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Nulato River Salmon Weir

Final Report for Study No. FIS 01-029-1

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Abstract:

The Office of Subsistence Management entered into an agreement with the Bering Sea Fishermen's Association and Nulato Tribal Council, wherein the Office of Subsistence Management provided funds for local hire technicians at the Nulato River Tower/Weir project. The purpose of the weir was to collect accurate, timely and as complete as possible salmon escapement information on this important Yukon tributary.

**Key Words:** abundance, distribution, escapement, enhancement, data collection, migration, habitat, subsistence, ASL (age-sex-length), Yukon

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## Introduction

Subsistence and commercial harvests are the major factors impacting annual spawning escapement. The Yukon River commercial salmon fishery evolved from being unlimited (early 1900s), progress to a quota system (1954-1960), developed into a published calendar date and preset time fishery (1961-1979), and is presently managed in-season based on run assessment projects and a combination of guideline harvest ranges and biological escapement goals (BEG).

Throughout the Yukon River drainage, summer chum spawning escapements prior to the middle 1990's were almost exclusively estimated using aerial surveys of select index streams after most of the salmon had reached their spawning areas. The Yukon River drainage is too extensive for complete comprehensive escapement coverage of all salmon spawning streams. Nevertheless, assessment studies employing a myriad of techniques are conducted to provide fishery managers a closer monitoring tool.

Two distinct runs of *Oncorhynchus keta* occur in the Yukon River, a summer and a fall run, along with, *O. tshawytscha*, *O. kisutch*, and *O. gorbuscha*. *O. nerka* salmon occur only infrequently. Successfully managing the harvest and escapement of these stocks over such a large river basin requires reliable information from locations along the mainstem Yukon River to indicate strength of the runs as they move up the river and through the fishing districts. Main river sonar, test fishing, age composition information, commercial fisheries catches, and subsistence harvest data provide considerable information, but in the past there were relatively few projects that provided spawning stock escapement information. Historically most information was used to make relative comparisons between years, variations between skill and experience of surveyors and pilots, timing, and survey conditions such as weather and water clarity, made inter-annual comparisons of aerial indices very questionable as a management tool. Counting tower, weirs, and sonar projects provide total population estimates and are far more consistent than aerial surveys (Paulus 2001). Such projects are utilized in key tributary rivers to assess the effectiveness of the current management strategies.

Regardless of the method utilized, the overall objective of escapement assessment in the Yukon Area is to estimate abundance (or often indices of relative abundance), timing, and distribution of spawning salmon populations throughout the drainage (ADF&G 1997).

The Nulato River is one of the ADF&G's primary aerial survey index areas for assessment of the relative magnitude of summer chum and chinook salmon spawning escapement within the Yukon Area. Escapement goals were established for the Nulato River beginning in 1981, and in 1997 the summer chum salmon aerial survey goal for the North Fork was set at 53,000 fish. Chinook salmon escapement goals have been established for the Nulato River since 1981 (Sandone 1995). Chinook salmon escapement goals for Yukon River stocks were reevaluated in the spring of 1991 and made effective for the 1992 season (Buklis 1993). Minimum interim escapement goals for Chinook salmon were established for both forks of the Nulato River. In 1997,

minimum aerial escapement goals were >800 Chinook salmon for North Fork and >500 for South Fork Nulato River.

The Anvik River, in the middle Yukon River at 512rkm, is the largest producer of summer chum salmon in the Yukon River Drainage. Prior to 1994, Lower Yukon River test fishing CPUE estimates, in-season passage estimates of summer chum salmon from the Yukon River sonar project at 198rkm, and the Anvik River sonar project provided much of the available information used to make management decisions concerning the commercial harvest of summer chum salmon in District 4. There was need for an in-season escapement monitoring project for summer chum salmon within the upper portion of District 4 that would serve as an index for the size and quality of spawning escapements in that portion of the middle Yukon River area. In addition, genetic stock identification sampling of escapements could contribute to attempts to apportion summer chum salmon fishery harvests to stock of origin.

The Nulato River, by location and historical magnitude of aerial spawning escapement indices, was chosen as representative of the middle Yukon River area. The Nulato River is believed to be the largest producer of summer chum salmon upriver of the Anvik River (Sandone 1995). Chinook occur in the Nulato River coincidentally with summer chum salmon. Pink and coho salmon have also been reported to spawn in the Nulato River.

The Nulato River is a narrow runoff stream with a substrate consisting mainly of gravel and cobble. The river is formed from two main branches, the North Fork and South Fork, which converge approximately 9km above its mouth. Both forks of the Nulato River originate at an elevation of approximately 600m. From its source, the South Fork flows in a northeasterly and easterly direction about 98km to the confluence with the North Fork. From its source, the North Fork, for the most part, also flows in a northeasterly and easterly direction. The North Fork drainage includes the Kalasik Creek drainage. The mainstem Nulato River joins the Yukon River at 777rkm at an approximate elevation of 33m (see appendix B).

In the normal course of the season in this area, the rivers are usually highest in the spring, and then continue to drop as the dry summer weather begins. The stream shows rapid changes in water depth when summer storms occur. Such flood conditions can make counting difficult.

Since 1994 the Bering Sea Fishermen's Association (BSFA) and the Alaska Department of Fish and Game (ADF&G) have provided support through cooperative agreements with the Nulato Tribal Council (NTC) to manage the initial salmon counting tower and invested in it being upgraded to a floating weir in 1999/2000. Unfortunately, installation of the weir was delayed in 2000 due to transportation obstacles.

The Nulato River tower was located approximately 5km upstream of the confluence of the Nulato and Yukon Rivers. The water is typically clear with some brown staining from peat and organic material along the watershed. Practically all chum salmon spawning areas appear to be upstream of the tower site.

The weir site was selected after ADF&G Fisheries Biologist Larry DuBois conducted a site survey, made two recommendations and the BSFA and NTC consulted and agreed upon a site to install for 2001. Unfortunately water levels made Larry Dubois' site unusable and did not permit the installation of a weir, at a new site, until the 2003 season.

Projects like this provide more accurate and timely methods of salmon escapement enumeration that help managers to provide more consistent annual counts.

### **Objectives**

- To provide funding for the hiring of local individuals to act as fisheries technicians at the weir site. These individuals are to help with all aspects of the weir, including enumeration of the resident salmon species.

The objectives are achieved through a partnership with The Office of Subsistence Management, The Nulato Tribal Council, The Alaska Department of Fish and Game and The Bering Sea Fishermen's Association. The Office of Subsistence Management issued funds to provide for local technicians.

### **Methods and Discussion**

The 2001 season was, for the most part, a failure. The crew began the season with the intent to install a resistance board weir. Late breakup and subsequent high water created a situation in which installation of the resistance board weir would not be possible. The decision was made to run the site as a tower project. Camp was made by June 22<sup>nd</sup>. The crew could not install the tower or fixed picket weir due to the water conditions, so efforts turned to fixing the floating weir panels, of which 25 of 80 were damaged in transit to the site.

By June 28<sup>th</sup> a fixed picket weir was installed on the right bank of the river and two towers were erected on both banks of the Nulato River with flash panels in between. Unfortunately, despite setup efforts succeeding, the water conditions remained too high for effective counting until July 12<sup>th</sup>. Four days of counts took place when equipment failure hindered travel to and from the project site and operations ceased on July 16, 2001.

The 2002 season began with a meeting on May 7, 2002, which was to discuss the difficulties with the project in the previous year. Those present were: Andrew Corcoran of BSFA, David Wiswar and Geoff Beyersdorf of USFW, Tracy Lingnau of ADF&G and Peter Demoski of the Nulato Tribal Council.

The meeting started off by addressing the general lack of respect the crew had for the project equipment. The importance of taking care of equipment due to respect and general budgetary concerns of replacement were discussed. Expensive equipment, such as a 30-06, was lost, stolen or damaged. The need for these things not to occur was stressed.

The other major concern was the need for strong leadership. At this time a new crew leader had not been found, and the need to find a strong crew leader was discussed. Also the need for more on site leadership from the Nulato Tribal Council, particularly Peter Demoski, was discussed. The parties present reiterated to Peter the importance of his involvement in the project. Peter made it known that he, in his position with the NTC, had a \$1million dollar budget, and did not have a lot of time to commit to a \$30,000.00 project. Those present reminded Peter that the NTC was budgeted \$3000.00 for administrative costs, which should be more than enough for weekly visits to the project site.

The need for a productive and successful season was stressed to Peter. It was also noted that continued funding, and quite possibly other future projects in the area, would be dependent on this season's success.

In the time between the May pre-season meeting and project setup, a new crew leader was found. The person selected, Eryn Kahler, was identified to ADF&G by BSFA. Eryn was a ground fish observer, and had the potential to be a strong leader.

Due to water level being high, the installation of the rail for the weir was not possible. In lieu of the floating weir, two towers were erected. On each bank of the river, two sections of scaffold were combined to make a 6 m high tower. The right bank tower was placed in the river to reduce the width of the counting area. A 15 m long weir of wire fencing and T-stakes extended from the right bank to the tower to divert fish into the counting area. To make the fish easier to see, light-colored sandbags, with sand, were distributed side by side across the counting area. This light-colored background improved the ability of the crew to see and count fish. Observers wore polarized glasses to reduce glare.

Tower counting operations were conducted 7 days a week, 24 hours a day, for a 15-minute period each hour on each bank. The left bank counting period began at the top of the hour and the right bank began at the bottom of the hour. The observer counted fish passage by species and noted the direction of movement (upstream or downstream). Hand-held tally counters were used to record the observed tower counts. These counts were then transferred to data forms immediately after completion of a shift. Each count was expanded for each hour and each bank by dividing the count by the proportion of the hour counted. Missed counts were estimated by averaging the counts for the hours before and after the missed hourly count. When salmon were not counted for a portion of a day, the expanded total daily count for that day was estimated by dividing the expanded partial daily count by the mean proportion of the count, for the corresponding hours for the day before and day after having full 24-hour counts. When counting was not conducted for a full day, the salmon passage estimate for that day was calculated as the mean salmon passage for the day before and after. When counting was not conducted for more than one

full day, the passage for those days were estimated by interpolating between the last full day and first full day of counts after counting resumed. The crew was also to obtain 150 ASL samples for each quarter of the projects run. They were not able to obtain this amount in any of the quarters, due in large part to an uncooperative crew that was unwilling to take direction. Continuous around the clock counts began on June 22<sup>nd</sup>, and continued through July 24<sup>th</sup> when the Emmonak ADF&G office decided to end counts.

Climatological and hydrological data were collected at approximately 1800 hours each day at the campsite. Relative stream depth was monitored on a staff gauge marked in 0.1-foot increments with measurements subsequently converted to cm. Water temperature was measured in Celsius (°C) near shore at a depth of about 0.5 m. Daily maximum and minimum air temperatures were recorded in °C using a “high-low” thermometer. Subjective notes describing wind speed and direction, cloud cover and precipitation were recorded by the crew.

The crew began counts on June 22, 2002 and ended on July 24, 2002. The total counts for the season were: 69,164 chum and 2,552 Chinook.

The season was riddled with personnel problems. Eryn Kahler (ADF&G) had to fire several of the local hire for many reasons stemming from poor performance. The interpersonal relations between Eryn and her crew were strained, but those involved with the project saw this year as an improvement despite the problems.

The problems with equipment care and on site guidance by NTC staff were addressed and some strides were made. Eryn Kahler, the ADF&G crew-leader, noted that she found Peter Demoski invaluable to the success of the project. Also many of the damaged supply items were replaced, and at the end of the season camp was broken properly and supplies were stored diligently.

Promptly at the end of the season, BSFA arranged for Rob Stewart of ADF&G to conduct a survey of the Nulato River to determine a site for the weir to be installed in 2003. The previous site, scouted by Larry Dubois, had become useless due to flooding dramatically changing the river profile.

Rob Stewart (ADF&G), accompanied by David Wiswar (USFWS OSM), surveyed the area and found a site upriver from the tower site. In the days to come a teleconference regarding the weir was organized, and was held on August 9, 2002. Those present were David Wiswar (USFWS OSM), Doug Molyneaux (ADF&G), Tracy Lingnau (ADF&G), Jeff Estensen (ADF&G), Eryn Kahler (ADF&G), and Andrew Corcoran (BSFA). Those involved in the meeting felt that the only feasible way to have the weir installed in time for the project was to install the substrate rail in the fall. Between August 15, 2002 and August 18, 2002 Rob Stewart (ADF&G), Eryn Kahler (ADF&G) and Andrew Corcoran (BSFA) installed the substrate rail at the Nulato River Weir site, in preparation for a 2003 season with a floating weir in place.

The 2003 season was the first season at the Nulato River project to be a floating weir. A preseason meeting was held in Nulato this year on May 21, 2003. An added objective of the 2003 season was tissue sampling of Chinook salmon for USFWS. Eric Barnhill, a Bering Sea Fishermen's Association biologist, went to Nulato to teach the crew proper fin clipping and storage techniques. At this time there was an inventory of the project, and many items were found to be in poor condition including the boat.

The installation of a floating weir in 2003 was decided in the previous season. The installation of the substrate rail the previous fall was to facilitate an on time installation of the weir. Unfortunately very high water caused the weir setup to be delayed until late June/early July. Rob Stewart (ADF&G) and Eryn Kahler (ADF&G) and the local hire crew began installation of the weir. Unfortunately Personnel problems continued to plague the project as it has in years past. The crew-leader, Eryn Kahler, found the crew to be combative and not willing to accept her as a leader. Eryn also found Peter Demoski, with the Nulato Tribal Council, to be only somewhat helpful and minimally involved. Peter's low level of involvement continues to be a problem from years past.

Eryn Kahler (ADF&G) contacted the BSFA office in Anchorage to let her troubles with the crew be known. Karen Gillis with the BSFA instructed Eryn to have a meeting with her crew and Peter Demoski. At this time Eric Barnhill (BSFA) traveled to Nulato to assist with the weir installation and be a backup to Rob and Eryn. With a somewhat elevated atmosphere and environment, the group got the weir operational and "fish tight" on July 1, 2003.

The weir consists of several PVC pipe panels connected together, with wooden panels that act as sails to help keep the weir in place. The weir spanned a section of the Nulato River that was below the majority of salmon spawning areas. One side of the weir has a fish trap that the crew allows fish through the weir and also captures fish for ASL sampling. A boat passage area was also installed in the weir to allow the passage of hunters, fishers, campers, travelers, etc.

Unfortunately the water level rose approximately 12 inches the night of becoming "fish tight". The rise in water level made counting fish and sampling impossible. The fish trap was under water and fish were making it past the weir easily. Debris on the weir, and a large tree caught on the trap delayed the project.

The crew began the first season of the project as a weir on the afternoon of July 5, 2003. The crew visited the weir 5 times a day at pre-determined times: 07:00, 11:00, 15:30, 18:00, and 21:00 hours. The crew went two at a time and performed half hour counts each time, during this time the weir was checked for damage and debris. In addition to counts of salmon passing, the crew was required to take ASL and tissue samples. The crew was given a quarterly schedule with specific dates. Fish were sampled when available, and those samples were sent to the U.S Fish and Wildlife Service Conservation Genetics Lab in Anchorage, AK.

The final unadjusted Nulato River weir counts for 2003 were: 1,762 Chinook salmon and 17,765 summer chum salmon. The final, extrapolated numbers (due to missed counts) was 1,997 chinook and 19,590-summer chum. The daily peak count of 314 Chinook salmon occurred on July 6; a second peak of 212 chinook occurred on July 19. The peak daily count of 1,817 summer chum salmon occurred on July 7; subsequent peaks of 1,430 summer chum passed on July 13 and 1,703-summer chum on July 18.

This season, 377 summer chum salmon were captured to obtain ASL data. Most of the summer chum were age- 0.3 (79.5%) and age- 0.4 (17.6%), with lesser numbers of age – 0.2 (1.7%) and age- 0.5 (1.2%) fish. The weighted sex ratio was 58.2% males and 41.8% female. Unfortunately, too few Chinook were collected to analyze for ASL data. Also, no carcass sampling study was performed. The continued unwillingness and malaise of the crew and growing negative local opinion of the Fish and Game technicians led to participating members of ADF&G concluding that making a carcass sample would not be possible.

Climatologic and hydrological data were collected as in the previous year.

### **Consultations and Capacity Development:**

The BSFA maintained frequent contact with Peter Demoski (NTC manager), Eryn Kahler (ADF&G crew leader) and David Wiswar (USFWS) regarding project matters, plans, and requirements.

### **Conclusions**

Despite the best efforts of the parties involved, this project never seemed to be able to run in a manner that yielded enough information to make it feasible to continue. The Alaska Department of Fish and Game and The Bering Sea Fishermen's Association have, for the 2004 field season, opted out of running and contributing to this project.

Despite the poor luck in high water conditions, the Nulato weir is a possible project. The water conditions are generally not as high as late into the summer as seen during the projects run. Several locals commented during the course of the project that the water was getting unusually high unusually late.

A possibility would be to continue the project either as a weir or a tower, but the success of the project is dependent on all parties involved contributing dedicated individuals to act as technicians.

The community was glad to have the project in Nulato. Equipment storage and logistics were not a problem; Peter Demoski of the NTC stored equipment at his residence, and travel to the weir was minimal compared to many enumeration projects. The main problem with this project was a lack of dedication by technicians.

The Nulato Tribal Council lacks the resources to run the project itself.

### **Recommendations**

Equipment and the weir itself remain in Nulato for the time being. If the project is to be picked up in the future, it is recommended that more effort is put into finding a crew that is willing to work and can take direction. Also if the Nulato Tribal Council is to be involved, there should be more hands on supervision of the project and more consequences for inadequate local hires.

A weir can definitely be run with the right crew. This point cannot be stressed enough. The Nulato Tribal Council would have to impress upon any local hire the importance of this project. The NTC would also have to work with whoever is onsite from Fish and game in setting up a set of rules and consequences. In the past the crew has had a definite youthful component, perhaps this aspect should be reduced or eliminated.

### **Acknowledgements**

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### **Literature Cited**

ADF&G. 1997. Annual management report, 1997, Yukon Area. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

Buklis, Lawrence S. 1993. Documentation of Arctic-Yukon-Kuskokwim Region Salmon Escapement Goals in effect as of the 1992 Fishing Season. Regional Information Report 3A93-03. Alaska Department of Fish and Game, Division of Commercial Fisheries AYK Region, Anchorage, Alaska.

Paulus, R.D., DerHovanisian, J.A., Lingnau, T.L. 2001. Nulato River Salmon Escapement Project, 1997. Regional Information Report 3A01-11. Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region, Anchorage, Alaska.

Sandone, G. J. 1995. Nulato River salmon escapement study, 1994. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 3A95-19, Anchorage, Alaska.

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## Appendix A



Nulato weir site 2002



Nulato weir 2003, tree stuck on weir



Nulato Weir 2003, tree stuck on weir



Nulato Weir 2003 fish trap mostly submerged

Appendix B



