INVENTORY OF CHINOOK SALMON HABITAT IN THE TINCUP CREEK DRAINAGE

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The Yukon River Salmon Restoration & Enhancement Fund

Prepared for:

The Yukon River Panel

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Kluane First Nation

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ABSTRACT

Investigations of chinook salmon utilization in Tincup and Nuntaea Creeks were conducted between September 2 and September 6, 2001. A total of 39 adult chinook salmon was observed in the core spawning area of Tincup Creek on September 2. Spawning activity appeared to be at its peak as most of the adults were observed in pairs or groups on redds. By September 6, most of these salmon had died and only nine remained on redds. Although one adult chinook was observed in Tincup Lake near the outlet of Nuntaea Creek none were observed in the lower reaches of Nuntaea Creek. A complete investigation of Nuntaea Creek was not conducted at this time due to time constraints. Hence, the destination of chinook salmon observed in the south end of Tincup Lake remains unknown. A total of 10 juvenile chinook salmon was captured in seven minnow traps set overnight in the first reach of Tincup Creek downstream of Tincup Lake. No juvenile chinook salmon were captured in seven minnow traps set overnight in Nuntaea Creek. Incidental catches in Nuntaea Creek included slimy sculpins and one juvenile lake trout. Biological and physical characteristics including: benthic composition, water quality and velocity and discharge were recorded in reach 1 of Tincup Creek and reach 2 of Nuntaea Creek and results compared with data collected in previous years. An important component of this study was to provide experience for KFN members through employment in field investigations.

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INTRODUCTION

A decline in chinook salmon populations has been observed throughout the Yukon River Basin in recent times as a result of increased fishing pressure in the ocean and in the Yukon River. Further declines in the number of chinook salmon returning to spawning grounds have been observed since 1998; in fact, some of the lowest runs have been recorded since then, despite predictions of average to above average runs based on parent year escapements. It has been speculated that changes in ocean temperature regimes which occurred in 1998 have affected the ocean ecosystem and hence the ocean survival of these year classes of salmon.

Corresponding declines in chinook spawning populations have been observed in the White River sub-basin of the Yukon River. Tincup Creek, a major chinook spawning creek in the White River sub-basin, once supported a chinook population large enough to sustain a native subsistence fishery (Horler, 2000). However, the number of salmon presently returning is so low that any significant subsistence fishery would seriously affect the productivity of the Tincup Creek stock.

In light of declining chinook salmon returns, the Kluane First Nation (KFN) and other agencies have conducted studies with the objective of conserving and restoring salmon populations within the White River sub-basin. Studies conducted since 1995 have included enumeration surveys of chinook spawners and habitat assessments to provide baseline data which can be used in the development of an overall plan to conserve and restore salmon. This report presents the findings of investigations of Tincup Creek in 2001 including the run size and physical and biological characteristics of the habitat which have been collected since 1998.

An additional component of this year's study was to investigate the possible usage of Nuntaea Creek by chinook salmon. In previous years, adult chinook have been sited at the south end of Tincup Lake near the outlet of Nuntaea Creek by KFN elders and the outfitter in this area. The destination of these chinook has not been determined. Preliminary investigations of Nuntaea Creek in 1998 indicated limited chinook salmon habitat (WMEC, 1998), however, no adult chinook salmon were observed utilizing this creek at this time and no juvenile chinook were captured in minnow traps. The extent of investigations was very limited, however, leaving the question of whether chinook salmon utilize this creek unanswered. Investigations were continued this year to determine if chinook salmon utilize Nuntaea Creek.

An important component of this and previous investigations has been to provide experience for KFN members through employment in field investigations. A traditional camp located at the outlet of Tincup Lake and its proximity to the major spawning area of Tincup Creek has provided an ideal location for studying a salmon population and its environment.

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STUDY AREA

Tincup Creek flows for about 20 km in a generally westerly direction from its headwaters at Tincup Lake (elevation 819 m) to its confluence with the Kluane River (elevation 680 m). The highest point in the drainage basin is 2,165 m. Tincup Creek and its tributaries drain an area of approximately 510 km^2 predominantly from the Ruby Ranges. Major tributaries of Tincup Creek include Nuntaea Creek, flowing from the southeast into Tincup Lake, and Swanson Creek, flowing from the north into Tincup Creek, less than 1 km upstream from the Tincup Creek-Kluane River confluence. The major lakes in the drainage basin include Tincup Lake and Dogpack Lake (Fig. 1). The drainage, which is inaccessible by road, has remained in a relative pristine state. The nearest community is Burwash Landing, located approximately 50 kilometers south of Tincup Lake.

The first reach of Tincup Creek is a known spawning location for chinook salmon and has been used for generations as a traditional fishing area by KFN members. A cabin located on the north bank of the creek approximately 2 kms downstream of Tincup Lake was once used while fishing the chinook run. The reach is characterised by wide run/glides and occasional riffles with a wetted width ranging from between 10 and 30 meters. Substrates are primarily gravel/cobble with occasional boulders. Stream banks are low and sedge and grass meadows are common along the upper section of the reach. The adjacent forest is mixed black and white spruce. Most spawning occurs in a gravel riffle area approximately 1.5 km downstream of Tincup Lake. The area investigated during this study is shown in fig. 2.

Nuntaea Creek is a small, clear water tributary draining mountains of the Ruby Range and Kluane Plateau at the southeast end of Tincup Lake. The watershed drains a number of small lakes, the largest being Dogpack lake, entering the creek approximately 10 kms upstream of the outlet. The creek below Dogpack Lake flows swiftly over cobbles and boulders through a relatively straight confined channel before joining a lake fed drainage from the southwest approximately 5 km downstream. The next 3.4 km of the stream meanders through the Tincup Lake valley. The section of stream is characterised by gravel/cobble substrates and riffle/run habitats. Stream banks are abrupt and rise to 2 meters. The lower 625 meters of the creek is a wide slow glide averaging 17 meters in width. Substrates are primarily sand/mud with a few areas of embedded gravel/cobble. Open sedge meadows line the banks in the vicinity of the creek outlet with a gradual transition from open white spruce, in a matrix of willow, dwarf birch and ericaceous shrubs, to spruce forest. The study area includes the lower reaches shown in fig. 3.

METHODS:

Fisheries investigations and habitat assessments were conducted by Kluane First Nation members, Gerald Dickson, Kirk Johnson, Edward Johnson, Billy Johnson, Shane Johnson, Dwayne Johnson, Aaron Doris and fisheries consultant, Jane Wilson. Personnel were flown in a 185 Cessna owned by Sifton Air of Haines Junction. A camp was set up at the outlet of Tincup Lake and sites were accessed by foot along a trail which follows the right bank of

Tincup Creek. The south end of Tincup Lake was accessed by boat and motor. Sites along Nuntaea Creek were then accessed by foot.

Fisheries assessments

Fisheries assessments were undertaken through the use of various methods including: trapping, seining and visually counting above water from shore.

Gee-type minnow traps with 1/4" mesh were placed in a variety of habitat types to determine the presence of juvenile chinook salmon (jcs). Traps were baited with a walnut-sized portion of Yukon River origin salmon roe suspended in a perforated plastic sandwich bag and set overnight for a minimum 12 hour period; up to a maximum of 24 hours whenever possible.

A seine net (7 x 1.5 meter, 1/8" mesh) was used to detect other species of fish present. Seining was restricted to depths of less than one meter in areas where a suitable landing site was available.

All juvenile fish captured were identified, enumerated and released. Jcs captured in minnow traps were anaesthetized with a small portion of an "Alka Seltzer' tablet, measured for fork length to the nearest millimeter, weighed (using a digital scale accurate to ± 0.1) and released after full recovery from the anaesthetic.

A visual count of adult chinook salmon in the spawning area was conducted on two separate occasions. The first count was made from the right bank and the second, four days later with two people counting on either side of the creek.

Analysis of fish captures

The results of the trapping program were expressed as the number of fish trapped per number of hours the trap was set (CPUE). Biological data including: mean length, mean weight and mean condition factor, was determined for jcs captured. Condition factor (K) was calculated for salmon fry using the formula: $K = \text{weight(grams)} \times 100/[\text{length(cm)}]^3$. The condition factor is used as an indicator of the general health and condition of salmonids.

Benthic Sampling

Benthic invertebrate samples were collected using a 30 cm D-frame invertebrate kick net sampler with a 363 micron mesh. Invertebrates were dislodged from the substrate at three locations for a total sample area of one square metre. Dislodged invertebrates and debris collected in the net held downstream of the disturbed substrate were then transferred to a one litre nalgene bottle and preserved in a 10% formalin solution.

A benthic sample collected in the first reach of Tincup Creek was observed in camp to familiarize trainees with methods used to sort and identify invertebrates. This sample along with a sample from Nuntaea Creek was preserved and sent to Laberge Environmental Services in Whitehorse to be sorted, identified and enumerated.

Water Quality

Basic water quality components including: temperature, pH, dissolved oxygen and conductivity were measured in-situ using a multi-parameter probe (Horiba water quality checker model U-10), calibrated prior to field operations. Velocity and discharge was determined using the floating object method in reach 1 of Tincup Creek, in approximately the same area measured in previous years (1998, 1999) and in reach 2 of Nuntaea Creek in the same area measured in 1998 (Connor,Sparling 1998). Water samples were taken from each creek for analysis of nutrients, anions and metals. Samples were collected in clean new plastic bottles at a point upstream of any disturbance associated with other site investigations. Bottles were rinsed several times with sample waters, then carefully filled to prevent contamination from external sources. Unfortunately, results of water samples were not made available due to delays in air traffic cargo the week following field studies preventing the sample from being sent to Norwest Laboratories in Surrey, B. C. for analysis.

RESULTS:

Juvenile Chinook Salmon (jcs)

Tincup Creek

A total of 10 jcs was captured in 7 minnow traps set overnight in reach 1 of Tincup Creek. The number of total trapping hours was 109.43, representing a catch per unit effort (CPUE) of 0.09. The average fork length of jcs captured was 76 mm and the average weight, 5.0 g. The condition factor (K), which is used as an indicator of the general health and condition of salmonids, averaged 1.13. Generally, a higher condition value is preferred to a lower value (Moodie, 1993) although no standards for comparison have yet been developed for the Yukon River system. A higher condition factor could mean greater over-wintering success. Slimy sculpins and juvenile burbot were captured incidentally in traps and in three seine sets at the outlet of Tincup Lake. Results of minnow trap catches since 1998 are presented in Appendix 1.

It is assumed that jcs captured were all young-of-year (fry emerged in 2000). Although no scale samples were taken for age determination of jcs captured, weight at length comparisons of fry in Croucher Creek in the Upper Yukon River system (Moodie, 1993) indicate the general length range of young-of-year (0+) jcs to be between 40 - 90 mm.

Nuntaea Creek

No jcs were captured in Nuntaea Creek in the seven traps set overnight in reaches 1 and 2. Incidental catches included slimy sculpins and one juvenile lake trout.

Adult chinook Salmon

During a ground survey on September 2 a total of 39 live adult chinook salmon was observed on spawning redds in reach 1. Spawning activity appeared to be at its peak as most salmon were observed on redds in groups or pairs. By September 6, spawning activity was nearing completion with only nine live chinook remaining. A total of 21 dead chinook salmon was observed at this time, many of which had been pulled into the bush, presumably by bears.

Although one adult chinook salmon was observed near the outlet of Nuntaea Creek, none were observed in the creek in the survey area between the outlet and a small unnamed headwater lake draining into Nuntaea Creek from the southwest. No observations were made above this area due to time constraints.

Water Quality

The water quality parameters measured in Tincup and Nuntaea Creeks indicate adequate water quality for freshwater aquatic life. Water temperatures in Nuntaea Creek were significantly cooler than Tincup Creek. A summary of water quality parameters in Tincup and Nuntaea Creeks is presented in Table 2.

Stream physical characteristics measured in Tincup Creek since 1998 show water levels and flows comparable to 1999 and 2001. The velocity of flow in Nuntaea Creek was comparable to velocities recorded in Tincup Creek. The physical characteristics in Reach 1 of Tincup Creek between 1998 and 2001 are summarised in Table 1.

Benthic invertebrates

Analysis of the benthic samples collected indicate diverse and abundant invertebrate communities in Tincup and Nuntaea Creeks. Pollution intolerant insects including, Ephemeroptera (mayflies), Trichoptera (caddisflies) and Plecoptera (stoneflies), were well represented in the samples collected indicating good water quality (Table 3). The predominant community in Tincup Creek was comprised of Gastropods (snail). In Nuntaea Creek, Dipterans (true flies) predominated, mostly in the form of chironomid larvae (midges). These invertebrates form a valuable part of the diet of fish.

DISCUSSION

Tincup Creek

Slightly more jcs were captured in reach 1 this year than in the previous year. It has been speculated that the high water conditions last year may have enhanced spawning and incubation success at lake outlets by providing sufficient water during the summer/autumn spawning period and during the winter by allowing lake outlets to remain open throughout the winter (von Finster, unpublished).

Although jcs captured this year were smaller on average, their overall condition was better than those captured in 2000 as indicated by the condition factor (K). As a result of the high water conditions last year, it is possible that food energy reserves were expended on increasing the overall length of jcs to enable them to maneuver in the stronger flows. Consequently, these fish may have had fewer reserves to enable them to over-winter successfully.

The number of adult chinook salmon observed in the primary spawning area in Tincup Creek was nearly double the number observed last year. In 2000, a record low number of chinook was estimated to have reached spawning grounds throughout the upper Yukon River Basin (JTC, 2000). The return this year was again expected to be low. However, surveys of index areas in other creeks and rivers in the upper Yukon River Basin conducted by DFO in 2001 indicated higher chinook salmon returns than expected (JTC, 2001). It is likely that the closure of all commercial fisheries in the Yukon River Basin during the chinook migration this year allowed more chinook salmon to reach spawning grounds.

Benthic communities were more diverse and abundant than the previous year. The strong water flows during the time of sampling last year may have dislodged organisms from riffle areas where samples were collected to more protected areas (Burns, pers.comm). This year, water conditions were moderate and comparable to conditions in 1999.

Nuntaea Creek

Nuntaea Creek has been considered as a possible spawning destination of adult chinook salmon observed in Tincup Lake at the south end. This creek is the only tributary entering the lake of sufficient size to support a spawning population. Since lake outlets are recognized as one of the primary habitat types for spawning chinook salmon, it was speculated that spawning may occur downstream of the small lakes which drain into Nuntaea Creek. However, it remains uncertain whether fish observed in Tincup lake are utilizing Nuntaea Creek at this time as time constraints and an approaching storm, prevented investigation of the upper reaches and lake outlets.

The habitat in reach 2, approximately 625 meters upstream of Tincup Lake, appears suitable for spawning. Adequate flow and suitable spawning substrate was observed throughout a this reach. However, the cold water temperatures observed in the lower reaches of Nuntaea Creek may limit utilization by chinook salmon.

No juvenile chinook salmon were captured in Nuntaea Creek this year. A previous investigation (1998) of this creek failed to capture jcs as well. Nuntaea Creek is likely more suitable for species such as juvenile lake trout which are tolerant of cooler water.

SUMMARY/RECOMMENDATIONS:

Investigations of the biological and physical characteristics of Tincup Creek, in 2001, indicate that conditions are presently adequate for all life stages of chinook salmon. The Tincup Creek drainage area has remained essentially unaffected by human activity and has probably

changed very little from the time when ancestors of Kluane First Nation were in this area. Accounts by elders of KFN which tell of an abundance of chinook salmon in Tincup Creek at one time and the present available habitat indicate that Tincup Creek is currently capable of supporting a much higher population of chinook salmon. Careful consideration should be given to land use practices which could have potential deleterious effects on the habitat of this creek and rivers downstream. Recommendations for further study include the following:

1. Continue monitoring the chinook salmon return and the physical and biological characteristics of habitat in Tincup Creek to provide information which can be used to compare changes over time.

2. Continue to use Tincup Creek as a forum for fisheries training for KFN members

3. Initiate studies of the spawning to fry emergence stages of chinook salmon in Tincup Creek and specific spawning requirements for future restoration considerations.

4. Conduct an over-flight of lake outlets draining into Nuntaea Creek to look for potential spawning habitat and/or spawning activity.

Acknowledgments

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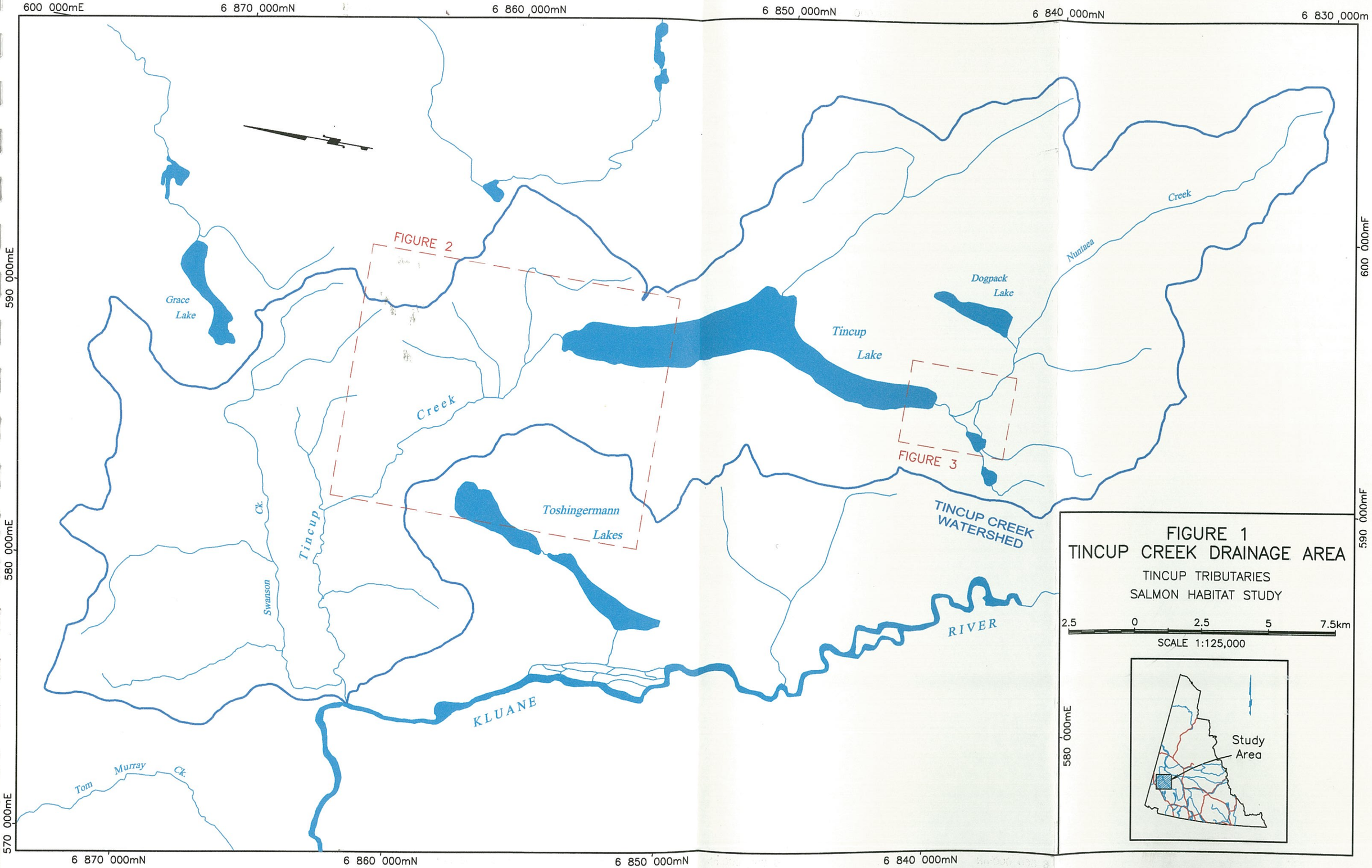
600 000mE
6 870 000mN
6 860 000mN
6 850 000mN
6 840 000mN
6 830 000m
590 000mE
580 000mE
570 000mE
600 000mF
590 000mF
580 000mE
FIGURE 2
FIGURE 3
Grace Lake
Tincup Lake
Dogpack Lake
Nuntaea Creek
Tincup Creek
Toshingermann Lakes
Swanson Ck.
Tom Murray Ck.
TINCUP CREEK WATERSHED
KLUANE RIVER
FIGURE 1
TINCUP CREEK DRAINAGE AREA
TINCUP TRIBUTARIES
SALMON HABITAT STUDY
2.5 0 2.5 5 7.5km
SCALE 1:125,000
Study Area

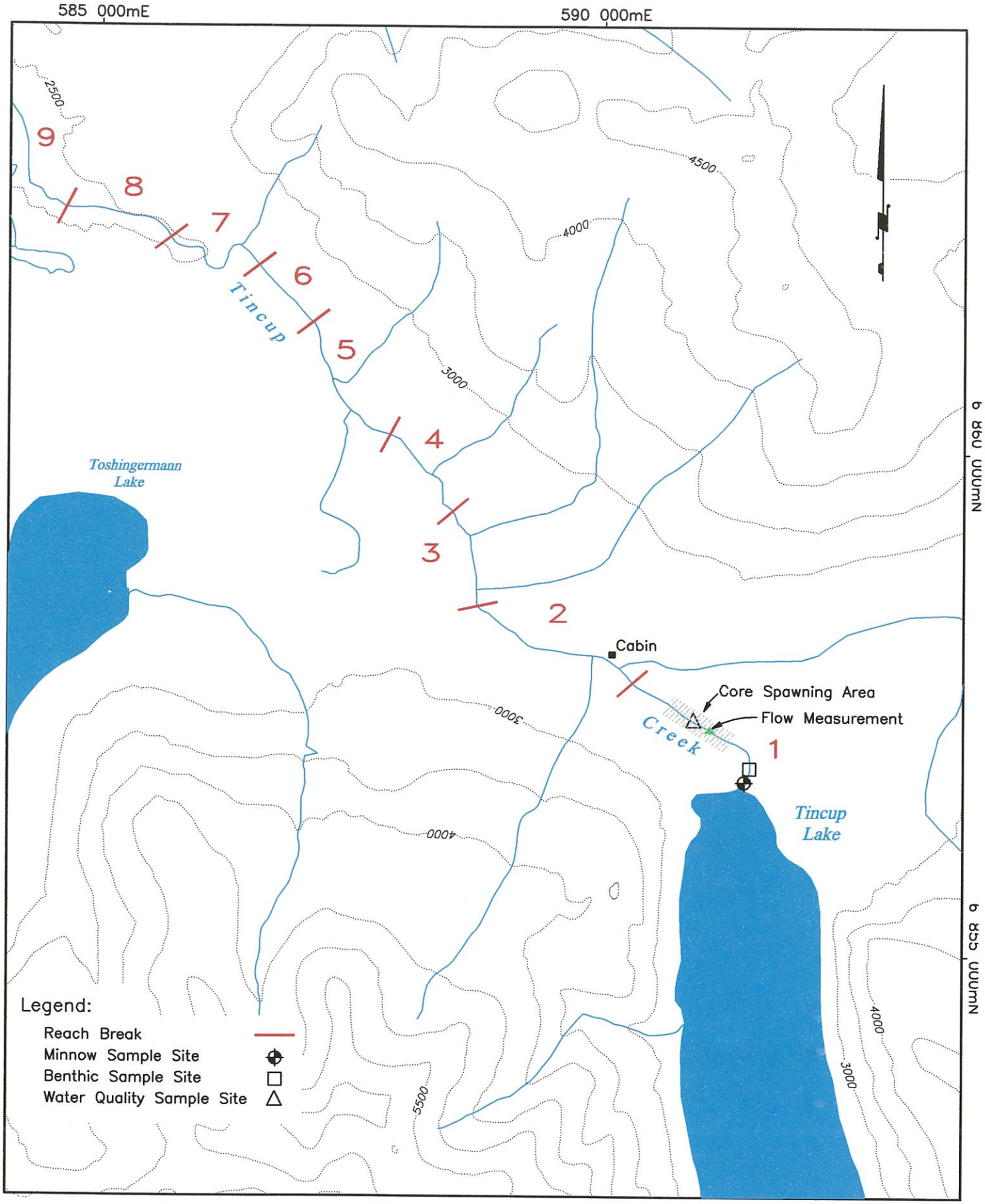

FIGURE 2 : UPPER REACHES OF TINCUP CREEK

SALMON HABITAT STUDY

1 0 1 2 3 km

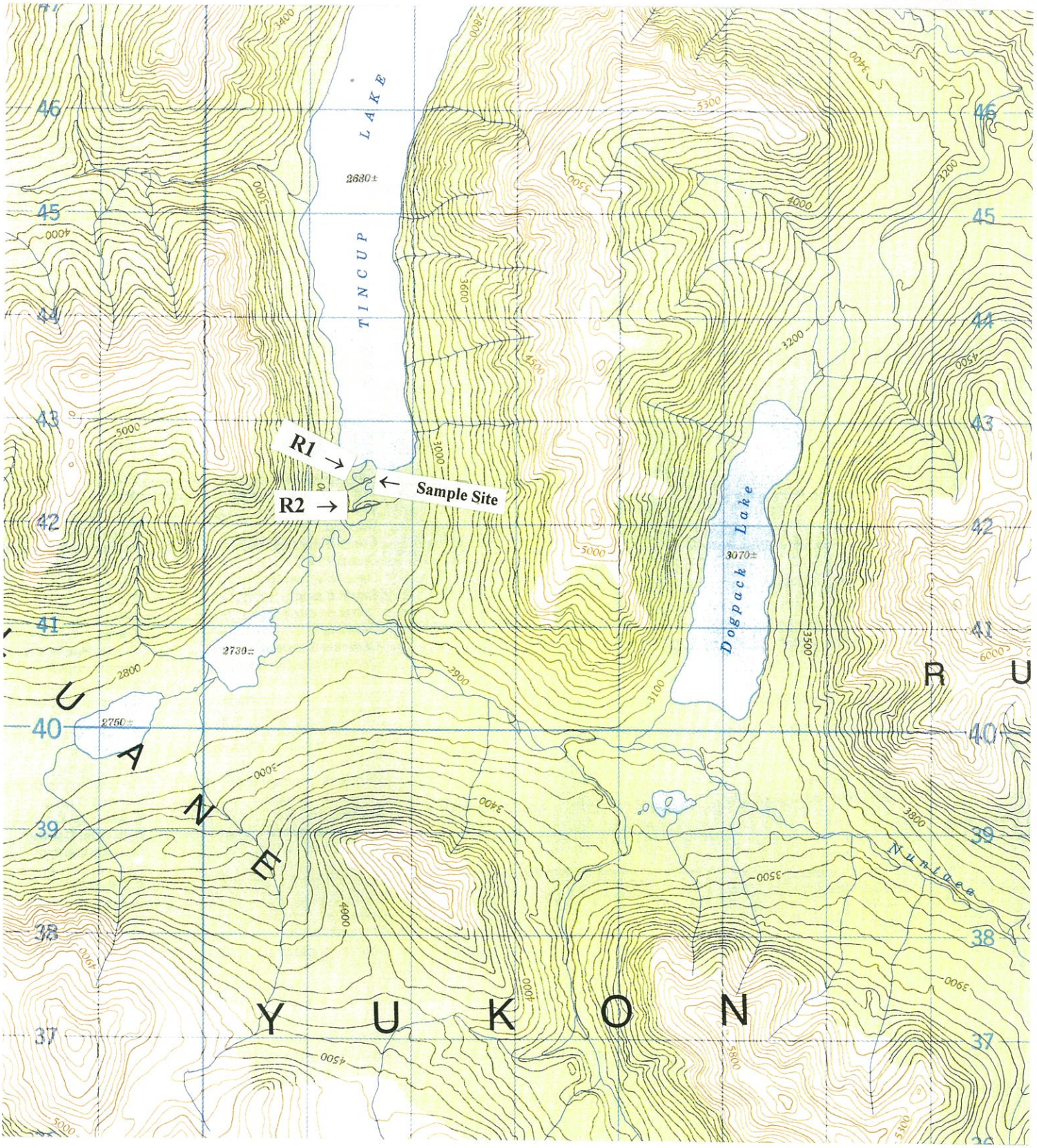

FIG 3. Nuntaea Creek Drainage Area

1 0 1 2 3 km

SCALE 1:50,000

Table 1. Comparison of Physical Characteristics of Tincup Creek in REACH 1, 1998*,1999*, 2000 and 2001 and REACH 2 of Nuntaea Creek, 2001.

Location	Date (d/m/yr)	Average Depth (m)	Wetted Width (m)	Average Velocity (m/sec)***	Discharge (m3/sec)
Tincup Creek**					
Reach 1*	24/08/**98**	0.61	13.4	0.07	0.43
Reach 1*	25/08/**99**	0.69	16.6	0.34	3.13
Reach 1	31/08/**00**	0.77	20.9	0.92	11.84
Reach 1	03/09/**01**	0.57	24.0	0.31	3.40
Nuntaea Creek ****					
Reach 2	04/09/**01**	0.60	10.0	0.41	1.96

* survey conducted by KFN and WMEC.

** measurements were taken each year at approximately the same location

*** velocity was determined each year using the floating object method

**** flow measurements were not determined in previous surveys

Table 2. Water Quality Parameters in Tincup and Nuntaea Creeks, 1998 - 2001.

Location	Date (d/m/yr)	Water Temp. (C)	Conductivity (uS/cm)	PH	Dissolved Oxygen (mg/l)	Turbidity
Tincup Ck						
Reach 1	03/09/**01**	12.3	230	8.1	12.8	Very clear
Reach 2*	25/08/**00**	11.1	236	8.1	13.7	Clear
Reach 1	25/08/**99**	14.5	261	8.4	10.8	
Reach 1	24/08/**98**	14.1	255	n/a	11.2	
Nuntaea Ck						
Reach 2	05/09/**01**	9.5	310	7.6	10.8	Clear
Reach 2	26/08/**98**	7.7	403	n/a	10.9	

* water quality parameters not measured in Reach 1.

Note: water quality parameters were measured in 1998 and 1999 by WMEC & KFN using a Multiline F/set-3 multimeter , and in 2000 and 2001 by Jane Wilson & KFN using A Horiba water quality checker model U-10 multi-parameter probe.

Table 3. Summary of Juvenile Chinook Salmon Catch Data in Tincup Creek (Reach 1) and Nuntaea Creek 1998 - 2001.

Location	Date	# of Traps	Total CH Captured	Total # Hrs Traps set	CPUE*	Ave. Length (mm)	Length Range (mm)	Ave. Weight (g)	Weight Range (mm)	Mean K
Tincup Ck.										
Reach 1	04/09/**01**	7	10	109.43	0.09	76	69 - 87	5.0	4.0 - 7.4	1.13
Reach 1	29/08/**00**	6	6	130.91	0.05	83	79 - 88	5.7	5.4 - 6.3	1.05
Reach 1	23/08/**99**	9	4	230.15	0.02	**	**	**	**	**
Reach 1	22/08/**98**	8	19	192.20	0.10	**	**	**	**	**
Nuntaea Ck.										
Reach 1	05/09/**01**	4	0	105.08	0.00	-	-	-	-	-
Reach 2	05/09/**01**	3	0	76.92	0.00	-	-	-	-	-
Reach 1	26/08/**98**	5	0	10.70	0.00	-	-	-	-	-
Reach 2	26/08/**98**	2	0	3.00	0.00	-	-	-	-	-

* Catch per unit of effort (CPUE) = # chinook captured per hour

** no measurements taken

Table 4. Comparison of Juvenile Chinook Salmon Catch Data, Tincup Creek, 1998 - 2001.

Site **	Date (d/m/yr)	# Traps	Total CH Captured	Total # Hrs Traps Set	CPUE** (#CH/hour)
Reach 1	23/08/**98** 24/08/**98**	6 3	1 3	148.80 81.35	0.01 0.04
Reach 1	22/08/**99**	8	19	192.20	0.10
Reach 1	29/08/**00**	6	6	130.91	0.05
Reach 1	04/09/**01**	7	10	109.43	0.09

Appendix 2. Juvenile Fish Collection Data, Tincup Creek, September 2001.

Date	Trap #	# Hours Set	Total CH Captured	Length CH (mm)	Weight CH (g)	Condition factor (K)	Other Species*	Trap Location
TINCUP Creek (Reach 1)								
4-Sep	1	15.67	0	-	-	-	BB (1)	Rt. Bank,grass,undercut bank, Shallow cobble substrate
4-Sep	2	15.67	0	-	-	-	BB (1)	Lt. of small island, LOD, instream vegetation, lge.cobble/boulder
4-Sep	3	15.67	1	80	6.1	1.19		Lt bank,between 3 boulders, grass/sedge, gravel substrate
4-Sep	4	15.67	0	-	-	-		Island channel, streambed with SOD,good water flow
4-Sep	5	15.50	1	74	4.2	1.04		Island channel,o.h spruce, lge cobble/boulders,good flow
4-Sep 4-Sep 4-Sep 4-Sep 4-Sep 4-Sep 4-Sep 4-Sep	6	15.67	8	69 76 74 87 72 74 78 75	4.3 4.9 4.7 7.4 4.0 4.0 5.3 4.9	1.31 1.12 1.16 1.12 1.07 0.99 1.12 1.16	SS (1)	side channel along Rt. Bank, good water flow, o.h. alder, silt/sand/cobble substrate, Instream vegetation, traps set near small island, shaded
4-Sep	7	15.58	0	-	-	-		Rt.Bank,under large root wad, cobble/gravel substrate,
NUNTAEA Creek								
5-Sep	1	24.00	0	-	-	-	SS (1)	Lt. Bank, deep pool, undercut bank, cobble substrate
5-Sep	2	26.42	0	-	-	-		Rt. bank, LOD, undercut bank, gravel/cobble substrate
5-Sep	3	26.50	0	-	-	-	SS (1)	Lt. bank, LOD, deep pool, cobble substrate
5-Sep	4	26.50	0	-	-	-		Lt. bank, undercut bank, gravel/mud substrate
5-Sep	5	26.33	0	-	-	-		Lt. bank, deep pool, mud substrate, o.h. spruce
5-Sep	6	26.25	0	-	-	-		Lt. bank, undercut bank,mud substr.
5-Sep	7	26.00	0	-	-	-	SS (1), LT (1)	Lt. Bank, mud/debris substrate, Overhanging willow

Appendix 3. **Benthic Invertebrates from the Tincup Creek Area, September, 2001.**

	Tincup Creek, Sept. 5, 2001			
Taxon	**Number**	**%**	**Number**	**%**
PHYLUM ARTHROPODA Class Insecta Insecta pupae	4	1.2	4	1.3
Order Diptera (trueflies) Diptera larvae Diptera adult Family Chironomidae	65	20.1	169	52.8
Family Tipulidae			1	0.3
Dicranota sp.			17	5.3
Order Plecoptera (stoneflies) Plecoptera nymph	1	0.3	14	4.4
Family Perlodidae			39	12.2
Order Trichoptera (caddisflies) Trichoptera larvae	11	3.4		
Family Limnephilidae	55	17.0	23	7.2
Order Ephemeroptera (mayflies) Ephemeroptera larvae			21	6.6
Family Ephemerellidae			17	5.3
Family Baetidae	1	0.3		
Class Arachnida Order Hydrachnidia	1	0.3		
PHYLUM ANNELIDA Class Oligochaeta			14	4.4
PHYLUM MOLLUSCA Class Pelecypoda			1	0.3
Family Sphaeriidae	28	8.7		
Class Gastropoda Family Planorbidae	121	37.5		
Family Lymnaeidae	14	4.3		
Radixauricularia sp.	11	3.4		
Family Physidae Aplexa sp.	10	3.1		
PHYLUM NEMATODA	1	0.3		
Abundance:	323	100.0	320	100.0
Diversity:	13		11	

Photo 1. Nuntaea Creek, Reach 2, Benthic sampling →
Left to right: *Gerald Dickson, Dwayne Johnson, Aaron Doris*

Photo 2. Nuntaea Creek, Reach 2
↓

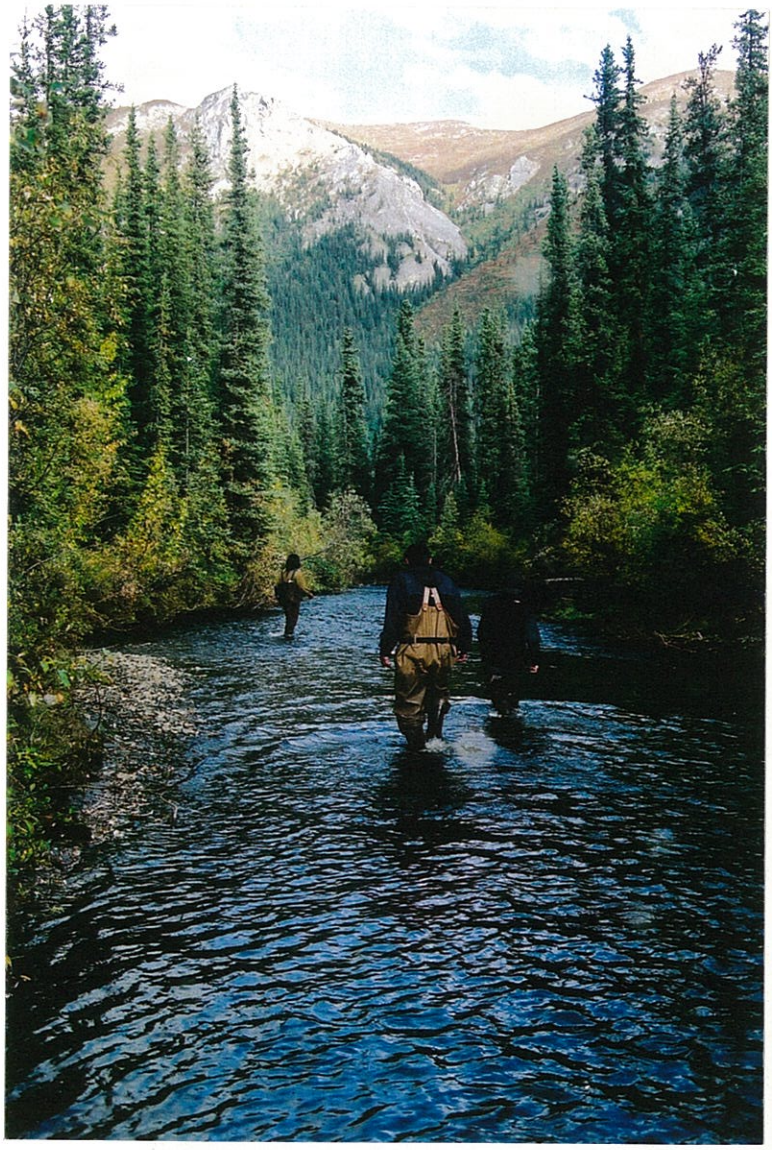

Photo 3. Benthic sampling, →
Aaron Doris and Dwayne Johnson

Photo 4.
← Setting minnow traps,
Aaron Doris, Dwayne Johnson

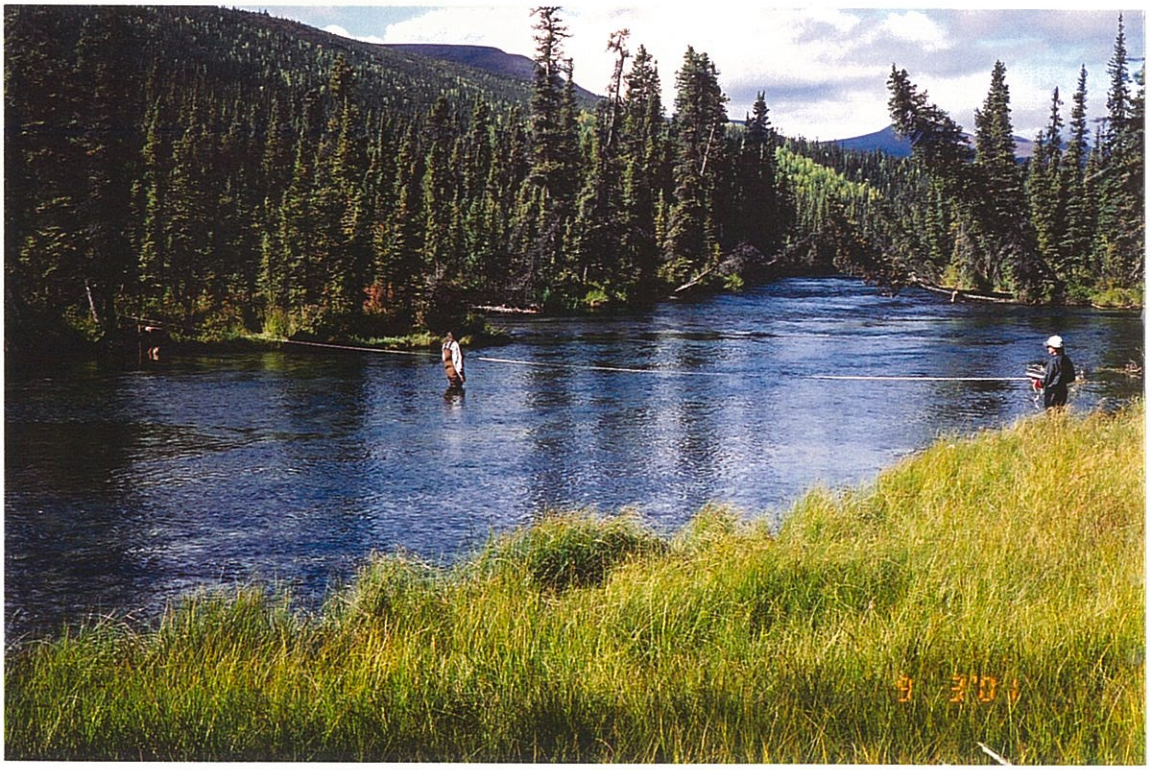

Photo 5. Measuring flow in Tincup Creek, upstream of core spawning area.