INTERIM SUMMARY REPORT

to the

Northwest Alaskan Pipeline Company

FALL AND WINTER STUDIES OF FISH IN THE UPPER TANANA RIVER DRAINAGE

by

Jack M. Van Hyning, Ph.D.

Fisheries Consultant

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INTRODUCTION

As a part of the baseline environmental information needed for planning and construction of the Alaska Highway gas pipeline, studies on the late fall and winter abundance and distribution of fish in the upper Tanana River were undertaken. Experience with the TransAlaska Pipeline System had demonstrated the importance of identifying and protecting fish in overwintering areas. Since virtually nothing was known of the stocks of fish that might be winter residents in the streams to be crossed by the pipeline and thus be subjected to detrimental environmental impact, these overwintering studies were contracted for by the Northwest Alaskan Pipeline Company. Little more was known about the streams themselves as to water quantity and quality and physical and chemical characteristics were recorded. In conjunction with the fishery surveys, wildlife species observed were also recorded.

We studied the area from Big Delta to the Canadian border during the periods September 26 - November 18, 1977 and February 25 - April 26, 1978. This report consists of a preliminary, narrative summary of the principal findings; the final report will present references, acknowledgements, maps, photographs and the data collected on each stream including fish and wildlife sampled and observed as well as water chemistry and physical characteristics. A few lakes were also examined and the results of these examinations will also be presented in the final report.

METHODS

Considerable "state-of-the-art" development was required to satisfy the objectives of the program since there have been few winter fish studies in sub-arctic Alaska and such work in cold climates is demanding on both equipment and personnel.

Underwater television worked well for under-ice observation of fish concentrations in the North Slope streams, but discussions with Alaska Department of Fish & Game (ADFG) staff members who had used it suggested that the technology might have limited utility in the less-than-crystal-clear Tanana River and its tributaries. A SCUBA dive confirmed this suggestion and the subsequent low density of fish found probably would have resulted in few actual fish observations.

Echo sounding with a commercial recording fish finder was tried with the hope of obtaining some measure of fish abundance under the ice. Estimation of fish abundance by echo sounding is a standard procedure for summer lake fisheries surveys and, of course, is extensively used by commercial fishermen in the marine environment for locating concentrations of fish. The technique has also been used for depth determination of lakes in the winter for lake mapping, but as far as known had not been attempted for fish detection through the ice on a river system. Technical problems and the apparent scattering effect on sound waves by passing through layers of ice, water, and air of differing temperatures and composition produced poor graphs. Further, the generally shallow waters found, the low fish density and lack of aggregation and movement may have effectively precluded fish detection by this method.

Due to ice depths generally in excess of 5 feet and the difficulty and time involved in finding water under the ice of sufficient depth to fish conventional nets, emphasis was placed on sampling open water areas. Due to the relatively mild 1977-78 winter, there were considerable open water areas available on the Tanana River, the springs, and the headwaters of several tributaries.

Variable-mesh gill nets (25 x 6 feet, ½ to 3 inch mesh), beach seines, fyke nets, minnow traps and a back-pack electrofishing unit were used. The gear generally worked well except that the minnow traps and fyke nets caught no fish and the gill nets and fyke nets would at times fill with ice or freeze in as temperatures and floating ice conditions changed.

Access was mainly by 4-wheel drive vehicle along the Alaska Highway, a rubber raft on the Tanana River, and for the upstream areas cross-country skiis, dog team and helicopter. Some observations were also made by fixed-wing aircraft.

SALMON SPAWNING GROUND SURVEYS

The surveys of the fall of 1976 were repeated again in 1977 in coordination with ADFG. Almost constant fog and snow in the mountainous areas during the fall of 1977 made aircraft surveillance difficult, but springs and open areas near the highway were checked periodically throughout the season.

In spite of what appeared by ADFG test fishing to be a significant run of chum salmon migrating above Delta Junction this year, again the only indication of spawning activity in the upper Tanana Drainage noted was near the Headwaters of the Chisana River. Several spring areas, although seemingly offering attractive gravel and water quality, were devoid of salmon spawning or rearing activities.

NARRATIVE SUMMARY OF STREAM AND FISH OBSERVATIONS, 1977 - 78

A brief summary of the data collected is presented here with documentation to follow in the final report. Miles refer to the Alaska Highway mileposts -- distance from Dawson Creek, British Columbia.

Scotty Creek, mile 1223.5, is a deep, sluggish stream that drains a large lake and marsh complex before emptying into the Chisana River south of the highway. Grayling, whitefish, and pike are reported as being abundant during the spring months near the highway. At the highway bridge in late February over 4 feet of ice was measured without reaching water. A resident stated that there is water present during the winter in the deep holes under 5 to 6 feet of ice, but questions if there are any fish there as they have tried fishing through the ice without success. On April 23, we found 3½ feet of ice over 2½ feet of good quality, clear water.

Desper Creek, mile 1225.5, is completely dry in winter, with ice and snow covering the stream bed. Residents state that many pike, whitefish and grayling appear in the spring and are often unable to pass upstream through the highway culvert when the water level is low -- as it was last year and appears likely this year due to the low snow fall. On April 23 we observed about 10 cfs of brown-colored water passing through the culvert with a 12 to 18-inch drop to the pool below. No fish were observed even though the stream was almost clear of surface ice. Although only two miles apart, Scotty Creek was completely ice covered on April 23, while Desper Creek was ice free; the water temperature was 34 and 33° F., respectively.

Sweetwater Creek and Tributaries, between mile 1234 and 1237, were all frozen over and appeared dry in late February. On April 23, various branches were flowing from ½ to 4 cfs of brown-stained water. There was no evidence of fish from visual observations above and below the highway. This is a major stream system, but the highway and pipeline cross only headwater tributaries.

Gardiner Creek, mile 1246.6, is reported to support spring runs of grayling as well as seasonal occurrence of pike and whitefish. On October 30 it was largely ice covered, but with a flow of 5 cfs. No fish were observed in the open areas. On February 28 the stream was frozen to the bottom, and on April 23 was flowing at about 2 cfs but was still mostly ice covered. The water quality was poor and no fish were apparent in the open areas.

Tenmile Creek, mile 1253, is a small, marshy stream and its fish fauna is unknown. It was dry on October 30. On April 23, about 2 cfs of humic-stained water was flowing - most of it over the surface of the bottom ice. No fish were observed in 50 yards above and below the highway.

Silver Creek, mile 1259, appears to support only a small summer pike population. On April 23, about 1 cfs of water was flowing over ice which was frozen to the bottom. No fish were observed.

Chisana River, is a large glacial stream which roughly parallels the Alaska Highway, usually at some distance, before heading up into the source in the Wrangell Mountains. The Chisana and the Nabesna combine near Northway to form the Tanana River. The river's ichthyofauna is unknown, but chum salmon must pass upstream and down and grayling, pike, whitefish and burbot from the system's vast expanse of lakes, streams and ponds, which freeze solid in winter, must winter somewhere within the system. In late September the river was flowing heavily and turbid and a month later was completely frozen over near the highway. On November 17 from the air, it could be observed that the river was mostly frozen in the lower part, but some areas from 10 to 20 miles above Northway were open and 30 miles above Northway there were large open areas where the river alternately flowed over gravel riffles and under overflow ice. The springs below the mouth of Sheep Creek contained about 50 salmon carcasses at that time. As late as April 22, the Chisana was still mostly ice covered near Northway, but with turbid water flowing along each bank. On April 25, from the air, the upper areas were mostly open but with large areas of aufies, especially above Sheep Creek. No fish were seen in the springs and beaver ponds from the helicopter on that date, nor have any whitefish been seen on the fall salmon surveys even though the large populations present in many of the adjacent lakes are believed to spawn and winter in the main-stem of the Chisana.

Tanana River, Tanacross to Northway. The chronology of freezing and melting during 1977-78 was as follows: October 15, water still murky and beginning to freeze along the edges with large volumes of slush ice coming downstream; October 30, mostly frozen over, but with some large open leads; November 17, almost completely frozen over with only a few small holes open; February 28, completely frozen and covered with snow; April 22, surface ice melting, flowing visibly only along the edges and mostly over the ice; April 25, most of the river still ice covered except along the edges, but with some large areas opening up in the middle. On March 23 we dug four holes under the bridge east of Tok and found 2½ to 5 feet of ice over 0 to 14 feet of water. Baited lines set overnight produced one burbot. An overnight gill net set in late April near Northway produced one large sucker.

Moose Creek, near Northway, is not crossed by the pipeline, but is an important fish stream inasmuch as large runs of humpback whitefish are reported migrating in and out of the extensive lake system in spring and fall via Moose Creek. In late September pike were still abundant in Fish Lake and had not emigrated. On October 30, Moose Creek had extensive edge ice, but was flowing open in the middle. On March 1 the stream was covered with a thin layer of ice and had a very low level of dissolved oxygen. On April 22 it was ice free and an overnight gill net set near the mouth produced two large humpback whitefish.

Beaver Creek, mile 1268, in summer contains a good population of grayling and a few round whitefish. On September 27 I made a careful visual survey from the highway to the mouth. No fish were observed even though the water was clear and flowing about 10 cfs. By late October the stream was frozen to the bottom. On April 22 one or two cfs of water was flowing over the surface of the bottom-fast ice. No fish were present at that time.

Bitters Creek, mile 1280.2, contains grayling and sculpin below the highway during the summer. It was dry during the winter and even on April 22 there was no surface flow with the culvert about ½ full of ice.

Tok River, mile 1309 at the Alaska Highway bridge, was completely open and flowing in excess of 50 cfs on September 29. A month later the river was completely ice covered. On November 18 I bored several holes through the ice down to the gravel and found the river to be completely dry at the bridge. On April 9 there was about 0.1 cfs of flow and on April 22 there was still just a trickle. In July, grayling, round whitefish, suckers, sculpins and chubs have been captured in the lower river and there is some sport fishery as the glacial flow is supplemented by springs and clear-water tributaries keeping the turbidity at a moderate level. Upstream 20 miles from Tok at the bridge on the Glenn Highway, the Tok River was flowing about 30 cfs of clear water on October 13. It was largely open and spot checking visually for three miles produced only one small unidentified fish sighting. On October 31 the upper Tok River was mostly ice covered, but with some open channels and showing a substantial flow. On March 2 the river was completely frozen over. On April 25 from the air the Tok River was open and flowing in the upper valley area, but as the valley opened up into the flats the stream bed became snow covered and the flow evidently went underground. We electrofished 50 yards near the mouth of the Tok Overflow on that date and caught only sculpins. The Little Tok River at the Glenn Highway bridge on October 13 was flowing open, fast, and clear; no fish were observed. On October 31, The Little Tok River was still open and flowing, but much anchor ice was forming. On March 2 the river was completely ice covered at the bridge, and on March 23 still frozen, but upstream areas below Mineral Lake were open and flowing. Tok Overflow is a spring area 19 miles from Tok on the Glenn Highway and an important recreational fishery for residents of the area. On October 13 it was flowing clear and open with several school of small to medium-sized grayling and round whitefish visible below the culvert. On October 31 numbers of grayling and round whitefish were again observed for a distance of ½ mile below the highway. On March 2 we checked 25 yards upstream and downstream from the highway and no fish were visible in the very clear water and on March 23 we walked one mile downstream with no fish seen. On April 13 we electrofished 100 yards below the road with no fish captured and on April 25 electrofished a 50 yard stretch at the mouth of the Tok Overflow and caught one 8-inch char and one 4-inch grayling.

The migration and winter habitat of fish in the Tok River presents several interesting problems. The lower river dried up sometime prior to November 18, probably in late October, and still was not flowing in any substantial volume by late April thus precluding any migration to or from the Tanana River during that period. Upstream flows, however, were large all winter. Throughout October, grayling and whitefish were abundant in the Tok Overflow, but were absent when we again sampled through March and into early April. These fish had either migrated downstream to the Tanana River before the lower Tok River went dry, or wintered in the upper Tok River. Grayling spawn in large numbers at the outlet of Mineral Lake at the headwaters of the Little Tok River in May and June and have been the subject of considerable ADFG research. These fish are not found in the winter in the open areas of the Little Tok River below the lake, but are suspected to winter in the Little Tok which is ice covered, or in the main-stem Tok River. While the Tok Overflow and Little Tok River are above the pipeline crossing, further determination should be made of the migratory and wintering behavior of these important fish populations in terms of when, or if, they pass the pipeline corridor. Because of easy accessibility, studies on the Tok River could give data applicable to other similar glacial and spring-fed streams for which access is difficult.

Tanana River, Tanacross to Crystal Springs, a river distance of about 5 miles. This section of the Tanana remained open all winter, although it was frozen over above and below, and was accessible by vehicle and boat thus affording an opportunity for study. During early October, the river was murky but gradually cleared and by November visibility was excellent over the extensive shallow gravel riffles. No fish were seen from ground and aerial observation. During April we periodically seined and electrofished along the beaches at the end of the Tanacross air field, across from Crystal Springs and at several points in between including deeper water shocking from the rubber boat. Moderately large numbers of small ($1\frac{1}{2}$ - 3 inch) grayling, suckers and sculpins were found at Tanacross with noticeably fewer at Crystal Springs. A few small chubs were caught in the lower part of the segment. Electrofishing the deeper areas produced adult round whitefish in some numbers in the 12 to 15 inch range, and grayling in small numbers between 6 and 8 inches in length. An overnight gill net set off Crystal Springs in early April caught one $9\frac{1}{2}$-inch grayling and a fyke net caught nothing. In late April we set three gill nets at intervals and caught 5 large humpback whitefish (14 - 17 inches) and one round whitefish (11 inches). Periodic angling and a set of 6 burbot hooks produced nothing. Nothing resembling an overwintering concentration of fish could be detected in this area although the round whitefish seemed to be loosely aggregated in schools. The round whitefish were found in moderately shallow water of 3 to 4 feet depth, while the humpback whitefish were deeper although the deepest water found was only 10 feet. Some interesting age or size specific fish distributions were noted: small suckers were abundant along the beaches, but no large suckers were caught in this area; adult whitefish were common, but no juvenile whitefish were taken. No salmon fry

were observed or captured even though at the same time large numbers were present in similar environments of the Tanana River at Big Delta. Most of the fish were feeding heavily on a green "soup" of algae and midge larvae. Large volumes of algae were noted suggesting that the primary productivity of this part of the Tanana in late winter and spring might be surprisingly high. Some enrichment might be contributed by the village of Tanacross.

Crystal Springs originates in part from an upwelling source near mile 1328 of the Alaska Highway. It remains open and clear all winter and fish, if present, would be readily visible. Gravel and water quality appear suitable for salmon spawning and survival. On October 14, a few sculpins and unidentified fingerlings (probably round whitefish) were present. Subsequent visits on October 29, March 22, April 2, April 14, April 20 and April 21 revealed no fish utilization.

Yerrick Creek, mile 1333.7, is a productive summer grayling stream in its upper reaches. By late October it was largely frozen over, but with some open patches and flowing perhaps 5 cfs at the bridge. On February 27 it was frozen to the bottom at the bridge and we walked ½ mile above the pipeline crossing and could find no evidence of flowing water. On April 13 water was flowing 5 miles upstream from the bridge, but disappeared about ½ mile upstream. We could see no fish in the limited open water areas. On April 19 and 26 the creek was still frozen at the bridge with no sign of surface flow.

Robertson River, mile 1347 - 1348, in summer is a very large, turbid glacial river. A previous summer survey had shown grayling, whitefish and char to be abundant in the upstream spring areas. In late September the river was still flowing heavily with turbid water. By early November the flood plain was largely ice covered, but with several braided channels flowing clear water over gravel beds. During the winter the entire stream bed from several miles above the bridge to the mouth became covered with a solid sheet of overflow ice. Above the solid ice channels with flowing water were alternately open or ice covered. During April we surveyed the spring areas 7 and 8 miles upstream from the bridge (on the south and north sides of the river, respectively) by dog team and helicopter. Visual inspection and an overnight gill net set showed no fish in the south bank spring. Likewise visual inspection by foot and helicopter gave no indication of fish in the open areas of the north bank spring area. Just at and below the spring's juncture with the Robertson River, two grayling (8 and 10 inches) and several sculpins were caught by electrofishing. The springs on the north side originate from several lakes and ponds, which are reported by local people to contain fish, but which were still frozen over in late April. The springs were difficult to sample because of edge ice and deep water.

The summer residents of the Robertson River springs may thus winter: (1) in the lakes and ponds; (2) in the Robertson River itself; or (3) in the Tanana River. Option 3 would entail a spring and fall migration through the pipeline corridor. It is speculated that the char may winter in the lakes since they show little proclivity for migration, while the grayling, being characteristically highly migratory, may migrate down to the Tanana for the winter. Those we caught may be the vanguard of the spring upstream migration. As for the Robertson River as an overwintering stream, the water quality in the winter is good, but the current is fast and there are few deep pools which might be a requirement for resting fish in a state of low energy intake. Since the fish do not winter in the springs, further studies must be done on this system to define fish migration and wintering patterns.

Bear Creek, mile 1357, is generally a small stream originating from both glacial and lake-fed tributaries. At the highway, grayling and suckers are summer residents and in the upper areas grayling and char were found in abundance during the summer. As of late September the stream was flowing about 10 cfs and no fish were observed near the bridge. By November 1 it was completely frozen with no flow. By mid-April there were puddles of melt water but no flow and by late April the stream was flowing about 5 cfs mostly over bottom ice. On April 26 we electrofished 150 yards of stream near the highway and captured nothing. Via helicopter we sampled the stream about 8 miles upstream from the bridge on April 25. There was a good flow of about 5 cfs of clear water, mostly free of ice and we electrofished about 100 yards of stream and captured one 8-inch char and three sculpins. Fish Lake, one of the sources of Bear Creek, was still ice covered. It would appear that the grayling present in the upper areas during the summer migrated downstream prior to fall freeze-up in the lower portion. Although Bear Creek was frozen solid in the lower reaches, the upper areas contained flowing water all winter with char and sculpins wintering there. By late April, lower Bear Creek was flowing again, but the grayling had not yet begun their spring upstream migration.

Chief Creek, mile 1358.7, is an intermittent stream at the highway. Spot checks when flowing have not revealed the presence of fish, but grayling probaly utilize it to some extent at least in the spring. On September 29 it was flowing about 10 cfs, but for the most part of the season was dry and snow covered. On April 19 there were melt puddles, but no flow.

Sam Creek, is a slough-like, spring-fed stream paralleling the Alaska Highway from near Dot Lake, mile 1362, to mile 1370. It originates from a number of springs and ponds in a large, marshy complex. We studied an important tributary at mile 1369.1 and the main creek about one mile upstream from the mouth. The tributary was found to contain large summer populations of grayling, round whitefish, suckers, and sculpins - especially the pool below the highway culvert. In mid-October, the tributary was flowing 2 cfs. Although no fish were observed, visibility was poor due to partial ice cover. On November 1 the tributary was frozen over, but water was flowing under the ice and sometime later it froze to the bottom. On April 25 the tributary was flowing about 5 cfs mostly over the surface of anchor ice; no fish were observed by spot electrofishing for 25 yards downstream from the highway. There has been no sampling in Sam Creek itself, but local residents report catching grayling, round and humpback whitefish, pike and burbot seasonally. No fishing effort was observed during the fall and winter although a number of boats are kept there for access to the Tanana River and adjacent lakes. In mid-October the creek was flowing about 10 cfs and open, but by November 1 the lower end was largely frozen over with some small open areas remaining. In mid-March some small open areas still persisted with a flow of about 5 cfs. A minnow trap baited with salmon eggs, canned fish and corn was set overnight, but nothing was caught. A gill net was set in an open lead near the mouth on March 22. On March 24 it contained one 12-inch pike, but was frozen in and was left until March 31. Nothing was in the net on that date. On April 24 - 25 large areas of open springs and ponds were evident from the air in the upper areas; no fish were observed, but the water was somewhat discolored. Obviously Sam Creek receives little utilization by overwintering fish.

Berry Creek, mile 1371.4, is one of the most productive of the streams crossed by the pipeline and in summer supports grayling, char, round whitefish and sculpins and a sport fishery. In early November, the stream was flowing about 5 cfs, but ice covered most of the channel. In February and March the creek was completely covered with ice and snow from the bridge to its mouth at Johnson Slough. Some fresh overflow ice was evident in the lower reaches. About a mile above the bridge there were a few open holes with a flow of about 3 - 4 cfs evident under the ice. A baited minnow trap was put in one of the holes for a week with no catch. Attempts to locate water underneath the ice at the bridge and in Johnson Slough were unsuccessful. Holes were dug through 4 or 5 feet of ice without finding water or bottom. On April 15, lower Berry Creek was still completely ice covered, but a trip upstream about three miles revealed considerable stretches of open water flowing 5 -10 cfs. One large char was observed in a pool. Electrofishing the same area on April 24 gave one large char (14 inches, the same one previously observed), one small char (6 inches) and

a number of sculpins. The lower part of the stream was near flood stage on April 26. It is believed that Berry Creek flows all winter at the highway bridge, as well as upstream, although under a very heavy ice cover. A previous summer survey about 5½ miles above the highway produced grayling, char, round whitefish and sculpins; it is thus likely that the grayling and whitefish migrated downstream while the char and sculpins remained as winter residents. Some, or perhaps most, of the char might also have emigrated as the winter fish density was low compared with the summer surveys, but further more comprehensive population studies would be necessary to determine this. The locations fished were not the same and it is difficult to determine how many fish may be hiding under the remaining ice cover in late winter and early spring.

Sears Creek, mile 1374.4, is a small, partly spring-fed creek which contains grayling, and possibly char, in the summer. By November 1 it was covered with slush ice. In late February overflow ice and water covered a large area near the bridge and Haines pipeline. An overnight minnow trap set produced nothing. By late April the area was still mostly ice and slush covered, with no well defined channel for the flowing water.

Dry Creek, mile 1378, is, as the name implies, usually dry at the highway. However, several miles upstream it flows year round mostly under ice cover with only an occasional opening. Residents report grayling, char and whitefish in summer, becoming winter residents also if downstream access in the fall is denied by lack of flow in the lower portion. On September 26, the creek was dry at the highway, but on September 29 was flowing 2 - 3 cfs. Later the stream bed became dry and remained that way through April 26. On April 10 we travelled 3 - 4 miles up Dry Creek were the stream was flowing perhaps 5 cfs mostly under ice with extensive glacering. Observation of open areas recorded one small char and one unidentified small fish. In clear, shallow water careful visual observation is a good method of obtaining information on fish populations, but when 90% of the stream is ice covered, this technique becomes questionable since there is no way of knowing what is under the ice. Grayling, for example, may prefer to remain under the ice cover. No other sampling technique is much better under these conditions, however.

Johnson River, mile 1380.5, is another large, braided glacial river. No fish were captured at the highway during summer surveys in the turbid water, but grayling, char and whitefish were found in upstream, clear tributaries. Throughout the fall the river remained open and clear, flowing in several channels over the gravel bottom. During the winter the lower river became completely ice and snow covered, but small open channels were present above the bridge. On April 1 several openings appeared in the 5-foot thick ice above and below the bridge with the water clear and flowing about 15 cfs in the western-most channel. In late April we electrofished about 100 yards of channel above the bridge with no catch.

Little Girstle River, mile 1388.4 , originates from mixed glacial and clear-water tributaries and is less turbid than the typical glacial stream. Grayling, whitefish, suckers and sculpins were sampled at the highway in July and grayling in the upstream tributaries. We found the Little Girstle River to have a good flow of clear water in early fall, but by November 1 was dry and the channel covered with ice and snow. On April 19 it was still dry and on April 26 only flowing about 5 cfs.

Girstle River, mile 1393, is an extensively braided glacial river. In late September, the stream was flowing in five main channels. We seined and inspected the clear western-most channel in several places with negative results. By mid-October, the stream was very low. In contrast to the Robertson and Johnson Rivers which become covered with solid ice and snow over their entire lower flood plains, the Girstle was largely bare. Some upwelling and minor flow occurred throughout the winter. On April 19 and 26 the flow was still low and a visual survey on the latter date of several small side channels produced no fish sightings. Since sampling near the highway has revealed a paucity of aquatic life and aerial reconnaissance of the upper reaches showed no productive tributaries, the Girstle River can probably be considered as an insignificant producer of fish.

The Tanana River near the mouth of the Girstle was completely ice covered throughout the winter. Two test holes on March 15, revealed 3 feet of ice over 5 feet of water and 4 feet of ice over one foot of water. Water under the first hole was flowing very rapidly.

Sawmill, Rhoads, and Granite Creeks, mile 1403.8 - 1409.6, remained dry throughout the period of the study. These streams contain flowing water during the summer in the upstream areas, but it is not known whether they support fish or not, or whether there are perennial springs which would permit winter survival of fish which might migrate upstream during freshets and then become landlocked.

Tanana and Delta Rivers at Big Delta. This area was observed extensively because of its importance as a chum salmon spawning ground and because ADFG considers it an overwintering area for grayling and whitefish and thus might serve as a "control" for observations of other areas. Due to extensive ground water upwelling, the lower Delta and this part of the Tanana remains open and flowing all winter. From mid-October through mid-November, chum salmon, and a few coho salmon, were spawning actively throughout the area. On February 25, cursory digging in the Delta River revealed alevins with considerable amounts of yolk sac still remaining; a similar effort on March 24 revealed that the yolk sac was almost completely utilized although few fry had emerged. On March 30 - 31 we surveyed the south shore line from the Alyeska Camp to the highway bridge by boat and SCUBA diving. A few small schools of chum salmon fry were observed in the shallow areas and one large sucker in deeper water; the water was not clear enough for meaningful SCUBA observations. In mid-April, chum fry were abundant in

both the Delta and Tanana Rivers. On April 26 we electrofished along the south shore from the mouth of the Delta River to the Alyeska Camp. Chum salmon were present by the thousands (about 1½ inches in length). In addition, we collected 5 chinook salmon smolts (3 inches in average length); 3 round whitefish from juvenile to adult (3 to 14 inches) with several others escaping; 2 grayling (9 and 10 inches); a few sculpins; and one 12-inch burbot. The burbot's stomach was crammed with 53 chum salmon fry; one chinook smolt had 2 chum fry in its stomach but the other fish were all feeding on aquatic insect larvae. One grayling had 7 salmon eggs in its stomach, but these were likely bait eggs used by sport fishermen. In contrast to Tanacross where the food of grayling and whitefish was almost entirely a thick "soup" of algae and midge larvae, here a variety of aquatic insects were consumed. It is also interesting to note that at Tanacross, small suckers were the most abundant fish of the shallow beaches while at Big Delta there were none. Only large round whitefish were present at Tanacross while at Big Delta there were juveniles and adults and no yearling grayling were present at Big Delta in contrast to their presence at Tanacross. While estimates of fish density from these data would be premature, there appeared to be at least an order of magnitude more fish present at Big Delta than at Tanacross, at least in terms of biomass if not in species diversity. From late February throughout the spring, fishermen were observed fishing the Tanana River near the highway bridge - pipeline crossing and upstream adjacent to the Alyeska Camp. Catches were poor and consisted mostly of round whitefish even though grayling was the preferred species.

SUMMARY

Probably the most important conclusion from this study is that the pipeline crossing tributaries of the upper Tanana River will impact no important fish overwintering or salmon spawning or rearing areas. Springs and upwelling ground water, so critical in the winter survival of North Slope fish populations, seem to be almost avoided in the winter by Tanana River fish.

Typically, most of the tributaries at the lower elevations dry up or freeze to the bottom in the fall and do not flow again until melting snow water again fills the channels in the spring. Most of the fish thus migrate downstream to larger, permanent water bodies before freeze-up. When this investigation began in late September we could find no fish remaining in the streams checked though time did not permit a complete coverage. By late April, when the winter studies terminated, spring run-off flows were increasing, but the upstream migration had not yet started. Many of the streams contain flowing water in the upstream areas all winter and char and sculpins, and perhaps grayling in some, reside in these upper systems year round.

By the process of elimination, one must conclude that most of the fish in the upper Tanana River drainage winter in the main-stem of the Tanana and Chisana Rivers. Studies of the open areas of the Tanana revealed nothing that could be categorized as a concentration; indeed, the fish appeared inclined toward solitary and sedentary behavior. What might be present under the thick ice that covers most of the upper Tanana in winter remains a mystery, however. Considering the vast complex of lakes and streams in the Tanana Basin, out of which it is believed most of the fish descend in winter, there could well be major concentrations of fish wintering somewhere in the Tanana Basin.