YUKON RIVER JOINT TECHNICAL COMMITTEE REPORT

prepared by

THE UNITED STATES/CANADA
YUKON RIVER JOINT TECHNICAL COMMITTEE

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Anchorage, Alaska

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1.0 INTRODUCTION

The spring meeting of the Yukon River Joint Technical Committee (JTC) was held in Anchorage on 1-2 May, 1996. The agenda for the JTC meeting was as assigned to the JTC by the Yukon River Panel at their April 1996 meeting, and consisted of the following:

1. Prepare salmon run outlooks for 1996 and discuss proposed management plans.

2. Review status of the Yukon River salmon GSI research.

3. Prepare a project plan for the upper Yukon - Porcupine River fall chum salmon radio telemetry and mark-recapture project at Rampart, including a feasibility level implementation in 1996.

4. Finalize the Restoration and Enhancement Fund proposal application form and develop a technical evaluation procedure based on the principles and guidelines section of the Interim Yukon River Salmon Agreement.

5. Other business?

A core group attended throughout the meeting, and additional staff attended as specific agenda items were discussed. The meeting was attended at various times by the following persons:

Canadian Department of Fisheries and Oceans (DFO)
- Sandy Johnston (co-chair)
- Ian Boyce
- Gail Faulkner

Alaska Department of Fish and Game (ADF&G)
- Fred Andersen
- Elizabeth Andrews
- Louis Barton
- Larry Buklis (co-chair)
- Jeff Bromaghin
- Dan Bergstrom
- Rich Cannon
- Penny Crane
- Russ Holder
- Bob Paulus
- Dan Schneiderhan
- Jim Seeb
- Lisa Seeb

United States Fish and Wildlife Service (USFWS)
- Steve Klein
- Steve Klosiewski
- Mike Millard
- Monty Millard
- Bill Spearman

National Marine Fisheries Service (NMFS)
- Richard Wilmot
- John Eiler

National Biological Service (NBS)
- Eric Knudsen
- Kim Scribner

Bering Sea Fishermen's Association (BSFA)
- Jude Henzler
- Art Nelson

Tanana Chiefs Conference, Inc. (TCC)
- Paul Headlee

2.0 CHINOOK AND CHUM SALMON RUN OUTLOOKS FOR 1996

The JTC held a general discussion on Yukon River salmon fishery management plans for the 1996 season. The U.S. plan is expected to include: a pre-season commercial chinook salmon harvest target of the mid-point of the guideline harvest range(s); a reduction in the depth of commercial gillnets in Districts 1,2 and 3; an increase in the upper Yukon border escapement target range to 44,800 to 47,800 chinook, which reflects recent changes resulting from Yukon River Panel deliberations in April, 1996; potential closure of the fall chum commercial fishery due to conservation concerns; and, the lowering of the fall chum conservation trigger point from 400,000 to 350,000 chum for years of very poor returns. For the False Pass fishery, it was noted that the chum salmon cap of 700,000 fish will remain in effect, however the release of chum salmon will no longer be permitted and all chum caught must be retained and reported.

The Canadian management plan is expected to include: a pre-season chinook salmon harvest target of the mid-point on the guideline harvest range; an increase in the escapement goal for upper Yukon chinook salmon to 28,000 chinook salmon as agreed by the Yukon River Panel; an anticipated chum harvest towards the lower end of the guideline harvest range; and an escapement goal of 65,000 upper Yukon chum salmon which is consistent with the chum rebuilding plan specified in the Interim Yukon River Salmon Agreement.

ADF&G and DFO will exchange copies of the respective management plans when available.

Detailed discussions were held regarding chinook and chum salmon run outlooks for 1996, and are described in this section of the report. In addition to discussing the 1996 run outlooks, mention was made of initial expectations for the 1997 fall chum salmon run. As a result of poor escapements in 1993, the 1997 Yukon River fall chum salmon run is expected to be weak.

2.1 Alaska

2.1.1 Chinook Salmon

The majority of chinook salmon returning to the Yukon River are 6-year-old fish; however, 5- and 7-year-old fish make a significant contribution to the run. Spawning ground escapements in 1990, the brood year producing 6-year-old fish returning in 1996, were judged to be above average in magnitude. However, the return of this brood year as 5-year-old fish in 1995 appeared to be no better than average. The 7-year-old return is expected to be strong based upon the large contribution of age-6 fish in the 1995 run. The return of 5-year-old fish in 1996 is expected to be below average to average in abundance based on below average to average spawning escapements observed in 1991. Overall, the 1996 chinook salmon run is anticipated to be average in strength. The commercial harvest in Alaska is expected to total 88,000-108,000 chinook salmon (82,000-100,000 fish in the Lower Yukon Area and 6,000-8,000 fish in the Upper Yukon Area).

2.1.2 Summer Chum Salmon

The return of 5-year-old fish in 1996 is expected to be average to above average based on spawning escapements observed in 1991 and the contribution of 4-year-old fish to the 1995 run. A below average to average return of age-4 summer chums is expected. Summer chum salmon spawning escapement to the Anvik River in 1992 was 775,000 fish, 55% above the escapement goal of 500,000 summer chum salmon. However, escapements to other spawning areas in 1992 appeared to be below average based upon aerial surveys. Overall, the 1996 outlook is for an average summer chum salmon run. The commercial harvest is expected to be 400,000-800,000 fish.

2.1.3 Fall Chum Salmon

A Ricker spawner-recruit model was used to project the return in 1996 from the 1990 to 1993 parent-years (all stocks in Alaska and Canada combined), using harvest and expanded escapement data to estimate run sizes. This process resulted in an overall 1996 run projection of approximately 631,000 fish, with the following age composition:

Age-3 fish	24,000	(1993 Brood Year)
Age-4 fish	407,000	(1992 Brood Year)
Age-5 fish	194,000	(1991 Brood Year)
Age-6 fish	6,000	(1990 Brood Year)
Total	631,000	

Note that the fall chum salmon run projection is for the entire drainage, and is not broken down by region. The 1996 preseason projection is below average. The overall median run size estimate for the years 1974 through 1995, using harvest and expanded escapement data to estimate run sizes, is approximately 730,000 fall chum salmon. If the return materialized as projected in 1996, there would not likely be a surplus sufficient for a commercial fishery in the Alaska portion of the drainage. However, the run will be managed based upon inseason assessments.

2.2 Canada

2.2.1 Chinook Salmon

The expected total run size of Canadian origin upper Yukon chinook salmon for 1996 is approximately 141,000 fish. In comparison, the upper Yukon chinook run size averaged approximately 135,000 fish during the six year cycle from 1990 to 1995. The 1996 run is therefore expected to be about average in magnitude. This outlook is based on escapement data for 1989 through 1991, calculated returns per spawner for the individual brood year escapements based on the spawner-recruitment relationship for the 1977 to 1988 brood years, and age composition. The interim escapement goal range for rebuilt upper Yukon chinook (excluding the Porcupine) is 33,000 to 43,000 chinook. The escapement in 1990, the principal brood year for the 1996 run, was within this escapement goal range. As a rebuilding plan, the Yukon River Panel agreed in April 1996 to a minimum escapement objective of 28,000 upper Yukon chinook for the 1996-2001 period.

In order to examine the relationship between escapement and production, returns were reconstructed for the 1977 to 1988 brood years. The year 1977 was chosen as the first data point since stock identification data from scale pattern analyses of Alaskan catches is only available for Yukon River chinook salmon since 1982; progeny from 1977 would have returned in significant numbers beginning in 1982. Escapements for 1977 and 1978 were estimated by expanding a cumulative four-area escapement index (Tatchun Creek, Big Salmon R., Nisutlin R., and the non-hatchery returns to the Whitehorse Fishway) by the average proportion the index represented of the total escapement estimates derived from DFO mark-recapture studies in 1982-83, 1985-89, i.e. 0.111. Escapements for 1979-81 and 1984 were estimated in a similar manner except that a five-area index was used which included the four-area index streams plus the Wolf River index counts. Mark-recapture results were used to estimate the escapement in 1982, 1983 and 1985 through 1995.

The total return from each brood year escapement was estimated by apportioning the total annual run sizes in the principal return years by the age compositions of harvest and spawning escapement. On average, the majority of adult chinook return at six years of age (63%) with significant numbers returning at age seven (20%) and age five (13%). Annual run sizes were reconstructed from ADF&G scale pattern data and DFO tagging results.

The relationship between the natural logarithm of the return per spawner (R/S) and number of spawners (S) for the 1977 to 1988 brood years is described as follows:

$$\ln(R/S)=2.617-0.0346(S); \quad [1]$$

where: S = # spawners (in thousands),
R = returns.

The correlation coefficient (r^2) of this regression is 0.78 and the relationship is significant ($p<0.005$).

Based on equation [1] and the average age composition, the estimated returns from the principal brood years in 1996 are as follows:

Brood Year	Esc.	Calc'd ln(R/S)	Calc'd R/S	Est'd prod'n	1996 Return
1989	25,201	1.744	5.720	144,149	29,406
1990	37,699	1.311	3.710	139,872	87,700
1991	20,743	1.898	6.675	138,459	17,584
sub-total (accounts for 95.8% of the return)					134,690
Total Expected Run Size in 1996					**140,595**

The method used to forecast the 1996 return is significantly different from that used prior to 1991, when a fixed rate of return of three to four adults per spawner was used. Using the former method, a run size of approximately 132,000 chinook would be expected in 1996 using a constant rate of return of four adults/spawner. In the approach adopted for the 1996 forecast, the expected returns per spawner vary for each brood year.

2.2.2 Fall Chum Salmon

On average, 71% percent of upper Yukon adult chum salmon are four years old and 27% are five years old. This suggests that the major portion of the 1996 fall chum run should originate from the 1992 escapement of chum salmon which was >39% below the escapement goal of >80,000 chum salmon. Additional returns can be expected from the 1991 escapement of 78,461 chum. The 1991 escapement was >2% below the escapement goal of >80,000 upper Yukon chum salmon.

Assuming an average productivity of 2.5 adults per spawner, which is used in the Canada/U.S. joint upper Yukon chum salmon rebuilding model, the brood year escapement estimates and average age composition data suggest a total run of approximately 143,000 upper Yukon chum in 1996 (excluding Porcupine River production).

Although there are insufficient stock identification data for Yukon chum salmon from which to estimate annual run sizes, estimates based on the following assumptions have been made to qualify the 1996 outlook in terms of the average estimated run size:

i) 30% to 50% of the U.S. catch of fall chum is composed of Canadian origin fish;

ii) the U.S. harvests Canadian stocks in the same ratio as: upper Yukon border escapement-to-Porcupine border escapement; and,

iii) the Porcupine stock consists of the Old Crow catch plus the Fishing Branch escapement.

Using these assumptions, the recent four-year cycle average (1992-1995) total return of upper Yukon Canadian-origin chum salmon is estimated to have been in the range of 151,000 to 179,000 fish. The forecast of 143,000 upper Yukon chum salmon for 1996 is therefore below average. It should be noted that the assumed productivity rate of 2.5 is an estimate based on limited data. Upper Yukon chum salmon run sizes have been highly variable in recent years.

For management purposes in 1996, and in keeping with the rebuilding plan established through the Interim Yukon River Salmon Agreement, the JTC recommends a target escapement for Canadian origin, upper Yukon fall chum salmon of 65,000 fish. With a run size of 143,000 chum and an escapement goal for 1996 of 65,000 fish, the total allowable catch is expected to be 78,000 chum. The overall exploitation rate therefore should not exceed 55%. Under terms agreed to in the Yukon Interim Salmon Agreement, the U.S. will endeavor to manage its fisheries to allow 88,600 - 112,600 chum to reach the Yukon River border. In light of the below average forecast, the Canadian fishery is expected to be managed towards the lower end of the 23,600 - 32,600 guideline harvest range.

The chum salmon run to the Canadian portion of the Porcupine drainage in 1996 should originate primarily from the 1992 escapement of 22,500 fish. The 1991 escapement of 37,500 chum to the Fishing Branch River will also contribute to the 1996 Porcupine River run. Both the 1991 and 1992 escapements were below the 1992-1995 cycle average of about 42,000 chum salmon, and were below the interim escapement goal range of 50,000 to 120,000 chum for the Fishing Branch River. The total run size in 1996 is expected to be approximately 67,000 chum based on an assumed productivity of 2.5 returns per spawner, and an average age composition of 71% age four and 27% age five. The stock size is estimated to have averaged 60,000 to 70,000 fish over the 1992 to 1995 four-year cycle (based on the assumptions previously described). In comparison with the 1992-1995 average run size, the 1996 forecast is therefore average. However, the assumed productivity rate of 2.5 returns per spawner is considered optimistic for this stock; thus, this forecast may be an over-estimate. It is unlikely recent escapements represent healthy stock levels since the lower end of the escapement goal range has been met in only two out of four years.

3.0 STATUS OF YUKON RIVER SALMON GSI RESEARCH

3.1 Project History

Alaska Department of Fish and Game (ADF&G), U.S. Fish and Wildlife Service (USFWS), and Canadian Department of Fisheries and Oceans (CDFO) began a Genetic Stock Identification (GSI) study for chum salmon and chinook salmon in the Yukon River in 1987. The objectives of this project were: to expand on preliminary GSI work by Beacham et al. (1988, 1989); to develop a comprehensive GSI program for the Yukon River drainage; and to determine if GSI could estimate the proportion of Canadian-origin chum salmon and chinook salmon caught in Yukon River fisheries in Alaska. A progress report (Wilmot et al. 1992) was written to summarize the first four years of the cooperative study. Genetic baselines for both species were presented, assessed for their ability to estimate stock of origin, and used to analyze actual mixture samples.

The genetic analysis for chum salmon revealed substantial genetic divergence between summer and fall stocks, permitting accurate and precise identification of these groups (Wilmot et al. 1992). Within fall stocks, Tanana River (Alaska) and Kluane/Teslin (Canada) stocks could be accurately allocated within mixed-stock fisheries samples, but estimates for Sheenjek River (Alaska), Fishing Branch (Canada), and Canadian mainstem populations were not as accurate nor precise. The chinook salmon baseline was capable of identifying country of origin of chinook salmon and also allowed accurate identification of lower-, mid-, and upper-river groups. Additionally, genetic stock composition estimates for chinook salmon were concordant with estimates using scale pattern analyses (SPA) (Wilmot et al. 1992), and therefore additional GSI work on chinook salmon was discontinued due to the age class and region of origin information obtained from SPA.

3.2 ADF&G Allozyme Studies, 1991 to 1996

GSI efforts in recent years have focused on chum salmon because SPA is not an accurate stock identification tool for chum salmon. Objectives have been to add new populations to the baseline, to resample populations of special concern, to identify additional genetic markers, and to test and augment the 1992 baseline. To date, 14 populations have been resampled, and 13 new populations have been analyzed for genetic data. A new database has been constructed from spawning populations with complete data using 22 allozyme loci.

The new baseline has been evaluated by defining potential reporting regions for mixture analyses. Based on genetic relationships and management interests, eight reporting groups for mixture analyses were identified that differed slightly from those used in Wilmot et al. (1992). A series of simulation studies were performed where each region comprised 100% of the mixture. Simulations were also performed on the reporting regions and baseline of Wilmot et al. (1992).

Reporting regions for the new baseline performed as follows in the simulations study: 1) allocation to the Lower river summer run, Teslin River, and Kluane/Donjek Rivers regions were accurate and precise with mean allocations of 0.95 and standard deviations ranging from 0.04 to 0.03; 2) the Toklat River and Upper Tanana fall run reporting regions also performed well with mean allocations of approximately 0.85 and standard deviations of approximately 0.07; and 3) mid-river summer run, Fishing Branch/Canadian Mainstem, and Chandalar/Sheenjek reporting regions had mean allocations ranging from 0.81 to 0.83 and standard deviations ranging from 0.07 to 0.09. The new baseline verified the results of Wilmot et al. (1992) and showed some improved accuracy and precision in estimating regional components. In particular, the mean allocation for the Lower River Summer component increased from 0.84 to 0.95. Separating Teslin River from Kluane River and separating Toklat River from Tanana Fall Run was possible. The accuracy of estimating the Midriver Summer, Chandalar/Sheenjek, and Fishing Branch/Canadian Mainstem improved, with smaller standard deviations. The two baselines also performed similarly in estimating summer versus fall components (Fall run: Wilmot et al. (1992): mean=0.93, s.d.=0.05; new: 0.95, s.d.=0.04). The new baseline improved the ability to correctly allocate Canadian stocks (Wilmot et al. (1992): mean=0.85, s.d.=0.09; new: 0.91, s.d.=0.06).

3.3 USFWS Allozyme Studies, 1987 to 1996

Two reports are approaching completion. The first, "Genetic Stock Identification of Yukon River Chum and Chinook Salmon, 1987-1991," will describe stock relationships, baseline performance, and stock composition estimates of mixed stock samples from District 1. A final draft will be distributed to reviewers in July. The second report, "Genetic Stock Identification of Chum Salmon (*Oncorhynchus keta*) from the Yukon River District 5 Subsistence Fishery", addresses hypotheses concerning stock composition, run timing, and bank orientation. This report will be finalized in June.

The chum baseline was improved with the inclusion of data from additional protein-coding loci for upper Yukon River stocks in coordination with ADF&G. A sample of chum salmon was collected from the Black River (Porcupine River drainage) in 1995 to expand the geographic baseline coverage. The data will be incorporated in the coast-wide chum salmon baseline upon completion of laboratory processing this summer.

Baseline samples of chum salmon will be collected from two locations in 1996, in conjunction with other USFWS projects. Early- and late-season collections from the South Fork Koyukuk

River will permit determination if there is genetic evidence of stock structuring with apparent early- and late-runs. Baseline collections from Innoko River chum salmon will provide current genetic information and improve the geographic coverage for that region.

3.4 DNA Marker Development, 1995-1996 (NBS, USFWS, ADF&G)

Determination of proportional contributions of specific spawning stocks of fall-run chum salmon to mixed stock fisheries remains an area of concern. At the spring 1995 JTC meeting, geneticists from the NBS, ADF&G, and USF&WS were charged with the evaluation of additional molecular genetic markers for fall-run chum salmon and for their implementation in mixed-stock fisheries analysis. The objectives of this study were: 1) to assay levels of genetic variability and inter-population differentiation for U.S. and Canadian stocks of fall-run chum salmon using four classes of genetic markers, and 2) to conduct simulations to ascertain the accuracy and precision of each marker classes in assigning country of origin for mixed stock fall-run chum salmon fisheries. Analyses using allozymes, mitochondrial (mt)DNA, microsatellites, and gene introns focused on eight fall-run chum stocks (Delta River, Chandalar River, Sheenjek River, Fishing Branch, Big Creek, Minto Slough, Tatchun, and Kluane River).

Levels of genetic diversity (H_t) as quantified by DNA markers (microsatellites, mtDNA, and gene intron polymorphisms) were greater than diversity estimates derived from protein allozymes (means 0.592 vs. 0.205, respectively). Differences between marker classes were principally due to the fact that only highly variable DNA loci were assayed while allozyme loci were screened without *a priori* regard to the relative degree of variation. The majority of loci assayed (13 of 25 loci across all marker types) showed significant heterogeneity in gene frequency among the eight populations. The proportion of total diversity apportioned among populations was higher for DNA markers compared to estimates from allozyme data (0.021 vs. 0.013), though this too is, in part, a function of total levels of variation resolved. Ten of 25 loci surveyed showed significant variation between U.S. and Canadian stocks.

Inter-stock genetic relationships were summarized using estimates of genetic distance, a composite measure of pair-wise allele frequency differences between all populations, across all loci. Estimates of genetic distance among stocks was generally related to geographic proximity. Border stocks of the Porcupine River and tributaries (Fishing Branch and Sheenjek River) and the Chandalar River were genetically more similar to one another than to other populations. Yukon River main-stem stocks (Big Creek, Minto Slough, and Tatchun) were more similar to one another than to other populations. The Delta River stock from the Tanana River and the stock from the Kluane River in the upper Canadian Yukon River drainage were most divergent in allele frequency. Overall, estimates of stock divergence were primarily the result of the sum of relatively small differences in allele frequency across the entire set of loci examined, rather than major shifts in allele frequency at a single or few loci. While results were generally concordant across the marker types, certain loci were more successful at elucidating differences among particular pairs of stocks than others. Results are in agreement with earlier allozyme work by Wilmot et al. (1992) and with ADF&G allozyme results described above.

Simulation studies were conducted to determine the accuracy and precision of estimates of fall-run chum allocation based on country-of-origin. Artificial mixtures were evaluated at 20% incremental increases in Canadian contributions (i.e., 0% Canadian, 20% Canadian, 40% Canadian, etc.). Simulations were conducted assuming that total U.S. and Canadian proportions of the simulated mixture comprised equal contributions of stocks from the respective countries. Bias in the estimates occurred at the extreme in the simulations, 0% Canadian or 100% Canadian, partially due to the properties of the algorithm to overestimate stocks with low contributions. Accuracy graphs revealed that Canadian stocks were consistently over represented up to contributions of less than approximately 50% and under represented at higher contributions. This bias was consistent regardless of the marker type used in the analysis. Greater precision was realized when using all four classes of genetic markers as compared to simulations conducted using each marker type separately. These results were consistent in terms of accuracy and precision with those of earlier studies using similar reporting groups.

Further analytical work will involve: 1) determining the accuracy and precision of stock allocations using "biologically meaningful" reporting groups rather than country of origin groups; 2) running simulations to assess the accuracy and precision of stock allocation when reporting groups are weighted by estimates of actual escapement; 3) selection of optimal subsets of genetic markers to use in future activities; 4) preparation of additional summary statistical measures of population differentiation using alternative weighting strategies based on relationships among alleles.

3.5 Summary and Recommendations

The project has undertaken two major objectives in the last year. The first objective was to finalize remaining baseline and fishery samples, identify reporting groups for the entire Yukon River that perform well within the constraints of the model using the allozyme database, and complete reporting from earlier years. The second objective was to develop additional DNA markers to separate Yukon River fall-run chum salmon and evaluate the added resolution provided by these additional markers.

The allozyme database for chum salmon from the Yukon River provides extensive geographic and temporal coverage. The stability of allele frequencies within stock groupings and across years has been verified by independent sampling and analyses by two laboratories representing separate agencies. Further, the results from the DNA study were concordant with allozyme results revealing similar patterns and levels of divergence. The DNA markers revealed the same inter-population relationships and provided similar accuracy and precision in stock allocation using U.S./Canada reporting groups. Greater precision was obtained when using the entire data set with the four marker classes. Decisions as to which marker class to use will ultimately be dictated by many factors, including sampling constraints, sample processing costs, turnaround time, etc. The comprehensive nature and observed stability of the database provide a strong foundation for estimating the components of complex mixtures from fishery or other stock aggregate samples using a maximum likelihood model.

The ability of the model to identify components of the mixture with a particular level of accuracy and precision is a function of the amount of genetic divergence among the components, and of desired groupings of baselines stock into reporting groups (i.e. country of origin versus other biologically meaningful aggregations). More divergent components can be estimated with a high level of accuracy and precision. Conversely, separating less divergent components, such as fall stocks within the Porcupine drainage, is more difficult, and estimates will have a lower level of accuracy and precision. During the next year, we plan to continue to evaluate the model and develop potential applications with an acceptable level of accuracy and precision necessary for fisheries management.

The JTC tasked a team to prepare an outline of a special report regarding the status of Yukon River chinook and chum salmon stock identification capability, including SPA, allozymes (electrophoresis), and DNA methodologies developed to date. The outline will be reviewed at the fall 1996 meeting of the JTC, with the intent that the report be completed in time for review at the spring 1997 meeting of the JTC. The team consists of the standing subcommittee on stock identification (Jeff Bromaghin, Penny Crane, Dan Schneiderhan, Kim Scribner, Lisa Seeb, Bill Spearman, and Dick Wilmot) plus one fishery management biologist from ADF&G (Rich Cannon) and one fishery management biologist from DFO (Sandy Johnston).

4.0 UPPER YUKON-PORCUPINE RIVER FALL CHUM SALMON RADIO TELEMETRY AND MARK-RECAPTURE PROJECT PLAN

The JTC had prepared a discussion paper dated April 1996 for the Yukon River Panel entitled "Capabilities and Potential Applications of Adult Salmon Tagging Methods in the Yukon River Basin", which was presented at the April 1996 Panel meeting. At that meeting, the Panel directed the JTC to develop a feasibility level project plan for an upper Yukon-Porcupine River fall chum salmon radio telemetry and mark-recapture project at Rampart for implementation in 1996. At the May meeting, the JTC developed a draft plan for this project, which is provided as Attachment I to this report. This effort was facilitated by making use of an initial draft project plan which had been developed prior to the preparation of the aforementioned discussion paper. The attached project plan is considered a preliminary draft. The planning team, which had prepared the earlier draft project plan and discussion paper, was tasked by the JTC to complete the development of the project plan prior to initiation of field activities this season. The team now consists of Milo Adkison, Louis Barton, Ian Boyce, John Eiler, Paul Headlee, Sandy Johnston, Eric Knudsen, Steve Klosiewski, Brian Lubinski, and for the near-term, Mike Millard. Upon approval by the JTC co-chairs, the final project plan will be made available to the JTC and Panel.

The JTC discussed the fact that the primary agencies leading the initial feasibility field work (NMFS for the radio telemetry component and USFWS for the mark-recapture component) may develop more detailed operational plans as per their internal standard operating procedures. It was agreed that the planning team would be afforded an opportunity to review and comment on any such operational plans that may be developed. Regardless of whether or not such operational plans are developed, it was agreed that the project will be expected to conform to the conceptual project plan developed and approved by the JTC.

5.0 RESTORATION AND ENHANCEMENT FUND APPLICATION FORM AND TECHNICAL EVALUATION PROCEDURE

The JTC finalized the Yukon River Salmon Restoration and Enhancement Fund application forms as directed by the Yukon River Panel, previous drafts of which were presented in the March 1995 and November 1995 JTC reports. The final version is provided as Attachment II to this report, and is now available to the Panel for the initial call for proposals targeted for the summer of 1996. The JTC also continued discussion on how it will evaluate incoming proposals, and developed a preliminary draft of an evaluation form, which is provided as Attachment III to this report. The JTC recognizes that substantial work remains to further develop and finalize the evaluation form, and to develop procedures for processing incoming proposals. To accomplish the necessary work on these aspects in sufficient time for the 1996/97 proposal evaluation cycle, the JTC tasked a team consisting of Elizabeth Andrews, Gail Faulkner, and Russ Holder to continue this work, with the aim of finalizing the evaluation form and process at the fall 1996 JTC meeting.

6.0 DISCUSSION OF OTHER BUSINESS

Under the "other business" agenda item, the JTC briefly discussed: 1) the status of a Yukon River chum salmon early life history study by the NBS now in its initial stages; and 2) the status of a Canadian mainstem Yukon River chinook salmon brood year escapement-return table being developed cooperatively by DFO and ADF&G staff, and the potential for a special report which might grow out of that work.

7.0 LITERATURE CITED

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Wilmot, R.L., R. Everett, W.J. Spearman, and R. Baccus. 1992. Genetic stock identification studies of Yukon River chum and chinook salmon, 1987 to 1990. Progress Report, U.S. Fish and Wildlife Service, Anchorage. 132 pp.

ATTACHMENT I

Preliminary Draft

Upper Yukon-Porcupine River Fall Chum Salmon Radio Telemetry and Mark-Recapture Program Plan

Upper Yukon River salmon spawn in numerous tributaries, and support important aboriginal, subsistence, and commercial fisheries in both the U.S. and Canada. Under the Interim Yukon River Salmon Agreement (1995), the U.S. and Canada have agreed to conduct cooperative research to determine the migratory patterns, exploitation, productivity and the status of stocks of common concern. The assessment and inventory of wild stocks is specified in the agreement as an integral part of any effort to maintain, restore and enhance salmon returns in the upper basin.

Mark-recapture, radio telemetry, and studies combining both methods have been suggested as a means for providing fisheries managers with additional information on: 1) total and stock specific run strength; 2) stock composition and timing; and 3) the location of spawning areas in the Yukon River basin. An overview of telemetry and mark-recapture applications in large river systems is described in a paper presented to the U.S.-Canada Yukon River Panel (JTC 1996).

A cooperative, multi-year interagency study to determine the distribution, relative abundance, and run characteristics of Yukon River fall chum is proposed. The primary long-term objectives of this program would include:

1. Estimating stock composition, stock-specific run timing, and movement patterns.

2. Estimating run contribution by nation of origin.

3. Estimating total and bi-weekly abundance of fall chum spawning above the Yukon-Tanana River confluence.

4. Identifying unknown spawning areas.

5. Refining and expanding the existing GSI baseline.

Work Plan

Feasibility Study. The first year of the study will focus primarily on establishing methods for use in subsequent years. A mark-recapture feasibility study will be conducted to assess whether adequate samples can be obtained, and obtain preliminary results to refine study design. A limited number of fish will be tagged with radio transmitters to determine tagging response, basic movement patterns and test some of the assumptions inherent in the mark-recapture study.

Additional elements of the 1996 program include:

1. Fall chum will be captured with fish wheels in the Rampart Rapids area, located about 50 river miles upriver from the Yukon-Tanana River confluence, from late July through September (Figure 1). This site was selected to avoid sampling summer chum, or fall chum destined for the Tanana River. Fish wheels, equipped with live boxes, will be located on both river banks. Fish will be tagged with numbered, color-coded spaghetti tags. A secondary mark will also be made to assess tag loss between the capture and recovery areas. Local operators will be contracted to run the fish wheels; interagency personnel will handle and tag the fish.

2. Up to fifty fish will be tagged with pulse-coded radio transmitters to evaluate tagging response, and estimate travel time between the tagging and recovery sites. The transmitters will be inserted through the mouth of the fish and into the stomach. The fish will also be tagged below the dorsal fin with numbered spaghetti tags as a secondary mark.

3. Fish wheels for recovering marked and unmarked fish will be operated on both river banks near the village of Rampart, approximately 30 river miles upriver from the tagging site. Local operators will be contracted to run the fish wheels. Data collected at the recovery wheels will include the daily totals of marked and unmarked fish, and the identification numbers of the tags recovered. In addition to information from the recovery wheels, information will also be solicited for tagged fish caught by commercial, aboriginal, and subsistence fishers, including: 1) tag number; 2) date, time and area caught; and 3) general condition of the fish.

4. Sex and body length data from a representative number of fish will be collected at both the capture and recovery sites. Hard tissues (type to be determined) for age analysis and DNA tissue samples will also be collected from radio-tagged fish.

5. Sites throughout the drainage (Figure 1) will be selected and prepared for the installation of remote tracking stations (Eiler 1995) (Figure 2). Stations will be installed to evaluate performance under fall and winter conditions.

Full Scale Study. If there is sufficient success in the initial year, a full scale telemetry and mark-recapture study will be conducted during subsequent years. The mark-recapture study will be conducted to estimate total and bi-weekly abundance of fall chum above the Yukon-Tanana River confluence. Fall chum will be tagged with radio transmitters and tracked upriver with remote tracking stations placed at strategic sites throughout the drainage (Figure 1). Telemetry data will be used to determine spawner distribution, and estimate stock composition, nation of origin, and stock-specific run timing.

Additional details of the full scale study include:

1. During late spring and early summer, remote tracking stations will be installed at selected sites.

2. Mark-recapture methods will be used to estimate the bi-weekly abundance of fall chum passing the capture sites during the tagging period. From late July through September, fall chum will be captured with fish wheels located in the Rampart Rapids area. Fish wheels, equipped with live boxes, will be located on both river banks. Approximately 15,000 fish will be tagged with numbered, color-coded spaghetti tags. A secondary mark will also be made to assess tag loss between the capture and recovery areas. Local operators will be contracted to run the fish wheels; interagency personnel will handle and tag the fish.

3. About 1,000 fish will be tagged with pulse-coded radio transmitters during the run; 100-200 fish during each weekly period. The transmitters will be inserted through the mouth of the fish and into the stomach. The fish will also be tagged below the dorsal fin with spaghetti tags as a secondary mark.

4. Fish wheels for recovering marked and unmarked fish will be operated on both river banks near the village of Rampart. Local operators will be contracted to run the fish wheels. Data collected at the recovery wheels will include daily totals of marked and unmarked fish, and identification numbers of the tags recovered. In addition to information from the recovery wheels, information will also be solicited for tagged fish caught by commercial, aboriginal, and subsistence fishers, including: 1) tag number; 2) date, time and area caught; and 3) general condition of the fish.

5. Sex and body length data from a representative number of fish will be collected at both the capture and recovery sites. Hard tissues (type to be determined) for age analysis and DNA tissue samples will also be collected from radio-tagged fish.

6. Remote tracking stations placed at strategic sites throughout the drainage will track the upriver movements of radio-tagged fish. Telemetry data collected by the stations will be transmitted via satellite to a receiving station, accessed daily by telephone modem, and downloaded into a computerized database for in-season analysis and dissemination to other agencies (Figure 3).

7. Based on the station reports, aerial surveys (fixed-wing and/or helicopter) may be conducted to determine the final location of radio-tagged fish and identify important spawning areas. GSI tissues can be collected from populations not previously sampled. Scales from tagged carcasses can be matched with scales collected at Rampart Rapids to determine the extent of scale resorption during migration to spawning areas.

8. Based on the study results, additional tracking station sites may be identified for subsequent station placement in the drainage if better information on spawner distribution and timing is needed.

Subsequent Years. Study design and objectives for subsequent years of the program will be based on the results of the previous years' work.

Data Analysis

Mark-recapture. Assumptions and methods for estimating abundance using mark-recapture techniques will be evaluated and refined during the first year.

Radio-tagging. Stock composition estimates will be computed by weighting the number of tagged fish located in spawning areas with abundance data for the corresponding week of tagging. Since fixed numbers of fish will be radio-tagged during weekly periods, this approach adjusts for the varying proportion of fish passing the capture site during the tagging period. Sampling error for the stock composition estimates will be calculated using the bootstrap method (Efron 1982).

Public Involvement

To increase project success, local support and direct involvement by local residents is desirable. Often the individuals who are directly impacted by fishery management decisions have limited involvement in the process. Telemetry and mass tagging programs provide opportunities for participation by local residents, thereby providing socio-economic benefits. Local residents could be involved in various program activities, including salmon capture and tagging, installation of project equipment, and tag recovery efforts (for example, weir operations). The satellite-linked technology associated with the remote tracking stations used in telemetry studies provides a means for interested parties to monitor project progress via a computer-modem up-link. Incorporating aspects of the program in school district curricula or through village council meetings could foster a greater sense of involvement and appreciation of project goals. Additionally, local involvement in a such multi-year program promotes greater awareness of fishery management techniques and the rationale for management decisions.

Literature Cited

Anonymous. 1985. Report on the status of salmon stocks, fisheries, and management programs in the Yukon River. Unpublished report prepared by the scientific working group for the delegations from United States and Canada concerning the Yukon River, April 23-24, 1985. Anchorage.

Efron, B. 1982. The jackknife, the bootstrap and other resampling plans. Society for Industrial and Applied Mathematics. Philadelphia. 92 pp.

Eiler, J. H. 1995. A remote satellite-linked tracking system for studying Pacific salmon with radio telemetry. Transactions of the American Fisheries Society 124:184-193.

JTC. 1996. Capabilities and potential applications of adult salmon tagging methods in the Yukon River Basin. Discussion paper for the U.S./Canada Yukon River Panel prepared by the Yukon River Joint Technical Committee. 19 pp.

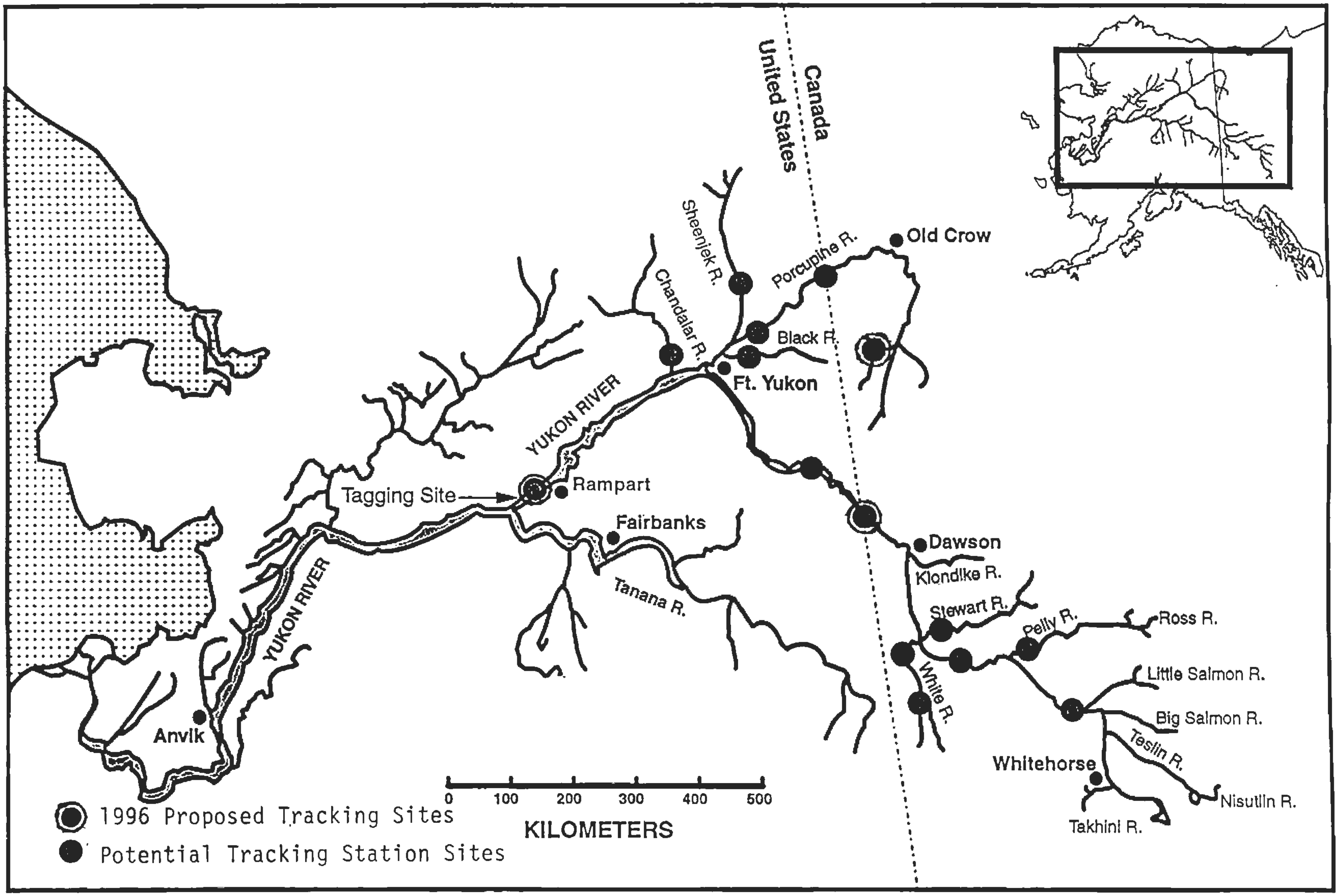

Figure 1. Map of the Yukon River drainage showing the proposed locations of the tagging site and the remote tracking stations.

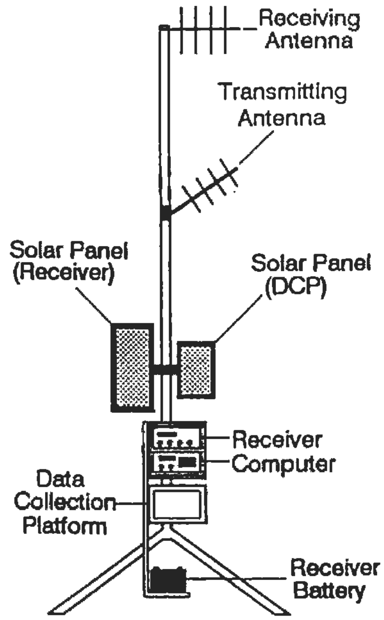

Figure 2. Remote tracking station used to detect and record salmon tagged with radio transmitters

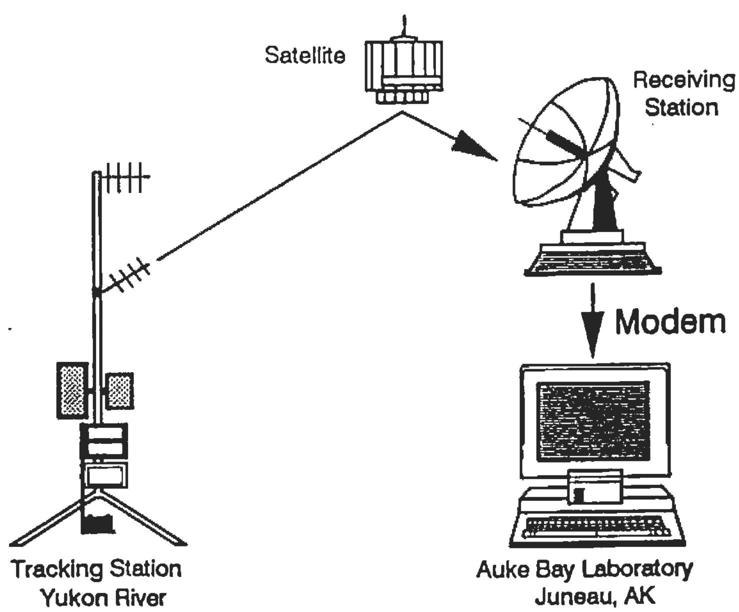

Figure 3. Data transfer system used to retrieve information collected by remote tracking stations

ATTACHMENT II

Yukon River Salmon Restoration and Enhancement Fund
Instructions For Submitting Funding Requests

Requests for funding from the Yukon River Salmon Restoration and Enhancement Fund administered by the Yukon River Panel consist of two components, **Part A** (Funding Summary Request Form), and **Part B** (Project Work Plan). Part A, and an example of the information required in, and the format for, Part B, are attached to these instructions. Both Part A and Part B must be fully completed and sent to one of the following addresses by the deadline identified in the cover letter from the Panel co-chairs:

Ms. Mary Pete
U.S. Co-Chair, Yukon River Panel
Alaska Department of Fish and Game
Subsistence Division
P.O. Box 25526
Juneau, AK 99802-5526

Phone (907) 465-4147
Fax (907) 465-2066

Mr. Burt Hunt
Canada Co-Chair, Yukon River Panel
Fisheries and Oceans Canada
200 Range Road
Whitehorse, Yukon Territory Y1A 3V1

Phone (403) 393-6717
Fax (403) 393-6738

The priorities for implementing projects with the Fund will be in this order: (a) restoring habitat and wild stocks; (b) enhancing habitat; and (c) enhancing wild stocks. The Yukon River Joint Technical Committee (JTC) will initially evaluate proposals based upon their technical merit. The technical merit evaluation is to include, when appropriate, evaluation of the ecological and genetic risks, socioeconomic impacts, and to identify alternative actions (including, but not restricted to, fishery management actions). The proposal and the JTC evaluation will then be released for public review and comment. The proposal, along with the JTC evaluation and public comments, will then be forwarded to the Panel for review and funding consideration.

Part A (Funding Summary Request Form) is a single page describing the proposed activity and is designed to provide an overview of the information fundamental to the request. The following instructions are intended as an aid for completing each section of Part A.

Name and Address. Complete this section in detail so that you can be contacted concerning your funding request. If an agency or organization is making the request, please provide the name of an appropriate individual to contact regarding the request, as well as the name of the agency or organization.

Project Name and Location. Provide an accurate and descriptive name for the proposed project, and indicate the river or area where the project is to occur.

Objectives Summary. Provide a brief summary of the objectives and expected benefits of the proposal.

Proposal Summary. Provide a brief summary of the activity to be funded. Include an indication of the stock(s) of salmon of interest, and the methods by which the objectives are to be accomplished.

Schedule and Costs. Indicate the year work is to begin, and if applicable, how many years the work will be conducted. Include critical timeframes for project activities. Examples would be; the requirement for open water, frozen ground for access, or calendar concerns for funding by other sources. Similarly, indicate the cost of the proposed project in the first year, as well as the total projected cost of the project over its intended duration. Please clearly identify total cost of the project (including all sources) and the R&E Fund amount being applied for.

Part A
Yukon River Salmon Restoration and Enhancement Fund
Funding Summary Request Form

Contact Name:____
Organization:____
Phone Number:____________ Fax Number:____________________
Mailing Address:____

Project Name:____

Project Location:____

Objectives Summary:____

Proposal Summary:____

Start Date:____________ Anticipated Project Duration (years):______

YEAR	R&E FUNDS REQUESTED	OTHER SOURCES OF FUNDS	
	Amount	Amount	Specify Source Name
1			
2			
etc.	use additional page if necessary		

A Project Work Plan (Part B) must accompany this form to receive consideration.

DO NOT WRITE IN THIS SPACE

Request Number: ____________ Date Received: ____________

Revised: 05/02/96

Part B
Yukon River Salmon Restoration and Enhancement Fund
Project Work Plan
Format and Instructions

Request Number: _Leave Blank_

Title: Provide a brief descriptive title for the project. The title should be identical to the title given on Part A (Funding Summary Request Form).

Objectives: State the specific objectives of the project beginning with the highest priority. Specifically state what data needs, fish or habitat problem, etc. your project will address. The objectives should specifically relate to the priorities of the Yukon River Salmon Restoration and Enhancement Fund. The priorities for funding projects will be in this order: (a) restoring habitat and wild stocks; (b) enhancing habitat; and (c) enhancing wild stocks.

Introduction: The Introduction should clearly present the rationale for funding the proposed project and highlight the expected benefits. Supply all existing information pertinent to the project proposal, including findings from previous work and local or traditional knowledge. Provide references for this information where possible. For ongoing projects, annual reports from earlier stages of the project must be cited. Photographs of project location or activities should be included if available.

Study Area: Describe the area in which the project is to be conducted and the salmon stocks of interest. Attach a 1:250,000 scale map with the location(s) of the proposed work area clearly marked. Identify on the map the location of potential conflicts relating to, but not limited to; human development, resident or migratory wildlife, access concerns, easement corridors, and land status.

Licenses and Permits: Describe license and permit applications which will be required, the probable timeframe for receipt, and a realistic assessment of being approved or denied. These may include land use, water, collection, and/or research permits or licenses.

Methods: Describe the methods to be used in the project. All methods should support the stated objectives. Include, if appropriate, descriptions of equipment to be used, data collection procedures or other field activities, statistical methods by which data will be analyzed, and expected products. The Methods section may be divided into subheadings that represent different phases of the project.

Personnel: This section should describe who will be involved in the project. If applicable, the number and size of field crews, and the number of project leaders and other supervisory personnel are to be listed. The names and credentials of project leaders and other supervisory staff should be included. The role of government, other organizations, public interest groups, private sector consultants, or technical staff of organizations should be described.

Schedules: A schedule for all activities should be provided in summary form, including projected dates of field activities, analyses, and any other primary component of the project. Whenever appropriate, the individual responsible for each component should be listed. Funded proposal applicants will be required to submit, at minimum, an annual report. Other reporting requirements (fiscal or technical) may be stipulated by the Panel as a condition of funding.

Proposed Budget: Funds requested should be provided for the following categories:

I. Personnel costs, including benefits.

II. Operating Costs:
   1. Administration (financial record keeping, communications, photo-copying, office supplies, computing supplies, etc.).
   2. Travel (commercial, charter, per diem, mileage, etc.).
   3. Materials, Supplies, and Maintenance (fuel, groceries, sampling and camp supplies, etc.).

III. Major Equipment Items (The proposed disposition of major equipment items purchased by R&E funds upon project completion, if not back to the funding source, should be indicated).

IV. Other (Please include indirect costs, if applicable).

Other Sources of Funding, Assistance, and/or Information: If appropriate, use this section to detail resources necessary to the success of the project, but that are not paid for by the R&E Fund. This includes, but is not limited to, vessel time, use of volunteers or personnel not funded by the project, data collection activities by other projects, and personal equity to be invested in the project. Indicate on a separate sheet by similar budget categories as those previously listed, the project costs being funded outside of the R&E Fund.

Literature Cited: If appropriate, include a complete list of all publications cited in the work plan using a standard format.

Consultation and Public Support: Applicants are encouraged to coordinate with any government, public, or other parties to solicit support for the proposed project. All such information should be held by the applicant until the proposal becomes available for public comment.

ATTACHMENT III

DRAFT YUKON RIVER
RESTORATION AND ENHANCEMENT FUND
PROPOSAL REVIEW FORM

Proposal #____________ Title:____

Fish Stock or Sub-basin: ____________________

Part 1. Interim Agreement Criteria

This proposal is for ______1) restoring habitat or wild stocks
______2) enhancing habitat, or
______3) enhancing wild stocks
______4) other, specify __________________________

1. Sub-basin priority (circle one): low medium high
2. Is the recommended stock level consistent with natural habitat capacity? (circle one) yes / no / not applicable
3. Is this proposal consistent with existing Yukon River basin wide stock rebuilding and restoration salmon plan? (circle one) yes / no / not applicable

Part 2. Risks

The following should be evaluated with respect to applicability, low, medium or high risk. This assessment is general in nature and does not constitute a regulatory review. (circle one)

- Ecological risks n/a low medium high
  Comments:

- Disease risks n/a low medium high
  Comments:

- Genetic risks n/a low medium high
  Comments:

Part 3. Technical Review

Rate the following on scale of 1 - 5 with 1 being poor and 5 being excellent.

1. How well do the proposal objectives meet the R&E Fund objectives and criteria?

   1 2 3 4 5

   Comments

2. What is the ability and likelihood of the applicant in achieving the objectives as stated in the proposal?

   1 2 3 4 5

   Comments

3. Do the objectives of this proposal compliment other previous, existing or proposed projects?

   1 2 3 4 5

   Comments

4. Is the methodology sound (methodology includes statistical design, where applicable)?

   1 2 3 4 5

   Comments

Part 4. Impacts

Rate the following to reflect the potential impacts of the project, with -5 being the greatest negative impact, and +5 being the greatest positive impact.

1. Does the proposal impact existing wild salmon stocks and habitats?

   -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

   Comments

2. Are there fishery management impacts associated with this proposal?

   -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5

   Comments

Part 5. Other information

Although this information is not a component of the technical review, the information may be used by the Yukon River Panel members in their deliberations.

- Potential ability of applicant to conduct the project

- Potential positive and negative socioeconomic impacts

- Potential alternative actions (including, but not limited to, fishery management actions)

- Educational or public involvement component

- Additional technical referrals required. If so, list.