CEPOA-EN-CW-ER (1105-2-10b)

MEMORANDUM FOR RECORD

SUBJECT: Takikchak River Fish Habitat Survey

1. Introduction. The village of Newtok, Alaska, is threatened by erosion on the Ninglick River. A likely relocation site has been identified on higher ground on Nelson Island, approximately 9 miles away (figure 1). The most likely water source at the new village location is the Takikchak River watershed, located about 3 miles west of the proposed village site. Chris Hoffman, biologist, U.S. Army Corps of Engineers, Alaska District, and Joseph Connor, biologist, U.S. Fish and Wildlife Service, conducted surveys from 29 August through 2 September 2005. The surveys were conducted to assess existing fish habitat and juvenile fish distribution on the Takikchak River. Observations from this trip may be useful in guiding future development to minimize impacts to the aquatic habitat and will form the basis for determining the need for future detailed studies.

A limited sampling effort was undertaken in June 2005 in a small area in the lower portion of the Takikchak River. Minnow trap data and sample locations are in attachment A. acceptable

2. Methodology. No development has occurred at the relocation site on Nelson Island, so a camp was established on high ground approximately one-quarter-mile upstream of the mouth of the Takikchak River.

Juvenile fish in the Takikchak River were sampled at nine locations using minnow traps baited with approximately 2 tablespoons of salmon roe. Traps were typically soaked for several hours, although traps placed in areas that had large numbers of visible juvenile fish were placed for less time. Upon retrieval, fish were identified, counted and measured (fork-length). When large numbers of fish were caught, 10 fish of each species were randomly selected and measured to determine the average length and size range. Trap data are included in table 1.

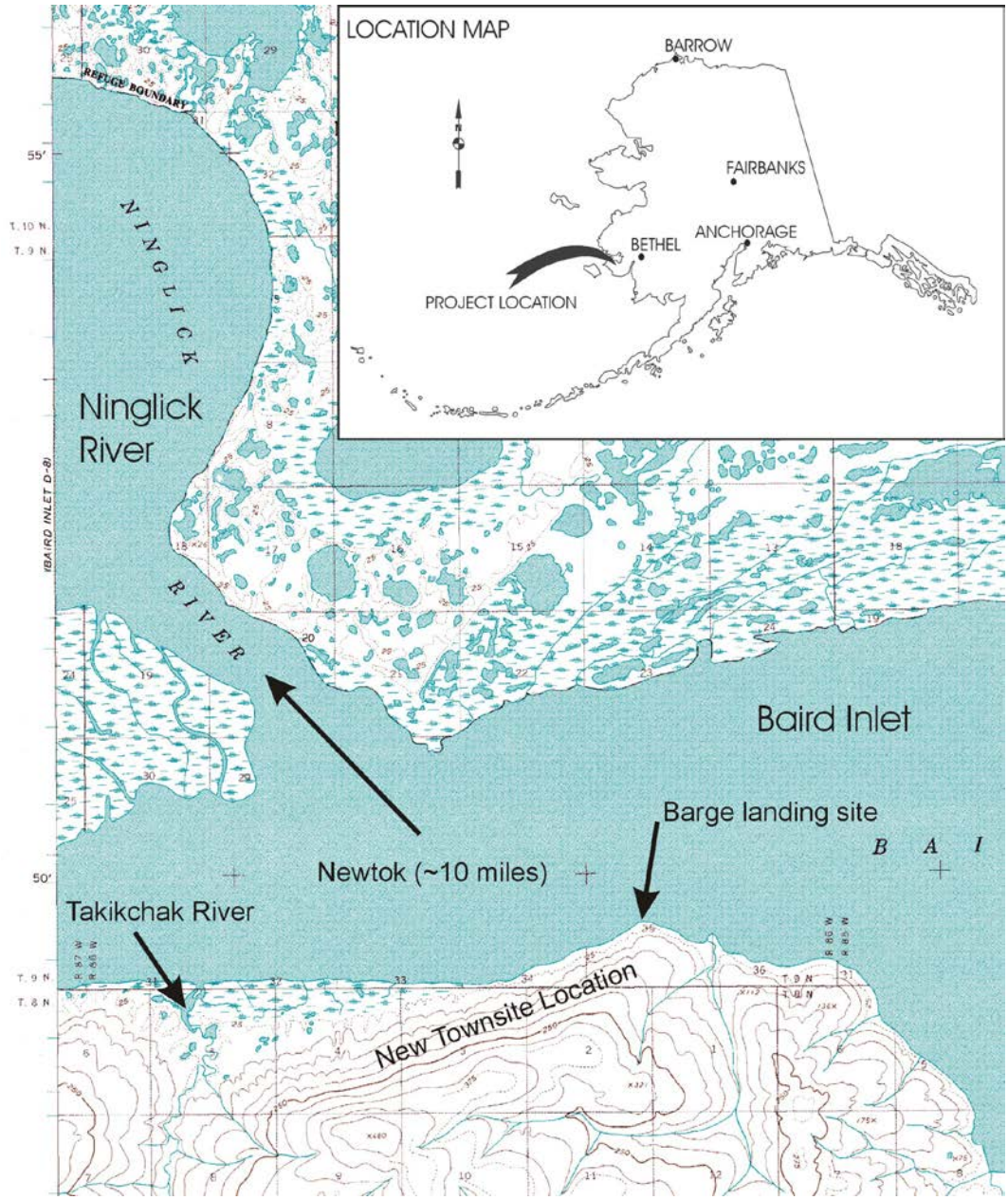


Figure 1. Nelson Island and Takikchak River location and vicinity map.

Initially, we intended to assess fish habitat in the lower reaches of the Takikchak River by quantifying fish habitat types (length of riffles, runs, pools, etc) in each reach over a length 20-times wider than the bank-full width of the particular reach. After a brief reconnaissance of the river we determined that it was not possible to take the necessary measurements due to the depth of certain pools. Many pools were estimated to be in excess of 15-feet deep. Accordingly, a small inflatable raft or float tube would be necessary to make accurate measurements. In addition to the logistical constraints, we did not have sufficient time available to conduct a quantified habitat assessment. For

instance, it would typically take about 8 hours to complete an assessment in reaches where the river is wide (40 feet wide X 20 = 800-foot-long longitudinal section). If one assessment was done in each reach, it would take approximately 8 days. Instead of a quantified habitat assessment, we chose to perform a qualitative assessment whereby we would break the river into different reaches and provide narrative and photographic documentation to serve as a basis for future field work. In doing so, we were able to cover a large area of the river, far beyond any anticipated development activities. Obtaining a larger view of the system was valuable to put the appearance and value of the lower reaches into perspective.

Annotated photographs are available in a Power Point presentation located at Q:\ProjectsbyLocation\Newtok\002019 Relocation of Village\09 Feasibility Phase\Environmental\Aug-Sep fish habitat survey COE-FWS. Takikchak River flow data is available on the USGS water resources website at http://waterdata.usgs.gov/ak/nwis/inventory/?site_no=15304400.

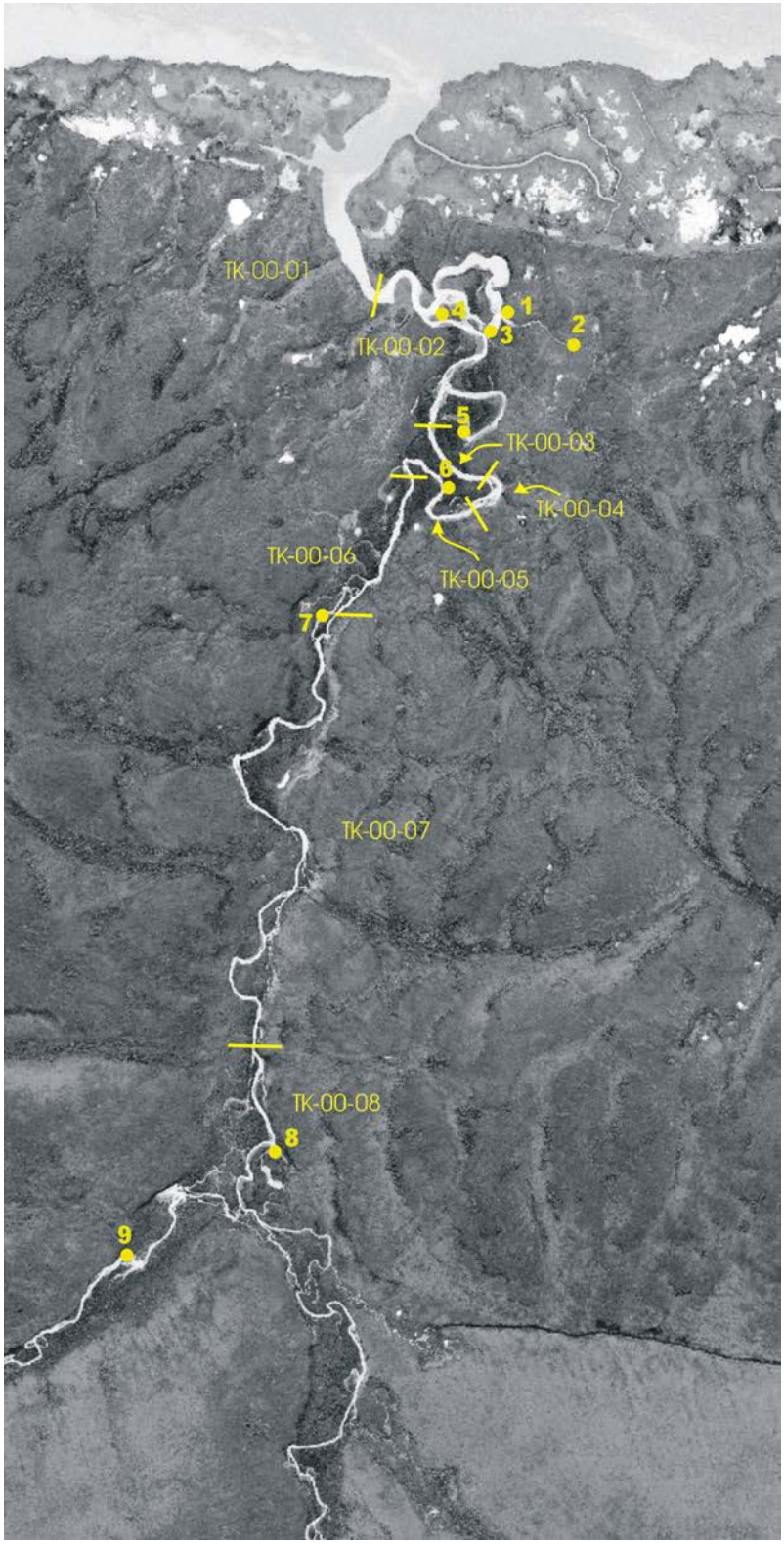


Figure 2. Minnow trap locations and reaches on the Takikchak River.

3. Biological Observations. Fish data gathered during this trip are representative of a single sampling effort; repeated efforts during other times of the year would be necessary to properly characterize adult and juvenile fish in the Takikchak River. However, data from this trip are useful to broadly characterize species present, relative abundance, and habitat associations during late summer.

The Takikchak River is located on the north shore of Nelson Island, immediately south of Baird Inlet Island. The river flows into Baird Inlet, which contains brackish water. At higher tides brackish water enters the intertidal portion of Takikchak River.

We walked the Takikchak River from the mouth to approximately one-half mile upstream on each fork from where the river splits about 1.8 miles inland from Baird Inlet. During this walk we broke the river into 8 different reaches based on habitat characteristics. The limits of each reach are shown in figure 2. A description of each follows:

TK-00-01 is intertidal and has a silt bottom. During our visit there was approximately an 18-inch difference in water height between high and low tides at the upstream end of TK-00-01. At low tides wide mud flats are exposed in the downstream portion of this reach.

TK-00-02 is tidally influenced in the lower half of the reach. Although silt-laden water did not extend far into this reach, clear water was obviously backed up at high tides. The bottom is composed of gravel. This reach contains a beaver pond that is fed by two small tributaries, the smaller of which was confirmed to be spring fed. The source of the larger tributary was not determined. It is likely that anadramous access to the beaver pond is possible during flood events when the beaver pond is either inundated or temporarily blown out.

TK-00-03 is narrower than TK-00-02 and has no side channels. The left bank is noticeably higher and has areas of long riffles and runs.

TK-00-04 is characterized by areas of large, deep pools, with some at least 12 feet deep. The right bank is approximately 20 feet high at the highest point.

TK-00-05 is characterized by more frequent meanders and sequences of riffles, runs, and pools. Many of the pools in this reach are approximately 15 feet deep. One of the larger pools has a beaver lodge built into the bank. Juvenile Dolly Varden were abundant here; 105 fish were caught in less than 45 minutes. This was the highest catch rate of any area sampled on the river. These deep pools are important sources of cover for juvenile fish and resting areas for adults. Because of the deep pools, this reach should be treated as a very important portion of the available fish habitat in the Takikchak River since, in addition to cover, it is a likely area for over-wintering. There is very little overhanging vegetation and few undercut banks, so the deep pools provide one of the few sources of cover for juvenile fish in the main stem. Side channels are the only other significant

source of cover for juvenile fish in this river, but are probably not utilized during most of the winter.

TK-00-06 is narrower than TK-00-05 and lacks deep pools.

TK-00-07 has a greater slope and the substrate has changed from cobble/gravel/sand to cobble/boulder. The slope break and substrate change is a critical factor in separating this area into a new reach.

TK-00-08 is characterized by a change in substrate back to cobble/gravel/sand. This reach ends where the river forks. Reaches were not determined upstream of the fork. The west fork is characterized by a series of beaver ponds and dams that serve as migration barriers, the east fork has several side channels and a portion of the flow appears to be from a spring (see figure 2).

Trap number	Latitude	Longitude	Set Time	Pull Time	Time in Water	Catch (n)	CPUE	Size Range (mm)	Avg. Size (mm)
1	60.81394494	-164.589245	1755 30 Aug	1050 31 Aug	16 hrs 55 min	13 DV	0.77	65-89	77.2
2	60.81333876	-164.586659	1815 30 Aug	1107 31 Aug	16 hrs 52 min	11 DV	0.65	78-94	86.9
3	60.81336021	-164.589797	1845 30 Aug	1124 31 Aug	16 hrs 39 min	2 DV, 1 9SSB	0.15	86-87 (DV only)	86.5 (DV only)
4	60.81388056	-164.591959	1940 30 Aug	1027 31 Aug	14 hrs 47 min	22 DV	1.49	52-148	100.1
5	60.81116617	-164.591214	1228 31 Aug	1839 31 Aug	6 hrs 11 min	27 DV	4.37	ND	ND
6	60.80981433	-164.592056	1322 31 Aug	1406 31 Aug	0 hrs 44 min	105 DV	143.84	53-105 (n=10)	86.6
7	60.80718040	-164.597152	1517 31 Aug	1802 31 Aug	2 hrs 45 min	37 DV	13.45	45-95 (n=11)	77.3
8	60.79472959	-164.600215	1248 31 Aug	1605 31 Aug	3 hrs 17 min	4 DV	1.22	46-55	49.5
9	60.79224586	-164.607602	1449 31 Aug	1538 31 Aug	0 hrs 49 min	0	0	0	0

Table 1. Minnow trap data form August 2005.

4. Conclusions. With the exception of a single nine-spined stickleback, all of the fish caught in minnow traps were Dolly Varden. It is interesting that no juvenile coho were caught despite trapping at various locations in the river. According to local residents in Newtok, coho typically arrive in late August to spawn. The coho run was late this year and did not get underway until sometime after we left on September 2nd (Stanly Tom, personal communication). It is possible that coho time their arrival for late in the fall to coincide with heavy rains that may temporarily blow out portions of beaver dams and allow access to additional spawning habitat further up the west fork of the river. Additional trapping effort should be placed on the beaver ponds in the west fork as well as in suitable locations in the east fork to determine coho presence or absence.

Local residents report catching whitefish at the mouth of the Takikchak River in late summer using gill nets and also in winter using nets fished under the ice (Stanly Tom, personal communication). Species reported include broad whitefish (*Coregonus nasus*), humpback whitefish (*Coregonus pidschian*), and round whitefish (*Prosopium cylindraceum*), as well as least cisco (*Coregonus sardinella*) and Bering cisco (*Coregonus laurettae*).

In June, biologists conducting a waterfowl nesting survey observed mew gulls feeding on smelt that were moving upstream in the intertidal portion of the Takikchak River. Species identification was not confirmed, but it is possible that these fish were either rainbow smelt (*Osmerus mordax*) or eulachon (*Thaleichthys pacificus*). Future field work should confirm the species identification.

Nelson Island has no trees, so there is no large or small woody debris in the Takikchak River. The woody vegetation on Nelson Island is composed of a variety of willow species that are used to construct beaver dams. Where large sections of tundra have broken free and become stranded, they often fulfill part of the role of large woody debris. While these stranded chunks provide little in the way of cover as would a pile of woody debris, they can serve to alter stream morphology on a small scale by affecting the formation of gravel bars and pools. In some cases, large chunks of tundra were observed that appeared to have broken off, forming submerged shelves in large pools (see photo 36 in the annotated Power Point photos). These submerged chunks are probably valuable cover in a system where overhanging vegetation is minimal and the only other cover consists of deep pools.

Beavers fulfill several important functions in watersheds and the Takikchak River watershed, being nearly pristine, is probably no exception. Several important functions of beaver dams are listed below.

- Improve fish habitat by providing rearing and overwintering habitat by increasing water depth, dissolved oxygen , and food production and introducing a range of water temperatures
- Elevate the water table upstream of the dam, which diversifies vegetation

- Diversify macroinvertebrate community by altering plant species, water temperature, and water chemistry (by increasing the retention and availability of nitrogen, phosphorus, and carbon)
- In headwaters, beaver dams can retain more water from spring runoff and major storm events and release it more slowly, resulting in a higher water table and extended summer flows
- Reduces water velocities and bank erosion
- Reduce sedimentation downstream of the dam
- Increase water storage capacity
- Create waterfowl nesting and rearing habitat

Attenuating spring flows and storm events is probably a critical function on the Takikchak River as it a relatively "flashy" system based on recent hydrographs with the beaver dams in place. Flashy systems are characterized by steep spikes in stream discharge following snowmelt or rain events (see attachment B). If beaver dams were removed, it is likely the flow regime would alter the characteristics of the stream significantly. Beaver dams should be regarded as part of the ecosystem and not as negative feature to be removed. If large scale removals were initiated, it is likely that there would be noticeable changes to the habitat and fish productivity. Beavers can have a negative impact on red salmon by blocking access to lakes, but this is not an issue on the Takikchak River as there are no lakes in the watershed.

Residents from Newtok and surrounding communities depend on the Takikchak River for subsistence fishing, and it will probably be utilized more frequently when people from Newtok relocate to Nelson Island. To maintain productivity in the river, certain measures could be enacted to reduce negative impacts to the watershed. These measures include minimizing alteration of the flow regime in the watershed to protect fish and fish habitat, limiting development on the floodplain, and establishing crossing locations for ATVs to limit habitat degradation. These issues are important with respect to development of a water source for the village and to reduce negative impacts of future development in the watershed.

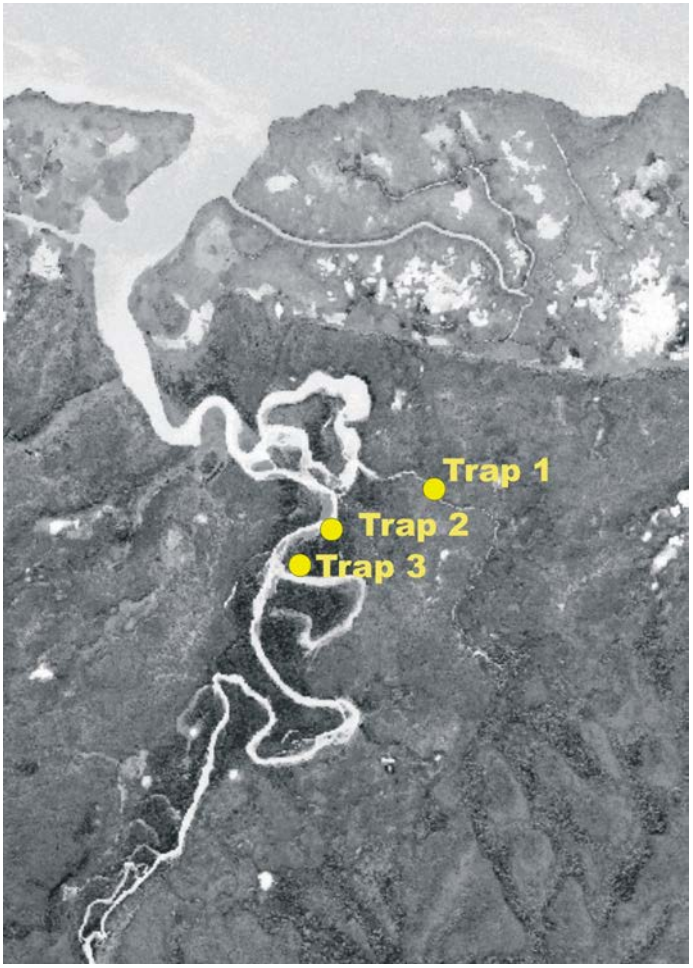
Future fieldwork will be needed to characterize fish use and habitat quality in the Takikchak River. An important aspect involves maintaining adequate water flow for fish and developing eggs at all times of the year. In addition to gathering detailed habitat data in the summer, it would be useful to determine pool and beaver pond water depths in the winter since this may be a limiting factor for fish production in the Takikchak River. Other than beaver ponds scattered throughout the watershed, deep pools are limited to reaches four and five. In winter, transition between these two reaches as well as between the river and the beaver ponds is likely limited by shallow areas due to ice and low flow. The amount of anchor ice in the pools is also unknown. It may be that the volume of water in the deep pools is reduced by surface and anchor ice as well as frazil ice and that the water velocity in the unfrozen portion is too strong for overwintering juvenile fish. In such a scenario, beaver ponds may be the only source of overwintering fish habitat. In beaver ponds with an active lodge, it is only logical that there is water available throughout the winter since beavers require

water for access to their lodges. An important step towards minimizing impacts from future development as a water source will be determining a limiting factor(s) to salmonid production, recognizing that the limiting factor(s) may be different for each species.

Christopher Hoffman
Biologist

Attachment A
Minnow Trap Data June 2005

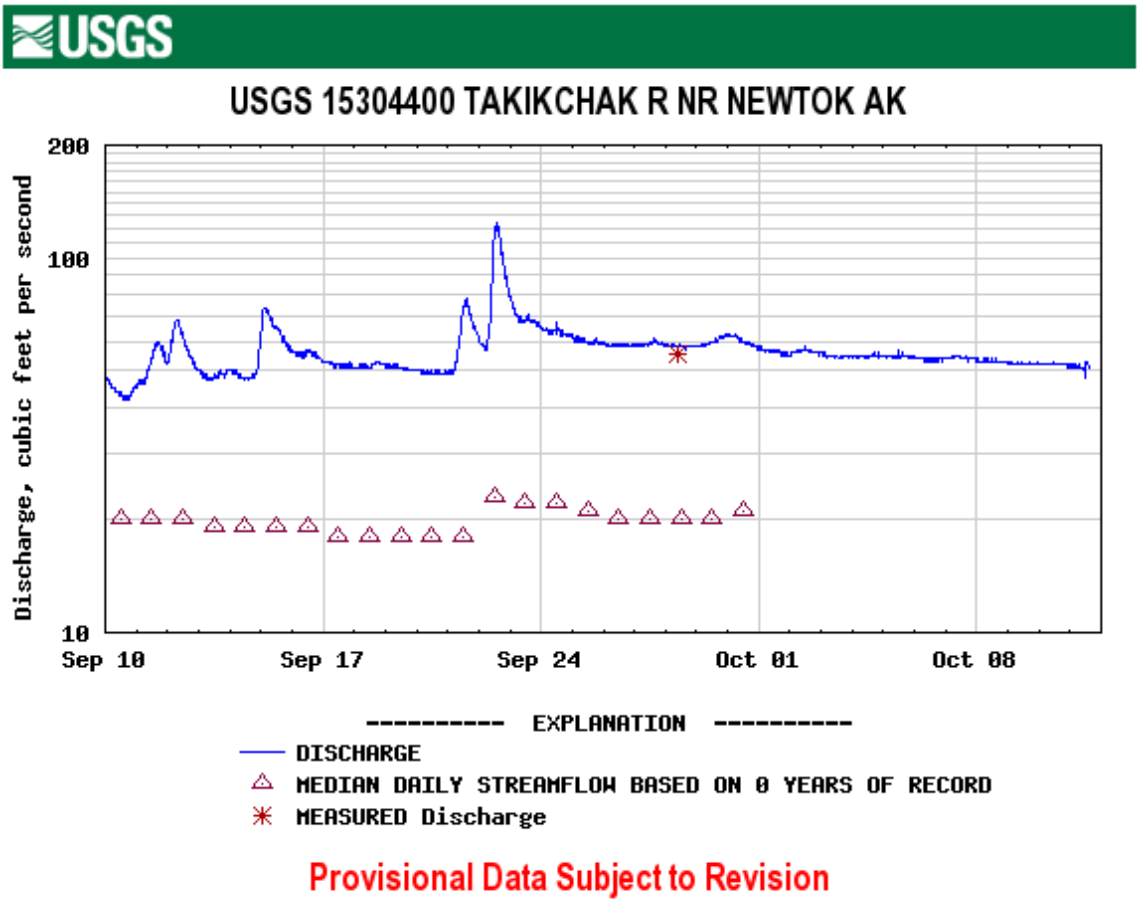
Only one set was made with minnow traps. Information on the minnow traps is included below.



Minnow Trap 1 Set 1800 02 June, Pulled 1440 3 June. Location: 60° 48’ 52” N 164° 35’ 05” W Catch: 1 Dolly Varden, 55mm fork length
Minnow Trap 2 Set 1850 02 June, Pulled 1510 3 June. Location: 60° 48’ 49” N 164° 35’ 14” W Catch: 7 Dolly Varden, 55-65 mm fork length size range
Minnow Trap 3 Set 1920 02 June, Pulled 1600 3 June. Location: 60° 48’ 47” N 164° 35’ 20” W Catch: Ø

Given the near 24-hour soak times for the minnow traps, the catch per unit effort (CPUE) is very low. Trap 1 was set above a beaver dam, which could explain its low CPUE. Access to this area is probably limited to time when the beaver dam is removed or partially blown out during floods. Trap 2 was set along a cut bank in water approximately 3 feet deep. Trap 3 was set in a abandoned channel near the main stem. This channel was only connected to the river at the downstream end, but still had anadramous access.

Appendix B
Takikchak River Flow Data



This graph is an example of a recent 31-day period. Real time flow data and archived data is available on the USGS website located at http://waterdata.usgs.gov/ak/nwis/inventory/?site_no=15304400