The system components were shipped down river to the village of St. Marys, Alaska in June and were installed in the field in June of that year on the East Fork Andreafsky River.

The weir was called fish tight on 6/17/2014. On 6/22/2014, video weir components had been installed and were operational. From 6/22/2014 the technicians at the weir validated counts between live feed, video, and motion capture files. The weir counted fish for the remainder of the season with motion capture files. Weir operations ceased on 7/31/14. For specifics on counts see Mears (2015).

Sampling/Statistical Design: The sampling design was unchanged for weir ASL data collection. Video counting and manual counting was performed, side by side, to ensure that the system was accurately counting returning salmon. The acceptable error rate was ±3% between weir counts and video counts for all species. Once the system was operating within this acceptable level of accuracy, periodic checks were performed till the end of the season to ensure data quality did not suffer. Counting took place by reviewing digital files from motion capture in the field. Counts were reported daily to the Fairbanks Fish and Wildlife Field Office.

The underwater video camera is housed in a sealed video box constructed of 3/16" aluminum sheeting, with a safety glass front. Two LED lights illuminate the video chute to provide near constant ambient lighting. The video box, which houses the camera and lights is filled with filtered water to help maintain good visibility, additionally, a cup of bleach is added to the water in the video box to inhibit fouling. The video box is attached to a passage chute constructed from aluminum angle and plywood. A white backdrop in the passage chute will be adjustable to minimize the number of fish passing through the chute at one time and to adjust for differences in clarity of the river water. Also, the backdrop is designed for easy replacement when it becomes fouled. The video box and chute will be attached to the front of the existing weir trap. No modification of the existing weir structure were required, and should the need arise the weir can revert to manual counting.

Data Analysis: No data analysis was performed or required under the proposal. In the field daily counts were compared between, traditional manual counts, live feed video, and motion capture video files and did not exceed the three percent error rate specified in the detailed proposal for any species (Chum or Chinook Salmon). Specific questions regarding between observer error are being collected but are not addressed here.

Results and Discussion: For a complete description of the season on the East Fork Andreafsky River please see Mears (2015): Abundance and run timing of adult Pacific salmon in the East Fork Andreafsky River, Yukon Delta National Wildlife Refuge, Alaska.

The results of the first season of video weir operation could only be called a success. We were able to design, build, and operate the system in a relatively short time span. The expected

efficiencies and data quality improvements appear to have been realized. The system accurately counted fish migrating through the weir to within the specified 3%. We are also now able to review periods where counts are questioned. This was quite helpful on July 8th when more than 2,500 Chinook Salmon passed through the weir in a single day; this is one of, if not the single highest Chinook passage days at this project, and files were available to be recounted to verify that this was not an error. We are also able to get second opinions on species identification after the fact, this helps to verify judgment calls during the initial count. Most importantly, we are now able to allow fish to pass through the weir with only small periods of interruption to accommodate ASL sampling. The weir was operated again in 2015 with the same system and achieved equally satisfactory results.

During 2014 the Gisasa River Weir, which was also upgraded to videography, experienced high water and was washed out. One key component was lost, the video chute. The video chute was redesigned for 2015 and this has led to further improvements over the original design still used on the Andreafsky River. The Andreafsky weir project will also be upgraded in the future utilizing this new design.

The sample size for Age, Sex, and Length of Chinook Salmon in 2014, 330 (Mears 2015)was smaller than what is currently considered ideal, This was a result of two factors; one the introduction of the new technology allows for fish to pass, and be counted, without closing the passage chute. While this does allow for less interruption of the run, it does limit the number of Chinook Salmon that are accessible for sampling. Additionally, just under half of all the Chinook salmon passed the weir on one day. In 2015 this problem was eliminated by closer monitoring of the migration and increasing sampling during periods with high number of Chinook Salmon passing the weir. Five hundred and fifty nine Chinook Salmon were sampled at the weir in 2015 (Jeremy Mears, personal communication August 2015). This is not an issue for summer Chum Salmon due to the larger volume of migrating fish.

In 2014 and 2015 data has also been collected to assess between observer error. This information is currently being analyzed to get a better understanding of observational biases.

This project has benefitted greatly from introduction of videography and we are continually looking for ways to improve the systems we have in place.

Acknowledgements:
The success of this project relied heavily on the pioneering work done on resistance board weirs and integration of video counting at similar projects in Alaska. In particular the information provided by the Kenai U.S. Fish and Wildlife Field Office, Ken Harper, Jeff Anderson, and Ken Gates. Ruslan Gregoriev, Jamie McGuire, Dan Donnelly, Jennifer Morella, and all the technicians who worked on this project were essential in making this project a success both pre and in-season. The Staff of the Fairbanks Fish and Wildlife Field Office, Fred Bue, Aaron Martin, Gerald Maschmann and Jeremy Carlson were also essential in making this project a reality. We would also like to thank Paul Banyas with the Arctic National Wildlife Refuge for facilitating the construction of the weir.

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