YUKON RIVER SALMON NEGOTIATION STUDIES
COMPLETION REPORT

July1, 2000 – June 30, 2003

Prepared By

Alaska Department of Fish and Game

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Alaska Department of Fish and Game
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PROJECT SPONSORSHIP

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OEO/ADA STATEMENT

TABLE OF CONTENTS

INTRODUCTION

The United States and Canada began negotiations on Yukon River salmon upon signing the Pacific Salmon Treaty March 1985. In March 2001, after 16 years of negotiating, a long-term agreement was initialed; and in December 2002, representatives of both countries signed the Yukon River Agreement. The Agreement has as its principal goals to rebuild and conserve stocks and to provide benefits to the people of both countries who live along this river system. The purpose of this federally funded program is to help provide the technical support necessary to effectively manage the complex Yukon River salmon fisheries in the context of U.S./Canada treaty commitments, and to help provide support for the Yukon River Panel. Further, much of this information has become the cornerstone of the management of Canadian-origin salmon within the Yukon River drainage.

Allocation of the allowable harvest of salmon between the United States and Canada, combined with concerns for conserving specific stocks in a fully developed fishery harvesting from a mixture of stocks, makes the Yukon River a challenging salmon fishery to manage for optimum sustainable yields. Additional responsibilities are anticipated as agreements are put into effect. The Yukon River Joint Technical Committee (JTC) has determined the technical programs for both countries, is inadequate to meet the requirements under a treaty management regime. Continued development of an adequate field program is essential, this process requires travel support for participation in technical, government, and Panel meetings.

Meetings for the Yukon River Panel and meetings for the JTC are each held twice a year. Treaty implementation relies heavily on information supplied by the Alaska Department of Fish and Game (ADF&G) about the salmon fisheries and stocks in the Yukon River drainage. Some of that information has been gained because of specific appropriations from Congress passed through the Department of Commerce to ADF&G. Federal FY 2000-2002 funds were passed through to ADF&G to provide support for meeting costs and field data collection for the period July 1, 2000 through June 30, 2003 through grant Award No. NA76FP0208.

The purpose of the program supported by Federal funds for Yukon River salmon studies is to help provide the technical support necessary to effectively manage the complex Yukon River salmon fisheries in the context of the U.S./Canada negotiations, and now treaty implementation, process, and to provide support for the treaty implementation process. Specifically, Article VIII (3) makes the following requirements:

> The Parties shall initiate in 1985, and conclude, as soon as possible, negotiations to, *inter alia*,
>
> > (a) account for United States harvests of salmon originating in the Canadian section of the River;
> >
> > (b) develop co-operative management procedures, taking into account United States management programs for stocks originating in the United States section of the River;
> >
> > (c) consider co-operative research programs, enhancement opportunities, and exchanges of biological data; and

(d) develop an organizational structure to deal with Yukon River issues.

The Yukon River is the largest river in Alaska, and one of the largest in North America. It drains an area of approximately 330,000 square miles, nearly two-thirds of which is in Alaska. For perspective, the Yukon River drainage exceeds the combined areas of the U.S. Pacific coast states of Washington, Oregon, and California. The area is mostly remote, undeveloped, and in its natural pristine condition. The Yukon River supports one of the largest runs of chinook and chum salmon in the world.

Providing harvest opportunity among the many users along the river in both the United States and Canada, and conserving specific stocks in a fully developed fishery harvesting from a mixture of stocks, makes the Yukon River one of the most challenging salmon fisheries to manage for optimum sustainable yields. The Yukon River Joint Technical Committee (JTC) has determined the technical program, for both countries, is inadequate to meet the requirements expected with a treaty management regime.

This report serves as a completion report in summary form for six field data collection projects or activities funded with this grant for the period July 1, 2000 through June 30, 2003. Specifically, the projects or activities described in this report are as follows:

1) JTC and Yukon Project Support
2) Chinook Salmon Stock Identification Using Scale Patterns Analysis (SPA)
3) Yukon River Salmon Stock Identification Using Genetic Stock Identification (GSI)
4) Subsistence and Personal Use Harvest Estimation
5) Spawning Escapement Surveys
6) Lower Yukon River Sonar at Pilot Station
7) Yukon Program Support
8) Sheenjek River Sonar
9) Yukon Radio Telemetry
10) Yukon Program Administrative Support.

Results from each of these projects or activities will be summarized in the subsequent individual sections of this completion report. Reference will be provided to specific reports in preparation or already completed. These reports provide a more comprehensive source of information on the background for these projects or activities, the methods used, the results and discussion, and literature references. A comprehensive review of the Yukon River salmon fisheries and overall field programs can be found in Vania, et al. 2002.

LITERATURE CITED

Vania, Tom; et al. 2002. Annual Management Report Yukon and Northern Areas, 2000. RIR No. 3A02-29, Alaska Department of Fish and Game, Anchorage.

1. JTC AND YUKON PROJECT SUPPORT

Susan McNeil, Alaska Department of Fish and Game, Commercial Fisheries Division
NA06FP0075
Period Covered by the Report: From: July1, 2000 To: June 30, 2003
Date Prepared: September 30, 2003

II. Executive Summary

A Fishery Biologist II, Fishery Biologist IV and Analyst Programmer IV were supported by these funds to provide assistance to the successful completion of JTC meetings and projects listed in this grant. The Yukon River Joint Technical Committee was established in 1985 to provide professional and technical support for the treaty negotiations. JTC activities include research planning, setting of escapement goals, and preparing season outlooks for panel approval. Semi annual meetings of the JTC were scheduled and conducted in spring and fall of each year. Reviews and outlooks were presented, invited speakers presented their research and a JTC draft plan was produced. This project provides support for a Principal Investigator, experienced in conducting research, leading research planning, and carrying out scientific technical reviews. This project also provides funding for a team of biometricians, analyst programmers, or professional consultants for needed data processing, programming, and biometric support for the programs described in this document.

III. Purpose of Project

The Yukon River Joint Technical Committee (JTC) was established in 1985 to provide professional and technical support for the treaty negotiations. JTC activities include research planning, setting of escapement goals, and preparing season outlooks for panel approval. After the Yukon River Agreement was ratified in 2002, the JTC provides professional and technical support to the Yukon River Panel. Examples of annual analysis and data processing tasks include analysis of escapement trends, preseason projections, estimation of Canadian origin stocks, escapement goal estimation and rebuilding planning. Since inception of the JTC, technical subcommittees and teams have been established to address specific tasks. Examples of tasks accomplished in the last three years are development of a research plan for Yukon salmon, technical review of proposals for funding under the Yukon River Salmon Restoration and Enhancement Fund, and a coordinated multi-year radio telemetry project.

The Fishery Biologist IV is the principal investigator for all the projects listed in this document. This position provides overarching support and supervision including review of all reports, audits and field visits to the project sites as necessary.

A team of biometricians, analyst programmers, or professional consultants provides needed data processing, programming, and biometric support for the programs included in the grant. This team provides consultation for each project to meet technical and statistical needs and reviews final reports for accuracy.

IV. Approach:

A Fishery Biologist II was funded to support JTC activities. Specifically, this position is responsible for the coordination and submission, in a timely manner, of the U.S. Section's

contributions to the semi-annual JTC reports and all other contributions from the U.S. Section of the JTC resulting from tasks assigned to the JTC. Additionally this position is responsible for the coordination of Yukon River Restoration and Enhancement Projects specified by the treaty and funded by the US federal government. This person made all travel arrangements for the meetings, and supported other Yukon US/Canada related projects in data analysis, planning and reporting.

Department staff members participated in U.S./Canada government-to-government meetings held in Anchorage, AK and Whitehorse, Yukon Territory. Staff made season review and season outlook presentations and distributed support materials. Many outside researchers were invited to speak to the JTC about their specialized research. *Ichthyophonus* researchers presented their project results to the JTC in Feb. 2002. Genetics researchers from various laboratories (ADF&G, USFWS, CDFO) were invited to a JTC meeting in March 2003 to present their research. NOAA, DFO and ADF&G staff presented information on the coordinated radio-telemetry project. This project is a good example of the excellent coordination between agencies and individuals to conduct a drainagewide project funded though various grantors.

This project provides support for a Principal Investigator experienced in conducting research, leading research planning, and carrying out scientific technical reviews. This position is co-chair of the JTC and oversees the US contributions to this body: cooperative research and scientific reports, and collaborates projects.

This project also provides funding for approximately one-half of the annual salary and benefits cost for a fulltime Analyst Programmer IV position in Anchorage. Although presented as a single position, a team of biometricians, analyst programmers, or professional consultants has provided needed data processing, programming, and biometric support for the programs described in this document.

V. Results, Evaluation and Conclusions

This project has successfully provided JTC Support. All the objectives stated in the scope of work are completed each year: travel to semi-annual JTC meetings, writing the JTC summary review and outlook reports, writing a JTC plan and established escapement objects. The JTC and the Panel met twice a year, spring and fall, during the report years. Programs were evaluated, escapement goals were set and cooperative projects were coordinated. One positive result of JTC support has been the near completion of the JTC Plan. The planning process began with Dr. Merritt's meetings in 2002. The JTC decided to rework this original plan by consolidating specific needs into more general objectives. The five original goals were consolidated into four: management, habitat, stewardship, and biology and ecology. The intent of the original plan was preserved. Projects are entered into the new plan under the appropriate issue, objective and goal. One intention of a JTC is a gap analysis of existing versus needed research projects. Once the analysis is conducted, programs will be developed to fill those gaps. A select number of JTC members attended the Restoration and Enhancement Fund research planning session in Whitehorse, YT, 21-23 May 2003. The Principal Investigator is active in all aspects of the projects listed and is on the JTC planning committee. The data processing and biometrics team supports all the projects with data analysis, database management and data retrieval.

VI. Products

The Joint Technical Committee published three spring and three fall committee reports for the panel (Joint Technical Committee 2000, 2001a, 2001b, 2002a. 2002b, 2003). The spring reports provide information about outlooks for the upcoming fishing season. Escapement targets for the Alaska Yukon border passage are recommended. The panel may revise these target numbers either up or down. Projects are updated. The fall reports are summaries of the season's fishing information, project updates and escapement estimates.

The JTC worked on a plan, inviting Dr. Merritt to facilitate. She wrote a report in support of the research she did to prepare for the planning meetings in 2002 (Merritt 2002). She wrote a draft plan, not for general distribution, as the JTC Plan. However, the committee decided this writeup needed additional work and formed a subcommittee to rewrite the plan. ADF&G staff who facilitated the second series of plan, meetings received training in special software to prioritize in-house the plan elements. The plan is now rewritten and the goals, objectives and issues are prioritized. Projects have been entered into the plan and the gap analysis will be developed soon. Eventually programs to fill those gaps will be developed and supported. The plan and the planning process were explained to the Panel through Power Point presentations.

VII. References

Joint Technical Committee. 2003. Yukon River Joint Technical Committee Report, Salmon Run Outlooks for 2002. Regional Information Report No. 3A03-12, Alaska Department of Fish and Game. Anchorage, Alaska.

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VIII. Key Words: Yukon River, chinook, chum, coho, salmon, border passage, Joint Technical Committee, Yukon River Panel, Pacific Salmon Treaty, Yukon River Agreement

2. CHINOOK SALMON STOCK IDENTIFICATION STUDIES USING SCALE PATTERN ANALYSIS (SPA)

Larry DuBois
Alaska Department of Fish and Game
NA06FP0075
Period Covered by the Report. From: July1, 2000 To: June 30, 2003
Date Prepared: September 30, 2003

II. Executive Summary

Yukon River chinook salmon *Oncorhynchus tshawytscha* (Walbum) are harvested in subsistence and personal use fisheries in Alaska, Aboriginal and domestic fisheries in Canada, and commercial and sport fisheries in both Alaska and Canada. Chinook salmon escapements indicate the largest concentrations of spawners occur in three distinct geographic regions. Chinook salmon stocks within these three geographic regions are collectively termed Lower, Middle, and Upper Yukon River stocks. These various stocks, or runs of origin, are sampled on or near the spawning grounds in the portions of the Yukon River drainage where they are assumed to be separate. Scales are taken from each fish sampled and these scale data are used to estimate the age composition at each sampling location. The scales of the more abundant age classes, typically age 5 (age-1.3) and age 6 (age-1.4) fish are digitized and a number of scale growth measurements are made on each scale. Maximum likelihood estimation models (MLE) were used to estimate stock composition for the most abundant age classes, typically age 5 (age-1.3) and age 6 (age-1.4) fish. Observed age composition ratios among escapements, in combination with maximum likelihood estimates, were used to estimate stock composition of less abundant age classes. These data are assumed to characterize all salmon from each of the runs of origin. Similar data are collected from subsistence, test fish, and commercial catch samples. These proportions are then used to classify and apportion their associated harvests. The Upper River run was the largest component of the drainagewide harvests, accounting for 53.4% in 1999, 53.8% in 2000, and 52.4% in 2001.

III. Purpose of Project

The Yukon River chinook salmon run consists of a mixture of different stocks. Without knowing the age and sex composition and the timing of the stocks entry pattern into the river, managers are at risk of over harvesting less abundant stocks. Evaluating stock production, spawning escapement goals and management strategies of Yukon River chinook salmon requires information on the age, sex, length and stock compositions of the various harvests. Stocks of the three distinct geographic regions enter the mouth of the Yukon River at varying times within a constricted run time period. Over-harvesting of an individual stock over several years could reduce the overall productivity of that individual stock. In addition, the U.S. and Canada have been engaged in treaty negotiations concerning management and conservation of stocks spawning in Canada. Biological information on these stocks provides the technical basis for the negotiation process.

The objective of this project is to provide area managers with the estimated age and sex and a historical pattern of the stock composition of chinook salmon entering the mouth of the Yukon River throughout the season. Post season, the estimated contributions of the two Alaskan-origin and the single Canadian-origin chinook salmon stocks to fishery harvests of the Yukon River

drainage are provided. Additionally, the age, sex and length compositions are estimated for harvests and escapements of chinook salmon throughout the Yukon River drainage.

IV. Approach

Yukon River chinook salmon were identified based on their geographic run of origin as Lower, Middle, and Upper River. The baselines for each run of origin were determined using scale pattern analysis (SPA) of chinook salmon scale characteristics sampled from Alaskan tributary streams and Canadian fish wheels. These baselines were used to apportion harvests by run of origin in the mixed stock fisheries, such as mainstem commercial and subsistence harvests. The baselines for the two regions of origin within the Alaska portion of the Yukon River drainage, the Lower and Middle river runs, were collected from pre-spawning chinook salmon at tributary escapement projects, such as weirs or towers, and post-spawning carcass samples. Scales collected by the Canada Department of Fisheries and Oceans (DFO) from test fish wheel catches in Canada, immediately upriver from the U.S.-Canada border were used for the Upper river run baseline. Lower river stocks originate in the tributaries that drain the Andreafsky Hills and Kaltag Mountains. Middle river stocks originate in the Upper Koyukuk River and Tanana River tributaries. Upper river stocks originate in Canadian tributaries that drain the Pelly and Big Salmon Mountains, and the Canadian Yukon River mainstem.

Three scales were removed from each chinook salmon and mounted on gummed cards and scale impressions were made into cellulose acetate using heat and pressure. These scale impressions were aged using a microfiche reader viewing at 40x magnification, and reported in European notation. After aging, selected scale impressions were converted to digital files by scanning, and measurements were made on these scale images using the OPTIMAS software program.

Mixed stock or non-baseline scale samples were collected from Yukon River chinook salmon caught in commercial, subsistence and test fisheries and tributary escapement projects throughout the drainage. The SPA program combines common characteristics from the digitized baseline samples and produces a maximum likelihood mixture model that assigns selected samples from the mixed stock harvests to Lower, Middle or Upper river run of origin.

Various organizations participated in collecting scale data from chinook salmon in the Yukon River drainage: Alaska Department of Fish and Game, Divisions of Commercial Fisheries and Sport Fish; United States Fish and Wildlife Service, Fairbanks Fishery Resource Office and Office of Subsistence Management; Emmonak Tribal Council, Bureau of Land Management, Bering Sea Fishermen's Association, City of Kaltag, Nulato Tribal Council and Department of Fisheries and Oceans, Canada.

V. Results, Evaluation and Conclusions

July 1, 2000 - June 30, 2001

In 2000, chinook salmon age-sex-length (ASL) samples were collected from commercial, subsistence, test fishing, radio tagging, and escapement projects and provided ASL compositions and SPA information. Commercial harvest samples were collected from Districts 1 and 2 and subsistence samples from District 4. Samples used for scale pattern analysis were collected from the

East Fork Andreafsky, Anvik, Gisasa, Chena and Salcha Rivers in Alaska, and from the White Rock and Sheep Rock tagging project fish wheels just upriver from the U.S.-Canada border. Other escapement samples were collected from Beaver and Henshaw Creeks, and Chatanika and Goodpaster Rivers. Usable samples collected in 2000 from the Yukon River drainage numbered 7,076. Samples collected by project type were 1,075 from the commercial harvest, 126 from the subsistence harvest, 2,084 from Alaskan test fishing, 660 from radio tagging, 1,951 from Alaskan escapement and 1,180 from Canadian test fishing. These samples were aged and the results were tabulated in an unpublished report, *Salmon age & sex composition and mean lengths for the Yukon River Area, 2000*. Digitizing of scales collected during the 2000 season was completed in the spring of 2001 and a new digitizing system was researched and purchased. A draft of the report, *Origins of chinook salmon in the Yukon River fisheries, 1999* was initiated.

Sampling of chinook salmon from the Lower Yukon River subsistence harvests and test fishery catches in the 2001 season was initiated. These subsistence and test fishing samples were aged inseason and preliminary age and sex tables were generated on a daily basis.

July 1, 2001 - June 30, 2002

In 2001, chinook salmon ASL samples were collected from subsistence, test fishing, radio tagging, and escapement projects and provided ASL compositions and SPA information. There was no chinook salmon commercial fishing in 2001. Subsistence harvest samples were collected from Districts 1, 4, 5 and 6. Samples used for scale pattern analysis were collected from the East Fork Andreafsky, Anvik, Gisasa, Chena and Salcha Rivers and Henshaw Creek in Alaska, and from test fish wheels in Canada. Other escapement samples were collected from Beaver Creek and from the Chatanika and Tozitna Rivers. Usable samples collected in 2001 from the Yukon River drainage numbered 7,396. Samples collected by project type were 1,218 from the subsistence harvest, 1,531 from Alaskan test fishing, 1,736 from radio tagging, 2,276 from Alaskan escapement and 635 from Canadian test fish wheels. These samples were aged and the results were tabulated in an unpublished report, *Salmon age & sex composition and mean lengths for the Yukon River Area, 2001*. Digitizing of scales during the 2001 season was completed in the spring of 2002 using the new digitizing system purchased during the previous year. Three reports were published summarizing the origins of chinook salmon: *Origins of chinook salmon in the Yukon River fisheries, 1999*; *Origins of chinook salmon in the Yukon River fisheries, 2000;* and *Origins of chinook salmon in the Yukon River fisheries, 2001*.

Sampling of chinook salmon from the Lower Yukon River commercial and subsistence harvests and test fishery catches in the 2002 season were initiated. These subsistence and test fishing samples were aged inseason and preliminary age and sex tables were generated on a daily basis.

July 1, 2002 - June 30, 2003

In 2002, chinook salmon ASL samples were collected from commercial, subsistence, test fishing, radio tagging, and escapement projects and provided ASL compositions and SPA information. Commercial harvest samples were collected from Districts 1, 2, 5, and 6 and subsistence samples from Districts 1 and 5. Samples used for preliminary scale pattern analysis were collected from the East Fork Andreafsky, Anvik, Gisasa, Chena and Salcha Rivers and Henshaw Creek in Alaska, and from test fish wheels in Canada. Other escapement samples were collected from the Chatanika,

Kateel, Nulato and Tozitna Rivers. Usable samples collected in 2002 from the Yukon River drainage numbered 10,597. Samples collected by project type were 2,805 from the commercial harvest, 775 from the subsistence harvest, 1,944 from Alaskan test fishing, 707 from radio tagging, 3,478 from Alaskan escapement and 888 from Canadian test fish wheels. These samples were aged and the results were tabulated in an unpublished report, *Salmon age & sex composition and mean lengths for the Yukon River Area, 2002*. Digitizing of chinook salmon scales during the 2002 season was not completed. Preliminary investigations concerning a stock-allocation model for the 2002 fishing season was initiated.

Sampling of chinook salmon from the Lower Yukon River commercial and subsistence harvests and test fishery catches in the 2003 season were initiated. These samples were aged inseason and preliminary age and sex tables were generated on a daily basis. Additionally, tissues were collected from chinook salmon harvested in the lower Yukon River test fisheries for development of Genetic Stock Identification markers.

Larry DuBois and Shawna Karpovich with the Alaska Department of Fish and Game process scale samples, tabulate and analyze associated data, and report findings. Personnel from various State, Federal, Canadian, tribal and private organizations collect scale samples from chinook salmon in the Yukon River drainage.

Results

2000

All three commercial fishing periods in the lower river during the 2000 summer season allowed gillnets with no restriction on mesh size. Without restrictions, fishermen generally fish larger mesh gear that harvests larger and older chinook salmon. Age-6 chinook salmon were dominant, contributing 62.5%, followed by 28.6% age-5 fish (Price 2001). Other contributing age classes were age-4 (0.9%) and age-7 (8.0%). Females were dominant in all of the commercial harvest samples, ranging from 56.9% to 66.7% and averaging 60.7%. Age-5 fish dominated the escapement samples collected at weirs on the East Fork Andreafsky (49.1%) and Gisasa (51.4%) Rivers and Beaver (63.1%) and Henshaw (62.2%) Creeks. Age-5 Chinook salmon dominated the carcass samples collected from the East Fork Andreafsky (65.6%), Chatanika (57.1%), Goodpaster (49.0%) and Salcha (48.8%) Rivers. Age-6 fish dominated the carcass samples collected from the Anvik River (52.7%) and similar numbers of age-5 and age-6 carcasses were present at Chena River (35.6%). Samples from the Canadian tagging project fish wheels were composed of 45.3% age-6 from Sheep Rock and 49.9% age-5 fish from White Rock. Fish wheels tend to catch smaller chinook salmon that are typically younger males. The percentage of males sampled from the Canadian test fish wheels was 64.4% from Sheep Rock and 76.5% from White Rock. The samples from the Dawson gillnet test fishing project were dominated by 62.0% age-6 chinook salmon. The total estimated Yukon River harvest in 2000 was 50,187 chinook salmon, of those, 33.9% were estimated to be of Lower, 12.3% Middle and 53.8% Upper Yukon River stock group origin (Moore and Lingnau 2002).

2001

An above average relative abundance of age-6 chinook salmon were observed in the lower river test fish catches (80.6%) and at other projects in 2002. Age-6 fish were the dominant age group from

subsistence harvest samples collected from Districts 1, 4, 5, and 6 (55.7%, Price 2002). Subsistence samples collected from fish wheels had a lower percentage of age-6 fish (range 27.3-39.4%) than large mesh gillnet samples (75.6%). Other ages observed in the subsistence harvest were 29.2% age-5, 9.7% age-4, and 5.5% age-7 fish. The percentage of males in the subsistence harvest was 65.6%. Age-6 chinook salmon dominated in the escapement samples collected at weirs on the East Fork Andreafsky (64.5%) and Gisasa (58.5%) Rivers and Beaver Creek (62.5%). Weir samples collected from Henshaw Creek had similar numbers of age-5 (44.0%) and age-6 (43.2%) Chinook salmon. Age-6 fish were the dominant age group in carcass samples collected from the Anvik (53.0%), Chatanika (57.1%), Chena (51.2%), Salcha (52.1%) and Tozitna (50.8%) Rivers. Male salmon dominated all the escapement samples except for the East Fork Andreafsky River weir samples. Age-5 fish accounted for 60% of the Rapids fish wheel samples. Samples from the Canadian tagging project fish wheels were composed of 49.1% age-6 at Sheep Rock and 47.7% age-5 chinook salmon at White Rock. The total estimated Yukon River harvest in 2001 was 63,726 chinook salmon, of those, 31.6% were estimated to be of Lower, 16.0% Middle and 52.4% Upper Yukon River stock group origin (Moore 2002).

2002

Inseason analysis of lower river test fisheries indicated near-average age composition for chinook salmon in 2002 with slightly higher percentages of age-4 and age-7 fish. All six commercial fishing periods in the lower river during the 2002 summer season allowed unrestricted mesh size gillnets, which tend to harvest larger and older chinook salmon. Age-6 chinook salmon were dominant, contributing 63.4% in District 1 and 58.7% in District 2 (Price 2003). Age-5 fish comprised 19.4% of the harvests in District 1 and 24.2% in District 2 and age-7 fish comprised 13.8% in both districts. Age compositions from the upper river commercial harvests were different, with age-6 fish comprising 54.7% from District 5 and 36.7% from District 6. Age-5 fish comprised 30.5% from District 5 and 47.7% from District 6. The difference in age compositions between the lower and upper river commercial harvests is attributed to gear selectivity, the lower river fish are harvested with eight inch or larger gillnets and the majority of the upper river fish are harvested with fish wheels. The gear used in the lower river also harvests more females (range 55.2-57.0%) than the gear used in the upper river harvests (range 21.0-47.3%).

Similar to the commercial fisheries, age and sex composition differences were observed between the lower and upper river subsistence harvests. Age-6 fish comprised 63.1% of the samples from large mesh gear in the lower river and ranged from 8.3% to 18.2% in the upper river fish wheel samples (Price 2003). The subsistence harvest of female chinook salmon was greater in the lower river (range 37.2-52.6%) than in the upper river (range 8.4-48.4%)

Escapement age compositions were generally younger than in the lower river commercial and test fisheries. Age-6 fish sampled from four weirs ranged from 13.6% in Kateel River to 31.4% in Henshaw Creek (Price 2003). Age-5 fish sampled from weirs ranged from 36.0% in Henshaw Creek to 48.2% in East Fork Andreafsky River. Age-4 fish sampled from weirs ranged from 30.3% in Henshaw Creek to 50.0% in Kateel River. Age-6 fish from five carcass sampling projects ranged from 17.6% in Tozitna River to 39.1% in Chatanika River. Age-5 fish from carcass sampling ranged from 13.8% in Salcha River to 43.1% in Anvik River. Samples from the

Canadian fish wheels were composed of 36.5% age-4 and 35.0% age-5 at Sheep Rock, and 47.3% age-4 and 35.7% age-5 chinook salmon at White Rock.

In 2002, unweighted sex compositions from escapement samples showed the percent of females from carcass samples (average 30.3%, median 31.7%) was greater than from weir samples (average 25.4%, median 25.0%). However, carcass during peak spawning with an experienced crew significantly reduces any bias. The total estimated Yukon River harvest in 2002 and estimates for assigning run of origin to this harvest are ongoing.

Evaluation and Conclusions

In terms of the overall project success, goals and objectives during this evaluation period were mixed. Attainment of sample size objectives has been considered to be a reasonable measure of operational success (Moore and Lingnau 2002). In 2000, only one escapement sample size objective was met in the Alaskan portion of the drainage (Gisasa 646 samples). The less than adequate sample sizes for both age-5 and age-6 chinook salmon can be partly attributed to weak returns of these age classes during the 2000 run. A consequence of less than adequate sample sizes was that the accuracy of the maximum likelihood estimates (computed from the baseline samples) were less than desirable. This resulted in higher standard error rates when assigning stock of origin to the harvest. For example, the standard errors for estimating the District 1 stock composition, by period, ranged from 4.3% to 12.6%.

In 2001, baseline sample sizes were judged adequate for assigning stock of origin to the Yukon River harvests (Moore 2002). However, several projects were short of the 400-fish sampling goal (East Fork Andreafsky 124, Salcha 192). The addition of another project to the baseline sample dataset (Henshaw Creek) was helpful when compiling the Middle river stock allocation model. A dedicated effort was made inseason to sample the lower river subsistence harvest because of an anticipated lack of commercial fishing periods, hence lack of commercial samples. Prior to 2001, the stocks of origin from the commercial samples were usually applied to the subsistence harvests. The dedicated lower river subsistence harvest sampling has been continued through the 2002 and 2003 field seasons, and the inseason ASL compositions from these samples are another tool available that fishery managers utilize when making inseason management decisions.

In 2002, adequate numbers of samples were collected from both the commercial and subsistence harvests in the lower river to digitize each of these mixed stock fisheries separately and likely determine run of origin separately. Baseline sample sizes appear to be adequate except for the Salcha River (n=282). Tozitna River weir chinook salmon samples may be included in the baseline sample dataset. A preliminary stock allocation model was initiated before the 2003 field season. However, the final 2002 stock allocation model is still in progress because not all datasets were digitized (lower river commercial, some escapement) and the summer season Yukon River research staff has had 100% turnover in the past year. Additional samples under consideration for digitizing and SPA analysis are those collected from the radio-telemetry project operating in District 3.

Insufficient sample sizes and poor quality scales continue to be of concern, especially with escapement samples. Sometimes we were unable to achieve desired sample sizes due to

circumstances beyond our control (e.g., high water events). However, when poor quality scales cause the expected rejection rate to be exceeded, the quantity of useable samples may become a problem. Lack of adequate samples may prohibit some aspect of the stock identification process. To ensure reliable stock allocation estimates, samples used for scale pattern analysis must have adequate sample sizes.

Yukon River fishery managers have historically needed an inseason assessment of chinook salmon stock composition. A project is needed to assess the feasibility of using historical data to estimate the inseason stock structure of test fishing, subsistence and commercial harvests. Inseason assessment of stocks entering the Yukon River would provide Alaskan and Canadian managers an effective tool for management. The mixed stock tissue samples collected during the 2003 field season, for analysis using Genetic Stock Identification techniques may, with additional collections and development, provide an additional tool for assessing inseason stock composition.

No modifications were made to the goals and objectives of the Chinook Salmon Stock Identification Study. However, the number of datasets used for scale pattern analysis are expanding, which will provide greater accuracy for estimating runs of origin for fisheries in the Yukon River drainage.

VI. Products

Project results were reported in the following Regional Information Reports (RIR) and unpublished documents:

Moore, H. and R.A. Price. 2002. Origins of chinook salmon in the Yukon River fisheries, 1999. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A01-36, Anchorage.

Moore, H. and T.L. Lingnau. 2002. Origins of chinook salmon in the Yukon River fisheries, 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-30, Anchorage.

Moore, H. 2002. Origins of chinook salmon in the Yukon River fisheries, 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-45, Anchorage.

Price, R.A. 2001. Salmon age & sex composition and mean lengths for the Yukon River Area, 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, *Unpublished*, Anchorage.

Price, R.A. 2002. Salmon age & sex composition and mean lengths for the Yukon River Area, 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, *Unpublished*, Anchorage.

Price, R.A. 2003. Salmon age & sex composition and mean lengths for the Yukon River Area, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, *Unpublished*, Anchorage.

These reports were distributed to personnel with the Alaska Department of Fish and Game, U.S. Fish and Wildlife Service and Canada Department of Fisheries and Oceans. Results have also been reported to the U.S./Canada Joint Technical Committees and Yukon River delegate members.

VII. References

Moore, H. and T.L. Lingnau. 2002. Origins of chinook salmon in the Yukon River fisheries, 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-30, Anchorage.

Moore, H. 2002. Origins of chinook salmon in the Yukon River fisheries, 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-45, Anchorage.

Price, R.A. 2001. Salmon age and sex composition and mean lengths for the Yukon River Area, 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, *Unpublished*, Anchorage.

Price, R.A. 2002. Salmon age and sex composition and mean lengths for the Yukon River Area, 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, *Unpublished*, Anchorage.

Price, R.A. 2003. Salmon age and sex composition and mean lengths for the Yukon River Area, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, *Unpublished*, Anchorage.

VIII. Key Words

Chinook salmon, *Oncorhynchus tshawytscha*, stock composition, run of origin, age-sex-length sampling, subsistence harvest, commercial fishing, test fishing, fish wheel, sport fishing, weir, carcass, Yukon River, Lower Yukon River, Middle Yukon River, Upper Yukon River, East Fork Andreafsky River, Anvik River, Beaver Creek, Chatanika River, Chena River, Gisasa River, Goodpaster River, Henshaw Creek, Salcha River, Tozitna River, Dawson, Sheep Rock, White Rock

3. YUKON RIVER SALMON STOCK IDENTIFICATION STUDIES USING GENETIC STOCK IDENTIFICATION (GSI)

Judy Berger and Lisa W. Seeb,
Gene Conservation Laboratory, Division of Commercial Fisheries, Alaska Department of Fish and Game,
NA06FP0075
Period Covered by the Report From: July1, 2000 To: June 30, 2003
Date Prepared: September 30, 2003

II. Executive Summary

All chum salmon entering the Yukon River after July 15 (July 18 at Pilot Station, river km 197) are considered fall-run for purposes of inseason management. We tested this management strategy using genetic stock identification (GSI). We estimated the migration and entry timing of summer- and fall-run chum salmon entering the Yukon River using the extensive allozyme baseline previously developed (Crane et al. 2001).

From 1999-2002, chum salmon were sampled from species-apportionment gillnetting conducted at the Pilot Station sonar site. Approximately 800-1,000 individuals were sampled yearly during the period July 28 – August 8. Sampling dates varied among the years, but at least four weekly samples were estimated. Sampling in 2002 was most comprehensive with estimates derived for six weeks. Muscle, liver, and heart tissues were collected from each individual for the allozyme analysis. Where weekly totals exceeded 200, individuals were subsampled proportional to the weekly passage estimates by day and by bank orientation (left or right) from the sonar passage estimates.

In 1999, fall-run chum salmon were not detected until the July 19-25 sampling period. In the subsequent years, fall chum salmon were evident as early as July 5-11 sampling period. In 2001, the summer chum salmon showed a significant decline in abundance during the July 12-18 sampling period, up to two weeks prior to the decline observed in other year. The estimates indicate that there is considerable annual variation in stock composition. Fall-run stocks were significantly more abundant in the early weeks before July 15 in the two even years, 2000 and 2002. These results indicate the July 15 date should be used as a guideline only, and management strategies should compensate for significant numbers of fall-run before that date and significant numbers of summer-run stocks after that date.

III. Purpose

Chum salmon entering the Yukon River after July 15 are considered fall run for purposes of inseason management. Abundance estimates for fall-run chum salmon are derived by summing Pilot Station sonar passage estimates from July 18 forward (three day migration time from mouth of river to sonar site) with subsistence and commercial harvests of fall- run chum salmon down stream from Pilot Station. Use of abundance estimates is an integral part of the management of fall-run chum salmon in the Yukon River; these data are used in part to open and close subsistence and commercial fisheries, achieve escapement goals, and meet agreed passage levels into Canada.

In 1999, ADF&G implemented a study to use genetic stock identification to estimate the migration timing of summer- and fall-run chum salmon entering the Yukon River. Here we report an expansion of that project and results from four years, 1999 through 2002. The application uses the allozyme genetic baseline described in Crane et al. (2001), a comprehensive baseline with over 8,000 individuals and 23 pooled groups. That study showed that chum salmon populations in the Yukon River do not segregate along political lines; however, the data have sufficient power to identify major stock groups in mixtures and can be used to investigate the run timing and migration patterns of those aggregates.

Objectives of this project are:

1. Develop genetic stock identification applications for chum salmon within the Yukon River.
2. Monitor run timing of summer- and fall-run chum salmon at Pilot Station (river km 197).

IV. Approach

Tissue collections

During the four years covered by this study, chum salmon tissues were collected from test fisheries in the Yukon River drainage at Pilot Station (river km 197) from 28 June to 8 August with the exact date depending on the year (Table 1). A goal of 200 individuals per week was set for the Pilot Station test fishery collections. Fish were sampled from species apportionment sampling conducted twice daily at the sonar site at Pilot Station run by ADF&G. Muscle, liver, and heart tissues were subsampled from 30 individuals from each sampling period, placed in labeled cryovials, and frozen at -20°C. All tissue samples were shipped on liquid nitrogen to the ADF&G Gene Conservation Laboratory within one week of collection and stored at -80°C (Table 1). Observations at the Pilot Station sonar site indicated lower than normal run strength for chum salmon entering the Yukon River for 2002. When incidental catch of chum salmon in the Pilot Station test fishery was below target levels, every fish caught was sampled for genetic stock identification. All individuals for these weeks were used in the analysis.

Five weekly periods were sampled in 1999, four in 2000, and six in both 2001 and 2002. Where weekly totals exceeded 200, individuals were subsampled proportional to the weekly passage estimates by day and by bank orientation (left or right) from sonar passage estimates (Table 1).

Laboratory Analysis

Tissue samples from the test fishery were assayed for genetic variation at the following loci: *sAAT-1,2**; *mAAT-1**; *mAH-3**; *ALAT**; *ESTD**; *G3PDH-2**; *GPIB-1,2**; *mIDHP-1**; *sIDHP-2**; *LDH-A1**; *LDH-B2**; *sMDH-A1**; *sMDH-B1,2**; *mMEP-2**; *MPI**; *PEPA**; *PEPB-1**; *PEPLT**; *PGDH**; and *TPI-1** using the laboratory protocols of Seeb and Crane (1999).

Statistical Analysis

Maximum likelihood estimates for mixture samples were calculated using SPAM 3.5 (Debevec et al. 2000). Ninety percent confidence intervals were computed from 1,000-bootstrap resamples

of the baseline and mixture genotypes. For each resample, contribution estimates were generated for all populations and summed into the six reporting regions and then into combined summer-run or fall-run estimates using an allocate-sum procedure. The 1,000 bootstrap estimates for a run were then sorted from lowest to highest with the 26th and 475th values in the sequence taken respectively as the lower and upper bounds of the 90% confidence interval for that run. This report presents estimates for the summer-and fall-run composite groups. Detailed estimates with the six individual reporting groups are available from the authors.

Project management:
Judy Berger and Lisa W. Seeb – Alaska Department of Fish and Game, Division of Commercial Fisheries

V. Findings

Baseline Analysis

Analyses of simulated mixtures using this database indicate that six reporting regions can accurately be identified in mixtures. These include two summer groups: 1) Lower Summer (Andreafsky, Chulinak, Anvik, Rodo, Kaltag, Nulato, Lower Koyukuk-early, and Melozitna) and 2) Middle Summer (Upper Koyukuk-late, South Fork Koyukuk-early, Tozitna, Chena and Salcha), and four fall-run groups: 3) Fall Tanana (Toklat, Delta, Bluff Cabin, Tanana Mainstem), 4) Border (Chandalar, Sheenjek, Fishing Branch, Canadian Mainstem, Pelly River), 5) White River (Kluane and Donjek); and 6) Teslin River (Figures 1 and 2). Individual population or stock estimates were first calculated then summed using the allocate-sum procedure into the six reporting regions and finally into the two larger summer and fall groups.

Pilot Station test fishery

Weekly stock composition estimates show variability in timing of entry of fall-run chum salmon across the four years; fall-run chum salmon appeared at Pilot Station sonar earlier in the run in 2000 and 2002 than in 1999 and 2001 (Table 2, Figure 3). In 2000 and 2002 fall-run chum were detected (confidence interval does not include zero) as early as July 5-11, while in 1999 and 2001 fall-run chum salmon were not detected until the week of 19-25 July (Table 2, Figure 3 and 4). In 2000, fall-run chum salmon contributed up to 25% of the test fishery in the week prior to the July 15 management date.

Similarly, in other years summer-run chum salmon continued to contribute through the last week of July. For example, in 1999 an estimated 30% of the run was composed of summer-run chum salmon during the week of July 26-August 1. However, in 2001 summer chum salmon showed a significant decline in abundance during the July 12-18 sampling period, up to two weeks prior to the decline observed in the other years.

VI. Evaluation

Genetic stock identification methods can accurately and precisely discriminate summer- and fall-run chum salmon from the Yukon River, and considerable annual variation was detected in the run timing of these two genetically diverse stocks. Differences were particularly apparent

between even- and odd-years with the fall-run appearing earlier in even years. The management date of July 15 should be considered a guideline only. Fall-run chum salmon can contribute significantly prior to that date while summer-run chum salmon can contribute significantly to the run after that date.

Using complementary funding, we are developing markers based on the 5'-nuclease reaction to genotype single nucleotide polymorphisms (SNPs) in large number of chum salmon. These markers are being developed in order to utilize the wealth of previously described polymorphisms that have not been applied on large scales due to throughput constraints of older methodologies. Results to date clearly show that SNP genotyping is a rapid, cost effective, and high-resolution approach to baseline development and to the analysis of large numbers of samples from complex mixtures. Time and monetary requirements for running SNP genotyping assays are low relative to other classes of genetic markers, and these assays are standardized across laboratories and platforms much more readily than are those for other genetic marker classes.

We anticipate that SNPs along with existing genetic markers will become an increasingly important tool for stock identification studies of chum salmon in the Western Alaska and on the high seas to address questions such as relative contribution to fisheries, relative abundance, timing and migratory patterns as well as timing of juvenile outmigrations.

VII. References

Crane, P. A., Spearman, W. J., and Seeb, L. W. 2001. Yukon River chum salmon: Report for genetic stock identification studies, 1992-1997, Regional Information Report No. 5J01-08 Alaska Department of Fish and Game, Anchorage, Alaska.

Debevec, E. M., Gates, R. B., Masuda, M., Pella, J., Reynolds, J., and Seeb, L. W. 2000. SPAM (Version 3.2): Statistics program for analyzing mixtures. Journal of Heredity 91: 509-511.

Seeb, L. W. and P. A. Crane. 1999. Allozymes and mitochondrial DNA discriminate Asian and North American populations of chum salmon in mixed-stock fisheries along the south coast of the Alaska Peninsula.

VIII. Key Words: genotype, western Alaska, nuclease reaction, stock composition, stock identification, chum salmon, Yukon River, Pilot Station, allozyme baseline

Table 1. Collection results by week and bank (left and right) for chum salmon at Pilot Station, 1999-2002. Where weekly totals exceeded 200, chum salmon were randomly subsampled proportional to the daily passage rate by bank orientation.

	Bank		Daily totals	Number analyzed
1999	Left	Right		
July 5-11	191	223	414	200
July 12-18	104	167	271	200
July 19-25	170	172	342	200
July 26-Aug 1	81	60	141	141
August 2-5	100	87	187	187

	Bank		Daily totals	Number analyzed
2000	Left	Right		
July 5-11	128	134	336	200
July 12-18	106	65	171	171
July 19-25	100	38	138	138
July 26-Aug 2	227	97	324	200

	Bank		Daily totals	Number analyzed
2001	Left	Right		
June 28-July 4	96	101	197	197
July 5-11	124	65	189	189
July 12-18	39	55	94	100
July 19-25	217	123	340	200
July 26-Aug 1	47	153	200	200
August 2-6	45	155	200	200

	Bank		Daily totals	Number analyzed
2002	Left	Right		
June 27-July 4	237	209	447	200
July 5-11	216	158	383	200
July 12-18	74	124	202	202
July 19-25	55	57	116	116
July 26-Aug 1	157	97	258	200
August 2-8	48	27	86	86

Table 2. Contribution estimates for summer- and fall-run chum salmon to mixtures of chum salmon sampled at Pilot Station sonar 1999-2002. Symmetric ninety percent confidence intervals are calculated from 1,000 resamplings of the mixture and baseline.

1999	July 5-11, N=200			July 12-18, N=200			July 19-25, N=200			July 26-Aug. 1, N=141			August 2-5, N=187		
		90% CI			90% CI			90% CI			90% CI			90% CI	
	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi
Summer	0.96	0.90	1.00	0.98	0.92	1.00	0.35	0.26	0.51	0.30	0.16	0.45	0.00	0.00	0.15
Fall	0.03	0.00	0.10	0.00	0.00	0.07	0.65	0.49	0.74	0.70	0.55	0.84	1.00	0.85	1.00

2000	July 5-11, N=200			July 12-18, N=171			July 19-25, N=138			July 26-Aug. 2, N=200		
		90% CI			90% CI			90% CI			90% CI	
	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi
Summer	0.84	0.69	0.95	0.74	0.60	0.88	0.28	0.15	0.50	0.08	0.04	0.21
Fall	0.16	0.05	0.31	0.25	0.12	0.40	0.72	0.50	0.85	0.92	0.79	0.96

2001	June 28-July 4, N=197[1]			July 5-11, N=189			July 12-18, N=100			July 19-25, N=200			July 26-Aug. 1, N=200			August 2-6, N=200		
		90% CI			90% CI			90% CI			90% CI			90% CI			90% CI	
	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi
Summer	0.99	0.94	1.00	0.98	0.81	1.00	0.84	0.70	1.00	0.30	0.18	0.47	0.12	0.07	0.32	0.10	0.04	0.31
Fall	0.01	0.00	0.06	0.02	0.00	0.19	0.16	0.00	0.30	0.69	0.54	0.83	0.88	0.68	0.93	0.90	0.69	0.96

2002	June 27-July 4, N=200			July 5-11, N=200			July 12-18, N=202			July 19-25, N=116			July 26-Aug. 1, N=200			August 2-8, N=86		
		90% CI			90% CI			90% CI			90% CI			90% CI			90% CI	
	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi	Estimate	Lo	Hi
Summer	0.94	0.86	0.99	0.81	0.67	0.93	0.79	0.66	0.94	0.48	0.39	0.75	0.11	0.04	0.24	0.18	0.05	0.38
Fall	0.05	0.00	0.13	0.19	0.06	0.32	0.20	0.06	0.33	0.52	0.25	0.61	0.89	0.76	0.96	0.82	0.61	0.95

[1] No samples were collected on June28, sampling began on the June29, 2001

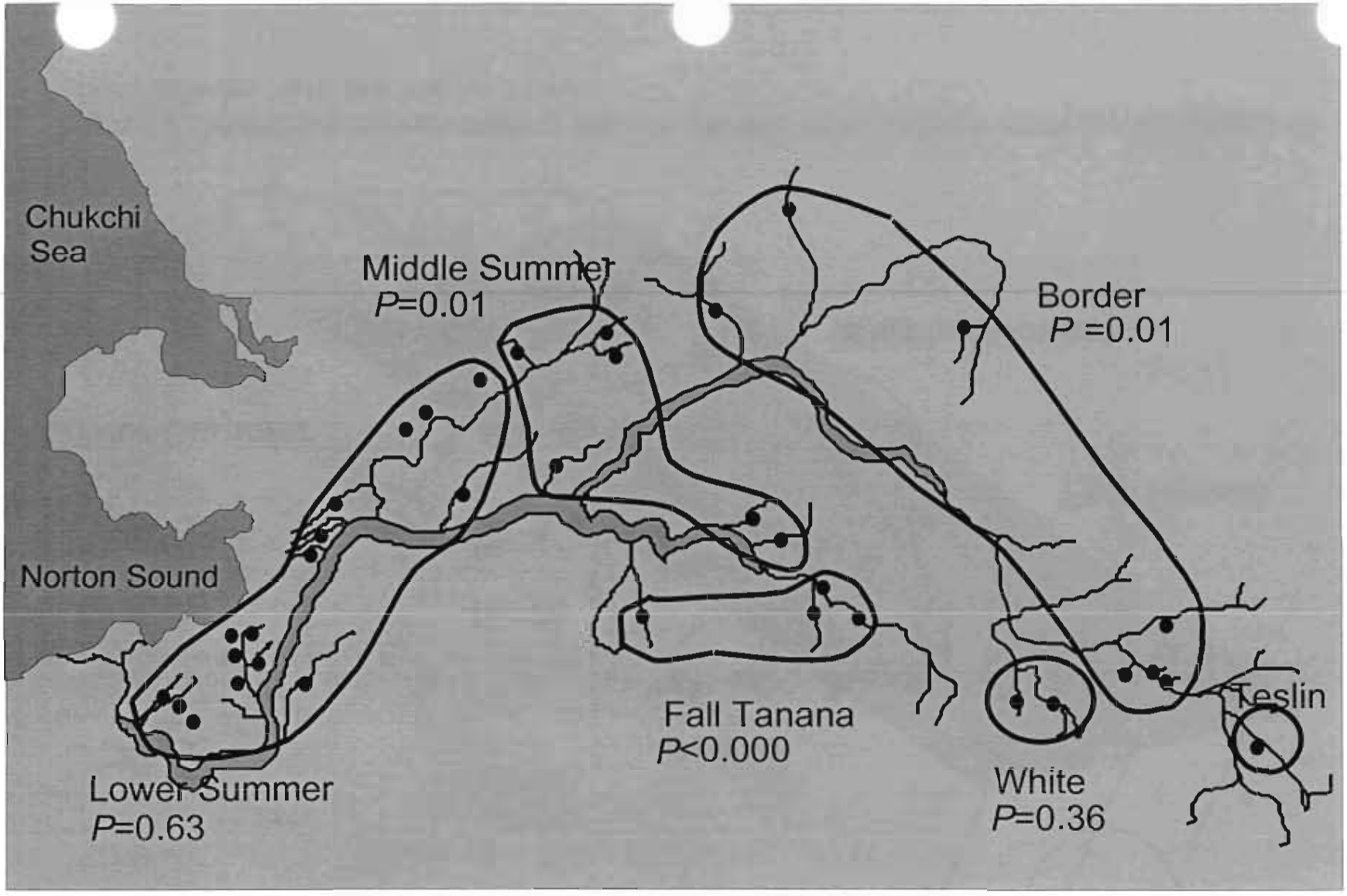

Figure 1. Six reporting regions for chum salmon from the Yukon River. P-values show levels of heterogeneity among populations within regions.

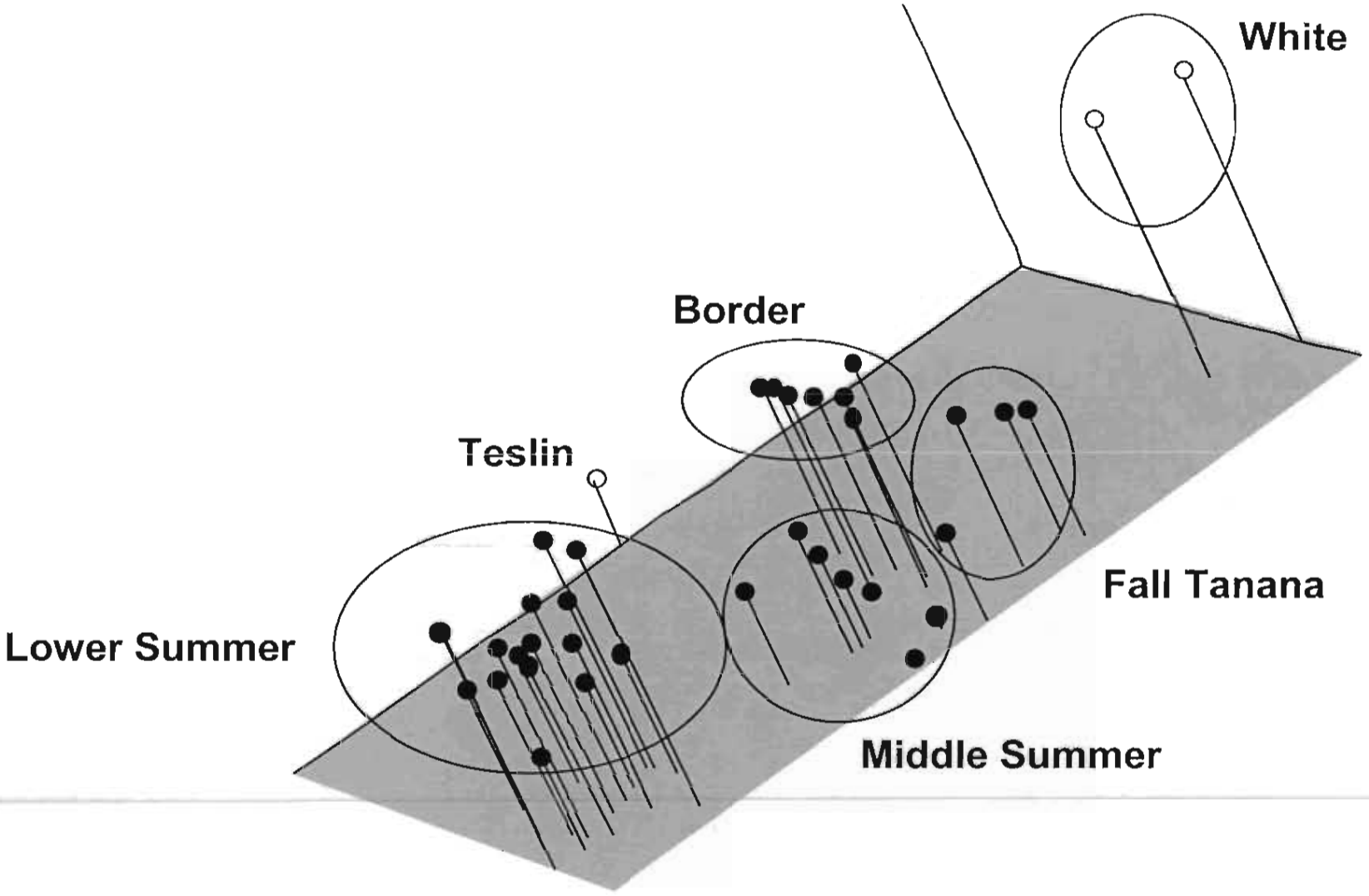

Figure 2. Multidimensional scaling depicts genetic relationships among populations of chum salmon from the Yukon River.

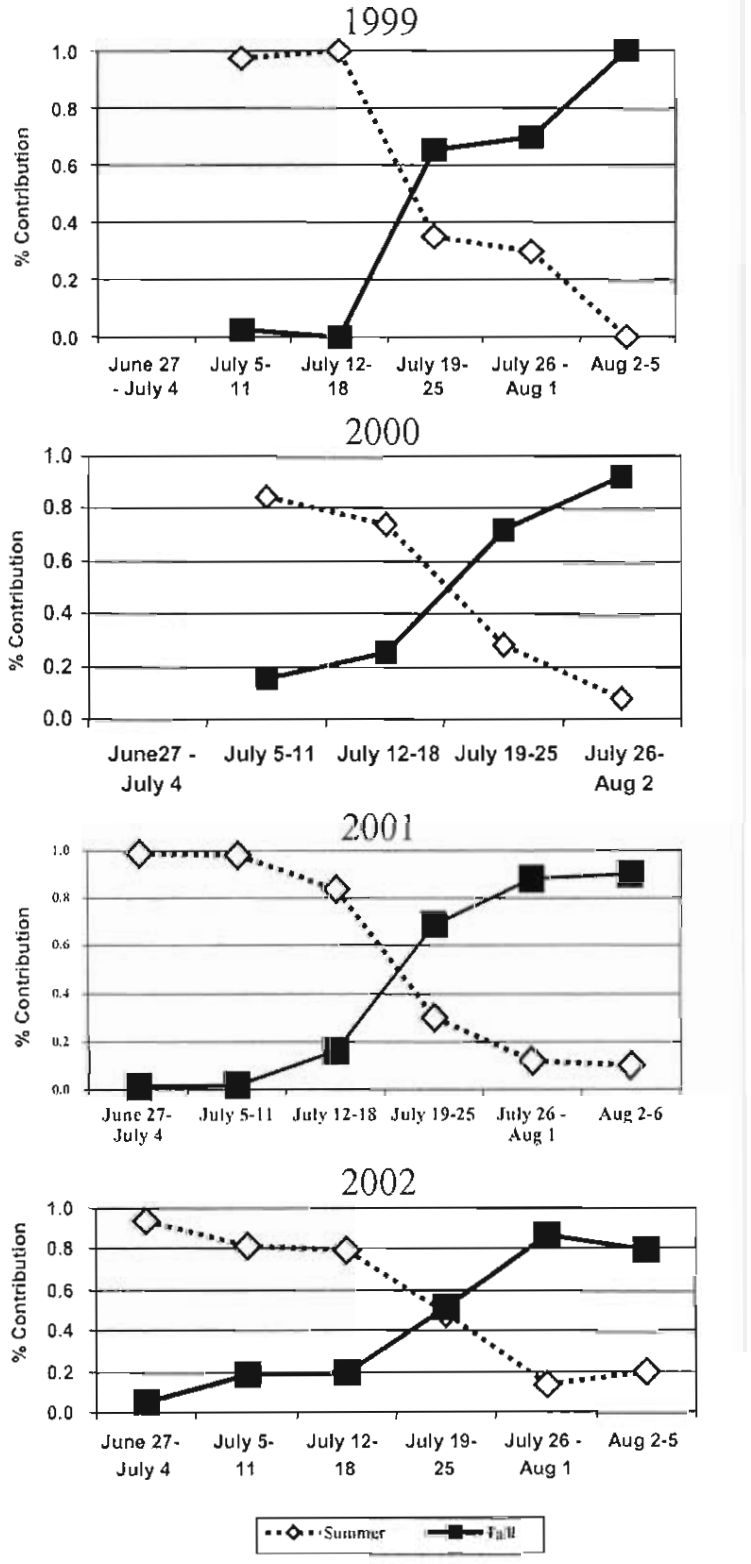

Figure 3. Estimated contributions of summer and fall run chum salmon at Pilot Station, 1999 - 2002.

a.

b.

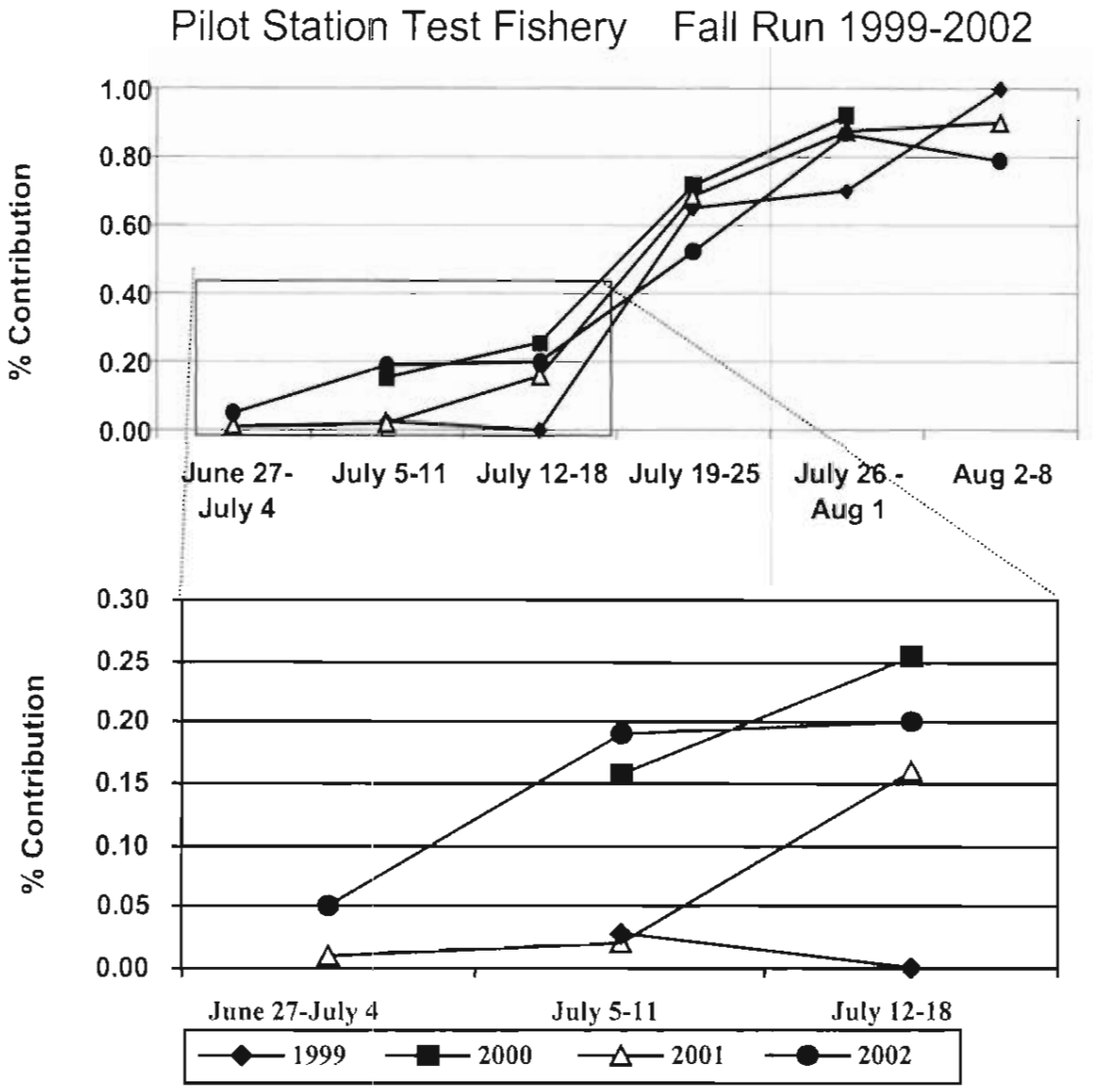

Figure 4. Contribution of fall run, 1999-2002.
a. June-August
b. Expanded view of June 27 to July 18

4. SUBSISTENCE AND PERSONAL USE SALMON HARVEST ESTIMATION

William H. Busher
NA76FP0208
Period Covered by the Report. From: July1, 2000 To: June 30, 2003
Date Prepared: September 30, 2003

II. Executive Summary:

The Yukon Area subsistence salmon harvests are the largest in the state. The subsistence program provides annual estimates of the subsistence and personal use salmon harvests within the Yukon Area. The annual salmon harvest estimate program includes information from fishing permit harvests, estimates of fish provided by test fisheries for subsistence use, as well as stratified random sampling techniques for surveyed communities. Demographic information is collected to provide an estimate of the number of households participating in the fishery, the number of people in the Yukon Area, the number of dogs, gear types utilized and areas fished. An estimate of chinook, summer chum, pink, fall chum, and coho salmon harvested from the subsistence and personal use fisheries within the Yukon Area is generated annually, by combining survey, permit, and test fishery information.

III. Purpose of Project:

The State of Alaska is mandated by the Board of Fisheries (BOF) to provide adequate escapement of salmon to spawning grounds and to provide for harvests in subsistence, sport, personal use, and commercial fisheries, of which subsistence has the highest priority. Estimates of harvests are required in order to allocate and manage salmon. At this time, salmon returning to the Yukon River drainage are fully allocated between the various fisheries, including both the U.S. and Canadian fisheries. Additionally, families in the Yukon Area communities are dependent upon the return of salmon to provide a natural food source. During those times of insufficient numbers of salmon to the Yukon Area, it results in a declaration of both economic and natural disaster.

Objectives:

1. Estimate the subsistence and personal use salmon harvests within the Yukon Area.
2. Estimate select demographics, including the number of people in households and the number of fishing households in the Yukon Area.
3. Estimate the primary gear type utilized by fishermen participating in the Yukon Area fishery.
4. Estimate the number of dogs, number of households with dogs, number of households that feed fish to dogs, and number of salmon fed to dogs.
5. Estimate the number of non-salmon harvests, consisting of primarily freshwater fish species utilized by the communities that participate in the Yukon Area subsistence and personal use fisheries.

III. Approach:

Subsistence Harvest Survey: The household lists for surveyed communities are updated annually, based on the previous year's fieldwork and most current Permanent Fund Dividend register. The

households to be surveyed in 34 communities are selected as a stratified random sample. Survey methods include post-season door-to-door personal interviews, as well as incorporation of harvest information provided on calendars, and telephone interviews. Prior to the fishing season, a mass mail out of salmon harvest calendars and a detailed letter providing the previous year's results by community is distributed to approximately 2,500 households. The mail out list is generated from household lists compiled following the previous year's survey.

Each year post-season salmon surveys begin in the Lower Yukon Area in September and in the Upper Yukon Area in October. The surveys are conducted immediately following the end of the fishing season while fishermen can easily remember their salmon harvest. Due to the length of their migration routes, it takes a month for salmon to reach the upper areas. Survey data editing and entry into the database occurs during November and December.

Subsistence and Personal Use Permits: Subsistence or personal use fishing permits are required in some portions of the Upper Yukon Area. The permits are issued by mail or in person at the Alaska Department of Fish and Game (ADF&G) office. Alaska Department of Fish and Game personnel travel to approximately eleven communities annually to issue the fishing permits and to contact fishermen. On average, 480 permits are issued each year, primarily from the Fairbanks office. A summary letter containing results from the previous year's harvests and a summary of the regulations required for the particular permit area are provided with each permit issued. Information from the permits is entered inseason into a database. A current Permit Holder's Household List is maintained inseason and is available to provide data for mass mail outs when management actions deem it necessary. Permit holders in a portion of the Tanana River near Fairbanks are required to telephone in their salmon harvests each week for use as an inseason management tool. Additionally, telephone-reporting requirements provide harvest numbers for the personal use area that has a harvest limit.

Upon return of the permits, harvests are entered into a database by species and by harvest date. Additionally, ADF&G staff concentrate on retrieving fishing permits, most of which expire October 15. Delinquent permit holders are notified in two separate mailings to return their harvest permits, and follow up telephone calls may be conducted.

Once the survey results and permit harvest information are entered into the databases, additional edit checks are conducted prior to running the expansion, which usually occurs in January and February. The draft Regional Informational Report (RIR) is produced in March, and comments are put together for the final report due out in April. In April the household and permit databases are once again updated, and the new list of households is provided for preseason mail outs beginning in May.

Project management:
Fishery Biologist II, Project Leader: Responsible for project management budget, data analysis, and report writing.
Analyst Programmer III, Data Analysis: Develop and maintain survey and calendar databases. Provides the expansion and random sample selection, and maintains the household list.

Fish and Wildlife Technician III, Survey Crew Leader: Responsible for survey preparations, including radio announcements and posters sent to communities prior to conducting surveys, logistics support, data editing, and data entry. Approximately four months salary annually is provided by grant.
Two Fish and Wildlife Technician II's, Yukon Surveyors: Travel between communities conducting annual surveys. Approximately two months salary each is annually provided by grant.
Fishery Biologist I, Permit and Report Support: Issues, recovers and compiles permit information as well as formats final report tables. Approximately four months salary is annually provided by grant.
Fish and Game Program Technician, Calendar and Report Support: Designs and produces calendars in Corel Draw, arrange bulk mail-outs, report editing, as well as administrative support.
Tribal and City Office Workers: Provide their time to review and keep current maps of the communities and household lists.

V. Results, Evaluation and Conclusions:

Results: Produced the 2000, 2001, and 2002 finalized RIR annual reports of estimated subsistence and personal use salmon harvests within the Yukon Area on schedule. Yukon Area subsistence and personal use recent three year average (2000 to 2002) harvest estimates of chinook salmon is 13 percent below the ten-year average (1993 to 2002) of approximately 50,000 fish. The estimated subsistence and personal use harvests have been declining due to the lack of commercial fishing (poor returns) in the middle Yukon, the area that normally contributes the highest levels of harvest. For example the recent three-year average (2000-2002) subsistence harvest estimate of 65,200 summer chum salmon was 27 percent below the ten-year average (1993 to 2002). Fishery restrictions or fishery closures were in place during fall salmon seasons in the years of 1993, 1998, and 2000 to 2002 based on poor fall chum salmon run sizes. The estimated subsistence and personal use harvest of fall chum salmon in those years was reflective of the poor runs. The recent three-year average (2000-2002) harvest of 24,600 fall chum salmon was approximately 80 percent below the six-year average harvest based on more typical years of 1991 and 1992 and 1994 to 1997. The estimated subsistence and personal use harvest of coho salmon also declined in those years of poor fall chum salmon harvests since management actions affected both species due to run timing. For example the 2000 to 2002 coho salmon harvest was 52 percent below the more typical six-year average harvest of 1991 and 1992 and 1994 to 1997 due to subsistence restrictions on fall chum salmon. These harvest estimates include test fish given away to local communities.

Evaluation: No significant problems were evident and the goals of this project have been met. Since the project has become reasonably standardized, the information collected over the years is comparable and provides for an effective data source concerning a variety of issues. The Yukon Area fisheries are unique because they provide the highest subsistence salmon harvests per household in the state. The fisheries contain highly controversial commercial roe fisheries which provide a by-product utilized in the subsistence fishery. Issues that continue to raise concerns are the high utilization of chum salmon for dog teams, feeding chinook salmon to dogs, and most recently the customary and traditional selling of salmon and salmon parts for cash. The customary and traditional issues reflect to the differences in state and federal interpretations and regulations regarding trade and bartering. The recent poor returns of chinook and chum salmon have developed into declaration of disasters as documented with each yearly project.

This harvest assessment program provides a tool to explore issues of importance that affect all user groups. The results are provided when they apply to issues brought before the BOF and the U.S./Canadian negotiations. Recent modifications to the program were in made 1999 and involved additional questions to gather information used to address the BOF concerns of feeding chinook salmon to dogs. In 2002, a question was added to ascertain the viability and document use of dip nets as an alternative gear type to harvest coho salmon during times of fall chum salmon harvest restrictions. Most recently, the 2003 survey addressed possible loss of fish due to spoilage, predation, and unpalatable fish attributed to *Ichthyophonus hoferi*, and whether or not these fish were accounted for when included in subsistence totals of surveyed households.

Tribal entities continue to show interest or have begun collecting their own salmon harvest information, although most lack the infrastructure or expertise to summarize the information in a useful format. This duplication of effort and questions of loyalties will become a problem in the future.

Additional work may be necessary to identify and contact households that take harvested salmon out of the Yukon Area (i.e., in particular, commercial and subsistence fishermen who reside outside the Yukon Area surveyed communities and remove chinook salmon as home pack).

Conclusion: The Yukon Area includes all waters of Alaska within the Yukon River drainage and all coastal waters of Alaska from Point Romanof southward to the Naskonat Peninsula. Successful management of fishery resources is dependent upon obtaining accurate estimates of subsistence and personal use salmon harvests within the Yukon Area. These estimates provide trend information by species in a dynamic and changing fishery. The estimates of salmon harvest are considered in Board of Fisheries (BOF) allocations as well as Canadian negotiations. In seasonal prosecution of fisheries, especially during poor returns, the estimates provide valuable insight into the level of harvest taken by species throughout the Alaskan portion of the Yukon River drainage.

VI. Products:

Products include the annual Alaska Regional Information Reports No. 3A01-27, No. 3A02-32, and 3A03-13 titled *Subsistence and Personal Use Salmon Harvests in the Alaska Portion of the Yukon River Drainage* for 2000, 2001, and 2002, respectively.

Dissemination of Project results: Individual households and all recent permit holders are annually provided a summary table of the salmon harvest estimates from the entire Yukon River drainage preseason. Various agencies are mailed copies of a completed report annually upon request. Report recipients include ADF&G (Division of Commercial Fisheries, Sport Fisheries, and Subsistence); U.S. Fish and Wildlife Service, including the Offices of Subsistence Management; National Park Service, Bureau of Land Management, and National Wildlife Refuge Managers. Tanana Chiefs Conference, Association of Village Council Presidents, Council of Athabascan Tribal Governments (Ft. Yukon and Stevens Village), Tribal Councils (Emmonak, Mt. Village, and Tanana), Alaska Outdoor Council, Yukon River Drainage Fisheries Association, Alaska

Resources Library Information Services, Department of Labor and Work Force, Department of Fisheries and Oceans (Canada), and select fishermen.

VII. References:

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VIII. Key Words:

Board of Fisheries, chinook, coho, fall chum, personal use, salmon, subsistence, summer chum, Tanana River, Yukon Area.

5. YUKON RIVER SALMON SPAWNING ESCAPEMENT SURVEYS

Tracy Lingnau, Chinook and Summer Chum Salmon Management Biologist, and Bonnie Borba, Fall Chum and Coho Salmon Research Biologist, Division of Commercial Fisheries, Alaska Department of Fish and Game
NA76FP0208
Period Covered by the Report From: July1, 2000 To: June 30, 2003
Date Prepared: September 30, 2003

II. Executive Summary:

An essential requirement for management of the Yukon River salmon fisheries is the documentation of annual salmon spawn ng escapements. Comprehensive salmon spawning assessment projects employ such techniques as intense ground surveys. mark-recapture methods, counting towers, weirs, and hydroacoustics on tributaries that are important salmon producers. The Yukon River drainage is too extensive for comprehensive escapement coverage of all individual salmon spawning streams during any given season. Consequently, low-level aerial surveys from single-engine fixed-wing aircraft or helicopters form an integral component of the escapement assessment program. Aerial surveys provide limited, but important indices of spawning salmon escapements and when paired with age and sex information, spawning salmon populations can be described in detail. The information is used for determination of appropriate escapement levels, or goals, for selected spawning areas or management units; evaluation of escapement trends; evaluation of the effectiveness of the management program, which in turn forms the basis for proposing regulatory changes and management strategies; and evaluation of stock status for use in projecting subsequent returns.

III. Purpose of Project:

Documentation of salmon returning to spawn in tributaries of the Yukon River is an essential requirement for management of Yukon River fisheries. Documentation of spawning indices, among other information, provides data to determine appropriate escapement levels and evaluation of escapement trends. Without escapement information managers do not have a basis to document levels of returning salmon to spawn. Without knowledge of weak salmon species and stocks, other salmon species and stocks risk over-harvesting.

The objective of this project is to provide escapement level indices and escapement spawning estimates of salmon returning to tributaries of the Yukon River. Another goal is to use long-term escapement information and indices to establish biological escapement goals. These goals represent the approximate minimum number of spawners considered necessary to maintain historical yields. Age composition from escapement projects allows development of brood year tables the foundation for spawner-recruit analysis which intern provides information for projecting future returns.

IV. Approach:

Aerial surveys were conducted in areas where indexes have been established for a particular species of salmon. The data provided by this funding source includes aerial surveys conducted in the middle Yukon River drainage within Alaska including the Andreafsky, Anvik, Nulato, Gisasa,

Chena and Salcha Rivers for chinook salmon; Andreafsky, Rodo, Nulato, Gisasa, Hogatza, Tozitna, Chena and Salcha Rivers for summer chum salmon; upper Tanana River continues to be monitored through aerial surveys for distribution of fall chum salmon spawning activities which congregate specifically in areas with upwelling ground water. The Tanana River is the most impacted by industrialization and development within the Alaskan portion of the Yukon River drainage particularly in the stretch between the communities of Nenana and Delta, which encompasses the Fairbanks area. In particular intense ground surveys are conducted annually in the Toklat and Delta Rivers where stream life data is used to estimate abundance of fall chum salmon spawners. A limiting factor of aerial surveys includes hindrance caused by inclement weather, high water, and fire season as well as stream morphology. Other areas are observed as time permits to get a feel for overall distribution outside of the index areas and may include identifying new areas where salmon are observed.

One Fishery Biologist I is budgeted to conduct apportion of both aerial and ground surveys particularly within the Tanana River drainage with assistance from Fish and Wildlife Technicians II's in conducting ground surveys. Additionally many of the surveys are conducted by Fishery Biologist IIs and IIIs, who's salaries are covered under another source.

There are many escapement assessment projects throughout the Yukon River drainage as attempts are made to be as comprehensive as possible and have the ability to cover main spawning areas for chinook, chum, and coho salmon assessment. Projects are operated by a substantial number of personnel from various agencies and organizations participated in the collection of salmon escapement and information. These agencies and organizations include the Alaska Department of Fish and Game (ADFG Divisions of CF and SF), U.S. Fish and Wildlife Service (USFWS), National Park Service (NPS), Bureau of Land Management (BLM), National Marine Fisheries Service (NMFS), Alaska Cooperative Extension 4-H program, Bering Sea Fishermen's Association (BSFA), Nulato Tribal Council (NTC) and Tanana Chiefs Conference (TCC). In Canada, participants include Canadian Department of Fisheries and Oceans (DFO), Yukon Fish and Game Association, Ross River Dena Council, Yukon First Nations and Quixote Consulting (Canada).

IV. Results, Evaluation and Conclusions:

Chinook salmon are the most important species concerning value in both the commercial and subsistence fishery. They are very important to our negotiations with Canada since nearly 46% of the U.S. harvests of chinook salmon originate from Canadian stocks. Chinook salmon aerial surveys are slightly easier to conduct since the salmon have a larger relative size and distinct red coloring, which assists in making them stand out and easier to count from the air. Aerial surveys for chinook salmon were conducted for the middle Yukon River index areas during June and July of 2000 to 2003 see results in table below.

Chinook Salmon	2000	2001	2002
East Fork Andreafsky River	1,018	1,065	1,447
West Fork Andreafsky River	427	570	917
Anvik River	1,721	1,420	1,713
South Fork Nulato River	No Survey	1,116	687
North Fork Nulato River	No Survey	768	897
Gisasa River	No Survey	1,298	506
South Fork Koyukuk	74	No Survey	No Survey
Jim River	79	No Survey	No Survey
Nenana River	72		
Chena River	934	1,487	No Survey
Salcha River	2,478	2,990	2,256

Since the Chena and Salcha Rivers are the largest Yukon River chinook salmon producers in the Alaskan portion of the drainage, in most years multiple surveys are conducted until a good representative was obtained and only the best surveys are presented here.

Funding was also extended to the chinook salmon radio telemetry study in 2002 and 2003 as part of the aerial surveys to track down tagged fish in the upper reaches of the drainage in both U.S. and Canada.

Summer chum salmon are much more difficult to see from the air due to smaller size and coloration however if conditions are right attempts are made to enumerate them along with the chinook salmon counts. Also the peak timing of spawning can be slightly different between the two species so the chum salmon surveys would be considered minimums unless they were strictly done to target that species.

Summer Chum Salmon	2000	2001	2002
East Fork Andreafsky River	2,094	No Survey	No Survey
West Fork Andreafsky River	18,989	Incomplete	Incomplete
Rodo River	No Survey	No Survey	Incomplete
South Fork Nulato River	No Survey	No Survey	No Survey
North Fork Nulato River	No Survey	No Survey	Incomplete
Gisasa River	No Survey	No Survey	Incomplete
Hogatza River	No Survey	No Survey	Incomplete
Tozitna River	480	No Survey	Incomplete
Chena River	107	Incomplete	1,080
Salcha River	228	Incomplete	18,640

Intensive ground surveys are conducted for fall chum salmon within the Tanana River drainage. The Delta River is walked once a week from the first week in October until early December. The replicate survey counts are used to develop a total spawning escapement for the system. The Toklat Springs fall chum salmon spawning population is estimated using stream life and relative timing and the relationship to the one time annual survey conducted at this site. Timing of the survey is nearest to the peak of spawning (mid October) but yet close enough to freeze up to allow for the water level to drop in order to increase visibility. Age, sex, and length data is collected at both of these locations annually. Additionally several surveys are conducted at the Bluff Cabin Slough area around the peak of spawning and aerial surveys are often used to indicate when the ability to ground survey should be attempted. Only the peak survey is shown in the table below. Other areas of the drainage upstream of Fairbanks are surveyed by airplane or helicopter at remote locations as they are being monitored for changes in spawning distribution as it may be related to the affects of logging practices along the river in the vicinity of Delta.

Fall Chum Salmon	2000	2001	2002
Delta River	3,001	8,103	11,992
Toklat River	8,911	6,007	28,519
Bluff Cabin Slough	1,595	1,808	3,116
Other Delta Areas	No Survey	3,183	3,617

The Delta and Toklat Rivers both have historical population estimates based on data from either aerial or ground surveys dating back to 1974. Additionally both of these systems have Biological Escapement Goals that have been modified over the years as more data became available. The latest revision made in 2000 included changing the single goal to ranges that encompassed maximum sustained yield. The analysis of the Delta River resulted in a range is 6,000 to 13,000 fall chum salmon while the Toklat River range is 15,000 to 33,000 fall chum salmon. These two areas are critical pieces in the run reconstruction within the Tanana River drainage and are utilized as an index for the system however a significant portion of the Tanana River stocks may spawn in the mainstem as indicated by the upper Tanana and Kantishna River mark-recapture projects. Bluff Cabin Slough has historical counts either aerial or ground dating back to 1980. The ground surveys in these areas should be continued as the regressions to the mark-recapture are being used to establish the relationship between the indexes and the Tanana River drainage as a whole. Remote sloughs along the mainstem upper Tanana River are monitored via aerial surveys.

In October of 2001, helicopter surveys were conducted on the upper Porcupine River from Dawson to Old Crow in attempts to document fall chum salmon mainstem spawning. Based on the 1995 fall chum salmon radio tagging of fall chum salmon in the US Yukon River mainstem (Rampart/Rapids), several radio tagged fish ended up in areas of open water along the Porcupine River in Canada and did not appear to travel up to the monitored Fishing Branch River. No chum salmon were observed during the survey and future aerial surveys it was recommended be conducted via helicopter commensurate with radio tracking efforts in this drainage.

Survey conditions in 2002 varied by location and ranged from poor to good in the Alaskan portion of the drainage during the chinook and summer chum salmon survey season from mid-

July though August. High water in the Tanana, Kantishna, and Koyukuk River drainages resulted in mostly poor surveys. Fair to good conditions were encountered in lower Yukon River tributaries. Survey conditions during the fall chum and coho salmon survey period of late September through November were affected by warm temperatures and associated high water but were fair to good overall. Good aerial and foot survey conditions were encountered on selected fall chum and coho salmon spawning areas in the Nenana River drainage. The high water caused by warm temperatures affected aerial surveying of the upper Tanana River mainstem resulting in counts after peak spawning. High water in the Delta and Toklat Rivers also affected foot surveying and more than likely resulted in conservative estimates for these areas. In the Canadian portion of the drainage, DFO was successful in surveying most major chinook and fall chum salmon index streams in Yukon Territory.

Because of the comprehensive coverage of fall chum salmon spawning areas and the current level of monitoring projects, a total run reconstruction can be attained for fall chum salmon. The year 2000 was the worst drainagewide return on record for fall chum salmon, and as a result none of the spawning areas met their established goals (or average returns if no goal existed) even though complete fishery closures occurred. The stocks were thought to be going through a depression brought on by factors in the marine environment since there were adequate parent year escapements and since it affected the entire Western Alaskan Region not just the Yukon River drainage. The returns have slowly risen in 2001 and 2002 in all areas monitored and indications are that the 2003 return is expected to be significantly better.

Coho salmon are typically surveyed as a secondary species during fall chum salmon aerial and ground surveys. Due to freeze up and timing surveys can only be conducted mid or late October. Other agencies have been utilized to count this resource within the Tanana River drainage.

Coho Salmon	2000	2001	2002
Geiger Creek (Toklat Survey)	142	578	744

Coho salmon run size is not fully monitored since the run timing is so late in the season and the spawning populations so scattered except for the Delta Clearwater River stocks which has an escapement objective of 9,000 coho salmon. However indications from the inseason monitoring projects, lack of harvests taken as part of protection of fall chum salmon, reduced harvests in marine waters, in combination with improved marine food supply the coho salmon populations appear to generally increasing in the region.

Overall, survey conditions in 2000 were considered poor throughout most of the Alaskan portion of the drainage during the chinook and summer chum salmon survey season from mid-July though August. This was due primarily to prevailing rainfall causing high, turbid water conditions. Survey conditions during the fall chum and coho salmon survey period of late September through November were good. Acceptable aerial survey conditions were realized on selected fall chum and coho salmon spawning areas both in the lower Nenana River and the upper Tanana River.

Survey conditions in 2001 varied by location but were considered fair to good overall in the Alaskan portion of the drainage during the chinook and summer chum salmon survey season from mid-July though August. Survey conditions during the fall chum and coho salmon survey period of late September through November also varied but were good overall. Acceptable aerial survey conditions were realized on selected fall chum and coho salmon spawning areas both in the lower Nenana River and the upper Tanana River. In the Canadian portion of the drainage, DFO was successful in surveying most major chinook and fall chum salmon index streams in Yukon Territory.

More ground-based escapements are needed to produce quality escapement information. Variability in aerial survey accuracy is dependent upon a number of factors such as weather, water conditions (turbidity), timing of the surveys with respect to peak spawning, type of aircraft used, availability of aircraft, experience of the pilot and the surveyor type and density of the salmon species being estimated. Further, peak-spawning abundance measured by aerial survey measured is significantly lower than total season abundance due to die-off of early spawners and subsequent arrival of later fish. Given these sources of variability, aerial survey estimates demonstrate a wide range in the proportion of the fish being estimated. Another concern is, of all the methods of determining abundance of fish, aerial surveys are the most dangerous due to the nature of slow flight at low altitudes.

In terms of the overall project success, most of the goals and objectives were met on an annual basis concerning ground based counting projects. However a channel change in the Toklat Springs although caused by natural elements, not a lack of resources, has made surveys more difficult in this index area from 2000 to 2002. Extremely warm fall weather in 2002 also caused problems with stream crossings in both the Delta and Toklat River ground surveys with high water persisting in the main channel of each system late into the season making it difficult to get to the spawning areas on the far side of the floodplains. Some aerial surveys were not flown or were hampered by weather conditions. Successful aerial surveys are highly dependent on good weather and water clarity.

V. Products

Project results have been reported in the following Regional Information Reports (RIR):

Vania T., V. Golembeski, B.M. Borba, T.R. Lingnau, J.S. Hayes, K.R. Boeck, and W.H. Busher. 2002. Annual Management Report Yukon Area, 2000. RIR No. 3A02-29, Alaska Department of Fish and Game, Anchorage.

Vania T., V. Golembeski, B.M. Borba, T.R. Lingnau, J.S. Hayes, K.R. Boeck, and W.H. Busher. 2002. Annual Management Report Yukon Area, 2000. RIR No. 3A02-29, Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region, 333 Raspberry Road, Anchorage, Alaska 99518-5526.

Bergstrom D.J., K.R. Boeck, B.M. Borba, A.L.J. Brase, F. Bue, W.H. Busher, J.S. Hayes, T.L. Lingnau, P. Salomone, and T. Vania. (In Prep), Annual Management Report, Yukon Area, 2001, Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region, 333 Raspberry Road, Anchorage, Alaska 99518-5526.

JTC. 2000. Yukon River Salmon Season Review for 2000 and Technical Committee Report. The United States/Canada Yukon River Joint Technical Committee, October 2000, Anchorage, Alaska.

JTC. 2001. Yukon River Salmon Season Review for 2001 and Technical Committee Report. The United States/Canada Yukon River Joint Technical Committee, November 2001, Anchorage, Alaska.

Joint Technical Committee of the Yukon River US/Canada Panel. 2002. Regional Information Report No. 3A02-44. Alaska Department of Fish and Game, Commercial Fisheries Division, AYK Region, 333 Raspberry Road, Anchorage, Alaska 99518-5526.

These reports were distributed to personnel with the Alaska Department of Fish and Game, U.S. Fish and Wildlife Service and Canada Department of Fisheries and Oceans. Results have also been reported to the U.S./Canada Joint Technical Committees and Yukon River delegate members.

VI. References:

Same as listed in Products.

VII. Key Words:

Yukon River, chinook salmon, chum salmon, coho salmon, aerial survey

6. LOWER YUKON RIVER SONAR AT PILOT STATION

Carl Pfisterer
NA06FP0075
Period Covered by the Report From: July1, 2000 To: June 30, 2003
Date Prepared: September 30, 2003

II Executive Summary:

Salmon are harvested for commercial and subsistence purposes throughout the Yukon River drainage in Alaska and Canada. These salmon fisheries are critical to the river's people and economy, providing an important source of food and income. Because of the unique need for these renewable resources, accurate and timely inseason estimates of salmon passage are critical. The lower Yukon sonar project at Pilot Station provides accurate, timely and comprehensive salmon passage estimates to fishery managers. Deployed at river km 197, near the village of Pilot Station, the project is located far enough upriver to avoid the wide multiple channels of the Yukon River Delta yet far enough downstream to assess the majority of salmon stocks. The Andreafsky River is the only major salmon spawning tributary downstream of the sonar site. This project was first operational in 1986 and has since provided daily salmon passage estimates each year with the exceptions of 1992 and 1996. Data are obtained using shore-based, split-beam sonar for enumeration and drift gillnets for species apportionment.

Sonar counts are conducted during three 3 h sampling periods each day. These numbers are expanded to generate a 24 h fish passage estimate. Several times during the season the accuracy of these estimates are verified by counting for an entire 24 h period. A simulated estimate using the normal 9 h sampling time is compared to the 24 h count for these days. Overall, for the years 2000-2002, the 9h estimates exceeded the 24 h counts by 2.2%.

Species apportionment data is generated during two 3 h drift gillnet periods each day. A suite of gillnets, with mesh sizes ranging from 2.75 to 8.5 inches, are drifted through the ensonified areas of the river. Species proportions are adjusted to account for the differing probability of capture by species and length in each mesh size. Adjusted catches are used to apportion sonar passage estimates by species in three zones - near shore on both banks and offshore on the left (south) bank. In the years of this grant, passage estimates for each season were:

Year	Chinook salmon	Summer chum salmon	Fall chum salmon
2000	41,277	457,687	267,181
2001	87,569	468,183	396,012
2002	112,550	1,158,475	359,565

III. Purpose of Project:

Salmon are harvested for commercial and subsistence purposes throughout the Yukon River drainage in Alaska and Canada. These salmon fisheries are critical to the river's people and economy, providing an important source of food and income. Because of the broad geographic distribution of the Yukon River's individual salmon stocks, management of the fisheries is complex, creating a need for accurate and timely inseason estimates of salmon passage.

The lower Yukon sonar project at Pilot Station provides accurate, timely and comprehensive salmon passage estimates to fishery managers. The project design incorporates fish passage estimates from shore-based, split-beam sonar data and species composition estimates from drift gillnet data obtained by fishing a suite of gillnets. Deployed at river km 197, near the village of Pilot Station, the project is located far enough upriver to avoid the wide multiple channels of the Yukon River Delta yet far enough downstream to assess the majority of salmon stocks, and provides timely information for the inseason management of commercial and subsistence fisheries. The Andreafsky River is the only major salmon spawning tributary downstream of the sonar site.

Project History

This project has produced estimates of daily fish passage annually since 1986, except during 1992 when it was operated for experimental purposes and 1996 when it was operated for training purposes. Since 1993, the project has used hydroacoustic equipment that operates at a lower frequency (120 kHz) than previously (420 kHz), and is capable of detecting fish at significantly longer ranges. Species apportionment methodology continues to be refined and net selectivity has been estimated more accurately (Fleischman et al. 1995). During the 2001 season the project transitioned from older dual-beam systems to newer split-beam equipment. The newer equipment operates at 120 kHz, the same frequency that has been used since 1993, and sonar counts are generated by hand-marking charts. Electronic data has been collected to explore the feasibility of using computers to group echoes into fish in the hopes of streamlining the process and reducing the subjectivity of chart marking.

Project objectives during this operational period, were to provide daily and cumulative passage estimates, along with 90% confidence limits, for chinook and chum salmon. Estimates of the number of coho salmon and combined "other" species were also generated. Passage estimates are only comparable after 1994 because of changes in frequency and aiming criteria initiated in 1995.

IV. Approach:

Bottom Mapping

Bathymetric maps of the river bottom in the vicinity of the sonar site were generated in 2001 and 2002 using a depth sounder coupled to a differential global positioning system (DGPS). Maps created during past field seasons allow inter-annual monitoring of changes in the bottom topography, which could affect fish migratory behavior and subsequent detection. Over time, the bottom has changed. We are noticing significant erosion of the south bank that, although it currently does not pose a problem, has the potential to affect deployment if it continues to degrade. Bottom topography will continue to be an important component of the project and will be closely monitored in future years.

Sonar Deployment

In 2000, we deployed a single transducer on the left (south) bank and right bank at a point where the river is approximately 1,000 m wide. The right bank has a stable, rocky bottom that drops off steeply to the thalweg with a vertical angle of 8.7°, calculated from a depth of 22.9 m at a range of 150 m. We positioned the right-bank transducer 5-10 m from shore, adjusting the aim between

two strata (0-60 m and 60-135 m) to position the beam as close to the river bottom as possible for each sample.

The left-bank river bottom drops off gradually with a vertical angle of 2.3°, calculated from a depth of 11.9 m at 300 m, with a slightly steeper slope near shore (4.2° calculated from a depth of 3.7 m at 50 m). A single transducer was deployed approximately 10 m offshore and utilized three aims to sample a near shore stratum (0-50 m), a midshore stratum (50-175 m), and an offshore stratum (175-350 m). The transducer was repositioned frequently to compensate for the dynamic water level.

In 2001 and 2002, the project transitioned from the dual-beam systems to split-beam equipment. The operational frequency (120 kHz) and deployment of the new sonar were kept consistent with 2000. The nominal beam widths for the transducers were similar to the previously operated dual-beam equipment. For the right bank we utilized a transducer with a 6°x10° nominal beam width and for the left bank we utilized a transducer with a 2.8°x10° nominal beam width.

ADF&G staff conducted project planning and oversight. Work was accomplished by ADF&G staff in cooperation with technicians provided by The Association of Village Council Presidents (AVCP).

V. Results, Evaluation and Conclusions:

Passage Estimates

Historical salmon passage estimates at Pilot Station have been based upon a sampling design in which acoustic data were typically collected on each bank for 9 h daily divided amongst three 3 h periods. Two gillnet sampling periods were scheduled between the acoustic sampling periods. This schedule was adhered to during all three years. Throughout the season, passage estimates were reported daily to fishery managers in Emmonak and Fairbanks. These estimates included chinook salmon, summer and fall chum salmon, coho salmon and other fish. Other fish included pink salmon, whitefish spp., sheefish, burbot, sucker spp., Dolly Varden, sockeye salmon, and northern pike. It was not the intent of this project to document complete coho or pink salmon runs.

In 2000, the sonar project was operational from June 10 through September 14. An estimated 1,304,925 ± 36,755 (90% CI) fish passed through the sonar sampling area, 27% along the right bank and 73% along the left bank. Included were an estimated 36,554 ± 4,469 large chinook salmon (>655 mm MEFL), 4,723 ± 1,256 small chinook salmon (<655 mm MEFL), 457,687 ± 18,853 summer chum salmon and 267,181 ± 16,060 fall chum salmon. Coho salmon monitored during the operation period totaled an estimated 192,108 ± 15,082. Other species totaled 306,654 ± 21,651.

In 2001, the sonar project was operational from June 11 through August 31. An estimated 1,407,716 ± 38,137 (90% CI) fish passed through the sonar sampling area, 39% along the right bank and 61% along the left bank. Included were an estimated 75,413 ±18,353 large chinook salmon (>655 mm MEFL), 12,156 ± 3,666 small chinook salmon (<655 mm MEFL), 468,183 ±15,961 summer chum salmon and 396,012 ± 21,120 fall chum salmon. Coho salmon monitored

during the operation period totaled an estimated 147,341 ± 14,269. Other species totaled 307,891± 21,633.

In 2002, the sonar project was operational from June 6 through August 31. An estimated 2,284,147 ± 72,717 (90% CI) fish passed through the sonar sampling area, 28% along the right bank and 72% along the left bank. Included were an estimated 83,612 ±21,214 large chinook salmon (>655 mm MEFL), 28,938 ± 24,807 small chinook salmon (<655 mm MEFL), 1,158.475 ± 47,691 summer chum salmon and 359,565 ± 29,551 fall chum salmon. Coho salmon monitored during the operation period totaled an estimated 135,737 ± 12,770. Other species totaled 452,756 ± 28,257.

24-Hour Sonar Periods

Several times during each season, 24 h sonar periods were conducted to check the accuracy of standard 9 h sampling estimates. For the most part these periods verified the assumption that fish passage rates are fairly uniform throughout the day. Uncertainties in fish behavior during the 24 h sonar periods, induced by drift gillnetting activities in front of the sonar counters can account for some of the variability of these data.

In 2000, 24 h continuous sampling sessions were conducted six times (June 28 and 29, July12, July 26, August 16 and August 30) to estimate uncertainty associated with the normal sampling schedule. On the right bank, the single stratum was sampled continuously with counts recorded at 15 min intervals. Left-bank sampling was divided among the three strata in proportions consistent with the regular sampling schedule. On average 24 h counts agreed with standard 9 h estimates within 7%.

In 2001 four 24 h sampling periods were conducted with an estimated average of 2% fewer targets than routine 9 h sampling estimates from the same days. The three 3 h estimates varied from 95% to 108% of the 24 h estimates.

In 2002 we sampled continuously for 24 h on June 17, July 02, 17 and 31, and on August 16 for a total of five 24 h sampling periods. On average the 24 h periods agreed with standard 9 h estimates within 2%.

Species Apportionment

Drift Gill netting was conducted to sample fish species counted by the sonar. Mesh size is systematically increased from 2.75" to 8.5" to ensure all fish species detected by the sonar are sampled, resulting in an estimate of daily passage by species. Captured fish were measured for length, the sex of each salmon was determined and scales were collected from each chinook salmon. Most captured fish were given to local residents for subsistence use. The net selectivity curves that are used in species apportionment have been reviewed during this time and the technique will continue to be reviewed for future refinement.

In 2000 a total of 8,755 fish were captured during 2,332 drifts totaling 14,094 minutes. The catch included 2,817 summer chum salmon, 1,295 fall chum salmon, 508 chinook salmon, 2,000 coho salmon, 362 pink salmon, 508 whitefish, 1,049 cisco, and 216 fish of other species.

In 2001 a total of 7,240 fish were captured during 1,928 drifts totaling 13,768 minutes. The catch included 2,227 summer chum salmon, 1,961 fall chum salmon, 673 chinook salmon, 1,192 coho salmon, 9 pink salmon, 429 whitefish, 565 cisco, and 184 fish of other species.

In 2002, 8,512 fish were captured during 2,070 drifts including 600 chinook salmon, 3,558 summer chum salmon, 1,160 fall chum salmon, 803 coho salmon, and 2,391 fish of other species.

VI. Products:

Project objectives of providing daily and cumulative passage estimates with 90% confidence limits for chinook and chum salmon were attained during each season. User configurable sonar was used to estimate the number of fish passing the sonar site by extrapolating the three daily sonar periods. This was checked several times each season against 24 h counts. A suite of gillnets was used to apportion sonar passage estimates by species. Fishing occurred twice daily throughout the operational seasons.

Project results are disseminated through Regional Informational Reports (McIntosh in prep, Pfisterer 2002, Rich 2001) and this report:

VII. References:

McIntosh B.C. Yukon River Sonar Project Report 2002. In prep.

Pfisterer, C.T. 2002. Estimation of Yukon River Salmon Passage in 2001 Using Hydroacoustic Methodologies. Regional Information Report No. 3A02-24. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

Rich, C.F. 2001. Yukon River Sonar Project Report 2000. Regional Information Report No. 3A01-13. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

7. YUKON PROGRAM SUPPORT

Alaska Department of Fish and Game, Division of Commercial Fisheries and National Marine Fisheries Service
Steve Hayes
NA06FP0075
Period Covered by the Report From: July1, 2000 To: June 30, 2003
Date Prepared: September 30, 2003

II. Executive Summary

Test fishing in the lower Yukon River was initiated in 1963 at Flat Island. Set nets were fished 7 days per week, 24 hours per day through the chinook and summer chum salmon runs (late May to mid-July). In 1977, test fishing was expanded to include the fall chum and coho salmon runs (mid-July to the first of September) in the Big Eddy area near Emmonak. Test fishing at Flat Island was discontinued in 1979 and test fishing in the south mouth (Kwikluak Pass) was conducted throughout the season in the Big Eddy area. Test fishing was initiated in the Middle Mouth area (Kawanak Pass) in 1979. During 1980 and 1981 the Middle Mouth project was extended in duration to cover the fall chum and coho salmon season, and geographically to cover the north mouth (Apoon Pass) of the delta.

The Lower Yukon Set Gillnet Testing project operates from end of May through July 15, each season. This project provides important information concerning the pattern of entry of the chinook and summer chum salmon into the Yukon River mouths. This project provides approximately 2,000 chinook and approximately 6,000 summer chum salmon annually for subsistence use in the local communities of Emmonak and Kotlik. Additionally, salmon harvested from the operation of the test fish program may be sold in years commercial fisheries were conducted in the area.

III. Purpose of Project

The State of Alaska is mandated to provide adequate escapement of salmon to the spawning grounds as well as provide harvests in the Alaskan subsistence, sport, personal use, and commercial fisheries. Additionally, the United States and Canada have maintained goals established in the previous interim agreement for the purpose of seeking to ensure the effective conservation and management of Yukon River salmon and to provide for Canadian origin Chinook salmon escapement and harvests. The information gathered from the assessment project is used inseason during prosecution of Alaskan commercial and subsistence fisheries.

The vast size of the drainage (330,000 square miles) makes it impossible to assess individual tributaries escapements. Other escapement estimates based on aerial surveys of index tributaries are not conducted for weeks and in some cases months after key management decisions have to be made in the lower river fishery. As a result, management decisions are currently based on commercial catch and test fishing data collected during the season in the lower river.

However, due to the increase in the efficiency of the commercial fishing fleet in recent years and the corresponding decrease in fishing time, commercial CPUE is of limited usefulness as a comparative statistic. As a result it has become increasingly necessary to place greater reliance on

relative abundance information gathered form test fishing and/or Pilot Station Sonar for inseason management.

IV. Approach

From July 1, 2000 through July 1, 2003, test fishing has been conducted from the Big Eddy and Middle Mouth camps located in District 1. The Big Eddy test fish project was conducted from the village of Emmonak. Two technicians fished set gillnets to monitor salmon passage through the south mouth of the delta. The Middle Mouth camp was located at the junction of the main Middle and North mouth passes. Two technicians fished set gillnets to monitor salmon passage through the Middle Mouth and north mouth of the delta.

Test fishing begins as soon after ice breakup as possible, usually late May or early June. Productive set net sites, leased from local commercial fishermen, were fished 24 hours per day, seven days per week throughout the duration of the projects. The contracted commercial fishermen typically operated the test nets during commercial fishing periods and either sold or retained the fish for their own use. The rest of the time Department personnel fished the nets. Gillnets were picked at least twice each day (just before 8:00 a.m. and 8:00 p.m.). When large catches occurred some nets were picked more often. Fish found in the test nets alive and in good condition were counted and released by the technicians. Dead fish were given away to subsistence users. Daily test net catch and effort data gathered at the Middle Mouth camp was transmitted by radio and Satellite telephone to the Fish and Game office in Emmonak.

Two set gillnet sites were fished at Big Eddy prior to July 16. Two 8.5 in mesh nets (stretch measure) were targeted on chinook salmon. The Middle Mouth camp operated two 8.5-inch mesh nets during the chinook salmon season. All nets were 25 fathoms in length. The 8.5-inch mesh gillnets were 28 meshes deep.

Typically, catch data for missed fishing time was linearly interpolated from preceding and following data by fishing site.

An attempt is made each year to maintain standardized set net site locations while maximizing the coverage of the passes and the productivity of each net. This becomes a difficult task when water levels, eddies and sand bar locations change between and within seasons. In order to quantify some of these factors, a bottom profile is made at each net site with a Fathometer.

In addition, scale samples are taken from each fish sampled and scale data used to estimate the age composition at each location. Throughout the season, daily catches of freshwater fishes and salmon species not taken commercially were tallied at both projects. Climatological observations of cloud cover, precipitation, wind, and air and water temperatures were collected on a daily basis.

V. Results, Evaluation and Conclusions

A. The information collected during the operation of the Lower Yukon River test fishery is utilized inseason as well as documented in the Yukon Area Summer Season Data Notebook. Test fishing in the various mouths assists in the decision making process when commercial fisheries

are considered. The pulses of chinook and summer chum salmon that enter the mouths can be tracked upriver through other strategically located projects and verified. Typically four to five pulses of chinook and summer chum salmon enter the Yukon River drainage as detected by the Lower Yukon Set Gillnet Test Fishery. Over time the set gillnet sites have changed and the sites appear to becoming overly efficient when compared to other projects.

B. No significant problems to discuss. Set net sites appear to be changing to the extent that comparing years is becoming difficult. However, this method is still the best indicator available for assessing the run below the majority of the commercial or subsistence fishing districts within the Yukon River drainage by using the timing of pulses and mouth of entrance.

C. The goals of this project have been met. The long-standing historical database provides a starting point on which to begin to make assessments of salmon returns to the Yukon Area. Most of the commercial harvests are taken in the Lower Yukon Area however subsistence harvests are substantial and obligations to spawning escapement including the U.S./Canada border passage remain a priority. This supporting program provides a tool used in fisheries management for the benefit of all users.

VI. Products

Dissemination of Project results: Various agencies are regularly e-mailed and faxed inseason project information along with written or oral interpretations of projects. The inseason information is disseminated by ADF&G Division of Commercial Fisheries to other department divisions (i.e. sport fisheries and subsistence), United States Fish and Wildlife Service, Tanana Chiefs Conference, Association of Village Council Presidents, Council of Athabascan Tribal Governments, Tribal Councils and city offices in Yukon Area communities, Alaska Outdoor Council, Yukon River Drainage Fisheries Association, Alaska Resources Library Information Services, Department of Fisheries and Oceans (Canada). These summaries are available to select fishermen in many areas throughout the Yukon River drainage through their tribal or city offices and inseason information is available upon request. Yukon Area annual management reports contain the finalized project information and are free to agencies and public.

8. SHEENJEK RIVER SONAR

Carl Pfisterer, Alaska Department of Fish and Game, Division of Commercial Fisheries

NA06FP0075

Period Covered by the Report From: July1, 2000 To: June 30, 2003

Date Prepared: September 30, 2003

Executive Summary

Fall chum salmon are harvested for both commercial and subsistence purposes. This salmon fishery is important to the river's people and economy, providing an important source of food and income. The Sheenjek River sonar project, one of the primary producers of fall chum salmon, provides accurate and timely chum salmon passage estimates to fishery managers.

The sonar project is located approximately 10 km upstream from the mouth of the river. The sonar project was initiated in 1980 and has operated every year since. The project utilizes fixed location, single-beam, side-looking sonar to estimate chum salmon passage. Because the original sonar equipment is no longer manufactured or supported, the Department purchased a split-beam sonar as a replacement. In 2002, this equipment was operated side-by-side with the single-beam system in preparation for replacement in 2003.

As in recent years, the Sheenjek River sonar project operated continuously 24-hours per day from one bank. Counts during periods of missed time (caused by such events as moving the transducer due to fluctuating water levels) were expanded and the numbers reported here reflect all expansions. The chum salmon escapement estimate for the Sheenjek River in 2001 was 53,932 and in 2002 it was 31,642.

Purpose of Project

Fall chum salmon are in great demand for commercial and subsistence uses. Commercial harvest is permitted along the entire mainstem river in Alaska as well as in the lower portion of the Tanana River. No commercial harvest is permitted in any other tributaries of the drainage including the Koyukuk and Porcupine River systems. Although commercial harvest also occurs in the Canadian portion of the Yukon River near Dawson, the majority of fish taken commercially occurs in the lower river, downstream of the village of Anvik. Fall chum salmon use as a subsistence item is greatest throughout the upper river drainage, upstream of the village of Koyukuk.

The Sheenjek River is one of the most important producers of fall chum salmon in the Yukon River. Located above the Arctic Circle, it heads in the glacial ice fields of the Romanzof Mountains, a northern extension of the Brooks Range, and flows southward approximately 400 km to its terminus on the Porcupine River. The importance of this river as a producer of fall chum necessitated a project to monitor escapement and the establishment of escapement goals for fall chum salmon to the system.

The primary objectives of the Sheenjek River sonar project are to estimate fall chum salmon passage using hydroacoustic techniques, as well as collecting biological information using seined samples. The enumeration information is provided to managers in a timely manner so as to be

used in prosecuting fisheries on the Alaskan portion of the Yukon River drainage. The biological data is analyzed postseason for documenting characteristics of the fall chum salmon escapement.

IV. Approach

In 2001 and 2002, fall chum salmon estimates were obtained using a fixed-location, single-beam sonar manufactured by the Hydrodynamics division of the Bendix Corporation. In 2002, a split-beam sonar system manufactured by Hydroacousic Technologies Inc. (HTI) was run concurrently with the Bendix equipment in preparation for an equipment upgrade in 2003. A detailed bottom profile was obtained after initial transducer placement at the counting location by stretching a rope across the river and measuring water depth with a pole every 3-m.

The Bendix transducer was configured such that the beam cross-section was 4° for the nearshore and 2° offshore. The sonar was operated 24-hours per day continuously on the right bank only. Counts during periods missed time (due to such events as moving the transducer due to fluctuating water levels) were expanded and the numbers reported here reflect all expansions. The 24-hour estimates from the Bendix sonar were relayed to the fishery managers daily.

The HTI transducer utilized in 2002 was a 2°x10° elliptical split-beam transducer. Daily estimates from the split-beam were compared to the estimates from the Bendix to verify that historical Bendix estimates will be comparable to future split-beam estimates.

As in previous years, a fish lead was constructed shoreward from the transducers to prevent upstream salmon passage inshore of the transducers. The leads were constructed to include the nearfield "dead range" of the sonar transducers.

V. Results, Evaluation and Conclusions

In 2001, the project was operational from August 11 through September 23. The sonar-estimated escapement was 53,932 chum salmon. Based on historical data, the timing of the 2001 chum salmon run was average. The median day of passage was observed on September 8. A diel migration pattern was observed, with a majority of the chum salmon passing the sonar site during periods of darkness or suppressed light.

Based on vertebrae collections, age-4 and age-5 chum salmon comprised 100% of the fish sampled. Age-5 fish dominated at 65% while age-4 fish represented 35%. Male chum salmon comprised 53% of the sample while 47% were female. Only 73 vertebrae samples were collected in 2001 due to the distribution and availability of the salmon for sampling, and difficulties operating the seine.

In 2002, the project was operational from August 9 through September 24. The sonar-estimated escapement was 31,642 chum salmon. The timing of the 2002 chum salmon run was similar to 2001 with the median day of passage occurring September 10.

Vertebrae collections were terminated early in 2002 because of the low chum salmon passage. Thirty-five samples were collected with age-4 and age-5 fish comprising 100% of the samples.

Age-4 fish dominated at 61% while age-5 fish represented 39%. Male chum salmon comprised 63% of the sample while 37% were female.

The comparison between the Bendix and split-beam equipment in 2002 was fairly consistent throughout the season. The relationship between the estimates produced by the two sonar systems was nearly one-to-one (Figure 1) and we will proceed with the switchover in 2003.

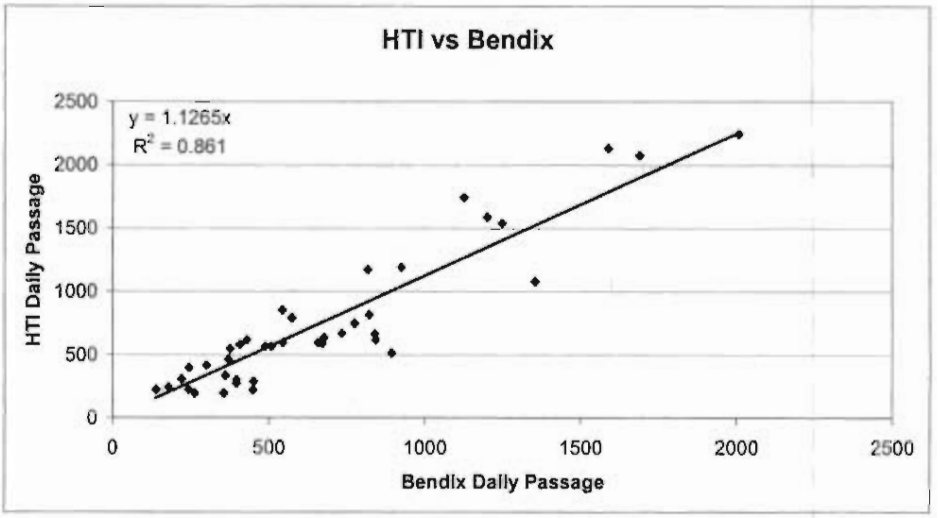

Figure 1. Daily comparison between split-beam and Bendix estimates, Sheenjek River, 2002.

VI. Products

During the reporting period, the project report for the 2001 field season was completed (Dunbar 2002) and the report for the 2002 field season initiated. Project results are disseminated through the following Regional Information Reports and this report:

Dunbar, R. 2002. Sonar Estimation of Fall Chum Salmon Abundance in the Sheenjek River, 2001. Regional Information Report No. 3A02-27. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

Dunbar, R. Sheenjek River Sonar Project Report, 2002. In prep.

VII. References

Dunbar, R. 2002. Sonar Estimation of Fall Chum Salmon Abundance in the Sheenjek River, 2001. Regional Information Report No. 3A02-27. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

VIII. Key Words:

Chum salmon, *Oncorhynchus keta*, sonar, hydroacoustics, escapement, enumeration, Yukon River, Porcupine River, Sheenjek River

9. YUKON RADIO TELEMETRY

Alaska Department of Fish and Game, Division of Commercial Fisheries and National Marine Fisheries Service
Ted Spencer and John Eiler
NA06FP0075
Period Covered by the Report From: July1, 2000 To: June 30, 2003
Date Prepared: September 30, 2003

II. Executive Summary

The Alaska Department of Fish and Game and the National Marine Fisheries Service initiated the Yukon River chinook salmon radio telemetry program in 2000. Work in 2000-2001 focused on feasibility and logistical components of the program in preparation for large-scale tagging studies in subsequent years. Results from this phase of the project indicated that basinwide tagging studies were feasible; large numbers of chinook salmon could be captured and their upriver movement tracked. A basinwide tagging and monitoring program was conducted in 2002 and 2003, which provided information on distribution, movement patterns, the location of important spawning areas, and run abundance estimates.

III. Purpose of Project

Poor returns of Yukon River chinook salmon in recent years have raised serious concerns about future returns and reduced confidence in projecting run abundance. Fisheries within the basin are managed to ensure spawning escapements, provide for a subsistence harvests in the U. S., and ensure escapements of upper river stocks into Canada. The current management strategy relies heavily on the historic sustainability of chinook salmon stocks within a relatively stable range of harvests. Management of Yukon River chinook salmon is difficult because of the mixed stock nature of the run, broad distribution of spawning stocks, and relatively compressed run timing. Available run assessment techniques, including sonar apportionment sampling, test fishing projects, age structure and escapement projects have inherent technical limitations that must be recognized when evaluating chinook salmon abundance. Managers using radio telemetry to track fish as they migrate upstream can follow the progression of the migration, determine the extent of their range, and estimate the proportion of the run returning to each monitored tributary. The specific objectives of this project were to: 1) estimate the abundance of chinook salmon in major Yukon River tributaries and the entire Yukon River basin upriver of Russian Mission with relative precision, i.e., coefficient of variation less than 20%, 2) estimate stock specific run timing, migration rates, and movement patterns, and 3) estimate stock composition (proportional distribution) of the total Yukon River chinook salmon escapement among major tributaries

IV. Approach

Estimates of total abundance for returning chinook salmon in the Yukon River (upstream of Russian Mission) were obtained using mark-recapture techniques. Chinook salmon were captured in the lower river with drift gill nets near the villages of Marshall and Russian Mission. The fish received a primary (spaghetti tag) and secondary (fin clip) mark, and were tagged with radio transmitters placed in the stomach. Biological data, including age, length, and genetics

sample, were also collected. Marked fish were recovered in upriver fisheries and at tributary recovery projects.

Radio-tagged fish migrating up river were recorded by remote tracking stations located at 37 sites along important migratory routes and spawning tributaries. Information recorded by the stations was used to calculate migration rates and document movement patterns for the different stocks tagged during the run. Data from remote tracking stations, paired with nearby tributary escapement data (towers, weirs, etc.), provided mark to unmarked ratios for population estimation. Aerial tracking surveys were flown to determine the status of radio-tagged fish in non-terminal reaches of the basin, and obtain detailed movement and distribution information in spawning tributaries.

Support for the project was provided by a number of agencies and organizations including the U.S. Fish and Wildlife Service (USFWS), U.S. Bureau of Land Management (BLM), National Park Service (NPS), Department of Fisheries and Oceans Canada (DFO), Bering Sea Fishermen's Association (BSFA), Yukon River Drainage Fisheries Association (YRDFA), and groups funded through the Yukon River Treaty Restoration and Enhancement (R&E) Fund. These organizations work together to develop a coordinated approach to fisheries research in the basin. Since the initial phases of the study, BSFA provided support for a tag recovery program at four upriver villages and two technicians for the capture and tagging effort. The USFWS and NPS provided funding for aerial surveys. BLM provided funding for completion of the remote tracking system. DFO and groups supported through the Yukon River Treaty R&E Fund installed and maintained additional tracking stations and conducted aerial surveys in Canada. The project also contracted with local residents to fish for chinook salmon and assist with the tagging phase of the project. Canadian First Nations were active participants in the Canadian portion of the study. Use of local knowledge and assistance by project leaders, and the infusion of money into the local economies (for housing, food and supplies, equipment storage, etc.) helped to develop long-term relationships with the communities of Marshall and Russian Mission. U.S. members of the Yukon River Panel have suggested developing educational curriculum for local schools involving radio telemetry and mark recapture techniques. This project received verbal support from the Association of Village Council Presidents, Village of Russian Mission, Village of Marshall, and Tanana Chiefs Conference, and letters of support from the Yukon River Panel, Council of Athabascan Tribal Governments, YRDFA, USFWS Subsistence Fishery Management, and ADF&G management staff.

V. Results, Evaluation and Conclusions

Results from work in 2000 and 2001 demonstrated full-scale radio telemetry studies were feasible. Adequate numbers of fish were captured with drift gill nets in the lower river. Capture and handling methods did not appear to influence the behavior of the fish (Eiler and Holder, in press). Improved transmitters and receiving equipment made it possible to monitor fish movements in the lower river where chinook salmon reportedly swim deep. In addition, the mark-recapture population estimation met the desired target precision (Spencer et al 2002).

The basinwide telemetry study conducted in 2002 was successful. Although the goal of 1000 chinook salmon was not attained, 768 fish were radio tagged and tracked upriver, which provide

an adequate sample for data analysis. Chinook salmon responded well to the capture and tagging procedures. A total of 748 (97.4%) fish resumed upriver movements after release; 258 (34.5%) of these fish were subsequently caught in fisheries. A total of 535 fish, including those recovered in terminal fisheries, were tracked to areas throughout the basin, providing information on run distribution, migration patterns, and the location of important spawning areas. An automated database-GIS mapping program was used inseason to summarize telemetry data. Fishery managers, comparing telemetry data with information from fish wheel assessment projects at Rampart Rapids, the lower Tanana River and Nenana, were able to better assess the movement patterns and relative abundance of chinook returns to the upper Yukon and Tanana Rivers, and take needed management actions

The basinwide telemetry study in 2003 was also successful. A total of 1098 fish were radio tagged from 3 June to 14 July. Response by chinook salmon to capture and handling was similar to the 2002 results, over 97% of the radio-tagged fish moved up river after release. Analysis of the 2003 data is still in progress.

In conclusion, the overall project goals were met during the 2000-2002 study. Despite severe challenges, the logistical and technical aspects inherent with a study of this size and scope were effectively addressed. Initial work during 2000-2001 demonstrated that large-scale tagging studies were feasible. Technical improvements in the telemetry equipment used made it possible to effectively track fish moving upriver. Finally, information from the basin-wide study in 2002 has provided a better understanding of the timing, movements and distribution of chinook returns in the drainage, and provided new insights for evaluating information from other assessment projects. The infrastructure provided by the project has also been used to facilitate additional studies on salmon and other fish species within the basin.

VI. Products

Study findings will be reported in Alaska Department of Fish and Game and National Marine Fisheries Service publication series, and made available on internet web sites. Technical reports and presentations were given to the Yukon River Joint Technical Committee and the Yukon Panel in 2000, 2001, and 2002. Project information has been presented to the public at various regional advisory councils and YRDFA annual meetings. Inseason reports and data summaries were provided to agency managers and fishing organizations. Updates were presented during weekly teleconferences sponsored by YRDFA. An Internet web site, detailing telemetry information from the study, was made available to agency managers during the 2003 study to facilitate inseason data exchange.

VII. References

Eiler, J. H. and R.R. Holder. Using radio telemetry to study chinook salmon returns in the Yukon River Basin in Alaska, USA and Yukon Territory, Canada. In F. Schober (editor). Biotelemetry 16: Proceedings of the 16th International Symposium on Biotelemetry. Vienna Austria. International Society of Biotelemetry. Wageningen, The Netherlands. In press.

Spencer, T. R., R. S. Chapell, T. Hamazaki, and J. H. Eiler. 2003. Estimation of abundance and distribution of chinook salmon in the Yukon River using mark-recapture and radio telemetry in 2000 and 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries Regional Information Report 3A02-37, Anchorage. 54 pp.

VIII. Key Words: salmon, Yukon River, radio telemetry

10. ADMINISTRATIVE SUPPORT

Jan Gamble
Administrative Manager
Alaska Department of Fish and Game
US/Canada Yukon River Salmon Negotiations Studies
Award Number: NA06FP0075 Grant Program/CFDA#: 11 438
Period Covered by the Report: From: July1, 2000 To: June 30, 2003
Date Prepared: September 26, 2003

II. Executive Summary

Administrative support is an essential function for successfully managing a project. Successful administration is measured by remaining within the authorized budget amount, and within compliance of the terms and conditions of the contract. Administrators provide assistance and guidance to managers on projects with mandated federal and state procedures and policies. Administrative support is the backbone to a well-managed project and a tool for managers who work to fulfill the scope of work identified and defined by each project within this report.

III. Purpose of Project

The essential function of administrative support is the day-to-day operational assistance given to each project manager: reviewing, tracking, approving and processing of grant obligations and to provide training and guidance to all personnel directly involved with the Yukon River Negotiations Studies grant projects. The funding received is mandated through the Alaska Administrative Manual, State and Federal Procurement Codes, OMB Circulars A-87 and A-102 and Personnel Rules extensively.

Approved and authorized budgets are established during the period of performance, a fiscal year between July 1, of one year through June 30, the following year, and for each fiscal year following. The budgets established also contain account line items for the needs identified within each project and specific to the scope of work.

IV. Approach

All obligations generated by the Yukon River Negotiation Studies are processed for payment through the Alaska Statewide Accounting System (AKSAS) and the Alaska Payroll System (AKPAY). Technical working knowledge is necessary to ensure all policies and procedures established are followed and remain in compliance with each projects scope of work and terms and conditions of the contracts. This insurance is obtained through the Accounting Technician I and Administrative Supervisor and with the assistance of an Administrative Clerk III and Accounting Clerk II. Objectives for the Accounting and Human Resources functions are to maintain accuracy and accountability, and to remain in compliance with the terms and conditions of the contract. Each staff member attends the yearly workshop prepared and presented by NOAA administrators.

Accounting

Expenditures are entered daily into Expenditure Tracking System (ETS) and reconciled monthly against the Alaska Statewide Accounting System. Balancing expenditures from ETS to AKSAS

for the month is a valuable tool for the managers. A monthly financial report is prepared utilizing the data obtained through the ETS program. This report compiles the year to date expenditures and is distributed to each project. The report provides the projects authorized allocation and a year to date balance report of the verified (paid) and unverified (unpaid) expenses to the project managers. Expenditures provided in this report cover personal services, travel, contractual, supplies and equipment costs.

Mid-year audits are performed on each project and allow for review and adjustment in expenditures to prepare for the next phase of the project for the up coming field season. A report is prepared and reviewed at the Regional and Headquarters level.

Year-end reports are prepared and completed by September each year. This schedule allows adjustments and outstanding expenditures to be processed in the fiscal year expenses are generated.

Human Resources

The Administrative Supervisor provides assistance to project managers with all aspects of human resources support. This includes but is not limited to: recruitment, training, termination, employee benefits, contractual bargaining unit information, benefits, time and attendance, and employee orientation. Employee information is maintained in an in-house program called ADAM. This system allows the Administrative Supervisor to enter and track employee information such as pay range, merit, and longevity steps, enter on duty dates, termination dates, seasonal leave without pay dates, location (duty stations), bargaining units, financial project codes and retirement systems. Another in house program utilized is EVE, specifically used for the bi-weekly payroll process and calculates data entered from timesheets: time and attendance, premium pays, and non-paid hours.

Employee and financial information is essential to the successful management of personnel for the project managers. Data retained in the personnel ADAM system is utilized during each payroll process and is downloaded each pay period into the EVE timesheet program, and compared against employee information from ADAM. Timesheets received and entered into EVE are carefully reviewed, compared for differences and corrected if wrong. This dual program system ensures an accurate entry and processing of the bi-monthly payroll.

Evaluations and position descriptions are received and reviewed, and files maintained and processed by this position. Discrepancies and recommendations are made by this position with all aspects of the evaluations and position descriptions.

V. Evaluation

The goals and objectives of this project have been met. Project managers receive accounting support and are able to monitor daily and monthly expenditures through reports and assistance with procurement and contractual needs. Human resource assistance is provided in areas of time and attendance, evaluations and in monitoring essential personnel action. This project is successful as an administrative support project. The success is measured through the overall awards success. Staff supported by this project is quite large and the logistics of each field camp are unique. Staff administration is difficult for a large and diverse group, but this project provides

accountability and accuracy by dedicated administrative support staff that manages the Yukon River Negotiation Studies grant.