State of Alaska
Department of Fish and Game
Division of Sport Fish

Nomination Form
Anadromous Waters Catalog

M

Region: Southeast

USGS Quad(s): Skagway B-1 NW

AWC Number of Water Body: 115-34-10300

Name of Water body: Skagway River ☑ USGS Name ☐ Local Name

☑ Addition ☐ Deletion ☐ Correction ☐ Backup Information

For Office Use

Nomination #	140384	James J Hasbrouck, Fisheries Scientist	10/3/2014 Date
Revision Year:	2015	Habitat Operations Manager	10/3/14 Date
Revision to: Atlas ____ Catalog ____ Both ✓		AWC Project Biologist	9/25/14 Date
Revision Code:	B-1, B-2, B-6	GIS Analyst	10/9/14 Date

OBSERVATION INFORMATION

Species	Date(s) Observed	Spawning	Rearing	Present	Anadromous
Pink salmon	October 2002, 2003, 2005			"numerous"	☑
Chinook salmon	October 2004			2	☑
Chinook salmon	October 2002-2006, annually		89 total		☑
					☐
					☐

no adults alive observed

IMPORTANT: Provide all supporting documentation that this water body is important for the spawning, rearing or migration of anadromous fish, including: number of fish and life stages observed; sampling methods, sampling duration and area sampled; copies of field notes; etc. Attach a copy of a map showing location of mouth and observed upper extent of each species, as well as other information such as: specific stream reaches observed as spawning or rearing habitat; locations, types, and heights of any barriers; etc.

Comments

In annual reports of fish passage monitoring of a scour control structure installed by ADOT&PF in the Skagway River downstream of the Klondike Highway bridge, authors Bethers and Sogge observed adult pink and Chinook salmon on stream foot surveys, and captured rearing Chinook salmon using minnow traps. Monitoring took place each October in years 2002-2006. The extent of juvenile Chinook salmon captures ranged from furthest downstream at 59.46528 N, 135.30556 W to furthest upstream at 59.47100 N, 135.29667 W. Adult Chinook salmon carcasses were observed near 59.47169 N, 135.29611 W. Adult pink salmon carcasses were observed between 59.46939 N, 135.30061 W and 59.47156 N, 135.29492 W.

??

Name of Observer (please print): Mike Bethers / Mark Sogge

Signature: Data from published reports Date: _____

Agency: Alaska Dept. of Transportation & Public Facilities

Address: PO Box 112506
Juneau, AK 99811

ALASKA DEPT. OF FISH & GAME
SEP 23 2014

This certifies that in my best professional judgment and belief the above information is evidence that this waterbody should be included in or deleted from the Anadromous Waters Catalog.

Signature of Area Biologist: _____ Date: 9/24/2014 Revision 11/13

Name of Area Biologist (please print): Richard Chapell

Add Chinook Salmon Rearing and present to River

~~Add Pink present~~ ?

The department will also accept for consideration nomination forms based on observations of adult salmon carcasses based on the following criteria

a. Two of more salmon carcasses were observed and species was positively identified, and

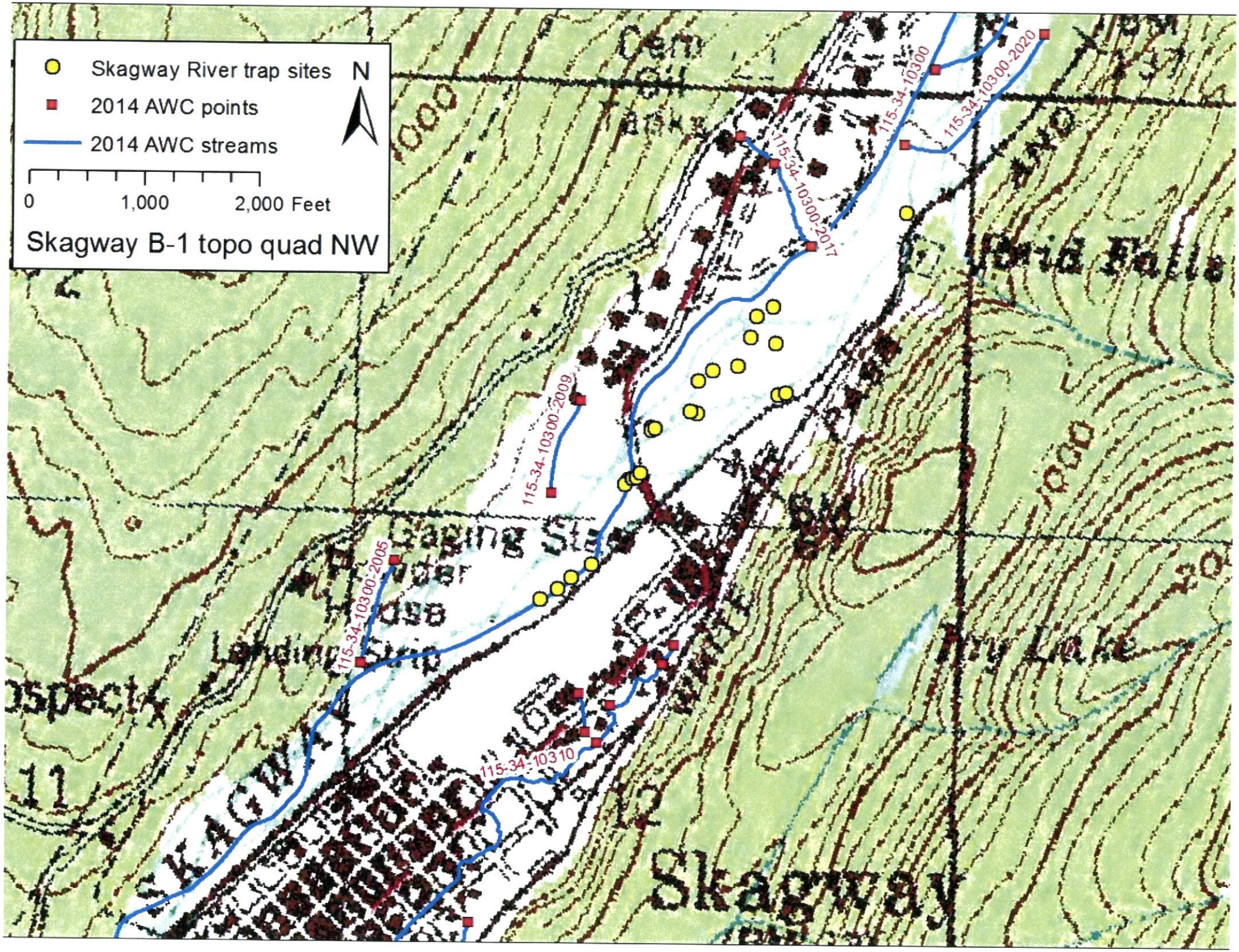
b. There is evidence of recent spawning activity such as the observed presence of redds and/or observation of fish eggs in the gravel, or

c. There have been recent observations of live/spawning salmon of the same species in the same location, or

d. The nominated water body is a tributary of a currently specified AWC water body that supports the same salmon species, or

e. There are observations of adult salmon of the same species immediately downstream and listed on a corresponding AWC nomination form.

8-2004-2006
Gaity-Car
115-34-10300-2017
Dyea Rd
5-2005
5-2004
4-2005
5-2006
6-2003
4-2006
6-2004-2005
7-2004-2005
7-2003
115-34-10300-2009
5-2003
3-2006
4-2003
3-2004
7-2006
6-2006
2-2006
115-34-10300-2009
98
State
10-2006
10-2003-2005
9-2006
115-34-10300
9-2003-2005
22nd Ave
21st Ave
Main St
23rd
© 2014 Google
Image © 2014 DigitalGlobe
Google ea
Imagery Date: 7/19/2012 lat 59.469411° lon -135.296787° elev 85 ft eye alt 38


Skagway River trap sites
2014 AWC points
2014 AWC streams
N
0
1,000
2,000 Feet
Skagway B-1 topo quad NW
115-34-10300
115-34-10300-2020
115-34-10300-2017
115-34-10300-2009
115-34-10300-2005
115-34-10310
Skagway

AN EVALUATION OF FISH PASSAGE ASSOCIATED WITH NEW STRUCTURES CONSTRUCTED IN THE SKAGWAY RIVER AND PULLEN CREEK, SKAGWAY, ALASKA

OCTOBER, 2002

PREPARED FOR:

Alaska Department of Transportation and Public Facilities,

Southeast Region

BY

Mike Bethers

2002
KR
P.1
n=18
1-P carcass

2003
CCR = n=41
KR n=43
P13

2006B

2004
↑
2-K carcass
P13 #4 near Trap
59°28' 1.67"
135° 18' 26"

2006
P5
numerous Pcarcass between Trap 3/4

ALASKA DOT & PF
SOUTHEAST REGION
NOV - 1 2002
ENVIRONMENTAL SECTION

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AN EVALUATION OF FISH PASSAGE ASSOCIATED WITH NEW STRUCTURES CONSTRUCTED IN THE SKAGWAY RIVER AND PULLEN CREEK, OCTOBER, 2002

ABSTRACT

Analysis of fish passage and hydraulic characteristics associated with new fish habitat improvements in Pullen Creek was conducted October 5,6 and 7, 2002. Analysis of fish passage associated with a new scour control structure in the Skagway River was done October 6 and 7, 2002.

Minnow traps and visual fish surveys were employed in these analysis and water flow measurements were also taken in Pullen Creek.

Counts of 962 adult pink salmon, 43 adult coho salmon and 4 adult Dolly Varden in Pullen Creek indicate that these adult forms are capable of moving upstream through the new culverts to more upstream areas. Minnow trap catches in Pullen Creek of 113 juvenile coho salmon and 114 juvenile Dolly Varden indicate viable populations of rearing fish for a small stream the size of Pullen Creek.

No juvenile salmonids were observed to move upstream through the new culverts on Pullen Creek during this work. Upstream movement by juveniles is likely occurring at lower water levels, however, lower tides at the stream mouth preclude entry into the stream and higher flows at Second Street culvert likely prevent upstream movement by juveniles.

On the Skagway River, one adult pink salmon carcass and four live adult Dolly Varden counted upstream from the scour control structure indicate that these species can move upstream over the scour control structure. Minnow trap catches of 251 juvenile Dolly Varden, 67 juvenile coho salmon and 18 juvenile chinook salmon indicate reasonable populations of rearing fish both upstream and downstream from the scour control structure.

No juvenile salmonids were observed to move upstream over the scour control structure during this work, however it is believed that they could move upstream over the structure at the water levels observed October 5,6 and 7,2002. At higher levels small salmonids could find upstream migration possible along the shorelines where there is considerable cover that would reduce water velocities. During very low flows in the river, velocity in the fish passage notch may preclude upstream movement by small salmonids, however during these low flows one would not expect significant upstream movement to be occurring.

The presence of juvenile chinook salmon rearing in the Skagway River was documented during this work.

The Skagway River has nearly annual runs of eulachon, however these runs moved above the scour control structure site only during years having very large runs. Runs since construction of the scour control device have been of lesser magnitude and as a consequence, it is not yet known whether eulachon can move upstream over the new structure.

BACKGROUND

The Skagway River runs along side the Skagway Airport and erosion and flooding have been major concerns for years. In 1998, the Alaska Department of Transportation and Public Facilities (DOTPF) received permits to improve the airport, including modification of the Skagway River to divert flow away from the airport. As mitigation for this in-water work, DOTPF replaced culverts and rebuilt the lower section of Pullen Creek, which was believed to be severely impacting fish movements in the stream. Pullen Creek, located in the middle of the City of Skagway has been subjected to relocation and many adverse modifications since the gold rush days. The stream mouth is presently many feet higher in elevation that it was originally due to land development along the waterfront (Photos 1, 2). Fish entering Pullen Creek have had trouble for many years due to the elevated outlet structure. Mitigation work by DOTPF was designed to improve fish passage in Pullen Creek. The effect of this work was to be evaluated for three years following the work. This report covers the first evaluation of fish passage associated with new structures constructed in the Skagway River and Pullen Creek.

OBJECTIVE

Determine if the scour control structure constructed in the Skagway River and associated mitigation done in Pullen Creek are providing adequate fish passage.

Fish passage associated with the following structures was analyzed during this work.

Skagway River
---Scour control structure

Pullen Creek
---Second Avenue culvert
---Broadway Street culvert
---Newly day lighted channel
---New outlet culvert and structure

METHODS

Gee minnow traps in 1/4-inch mesh baited with salmon eggs were set in prime habitats and in areas where concentrations of rearing fish were observed. Bait was treated with 1/100 betadyne solution for a ten-minute soak, boraxed and frozen prior to use. Traps were set for approximately a four-hour long soak. The numbers of fish caught per species per trap were recorded along with notes on whether the fish were small fry or presmolt which would likely out-migrate next spring. All fish caught in minnow traps during course of this work were released unharmed, except for three juvenile chinook which were collected for positive identification.

In visual surveys, Polaroid glasses were worn to enhance visibility in the water. The numbers of live and dead fish were recorded by species. Under cut banks and brushy habitats were probed

with a walking stick to count fish in those areas.

Visual stream surveys were conducted on Pullen Creek from the stream mouth upstream to the hatchery on the east fork and up to 14th Avenue on the west fork. The survey area and minnow trap sites on Pullen Creek are shown on figure 1.
Minnow trap site locations in Pullen Creek are described later in this section. This stream channel is quite stable and the trap locations could be duplicated in the future.

Visual surveys on the Skagway River were conducted from the lower end of the runway to a point approximately 600 yards upstream from the Klondike Highway Bridge and in a clearwater channel that paralleled the Cemetery Road. The channel was surveyed upstream to a point where the Cemetery Road crossed the railroad tracks. The survey area and minnow trap sites used in the Skagway River are shown on figure 2.

Flow measurements were taken with a Global Flow Probe, model FP 201. Distances were determined with a Ranging model 400 range finder.

Minnow trap sites in Pullen Creek.

1. Most downstream site, in small pool near east shore, 30 yards upstream from upstream end of Broadway Street culvert.

2. Downstream from overhanging brush on east shore, directly under power/telephone line that crosses stream.

3. Directly downstream from rock on east shore, 60 ft. downstream from foot bridge.

4. East side, most downstream section of Pullen Pond, (Photo 3).

5. East shore, inlet end of Pullen Pond, next to largest rock in lawn, (Photo 4).

6. West shore, inlet end of Pullen Pond, midway from culvert to wooden dock, (Photo 4).

7. In pool between Second Avenue culvert and Railroad Track culvert, just east of outlet end of RR culvert, (Photo 5).

8. Above powerhouse next to cut bank under large conifer on east shore of stream. Directly across tracks is tombstone of Mrs. Pullen, (Photo 6).

9. Under high over hanging Alders directly adjacent to large white oil tank on west shore, just upstream from museum, (Photo 7).

10. At tail of shallow pool, 20 ft. downstream from Pullen Creek Hatchery Building, (Photo 8).

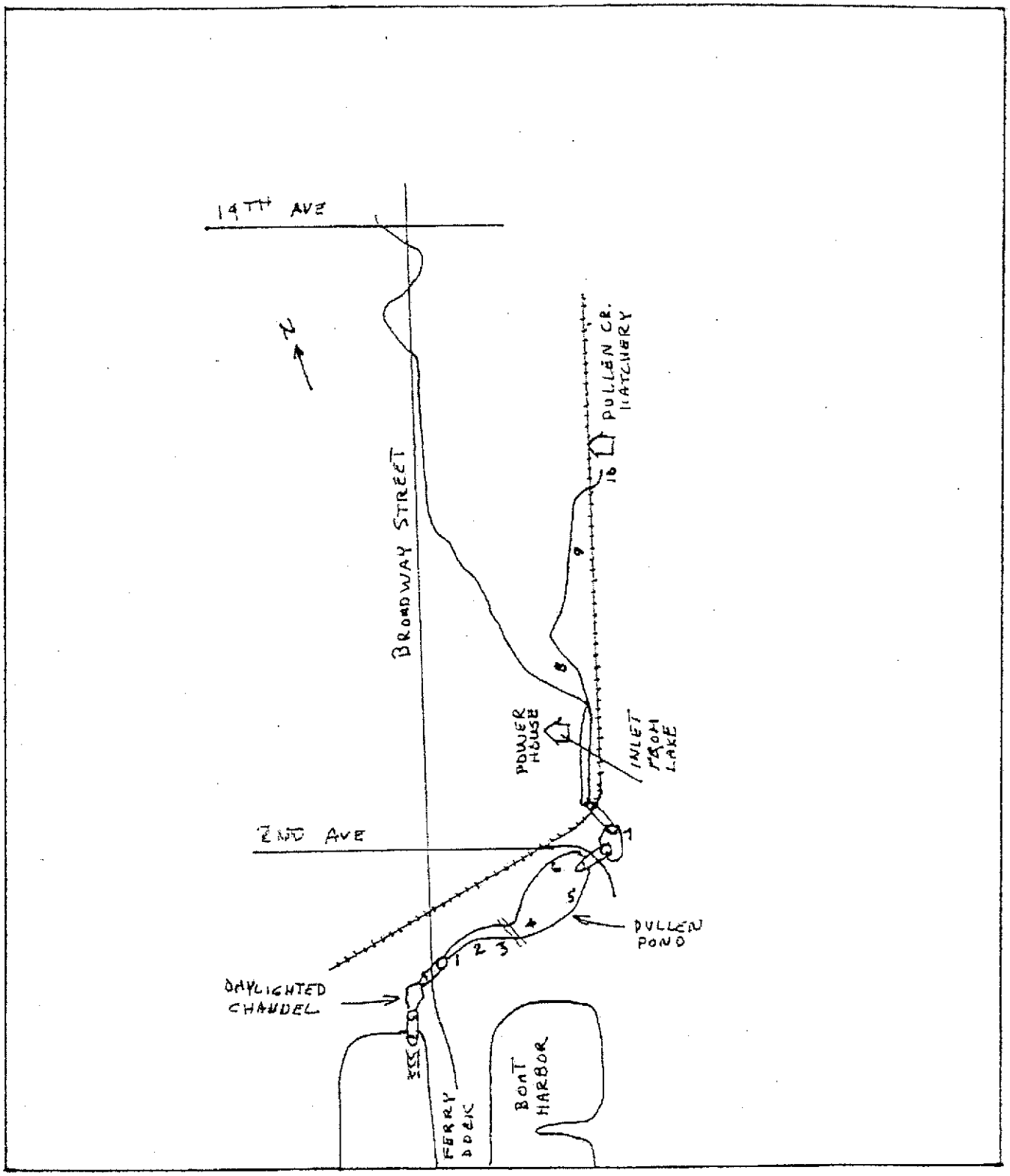

Figure 1. Minnow trap locations and survey area, Pullen Creek.

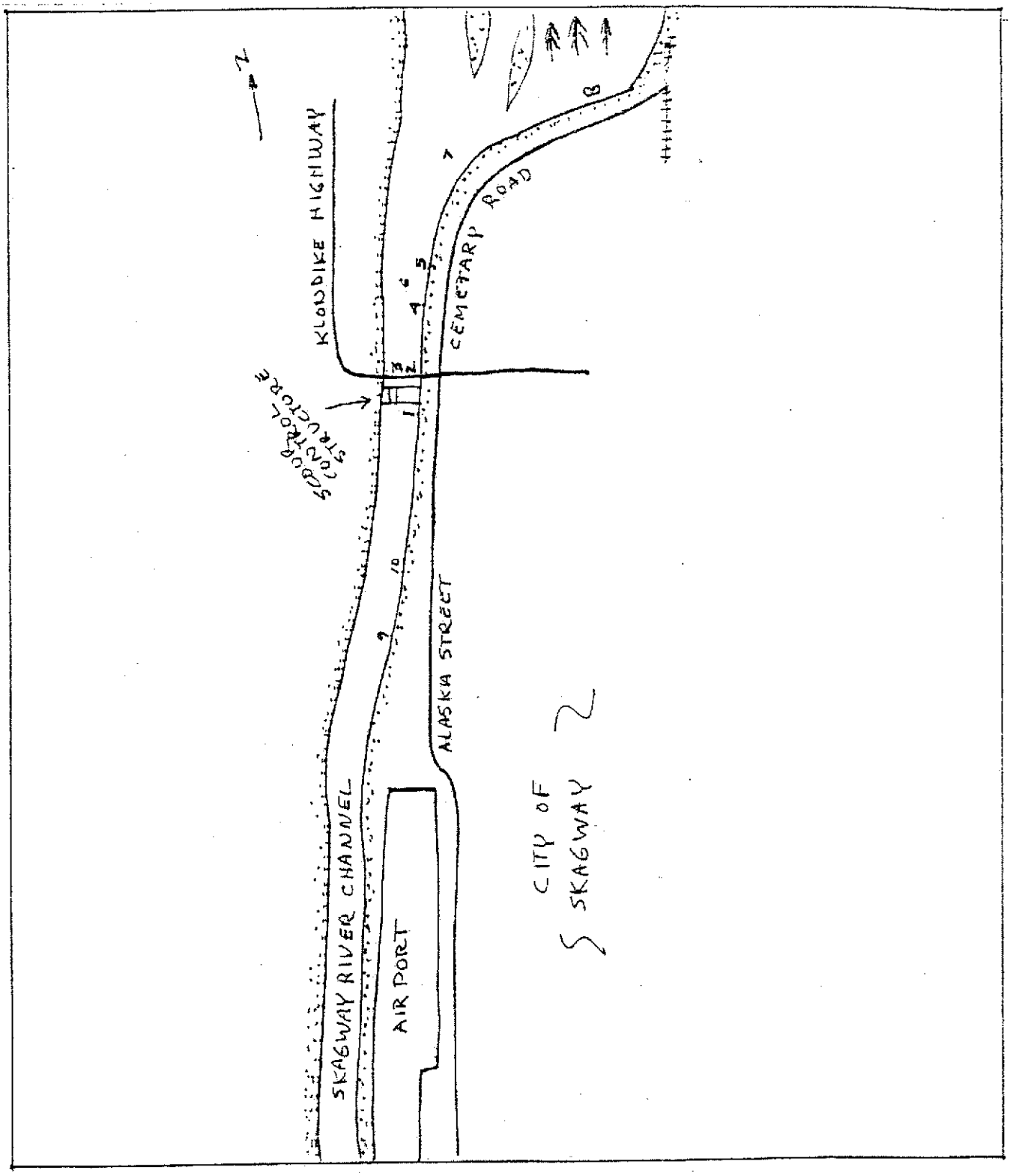

Figure 2. Minnow trap locations and survey area, Skagway River.

Minnow Trap sites in the Skagway River.

1. In a small gravel/riprap pocket at the downstream edge of scour control structure, east shore, (Photo 9).

2,3. Set at top end of large brush wad stuck on #3 bridge support (from east shore). One trap set each side of brush, (Photo 10).

4. Set at upstream end of small clear side channel 70 yds. above bridge, east shore, (Photo 11).

5. Set at upstream end of small clear side channel 150 yds. above bridge, near old auto differential/axle, (Photo 12).

6. Set in secondary river channel directly off mainstem, 130 yds. above bridge, (No photo).
7. Set in secondary river channel 450 yds. above bridge under small root wad, (No photo).

8. Set in clear side channel along east shore that runs beside road that goes to cemetery. Trap set downstream 40 yds. from sign where railroad crosses road. Many small salmonids and three mature Dolly Varden observed in channel, (Photo 13).

9. Most downstream site, 51 yds. upstream from airport boundary fence on east shore, next to large "habitat rock", (Photo 14).

10. Set 175 yds. upstream from airport boundary fence, next to large 'habitat" rock, some brush caught on rock, (Photo 14).

Fish species inhabiting the Skagway River and Pullen Creek are listed below:

Coho salmon	Onchorhynchus kisutch
Pink salmon	Onchorhynchus gorbuscha
Chum salmon	Onchorhynchus keta
Chinook salmon	Onchorhynchus tschawytscha
Dolly Varden	Salvelinus malma
Eulachon	Thaleichthys pacificus
Sculpins	Cottus spp.

FINDINGS

Pullen Creek Fish

Water levels and clarity were excellent for visual surveys on October 5, 2002. Weather was high overcast with air temperature of 43 and water temperature of 41 degrees fahrenheit. Visual surveys and minnow trap catches showed the largest numbers of rearing fish to be using Pullen Creek above Second Avenue culvert where the average catch per trap was 44 fish, (Photo 15). Traps set between Broadway Street culvert and Pullen Pond averaged 16 fish per trap and traps

set in Pullen Pond caught no fish. No traps were set in the West fork of Pullen Creek, however rearing fish could be easily observed in the stream up to 14th Avenue. Minnow trap catch data is presented in table 1.

Pullen Creek obviously had a very strong return of pink salmon this summer. Escapement surveys showed 962 dead pink salmon in the stream from the creek mouth up the hatchery on the east fork and up to 14th Avenue on the west fork. This count was likely only a portion of the total escapement as many of the fish had been dead for a long time.

A total of 43 adult coho were counted from the Railroad culvert upstream to the powerhouse on October 5, 2002. Most of the fish were starting to color up and several were actively spawning. Additional adult coho were observed jumping in Pullen Pond.

Total numbers of chinook salmon returning to the Pullen Creek Hatchery was unknown this year as the fish trap was vandalized and an unknown number of fish were believed to have been taken. From 40 to 50 chinook salmon were collected for the hatchery program this summer, (Rex Kilburn, pers. com.).

A total of four adult Dolly Varden were counted in Pullen Creek just upstream from the Railroad culvert. The fish were mature spawners but did not appear to have begun spawning. Escapement survey data taken at Pullen Creek is presented in table 2.

Pullen Creek Water Flows

The presence of adult pink and coho salmon and Dolly Varden upstream from Second Avenue culvert clearly shows that these forms are moving through the Second Street culvert--at some water levels. It should also be noted that pink salmon are considered to be a low-performance swimmer and Dolly Varden are considered to be only moderately strong swimmers, (Behlke, et al.).

Second Avenue Culvert

On October 5,2002, Pullen Creek was running approximately 15.4 cfs. At this flow, velocity at the upstream end of the Second Street culvert averaged 1.83 fps, (Table 3). At this flow the water flowed smoothly through the culvert and although it was quite fast, there was minimal surface turbulence which would handicap small fish trying to move upstream through the culvert. Even at this low flow the "step pool" at the culvert outfall had little, if any effect on velocity of water exiting the culvert, (Photo 16). On October 7, 2002, Pullen Creek was flowing approximately 23.7 cfs due to increase of powerhouse outflow. The flow at the outlet of Second Avenue culvert ranged form .86 fps in one upper "corner" of flow to 6.6 fps for the remainder. At this level there was no sign of a step pool below the culvert. Four feet inside the outlet of the culvert, the velocity was very fast but could not be accessed for a flow measurement. Further, there were standing waves on the surface, which would handicap small fish attempting to move upstream, (Photo 17). It is not known at what flow level the velocity and turbulence in the culvert become a barrier to upstream movement to small rearing fish, however it is doubtful there is any upstream movement at flows of 23cfs or greater.

Table 1. Minnow trap catches of juvenile coho salmon and Dolly Varden in Pullen Creek, October 5, 2002

Trap Number	Dolly Varden	Coho Salmon	Total
1	4	0	4
2	6	36	42
3	1	2	3
4	0	0	0
5	0	0	0
6	0	0	0
7	0	2	2
8	3	1	4
9	30	31	61
10	70	41	111
Total	114	113	227

Note: A total of 18 coho and 17 Dolly Varden were considered to be pre-smolts which would likely out migrate to salt water next spring. The remainder of fish caught were considered to be fry, approximately 1 1/2 to 2 inches in length.

Table 2. Visual survey counts of adult salmon and Dolly Varden in Pullen Creek, October 5, 2002

Area	Pink	Coho	Dolly Varden
Broadway Street to Second Avenue	150 dead	0	0
Pullen Pond		frequent jumpers	
Second Avenue to Powerhouse	494 dead	43 live	3 live
Powerhouse to Hatchery	18 dead	0	0
Westfork to 14 Avenue	297 dead	0	1
	962	43	4

Table 3. Water flow measurements taken in Pullen Creek, October 5 and 7, 2002

Date	Location	Flow (f/s)
October 5	Above Powerhouse	.65
October 5	Below Powerhouse	.82
October 5	30 yds above RR crossing	.81
October 5	Inlet of Second Ave. culvert	1.83
October 5	Above Broadway St. culvert	1.67
October 5	Above stream mouth culvert	1.87
October 7*	Outlet of Second Ave. culvert	.86-6.60
October 7*	Outlet of Broadway St. culvert	1.58-1.88
October 7	Outlet of streammouth culvert	too fast

*On October 7, power company increased powerhouse outflow to 15 cfs

Broadway Street Culvert

The new culvert under Broadway Street is 130 feet long, 72-inch diameter with a gravel bottom except for the outlet where the gravel has been washed out. The culvert has a gradient of approximately .5%. This culvert lies about 380 feet upstream from the stream mouth and flows in the culvert are slowed to some degree by tidal backflow on a daily basis, (Photo 18). Without tidal influence and with a stream flow of approximately 19 cfs, velocity in the culvert outlet averaged from 1.5 to 1.9 fps. Even though flows were greater than the sustained swim speed of a juvenile coho,(0.8 fps), (McLean, 1998), it is believed that small fish could find areas of lesser velocity near culvert walls and rocks in the bottom of the culvert. At flows observed during this study, it is believed that small salmonids could move upstream through the Broadway Street culvert.

Day Lighted Channel

The new 230 foot long day lighted channel between Broadway Street culvert and the outlet culvert was found to be lacking the four "step pools" as shown in the project plans, (Photo 19). Evidently, if the dams were installed they were washed out by water velocity in the channel, which has a gradient of 1+%. Water velocity in the downstream end of the channel averaged 1.9 fps on October 5,2002, with no tidal influence. Stream width was approximately 13 feet with an average depth of 13 inches on October 5, 2002. Water flow in the new channel was quite uniform and continuous with only two possible remnants of step dams showing, (Photo 19).

The new channel, given its location near the stream mouth and steep gradient is likely used more as a migratory passage than a rearing area. Flow in some parts of the channel may pose a problem for small fish attempting upstream movement, however, given the rocky shorelines, one would assume that there would be sufficient areas where small fish could find refuge and lesser flows.

New Outlet Structure

The outlet elevation of the recently installed culvert is about 8.7 feet, near the mid-range of tides, (Photo 20). Tidewater back flows in to the culvert to some degree on a daily basis, which provides opportunity for fish of all sizes to enter the Pullen Creek system, (Photo 21). In other areas, salmon have been observed to enter river mouths and pass through similar culvert situations after the tide has started to fall, but while there is still sufficient water for upstream movement. Once the tide has receded to a level lower than the culvert outlet, the water drops into a smooth wooden trough before entering an incline with velocity barriers, (Photo 20). On October 7, 2002, the stream was running approximately 23-24 cfs and the flow at the outlet end of the culvert was too fast to take a flow measurement. With such high velocity and water spilling onto the smooth wooden trough, fish entry into the stream would be essentially over until the next high tide reached the culvert outlet

Skagway River Fish

Most of the water in the Skagway River on October 5, 2002 was flowing through the fish passage

notch with several small trickles flowing over the top of the scour control structure (SCS), (Photo 9). Water velocity in the fish passage notch was very fast, but there were likely areas along the shorelines where fish could find slower velocities and move upstream. Small trickles flowing through the rough riprap rock surface of the SCS would provide passage for small salmonids attempting upstream movement. (No small salmonids were observed to move upstream over the SCS during this work).

Water had a glacial tint on October 6, 2002 during surveys with a visibility of approximately two feet. Weather was high overcast, air temperature and water temperature of 42 degrees fahenheit.

One dead pink salmon and three mature Dolly Varden were observed in the Skagway River upstream from the SCS on October 6,2002 show that these forms were able to negotiate upstream over the structure, however it is not known at what water level the passage was made.

Three minnow traps set downstream from the SCS averaged 16 juvenile salmonids per trap. Seven traps set upstream from the SCS averaged 41 fish per set, Table 4, (Photo 25). Small, rearing salmonids could be easily observed in the small clear side channels of the Skagway River on October 6, 2002. It is not known whether the small salmonids trapped and/or observed upstream from the SCS were hatched there or whether they moved up over the structure from downstream areas. However, the Skagway River definitely had good numbers of rearing salmonids as shown by minnow trap catches and observations.

Juvenile chinook salmon were documented to be rearing in the Skagway River during this work. A total of 18 juvenile chinook salmon were trapped both above and below the SCS. Identification of three fish, which were collected, was verified by three ADF&G fish biologists in Juneau, (Leon Shaul, Kent Crabtree, Keith Pahlke), on October 8, 2002

Sources of Information

Alaska Department of Fish and Game biologists were able to provide little information on fish stocks in the Skagway River or Pullen Creek. The only information on rearing fish in the Skagway River that could be found was minnow trap data collected by Pickett, (1998), for inclusion in the Skagway Airport Improvement Habitat Assessment, (McLean, 1998).

Pullen Creek Hatchery reports lacked information on total fish runs, stream surveys, etc. Consistent surveys have not been done and the fish weir has been frequently vandalized so the exact numbers of fish returning have not been determined. As a consequence, hatchery information is anecdotal at best.

Alaska Power and Telephone, Inc. Manager and Chief Engineer were very knowledgeable on local resources and Pullen Creek-Powerhouse hydrology.

A long term Skagway resident outdoorsmen provided anecdotal information on fish species, timing and locations in the Skagway River and Pullen Creek.

Table 4. Minnow trap catches of juvenile salmon and Dolly Varden in Skagway River, October 6, 2002

Trap Number	Dolly Varden	Coho Salmon	Chinook Salmon	Total
1*	20	2	0	22
2	5	9	0	14
3	61	2	0	63
4	14	0	0	14
5	2	50	7	59
6	27	0	0	27
7	23	3	6	32
8	75	1	2	78
9*	21	0	3	24
10*	3	0	0	3
Total	251	67	18	336

*Traps downstream from scour control device.
Two sculpins also caught in trap #2.

Note: A total of one coho and 12 Dolly Varden were considered to be pre-smolts which would likely out migrate to salt water next spring. The remainder of fish caught were considered to be fry, approximately 1 1/2 to 2 inches in length.

DISCUSSION

Pullen Creek

Adult salmon and Dolly Varden are obviously moving upstream through the new culverts and modifications placed in Pullen Creek. Over 800 of the pink salmon carcasses counted on Pullen Creek were found upstream from the culvert under the railroad tracks. A total of 43 adult coho and 4 mature Dolly Varden were also located above the culverts.

The Second Street culvert is known to pass fish upstream at some lower water levels however is suspect of being a barrier at higher flows. It is not known at what flows either adult or juvenile salmonids are able to pass upstream through the culvert.

Stream surveys revealed that the cleanest stream substrate was located upstream from the powerhouse, and this area had been well utilized by spawning pink salmon. From the powerhouse downstream, the streambed had a thin layer of glacial type silt over the rocks and gravel, which could impact production and spawning success to some degree. Coho salmon were however spawning directly downstream from the powerhouse.

The average catch per minnow trap set upstream from Second Avenue culvert was 25 Dolly Varden and 19 coho. Catches of this magnitude along with numerous observations of rearing fish in the upper reaches of Pullen Creek show that the stream is heavily used by rearing fish. It is normal for the largest numbers of rearing fish to be found in the upper reaches of small systems until the stream levels drop in the fall due to cold weather. At that time fish often tend to move down into mainstream pools and downstream where there is more water.

A total of three minnow traps set in Pullen Pond caught no fish. Such ponds are often good trap sites and this writer would have expected some fish to have been caught in the pond. The pond is likely a very important over wintering area for small fish in Pullen Creek.

It should be noted that the hatchery weir was still in place in Pullen Creek and was causing a rise in water elevation of 14-18 inches due to heavy buildup of litter and leaves. This may have been a barrier to upstream movement to small fish. The weir was removed on October 7,2002.

Tidal flow and back pressure caused by tidal back flow effect Pullen Creek up to point above Broadway Street culvert. Trap catches in this stretch averaged four Dolly Varden and 13 coho salmon. Smaller trap catches indicate that this is less than prime rearing habitat. The reach has increased gradient, few pools, and is influenced by salt water on a regular basis. This area is likely very important to fish entering and exiting Pullen Creek as they adapt to salt and fresh water and vice versa.

The Broadway Street culvert has a layer of heavy gravel in the bottom except near the outlet where it has been washed out. Velocity in the culvert was running from 1.5 to 1.9 fps on October 7, 2002. Even though these velocities are higher than the swim speed of small coho, they would likely be able to move upstream near the culvert walls and through pockets provided by the gravel. Small fish may have trouble entering the culvert outlet as the gravel is missing and the

check dams downstream from the culvert, which would slow velocity, are also missing.

Once fish migrate downstream to the outlet of the Broadway Street culvert it is essentially a straight flush to the ocean. The check dams which are supposed to number at least four in the day lighted channel would slow this flush and give fish more time to adapt to the fresh-salt water changes.

Skagway River

Rivers such as the Skagway which are very glacial, with high gradient, changing channels and fluctuating water levels are viewed as less than prime salmonid habitat however they are still very important producers of fish. This is especially important in areas such as Skagway where there are few fish streams.

An adult pink salmon carcass and observations of mature Dolly Varden upstream from the SCS show that these forms are getting up stream over or through the SCS. Excellent minnow trap catches of juvenile Dolly Varden and coho (and chinook) salmon indicate that the area has been well seeded by mature spawners in recent years.

On October 5, nearly all flow in the Skagway River was flowing through the fish passage notch with small trickles flowing over the top through small channels in the riprap. At this lower stream level, small salmonids could have found their way upstream over the SCS. As the river flow increases it is believed that small salmonids could move upstream over the SCS along the shores where large rocks and woody cover would provide areas of reduced velocity.

One would not expect much upstream movement by small salmonids in the fall when water levels are dropping-as during this work. More likely, small fish would be moving out of their small summer rearing streams and sloughs toward the mainstream where there are larger pools. As upper stream reaches tend to dry up due to freezing, fish tend to congregate in larger pools often in lower sections of the stream. Picket, (1998) documented good numbers of Dolly Varden and coho salmon rearing downstream from the bridge during the winter.

The Skagway River often has a small fall run and a larger spring run of eulachon, (Jay Frey, pers.com.). The fall run typically moves up into the river in the areas along side the airport, whereas during very large spring runs, the fish would move upstream for the bridge. Eulachon runs have not been large since construction of the SCS, so it is not known at this time whether they can move upstream over the SCS.

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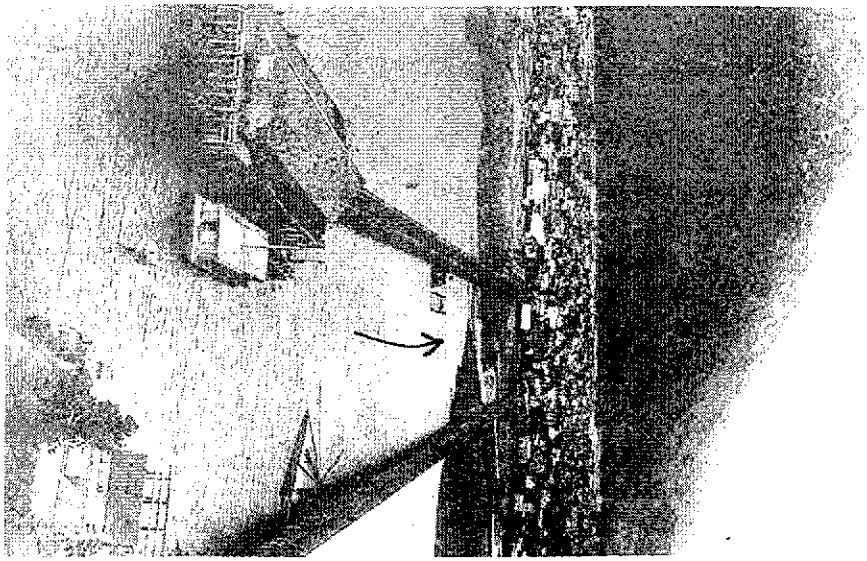

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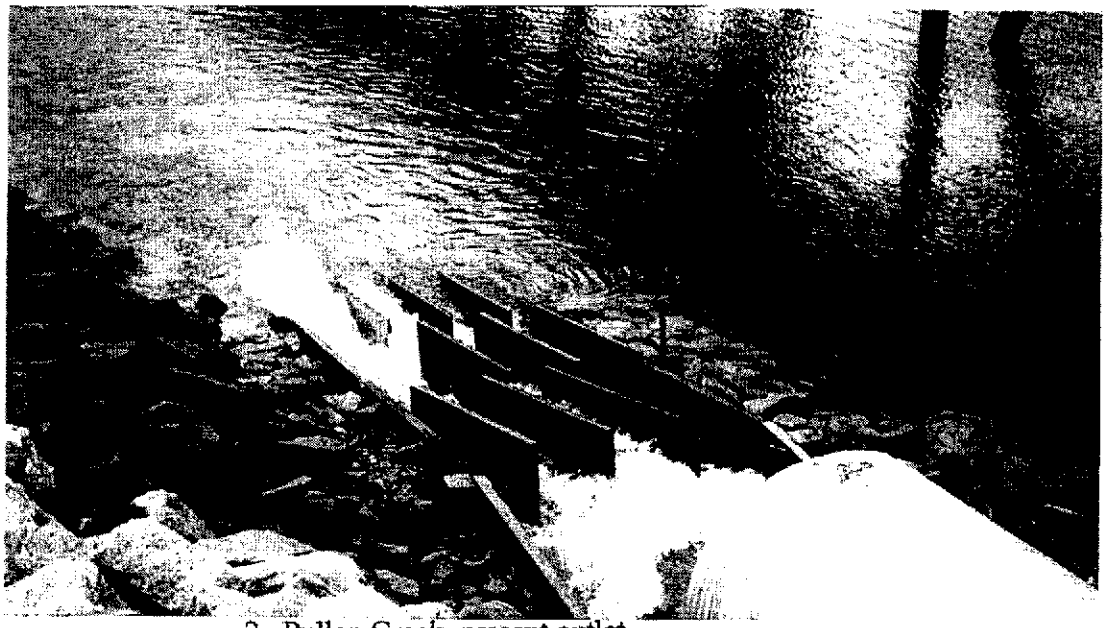

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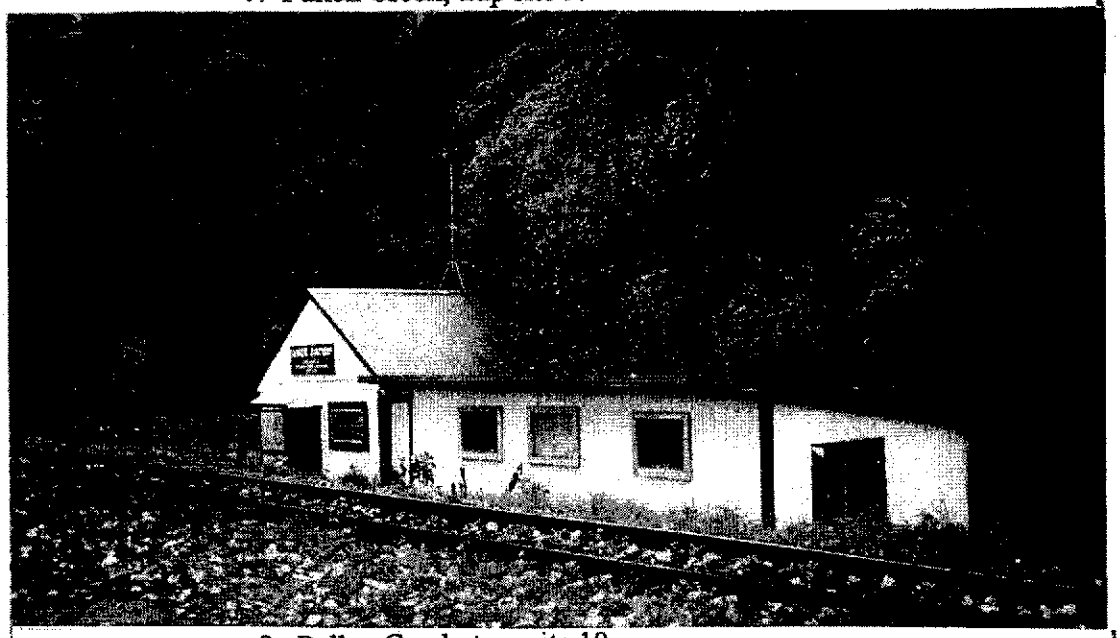

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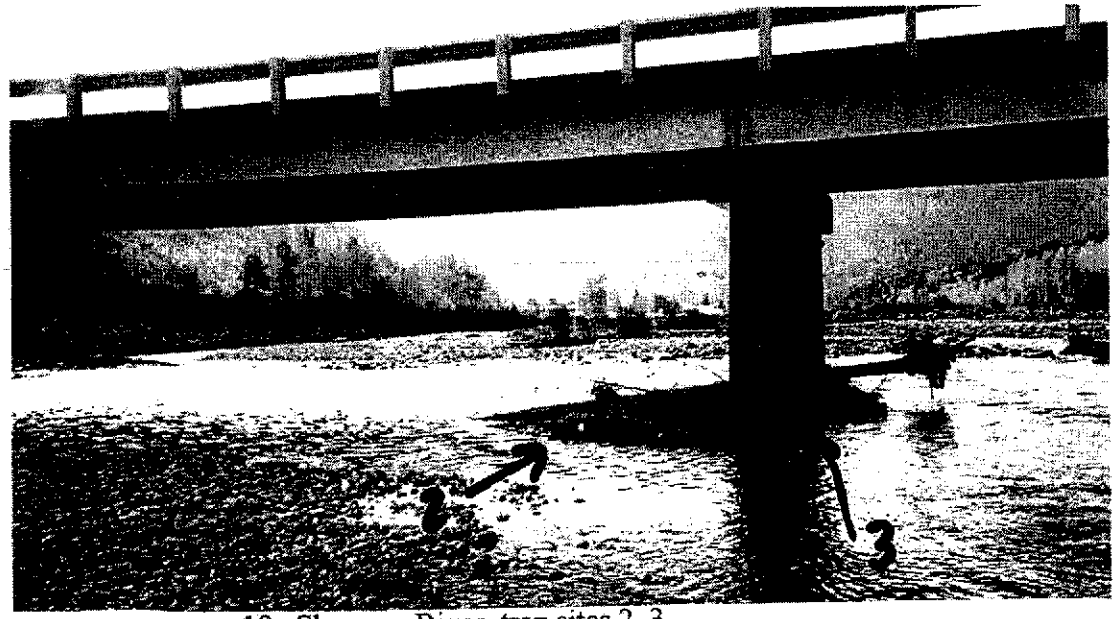

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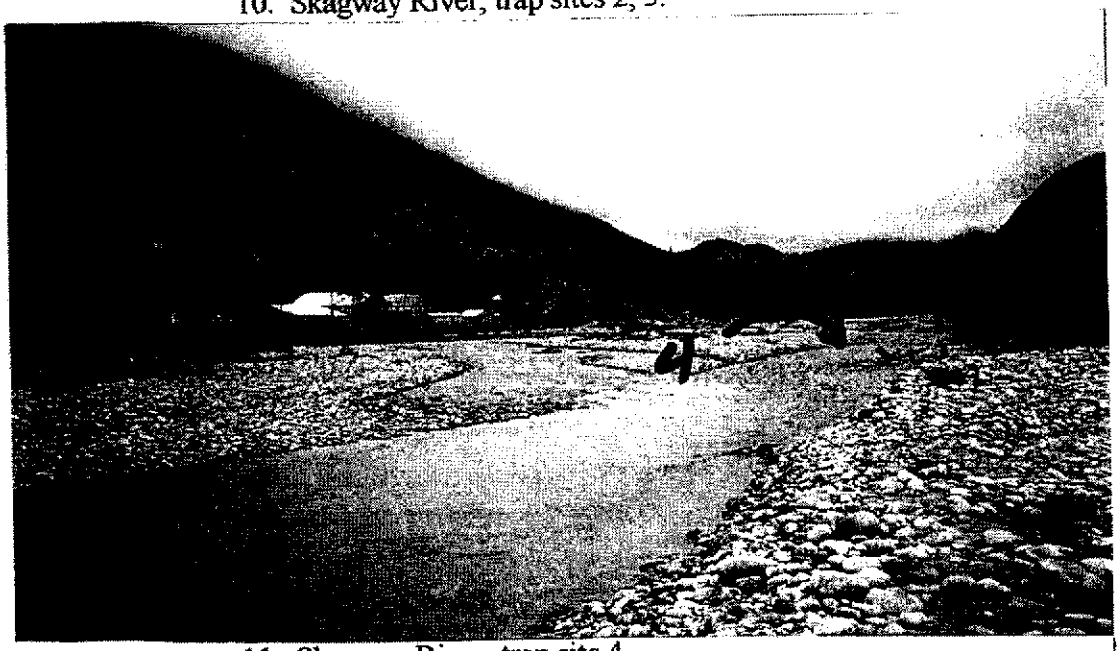
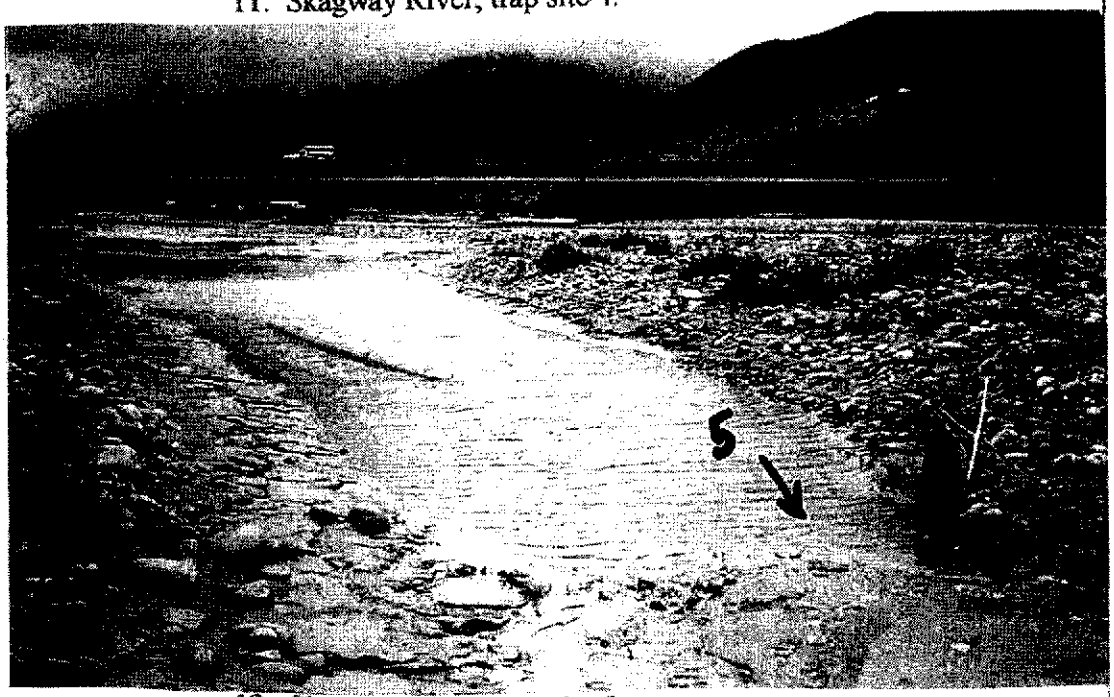


11. Skagway River, trap site 4.



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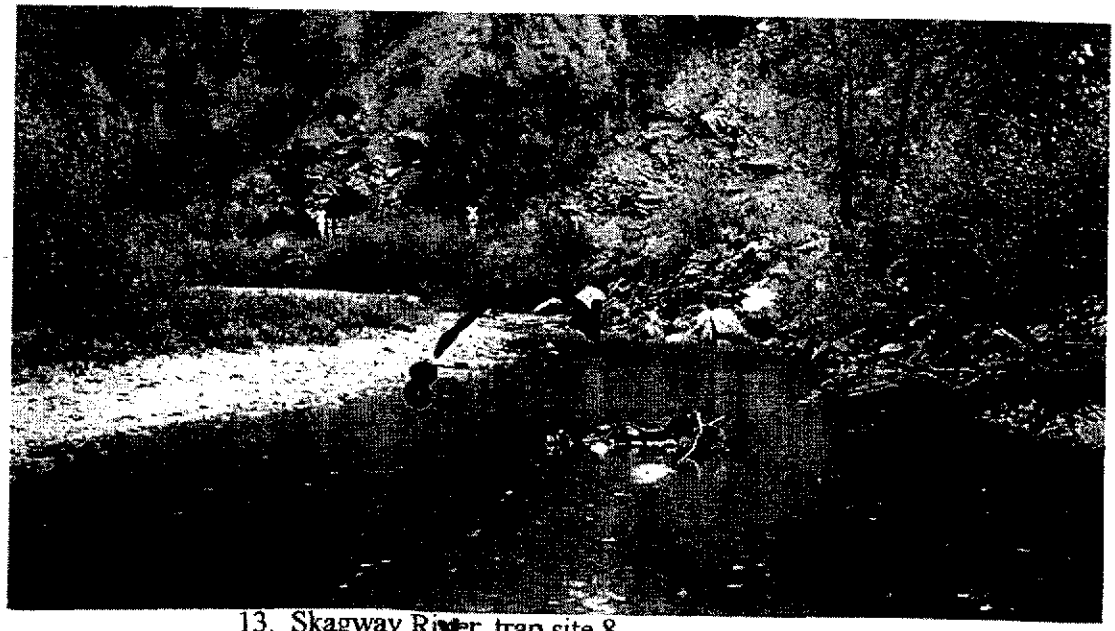

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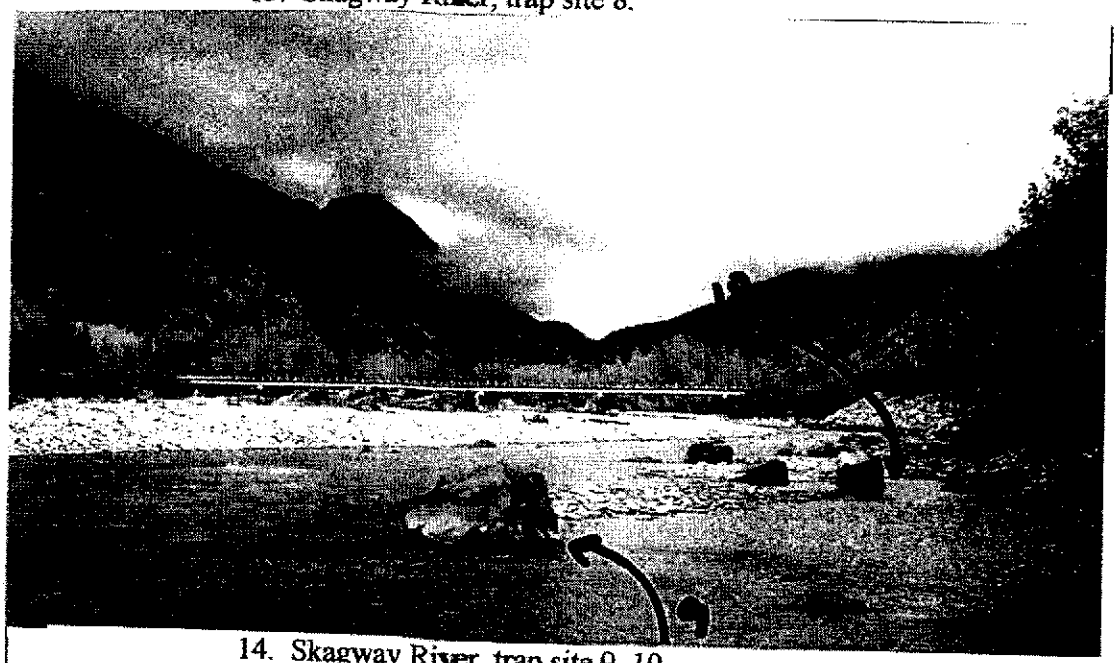
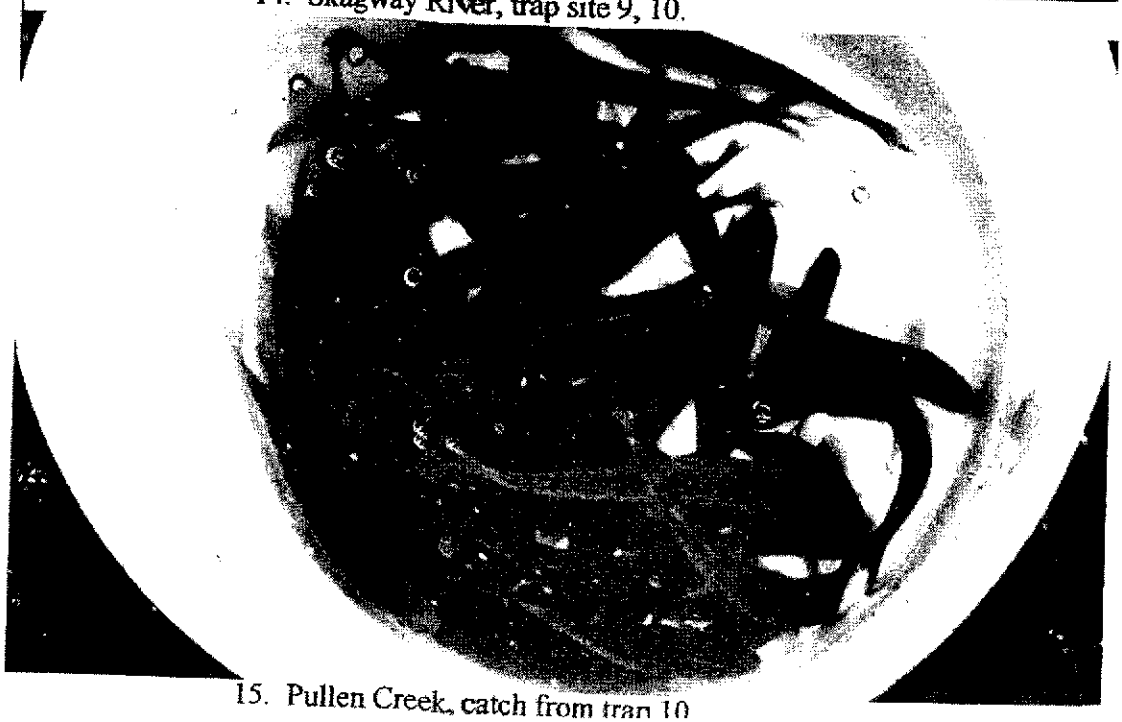
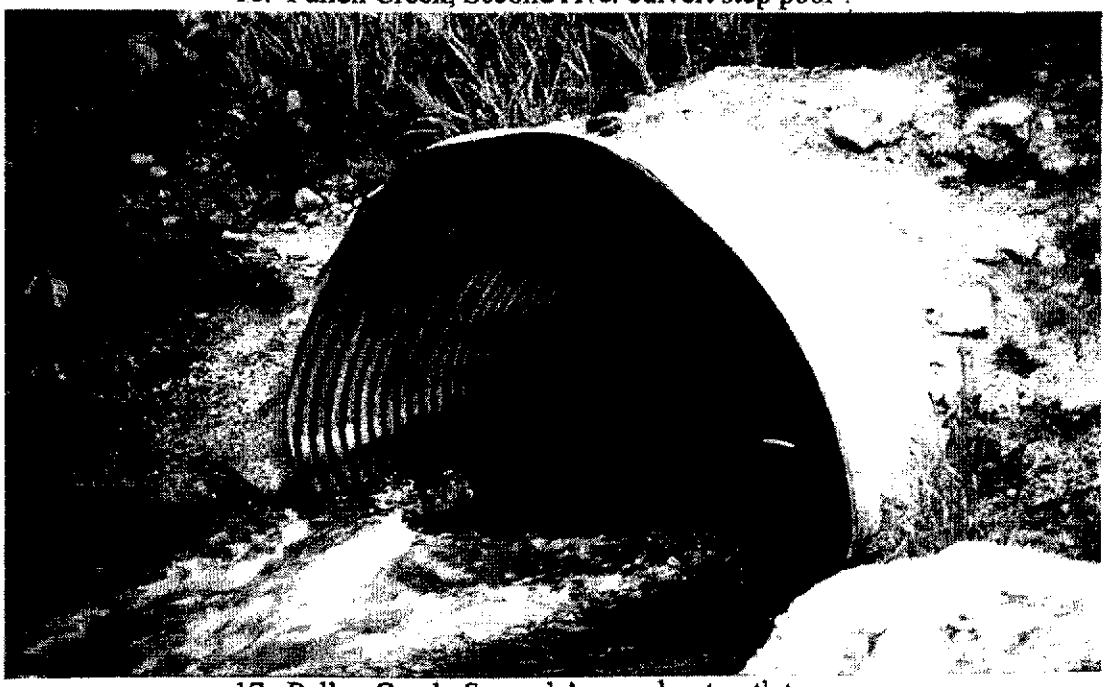


14. Skagway River, trap site 9, 10.



15. Pullen Creek, catch from trap 10

16. Pullen Creek, Second Ave. culvert step pool ?



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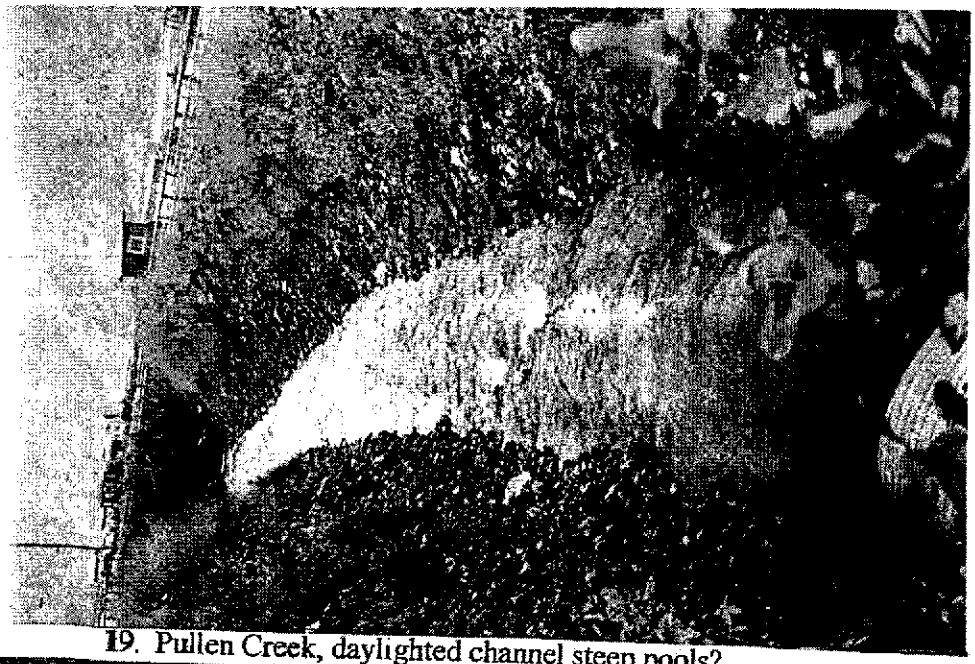
18. Pullen Creek, Broadway Street culvert outlet with tidal back flow.



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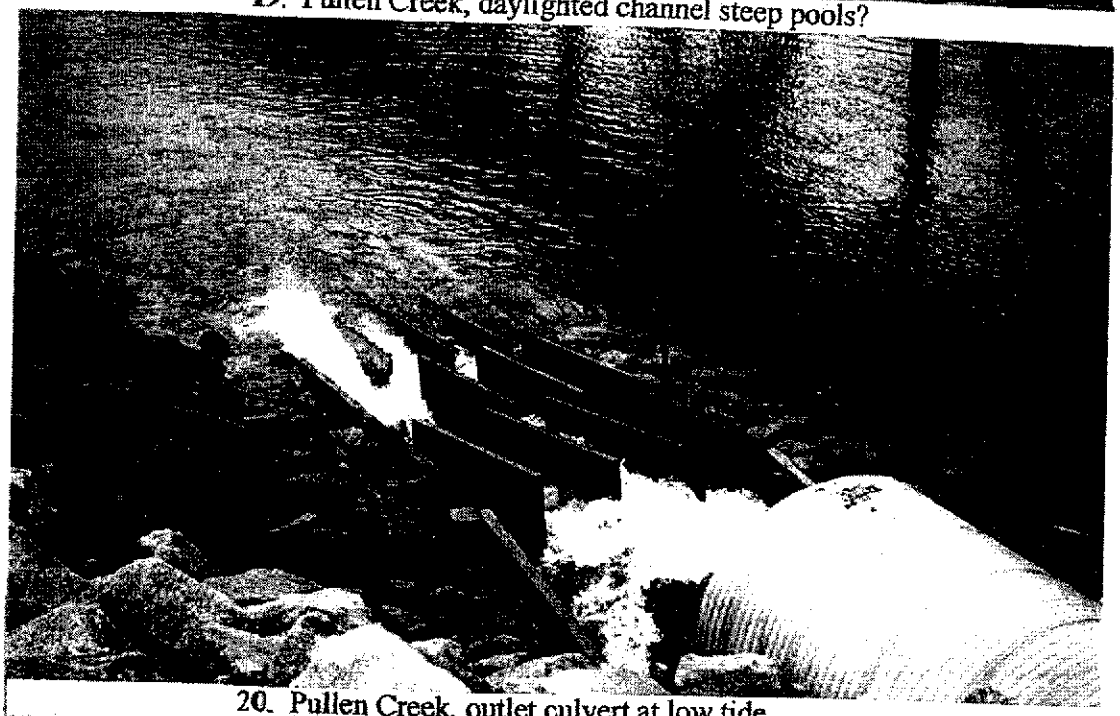

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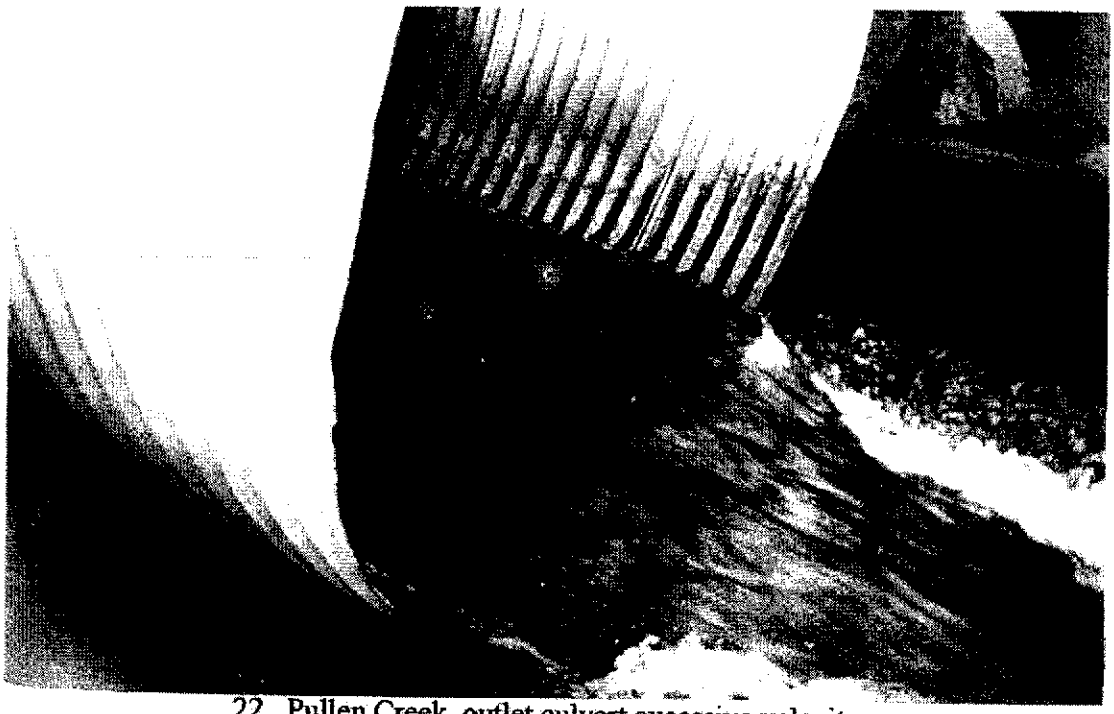
21. Pullen Creek, outlet culvert at higher tide.



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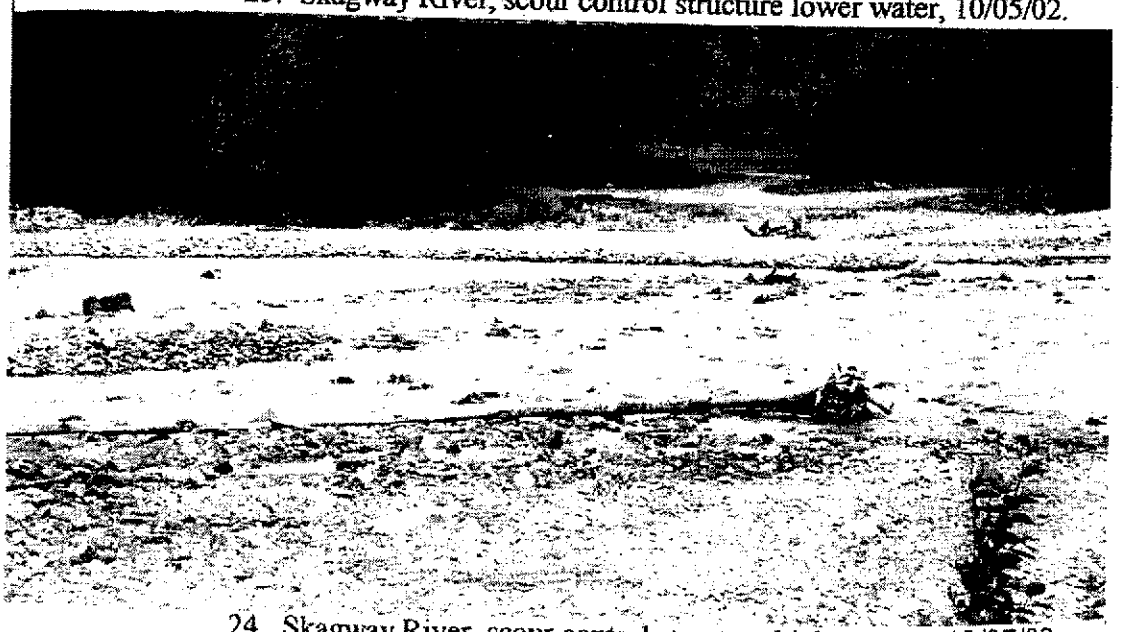

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ALASKA DOT & PF
SOUTHEAST REGION
OCT 29 2003
ENVIRONMENTAL SECTION

An Evaluation of Fish Passage Associated With New Structures Constructed In The Skagway River And Pullen Creek

October, 2003

PREPARED FOR

Alaska Department of
Transportation and Public Facilities
Southeast Region

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An Evaluation of Fish Passage Associated
With New Structures Constructed In
The Skagway River And Pullen Creek,
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ABSTRACT

Analysis of fish passage associated with new fish habitat improvements in Pullen Creek and a scour control structure placed in the Skagway River was conducted October 20 and 21, 2003. Visual fish surveys and baited minnow traps were employed in these analyses and water flow measurements were taken in Pullen Creek.

No fish were observed to move upstream through the improvements in Pullen Creek during this work. However, counts of 45 adult coho salmon, 10 adult Dolly Varden, and remains of hundreds of adult pink salmon indicate that these fish are able to pass through all the improvements to the upper reaches of Pullen Creek. Minnow trap catches of 59 juvenile Dolly Varden and 33 coho salmon and visual observations indicate viable populations of rearing fish for a small stream the size of Pullen Creek.

Upstream passage through improvements by small salmonids is likely occurring at particular water levels in Pullen Creek, however, high water velocity at 2nd Street culvert may prevent upstream movement.

No fish were observed to move upstream through the scour control structure in the Skagway River during this work. However, it is apparent that mature fish can negotiate the structure as eight mature Dolly Varden were counted upstream from the scour control structure. Clearly these fish can negotiate the structure. Minnow trap catches of 31 juvenile king salmon and 38 coho salmon above the scour control structure indicate that juvenile adult forms of these species are also able to negotiate the structure. An additional 12 juvenile kings and 3 cohos were trapped in the main stem downstream from the scour control structure.

The Skagway River was reported by local residents to have a large run of eulachon in spring, 2003 which moved upstream at least as far as the scour control structure. Movement of the fish upstream through the scour control structure could not be documented in this study.

BACKGROUND

The Skagway River runs along side the Skagway Airport and erosion and flooding have been major concerns for years. In 1998, the Alaska Department of Transportation and Public Facilities (DOTPF) received permits to improve the airport, including modifications of the Skagway River to divert flow away from the airport. As mitigation for this work, DOTPF replaced culverts and rebuilt the lower section of Pullen Creek, which was believed to be severely impacting fish movements in the stream. Pullen Creek, located in the middle of the City of Skagway has been subject to relocation and many adverse modifications since the gold rush days. The stream mouth is presently many feet higher in elevation than it was originally due to land development along the waterfront. Mitigation work by DOTPF was designed to improve fish passage in Pullen Creek. The effect of this work was to be evaluated for three years following completion of the work. This report covers the second year of evaluation of fish passage associated with new structures constructed in the Skagway River and Pullen Creek.

OBJECTIVE

Determine if the scour control structure constructed in the Skagway River and associated mitigation done in Pullen Creek are providing adequate fish passage.

Fish passage associated with the following structures was evaluated during this work:

Skagway River
- Scour control structure

Pullen Creek
- Second Avenue culvert
- Broadway Street culvert
- Newly day lighted channel
- New outlet culvert and tidal outfall

METHODS

Gee minnow traps in ¼ inch mesh baited with salmon eggs were set in prime habitats and in areas where concentrations of rearing fish were observed. Bait was treated with 1/100 betadyne solution for a ten-minute soak, boraxed and frozen prior to use. Traps were set for approximately a four-hour long soak. The numbers of fish caught per species per trap were collected along with notes on whether the fish were small fry or presmolt which would likely out migrate next spring. All fish caught in minnow traps during course of this work were released unharmed.

In visual surveys, Polaroid glasses were worn to enhance visibility in the water. The numbers of live and dead fish were recorded by species. Undercut banks and brushy habitats were probed with a walking stick to drive fish out for counting.

Visual stream surveys were conducted on Pullen Creek from the mouth upstream to the hatchery on the east fork and up to 14th Avenue on the west fork. The survey area and minnow trap sites on Pullen Creek are shown in figure 1. Minnow trap site locations are described later in this section. This stream is quite stable and trap locations could be duplicated in the future.

Visual surveys on the Skagway River were conducted from the upper end of the runway to a point approximately 600 yards upstream above the Klondike Highway Bridge, in a clear tributary/side channel that paralleled the Cemetery Road and on Lillegravin Creek from the new culvert upstream approximately 50 yards. The survey area (exclusive of Lillegravin Cr.) and minnow trap sites used in this work are shown in figure 2. Please note that the Skagway River is seasonally glacial with very high flows which make for very unstable channels. As a result, many trap sites used in 2002 were not present for use in this years study.

Flow measurements were taken with a Global Flow Probe, model FP201. Distances were estimated with a Ranging model 400 range finder and locations of unstable trap sites in the Skagway River were identified with a Garman E-Trek GPS.

Minnow trap sites in Pullen Creek are identified below. Photos of most trap sites are included in last years report.

1. Most downstream site, on east shore, 30 yards upstream from upstream end of Broadway Street culvert.

2. Downstream from overhanging brush on east shore, directly under power/telephone line that angles across the creek.

3. Directly downstream from rock on east shore, 60 ft. downstream from foot bridge.

4. East side, most downstream section of Pullen Creek pond.

5. East shore, inlet end of Pullen Creek pond, next to largest rock in lawn.

6. West shore, inlet end of Pullen Creek pond, midway from culvert to wooden dock.

7. In pool between 2nd Avenue culvert and railroad (RR) track culvert, just east of outlet end of RR culvert.

8. Above powerhouse next to cut bank under large spruce tree on east shore of stream. directly across RR track is tombstone of Mrs. Pullen.

9. Under overhead alders directly adjacent to large white oil tank on west shore, just upstream from museum.

10. At tail of pool, directly downstream from Pullen Creek Hatchery building.

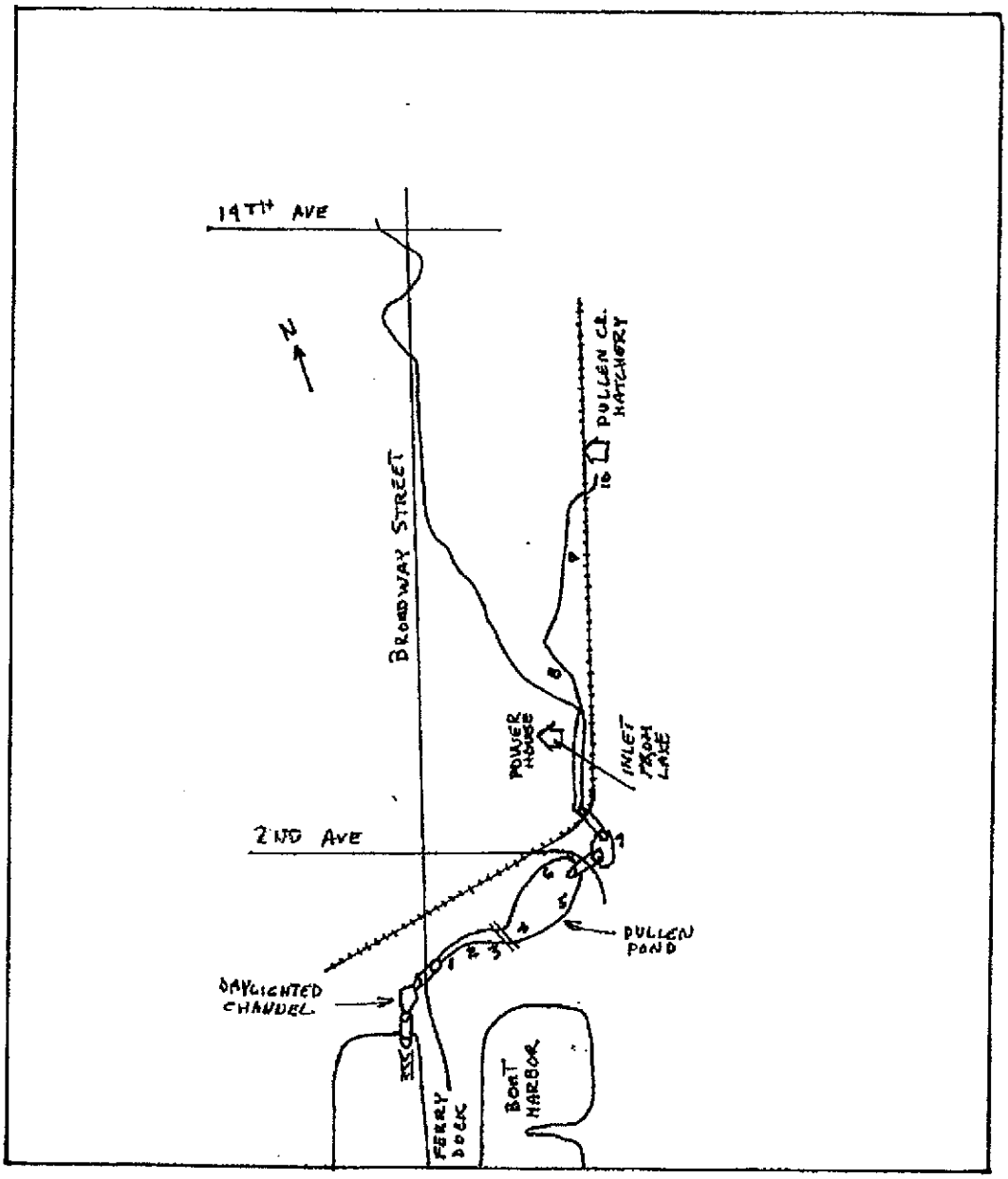

Figure 1. Minnow trap locations and survey area, Pullen Creek.

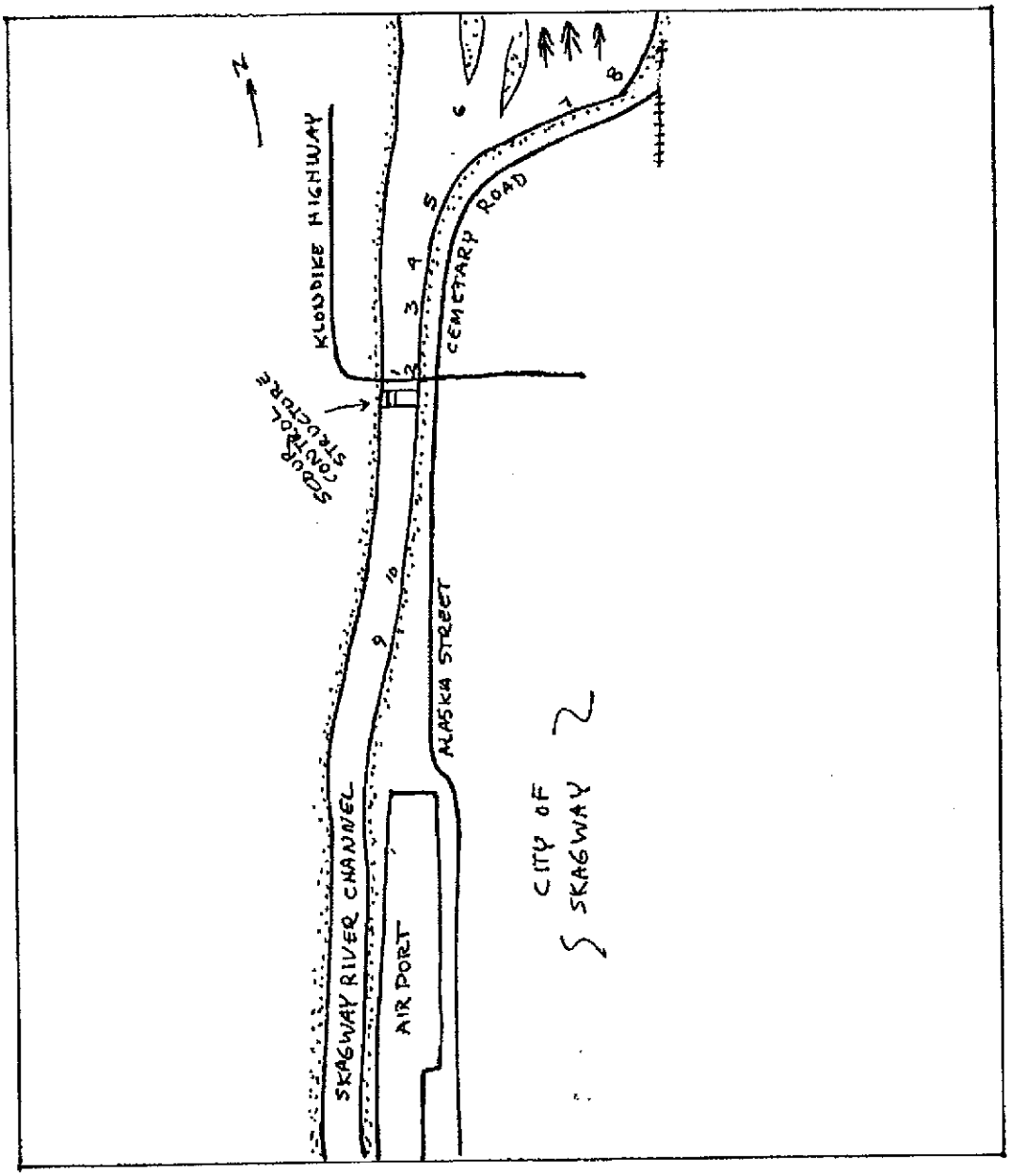

Figure 2. Minnow trap locations and survey area, Skagway River.

Minnow trap sites on the Skagway River are identified below. Photos of trap sites in stable habitat are presented in the 2002 project report. Trap sites in unstable areas were not photographed, as these areas would likely be different in the future. These locations are identified only by latitude and longitude.

1, 2. Set in large brush wad stuck on #3 bridge support (from east shore).

3. In a side pool in gravel bar on east shore, 59-28-093N x 135-18-084W.

4. In a side channel in gravel bar above bridge, 59-28-167N x 135-18-026W.

5. In a channel in gravel bar above bridge, 59-28-193N x 135-17-929W.

6. In a channel near middle of bar above bridge, 50-28-252N x 135-17-868W.

7. In side channel paralleling cemetery road, 55 yards below RR crossing sign.

8. Upstream end of wet channel paralleling cemetery road, 20 yards below RR sign.

9. Most downstream site approximately 60 yards upstream from airport security fence next to large "habitat rock".

10. Approximately 200 yards upstream from airport security fence next to large "habitat rock".

Fish species inhabiting the Skagway River and Pullen Creek are listed below:

Coho salmon, Onchorhynchus kisutch
Pink salmon, Onchorhynchus kisutch
Chum salmon, Onchorhynchus keta
Chinook salmon, Onchorhynchus tshawytscha
Dolly Varden, Salvelinus malma
Eulachon, Thaleichthys pacificus
Sculpins, Cottus spp.

FINDINGS

Pullen Creek, 2003

Water level in Pullen Creek below the power house on October 20 and 21, 2003 was approximately five inches lower than when surveys were done in October, 2002. Water clarity was excellent for visual surveys. Water flowing from the powerhouse outfall had a slight glacial tint while water in Pullen Creek above the powerhouse was crystal clear. Air temperature was 48° Fahrenheit (F) during mid-day and water temperature was 46 degrees F.

Pullen Creek Fish, 2003

No adult salmon, Dolly Varden, or rearing salmonids were observed to move upstream through the new structures placed in Pullen Creek during this survey.

The trap sites used in 2002 were trapped again on October 21, 2003. In 2002, all three traps set below Pullen Pond caught fish and averaged 16 fish per trap while this year, all three traps took a total of only one coho fry (table 1). It was again obvious that rearing fish were not using Pullen Pond this time of the year as no rearing fish were taken in three traps set in the pond. Upstream from the railroad crossing, Pullen Creek was very shallow with a smooth, flat bottom with little cover. No rearing fish were observed in this stretch.

Table 1. Minnow trap catches of juvenile coho salmon and Dolly Varden in Pullen Creek, October 21, 2003

Trap Number	Dolly Varden	Coho Salmon	Total
1	0	0	0
2	0	1	1
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	2	2
8	2	2	4
9	9	22	31
10	47	6	53
Total	**58**	**33**	**91**

Note: A total of 18 coho and 17 Dolly Varden were considered to be pre-smolts which would likely out migrate to salt water next spring. The remainder of fish caught were considered to be fry, approximately 1 1/2 to 2 inches in length.

Rearing fish could be easily seen in Pullen Creek upstream from the power house and minnow trap catches averaging 27 fish per trap in this area demonstrated that it is the primary rearing area in the drainage, (figures 3,4). Rearing fish could also be observed in the west fork of Pullen Creek, however this area was not trapped.

Figure 3. Minnow trap in Pullen Creek.

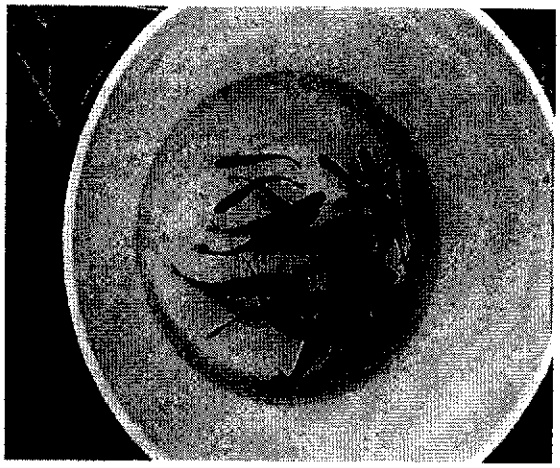

Figure 4. Juvenile coho and Dolly Varden, Pullen Creek.

Most of the rearing coho trapped and observed in Pullen Creek appeared to be fry from one and a half inches to three inches in length. Only three of the cohos trapped were likely going to outmigrate as smolts next spring. Dolly Varden, which rear for several years in fresh water had a larger range in size. Approximately half were likely to be smolts in 2004.

A total of 45 coho spawners (live and dead) were surveyed on October 20, 2003. Thirty-nine of the coho were found upstream from 2nd Avenue to the powerhouse and six upstream from the powerhouse,(Table 2) (Figure 5). The number of pink salmon spawning in the system could not be estimated as most of the carcasses had deteriorated to only small skeletons scattered along the stream. It was apparent that the pink run had numbered at least in the hundreds of spawners. Only 13 could be positively identified as pink salmon. The greatest numbers of pink salmon remains were upstream from the 2nd Avenue culvert.

Table 2. Visual survey counts of adult salmon and Dolly Varden in Pullen Creek, October 20, 2003

Area	Pink	Coho	Dolly Varden
2nd Avenue to Powerhouse	0	13 Live 16 Dead	5 Live
Powerhouse to Hatchery	0	3 Live	5 Live
Westfork to 14th Avenue	13 Dead	3 Live	0
Total	**13**	**35**	**10**

Figure 5. Coho spawning, Pullen Creek.

A total of 10 Dolly Varden spawners were counted in Pullen Creek on October 20, 2003. Here again, all spawning fish were observed upstream from the 2nd Street culvert. This date, being some 15 days later than last year is apparently closer to the peak of Dolly Varden spawning. It appears however to be after the peak of coho spawning and far too late to estimate the number of pink salmon.

The total number of hatchery-produced king salmon returning to Pullen Creek this year was not known, however was estimated to be several hundred fish, (Rex Kilborn, pers. Com.). Eggs were taken from 50 adult female kings for the enhancement program and hundreds were released upstream to provide for the sport fishery. The majority of these fish ultimately moved upstream through the 2nd Avenue culvert.

Pullen Creek Water Flows, 2003

During this work, Pullen Creek was running considerably lower than in 2002. Stream flow was estimated to be 9.3 cubic feet per second (cfs) at 2nd Street culvert inlet and 12.5 cfs at Broadway Street culvert inlet on October 20, 2003. The powerhouse, which typically provides most of the water in the stream, had been releasing an estimated flow of nine to 11 cfs into the stream for several days prior to this study (Ken Nalin, pers. Com.). Their actual flow meter was not working.

2nd Avenue Culvert

At the current water level on October 20, 2003, average flow at the upstream end of the 2nd Street culvert was 1.6 feet per second (fps) as the flow was being held back to some degree by baffles inside the culvert (Table 3). The culvert baffles were providing definite steps in water level going through the culvert. There was a small falls of approximately

six inches from the outlet of the 2nd Street culvert to the surface of the pond below. There was some evidence of a low check dam around the outlet of the culvert. Flow from the lowest baffle to the culvert outlet was running straight and fast at 5.5 fps, (Figure 6).

Table 3. Water flow measurements taken in Pullen Creek, October 20 and 21, 2003

Date	Location	Flow (fps)
October 20	Inlet of 2nd Ave. culvert	1.6
October 20	Above Broadway St. culvert	2.7-1.2
October 21	Above Powerhouse	0.60
October 21	Below Powerhouse	0.76
October 21	30 yds above RR crossing	0.52
October 21	Above stream mouth culvert	1.5
October 21	Outlet of 2nd Ave. culvert	5.5
October 21	Outlet of Broadway St. culvert	0.7
October 21	Outlet of stream mouth culvert	too fast

Figure 6. Outlet of 2nd Street culvert, Pullen Creek.

Broadway Street Culvert

The culvert under Broadway Street is approximately 130 feet long and 8 feet in diameter with gravel in the bottom. Water depth in the culvert inlet was quite uniform at eight to ten inches and flow ranged from over 2.0 fps in the middle to 1.2 fps next to the culvert wall. A small rock formation at the culvert outlet, which was not present in 2002, actually slowed the flow of water exiting the culvert to approximately 0.4 fps, (Figure 7). Water depth in the culvert outlet was a uniform 22 inches. In 2002, it appeared that gravel had been washed out of the outlet end of the culvert. This year it appeared that gravel had washed down the culvert and filled in the outlet end. The small rock structure seemed to hold the gravel in place. In 2002, the stream was higher and without the small rock formation, the flow ran from 1.5 to 1.9 fps.

Figure 7. Outlet of Broadway Street culvert, Pullen Creek.

Day Lighted Channel

The new day lighted channel just upstream from the outlet culvert was approximately 8 feet wide with a depth of 11 to 12 inches. Flow in this area averaged 1.55 fps, whereas last year flow averaged 1.87 fps.

New Outlet Structure

Water exiting the culvert at low tide cannot be properly accessed for flow measurement; however, outflow velocity is believed to be well above fish capability. Tide level appears to be the critical factor in fish gaining access into the mouth of Pullen Creek.

Skagway River, 2003

Water level in the Skagway River was eight to ten inches lower than during surveys in 2002, and essentially all the river was flowing through the fish passage notch on October 20 and 21, 2003, (Figure 8). With the lower water level, there were fewer side channel and tributary areas in which to set traps than in 2003. Water temperature was 40° F and air temperature was 48° F. Water had a slight glacial tint with a visibility of approximately two feet.

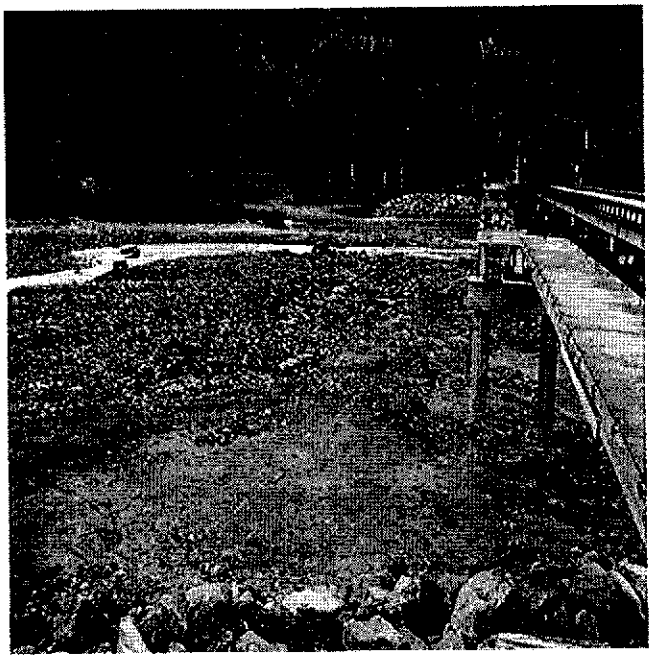

Figure 8. Skagway River scour control structure.

Skagway River Fish, 2003

No fish were observed to move upstream through the scour control structure during this years survey and no adult salmon spawners were found in the Skagway River. Four mature Dolly Varden that appeared to be spawned out were observed near trap sites four and eight. The channel that paralleled Cemetery Road had two areas that had been used for spawning, probably by Dolly Varden.

A short survey was made at Lillegravin Creek from the new culvert upstream approximately 50 yards. Four mature Dolly Varden were found to be hiding in the new culvert and there was an area where spawning had occurred near a cliff 50 yards upstream, (Figure 9). Many small rearing fish were also observed in small pools in the stream.

Figure 9. Lillegraven Creek spawning area.

A total of 226 rearing salmonids were captured in the Skagway River on October 20, 2003. 8 traps set upstream from the scour control structure (SCS) captured 176 fish and 2 traps set in the main stem downstream from the SCS captured 47 fish. Dolly Varden made up over half of the fish captured while the numbers of king and coho captured were nearly equal, (Table 4). The largest numbers of rearing king salmon were trapped in the main stem or in areas adjacent to it, and coho were found more in the side channel and pond areas, (Figures 10,11).

Table 4. Minnow trap catches of juvenile salmon and Dolly Varden in Skagway River, October 20, 2003

Trap Number	Dolly Varden	Coho Salmon	Chinook Salmon	Total
1	31	0	3	34
2	27	3	20	50
3	3	22	3	28
4	0	0	0	0
5	0	0	0	0
6	0	0	1	1
7	32	10	3	45
8	17	3	1	21
9 *	25	2	10	37
10 *	7	1	2	10
Total	**142**	**41**	**43**	**236**

*Traps downstream from scour control device.
*Total of 10 sculpins also caught.
*Trap number five was smashed by an off-road vehicle crossing the channel.
Note: All of the king salmon,one coho and approximately 50% of the Dolly Varden were considered to be pre-smolts which would likely out migrate to salt water next spring. The remainder of fish caught were considered to be fry, approximately 1 1/2 to 2 inches in length.

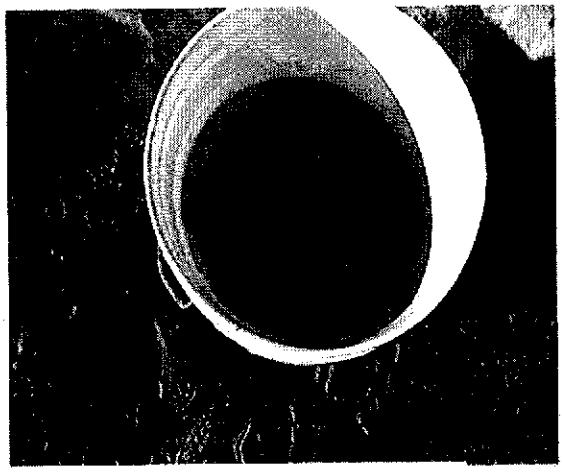

Figure 10. Skagway River, Mixed Species Catch.

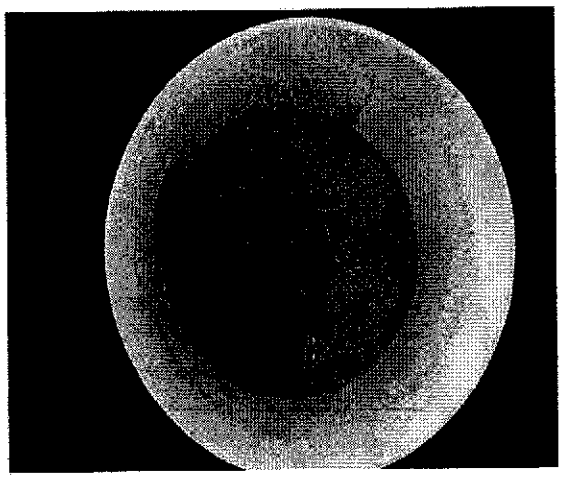

Figure11. Skagway River Catch, Mostly Coho Fry.

Dolly Varden ranged in size from 1 1/2 inches up to approximately seven inches. The smaller Dolly Varden were likely hatched this year while the larger fish had spent several

years in the river and would likely out migrate next spring. The rearing king salmon and the majority of rearing coho were likely one-year old fish.

One minnow trap set in a small side channel of the Skagway River was smashed when run over by an off road vehicle driving up the channel. No dead fish were found in or around the trap.

DISCUSSION

Pullen Creek

Adult salmon and Dolly Varden are obviously moving upstream through the new culverts and modifications placed in Pullen Creek. All of the mature Dolly Varden and salmon spawners that could be identified were upstream from the culvert under the railroad tracks and the 2nd Street culvert, which is likely the greatest challenge to upstream fish passage.

In this study, Pullen Creek was flowing from 9.3 to 12.5 cfs, and the water velocity in the outlet of the 2nd Street culvert averaged 5.5 fps. Flow from the upstream end of the culvert down through the baffled area could likely be negotiated by a small salmonid, however it is doubtful that a small fish could negotiate the velocity from the culvert outfall up to the first baffle. Passage through this area by small fish may be possible at times when the surface of Pullen Pond is at a higher elevation.

The majority of rearing fish trapped the last two years in Pullen Creek were upstream from the powerhouse. This may be due to much more natural, stable habitat in the upstream areas, a combination of factors downstream from the power house that reduce the streams productivity or the lack of small fish capability to pass back upstream through the 2nd Street culvert.

Even though minnow trap catches in Pullen Creek were considerably less than in 2002, this years observations showed strong populations of rearing fish in upper Pullen Creek. It is obvious that sufficient numbers of mature spawners are passing through the structures to adequately seed the rearing areas with fry. The greatest number of rearing fish observed and trapped were close to the hatchery. This channelized stream provides excellent rearing habitat, and fish may also be attracted to the hatchery outflow.

A small rock formation which reduced the flow from Broadway Street culvert improved potential for upstream fish passage through the culvert. The small formation was not present at the culvert outlet last year and the gravel had been washed out of the end of the culvert. This year gravel was found to be present in the bottom of the culvert. In the current situation, the Broadway Street culvert would provide the first resting area for fish moving into Pullen Creek through the outlet control structure and newly day lighted channel.

Water velocity in the day lighted channel was found to average 1.55 fps in this years study. At this stream flow there appeared to be sufficient areas of lesser velocity next to the rocky shore to provide passage for small fish. This lower section of Pullen Creek is likely most important as a migratory corridor and area of adjustment for anadromous fish leaving/entering fresh/salt water.

Skagway River

The Skagway River was considerably lower during this years survey and as a consequence there were fewer areas to set minnow traps, especially in the side channel and tributary areas. These are the type of habitats preferred by coho. Many small rearing fish presumed to be coho were observed in the side channel where the trap was smashed.

Some of the side channels which were flowing during last years study were no more than elongated ponds with no visible flow during this years study. Small fish carrying wounds and bird tracks in the sand around the ponds indicated that birds were feeding on the fish trapped in the ponds as the water dropped.

The numbers of rearing king and coho salmon and Dolly Varden captured above the SCS indicate that sufficient numbers of mature fish are passing through the SCS to seed the upper rearing areas. Most of the juvenile salmonids captured in this study likely originated above the SCS as typically, these species spawn in more upper reaches rather than near the tidal areas such as downstream from the SCS. There may be times at lower water level when small salmonids have difficulty traveling upstream through the SCS fish passage notch, however even at such water levels; there are likely less turbulent areas along the rocky shorelines that would provide passage. During the spring, fall and winter when such low water levels would be expected, one would not anticipate much upstream movement by small rearing salmonids. At times of the year when the SCS is covered by water there would likely be sufficient areas along the rocky and brushy shorelines where small fish could travel upstream.

The Skagway River was reported to have received a sizable run of eulachon in spring, 2003, (Randy Erickson, Ben Kirkpatrick, ADF&G and others, pers. com.). Local residents and the area AlaskaDepartment of Fish and Game fish biologists confirmed a large abundance of eulachon, which were known to move up to the rapids below the bridge, (just below the SCS). None of the contacts could confirm whether eulachon made it up through the SCS to areas above the bridge. Prior to the SCS, eulachon were reported to migrate upstream above the bridge during years of high abundance. It is unknown at this time whether eulachon can pass upstream through the SCS.

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AN EVALUATION OF FISH HABITAT AND FISH PASSAGE ASSOCIATED WITH SKAGWAY AIRPORT MITIGATION PROJECTS ON PULLEN CREEK AND THE CONSTRUCTION OF A SCOUR CONTROL STRUCTURE IN THE SKAGWAY RIVER

DECEMBER 2004

PREPARED FOR

ALASKA DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

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INTRODUCTION

As mitigation associated with the construction of the Skagway Airport Improvement Project in 1999 through 2001, the Alaska Department of Transportation and Public Facilities (DOTPF) completed several projects on Pullen Creek designed to improve fish passage and increase the quality of fish habitat in the lower reaches of the creek. Pullen Creek flows through the middle of Skagway and empties into tidewater in an area that has been heavily impacted by development since the Gold Rush days. The creek has been realigned and the outlet elevation raised as the waterfront was filled. The lower section of Pullen Creek also serves as the conduit for the variable flows resulting from the Dewey Lake hydroelectric project operated by Alaska Power and Telephone (APT). These flows can be as high as 40 cubic feet per second (cfs).

As part of the Airport Project mitigation, an existing 481' culvert at the outlet of the creek was replaced with two shorter pipes separated by a 230' open channel. The pipes were lined with about 2 feet of river rock and the open channel was constructed with weirs designed to create step pools. The weirs subsequently washed out and were replaced in April of 2004 with 21 large rocks placed to force a meander into the stream flow and increase habitat complexity.

Further upstream, DOTPF installed a series of four steel baffles in the existing culvert under Second Avenue and constructed a rock weir 10' below the outlet of this pipe which was designed to partially backwater the culvert. These improvements were intended to increase the probability of successful fish passage through the culvert. Due to inadequate rock sizing, the weir washed out. In April of 2004, the weir was reconstructed with larger rock.

In addition to the Pullen Creek mitigation projects, the DOTPF installed a scour control structure (SCS) below the Skagway River highway bridge. This structure was designed with a low water notch intended to assure fish passage during all water levels.

During the environmental process for the Skagway Airport Improvement Project, the DOTPF committed to monitor fish passage at the SCS in the Skagway River for a period of five years and in Pullen Creek for a period of three years following completion of the project. This report covers the third year of the evaluation of fish passage associated with new structures constructed in the Skagway River and Pullen Creek. To allow for ease of comparison between the years, the format of this report has been modeled on the 2002 and 2003 reports completed by Mike Bethers.

OBJECTIVES

1. Evaluate the fish habitat associated with constructed improvements at the outlet of Pullen Creek and proceeding upstream to above Second Avenue. This will

involve monitoring and analyzing the hydraulic and fish passage characteristics of the following structures:

- New 6' x 140' culvert at the outlet of Pullen Creek
- New 230' daylighted channel
- New 8' x 130' Broadway Street culvert
- Second Avenue culvert modified with weir and baffles

2. Evaluate the fish passage associated with the scour control structure in the Skagway River immediately downstream of the Klondike Highway bridge.

METHODS

Fish Trapping

Minnow trapping has been used to determine the presence and species composition of juvenile fish in each of the two prior monitoring events for this project. The trap locations for Pullen Creek were set in the first year of monitoring and repeated in subsequent years, including this one. Given the dynamic nature of the Skagway River, some trap locations on this system must vary from year to year. However, it is possible to repeat similar trap location conditions in the river from year to year.

Gee minnow traps baited with salmon eggs were used to capture juvenile fish. The traps used were constructed of 0.25" screen. The bait was disinfected prior to use by means of a 10 minute soak in 1/100 Betadyne solution. The salmon eggs were then boraxed and frozen until the day of use. As in prior years, traps were set for an approximately four hour long soak. The number of fish caught per species per trap was recorded. Additionally, the fish were roughly divided by size to estimate the number of fry vs. presmolt (those fish that will likely emigrate to salt water next spring). All fish were released unharmed at the point of capture.

The locations of the Pullen Creek fish traps (Figure 1) were photo-documented in the monitoring report of 2002 (Bethers, 2002). The trap locations in 2004 were checked against these photographs in conjunction with the following site descriptions, also taken from the Bethers report:

Trap #

1. Most downstream site, in small pool near east shore, 30 yards upstream from upstream end of Broadway Street culvert.
2. Downstream from overhanging brush on east shore, directly under power/telephone line that crosses stream.
3. Directly downstream from rock on east shore, 60' downstream from foot bridge.
4. East side, most downstream section of Pullen Pond.
5. East shore, inlet end of Pullen Pond, next to largest rock in lawn.
6. West shore, inlet end of Pullen Pond, midway from culvert to wooden dock.
7. In pool between Second Avenue culvert and RR culvert, just east of outlet end of RR culvert.

8. Above powerhouse next to cut bank under large conifer on east shore of stream. Directly across tracks is the tombstone of Mrs. Pullen.
9. Under high overhanging alders directly adjacent to a large white oil tank on the west shore, just upstream of the museum.
10. At tail of the shallow pool, 20' downstream from the Pullen Creek Hatchery.

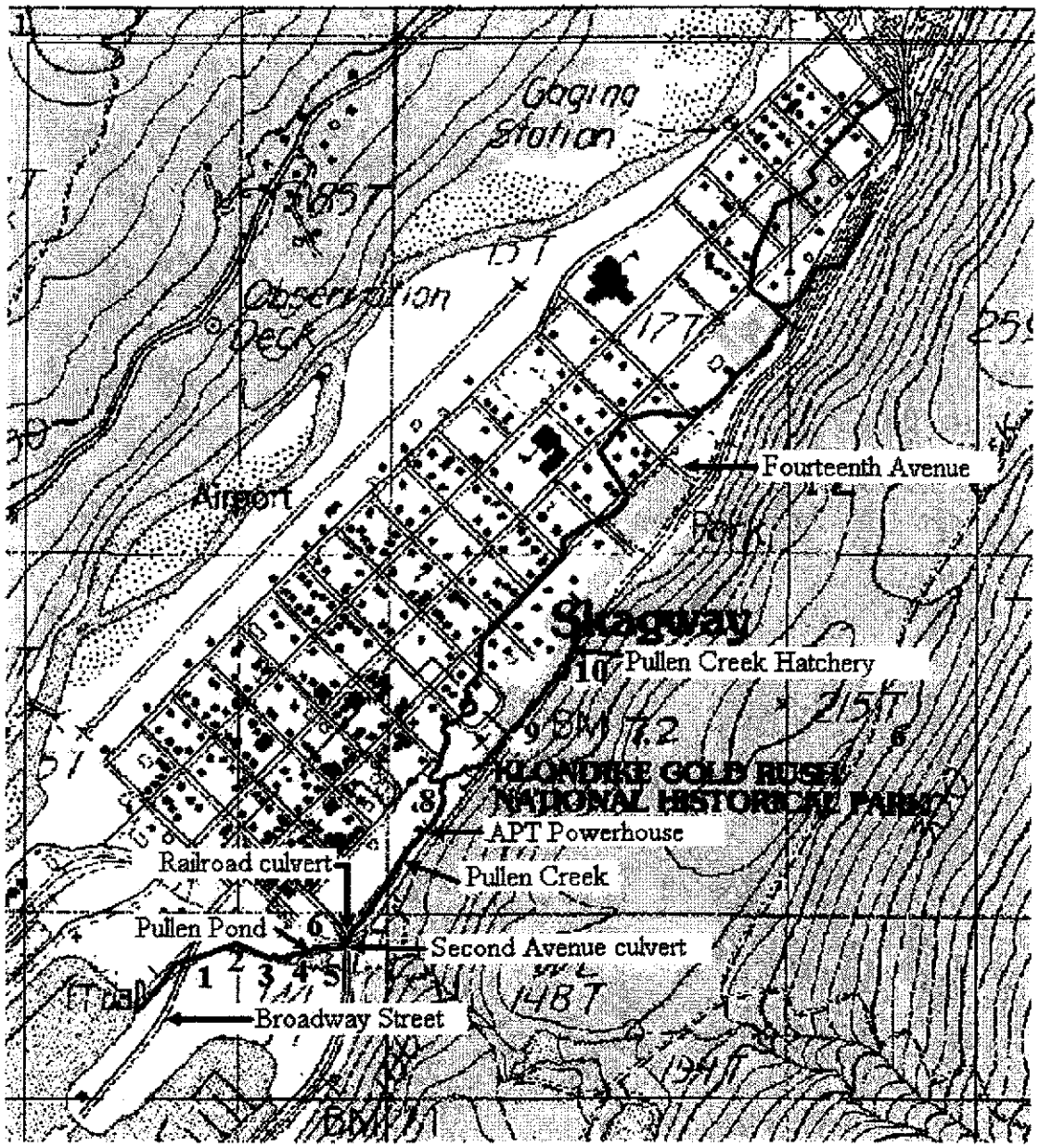

Figure 1. Minnow trap locations (1-10) and survey area, Pullen Creek

Parts of the Skagway River are stable enough to allow traps to be set in the same locations from year to year. The Skagway River trap locations 1, 2, 7, 8, 9 and 10 are repetitions of the sites trapped during the 2003 monitoring study (Bethers, 2003). The 2004 Skagway River trap locations are shown on Figure 2. In addition to a physical description of the trap locations, the following location list includes GPS coordinates of the traps set in active side channels of the Skagway River:

Trap #

1. Set in a pile of large woody debris jammed up on the third bridge support from the east side.
2. Opposite side of the same debris structure where trap 1 was set.
3. Set in a deep side pool on a gravel bar in the river. Outlet of pool directly connected to the active river. Coordinates: 59° 28' 10.1"N x 135° 18' 02.2"W
4. In a side channel in a gravel bar above the bridge. Coordinates: 59° 28' 18.1"N x 135° 17' 46.0"W
5. In a side channel in a gravel bar above the bridge. Coordinates: 59° 28' 19.9"N x 135° 17' 45.1"W
6. In a clear side channel paralleling Cemetery Road, 55 yards below the RR crossing sign.
7. Upstream end of the same clear channel where trap 6 was set.
8. In a boulder cluster in the main river channel along the east shore, adjacent to the Gold Rush cemetery, coordinates: 59° 28' 29.1"N x 135° 17' 20.5"W
9. In the main river, approximately 60 yards upstream from the airport security fence, next to a large "habitat rock."
10. In the main river, approximately 200 yards upstream from the airport security fence, next to a large "habitat rock."

Visual Survey

Visual surveys were conducted on Pullen Creek and portions of the Skagway River to determine if adult fish were present above the mitigation projects on Pullen Creek and the scour control structure on the Skagway River. Polarized glasses were worn during the Pullen Creek surveys to enhance the visibility of fish. Undercut banks and brushy habitats were probed with a walking stick to flush fish for counting.

The Pullen Creek visual survey was conducted from the stream mouth upstream to the hatchery on the east fork and up to 14th Avenue on the west fork of the stream (Figure 1).

The Skagway River visual survey was conducted from the upper end of the runway to a point approximately 600 yards upstream of the Klondike Highway Bridge (Figure 2). Additionally, visual surveys were conducted along the presently clear side channel that parallels Cemetery Road where it curves around the north end of the railroad yard (Figure 2), and on portions of Lillegravin Creek near the new culvert. The survey of the Skagway River was conducted by walking the east shoreline of the river and zigzagging

back and forth along the floodplain. The survey did not cover all of the surface area of the floodplain in the portion of the river surveyed.

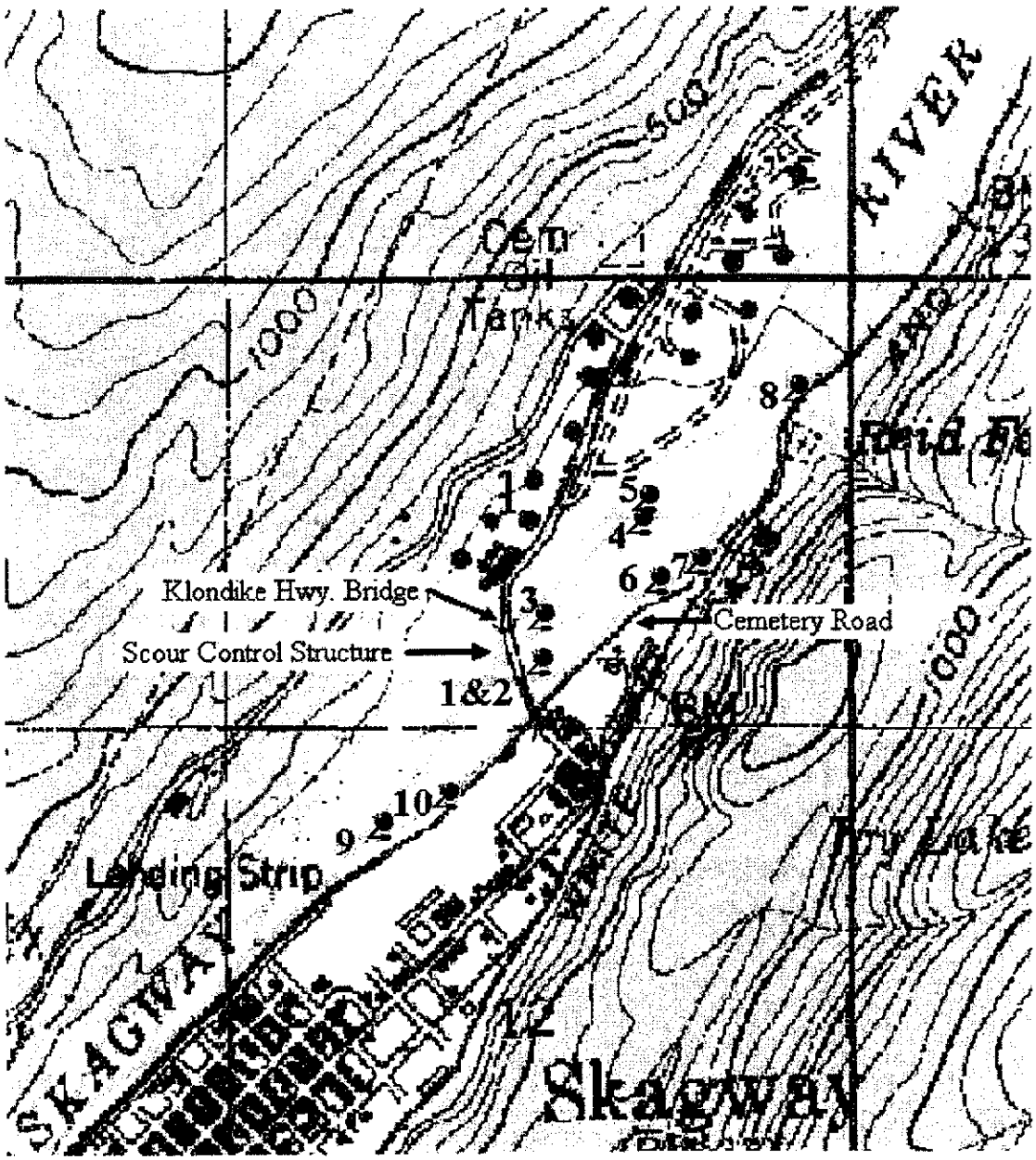

Figure 2. Minnow trap locations (1-10) and survey area, Skagway River

Physical Parameters

Water velocity measurements were taken with a Global Flow Probe, model FP 201. Temperatures were measured with a standard pocket thermometer. Distances were estimated by pacing or by measuring with a 300' tape. A Garmin Map76 GPS was used to provide the coordinates for some of the traps.

Fish Species

Fish species inhabiting the Skagway River and Pullen Creek are listed below:

Coho Salmon	Onchorhynchus kisutch
Pink Salmon	Onchorhynchus gorbuscha
Chum Salmon	Onchorhynchus keta
Chinook Salmon	Onchorhynchus tschawytscha
Dolly Varden	Salvelinus malma
Eulachon	Thaleichthys pacificus
Sculpin	Cottus spp.

FINDINGS

Pullen Creek Water Characteristics

During the survey and trapping period of October 16th and 17th, the Pullen Creek water volume was about equivalent to the flows observed in 2002 and significantly greater than the flows observed during the monitoring periods in 2003. Although the water flowing from the powerhouse had a slight glacial tint, this coloration decreased downstream and the water clarity was adequate for accurate visual surveys. Above the powerhouse the Pullen Creek water clarity was excellent. On October 16th, air temperature at mid-day was 11.0° Centigrade (C) and water temperatures were 4.5°C below the powerhouse and 4.9°C above the powerhouse.

Pullen Creek Fish

The minnow traps set this year were placed in the same locations as previous years. However, the catches of juvenile coho and Dolly Varden (DV) were generally lower than in previous years, due primarily to a very low catch in the most upstream of the traps.

In the section of Pullen Creek downstream of Pullen Pond, the three traps set in 2002 caught 38 coho and 11 DV. These same three traps produced only 1 coho during the 2003 monitoring study. This year a total of 10 coho were captured at these trap locations

(Table 1). Although the three traps set in Pullen Pond during the 2002 and 2003 monitoring did not catch any fish, these traps (# 4, 5 and 6), did catch six coho this year, indicating that Pullen Pond is being utilized by rearing coho. Coho and DV were also captured in the small pond between the RR culvert and the Second Avenue culvert.

Unlike either of two previous monitoring events, very few juvenile fish were initially captured in the traps set above the RR culvert. However, the visual survey of Pullen Creek revealed a school of juvenile fish between trap locations 9 and 10. On the evening of 10/17 a trap was set to determine the species composition of the school (Figures 3 and 4). The trap was picked the next morning and found to contain 59 coho and 29 DV.

Table 1. Minnow trap catches of juvenile Dolly Varden and coho salmon in Pullen Creek, October 16, 2004

Trap Number	Dolly Varden	Coho Salmon	Total
1	0	0	0
2	0	10	10
3	0	0	0
4	0	0	0
5	0	1	1
6	0	5	5
7	3	7	10
8	0	1	1
9	0	1	1
10	0	0	0
Total	**3**	**25**	**28**

Note: A total of 6 coho were large enough to classify as pre-smolts likely to migrate to salt water next spring. The remainder of the fish caught were 1.5" - 2" in length and will likely remain in fresh water for an additional year.

Table 1. Minnow trap catches of juvenile Dolly Varden and coho salmon in Pullen Creek, October 16, 2004

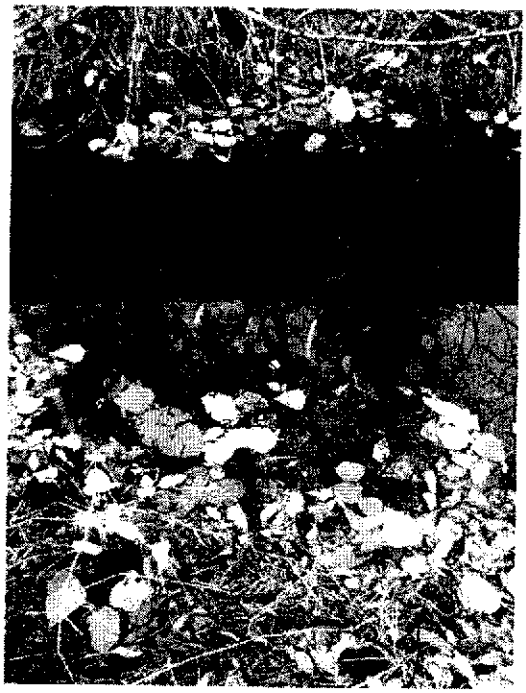

Figure 3. Minnow Trap in Pullen Creek.

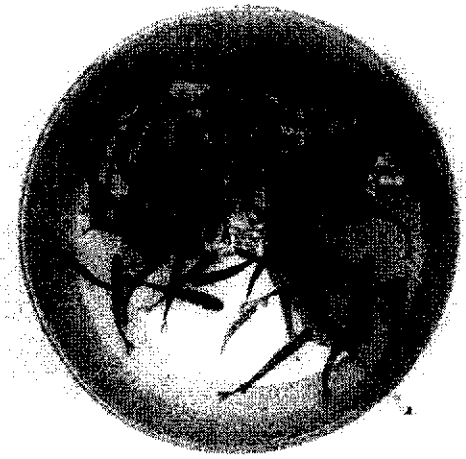

Figure 4. Juvenile coho and Dolly Varden, Pullen Creek

The visual survey of Pullen Creek did not reveal any other areas with high densities of juvenile fish. The West Fork of Pullen Creek appears to contain excellent rearing habitat, with scattered pools and enough woody debris to provide adequate cover. It was surprising that more fish were not observed.

Pullen Creek is known to have a healthy return of pink salmon, and although this survey was conducted too late in the year to count live pinks, the remains of more than 181 of what were assumed to be pink salmon could be seen (Figure 5). Most of the pink salmon were found in the area between the RR crossing culvert and the APT powerhouse. Due to the rapid decomposition of salmon carcasses, the pink salmon count tallied in Table 2 likely represents only a small portion of the total return to Pullen Creek.

Figure 5. Pink salmon in Pullen Creek

No adult coho salmon were observed below the RR culvert during the survey conducted on October 17, 2004. Several coho were holding right near the RR culvert inlet, and two appeared to move up out of the pipe as the survey was being conducted. A total of 25 live coho were counted in the stream section between the RR culvert and the APT powerhouse. The lower section of this stream reach is slow moving with a sandy/silty bottom and appeared to serve primarily as a holding area for the coho. Active coho spawning was occurring in the more rapidly moving water below the powerhouse. One live coho was seen just above the powerhouse.

Figure 6. Spawning coho in Pullen Creek

A large school of Dolly Varden was counted in the reach between the RR culvert and the APT powerhouse. These fish appeared to be just moving into the system. Actively spawning Dolly Varden were observed in the narrow part of Pullen Creek just above the powerhouse, and also in the west fork of Pullen Creek, between 11th Avenue and 14th Avenue.

Area	**Pink Salmon**	**Coho Salmon**	**Dolly Varden**
Broadway culvert to Footbridge	75 dead	0	0
Second Avenue to APT Powerhouse	>100 dead	25 live	27 live
APT Powerhouse to Hatchery	6 dead	1 live	3 live
West fork to14th Avenue	0	0	12 live
Total	**>181**	**26**	**42**

Table 2. Visual survey counts of adult salmon and Dolly Varden in Pullen Creek, October 17, 2004

The total escapement of hatchery produced chinook salmon into Pullen Creek was estimated to be 120-130 fish (Ryan Ackerman, pers. com.). Of these fish, it was estimated that 50-60 successfully passed through all the culverts and reached the spawning area below the APT powerhouse spillway. Due to adult mortality in the holding pens there were no viable eggs collected for the school hatchery program.

Pullen Creek Water Flows

At the time of this monitoring, the APT hydroelectric plant was discharging 21 cubic feet per second (cfs) into Pullen Creek (David Vogel, APT Skagway manager, pers. com.). Although not directly measured, the actual Pullen Creek flows upstream of the powerhouse can be estimated to be 1-2 cfs. This total volume of water (22-23 cfs) is similar to the conditions present during the 2002 monitoring but approximately twice the flows measured during the 2003 monitoring. Water velocity and depth measurements are tabulated in Table 3. Water velocity was measured in feet per second (fps).

Location	Water Depth (ft.)	Velocity (feet per second) mid-stream	edge
Outlet of stream mouth culvert	0.9	7.2	6.9
Inlet of stream mouth culvert	0.9	4.5	3.5
Daylighted Channel	1.8 (max)	1.7 to 2.2	
Outlet of Broadway St. culvert	2.2	1.4	0.9
1/2 way down Broadway St. culvert	1.3	1.8	1.6
Inlet of Broadway St. culvert	1.2	2.7	0.8
10' upstream of Inlet of Broadway St. culvert	1.0	2.2	0.5
Outlet of 2nd Ave. culvert	1.8	2.6	1.2
2nd Ave. culvert, most downstream baffle	1.5	4.7	2.8
1/2 way down 2nd Ave. culvert	1.4	1.5	0.8
Inlet of 2nd Ave. culvert	1.6	2.3	0.9
30 yards above RR crossing culvert inlet		no flow on meter	
Below Powerhouse		1.5	
Above Powerhouse		0.4	

Table 3. Water velocity measurements taken in Pullen Creek, October, 16, 2004

Second Avenue Culvert

The average mid-stream water velocity at the inlet of the culvert was 2.3 fps, with the pipe edge velocity measured at 0.9 fps (Table 3). The series of baffles installed within the pipe tend to slow down the flow and back water up to the next upstream baffle. The weir structure constructed downstream of the culvert outlet does not backwater the culvert enough to slow the flow over this last baffle (Figure 7). Consequently, the water rushes over the baffle at high velocity, ranging from 2.8 to 4.8 fps. The weir does create a single pool downstream of the culvert outlet, but the elevation of the surface of this pool is not high enough to slow the flow within the barrel of the culvert. Instead, at these flows, there is a straight high velocity wash from the baffle to the pipe outlet (Figure 8).

Figure 7. Second Avenue Culvert outlet weir

Figure 8. Second Avenue flow downstream of last baffle

The design of the weir at the outlet end of the Second Avenue culvert indicated that large rocks were to be placed closely adjacent to each other and that the gaps on the upstream side were to be filled with smaller rocks. A 3' wide notch was designed into one side of the weir. The weir was constructed as designed with the addition of four large boulders placed on top of the weir rocks. The extra boulders are widely spaced, but may serve to backwater the last baffle at higher flows than those observed during this monitoring. It must be noted that the weir structure itself creates a series of steep rapids leading into Pullen Pond.

Broadway Street Culvert

The 8' diameter, 130' long Broadway Street culvert is lined with about 2' of rock and gravel throughout the length of the pipe. The pipe elevation is close enough to sea level to result in flow alterations at some high tides. Velocity measurements were taken at low tide and with a measured stream flow of approximately 23 cfs. The highest velocities for this culvert were found to occur at the pipe inlet, where the mid-stream velocity measurement was 2.7 fps (Table 3). The water velocity was found to decrease as it moved down the pipe, exiting with a flow of 1.4 fps (Figure 9). Much of this reduction of flow results from the backwatering of the culvert due to the placement of large rocks in

the daylighted channel downstream of the pipe outlet. Although the average midstream flows through this culvert were moderately fast, it should be noted that there was a zone of lower velocity adjacent to the culvert wall. The rocky substrate on the stream bottom will also provide zones of reduced velocity (Behlke, et al, 1991).

Daylighted Channel

The 21 large boulders placed within the daylighted channel in April of 2004 appear to be stable. The rock placement results in the meandering of the stream within the otherwise straight channel and the concurrent creation of areas of increased velocity between the rocks and reduced velocity behind them (Figure 10). The substrate of the channel is rocky, with no noted deposition of gravel. Water flow varied throughout the channel but averaged 1.7 to 2.2 fps mid-stream. Channel width is approximately 10-12', with the deepest pool measured at 1.8'. The addition of the large boulders has given the channel some needed habitat complexity. It is still most likely true that this channel functions primarily as a migration corridor (Bethers, 2002), but it is possible it may support rearing fish acclimatizing to salt water.

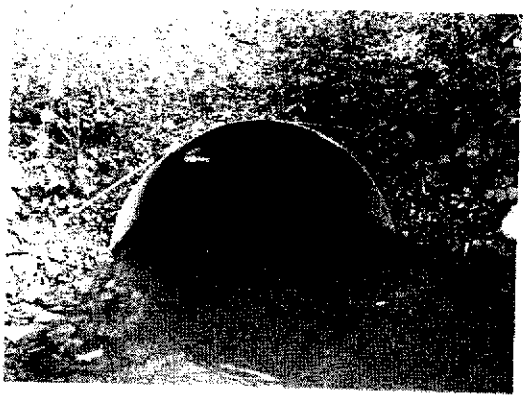

Figure 9. Broadway St. culvert outlet

Figure 10. Daylight Channel, looking up to Broadway St. culvert outlet

Stream Outlet Culvert and Spillway

The most downstream culvert on Pullen Creek is 6' in diameter and approximately 140' in length. The culvert spills directly into a very steep wooden slide which spills the water onto the beach below the riprap slope. In April of 2004, DOTPF removed aluminum baffles that had been placed in the slide. These baffles had been recently damaged, and the subsequent misalignment created a possible hazard for outmigrating salmonids. At low tide both the slide and the culvert pass water at a very high velocity, with the slide providing a very steep sheet flow. These structures provide a definite velocity barrier for salmon passage during low tide. On the other hand, the slide and the outlet of the culvert are completely inundated during high tide, providing easy passage for any fish moving upstream during this time.

Skagway River Water Characteristics

On October 17th, 2004 the Skagway River flow was contained entirely within the fish passage notch constructed in the scour control structure (SCS) below the Klondike Highway bridge (Figure 11). The current within the confined channel was swift, but the rocky shoreline provided a zone of much reduced velocity. The weather was partly cloudy and the air temperature was 11.0°C. The water temperature was 3.0°C and water clarity was fairly good, with 2-3' of visibility. The side channels of the river were significantly clearer than the main channel.

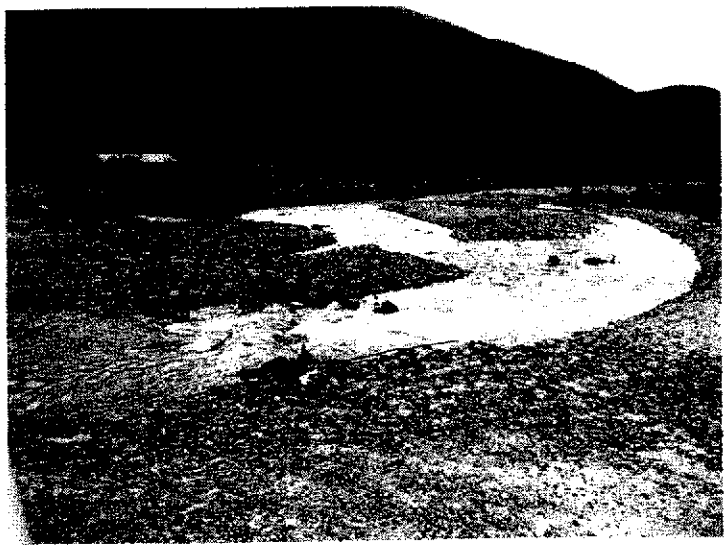

Figure 11. Scour River, scour control structure. Photo taken from the Klondike Highway bridge.

Skagway River Fish

The Skagway River visual survey did not reveal any live adult salmon or Dolly Varden. No fish of any age were observed to move through the SCS during the survey. However, the carcasses of two chinook salmon were found near the juvenile trapping site 4 (Figure 12). Additionally, one dead adult coho was found during a survey of part of Lillegravin Creek well upstream of the SCS (Figure 13). These observations indicate that adult chinook and coho are able to transit the SCS at some water levels.

Figure 12. Chinook salmon in the Skagway River. Book is 7" long.

Figure 13. Coho salmon in Lillegraven Creek

In general, the minnow traps set in the Skagway River this year caught significantly fewer fish than were captured during the previous monitoring periods (Table 4).

Trap Number	Dolly Varden	Coho Salmon	Chinook Salmon	Total
1	0	1	1	2
2	1	1	0	2
3	3	0	0	3
4[a]	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	9	26	0	35
8	1	4	0	5
9[b]	1	0	0	1
10	2	0	0	2
Total	**17**	**32**	**1**	**50**

[a]This trap was removed by a member of the public soon after it was set

[b]Two sculpins were also caught, one each in traps 9 and 10

Notes: A total of 7 coho, 10 Dolly Varden and one king were large enough to classify as pre-smolts likely to migrate to salt water next spring. The remainder of the fish caught were 1.5" - 2" in length and will likely remain in fresh water for an additional year.

Table 4. Minnow trap catches of juvenile Dolly Varden and salmon in the Skagway River, October 17th, 2004

The two minnow traps (9&10) set downstream of the SCS caught only three juvenile DV and no juvenile salmon. During the 2003 monitoring study juvenile chinook and coho

were caught at these same trap locations, as well as many more DV. The traps set under the bridge (1&2), produced only one DV, two coho and the lone juvenile chinook captured this year. The traps set in the active side channels of the Skagway River (3,4,5&8) caught just four DV and four coho between them. It should be noted that one of these traps was removed by a concerned land owner soon after it was set. He said it contained no fish when he took it from the water. The two traps (6&7) set in the clear side slough along Cemetery Road produced 9 DV and 26 coho total.

DISCUSSION

Pullen Creek

The 2004 monitoring of the Pullen Creek mitigation work confirmed that adult salmon and Dolly Varden are able to move upstream through the channels and culverts constructed or modified as part of the project. A similar conclusion was reached in both the 2002 and 2003 monitoring reports. This year 26 adult coho salmon, 42 adult Dolly Varden and over a 100 spawned out pink salmon were counted above the Second Avenue culvert. Indeed, these fish also made it through the Railroad crossing culvert just upstream of the Second Avenue culvert. Although the Railroad culvert is not part of this monitoring and appears to be passing fish, the debris screen at the inlet of the pipe was 75% clogged on October 16th and could impede fish passage if allowed to become too blocked.

Pullen Creek (downstream of the APT powerhouse) was flowing at 22-23 cfs during the monitoring. At this flow the velocity of water over the downstream baffle inside the 2nd Avenue pipe was found to be flowing at 4.7 fps mid-stream, with an edge flow of 2.8 fps. From the downstream baffle to the culvert outlet the stream flows very rapidly, but reduces in velocity to 2.6 fps at the culvert outlet, largely due to the effects of the rock weir built just downstream of the culvert. Although adult fish are clearly passing up the culvert at some recently occurring flow, it is not known whether the current flow is allowing passage. It is unlikely that juvenile salmonids can move upstream through the Second Avenue culvert under the flow conditions encountered during this monitoring, but it is not known if upstream passage is possible at lower flows. Certainly, juvenile fish are present above this culvert indicating, at a minimum, that successful coho and DV spawning is occurring above the Second Avenue culvert.

The downstream migration of juvenile fish through the Second Avenue pipe should not be negatively affected by any of the conditions encountered during this monitoring study.

The trapping results and visual survey of Pullen Creek did not indicate that this stream is heavily utilized by juvenile fish, as was thought in the previous monitoring reports. Only one large school of fish was observed, and much of what appeared to be excellent rearing habitat upstream of the powerhouse seemed to be devoid of fish. It is beyond the scope of this report to determine the reason for this.

The reconstruction of the weir below the Second Avenue pipe resulted in an area of steep vertical drop over a rocky substrate into Pullen Pond. This flow is rapid, but well spread out over the face of the weir, and should not provide an impediment for the upstream or downstream migration of either adult or juvenile fish present in this system.

The tidal influence on Pullen Creek extends through the Broadway Street culvert and up to Pullen Pond at some high tides. This tidal influence has the effect of reducing the velocity of Pullen Creek through the Broadway Street culvert, the day-lighted channel and the outlet culvert to essentially zero twice a day. Thus fish passage through the reach of the stream influenced by the tide is not really an issue. If there is a velocity barrier, it will only exist temporarily.

The reach of Pullen Creek from Pullen Pond to the ocean is not prime rearing habitat, due largely to the impact of this tidal influence. This reach of stream does likely serve a very important function for smolt, serving as the area in which the fish acclimatize to salt water. The Broadway Street culvert, with its intact substrate, may provide an essential refuge for emigrating fish. The large rocks placed in the daylighted channel have added a high degree of habitat complexity to this stream reach. The channel now provides numerous refuges for juveniles to rest and hide in as they adapt to the salt water environment. However, at low tide, once the fish move out of the daylighted channel and into the outlet culvert they will be flushed straight to the ocean. Under most tidal conditions, the spillway constructed at the outlet of the downstream culvert functions as designed to prevent outmigrant fish from landing directly on the rip rap slope at the mouth of the culvert. However, at very low tide the spill way itself dumps onto the rocky beach, and may result in some degree of mortality in the fish unlucky enough to be swept out of Pullen Creek under these conditions.

The large rocks placed in the daylighted channel will also serve to provide an essential refuge for adult fish entering Pullen Creek and ending up in this section of the creek as the tide drops. This area now provides adult fish with a safe area in which to adapt to fresh water.

Skagway River

The discovery of two adult chinook salmon carcasses within the Skagway River floodplain above the Klondike Highway bridge confirms that these fish can successfully transit the scour control structure (SCS). The presence of spawning coho in Lillegravin Creek also proves that adult coho can move up past the bridge under some flow conditions.

The stream surveys conducted as part of the monitoring in 2002 and 2003 indicated that adult pink salmon and mature DV were also successfully moving through the SCS.

The Skagway River minnow trapping conducted during this year's monitoring did indicate that coho salmon, DV and chinook salmon were rearing above the SCS. These

fish may have moved up through the SCS or they may have hatched in sections of the river above the structure and never migrated downstream.

At low flow conditions such as those encountered on October 17th, 2004, the entire Skagway River flows through the fish passage notch. Although the flow is very rapid in the center of the notch, an examination of the banks of the notch revealed that there were numerous low velocity branches of the river moving through the rocky margins of the channel. These side streams could be navigated by juvenile fish. Additional trapping later in the year would indicate if the main Skagway river functions as over-wintering habitat. However, a much more involved mark and recapture study would be necessary to determine if juvenile fish are in fact moving upstream through the SCS.

The strength of the 2004 Eulachon run in the Skagway River was very weak (Ben Kirkpatrick, ADF&G, pers. com.). It is not known if any of these fish moved over the scour control structure to spawn above the bridge.

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AN EVALUATION OF FISH PASSAGE THROUGH THE SKAGWAY RIVER SCOUR CONTROL STRUCTURE CONSTRUCTED IN ASSOCIATION WITH THE SKAGWAY AIRPORT IMPROVEMENTS PROJECT in 2005

JANUARY 2006

PREPARED FOR

ALASKA DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

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INTRODUCTION

As mitigation associated with the construction of the Skagway Airport Improvement Project in 1999 through 2001, the Alaska Department of Transportation and Public Facilities (ADOTPF) completed several projects on Pullen Creek. To protect the Klondike Highway bridge piers from river scour, ADOT&PF also installed a scour control structure (SCS) below the bridge over the Skagway River, as part of the Skagway Airport improvements project. The Pullen Creek projects were designed to improve fish passage and increase the quality of fish habitat in the lower reaches of the creek. The SCS structure was designed with a low water notch intended to assure fish passage during all water levels.

During the environmental process for the airport project, the ADOTPF committed to monitor fish passage at the SCS in the Skagway River for a period of five years and in Pullen Creek for a period of three years following completion of the project. The monitoring of the Pullen Creek mitigation is complete. For the SCS, The Army Corps permit (DA #2-950341, Skagway River 9) required three years of monitoring, but the Fish Habitat permit (98-I(J)-59) required five years of the monitoring. This report covers the fourth year of the evaluation of fish passage associated with the new structure constructed in the Skagway River. To allow for ease of comparison between the years, the format of this report has been modeled on the 2002 and 2003 reports completed by Mike Bethers, and the 2004 report completed by Mark Sogge.

OBJECTIVE

Evaluate the fish passage associated with the scour control structure in the Skagway River immediately downstream of the Klondike Highway bridge.

METHODS

Fish Trapping

Minnow trapping has been used to determine the presence and species composition of juvenile fish in each of the three prior monitoring events for this project. Trap locations for the Skagway River were set in the first year of monitoring and, if possible, used again in subsequent years, including this one. Given the dynamic nature of the Skagway River, some trap locations on this system must vary from year to year. However, it is possible to repeat similar trap location conditions in the river from year to year. This year all but three of the trap locations are the same as the trapping locations used in 2004.

Gee minnow traps baited with salmon eggs were used to capture juvenile fish. The traps used were constructed of 0.25" screen. The bait was disinfected prior to use by means of a 10 minute soak in 1/100 Betadyne solution. The salmon eggs were then boraxed and frozen until the day of use. As in prior years, traps were set for an approximately four hour long soak. The number of fish caught per species per trap was recorded.

Additionally, the fish were roughly divided by size to estimate the number of fry vs. presmolt (those fish that will likely emigrate to salt water next spring). All fish were released unharmed at the point of capture.

The monitoring report of 2004 (Sogge, 2004) included descriptions of all the sites and GPS coordinates for four of the sites. Photographs were also taken of each of the sites. The Skagway River trap locations 1, 2, 6, 7, 8, 9 and 10 are repetitions of the sites trapped during the 2004 monitoring study. Due to a slight change in the river course, trap location 3 was approximately 30 feet to the south of the 2004 location for this trap. The gravel mining operations conducted in the Skagway River during the last year changed the course of the river in the area of traps 4 and 5. Relative to trap locations in 2004, trap 4 was moved east about 225 feet and trap 5 moved east about 150 feet. The 2005 Skagway River trap locations are shown on Figure 1. In addition to a physical description of the trap locations, the following table (Table 1) includes GPS coordinates for each site:

Trap	Description	Coordinates
1	Set in a pile of large woody debris jammed up on the third bridge support from the east side	59° 28' 05.1"N x 135° 18' 06.4"W
2	Opposite side of the same debris structure where trap 1 was set	59° 28' 05.1"N x 135° 18' 06.4"W
3	Set in a deep side pool on a gravel bar in the river. Outlet of pool directly connected to the active river	59° 28' 09.8"N x 135° 18' 02.2"W
4	In a side channel in a gravel bar above the bridge	59° 28' 17.6"N x 135° 17' 41.7"W
5	In a side channel in a gravel bar above the bridge	59° 28' 20.7"N x 135° 17' 42.4"W
6	In a clear side channel paralleling Cemetery Road, 55 yards below the RR crossing sign	59° 28' 13.2"N x 135° 17' 41.1"W
7	Upstream end of the same clear channel where trap 6 was set	59° 28' 13.4"N x 135° 17' 39.8"W
8	In a boulder cluster in the main river channel along the east shore, adjacent to the Gold Rush cemetery	59° 28' 29.1"N x 135° 17' 20.5"W
9	In the main river, approximately 60 yards upstream from the airport security fence, next to a large "habitat rock"	59° 27' 55.0"N x 135° 18' 20.0"W
10	In the main river, approximately 200 yards upstream from the airport security fence, next to a large "habitat rock"	59° 27' 56.9"N x 135° 18' 14.8"W

Table 1. Minnow trap location descriptions and coordinates, Skagway River.

Visual Survey

Visual surveys were conducted on portions of the Skagway River to determine if adult fish were present above the scour control structure on the Skagway River. The Skagway River visual survey was conducted from the upper end of the runway to a point approximately 600 yards upstream of the Klondike Highway Bridge (Figure 2). Additionally, visual surveys were conducted along the presently clear side channel that parallels Cemetery Road where it curves around the north end of the railroad yard (Figure 2), and on portions of Lillegravin Creek near the new culvert. The survey of the Skagway River was conducted by walking the east shoreline of the river and zigzagging back and forth along the floodplain. The survey did not cover all of the surface area of the floodplain in the portion of the river surveyed.

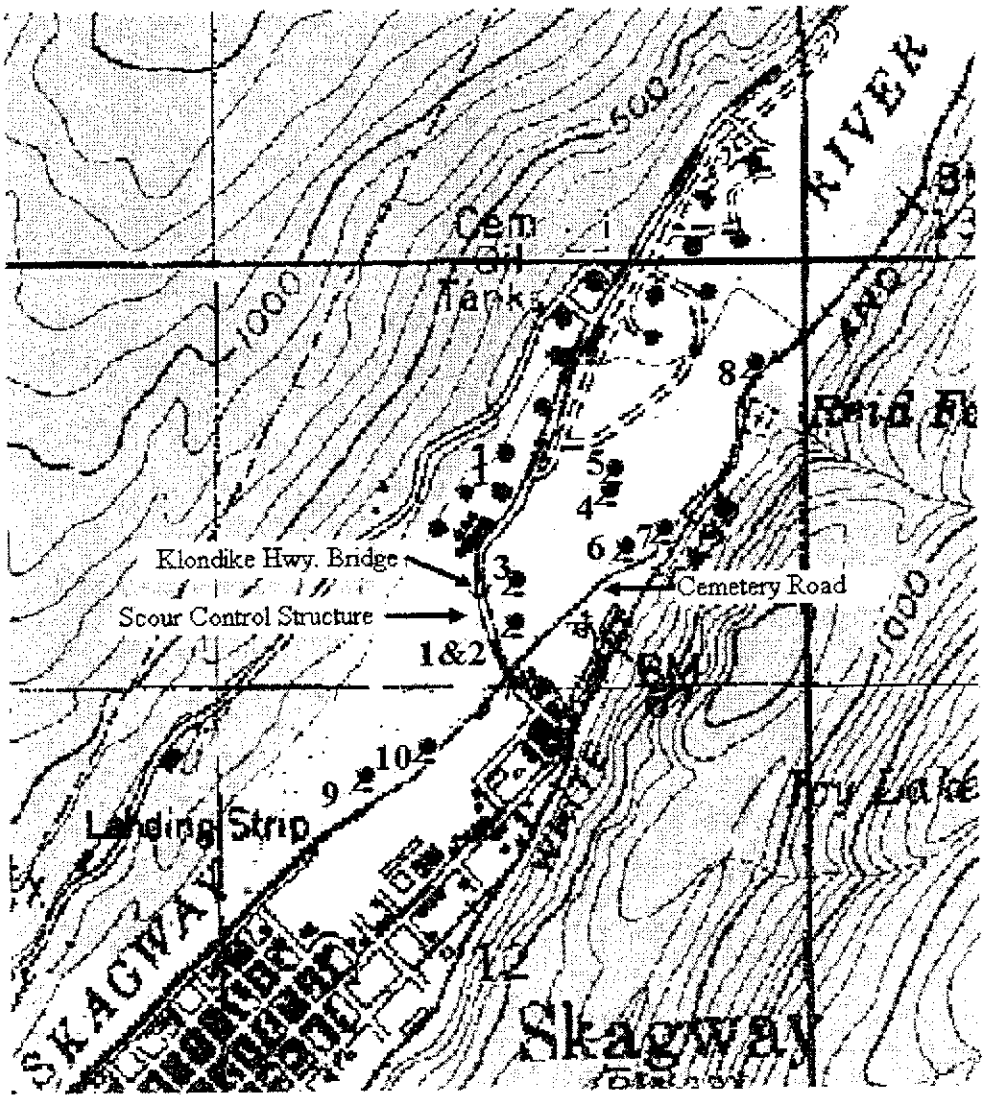

Figure 1. Minnow trap locations (1-10) and survey area, Skagway River

Physical Parameters

Temperatures were measured with a standard pocket thermometer. Distances were estimated by pacing or by measuring with a 300' tape. A Garmin Map76 GPS was used to provide the coordinates of the minnow trap locations.

Fish Species

Fish species inhabiting the Skagway River and Pullen Creek are listed below:

Coho Salmon	Onchorhynchus kisutch
Pink Salmon	Onchorhynchus gorbuscha
Chum Salmon	Onchorhynchus keta
Chinook Salmon	Onchorhynchus tschawytscha
Dolly Varden	Salvelinus malma
Eulachon	Thaleichthys pacificus
Sculpin	Cottus spp.

FINDINGS

Skagway River Water Characteristics

On October 18th, 2005 the Skagway River flow was contained almost entirely within the fish passage notch constructed in the scour control structure (SCS) below the Klondike Highway bridge (Figure 2). The current within the confined channel was swift, but the rocky shoreline provided a zone of much reduced velocity, especially on the east side of the notch (Figure 3). There was also a small side channel that separated from the main river just above the bridge and flowed over the SCS, intersecting the Skagway River below the fish passage notch (Figure 4). The gradient of this small channel was fairly flat for the most part, and of adequate depth for juvenile fish.

The weather was cloudy and very windy. The air temperature was 8.9°C. The water temperature was 5.0°C and water clarity was excellent, with 3-4' of visibility. The side channels of the river were clearer than the main channel.

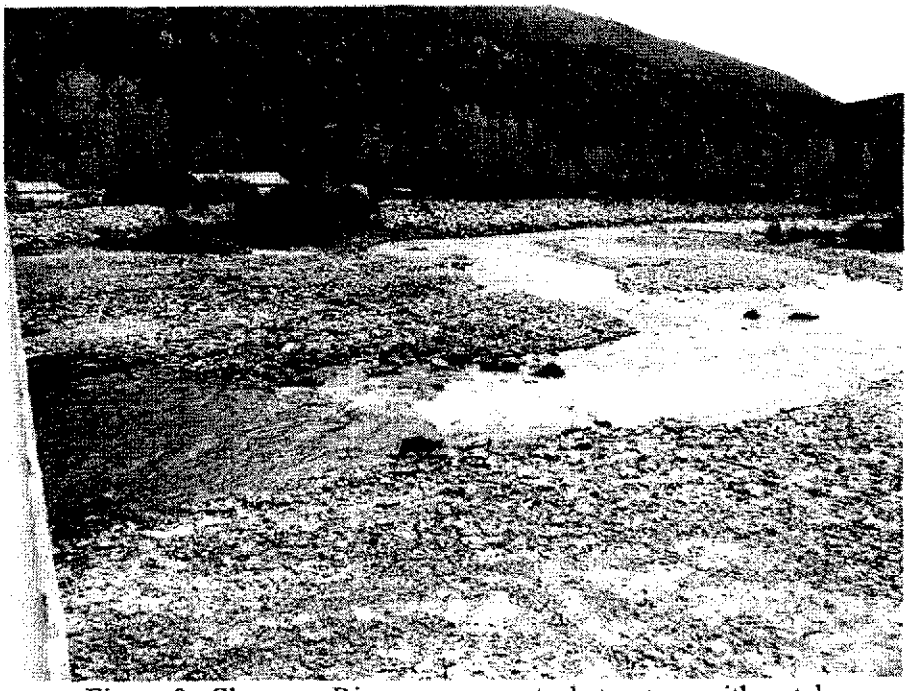

Figure 2. Skagway River, scour control structure with notch

Figure 3. East side of the notch through the scour control structure.

Figure 4. Small side channel running over the top of the scour control structure

Skagway River Fish

The Skagway River visual survey did not reveal any live adult salmon or Dolly Varden. No fish of any age were observed to move through the SCS during the survey. Juvenile fish were observed in the side channels of the Skagway River and in Lillegravin Creek. The only fish carcasses found above the bridge were of the numerous pink salmon that appeared to have attempted to spawn during higher water (Figures 5 and 6). These carcasses were found between trapping sites three and four. No adult salmon were

observed during a survey of part of Lillegravin Creek well upstream of the SCS. These observations confirm that adult pink salmon are able to transit the SCS at some water level

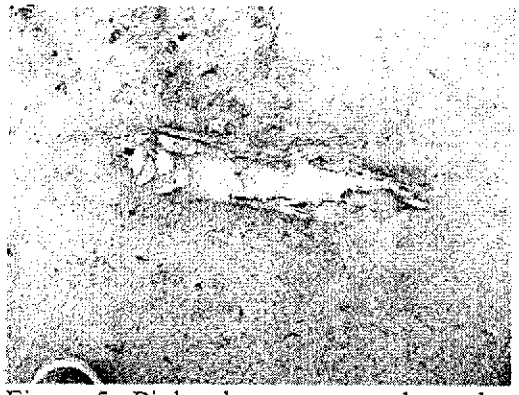

Figure 5. Pink salmon carcass above the Klondike Highway bridge.

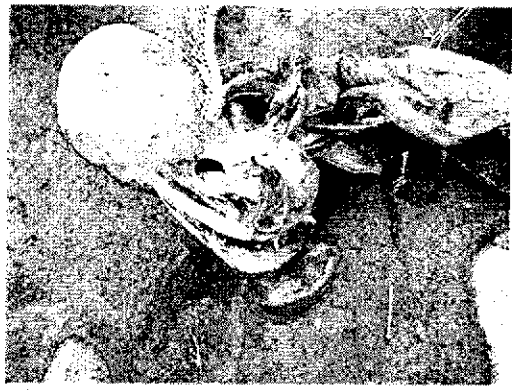

Figure 6. Pink salmon remains above the Klondike Highway bridge.

The results of the 2005 fish trapping in the Skagway River are tabulated in Table 2.

Trap Number	Dolly Varden	Coho Salmon	Chinook Salmon	Total
1	17	20	0	37
2	2	2	2	6
3	3	1	0	4
4	0	1	0	1
5	0	0	0	0
6	3	8	0	11
7	2	12	2	16
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
Total	**27**	**44**	**4**	**75**

Notes: A total of 6 Dolly Varden, 19 coho, and 2 kings were large enough to classify as pre-smolts likely to migrate to salt water next spring. The remainder of the fish caught were 1.5" - 2" in length and will likely remain in fresh water for an additional year.

Table 2. Minnow trap catches of juvenile Dolly Varden and salmon in the Skagway River, October 18th, 2005.

The minnow traps set in the Skagway River this year caught more fish than were captured during the 2004 monitoring period but significantly fewer fish that were captured during the 2002 or 2003 monitoring (Table 3).

	Dolly Varden				Coho Salmon				Chinook Salmon			
	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005
Trap Number												
1	20	31	0	17	2	0	1	20	0	3	1	0
2	5	27	1	2	9	3	1	2	0	20	0	2
3	61	3	3	3	2	22	0	1	0	3	0	0
4	14	0	0	0	0	0	0	1	0	0	0	0
5	2	0	0	0	50	0	0	0	7	0	0	0
6	27	0	0	3	0	0	0	8	0	1	0	0
7	23	32	9	2	3	10	26	12	6	3	0	2
8	75	17	1	0	1	3	4	0	2	1	0	0
9	21	25	1	0	0	2	0	0	3	10	0	0
10	3	7	2	0	0	1	0	0	0	2	0	0
Total	**251**	**142**	**17**	**27**	**67**	**41**	**32**	**44**	**18**	**43**	**1**	**4**

Table 3. Summary of 2002 through 2005 minnow trap catches of juvenile Dolly Varden and salmon during the Skagway River SCS monitoring events.

The two minnow traps (9&10) set downstream of the SCS caught no fish at all this year. The traps set under the bridge (1&2), produced a combined twenty two coho salmon, nineteen Dolly Varden, and two juvenile chinook salmon. The minnow trap set at site 7, a clear side channel of the Skagway River, produced good catches of juvenile coho salmon in 2004 and 2005. This channel is only connected to the river during periods of high water. Similar to 2004, the traps set in the active side channels of the Skagway River (3,4,5&8) caught few fish: just three Dolly Varden and two coho salmon between them. In 2005, The two traps (6&7) set in the clear side slough along Cemetery Road produced 5 DV and 20 coho total.

DISCUSSION

The discovery of pink salmon carcasses within the Skagway river floodplain above the Klondike Highway bridge confirms the similar findings of the 2002 and 2003 monitoring studies. Pink salmon can successfully transit the scour control structure (SCS). The 2002 and 2003 monitoring studies also found that adult Dolly Varden were present above the SCS. The 2004 monitoring study found that adult coho and Chinook were able to move up past the bridge under some flow conditions.

The Skagway River minnow trapping conducted during this year's monitoring did indicate that coho salmon, DV and chinook salmon were rearing above the SCS. These fish may have moved up through the SCS or they may have hatched in sections of the river above the structure and never migrated downstream.

At moderately low flow conditions such as those encountered on October 18th, 2005, nearly the entire Skagway River flows through the fish passage notch. Although the flow is very rapid in the center of the notch, an examination of the banks of the notch revealed that there were numerous low velocity branches of the river moving through the rocky margins of the channel, especially on the east side. These side streams could be navigated by juvenile fish. Additionally, the small side branch of the Skagway river flowing over the SCS to the east of notch, providing a route for juvenile fish to move over the SCS. Fish trapping later in the year would indicate if the main Skagway river functions as over-wintering habitat. However, a much more involved mark and recapture study would be necessary to determine if juvenile fish are in fact moving upstream through the SCS.

The strength of the 2005 Eulachon run in the Skagway River was very weak and of very short duration (Marian Twitchell, Skaway Traditional Council, pers. com.). It is not known with certainty if any of these fish moved over the scour control structure to spawn above the bridge.

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AN EVALUATION OF FISH PASSAGE THROUGH THE SKAGWAY RIVER SCOUR CONTROL STRUCTURE CONSTRUCTED IN ASSOCIATION WITH THE SKAGWAY AIRPORT IMPROVEMENTS PROJECT

DECEMBER 2006

PREPARED FOR

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INTRODUCTION

As mitigation associated with the construction of the Skagway Airport Improvement Project in 1999 through 2001, the Alaska Department of Transportation and Public Facilities (DOT&PF) completed several projects on Pullen Creek and installed a scour control structure (SCS) below the Klondike Highway Bridge over the Skagway River. The Pullen Creek projects were designed to improve fish passage and increase the quality of fish habitat in the lower reaches of the creek. The SCS structure was designed to reduce the possibility of scouring occurring just below the Klondike Highway Bridge and was designed with a low water notch intended to assure fish passage during all water levels.

During the environmental process for the airport project, the DOT&PF committed to monitor fish passage at the SCS in the Skagway River for a period of five years and in Pullen Creek for a period of three years following completion of the project. The monitoring of the Pullen Creek mitigation is complete. This report presents the results of the 2006 SCS survey. This is the fifth and final year of the evaluation of fish passage associated with the new structure constructed in the Skagway River. To allow for ease of comparison between the years, the format of this report has been modeled on the 2002 and 2003 reports completed by Mike Bethers, and the 2004 and 2005 reports completed by Mark Sogge.

OBJECTIVE

Evaluate the fish passage associated with the scour control structure in the Skagway River immediately downstream of the Klondike Highway Bridge.

METHODS

Fish Trapping

Minnow trapping at 10 stations in the Skagway River has been used to determine the presence and species composition of juvenile fish in each of the four prior monitoring events for this project. Gee minnow traps constructed of 0.25" screen and baited with salmon eggs were used to capture juvenile fish. . The bait was disinfected prior to use by means of a 10 minute soak in 1/100 Betadyne solution. The salmon eggs were then boraxed and frozen until the day of use. As in prior years, traps were set for an approximately four hour long soak. The number of fish caught per species per trap was recorded. Additionally, the fish were roughly divided by size to estimate the number of fry vs. presmolt (those fish that will likely emigrate to salt water next spring). All fish were released unharmed at the point of capture.

Trap locations were set in the first year of monitoring and, if possible, used again in subsequent years, including this one. Given the dynamic nature of the Skagway River, some trap locations on this system must vary from year to year. However, it is possible to repeat similar trap location conditions in the river from year to year. This year, the Skagway River flood control project completed by the City of Skagway resulted in the elimination of some of the side channel habitat previously trapped, and necessitated the relocation of prior trapping sites 6 and 7. All of the other trap locations are essentially the same as the trapping locations used in 2004 and 2005 (Figure 1).

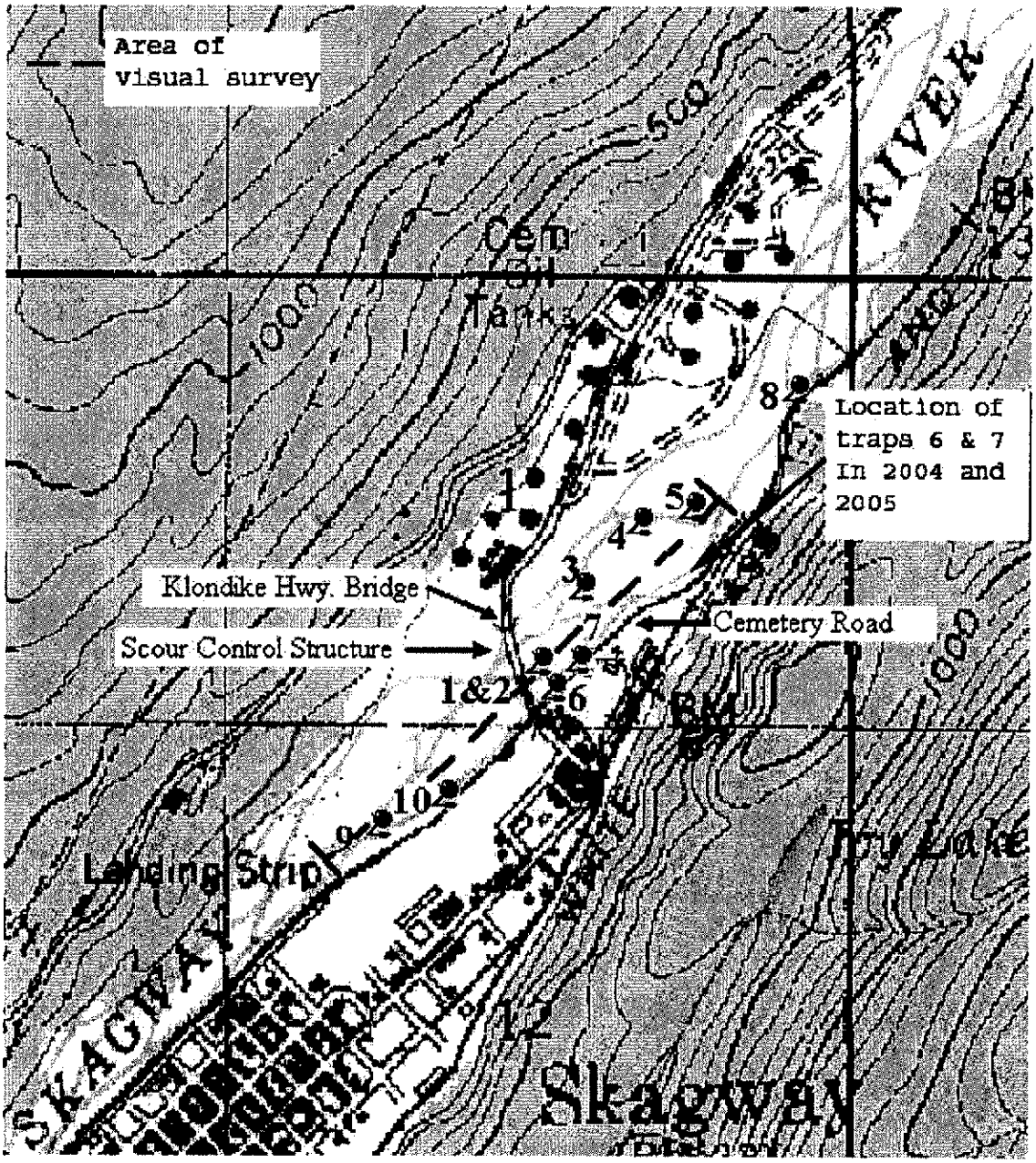

Figure 1. Minnow trap locations (1-10) and survey area, Skagway River

The shifting of the river and the establishment of a new debris jam on the fourth bridge pier (from the east side) created an excellent trapping location, so trap 2 was moved from pier three to this location. Trap 5 was placed a bit downstream of the 2005 location, and within the main channel instead of a side channel. The flood control project included the construction of some rock barbs that protrude into the river, and the trap was set in the eddy created by one of these structures. The flood control project also resulted in the filling of the side channel that had previously been the location of trapping sites 6 and 7. These traps were moved downstream to a clear side channel just upstream of the bridge, on the east side of the river.

In addition to a physical description of the trap locations, the following table (Table 1) includes GPS coordinates for each site:

Table 1. Minnow trap location descriptions and coordinates, Skagway River.

Trap	Description	Coordinates
1	Set in a pile of large woody debris jammed up on the third bridge support from the east side	59° 28' 05.4"N x 135° 18' 06.1"W
2	Set in a pile of large woody debris along the fourth bridge support from the east side	59° 28' 05.5"N x 135° 18' 05.8"W
3	Set in the head of an overflow channel about 250 yards upstream of the bridge. Outlet of channel directly connected to the active river	59° 28' 11.4"N x 135° 17' 54.5"W
4	In a side channel in a gravel bar above the bridge	59° 28' 14.2"N x 135° 17' 54.5"W
5	In the main river channel, behind a recently placed rock abutment	59° 28' 15.6"N x 135° 17' 48.0"W
6	In a clear side channel paralleling Cemetery Road, 20 yards upstream of the bridge	59° 28' 05.7"N x 135° 18' 04.5"W
7	Upstream end of the same clear channel where trap 6 was set, 50 yards upstream of the bridge	59° 28' 6.1"N x 135° 18' 03.9"W
8	In a boulder cluster in the main river channel along the east shore, adjacent to the Gold Rush cemetery	59° 28' 29.1"N x 135° 17' 20.5"W
9	In the main river, approximately 100 yards upstream from the airport security fence, next to a large "habitat rock"	59° 27' 55.9"N x 135° 18' 17.0"W
10	In the main river, approximately 200 yards upstream from the airport security fence, next to a large "habitat rock"	59° 27' 58.1"N x 135° 18' 11.5"W

Visual Survey

Visual surveys were conducted on portions of the Skagway River to determine if adult fish were present above the scour control structure on the Skagway River. The Skagway River visual survey was conducted from the upper end of the runway to a point approximately 600 yards upstream of the Klondike Highway Bridge (Figure 1). Additionally, visual surveys were conducted along portions of Lillegravin Creek parallel to the Klondike Highway. The survey of the Skagway River was conducted by walking the east shoreline of the river and zigzagging back and forth along the floodplain. The survey did not cover all of the surface area of the floodplain in the portion of the river surveyed.

Physical Parameters

Temperatures were measured with a standard pocket thermometer. Distances were estimated by pacing or by measuring with a 300' tape. A Garmin Map76 GPS was used to provide the coordinates of the minnow trap locations.

Fish Species

Fish species known to inhabit the Skagway River and Pullen Creek are listed below:

Coho Salmon	Onchorhynchus kisutch
Pink Salmon	Onchorhynchus gorbuscha
Chum Salmon	Onchorhynchus keta
Chinook Salmon	Onchorhynchus tschawytscha
Dolly Varden	Salvelinus malma
Eulachon	Thaleichthys pacificus
Sculpin	Cottus spp.

FINDINGS

Skagway River Water Characteristics

On October 16th, 2006 the Skagway River flow was considerable higher that the previous two years when the river was contained almost entirely within the fish passage notch constructed in the SCS below the Klondike Highway Bridge. This year, the Skagway River was spread out over most of the western half of the river floodplain (Figure 2). The current within the fish passage notch was swift, but the rocky shoreline provided a zone of much reduced velocity, especially on the east side of the notch (Figure 3). There was also a small side channel that separated from the main river just above the bridge and flowed over the SCS, intersecting the Skagway River below the fish passage notch (Figure 4). The gradient of this small channel was fairly flat for the most part, and the water depth within the channel was much greater than last year, easily providing fish access to the river above the SCS.

The weather was partly cloudy and calm. The air temperature was 8.5°C. The water temperature was 4.1°C and water clarity was excellent, with 3-4' of visibility. The side channels of the river were clearer than the main channel.

2005

2006

Figure 2. Skagway River, scour control structure with notch

Figure 3. East side of the notch through the scour control structure.

Figure 4. Small side channel running over the top of the scour control structure

Skagway River Fish

The Skagway River visual survey did not reveal any live adult salmon or Dolly Varden. No fish of any age were observed to move through the SCS during the survey. Juvenile fish were observed in the side channels of the Skagway River and in Lillegravin Creek. This year no fish carcasses were found above the Klondike Highway Bridge. The strong odor of rotting fish was sensed emanating from a log jam just upstream of the bridge, but

a search did not reveal any identifiable fish parts. No adult salmon were observed during a survey of part of Lillegravin Creek well upstream of the SCS. Although observations during previous surveys have revealed that adult pink salmon, Chinook salmon and coho salmon are able to transit the SCS (Bethers 2002; Bethers 2003; Sogge 2004 and Sogge 2005) this year's survey did not serve to further confirm those observations. The results of the 2006 fish trapping in the Skagway River are tabulated in Table 2.

Table 2. Minnow trap catches of juvenile Dolly Varden and salmon in the Skagway River, October 16th, 2006.

Trap Number	Dolly Varden	Coho Salmon	Chinook Salmon	Total
1	6	5	2	13
2	18	1	5	24
3	5	4	0	9
4	0	0	0	0
5	2	0	1	3
6	5	1	10	16
7	7	10	5	22
8	7	0	0	7
9	10	2	0	12
10	12	0	0	12
Total	**72**	**23**	**23**	**118**

Notes: All of the Dolly Varden, coho, and Chinook caught this year were large enough to classify as pre-smolts likely to migrate to salt water next spring. In addition to the salmonids listed, a total of 15 sculpins were also trapped: 4 sculpins in trap 2, 5 sculpins in trap 5, and 6 sculpins in trap 9.

The minnow traps set in the Skagway River this year caught more Dolly Varden and Chinook than were captured during the 2004 or 2005 monitoring period but fewer coho than either of those years. Compared to 2002 and 2003 monitoring results, fewer Dolly Varden and coho were captured this year, but the Chinook catch was comparable (Table 3).

Table 3. Summary of 2002 through 2006 minnow trap catches of juvenile Dolly Varden and salmon during the Skagway River SCS monitoring events.

	Dolly Varden					Coho Salmon					Chinook Salmon				
Trap Number	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006
1	20	31	0	17	6	2	0	1	20	5	0	3	1	0	2
2	5	27	1	2	18	9	3	1	2	1	0	20	0	2	5
3	61	3	3	3	5	2	22	0	1	4	0	3	0	0	0
4	14	0	0	0	0	0	0	0	1	0	0	0	0	0	0
5	2	0	0	0	2	50	0	0	0	0	7	0	0	0	1
6	27	0	0	3	5	0	0	0	8	1	0	1	0	0	10
7	23	32	9	2	7	3	10	26	12	10	6	3	0	2	5
8	75	17	1	0	7	1	3	4	0	0	2	1	0	0	0
9	21	25	1	0	10	0	2	0	0	2	3	10	0	0	0
10	3	7	2	0	12	0	1	0	0	0	0	2	0	0	0
Total	**251**	**142**	**17**	**27**	**72**	**67**	**41**	**32**	**44**	**23**	**18**	**43**	**1**	**4**	**23**

In contrast with 2005, the two minnow traps (traps 9&10) set downstream of the SCS caught a number of fish this year. These two traps caught a total of twenty two Dolly Varden and 2 coho. The traps set under the bridge (traps 1&2), produced a combined six coho salmon, twenty-four Dolly Varden, and seven juvenile Chinook salmon (Figures 5 and 6). The two traps set just above the bridge in a low velocity side channel of the Skagway River (traps 6&7) caught a fairly even mix of the three primary species. Notable was the catch of 10 Chinook salmon in trap 6. One of the two traps set in more active side channels of the river caught no fish at all (trap 4), while the other (trap 3) captured 5 dolly Varden and 4 coho salmon. Trap 5, set in an eddy produced by a rock structure recently constructed in the Skagway River, produced 2 Dolly Varden and 1 Chinook salmon. Trap # 8 captured 7 Dolly Varden.

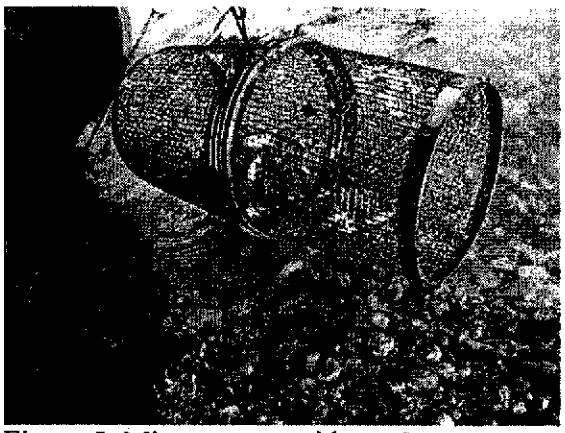

Figure 5. Minnow trap with catch

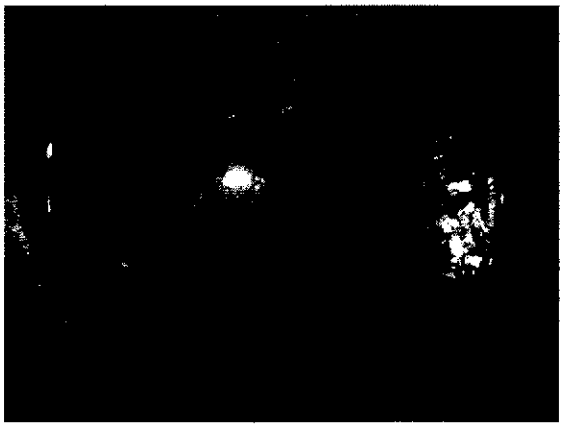

Figure 6. Juvenile Dolly Varden, coho salmon, and Chinook salmon. Sculpins are also present

DISCUSSION

The Skagway River juvenile fish trapping conducted during this year's monitoring did indicate that coho salmon, Dolly Varden and Chinook salmon were rearing above the SCS. These fish may have moved up through the SCS or they may have hatched in sections of the river above the structure and never migrated downstream. In contrast with 2004 and 2005, the extended period of high water levels during the summer and fall of 2006 may have allowed juvenile salmonids to move through the SCS without the necessity of transiting the high velocity fish passage notch or the shallow channel to the east of the notch. It is beyond the scope of this monitoring to determine if the juvenile fish are capable of moving upstream through the SCS under all water conditions. If this seasonal migration pattern is to be determined with certainty, it would be necessary to conduct a detailed mark and recapture study.

The increase in juvenile Chinook numbers relative to the catches of 2004 and 2005 likely indicates successful Chinook salmon spawning in the Skagway River in the last year or two. The discovery of adult Chinook salmon carcasses upstream of the Klondike Highway Bridge in 2004 indicates that the river above the bridge is available as spawning habitat. The juvenile Chinook salmon trapped during this monitoring appeared healthy. These indicators combine to suggest that the Skagway River is successfully producing Chinook salmon, contributing to the commercial, sport and subsistence fisheries of the Lynn Canal.

Prior visual surveys have proven that at least three kinds of adult salmon are able to successfully transit the SCS. The surveys of 2002, 2003, and 2005 found pink salmon carcasses upstream of the Klondike Highway Bridge. The 2004 monitoring study found that adult coho and Chinook were able to move up past the SCS under some flow

conditions. The 2002 and 2003 monitoring studies also found that adult Dolly Varden were present above the SCS. It is possible that the late high water flows that occurred during the summer and fall of 2006 served to wash any carcasses of spawning fish downstream, out of the study area. It is also possible that the escapement into the Skagway River was lower this year than previous years, decreasing the likelihood of finding a spawned-out fish carcass. However, since the escapement is not closely monitored by state or federal agencies, the relative yearly escapement cannot be determined with accuracy.

The strength of the 2006 Eulachon run in the Skagway River was very weak, or perhaps non-existent. Dan Schultz, a ranger with the National Park Service, Klondike Gold Rush National Historic Park in Skagway, conducted initial eulachon assessment on both the Taiya and Skagway rivers in 2005 and 2006. No eulachon were observed in the Skagway River in 2006

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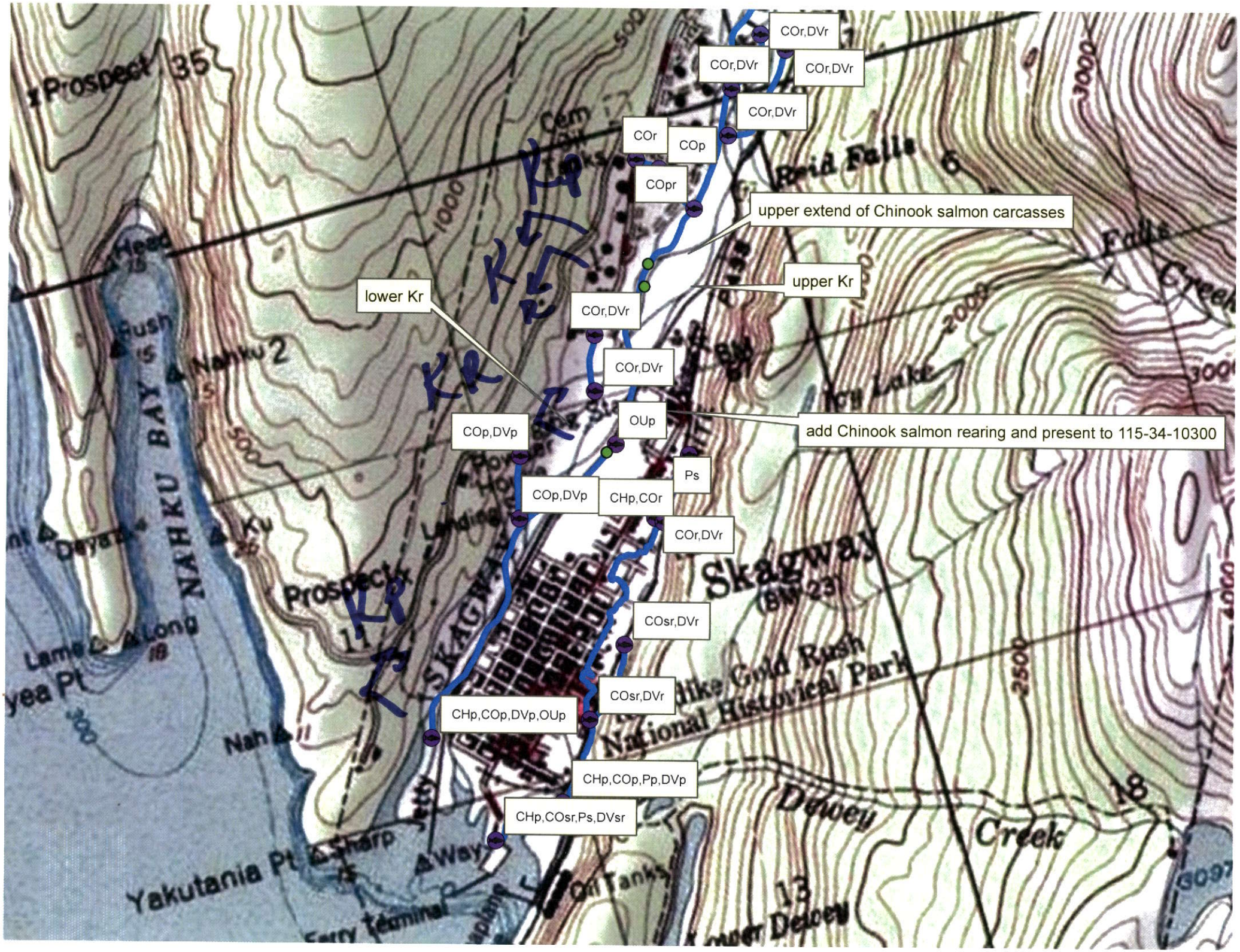
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OUp
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Kr
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Prospect 35
Reid Falls 6
Falls Creek
Ice Lake
Skagway
Klondike Gold Rush National Historical Park
Dewey Creek
Lower Dewey
Prospect 11
SKAGWAY
NAHKU BAY
Nahku 2
Yakutania Pt
Ferry terminal
Oil Tanks
Jetty
Head
Bush
Deyea
Ku
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Lame
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Sharp
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