2012 Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative
Project Final Product[1]

Yukon River Chinook Salmon Subsistence Sampling

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Abstract

The Yukon River is home to many native village communities which depend on subsistence harvest for their livelihood. This research project sampled the subsistence-harvest from the communities of Anvik, Nulato, Galena, Ruby, Tanana, mainstem Yukon River above Hess Creek, Fort Yukon and Eagle on the Yukon River; it also sampled in Huslia on the Koyukuk River. This project focused on the Chinook salmon *(Oncorhynchus tshawytscha*) for biological information, scale samples and genetic tissue. The research data collected will serve to understand the stock biology and composition of salmon that are harvested in these communities. The age-sex-length (ASL) and genetic data from this research project will help to rebuild the Canadian origin of the Chinook salmon run by determining the proportion of Canadian origin stocks. The Fisheries Biologist contacted the Tribal Councils in the respective communities and asked for their assistance with recruiting local fisherman to collect a sample size of 250-300, taken in the proportion to the actual harvest for each village. In 2011, thirty one subsistence fishermen/fisherwomen were trained to collect biological samples; 2,083 samples were obtained and analyzed. Various gear types and mesh sizes were used in each community to harvest the subsistence catch (Table 2). The data in this study indicates that average girth and length measurements for all males showed a decrease as distance increased from the mouth of the Yukon River, with the exception of the mainstem above Hess Creek The data in this study indicates that males harvested further from the mouth of the Yukon River, on average, are younger than males caught near the mouth. Girth measurements indicate that males harvested further from the mouth of the Yukon River are smaller than males caught near the mouth. This could be a byproduct of gear selectivity or a reflection of how the run changes as the distance increase away from the mouth. More in depth statistical analysis needs to be done to determine the true relationships but this was beyond the scope of this project.

Key Words: subsistence harvest sampling, Chinook salmon, Yukon River.

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Introduction

The Yukon River is home to many native village communities which depend on subsistence harvest for their livelihood. Chinook salmon *(Oncorhynchus tshawytscha)* stocks on the Yukon River have been decreasing in the last decade. During this same time, the subsistence harvest has been the largest and most consistent component of the Yukon River Chinook salmon harvest, averaging 45,000-60,000 fish (Howard 2009). The Board of Fisheries (BOF) listed Chinook salmon as a stock of concern in 2000. The BOF defines a stock of concern as a concern arising from a chronic inability, despite the use of specific management measures, to maintain specific yields, or harvestable surpluses, above a stock's escapement needs (State 2012). Providing escapement into Canada and the United States is the first priority, with subsistence harvest being the second priority, and is legally backed by the Pacific Salmon Treaty (Pacific 2009).

This research project sampled the subsistence-harvest from the communities of Anvik, Nulato, Galena, Ruby, Tanana, mainstem Yukon River above Hess Creek, Fort Yukon and Eagle on the Yukon River and Huslia, located on the Koyukuk River. We focused on the Chinook salmon *(Oncorhynchus tshawytsch*) for biological information, scale samples and genetic tissue. The research data collected will serve to understand the stock biology and composition of salmon that are harvested in these communities. The age-sex-length (ASL) and genetic data from this research project will help to rebuild the Canadian origin of the Chinook salmon run by determining the proportion of Canadian origin stocks. We contacted the Tribal Councils in the respective communities and asked for their assistance with recruiting local fisherman to collect a sample size of 250-300, taken in the proportion to the actual harvest for each village.

The data collected from this project will provide post-season genetic stock identification and information on biological composition of subsistence-harvested Chinook salmon from lower, middle and upper river villages on the Yukon River. Research data collected through this project will contribute to the existing ASL database, emphasizing the total characterization of the Yukon Chinook salmon run. Spawner-recruit models, which are used to estimate run productivity and will form the basis of selective biological escapement goals, require ASL composition estimates of the total run. Chinook salmon runs vary depending on cohort survival; therefore, it's necessary to collect specific data on a yearly basis for the Chinook salmon. Consequently, the need to annually update brood year tables and total run reconstructions will require continued monitoring and collection of genetic samples and the ASL data from subsistence harvest. The same reporting is done for commercial harvest and escapements.

Objective

1. To representatively sample the subsistence-harvested Chinook salmon in selected communities on the Yukon and Koyukuk rivers for biological information, scale samples, and genetic tissues.

    This objective was successful in sampling Anvik, Nulato, Galena, Tanana, mainstem Yukon River above Hess Creek, Fort Yukon and Eagle on the mainstem Yukon River; Huslia on the Koyukuk River. The main sampler from Bishop Mountain was not available; therefore, we changed the sampling site to Ruby and it was successful. The two sites that did not provide samples, due to a poor Chinook salmon subsistence season and logistics, are Holy Cross and Hughes.

Methods

Chinook salmon were sampled from the subsistence catch from the communities of Anvik, Nulato, Galena, Ruby, Tanana, mainstem Yukon River above Hess Creek, Fort Yukon and Eagle on the Yukon River as well as Huslia (located on the Koyukuk River) to characterize the sex ratio, age and length (ASL) of subsistence-caught salmon, as well as to collect genetic tissue for stock of origin estimates. Chinook salmon were sampled by contracted subsistence fishermen under the direction of the TCC biologist. Sampling methods followed routine procedures outlined by the ADF&G protocols (Molyneaux 2010). Samples were taken as soon as possible after fish are caught and prior to or during cutting (processing). Special efforts were made to collect samples throughout the duration of the run and in proportion to the harvest and gear types used in order to provide samples representative of the entire harvest. All available fish were sampled for an axillary process clip (genetic sampling) and scales (age determination) to be processed by the ADF&G (collaborator). Local fishermen were trained to collect three scales from the preferred area above the lateral line on the left side of the fish, which were mounted on pre-printed gum cards. Length was measured from mid eye to tail fork to the nearest 5mm. Girth was measured around the fish in front of the dorsal fin. Sex was visually determined from external morphological characteristics combined with internal examination of the fish during processing. An axillary process fin was clipped from each fish and placed in an individually numbered vial filled with ethanol and specifically segregated and identified to individual fish. Data sheets included capture methods, mesh size, location, date, fish number, scale card number and genetic vial numbers were recorded according to coordinated protocols with agency partners. Samples and data were sent to ADF&G for processing. Sampling crews collected heads from all fish with a clipped adipose fin, which may contain a coded wire tag inserted at the Whitehorse Hatchery in Canada. Tag recovery forms will be completed for all fish with clipped adipose fins and heads and data sent to the appropriate location. Data sheets included capture methods, mesh size, location, date, fish number, scale card number and genetic vial numbers were recorded according to coordinated protocols with agency partners. Scales were processed and aged by the ADF&G Aging Lab. Genetic samples were processed and analyzed by the ADF&G Gene Conservation Lab to determine stock of origin.

A preseason training session was held in each village by the PI to familiarize the fishers with the protocols for sampling. The PI returned to the villages during the beginning of the fishing season to assist the subsistence fishers with sampling and to provide quality control by assuring that sampling methods were being followed accurately. All sampling methods were detailed in a sampling workbook included in each subsistence fishers sampling kit for reference during sampling. Sampling kits included: sampling workbook, notebooks, data sheets, pencils, forceps, scale cards, measure tape, ethanol, vials, clippers, squirt bottle and clipboard.

Sample Design

The project aimed to characterize the annual age, sex, and size of the Chinook salmon subsistence harvest in the US portion of the Yukon and Koyukuk Rivers. The grab sample design (Geiger et al. 1990) used by the Lower Kuskokwim ASL sampling program since 2005 (Molyneaux 2010) guided our sample design. This method assumes that large sample sizes collected in the "grab" sample strategy was influenced by the availability of fish and samplers through time and locations. Large sample sizes in a given time period will imply large harvests with many opportunities to collect samples from either the sampler's own harvests or those of others. Samples will therefore be self-weighting by gear, over the time period, and in the area that the participants are harvesting. The assumption is that if participants make consistent search

efforts (each day of weekly subsistence periods) more samples will be collected on days when more fish are harvested.

Results

In 2011, 31 subsistence fishermen/fisherwomen were trained to collect biological samples. The fishers sampled their Chinook salmon subsistence catch for ASL, girth and genetic information; 2,083 samples were obtained and analyzed. Due to the low return of Chinook salmon and increased regulations, many of the fishermen opted to fish harder in the allotted windowed schedule and sampling was left to the wayside. In cases where there was adequate coverage by TCC staff we were able to counteract those effects but sample sizes were generally low, regardless of how much coverage there was in the villages. The villages that sampled their catch are Anvik, Nulato, Galena, Ruby, Tanana, mainstem Yukon River above Hess Creek, Fort Yukon and Eagle on the mainstem Yukon River; and Huslia, located on the Koyukuk River (Figure 1). We deviated from sampling in Bishop Mountain due to lack of samplers (we sampled in Ruby instead) and we did not receive samples from Holy Cross or Hughes; therefore, proposed sampling locations differed from the number of locations sampled. Various gear types and mesh sizes were used in each community to harvest the subsistence catch (Table 1). Samples sizes were low for Nulato, Ruby and Fort Yukon (<100 samples); therefore, data taken from these communities may be less reliable than communities with larger samples sizes (greater than 200); samples sizes are shown in Table 2.

Koyukuk River location

Huslia samples, taken from the Koyukuk River drainage, will be characterized separately from the Yukon River villages. Huslia collected a total of 100 samples from one fisherman. There were more males (70%) than females (29%) and one (1%) of the samples collected did not include the sex. The male Chinook salmon caught were primarily (65%) age 1.3 and 7% were age 1.4. The females were primarily age 1.4 (16%) followed by age 1.3 (10%) (Figure 2). The genetic fin clips were not analyzed.

Yukon River locations

Age results- In 2011, female Chinook salmon caught were primarily age 1.4.; males were primarily age 1.3. Tanana, Fort Yukon and Eagle collectively harvested more age 1.2. and fewer 1.4. resulting in a lower age structure than villages closer to the mouth of the Yukon River. The mainstem above Hess Creek had a similar proportion of age 1.3. males to Fort Yukon and Eagle but had a much higher proportion of age 1.4. fish, resulting in a harvest of older fish (Figure 2).

Sex proportions- Female Chinook salmon accounted for less than 45% in each of the villages. Ruby and Fort Yukon had the lowest proportion of females at 6.17% and 16.33% respectively. Tanana caught the highest percentage of females at 42.46% (Figure 3).

Length and girth- Average length and girth measurements for all females did show a trend (excluding one location) based on distance from the mouth of the Yukon River. Average length and girth measurements decreased as distance increased from the mouth of the Yukon River. The mainstem above Hess Creek samples did not fit in the trend. In fact, both females and males sampled in this location were longer, on average, than fish caught in any other location. The male and female girth measurements were comparable to fish caught in Anvik, Nulato and Galena but were twice the size, on average, than fish caught in Ruby, Tanana, Fort Yukon and

Eagle (Length: Figure 4, Girth: Figure 5). Females are about 50-100 mm larger than males caught in the same location (Figure 4).

Genetic results- All of the genetic samples collected in 2011 were sent to the ADF&G Gene Conservation Lab to be analyzed and archived; however, only Anvik, Galena, Ruby and Tanana were analyzed. Ruby had a sample size of 82; therefore, the results were omitted from the table of figures due to low sample size. ADF&G analyzed 236 samples from Anvik. Anvik harvested about 60% of Canadian bound Chinook salmon. The remaining percentages were about 37% middle Yukon and 3% lower Yukon Chinook salmon. Galena had a sample size of 238. The majority of Chinook salmon caught (60%) were middle Yukon Chinook salmon. Canadian origin Chinook salmon made up about 39 % of the Galena catch. The lower Yukon Chinook salmon caught in the Galena subsistence harvest catch made up less than 1%. Tanana had a sample size of 239. Canadian bound Chinook salmon made up the bulk of the catch at 71%; 24% of the catch were Middle Yukon and less than .5% were from the lower Yukon River (Figure 6).

Discussion

Koyukuk River location

The community of Huslia generally does not harvest large quantities of Chinook salmon. For example, a survey conducted by the ADF&G in 2007, showed that from 66 households only an estimated 146 Chinook salmon were harvested for subsistence purposes (Fall 2009). This project sampled 100 Chinook salmon which is 68% of Chinook salmon caught in 2007. Additional research should shed the light on how many Chinook salmon are being harvested and develop a trend over time.

Yukon River locations

The sample locations (villages) utilized varying types of fishing gear. Fishers were restricted from using mesh larger than 7.5 inches on the Yukon River, per regulations set by the Board of Fisheries and Federal Subsistence Board. Anvik, Nulato and Galena mainly used 7.5” drift nets as well as 7.5” set nets. Ruby and Tanana operated fishwheels but did not use a 7.5” set net; Eagle used both a fishwheel and 7.5” set nets to harvest Chinook salmon. Fort Yukon, Huslia and the mainstem (above Hess Creek) used mainly 7.5” set nets. Fishers can harvest a certain range of fish while using different gear types.

This project is a continuation of a similar project, conducted by the TCC, which studied the subsistence harvest of Chinook salmon on the Yukon River. In 2009 and 2010, subsistence fishers were hired to sample their entire catch of Chinook salmon for ASL, girth and genetic information and 1,281 and 2,754, respectively, were collected and analyzed (Drobny 2011). The average girth and length measurements for all females and males showed a decrease as distance increased from the mouth of the Yukon River. In comparison, the data in this study indicates that average girth and length measurements for all males showed a decrease as distance increased from the mouth of the Yukon River, with the exception of the mainstem above Hess Creek Length: Figure 4, Girth: Figure 5). The longer and girthier mainstem Hess Creek fish can be attributed to the combined effect of having a higher proportion of age 1.4 and 1.3 age fish and have a smaller proportion of age 1.2 compared to Tanana, Fort Yukon and Eagle (Figure 2). A study has shown that larger mesh will have a tendency to harvest larger and older Chinook salmon (Howard and Evenson, 2010). The data in this study indicates that males harvested further from the mouth of the Yukon River, on average, are younger than males caught near the

mouth. Girth measurements indicate that males harvested further from the mouth of the Yukon River are smaller than males caught near the mouth. This could be a byproduct of gear selectivity or a reflection of how the run changes as the distance increase away from the mouth. More in depth statistical analysis needs to be done to determine the true relationships but this was beyond the scope of this project.

According to the genetic fin clip analysis from the samples taken during the summer of 2011, about half of harvested Chinook salmon originated in Canada (Figure 6). This is important because the United States has a treaty with Canada to ensure escapement needs are met. Preliminary Chinook salmon escapement into Canada for 2011 was 46,307 Chinook salmon and fits within the 42,500-55,000 escapement goal range (JTC 2011). The stock identification and run timing information from this project can help differentiate certain stocks based on run timing. Identifying stocks based on run timing can help managers effectively manage the Chinook salmon to ensure escapement goals are met.

From these data, and other data taken throughout the years, managers have a better idea of when the salmon are entering the river, how big they are, and where they are heading. Providing technical fishery sampling training to subsistence fishers within each of these communities will better facilitate future research within this region and provide local commercial and subsistence users with a meaningful role in the fishery research in the region. ASL and genetic sampling are tools which will continue to provide insight on this valuable resource for years to come.

Tables

Table 1: 2011 fishing gear used in each village.

	Fishwheel	7.5" Drift net	5.5" Set net	6.0" Set net	6.5" Set net	7.5" Set net
Anvik		X				X
Nulato		X				X
Galena		X	X		X	X
Ruby	X			X		
Tanana	X					
Mainstem above Hess						X
Fort Yukon						X
Eagle	X			X		X
Huslia						X

Table 2: Sample sizes in each community; broken down by number of females, males, sex unknown and percentage of females in each location.

Location	F	M	Sex Unknown	**Total**	% Female
Anvik	150	287	64	**501**	34.32
Nulato	27	44	0	**71**	38.03
Galena	153	418	0	**571**	26.80
Ruby	5	76	14	**95**	6.17
Tanana	107	145	0	**252**	42.46
Mainstem above Hess	63	161	0	**224**	28.13
Fort Yukon	8	41	4	**53**	16.33
Eagle	38	178	0	**216**	17.59
Huslia	29	70	1	**100**	29.29
Total	**580**	**1420**	**83**	**2083**	

Figures

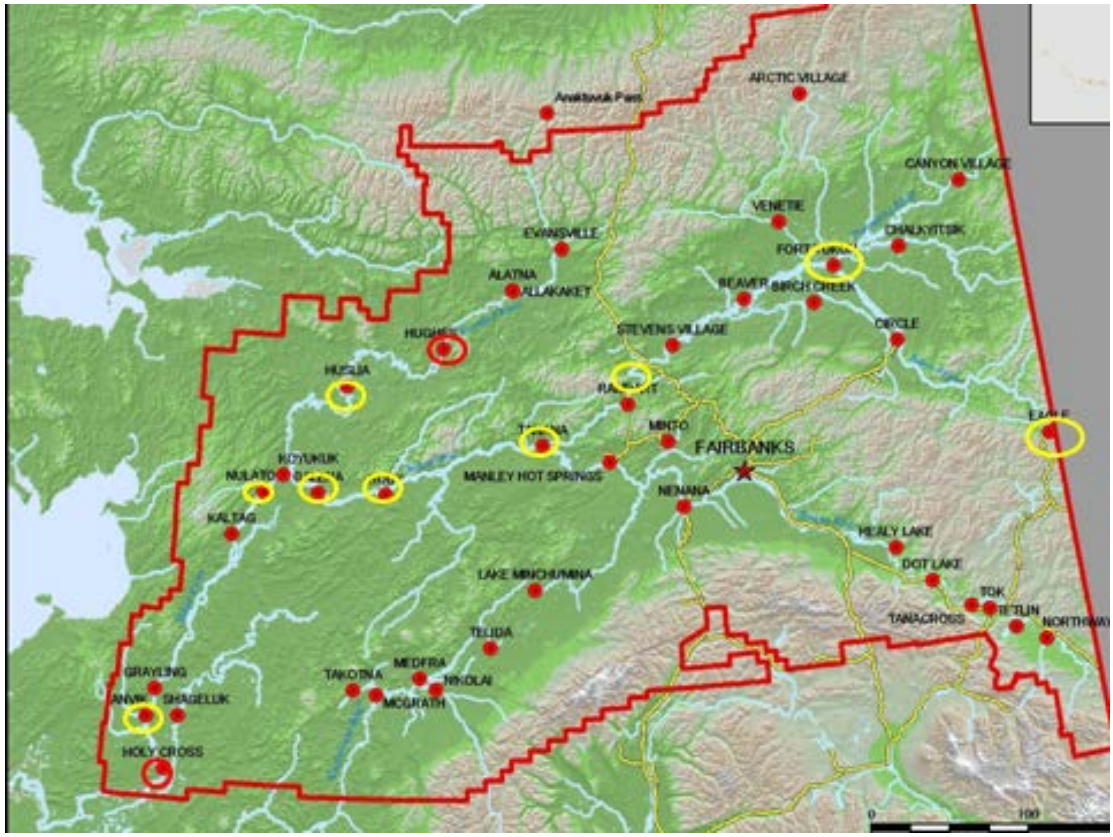

Figure 1. Map of the Tanana Chiefs Conference region and the eleven study sites which include Huslia, Anvik, Nulato, Galena, Ruby (replaced Bishop Mountain), Tanana, mainstem Yukon River above Hess Creek, Fort Yukon and Eagle on the mainstem Yukon River (circled in yellow). The two sites that did not provide samples are Holy Cross and Hughes (circled in red).

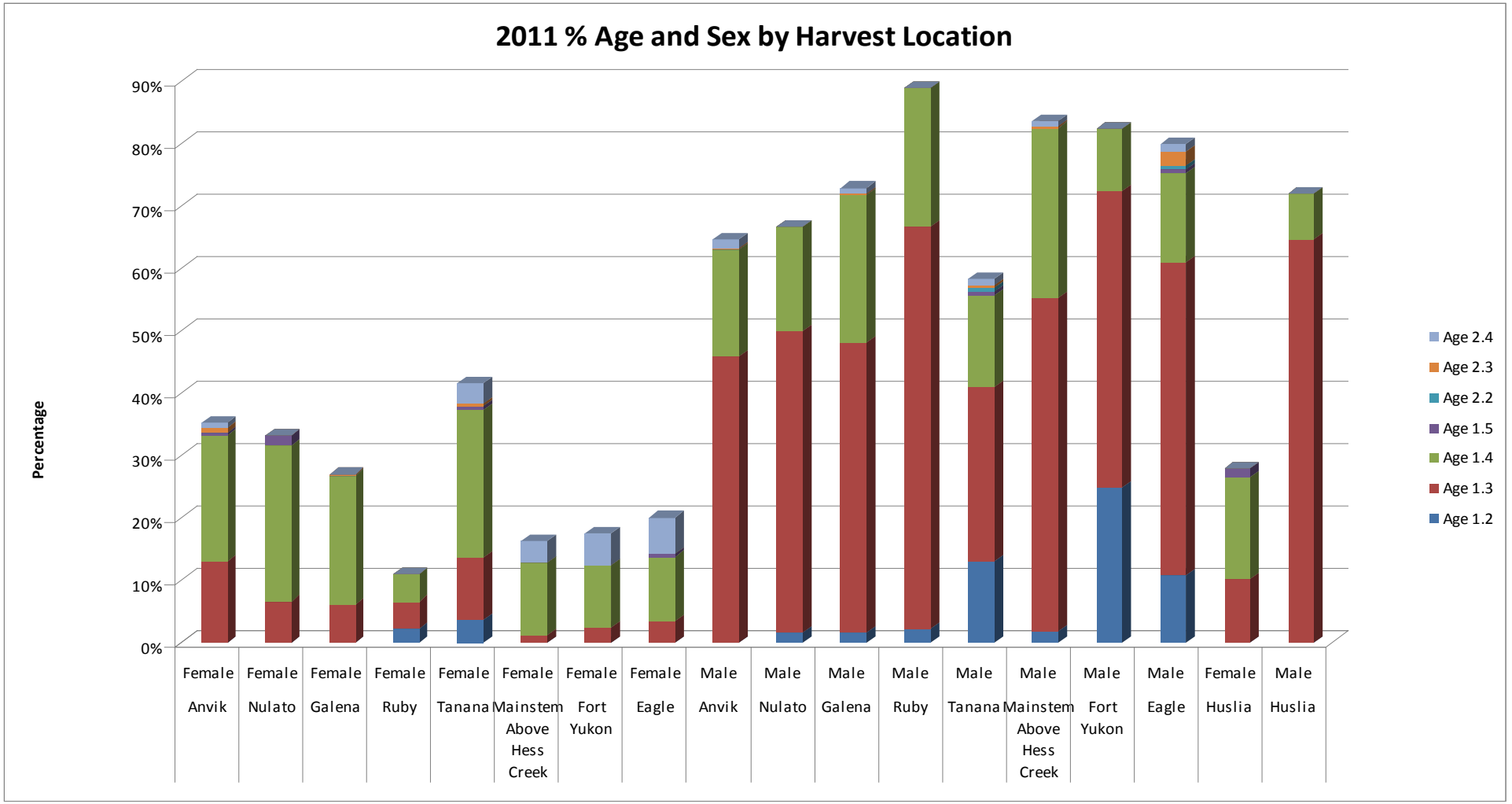

Figure 2. 2011 proportional ages for Chinook salmon separated by sex and harvest location. Sample locations are listed in chronological order moving upstream with Huslia at the far right.

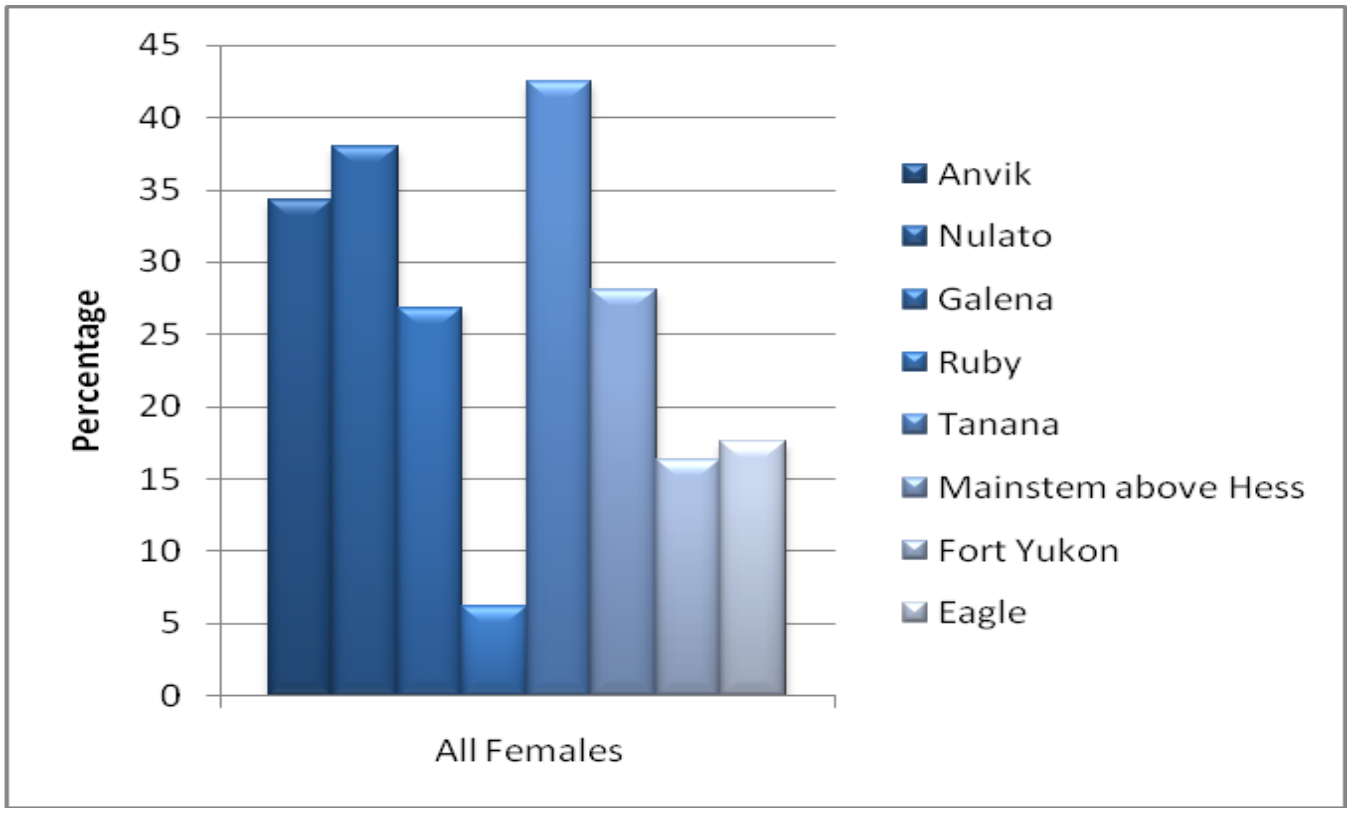

Figure 3. Percentage of females sampled from the subsistence catch in each community. Sample locations are listed in chronological order moving upstream, excluding Huslia.

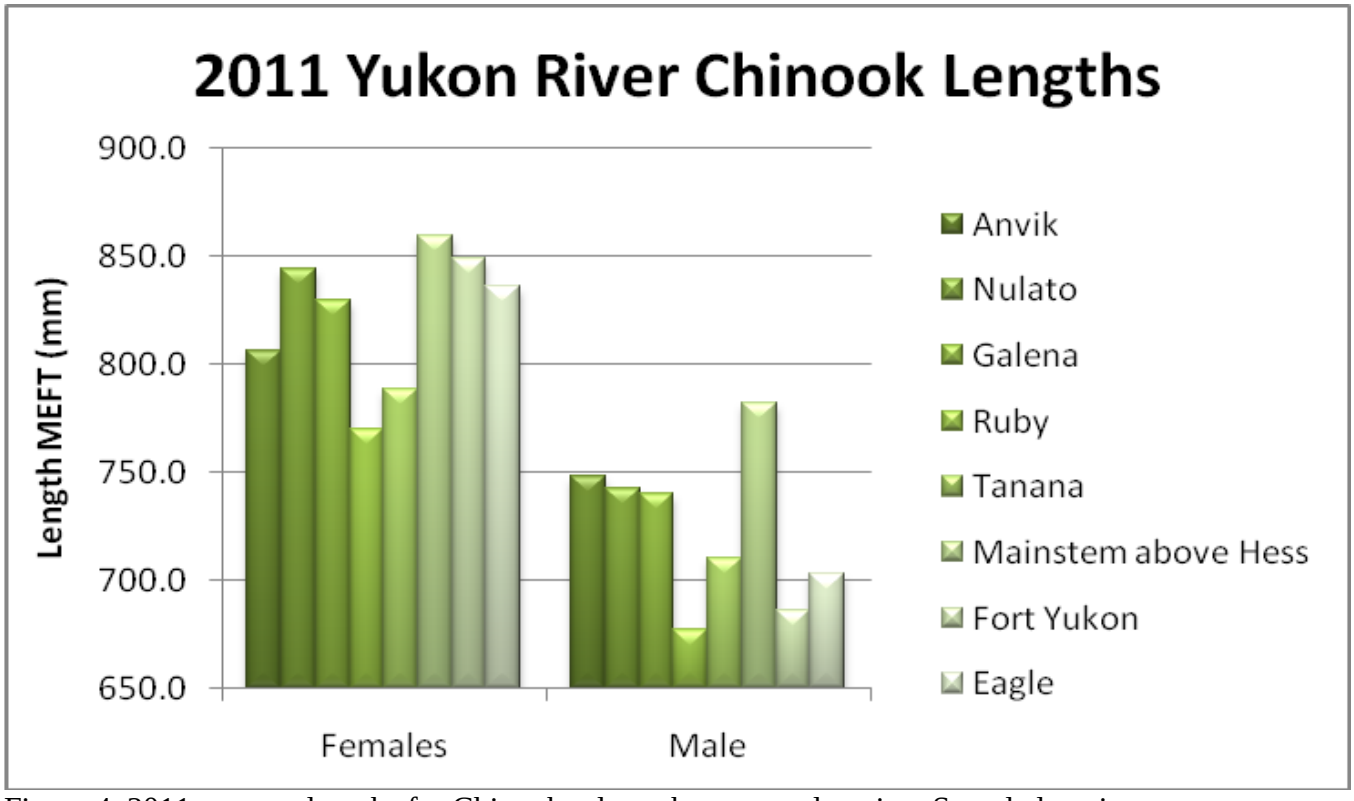

Figure 4. 2011 average lengths for Chinook salmon by capture location. Sample locations are listed in chronological order moving upstream, excluding Huslia.

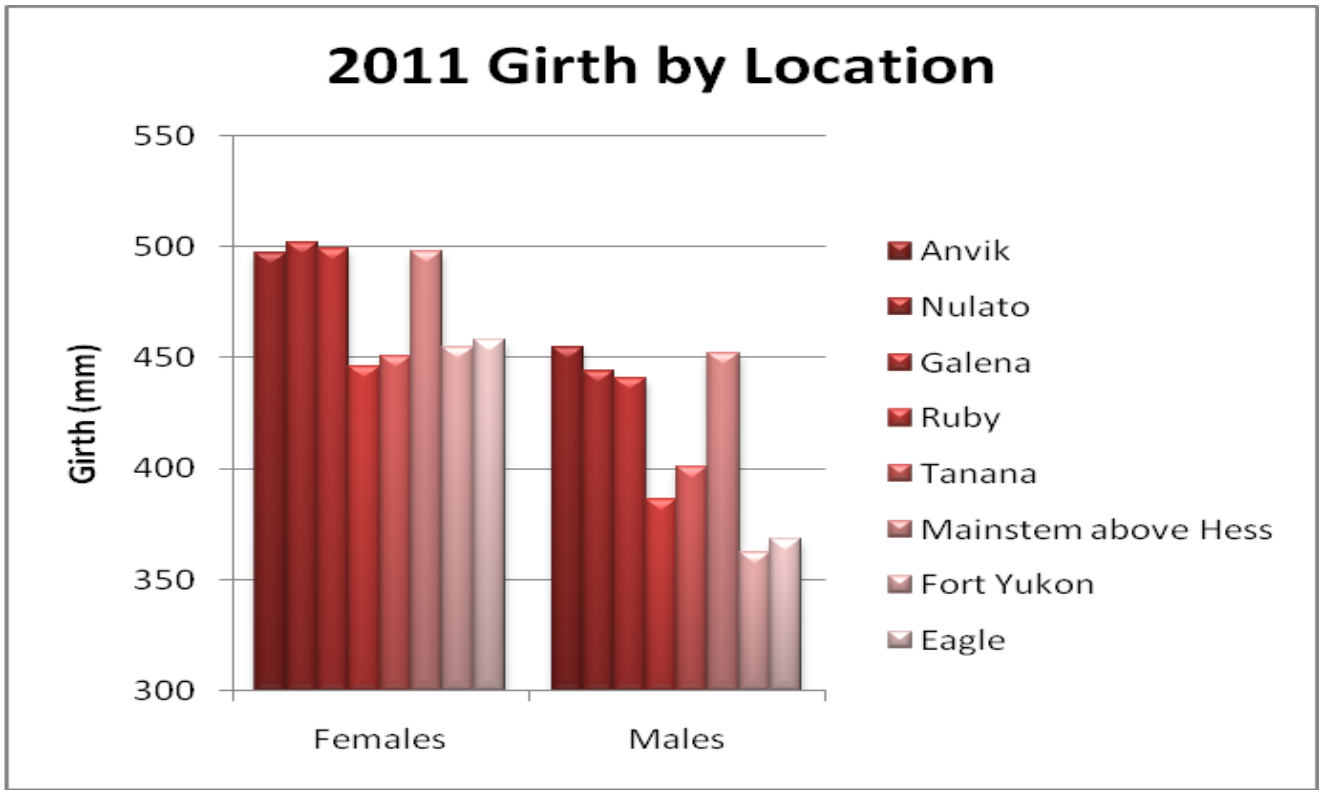

Figure 5. 2011 average girth for Chinook salmon. Sample locations are listed in chronological order moving upstream, excluding Huslia.

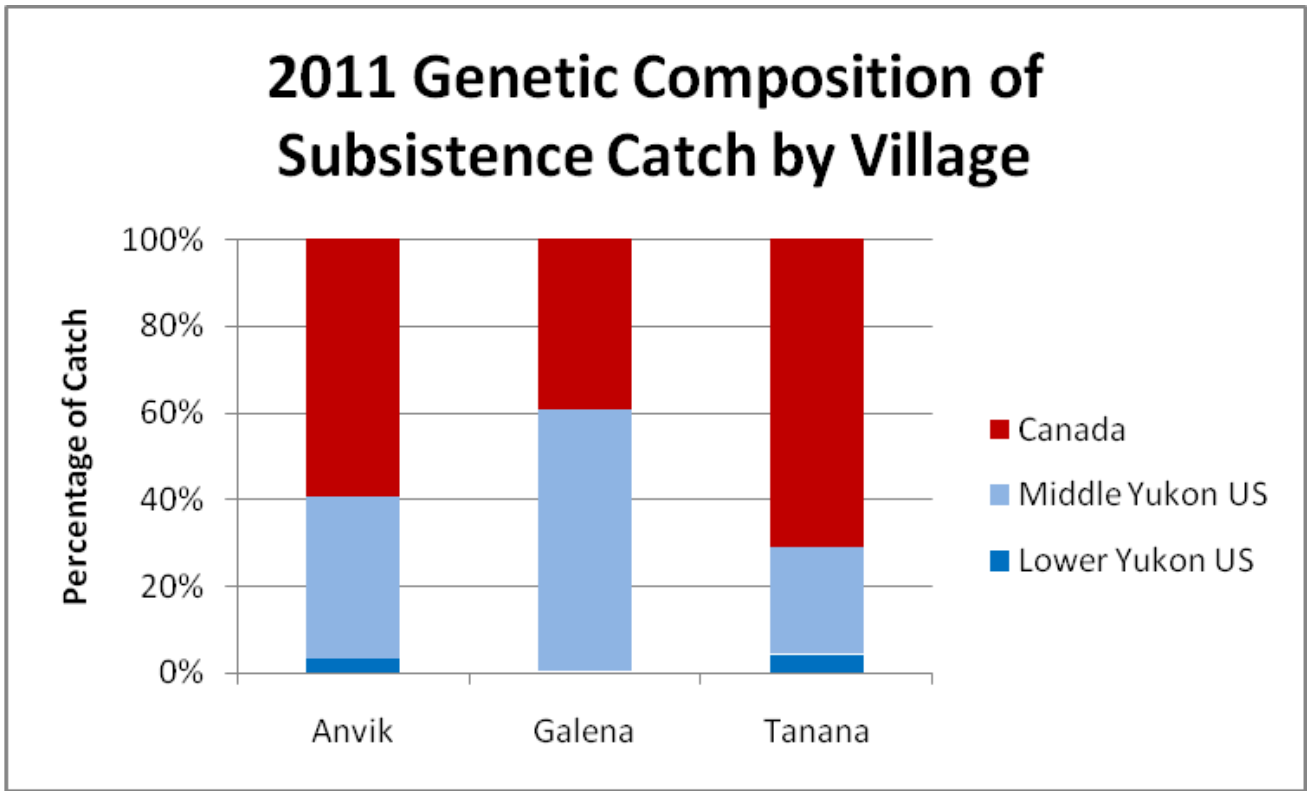

Figure 6. 2011 proportional genetic composition of the subsistence catch sampled by location. Sample locations are listed in chronological order moving upstream

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Deliverables

Semiannual progress report
Final report
All samples and data sent to ADF&G for archiving and storage
Successfully trained 31 fishers on proper protocols for sampling season
Presentation of project results at American Fisheries Society, Alaska Chapter, November 2011 in Girdwood, AK.
Informal presentations at state and Federal meetings

Acknowledgements

This project was funded by the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative http://www.aykssi.org/. I would like to thank the subsistence fishers on the Yukon and Koyukuk Rivers who participated in this study. The dedication to their fishery, the project and fine effort to detail made this project successful. I would also like to thank the Alaska Department of Fish & Game staff for analyzing the scale and genetic fin clip samples, Orville Huntington (TCC), Alyssa Frothingham (TCC), Aaron Dupuis (TCC), Paige Drobny (Spearfish Research), Art Nelson (BSFA), and Yukon River super samplers, Andy Bassich, Sandy Scotton and Ed Sarten for their helping hand at various times throughout the project.

Press Release

Yukon River is home to many native village communities which depend on subsistence harvest for livelihood. Chinook salmon *(Oncorhynchus tshawytscha)* stocks on the Yukon River have been decreasing in the last decade. During this same time, the subsistence harvest has been the largest and most consistent component of the Yukon River Chinook salmon harvest, averaging 45,000-60,000 fish (Howard 2009). Sustainable salmon management relies on salmon stock information (age, sex, length, and genetics) obtained from commercial or subsistence harvests. Downward trends in commercial harvests, followed by recent years of no commercial harvests, have led to the inability to collect this crucial information. This research project sampled the subsistence-harvest from the communities of Anvik, Nulato, Galena, Ruby, Tanana, mainstem Yukon River above Hess Creek, Fort Yukon and Eagle on the mainstem Yukon River; it also sampled in Huslia on the Koyukuk River. We focused on the Chinook salmon *(Oncorhynchus tshawytsch*) for biological information, scale samples and genetic tissue. The research data collected will serve to understand the stock biology and composition of salmon that are harvested in these communities. The age-sex-length (ASL) and genetic data from this research project will help to rebuild the Canadian origin of the Chinook salmon run by determining the proportion of Canadian origin stocks. We contacted the Tribal Councils in the respective communities and asked for their assistance with recruiting local fisherman to collect a sample size of 250-300, taken in the proportion to the actual harvest for each village. In 2011, thirty one subsistence fishermen/fisherwomen were trained to collect biological samples; 2,083 samples were obtained and analyzed. Various gear types and mesh sizes were used in each community to harvest the subsistence catch (Table 2). Samples sizes were low for Nulato, Ruby and Fort Yukon (<100 samples); therefore, data taken from these communities may be less reliable than communities with larger samples sizes (greater than 200).