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Paul McLammer

BASELINE FISHERIES INVESTIGATIONS
1993 FOLLOW-UP RECONNAISSANCE

BUELL & ASSOCIATES, Inc.

Consulting Biologists

Aquatic Resource Management • Estuarine Ecology • Salmonid Enhancement • Bioengineering

TECHNICAL MEMORANDUM

To: Cominco Alaska Exploration
From: J. W. Buell, Ph.D.
Date: September 1994
Subject: Pebble Copper Prospect:

BASELINE FISHERIES INVESTIGATIONS 1993 FOLLOW-UP RECONNAISSANCE

INTRODUCTION

Baseline fisheries reconnaissance investigations related to Cominco Alaska Exploration's Pebble Copper prospect in the headwaters of the Koktuli River and Upper Talarik Creek watersheds were undertaken during the summer of 1991. The results of those investigations are reported in a Buell & Associates Technical Memorandum dated 04 October 1991. The 1991 fisheries reconnaissance raised certain questions related to the distribution of anadromous fish, especially sockeye and chinook salmon, in the Upper Talarik Creek and South Fork Koktuli watersheds, respectively. Specifically, these questions are:

- ▶ What are the distribution limits and relative abundance of adult sockeye salmon in the two headwater forks of Upper Talarik Creek?
- ▶ What is the limit of distribution of adult chinook salmon (and other salmon species) in the South Fork Koktuli River, and what factors contribute to this limit?

The first of these questions arises from the 1991 observation a large number of adult sockeye salmon spawning in a small lake tributary to the East Fork of Upper Talarik Creek, outside the distribution of this species indicated on the 1982 version of the ADFG Anadromous Stream Catalogue ("Iliamna D-6"); the distribution of this species in the West Fork of Upper Talarik Creek observed during the 1991 reconnaissance was virtually identical to that indicated in the Anadromous Stream Catalogue. Part of the purpose of the 1993 follow-up reconnaissance was to confirm the use of the small lake in the East Fork drainage by a lake-spawning population of sockeye salmon, and to confirm the distribution of stream-spawning sockeye salmon in the West Fork drainage.

The second of these questions is of particular interest, since the 1991 reconnaissance indicated the upstream limit of chinook and coho salmon to be much further downstream (about 9 mi along the valley bottom) than the 1984 update of the ADFG Anadromous Stream Catalogue ("Iliamna D-7"), which shows the distribution of these species to extend to within about 1 mile of Frying Pan Lake. The 1991 reconnaissance attributed the limiting factor for anadromous fish distribution to a very large beaver dam complex with impassable dams. It was reasoned in the 1991 Technical Memorandum summarizing the reconnaissance that the apparent discrepancy could be due either to the contemporary condition of the beaver dam complex, or annual hydrologic variation which allows access through the complex to within a mile of Frying Pan Lake in some years, but not in others. Part of the purpose of the 1993 follow-up reconnaissance was to confirm the distribution of adult anadromous fish in the South Fork Koktuli River and to gather additional information regarding possible physical migration barriers.

UPPER TALARIK CREEK OBSERVATIONS

Close aerial observation, with limited direct-observation ground truthing (no electrofishing) was conducted along the headwater reaches of Upper Talarik Creek and its tributaries on 30 July 1993. Adult sockeye salmon were observed spawning or "holding" in the main stem of Upper Talarik Creek below the confluence of the East Fork and the West Fork, especially in the lower reaches of larger tributaries, such as UT.310 (see Figure 1, reproduced from the 1991 Technical Memorandum). In the West Fork of Upper Talarik Creek, sockeye salmon were observed slightly further upstream than in 1991, to the confluence of UT.440. Only a few adult fish were observed upstream of the East Fork / West Fork confluence, however. Fewer adult sockeye salmon were observed in this reach in 1993 than in 1991.

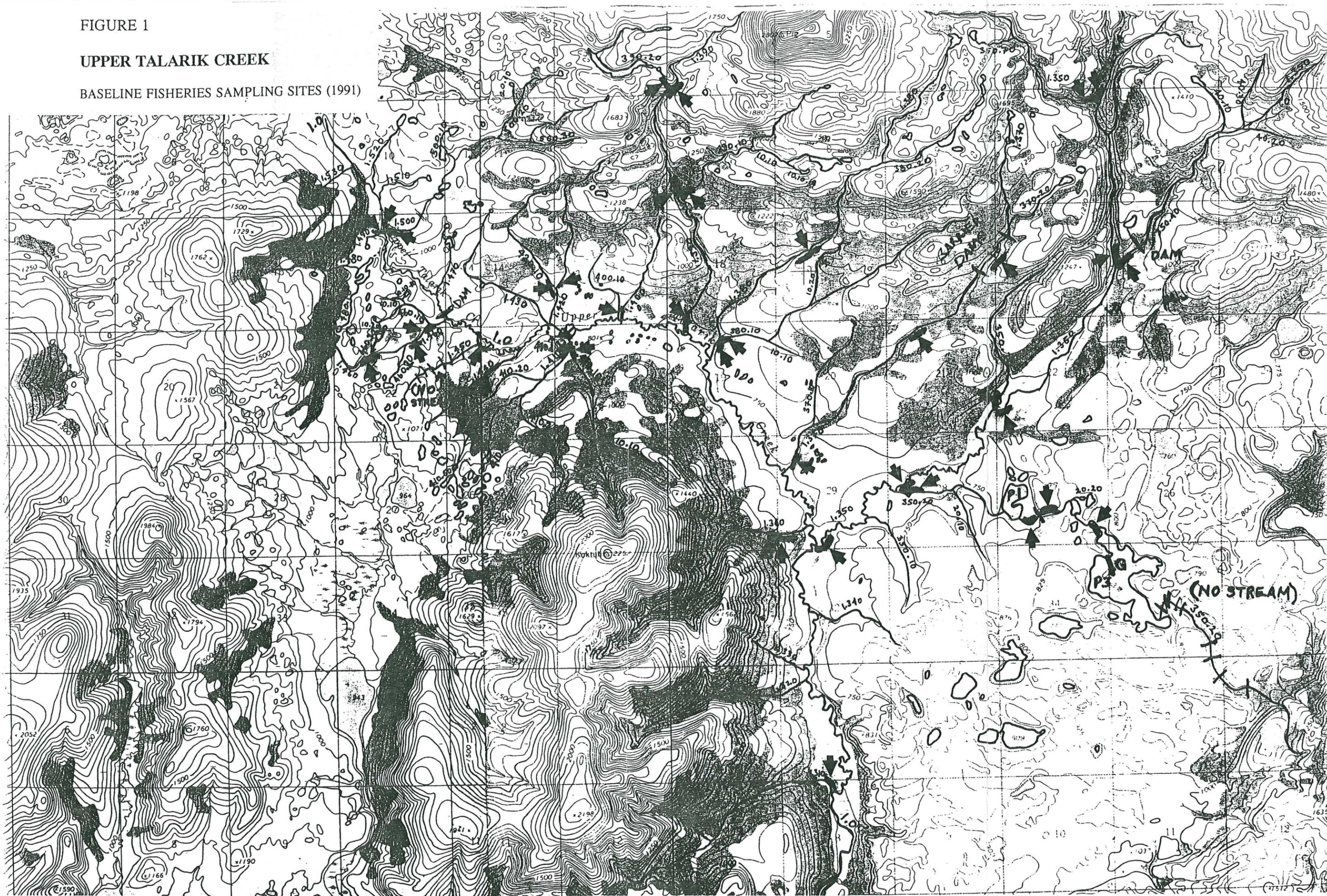
Only a few adult sockeye salmon were observed in the main stem of the East Fork of Upper Talarik Creek. No adult sockeye salmon were observed in the small lake in the East Fork drainage (UT.350.20.P1) where a large number of these fish were observed actively spawning in 1991. The reason for the absence of fish in this lake in 1993 is unclear, but could be related to the very dry spring and summer in this year. All of the outflow of the much larger UT.350.20.P3 and much of the outflow of UT.350.20.P1 was observed in 1991 to be derived from copious lake bottom springs. This is consistent with the observation of lake-spawning sockeye salmon in the lower of these two lakes in 1991 (a migration barrier between the lakes was documented). Although the outlet stream (UT.350.20) was observed to be flowing in 1993, the aquifer feeding the lake-bottom springs in UT.350.20.P1 may not have been recharged sufficiently to provide needed attraction cues to adult fish. Although other factors may be at work, no other plausible explanation has been forthcoming to date.

In general, fewer sockeye salmon were observed in the Upper Talarik Creek system in 1993 than in 1991. This observation could be due to the very dry spring and early summer, a weaker run due to factors outside the Upper Talarik Creek system (ocean conditions, harvest, etc.) or a

FIGURE 1

UPPER TALARIK CREEK

BASELINE FISHERIES SAMPLING SITES (1991)



combination of these and other factors. Determination of the reasons for a weaker run is outside the scope of these observations.

SOUTH FORK KOKTULI RIVER OBSERVATIONS

Close aerial observations

Close aerial observations undertaken along the South Fork Kuktuli River on 31 July 1993 revealed a profound effect of the very dry 1993 spring and summer. This was in sharp contrast to conditions observed in 1991. Between the outlet of Frying Pan Lake and the major tributary entering the South Fork Kuktuli River from the north about 9 valley miles downstream (SFK.190, about 4 air miles south of Kaskanak Peak, S-23; see Figure 2), major portions of the main stem of the river were found to be completely dry, and surface flow in the remainder of the river channel was found to be greatly reduced, compared to conditions observed in 1991. Active surface flow was observed from the outlet of Frying Pan Lake for a distance of about 3.8 miles, through most of the upper portion of the extensive beaver dam complex in the lower part of this reach. Except for beaver ponds themselves, the stream was easily wadeable and most riffles were ankle-deep.

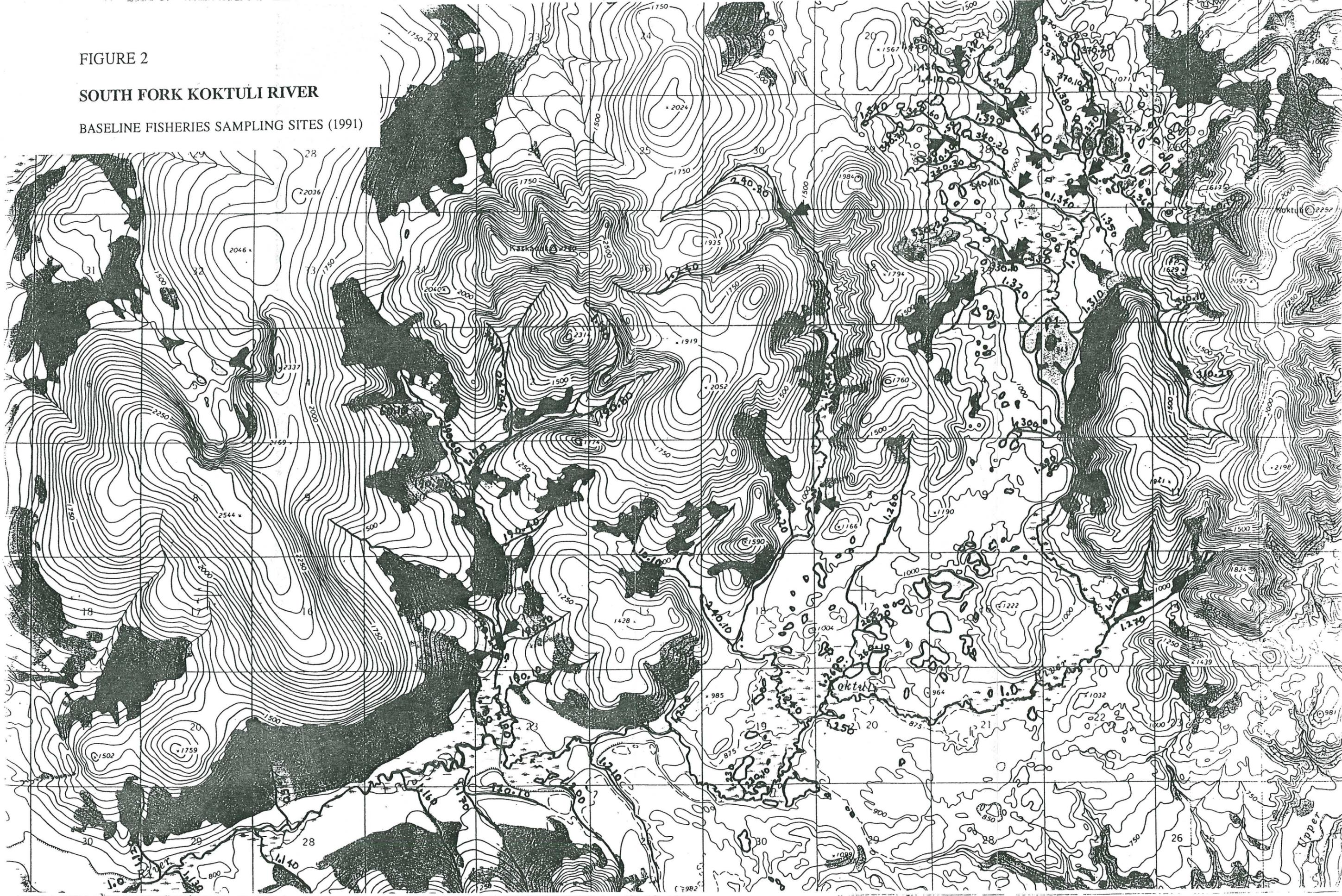
For the next 5.2 miles, to the confluence of SFK.190, the great majority of the river channel was completely dry, with a segment of continuous surface flow about 0.7 mi in length downstream of SFK.230 and a few short segments containing isolated pools and some intermittent flow. The wet, dry and intermittent reaches are shown on the expanded view of this portion of the watershed in Figure 3. These conditions were obviously brought about by greatly reduced precipitation and shallow aquifer recharge, allowing the entire flow of the South Fork Kuktuli River to subside into the loose morainal deposits which comprise the valley floor. Once downstream of the upper beaver complex, continuous surface flow only occurred immediately downstream of significant tributary streams, and then only for short distances (a few hundred meters). Naturally, these conditions produced a complete block to upstream migration of adult anadromous fish, as well as barriers to within-stream movement of resident and rearing anadromous fish.

Because of the greatly reduced stream flow, even in "wet" reaches, instream cover for fish was very limited. Visibility from the air was excellent. Fish were easily "spooked" by the helicopter, but usually could find no refuge. Both adult chinook and adult sockeye salmon were observed in the South Fork Kuktuli River immediately downstream of the lowest dry reach, near the confluence of SFK.190. No adult anadromous fish were observed upstream of this point. This is in close correspondence with the upstream limit of adult anadromous fish distribution observed in 1991. Fewer fish were seen than in 1991, although the difference was not large. Representatives of other species, some relatively large, were seen from the air in isolated pools and intermittent reaches. These fish turned out to be primarily adult grayling and a few adult whitefish (humpback) and suckers (longnose) (see below).

FIGURE 2

SOUTH FORK KOKTULI RIVER

BASELINE FISHERIES SAMPLING SITES (1991)



Electrofishing and direct ground observations

Semiquantitative fish sampling using a Smith Root model XI-A backpack electrofisher was conducted at four sites in the main stem of the South Fork Kaktuli River between the outlet of Frying Pan Lake and the large beaver pond complex downstream of SFK.270, the only significant tributary in that reach (SW 1/4, S-15), and at one site in that tributary. Approximate locations of these sites are shown on Figure 3. A minimum effort consisted of a continuous segment at least 100 ft in length, with some "spot" sampling to confirm presence of fish near cover or in deeper pools. As indicated above, stream flow in 1993 was greatly reduced compared to 1991, and stream conditions were ideally suited to sampling with a backpack electrofisher. The primary purpose of this electrofishing effort was to make a concerted effort to find rearing juvenile anadromous fish (salmon) in this area. Detection of rearing juvenile chinook or coho salmon would confirm access to this reach by adult fish. This would effectively constitute an analysis of adult salmon access over a three year span: direct observation in 1991, direct observation in 1993, and indirect but compelling evidence of access (or lack of it) in 1992 through rearing juvenile sampling in 1993.

The results of semiquantitative electrofishing efforts between Frying Pan Lake and the large beaver complex are presented in the Appendix. The catch was dominated by juvenile arctic grayling at all sites. Large numbers of slimy sculpin were seen but not taken at most sites. Juvenile northern pike were taken at all sites and were sometimes relatively abundant. Rearing habitat for all three species was judged to be good to excellent in most areas. "Spot" electrofishing conducted between sites confirmed the presence of these three species throughout this three mile reach of the South Fork Kaktuli River, but no other species were taken or seen. Electrofishing conditions were excellent, and it is strongly felt that if other species were present they would have been taken.

Qualitative electrofishing and direct observations were conducted at several locations along the main stem of the South Fork Kaktuli River and significant tributary streams between the large beaver complex and the confluence of SFK.190. These locations are shown on Figure 3. Below the upstream limit of adult anadromous fish access (downstream of SFK.190), several adult chinook and one adult sockeye salmon were observed. Slimy sculpin were observed throughout this area as well as in intermittent reaches. Many chinook salmon fry were captured in this reach, especially under overhanging vegetation. Several adult (> 30 cm FL) grayling and large numbers of yearlings were taken in this area, but no fry of this species were observed. Large numbers of Dolly Varden char fry and yearlings were taken in this area, but these fish were outnumbered by chinook salmon fry in many pools.

Electrofishing was conducted in isolated pools in the main stem of the South Fork Kaktuli River immediately upstream of the upper limit of adult anadromous fish access. In the first isolated pool (moving upstream from the permanently wetted channel section), a few chinook fry, Dolly Varden fry and sculpins were taken. The densities of these fish were lower in this pool than in

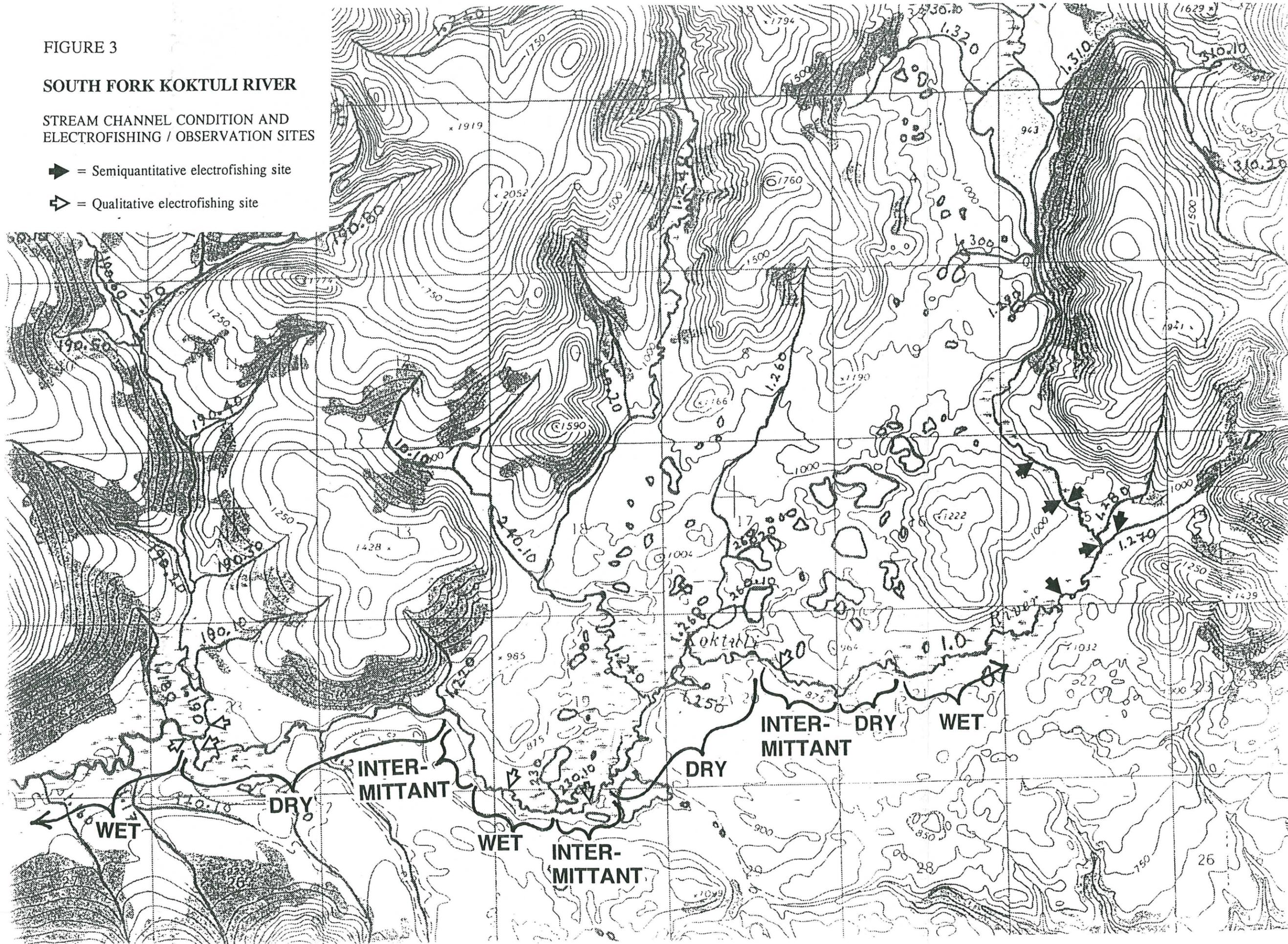
FIGURE 3

SOUTH FORK KOKTULI RIVER

STREAM CHANNEL CONDITION AND
ELECTROFISHING / OBSERVATION SITES

➡ = Semiquantitative electrofishing site

⇨ = Qualitative electrofishing site



the permanently wetted channel immediately downstream. The second isolated pool, which was small, contained one juvenile coho salmon only. This fish appeared extremely well fed. The third and last isolated pool was found to contain many coho fry, especially at its upstream end, a few Dolly Varden fry, one adult humpback whitefish and many sculpin. Juvenile chinook were not present. From this point upstream, the stream channel was dry for a distance of at least 1.5 miles.

The lower reaches of the major tributary, SFK.190, was electrofished qualitatively (intermittantly) for a distance of several hundred feet. This stream segment yielded many chinook salmon fry and a few yearlings, many Dolly Varden fry and a few yearlings, many sculpin and a few yearling grayling. A small burbot (about 20 cm SL) was found dead on an exposed gravel bar about 100 ft from the mouth of this stream.

In the area of continuous surface flow between long dry channel segments, and in reaches with intermittent flow (S-20; S-30), most of the large fish observed from the air were determined to be adult grayling (30-50 cm FL). One large (35 cm FL) longnose sucker was positively identified and several other representatives of this species tentatively identified in the same areas. Several adult humpback whitefish were also positively identified in these areas. Electrofishing and direct observations in this area revealed many grayling fry and a few Dolly Varden yearlings. No salmon fry were taken or observed in this area in spite of concerted efforts and excellent sampling conditions.

CONCLUSIONS

Both questions identified at the beginning of this memorandum were answered. The upstream distribution limits and relative abundance of sockeye salmon in the two headwater forks of Upper Talarik Creek were documented. Specifically, the upstream limit of adult sockeye in the West Fork of Upper Talarik Creek was at the confluence of UT.440, slightly further upstream than these fish were observed in 1991. Relative abundance was lower than in 1991. In the East Fork of Upper Talarik Creek (UT.350), the upstream limit of adult sockeye salmon distribution was between the confluences of UT.350.20 and UT.350.30. This distribution limit is consistent with observations in 1991. The lake-spawning population observed in UT.350.20.P1 in 1991 was absent in 1993. This is considered a significant observation, but the reasons for the absence of adult sockeye in this small lake are unclear; the dry spring and summer may have failed to recharge the aquifer feeding lake-bottom springs thus removing an attraction cue, but this potential explanation is speculative.

The upstream limit of adult anadromous fish distribution in the South Fork Koktuli River was firmly established, as was the reason for this limit. The upstream limit of distribution of adult anadromous fish in this stream in 1993 was found to be the confluence of a major tributary entering from the north, SFK.190. This is consistent with the distribution pattern for both chinook and sockeye salmon observed in 1991. The factors determining this limit were different

in 1993 than in 1991, however. In 1991, the upstream limit of adult anadromous fish access was attributed to the presence of a large beaver pond complex with a series of impassible dams. In 1993, migration was blocked by long segments of dry stream channel. Careful electrofishing and direct observation in 1993 indicated that a similar distribution pattern for adult salmon (chinook and coho) must have been the case for 1992. Rearing juveniles for both chinook and coho salmon were restricted to the lower reaches of the major tributary at the upper limit of adult access (SFK.190) and a few isolated pools in the main stem channel immediately upstream of the confluence of this tributary with the South Fork Kaktuli River. In spite of excellent sampling conditions and concerted effort, no juvenile salmon were found in the intermittent channel sections in the vicinity of SFK.230 (about 2.5 miles upstream of SFK.190), or in the continuously flowing reach and significant tributary between the outlet of Frying Pan Lake and the upstream end of the beaver pond complex. It is concluded that the upstream distribution of adult anadromous fish has not extended significantly upstream of SFK.190 from 1991 through 1993.

APPENDIX

PEBBLE COPPER--AQUATIC BASELINE STUDIES (July, 1993)

SOUTH FORK KOKTULI RIVER FISH INVENTORY

(all entries are fork or standard length in mm)

STREAM: SFK.0 (Main stem; outlet of Frying Pan Lake
NW 1/4 S-15)

GEAR: Backpack electrofisher DATE: 31 JULY 1993

STREAM SEGMENT: 300 ft

ARCTIC GRAYLING	SLIMY SCULPIN
--------------------	------------------

210	78
-----	----

188	59
-----	----

172	49
-----	----

130	-----
-----	-------

130	1/100'
-----	--------

129	
-----	--

122	
-----	--

113	
-----	--

111	
-----	--

71	
----	--

63	
----	--

62	
----	--

61	
----	--

4/100'

NOTE: Many more slimy sculpin seen but
not taken.

More grayling seen but not taken

No other spp. seen

Shallow, flat; cobble/gravel

PEBBLE COPPER--AQUATIC BASELINE STUDIES (July, 1993)

SOUTH FORK KOKTULI RIVER FISH INVENTORY

(all entries are fork or standard length in mm)

STREAM: SFK.0 (Main stem; downstream of Frying Pan Lake;
MAIN CHANNEL, 800 ft dnstrm. of gage #17, below gorge)

GEAR: Backpack electrofisher DATE: 31 July 1993

STREAM SEGMENT: 100 ft

GRAYLING	SLIMY NORTHERN SCULPIN	PIKE
----------	---------------------------	------

198	89	102
133	-----	-----
128	1/100'	1/100'
126		
117		
75		
73		

7/100'

NOTE: Side pool of main channel
(west side of low island)

PEBBLE COPPER--AQUATIC BASELINE STUDIES (July, 1993)

SOUTH FORK KOKTULI RIVER FISH INVENTORY

(all entries are fork or standard length in mm)

STREAM: SFK.0 (Main stem; downstream of Frying Pan Lake;
SIDE CHANNEL, 800 ft dnstrm. of gage #17, below gorge)

GEAR: Backpack electrofisher DATE: 31 July 1993

STREAM SEGMENT: 150 ft

NORTHERN PIKE	ARCTIC GRAYLING	SLIMY SCULPIN
------------------	--------------------	------------------

167	200	72
108	188	70
107	140	63
106	135	55
-----	133	53
2.7/100'	131	-----
	129	3.3/100'
	128	
	120	
	118	
	65	
	65	
	65	
	65	
	64	
	62	
	62	
	62	
	58	
	58	
	55	

14/100'		

NOTE: Quiet, narrow. Soft Bottom.
Good northern pike
rearing habitat.

PEBBLE COPPER--AQUATIC BASELINE STUDIES (July, 1993)

SOUTH FORK KOKTULI RIVER FISH INVENTORY

(all entries are fork or standard length in mm)

STREAM: SFK.0 (Main stem; upstream of SFK.270)

GEAR: Backpack electrofisher

DATE: 31 July 1993

STREAM SEGMENT: 100 ft

GRAYLING	SLIMY SCULPIN	NORTHERN PIKE
----------	---------------	---------------

270	76	83
68	73	-----
79	65	1/100'
-----	65	
3/100'	63	
	62	
	62	
	62	
	59	
	56	
	53	
	53	
	50	
	42	

14/100'		

NOTE: Small cobbles, mud bottom.
Open, old beaver pond area.

PEBBLE COPPER--AQUATIC BASELINE STUDIES (July, 1993)

SOUTH FORK KOKTULI RIVER FISH INVENTORY

(all entries are fork or standard length in mm)

STREAM: SFK.270 (Larger trib. from E., S-15)

GEAR: Backpack electrofisher

DATE: 31 July 1993

STREAM SEGMENT: 250 ft

GRAYLING			SLIMY SCULPIN	NORTHERN PIKE
72	65	61	61	98
71	65	61	57	105
70	65	61	55	89
70	64	61	54	87
69	64	61	50	78
69	64	61	48	86
69	64	61	48	97
69	64	60	47	79
69	64	60	46	77
69	64	60	38	89
69	64	59	31	85
68	64	59	25	79
68	64	59	-----	89
68	64	59	2.5/100'	90
68	63	59		91
67	63	59		-----
67	63	59		6/100'
67	62	59		
67	62	59		
66	62	59		
66	62	59		
66	62	58		
66	62	58		
66	62	58		
66	62	57		
66	61	56		
65	61	-----		
65	61	34/100'		
65	61			
65	61			

NOTE: In old beaver pond area;
dam washed out. No cover;
many caddis flies.
Mud bottom most areas.

** Few grayling
first 150 ft.

PEBBLE COPPER--AQUATIC BASELINE STUDIES (July, 1993)

SOUTH FORK KOKTULI RIVER FISH INVENTORY

(all entries are fork or standard length in mm)

STREAM: SFK.0 (Main stem, > 2 mi downstream of Frying Pan Lake
SW 1/4 S-15)

GEAR: Backpack electrofisher DATE: 31 July 1993

STREAM SEGMENT: 150 ft

GRAYLING	NORTHERN PIKE	SLIMY SCULPIN
330	92	60
310	-----	60
237	<1/100'	85
217		-----
192		2/100'
175		
127		
75		

5.3/100'

NOTE: Head of old beaver dam area.
Gravley stream segment; deep "slot,"
some bedrock showing on W side.

Northern Dynasty Minerals Ltd.

1020 • 800 W Pender St.

Vancouver BC

Canada V6C 2V6

Tel 604 684-6365

Fax 604 684-8092

Toll Free 1 800 667-2114

<http://www.northerndynasty.com>

March 11, 2004,

Mr. Mark Dalton

Vice-President

HDR Alaska Inc

2525 C Street, Suite 305

Anchorage, AK 99503

USA

Dear Sir;

As we discussed the other day NDM will be asking your firm to conduct the fish and aquatic studies required to develop the EIS for the Pebble Gold Copper Project. Enclosed with this letter are copies of Jim Buell's reports on work he did for Cominco in the Pebble Gold Copper Project area. They are for your information and use.

The reports are:

1. Baseline Fisheries Investigations – 1991
2. Baseline Fisheries Investigations – 1993 Follow-up Reconnaissance,

If you have any questions about these reports you should contact Jim directly.

Yours truly,

Northern Dynasty Minerals Inc.

Dennis Deans

Manager of Environmental Affairs

