Rampart Rapids Summer Catch Per Unit Effort Video Monitoring, 2001-2003

Using a Fishwheel on the Yukon River, Alaska

By Stan Zuray

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Final Report to the U.S. Fish and Wildlife Service
Federal Office of Subsistence Management

Federal Subsistence Fishery Monitoring Program Report

Rampart-Rapids Summer Catch-Per-Unit-Effort Video Monitoring, 2001-2003

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Fishery Information Services Division Project FIS 01- 197
Final Report

2ND Edition

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Cover: Two-basket fishwheel, equipped with netting sides, water generator, equipment enclosure, video camera, automated lighting, microwave transmitter and video chute.

Title: Rampart Rapids Summer Catch Per Unit Effort Video Monitoring, 2001-2003

Study Number: FIS 01- 197
Investigator(s)/Affiliation(s): Stan Zuray, Box 172, Tanana, Alaska
Tel: (907) 366-7114, Fax: (907) 366-7195, stanzuray@netscape.net
Management Regions: Yukon River Geographic Area
Information Type: Stock Status and Trends
Issue(s) Addressed: Currently no other in-season project in Alaska provides assessment data on Canadian Chinook salmon in the Yukon River above Pilot Station. Catch per unit effort (CPUE) data on Chinook and the numerous other species counted at this site provides valuable run timing and abundance data useful to fishery managers.
Study Cost: 3 year project total 64,250.00
Study Duration: June 1, 2001 to August 1, 2003

Abstract: Fishwheels have been used to harvest fish in the Yukon River since the early 1900's. They are now commonly used as platforms for the collection of biological data for in river fisheries. Recently, the concern over possible negative impacts to fish handled and released from fishwheels has lead to attempts to minimize the handling stress associated with this sampling technique. The 2001 to 2003 video monitoring project was designed to collect run timing and assessment information for Chinook salmon (Oncorhynchus tshawytscha) and other migratory fish species through the development of a video capture system that met the project objectives and minimized the handling stress to the fish sampled. The video camera capture system was developed for application in the remote field site at the Rampart Rapids fish camp on the Yukon River and collects run timing, and CPUE data on Chinook and chum salmon (Oncorhynchus keta), sheefish (Stenodus leucichthys), humpback whitefish (Coregonus pidschian), broad whitefish (C. nasus), and cisco spp (C. laurettae and C. sardinella). The video capture system has also been applied to a mark fall chum recapture project and is able to identify individually marked fish. This video capture system has evolved substantially and "fish friendly" improvements have been made to the fishwheels. Through a better understanding of the factors affecting the capture efficiency, the project provided specifications on fishwheel components and operation that improved the comparability of CPUE results between years. The final report includes assessments of counting methods, equipment used, and further recommendations on the use of the video system.

Key Words: catch-per-unit-effort, Chinook salmon, Oncorhynchus tshawytscha chum salmon, Oncorhynchus keta, video capture system, fishwheel, microwave transmitter, stored video images, video camera, Yukon River.

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Author

Stan Zuray has been a fisherman and trapper in the Tanana area since 1973. During the last eight years he has had a contract with the U. S. Fish and Wildlife Office in Fairbanks to run fishwheels for their chum salmon tagging project at the Rampart Rapids. He is one of the developers of the fishwheel video system currently in use on a number of Yukon River drainage fishwheels.

Sponsorship

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Introduction

Monitoring of Chinook salmon (Oncorhynchus tshawytscha) passage in the middle Yukon River began in 1999 at Rampart Rapids (Rapids: 730 miles upstream from the Yukon River mouth). Before this time, there were no U.S. run assessment projects for mainstem Yukon River Chinook salmon above Pilot Station, 138 miles from the mouth. This unmonitored area covered over 1,000 miles. Numerous subsistence and commercial fishermen harvest salmon along this section of river. In 1999 daily subsistence fishwheel Chinook salmon catch–per-unit-effort (CPUE) was supplied to the Alaska Department of Fish and Game by satellite phone from the Rapids. In 2000 and 2001, daily catch rates of Chinook and chum salmon (O. keta), sheefish (Stenodus leucichthys), humpback whitefish (Coregonus pidschian), broad whitefish (C. nasus), and cisco spp (C. laurettae and C. sardinella) were reported. Future data on Chinook salmon and the numerous other fish species (many important subsistence resources) caught at Rapids will help build a long-term population trend data base that will increase in value as the project continues. A continuous funding source has not been found however, that will finance this project over the long-term.

The project site at the Rapids has probably been a subsistence fishwheel site since fishwheels came to the Yukon (around 1900). Traditionally, the particular bend in the river where the site is located has always been well known for its ability to consistently produce good catches of fish, Chinook as well as chum salmon, whether the water was high or low. Because of the unique currents in the Rapids, fishwheels are capable of being run there even during the spring drift that happens at the same time as the Chinook salmon run. Traditionally, people would travel to the Rapids area to spend their summers because of these qualities. Even today it is one of the most densely populated active fish camp areas on the Yukon River.

Fishwheels are commonly used as a capture method for management and research activities in the Yukon River drainage. Specifically, fishwheels have provided catch-per-unit-effort (CPUE) data at various locations to fishery managers. Also, fishwheels are used to capture and hold fish for tagging studies. The majority of these fishwheels use live boxes to store fish until the researchers or contractors process and release the fish. Crowding and holding times greater than four hours are common and a growing body of data suggests that delayed mortality and reduced traveling rates are associated with holding, crowding, and/or repeated re-capture (Underwood et al. in prep: Underwood, U.S. Fish and Wildlife Service, Fairbanks, personal communication: and Eiler, National Marine Fisheries Service, personal communication).

From 1996 to 2003 (present) the site has been used to run fishwheels for the Rampart Rapids fall chum salmon tagging project (Underwood et al. 2000). During these seven years the site fishwheel operated without any down days or days when data were compromised. In 1996, 1998 and 1999 a fall chum radio-tagging project was also conducted from this site (J. Eiler, National Marine Fisheries Service, personal communication). During the first year of operation the radio tag project became aware of a possible problem with live box held chum salmon. This was studied in 1998 and 1999 and results (not yet published) showed a significant negative effect on fish held in the live box for 4 to 6 hour (Eiler, personal communications). A further indication of a possible problem with live boxes was a 1998 radio-tagging project done on sheefish showing excellent results from fish tagged and immediately released with no holding time in the live box (Brown, 2000). While this study was not designed to look into the livebox holding issue the fact that all of the immediately released sheefish were detected in the known upriver spawning area later in the season added weight to the livebox mortality theory.

In 1999 the fishwheel operator at Rapids was supplied with a satellite phone from the U.S. Fish and Wildlife (USFWS), Fisheries Resources Office in Fairbanks and called in daily subsistence Chinook salmon CPUE data to the Alaska Department of Fish and Game. In the fall of 1999 a development project was undertaken at this site to address the increasing concerns over live box held fish and come up with an alternative method of monitoring catch using video (Zuray and Underwood 1999). Video technology, as an alternative to live boxes, avoids all of the handling and live box crowding issues by eliminating the use of live boxes altogether. Video systems have been used in counting windows at dams in the Columbia River basin for several years (Hatch et al. 1998). These systems have proved to be efficient and able to provide accurate counts. They have however been designed for use in developed areas where standard power is available and environmental variables are easily controlled. In transferring this technology to a fishwheel on the Yukon River it was necessary to deal with many problems that did not exist in prior applications of this technology. A video capture system was developed that had low DC power requirements. The system used an analog CCD camera, mounted above the fish wheel chute. As fish slide down the fishwheel chute, they were recorded to a time-lapse VCR in 12-hour recording mode. The fish images were then extracted from the VCR tape and digitized using Salmonsoft video capture software. Fish were then tallied by species and CPUE data were generated (see the methods section of Zuray and Underwood, 1999 for a detailed description of the video methods). Also, a specially built fishwheel was used having many features designed to reduce possible injury to fish. The USFWS Fairbanks Field Office in was directly involved in the development and support of the Rapids CPUE video project in 1999.

In 2000 a Chinook and fall chum salmon CPUE video project was funded at the Rapids site by contracts from the USFWS through the Restoration and Enhancement Fund (Zuray 2000a and Zuray 2000b). Also, catches of sheefish, humpback whitefish, broad whitefish and cisco spp. were monitored. The fall chum video project funded through the Restoration and Enhancement Fund is reported under separate cover. The Chinook and fall chum video projects were run both years without any down days or days when data were compromised. They provided data without any live box held fish being released back into the river.

From 2001 to 2003 operation of the Chinook video project was funded by the USFWS Office of Subsistence Management. The 2001 to 2003 Office of Subsistence Management project is a mating of the need for Chinook run timing and assessment data and the use of video capture as a means of producing data in a way that is much less harmful to fish. This report will cover all the major developmental changes and major equipment used in the project, the field video taping procedures, and computer image capture methods. Data worksheets will be presented on all species, some Chinook counts compared to other projects, and a 2000-2003 comparison of Chinook data provided (figure 1 and tables 1 through 6). Aspects of the project that may help someone implement their own project and recommendations for further work are discussed that shed light on the practical aspects of making a video project work.

Objectives

1. To obtain catch-per-unit-effort data on Chinook and summer chum salmon, sheefish, broad, humpback whitefish and cisco spp. using the video collection system developed in fall of 1999 and improved upon in 2001.

2. To provide the U.S. Fish and Wildlife Service and the Alaska Department of Fish and Game with the above catch-per-unit-effort data via satellite phone on a daily basis.

3. To provide a yearly report on project operations and results

Study Area

The project was conducted on a fishwheel 40 miles upriver from the village of Tanana at an area locally known as "The Rapids", a narrow canyon 1176 km (730 miles) from the mouth of the Yukon River. Traditionally and at the present time it is an area known for its abundance of a wide variety of fish species. This condition exists because of the fast currents and steep banks that force fish to migrate through the area relatively concentrated and close to shore.

Methods

Fishwheel

A two-basket fish wheel equipped with a video capture system was used to count salmon and other species from 2001-2003. Effort was taken so the site of the project was consistent from year to year. The fishwheel rotation speed, the baskets dip depth, distance from the basket to river bottom, and length of the lead fence were kept similar between years. Sonar readings were used to improve the consistent positioning of the wheel relative to the migrating fish. Basket width was 10 feet and dip was kept around 13 feet. Nylon seine netting was installed on the sides of the baskets to minimize injury to the fish as they were lifted clear of the water. Plastic mesh was placed on the bed or sliding portion of the baskets for "fish friendly" operation. Underwater holding boxes that were used for subsistence by the operator and as a means of catching fish for research activities that the project supported were eight feet long, four feet deep and two and one half feet wide. Two and one half inch holes were drilled throughout the live box to allow a continuous flow of water while preventing heavy current. The fishwheel was put in the water during the first week of June and assembled in running order within a week. The water generator and associated electronics gear was mounted on the wheel. By mid-June all of the electronic gear to be used in the video project were mounted on the fishwheel or set up back at camp. This included the surveillance camera, video tape recorder (VCR), portable monitor, laptop and desktop computers, 2 generators, and in 2002 and 2003 the data transmitter and receiver (figures 2 and 3 show some of this equipment). Secchi disk readings related to fishwheel efficiency testing are started at this time (see table 7).

The first Chinook salmon arrive as early as mid June or as late as the first week of July. Because of the large amount of subsistence gear in the river at the Rapids prior to the arrival of

the Chinook salmon and the applicants own participation in this fishery monitoring the arrival of the first fish was always easy. Nets were in the water each year at the Rapids in early June and reports monitored from ADF&G's Pilot Station Sonar Project. Within a day or so of the first reported fish caught anywhere in this section of river the Rapids test wheel started counting.

The schedule for running the wheel was 12 hours per day, 6 days per week (excluding Sundays). This schedule was originally worked out in a discussion with Keith Shultz of the Department of Fish and Game in 2000. The reasons for this schedule are as follows:

1. Because of the high amount of drift in the river at this time of year, continuous nighttime (unattended) running of the fishwheel is not advisable. This was clearly the case in years such as 2000 and 2001.
2. Twelve hours running time would reduce the amount of Chinook salmon processed by the wheel yet still provide the data needed.
3. The logistics of one person running a site, 40-miles from the nearest town, necessitate one day a week being used for a supply trip to Tanana. In all years the town trip was not needed every week and a count would be taken for that Sunday.

Project Specifications

This section provides specifications on fishwheel components and operation so future year's CPUE results can be as comparable as possible. Changes in some of these could easily make these comparisons meaningless. Because of shifting silts and-or changing sites frequently, some projects are not able to collect data consistently using these specifications from one year to the next. The Rapids has a hard rock bottom and the same site can be used each year. These listed below should be kept as consistent as possible each year.

Project Specifications:

1. Basket dip (amount of basket in water when vertical) is 13 feet (12 ½ to 13 ½).
2. Width of basket (outside to outside) is 10 feet.
3. Lead fence length is 20 feet.
4. Wheel is two-basket design with a basket side height on the lead facing side of 5 feet
5. A multiple beam (6), down looking sonar is used in season to slightly adjust fish wheel location, keeping the concentration of migrating salmon centered in line with the inside logs of the fishwheel raft. The size of the fishwheel was made to fit this specific spot. After many years of using the sonar in conjunction with this size fish wheel, the wheel seems to normally center itself over the concentration of passing fish when these operational specifications are followed. This appears to be especially true of fall chum salmon, which prefer a very consistent depth range to run at.
6. Wheel baskets are always run between one and 1.5 feet off bottom (hitting the rocky bottom can be disastrous).
7. Basket rotation speed is approximately one to 1.5 turns per minute (this slow speed is part of the fish friendly operation).

Video System

The video system used in 2001 consisted of a color CCD camera mounted above the fish wheel chute and directly connected to a laptop computer through a video capture card. After the fish wheel captured the fish, they traveled down a chute, were video recorded, and then re-entered the river. A time-lapse VCR was linked to the system for continuous video recording backup. Twelve-volt batteries powered the whole system. During daytime

operation, a water-wheel generator charged the batteries. At night, lights necessitated the use of a small generator. This system differed substantially from what was used in the development year of 1999 and the first full project year of 2000. In 1999and 2000 the camera was attached directly to the time-lapse VCR using 12-hour recording mode. These tapes were taken back to camp and run through a capture program (Salmonsoft Vcap 1.07) that extracted the video frames that contained fish into digital avi format files. This process took two hours per 12-hour tape. The software program pulled the fish images out of the VCR tape with a "luminescence trigger" that used the change in pixel brightness between the background and the passing fish image. The system worked fairly well as long as any sources of strong shadow and light was eliminated from the viewing area. The major limitations of this method were: 1) the frame rate was limited to 5 frames per sec, 2) camera positioning was limited by the background (no shadows), 3) the system could only be run for 12 hour periods, and 4) VCR tapes would take an additional two hours of processing before digital files could be counted for fish.

In 2001, Dave Daum, USFWS, Fairbanks Office, developed a new system that improved on the past limitations of the system. A camera was mounted directly to a laptop computer on the fishwheel. Then a new version of Salmonsoft software (funded by USFWS) that used electronic triggers to initiate capture of fish images as they slid down the fishwheel chute. A lightweight door was installed at the bottom of the chute with a magnetic switch attached. When a fish exiting the chute opened the door, a signal was sent to the computer. Frame rate and numbers of frames captured before and after the triggering event were controlled by software so the limitation of using time-lapse tapes was eliminated. Since the time-lapse VCR was still linked to the camera, any failure of the magnetic switch would be "backed up" on tape. Every day, the video data was downloaded off the computer using a 1GB IBM, micro-drive and brought back to camp. A plywood shack and wood stove was constructed and set up to house the equipment in camp. The same system was deployed in 2002 and 2003. Here is a list of daily video procedures followed at the fishwheel (this gives a general idea only as these procedures changed over the 3 years):

Start up

- Arrival at the fishwheel - make sure wheel is adjusted for running (the most complicated part).
- Switch on power to water generator and lower into water. Turn on fishwheel.
- Open electronics cabinet, turn on DC power from batteries, and turn on VCR and laptop.
- Check laptop monitor to make sure camera is on, in focus and positioned (rarely changes).
- Wipe window clean on camera case (splash marks) and clean chute background (for nice pictures).
- Start recording VCR tape. Turn on computer capture program.

Shut down

(12 hours later: at least one trip was made to wheel mid-day and often more when drift was heavy).

- Remove VCR tape and turn off VCR.
- Transfer data file from hard drive to portable microdrive and shut down computer.
- Turn off main DC power switch.
- Lift water generator out of water and turn off DC current to water generator.
- Turn off fishwheel and lift baskets up to protect from nighttime drift.

Fish Counting

In 1999 and 2000 time-lapse VCR 12-hour tapes were brought back to camp and run through Salmonsoft's "luminescence" program to digitize the fish images to electronic video format (avi). This process took two hours. Then avi files were viewed through a Windows media player and hand-tallied. We were unable to adjust scroll speed while viewing video and all numbers of fish by species and sample times had to be entered into the data base by hand.

In 2001, an electronic tally system was developed that facilitated rapid counting and calculating of CPUE data by fish species. This new video counting system, Salmonsoft capture review program, (funded by USFWS) allowed tallying of individual fish species using a computer keyboard. Images could be reviewed at user-defined speeds and played forward or reverse for review. Dave Daum, USFWS, did considerable Beta testing of the software, so a finished product would be available for the beginning of the 2001 season. After fish were tallied on the computer, numbers and times were entered into an Excel spreadsheet, which calculated 24-hour CPUE by day. These daily counts and CPUE calculations were then called into ADF&G using a satellite phone usually within a couple hours after retrieval of the data from the Fishwheel. All avi files and Excel spreadsheets were backed up on compact discs daily. VCR tapes were collected daily as backup, but were not processed daily. The primary purpose of the tape recordings was to provide data in case of a failure in the laptop/switch system, data for in-season evaluation, and post-season assessment. The project in 2002 and 2003 used this tally system throughout the season except in 2003 tapes were made one day a week for in season assessment purposes only. This was because the lack of system failures warranted less backup effort.

Assessment of Capture Program

As a final assessment, segments of original VCR tapes were viewed and compared to the corresponding video capture files generated from the magnetic switch video system. The original VCR tapes contain all fish that pass through the chute, so assessing how many fish, if any, were missed by the program was a fairly straightforward process although rather tedious and boring. Selection of assessment samples was two-part. 1. A day was selected (procedure differed each year). 2. The first six hours or the first 50 fish each Tuesday was selected to review (based on workload in reviewing that much material).

The process was as follows:

1. The VCR tape for a particular day was put in the VCR and played into a computer software program called Win TV that simply opened up a window on the monitor for viewing. This window was moved onto one half of the monitor screen.

2. On the other half of the monitors screen the AVI file made by the fishwheel laptop/switch program was opened using Salmonsoft review program or the Windows 98 default video viewer found in Windows Explorer.

3. Both viewing samples were set at the beginning of the assessment sample period. The regular VCR controls on the VCR and remote were used for viewing the VCR tape and the computer mouse and keyboard forward and reverse features were used for viewing the AVI file from this point on.

4. The AVI file was advanced to the first fish, stopped and the time stamp noted.

5. The VCR tape was then run forward until a fish appeared and then was paused.

6. If all went well the VCR frame fish and the AVI file fish should be the same and have corresponding times. What was looked for was a fish that was on the VCR tape and not in the AVI file. If one were found that would signify a miss by the laptop/switch program.

7. Each fish reviewed on the VCR tape was counted on a multiple tally denominator.

8. Misses are recorded in the project workbook in case further study is needed to see why the error occurred, however most of the time the reason was apparent.

9. The AVI file was advanced to the next fish frame and the process repeated itself.

10. After an assessment selection went through this process the AVI file was then opened in Salmonsoft review program and the AVI file counted and compared to the VCR tally figure. These figures are seen in Table 8 through 10 and show the consistent video capturing of all the medium and large fish species.

In the 2000 video project selections of the VCR tapes were viewed and fish on them counted. That number was then compared to the number of fish on a corresponding AVI file. The process described above and used in 2001-2003 was much more time consuming per fish viewed but produced better information about the precise reasons for counting errors.

Power Equipment

Aquair UW propeller driven water generator: This generator had very little output for the water speed encountered at the fishwheel (approx. 6-8 ft/sec.). It could only produce 1-2 amps. Because the project was run in the daytime hours (no lights needed), the camera, laptop, and VCR were able to run without a supplemental generator and keep a full charge on the batteries. Its use is recommended only after carefully assessing the water current at each site, power needs of the project, cost ($2000.00) and work of setting up. On a positive note it seems like a durable, continuous use piece of equipment and lasted the 3 years of the project.

Honda 1000 watt generator (EU1000I): With the color video camera running at higher shutter speeds, it required about 180 watts of light at night to produce a nice picture. This plus other equipment (camera, VCR, and inverter) came to under 300 watts, which this generator easily handled, on a lower RPM setting that this generator was equipped with. This also boosted gas economy to 10 hours per 6.1 gallons. An extended gas supply was run into the generator's carburetor for more use without refueling. When not in use the extended gas supply was lowered to a level below the generator to avoid possible problems associated with a leaking carburetor needle valve. Another method was also used where the fuel supply was run into the generator fuel pump. It required more dismantling of the generator but the fuel supply could then be kept at a level lower than the generator. Although not necessary a timer switch was also wired into the generator so that the generator would shut off whenever you desired. The generator was light and ran on the shore in a converted doghouse with an open front and a 6" square hole in the back for the exhaust to blow out. A 100' extension cord ran from shore along the fishwheel spar pole to the equipment enclosure. Because the project was run in daytime it was used infrequently. Depending on site or project it could be the main fishwheel power source however. The original generator had to be replaced and overall they don't seem to hold up to the long run times the project requires on the days it is used.

Honda 2500-watt generator (EB2500): This generator was used at camp to run the desktop computer. It lasted the project but was burning oil regularly at the end.

Batteries: Four 6-volt deep cycle batteries supplied the stored 12-volt DC power. While fewer batteries could be used, a generator shut down could necessitate the use of this much reserve power to keep the video running. Also the reserve allowed for minimal use of the water generator on days when drift was especially bad. The batteries all sat neatly in an inexpensive waterproof plastic tote in the bottom of the equipment enclosure. These lasted but seem to hold less charge at the end of three years of use.

Battery charger: A 10/30/50 amp (Schumacher SE-1250), taper charge, automobile type, charger was used. As the charger will run constant at 8 amps at night with lights on, any taper charge, 15 amps or larger should work. This lasted the project.

Inverter for light: An inexpensive 150-watt modified sine wave inverter worked well and drew minimum watts. A 300 watt modified sine wave inverter was used also and had the advantage of a power off switch. These were replaced each year and because of durability problems. Spares were purchased also.

Lights: Two 90-watt halogen 27^0 beam GE floodlights. One was run off an inverter from the DC batteries in case the gas generator system ever shut down. The other light ran directly off the generator in case the DC inverter system failed. Each light had an adjustable light sensor wired in and was quite workable with each light coming on independent of the other as darkness progressed. During a generator, light, or inverter failure, one light could produce a dark yet fully countable video. I found these to last the length of time stated by the manufacturer so I started writing installation dates on each light and changing them before they would fail.

Fishwheel Chute

On wheels equipped with live boxes a "chute" is used to pass the fish from the wheel baskets over the raft logs and into the live box. Wheel sites do exist that do not require vertical adjustments to the axle; this site however required adjustment in times of lower water. The chute, therefore, had to be adjustable in that it must go up and down to match up to the changing level of the baskets or fish injuries increase from fish dropping rather than sliding into the chute. This means the camera, enclosed sides of the chute and the chute must be one unit to eliminate refocus of camera, especially in bad weather, in times when the wheel axle/baskets are needed to be raised. The chute enclosure in 2000 was the source of some of the greatest trials and tribulations (Zuray, S. 2000). In 2001 the laptop/switch method developed, with the help of USFWS biologist Dave Daum, eliminated the need for all the sunlight and wind blocking structures of the fishwheel chute. The bottom (viewing area) of the chute was lined with white UHMW 3/16'' thick plastic. It was easily cleaned and stayed white which was the preferred color background for the video images.

Chute Door/ Magnetic Switch

A door made of 1/4-inch plywood covered with 3/8-inch thick closed cell foam was constructed to fit over the exit area of the camera chute. The magnet that activated the trigger switch was mounted on the door. The switch itself was mounted in a stationary position adjacent to the magnet. When the door moved outward approximately three inches the magnetic field around the switch weakened sufficiently to close the switch. This sent an electrical current to a serial interface that in turn communicated the switch event with the computer. The door was hinged on top with fish exiting out the bottom. The operation of the door had to be light enough so that even small whitefish could open it, and at the same time, it had to close positively without bouncing when large fish passed. Bouncing of the door could cause the switch to open again after a fish had passed, resulting in empty frames captured. A 2-foot wooden rod was attached to the top of the door and acted as a counter-balance. The rod was attached by a length of nylon cord that passed through a pulley to a weight suspended in an "ABS" plastic pipe that was filled with a water/anti-freeze mixture for all weather use. The weight was made of a plastic pill bottle filled with the solution and some lead shot. The action of the weight, dampened by its movement through the liquid, caused the door to slow down

just before it reached the closed position, providing bounce-free operation. This system, developed on site, worked very well but required considerable trial and error to install correctly. The length of the handle, the height of the pulley, and the amount of shot used for weight are factors that have to be synchronized. This dampening system was necessary because of the vast differences in the way a 1/2-pound cisco and a 50-pound chinook salmon went through a hinged door. A buzzer was installed in-line with the switch to provide an audible indicator that the switch was working. In 2003 a simple wind counterbalance was installed at the top of the 2' wooden rod on the chute door that removed much of the false door openings cause by heavy wind.

Fishwheel Construction

It is counterproductive to install a video system only to have fish injured by the fishwheel unnecessarily. The fishwheel used was specially built to try to eliminate injuries. Basket sides have seine webbing and no braces creating a sort of trampoline in the critical areas. The basket bed was lined with 1 1/2" x 1 1/2" high-density plastic webbing in 2001 and 2002 and 1" x 1" vinyl coated wire in 2003. All entrance and exit doors are lined with closed-cell foam. Easily removable paddleboards of different sizes allow much control of the fishwheel rotation speed. Rotation needs to be consistent with no prolonged hesitations but should not be so fast as to lift the fish high before it has a chance to migrate towards the basket chutes. In 2003 basket chutes were completely lined with durable 5/16" closed cell foam that was contact cemented to the chute boards. This produced dramatic results in the reduction and for all practical purposes the elimination of bloody gills in Chinook.

Electronics

Panasonic color 1/3" format CCTV camera: (model WV-CP474 with 480 lines horizontal). This camera has many user selectable features including shutter speed that was critical for providing quality images. The camera has 12-volt DC power input and standard BNC video connectors for video output. Numerous lenses are available. The lens selected is described below. This camera used in 2001-2003 produced noticeably better images than the similar model WV-CP464 used in 2000. This is still running fine.

Lens: By Computar vari-focus model TG3Z271FCS, 2.7-8mm,F1.0 TV lens, color camera. A nice piece of equipment new in 2002, improved the pictures that made the system work. The color, zoom and focus capabilities of this camera were essential features. The camera mounts and waterproof case were under $1000. A waterproof camera housing was necessary and we kept a good amount of silica gel in it at all times to absorb any water vapor trapped inside the case (Pelco Surveillance Camera Housing). This is still running fine.

Monitor: A 3"X5" color LCD monitor wired to the 12 volt system and the VCR provided a picture of the camera's view for focusing, zooming, and positioning and camera parameter settings at the fishwheel. All of these of course needed to be done on the wheel. It was supplied with 6-ft long wires and could be put right next to the camera during these adjustments for easy viewing. This is still running fine.

Video Recorders: Video cameras were connected to a 12 volt DC video recorder (Panasonic AG-1070dc) with 12 and 24-hour time-lapse capability. The video recorder was placed in a waterproof Pelican case and wires ran to the outside via waterproof connectors. The video recorder stored images on the videotape at a rate of approximately 5 frames per second on the 12 hour setting and it had a date and time stamp feature that was used at all times. A matching, second video recorder was used to play images into the video capture

card/computer. These VCRs have factory-cleaning recommendations of every 60 hours. Conditions at the wheel are very clean and dry and new tapes are used for each recording but use is sometimes pushed well beyond the 60 hours. VCR's are sent in for cleaning, adjustment and parts replacement after every season. This model of VCR is no longer manufactured. These are still running.

Desktop Computer: A desktop computer was used in camp to download video files from the fishwheel video system, review and tally fish, capture fish from VCR tapes, and organize data in spreadsheets and graphs. The computer had 1000 Mhz Pentium III processor, 384 MB of SDRAM memory, Windows 98 SE operating system, Recordable/Rewriteable 12x/8x/32x CDRW, analog PCI video capture card, and a PC card reader installed. The PC card reader was used to download the video files from the IBM micro-drive. All files were backed up on compact disk. This computer has made it but not without replacing a memory card, hard drive, and motherboard and spending countless hours of work on it. It is also unable to run all of the video capture software available because of the way advancing technology makes a 3-year-old computer obsolete. It should be realized that a season's work could fill a 40GB hard drive up each year and possibly require a reinstall of the operating system to run cleanly each year

Laptop: The laptop was connected directly to a camera on the fishwheel though a USB analog capture card. The laptop was a Panasonic Toughbook CF-48. It was the only laptop found that was capable of running on straight 12-volt current. The laptop had a Pentium III 700 Mhz processor, Windows 98 SE operating system, 20 GB hard drive, 256 MB of SDRAM, and an 8 MB video card. An IBM 1 GB micro-drive was used to move video files from the laptop to the camp's desktop computer. The laptop was enclosed in a waterproof case. This is still running.

Capture and video review software: Salmonsoft capture software Vcap 1.3.3 was used to capture fish images off the fishwheel. The software allowed use of a trigger switch to record fish images as they slide down the fishwheel chute. In camp, video files (AVI format) were reviewed and tallied using Salmonsoft viewing software Vcap Rev 1.3.4. This software could view video files, play files forward and reverse using user controlled scroll speeds, and tally fish with user defined keyboard keys.

Wireless Video Communications System: Model CS-300 made by Premier Wireless Inc. In 2002 this 5.8 Mhz microwave transmitter and receiver were used to experiment with sending the video signal from the fishwheel to camp 1/2 mile away. The objective was to run the system for the entire fall season along side the existing video capture system to see how it performed in various environmental conditions, i.e., wind, rain, and fog. The system performed flawlessly in 2002 and the complete system was installed and ran on the fishwheel in 2003 thereby eliminating the need for having the laptop capture system on the fishwheel. All video capture was done back at camp. This reduced power requirements at the fishwheel, reducing amp/hr usage from approx. 3.4 to around .5 amp/hr. The USFWS Fairbanks Field Office loaned the project the wireless system used in 2002 and 2003. Along with the advantages realized in normal use of this wireless system, the ability to run multiple capture systems, both luminescence and magnetic trigger initiated ones, for experimentation purposes, has been greatly enhanced. Having multiple unproven systems on the fishwheel would be difficult in many regards. With wireless this experimentation can be done at camp. For the 2004 season we are planning to run 2 trigger systems with different operating systems and one luminescence

system for assessment. The wireless video system makes this much simpler. This system is still running fine.

Related Areas of Study

Diel catch patterns: These patterns are not at present available for Chinook because of the lack of large enough numbers of captured Chinook, large amount of days containing hours with 0 Chinook captured and 12 hour project run time. While the data has been looked at with interest, the project is unable to present any statistically valid diel patterns at this time. The project's equipment and time does support this type of effort on the fall chum salmon run which typically starts during the latter part of the project. Seasonal mean hourly catch rates were calculated from days with 24 h of continuous data for fall chum salmon. First, hourly catch rates (fish/h) were calculated for all hours in each day. These hourly catch rates were expressed as proportions (%) of the daily catch so high catch days did not bias results. Then mean catch rates (%) by hour were calculated for the season. Only days with catches of over 100 fish were used to minimize using hours with no fish captured. This is another part of the work being done to explore movements of fish as it relates to the operations of the video project in an attempt to make the project more consistent and accurate (see figure 4)..

An Onset StowAway TidbiT© water temperature data logger was installed at the fishwheel for the duration of the fishing season. The logger was installed on the fishwheel lead at about 1 m depth. Four measurements were taken daily at 6 h intervals and mean daily water temperature was calculated by averaging the four readings. These measurements were taken in 2002 and 2003 in an effort to provide more points of temperature data collection on the Yukon River and to explore possible effects on fishwheel efficiency that temperature variations might have (see figure 5).

Daily mean water discharge readings from the Yukon River, near the Haul Road Bridge, were used to monitor the changes in river volume at the Rapids after adjusting for time differences. These daily readings were compared to historical data from 1996 – 2002. The discharge site is maintained and the data distributed by USGS. Since very little addition to the Yukon River's water volume occurs between the Haul Road Bridge and the Rapids, the USGS site should be a useful tool for estimating river volume at the Rapids. Also the existence of an historical database adds to the site's utility (Figure 6 shows 2001-2003 levels). The Rapids site is fortunate in that discharge levels directly affect current speed at the fishwheel in a linear fashion. The correlation between discharge/water speed and fishwheel catch efficiency, it is hoped, may provide a model for more accurately describing run strength in the future.

Secchi Disk: A standard disk was used to take daily readings on water clarity changes at the Rapids starting in 2003. This was done in a shaded area about 10" away from shore. Two readings were taken each day (see table 7). Water clarity is known to affect fish capture and this is another area being explored for its effect on catch efficiency at the Rapids fishwheel.

Results and Discussion

The primary objective of the project is to provide catch per unit effort data. The Chinook salmon numbers are presently the ones of most interest to the Alaska Department of Fish and Game and USFWS. This data is only meaningful in as far as it relates accurately to the actual Chinook passing through the site area. That actual number is of course not available for comparison so other established Chinook assessment and escapement projects on the river are looked at and compared for indications of project accuracy.

Prior to the Rampart-Rapids Summer catch per unit effort video monitoring project the Lower Yukon test net catches and Pilot Station Sonar passage estimates were the only Chinook

assessment projects before the fish reached the Canadian border. Data provided at the Rapids video project provides fisheries managers with another view with which it to help confirm or reassess estimates made in the lower river. This second look takes place after a large amount of subsistence harvest has taken place and the Tanana River component of the Chinook run has branched off. Chinook salmon passing through the Rapids (40 miles above the confluence of the Tanana and Yukon rivers) are largely Canadian bound and accurate assessment of those numbers are of great importance in meeting U.S. border passage obligations. (Figure 8 – map)

Below the project is compared to three major Chinook, Yukon River drainage projects. The project is only four years old so only years 2000-2003 are compared.

Year	24 hr. expanded Rapids cumulative	Lower River set net cumulative	Pilot Sonar estimates	Canadian Border estimates
2000	1708 Chinook	14.12	70,000	17,215
2001	5563 Chinook	15.23	141,816	55,400
2002	1667 Chinook	20.23	183,000	28,000
2003	1646 Chinook	26.98	254,000*	58,000*

. * Some figures are preliminary numbers at this time

Some comments on the above numbers:

One area of note is the similarity in overall Chinook numbers in 2002 and 2003 for the Rapids project. This drew our attention because the overall number was the one most used in the past to measure run strength and the project operator did not feel that the 2002 and 2003 runs were similar in strength at all. The runs were also not viewed as similar in strength by any of the subsistence fishermen in the Tanana and Rapids area fish camps which numbered about 15. This accelerated an ongoing investigation into just how extreme the abundance or absence of jack Chinook in a population can effect the projects assessment of run strength.

Starting in 2003, length measurement marks in the video chute have allowed the classification of Chinook salmon into jack or mature salmon based on length (< 71 cm total length = jack). Though not as accurate as manual measurements, the marked chute does provide a way to differentiate between two size-classes of fish. It was believed that separating the Chinook run into these two components can give a better picture of the run when comparing its catch to other assessment projects. Because the video chute in 2002 had the same marks as the 2003 chute, the 2002 Chinook video avi files were recounted separating the jack and mature fish. The results were dramatic and show just how far off a run assessment can be if some jack separation technique is not employed. For example, the total number of Chinook salmon captured at Rampart Rapids video project was just over 1,600 fish in both 2002 and 2003, but when the jacks and mature Chinook are separated one sees a catch of mature Chinook salmon (> 71 cm total length) in 2003 that is 67% higher than 2002. When the run is looked at from this perspective a very different picture in terms of fish numbers and pounds available to Chinook net fishermen, pounds available to wheel fishermen, and mature fish (females) headed to the spawning grounds emerges (see graph, figure 7).

Thus, by having the ability to separate the Chinook salmon run into the two size components, the result is a better understanding of the run characteristics and true strength. Future project plans are to develop a reporting method that includes the accuracies of the jack separation technique and to continue work on developing a digital measuring method to accurately measure individual fish with the help of Dave Daum of the USFWS Field Office in Fairbanks.

The video system proved to be very accurate at counting fish that were captured by a fishwheel (see assessments, tables 8-10). Many of the potential fish handling problems associated with fishwheel capture have been eliminated by the development of this method. The video capture system used in 2001-2003 had many improvements over the system used in 2000. Being able to have the laptop computer and capture software eliminate empty frames and store frames containing fish in real time on the fishwheel was a time saving of two hours for each 12 hours of data collected. The assessment figures in tables 8 through 10 show the consistent video capturing of all the medium and large fish species. Small cisco whitefish continue to be a challenge, however even the cisco assessment figures show them being captured at a 94% capture success rate.

Finding the best software program settings that controlled the amount of frames captured before and after the magnetic switch was tripped was a matter of trial and error during the test period prior to the official start date. A setting that captured more frames than was necessary would mean larger than needed file sizes and more time spent reviewing video files. Settings that captured not enough frames caused some fish to be missed either because they were not recorded at all or there were so few frames in the video file that human error came into play during the review process. Some adjustments to these settings were made in season usually associated with fishwheel captures of multiple fish when the run was the strongest. Software settings are influenced by the goals of each project. The summer video project is primarily used at present to provide CPUE data, with fish needing to be identified by species. If the project was attempting to sex chum salmon the number of frames collected might need to be increased. In applying this technology to a recapture wheel in a spaghetti tagging study one might also want to increase the numbers of frames collected so tagged and untagged fish could be identified consistently. Because of the improved review program being able to speed up or slow down the review process, more frames captured for each fish does not substantially slow down the overall counting process. The increase in file size this may cause is also of small consequence considering the storage capacity of the laptop hard drive, micro drive transfer disk and final storage on CD-R disks.

A good review program is important for accurate and timely counting of captured fish. Improvements made to the program in 2001 allowed the user to adjust the speed at which the frames were reviewed. The tally for each species was made with a single click of the computer mouse instead of a mechanical counter and hand tallied on a paper form. Reverse, stop and forward controls were easily accessible and controlled by the keyboard. These features became more important as the numbers of fish counted in a day increased. For example in 2002 a separate fall project counted 2003 chums on Sept. 6. At high numbers such as these every refinement becomes meaningful, not just to speed up the process but also to reduce operator error.

Operation of the laptop computer, interface, electronic components, software program, VCR, and camera all worked well enough in the 3 years of operation that there was no day that data could not be collected. Running longer into the evening or using our backup luminescence video capture system solved the few examples of problems threatening a loss of a day's data. The laptop computer experienced occasional lockups during file transfer if files were large and the capture program was running in the background.

The building and maintenance of the fishwheel chute door was greatly simplified in 2001and 2002. Construction techniques still require attention, as its operation is critical to the proper triggering of the laptop capture system. A door that was too heavy would not allow tiny cisco whitefish through properly and a door that was to light could be triggered by gusting winds. Both these conditions were again dealt with in the 2002 and 2003 season as a new chute was constructed and a workable compromise was arrived at.

The chute door dampening system never had a problem but did need to be readjusted anytime the chute door was reworked.

The magnetic switch experienced no failures in 2002 and 2003 (one failure in 2001).

Discharge levels are currently being explored for their effects on catch efficiency by the Rapids video project, Dave Daum with the USFWS Fairbanks Field Office, and Bonnie Borba from ADF&G's research division. Preliminary work by project leader Stan Zuray shows a strong linear correlation between discharge and efficiency in chum salmon when using the Rampart fall chum tagging project as a standard.

Daily mean water temperatures in 2003 varied from a high of 18.8 °C on July 11 to 3.3 °C on September 23 (Figure 5). Within a day, water temperatures varied by around 1 °C during the first half of the season and about 1 °C during the last half. The lowest readings were between 0600 and 1200 each day.

Hourly catch rates for fall chum salmon were slightly diel, with the highest catches occurring between 1000 and 1900 (Figure 4). This trend was also apparent in 2001 and 2002.

Secchi Disk readings responded to rises in river levels and early in the season the normal melting of glacial streams from high temperature days. Also the colder temperatures of advancing fall weather, lowering of the water level and subsequent clearing of the river are seen in the data as well (Table 7).

The mechanical triggered video system developed during the 2001 to 2003 Rapids video project was installed and tested on four fishwheels operated in the Yukon River drainage. Two wheels were used for monitoring daily catch during the summer and fall season and two wheels were used for counting tagged and untagged salmon for mark-recapture experiments. The video system operated for over 14,000 hours and recorded over 262,000 fish images. Salmon species (Chinook, chum, and coho salmon) were the most common species captured (235,962), followed by Bering and least Cisco (14,746), and sheefish (7,145). Data were collected on total operation time, number of fish captured by species, and type and number of system failures. Throughout the testing period, comparisons were made between fish counted from the switch-triggered video files to: 1) fish collected in the fishwheel live boxes, or 2) fish recorded on time-lapse videotape. A video review program, Salmonsoft Fish Review, was used to tally fish by species from the digitized video files. Live box captured and time-lapse recorded fish were tallied by hand. Digitized and time lapse recordings were synchronized and each frame was time-stamped so similar time segments could be compared.

During the three-year testing period, comparisons between numbers of fish recorded from the triggered video system were similar to fish recorded on time-lapse videotape and fish captured in fishwheel live boxes. A total of 357 hours of fishwheel capture were recorded on videotape and 1794 hours from live boxes. Compared to time-lapse recordings, the video system missed 34 of 3,462 fish (1%) that passed down the video chute. Of the 34 missed fish, 22 were small cisco species that passed under the exit door without triggering the switch and 12 salmon were missed because the software capture settings for frames captured before the trigger event needed to be increased to allow for multiple fish captures i.e., more than one fish sliding down the chute at once. Subsequent adjustments to the door and software capture settings eliminated undercounting by the video system. Compared to live box capture, the triggered video system recorded 660 additional fish, i.e., of the 19,499 fish recorded using the switch program, 18,839 were counted in the live box. Fish jumping out of the live box before counting began and data recording errors explained the difference

Consultations and Capacity Development

The Chinook video project continued a close working relationship with the USFWS office in Fairbanks for the 3 years of the project. Dave Daum with the USFWS Fairbanks Field Office has made trips each season to help with operations of the video CPUE project and assist in assessing those operations. Rapids video projects in 1999 through 2003 have also served as a center for research into fish friendly video development, low fish impact fishwheel improvements, and run assessment improvements related to diel catch patterns, and water discharge and clarity effects on catch efficiency, by the project manager and the Fairbanks Fish and Wildlife Office.

In 2001Tevis Underwood, a fisheries biologist with the U.S. Fish and Wildlife Field Office in Fairbanks in charge of the fall chum salmon tagging project at the Rampart Rapids, flew in fishwheel operators from Beaver and Circle on the upper Yukon River to view and talk about operations of the Chinook video project. These fishwheel operators were part of an upriver mortality study related to the tagging project and Tevis Underwood wanted them to see any improvements to the video project they could put to use.

All years the projects doors were always open to the public and any agency personnel. A number of persons from the Fish and Wildlife Service, Department of Fish and Game and the Office of Subsistence Management viewed the workings of the project each summer.

Bill Busher was the main contact person at the Department of Fish and Game for the daily reporting of data from the project.

The Tanana Tribal Council and the Tanana City School District have been running a USFWS FY 2001-2003 Fishery Resource Monitoring Project called Tanana Fisheries Conservation Outreach (Peters Zuray, K. 2003). This project has brought multiple groups of elders and school children to the Rapids project site to view and work with the Chinook 2001-2003 video project. The Rapids video project equipment and project leader directly aided student activities. These included students running their own Chinook Ichthyophonus study with each shown how to set up and enter data into Excel spreadsheets using the video project computer, and a work program where students cleared campsites for a future youth research camp.

Dr. Kocan used the Rapids video project during the Chinook 2001 and 2002 season for samples for his Ichthyophonus study. Dr. Kocan was able to work directly with students in the outreach project. The video project and Kathleen Zuray of the Tanana Native Council Environmental Office took care of student scheduling and making sure Dr. Kocan had fresh helpers each day. Students putting in the required hours each day received payment for their work from Dr. Kocan. He was accompanied on his second trip by Paul Herschberger another of the project investigators.

Keith Mueller and Angela Matz with the Fish and Wildlife Service made two trips to the video project in 2001 for samples in their study on contaminants in salmon. On their first trip Kathleen Zuray working with the Tanana Tribal Council also assisted them.

Each year the video project hosts groups wishing to see operations. In 2001 thirty-six students, counselors and elders from the 16 Mile Island Spirit Camp spent one day at the Rapids camp during the Chinook video project. The Tanana Tribal Council runs the spirit camp. Visitors were shown project operations, the camp provided facilities for lunch and supper and Chinook salmon from the project fishwheel were given to them to take back to the spirit camp. The trip was coordinated to also coincide with a visit by Dr. Kocan working on his Ichthyophonus study. At one time he had the entire group of visitors surrounding him on the beach talking about his project.

The efforts made in reducing the stress of capture have been interesting enough that the project each year is visited by numerous agency personnel. In 2003 channel 2 new in Anchorage, an Austrian TV film crew, and a YRDFA sponsored group of Canadian fisher people came to the Rapids to see and film its fish friendly capture features. The project was invited this past winter by

the USFWS to run a booth at the American Fisheries Society meeting and was chosen by the USFWS as one of two successful resource-monitoring projects in the state to give a presentation before the new Office of Subsistence Management Partners for Fisheries Monitoring Program regarding these advances.

In 2003 the project, working with the student science camp, completed a bering cisco data and otolith sample effort for Randy Brown of the USFWS Fairbanks Field Office. The project also helped Bill Carter of the USFWS Fairbanks Field Office in his efforts with whitefish radio telemetry done at the video fishwheel in 2002 and 2003.

The video system developed at the Rapids project has been transferred to and currently operates on the Tanana River 5A test fishwheel (Fliris, B. 2000), Rampart fall chum tag recapture fishwheel (USFWS) and the Nenana test fishwheel (ADF&G) and I have recently heard Canadian wheels are looking into going to video data collection. Numerous other inquires have been made from other river systems and the technology has been adjusted to operate at weirs and counting towers.

All the major equipment purchased for the functioning of the 2001-2003 Chinook project was used to run a similar fall chum salmon video project, at this site, funded by Fish and Wildlife Service, Restoration and Enhancement money. Figures 2 and 3 in this report show some of this capacity development effort. The site of these projects can be seen in the map provided (figure 8).

Conclusions

1. CPUE data can be dependably generated by a fishwheel livebox alternative such as a video capture system.
2. Workable and often inexpensive improvements to a fishwheels construction and operation can dramatically reduce injury to sampled fish.

Recommendations

1. CPUE data is only valuable in as much as it is a reflection of what's actually happening in the river. To this end the Rapids video project began a list of project components that may influence CPUE data (see Project Specifications on page 10). Future projects at this site should incorporate these to aid in more accurate data collection and interpretation.
2. In 2003 USGS water discharge data for the Yukon River was looked at with the idea of incorporating it into the assessment of the CPUE data at the Rapids. The effects of high and low water and other factors on CPUE should be investigated further.
3. Proper assessments of test fishwheel projects as well as other fish projects will only be made if raw data and methods of project operations are available in the project reports. Without these reporting requirements projects cannot be assessed for operational integrity and usefulness.
4. An internet web site needs to be run and kept updated with the daily numbers and information from all projects on the Yukon River. Project managers, fishermen, and concerned persons need to have the data in a timely manner to assess their own projects, know when fish pulses are arriving, provide information for Yukon River Drainage Fishermen's Association (YRDFA) representatives for weekly teleconferences, and to facilitate making more informed decisions. This continues to be an area in need of address.

Budget Summary

Total Cost: 64,250 (3 year project) Project Dates: June 1 to August 1, 2001-2003

2001 - 36,150
2002 - 14,050
2003 - 14,050

FY 2003

a. Total Annual Budget	14,050
b. Expenditures Thru December	14,050
c. Balance Thru December	0
d. Anticipated Remaining Expenditures	0
e. Anticipated Final Balance	0

Additional information: No alterations to the budget appear to be necessary.

Literature Cited

Brown, 2000**,** Migratory Patterns of Yukon River Inconnu As Determined With Otolith Microchemistry And Radio Telemetry.

Fliris, B. 2000. Installation and operation of video storage equipment for purposes of providing accurate catch-per-unit-effort data from the Yukon River Sub-district 5-A test fishwheel. A final report to the Yukon River Panel, Anchorage, Alaska

Hatch, D. R., J. K. Fryer, M. Schwartzberg, D. R. Pederson, and A. Ward. 1998. A computerized editing system for video monitoring of fish passage. North American Journal of Fisheries Management. 18:694-699.

Peters Zuray, K. 2003. Tanana Conservation Outreach, 2003, Federal Subsistence Fishery Monitoring Program Final Project Report FIS 01- 199, U.S. Fish and Wildlife Service, Office of Subsistence Management, Fishery Information Services Division, Anchorage, Alaska.

Underwood, T. J., S. P. Klosiewski, J. A. Gordon, J. L. Melegari, and R. J. Brown. 1999. Estimated abundance of adult fall Chum salmon in the upper Yukon River, Alaska, 1997. U. S. Fish and Wildlife Service, Fairbanks Fishery Resource Office, Alaska Fisheries Technical Report Number 51, Fairbanks, Alaska.

Zuray, S., and T. J. Underwood. 2000a. Development of video technology to measure catch-per-unit-effort using a fish wheel on the Yukon River, Alaska, 1999. A final report to the Yukon River Panel, Anchorage, Alaska.

Zuray, S. 2000b. Stored video images as an alternative to fishwheel live boxes for the collection of Chinook catch-per-unit-effort data using a fishwheel on the Yukon River, Alaska, 2000. A final report to the Yukon River Panel, Anchorage, Alaska.

Zuray, S. 2001a. Stored video images as an alternative to fishwheel live boxes for the collection of fall chum catch-per-unit-effort data using a fishwheel on the Yukon River, Alaska, 2000. A final report to the Yukon River Panel, Anchorage, Alaska.

Zuray, S. 2001b. Rampart Rapids summer catch-per-unit-effort video monitoring - 2001 using a fishwheel on the Yukon River, Alaska. Federal Subsistence Fishery Monitoring Program Annual Project Report FIS 01-197, U.S. Fish and Wildlife Service, Office of Subsistence Management, Fishery Information Service Division, Anchorage, Alaska.

Zuray, S. 2002a. Rampart Rapids fall catch-per-unit-effort video monitoring - 2001 using a fishwheel on the Yukon River, Alaska. A final report to the Yukon River Panel, Anchorage, Alaska.

Zuray, S. 2002b. Rampart Rapids summer catch-per-unit-effort video monitoring- 2002 using a fishwheel on the Yukon River, Alaska. Federal Subsistence Fishery Monitoring Program Annual Project Report FIS 01-197, U.S. Fish and Wildlife Service, Office of Subsistence Management, Fishery Information Service Division, Anchorage, Alaska.

Zuray, S. 2002c. Rampart Rapids fall catch-per-unit-effort video monitoring - 2002 using a fishwheel on the Yukon River, Alaska. A final report to the Yukon River Panel, Anchorage, Alaska.

Figure 1, 2000 to 2003 Rapids Chinook CPUE Compared

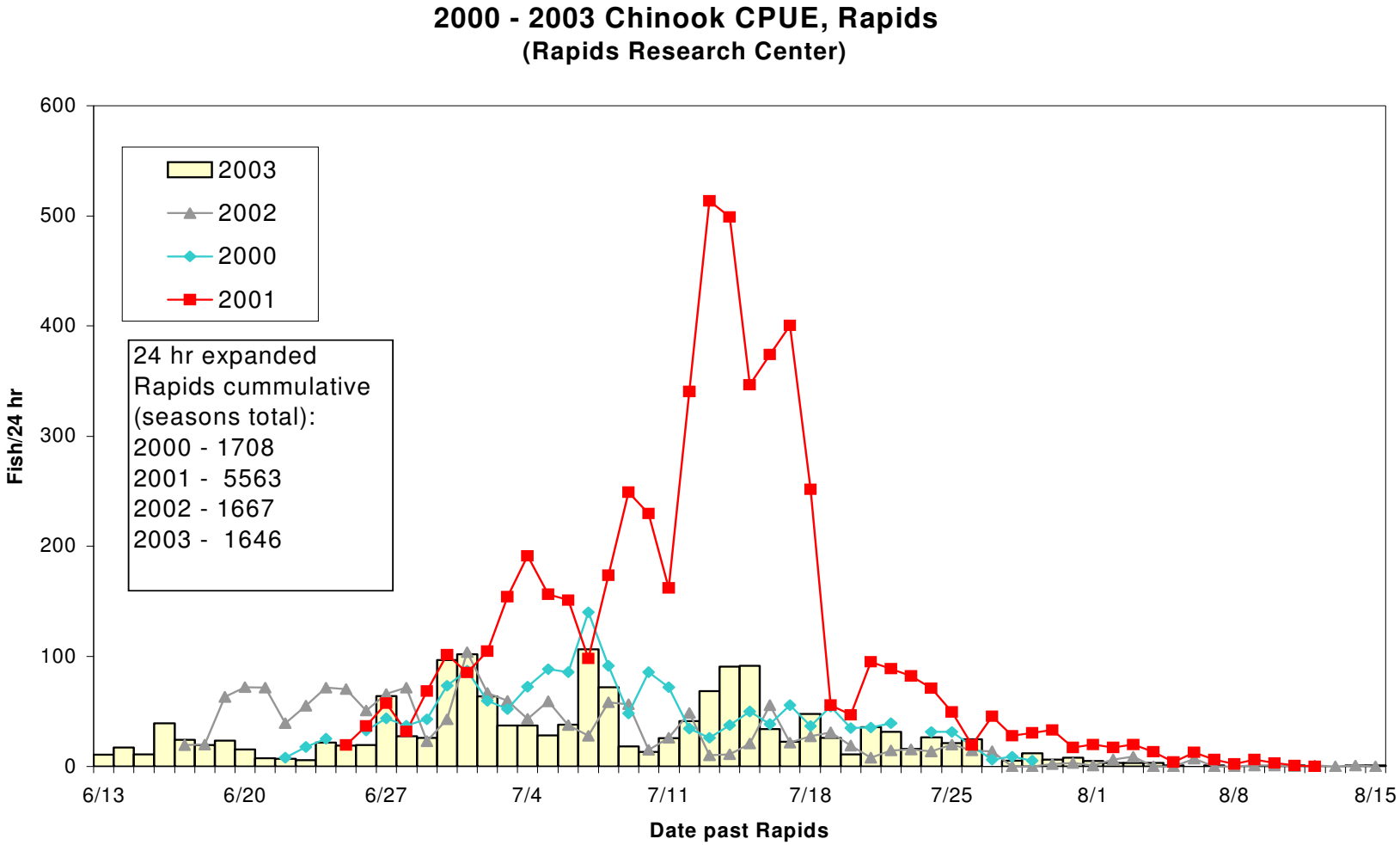


Figure 2

Rapids video fishwheel

One of approx. 10 frames taken of these chum coming down the video chute at night.

Dave Daum (USFWS) checking video equipment

Compact laptop/VCR capture system for Fishwheel installation.

Strategic placement of closed cell foam padding reduces injury dramatically

Students from the fisheries camp enter their data on the video project computer.

Figure 3

Video capture system on wheel

Computer shack - microwave reciever

Microwave transmitter on wheel

USFWS tag crew and students

Students aiding in ICH research

Tanana Conservation Outreach

Figure 4. Diel catch patterns of 2003 fall chum (normally start running towards the end of the chinook video project).

Mean (± 2SE) hourly frequency of fall chum salmon caught at the Rapids test wheel, Yukon River, 2003. Dashed line represents the average hourly catch (4.16%). Data include only days with 24 h of continuous records and a daily capture of over 100 fish.

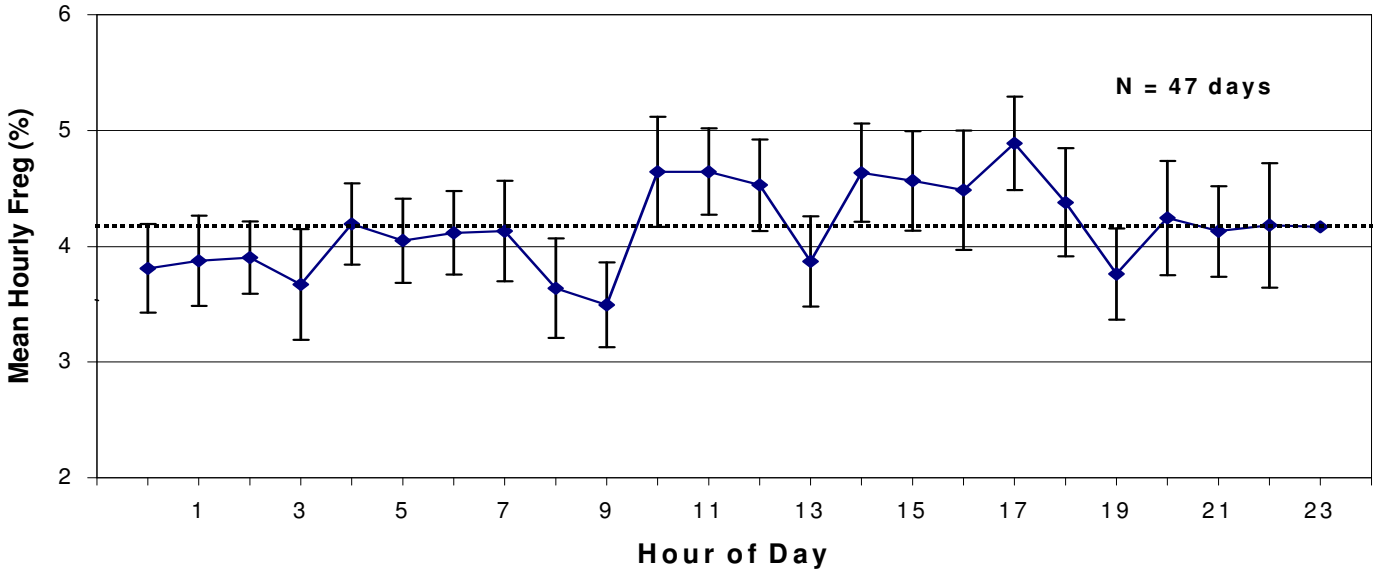


Figure 5. Mean daily Yukon River water temperature at Rapids, 2003.

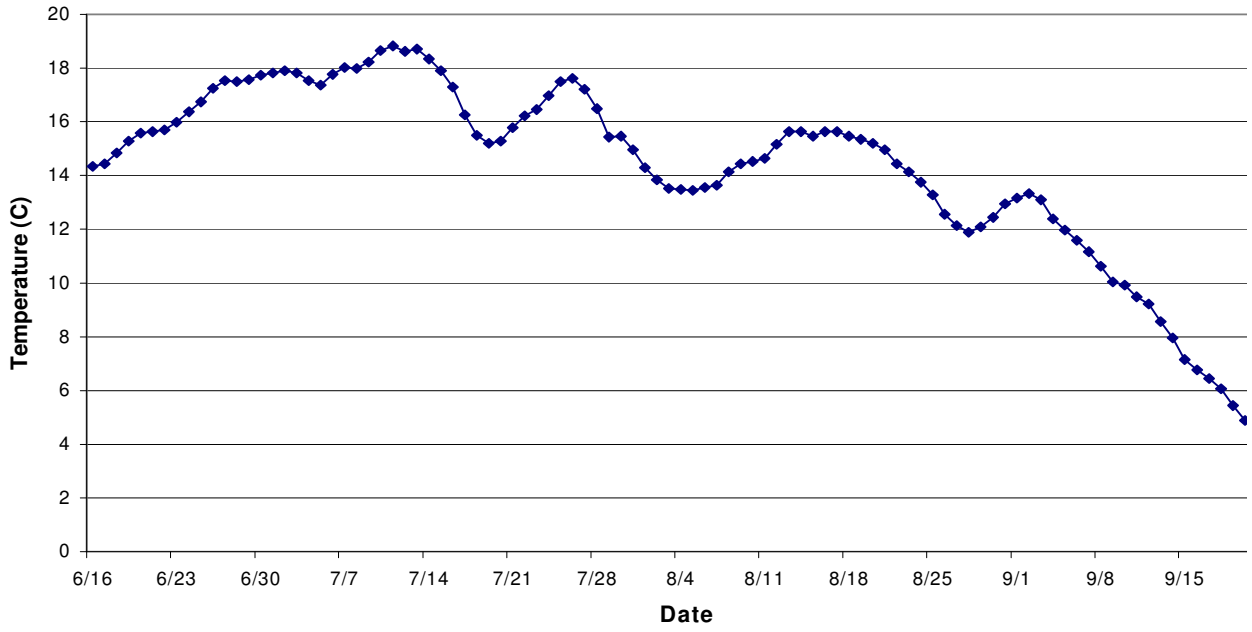


Figure 6

2001 - 2003 Water Discharge at Rapids Video Fishwheel

(USGS Dalton Hwy. Bridge Data Adjusted for Rapids)

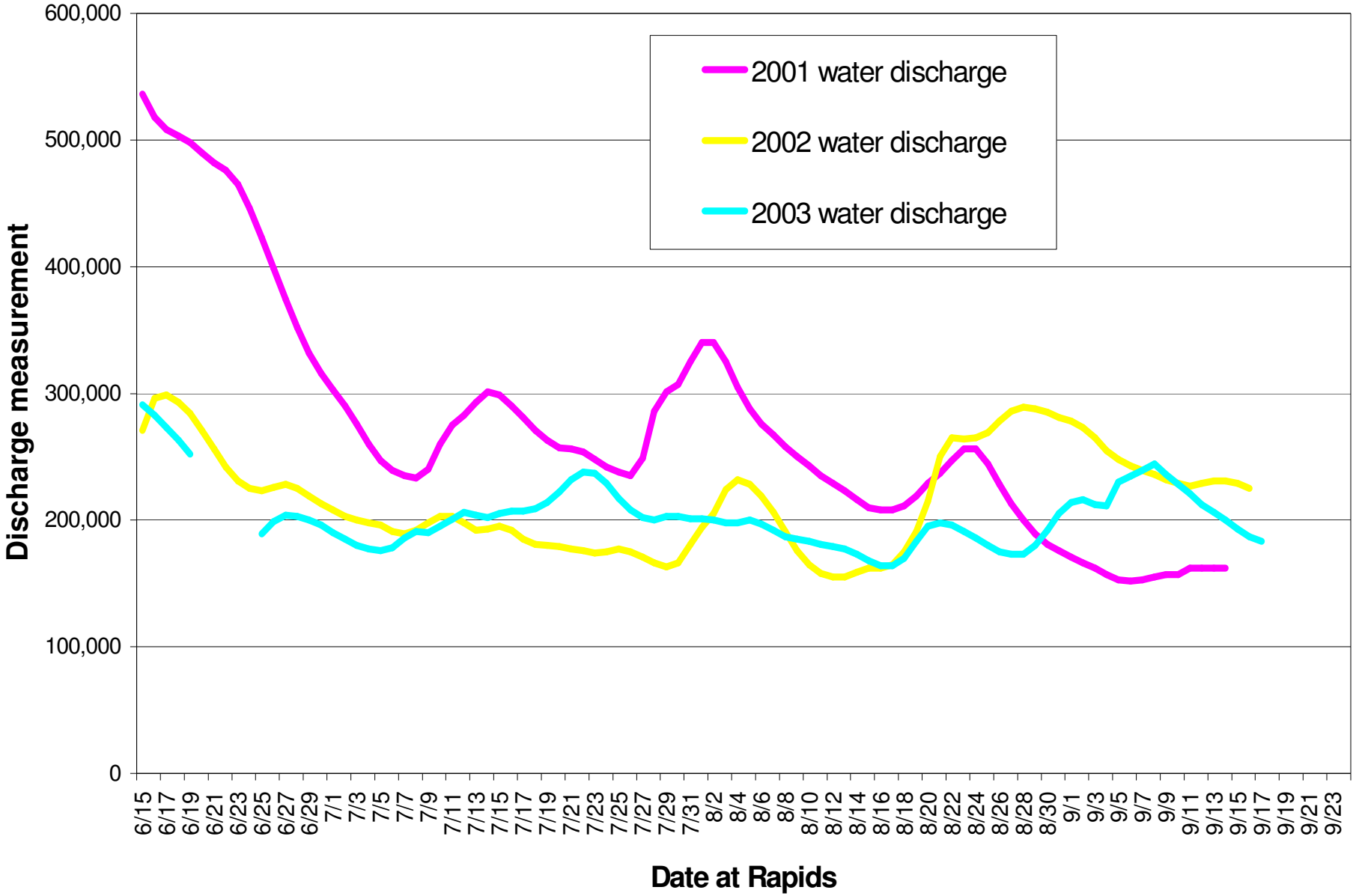


Figure 7

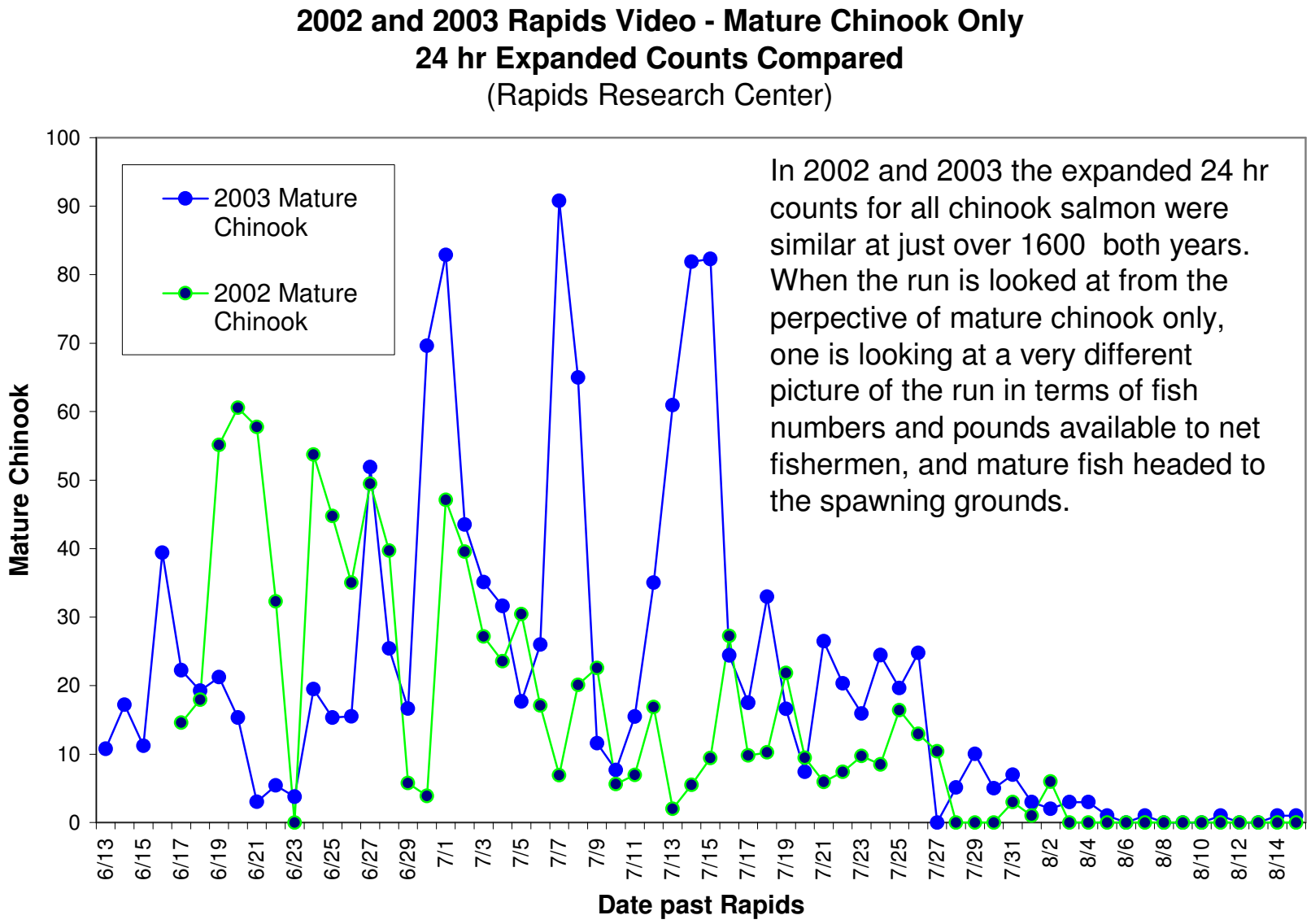

2002 and 2003 Rapids Video - Mature Chinook Only
24 hr Expanded Counts Compared
(Rapids Research Center)
2003 Mature Chinook
2002 Mature Chinook
In 2002 and 2003 the expanded 24 hr counts for all chinook salmon were similar at just over 1600 both years. When the run is looked at from the perpective of mature chinook only, one is looking at a very different picture of the run in terms of fish numbers and pounds available to net fishermen, and mature fish headed to the spawning grounds.
Mature Chinook
Date past Rapids
100
90
80
70
60
50
40
30
20
10
0
6/13
6/15
6/17
6/19
6/21
6/23
6/25
6/27
6/29
7/1
7/3
7/5
7/7
7/9
7/11
7/13
7/15
7/17
7/19
7/21
7/23
7/25
7/27
7/29
7/31
8/2
8/4
8/6
8/8
8/10
8/12
8/14

Table 1. 2001 Video Short Summary-Rapids

Start Day	No.	Counting Date	Start Date/Time	End Date/Time	Run Time (hr)	King Salmon	Chum Salmon	Shee-fish	Broad WF	Humpback WF	Cisco WF	Comments	King per hr	King per 24 hr	Chum per hr	Chum per 24 hr
Mon	1	6/25/01	6/25/01 9:55	6/25/01 22:15	12.33	10	0	1	0	0	146		0.81	19.46	0.00	0.00
Tue	2	6/26/01	6/26/01 8:37	6/26/01 21:04	12.45	19	0	0	0	0	68		1.53	36.63	0.00	0.00
Wed	3	6/27/01	6/27/01 9:31	6/27/01 22:05	12.57	30	0	0	2	0	54		2.39	57.29	0.00	0.00
Thu	4	6/28/01	6/28/01 9:26	6/28/01 21:26	12.00	16	0	1	1	1	93	4.75 hrs-dip only, Rapids down	1.33	32.00	0.00	0.00
Fri	5	6/29/01	6/29/01 9:09	6/29/01 21:46	12.62	36	0	0	0	0	54	all Rapids up	2.85	68.48	0.00	0.00
Sat	6	6/30/01	6/30/01 9:40	6/30/01 21:56	12.27	52	1	1	0	1	22		4.24	101.74	0.08	1.96
Sun	7	7/1/01	7/1/01 1:00	7/1/01 14:48	13.80	49	1	0	0	0	21	more jacks-smaller fish	3.55	85.22	0.07	1.74
Mon	8	7/2/01	7/2/01 9:25	7/2/01 21:48	12.38	54	0	0	0	0	20	40' log hit wheel	4.36	104.66	0.00	0.00
Tue	9	7/3/01	7/3/01 9:00	7/3/01 21:47	12.78	82	0	0	0	0	5	all Rapids up	6.41	153.95	0.00	0.00
Wed	10	7/4/01	7/4/01 6:00	7/4/01 20:41	14.68	117	1	1	0	0	9	Ich work underway	7.97	191.24	0.07	1.63
Thu	11	7/5/01	7/5/01 9:16	7/5/01 22:10	12.90	84	8	0	0	1	14	all Rapids down-	6.51	156.28	0.62	14.88
Fri	12	7/6/01	7/6/01 9:17	7/6/01 22:29	13.20	83	7	0	0	0	22	Chemical testing underway	6.29	150.91	0.53	12.73
Sat	13	7/7/01	7/7/01 9:11	7/7/01 22:23	13.20	54	11	0	0	0	25	all Rapids down-	4.09	98.18	0.83	20.00
Sun		7/8/01			#VALUE!								######	#VALUE!	#######	#VALUE!
Mon	14	7/9/01	7/9/01 9:25	7/9/01 22:14	12.82	133	22	1	1	0	19		10.38	249.05	1.72	41.20
Tue	15	7/10/01	7/10/01 9:05	7/10/01 22:46	13.68	131	20	0	0	0	5	all Rapids up	9.57	229.77	1.46	35.08
Wed	16	7/11/01	7/11/01 9:14	7/11/01 21:32	12.30	83	18	0	1	0	6		6.75	161.95	1.46	35.12
Thu	17	7/12/01	7/12/01 9:29	7/12/01 21:28	11.98	170	28	0	1	1	10	all Rapids up	14.19	340.47	2.34	56.08
Fri	18	7/13/01	7/13/01 9:22	7/13/01 21:59	12.62	270	21	1	0	0	10	all Rapids up (Cambell 1 / min.)	21.40	513.61	1.66	39.95
Sat	19	7/14/01	7/14/01 9:09	7/14/01 22:20	13.18	274	53	0	0	1	8	Johnson 1 / min.+	20.78	498.81	4.02	96.49
Sun	20	7/15/01	7/15/01 9:39	7/15/01 22:07	12.47	180	120	4	1	1	13	log took out Cambell	14.44	346.52	9.63	231.02
Mon	21	7/16/01	7/16/01 9:53	7/16/01 22:24	12.52	195	154	0	1	0	4	kings looking old	15.58	373.90	12.30	295.29
Tue	22	7/17/01	7/17/01 8:59	7/17/01 22:32	13.55	226	143	1	0	0	2	big kings-all Rapids up	16.68	400.30	10.55	253.28
Wed	23	7/18/01	7/18/01 10:22	7/18/01 22:29	12.12	127	130	1	1	0	5		10.48	251.55	10.73	257.50
Thu	24	7/19/01	7/19/01 10:06	7/19/01 22:09	12.05	28	138	2	0	3	11		2.32	55.77	11.45	274.85
Fri	25	7/20/01	7/20/01 9:56	7/20/01 22:45	12.82	25	114	2	0	0	10		1.95	46.81	8.89	213.47
Sat	26	7/21/01	7/21/01 9:48	7/21/01 22:40	12.87	51	159	1	1	3	17		3.96	95.13	12.36	296.58
Sun		7/22/01			#VALUE!								######	#VALUE!	#######	#VALUE!
Mon	27	7/23/01	7/23/01 9:11	7/23/01 21:26	12.25	42	127	4	1	0	13	10% red flesh-Johnson	3.43	82.29	10.37	248.82
Tue	28	7/24/01	7/24/01 9:04	7/24/01 21:34	12.50	37	130	3	1	1	8	100 chums Bear creek	2.96	71.04	10.40	249.60
Wed	29	7/25/01	7/25/01 9:58	7/25/01 22:08	12.17	25	139	1	0	2	14	10% red flesh- NC Frank	2.05	49.32	11.42	274.19
Thu	30	7/26/01	7/26/01 9:33	7/26/01 22:02	12.48	10	103	1	2	0	15	30 chums bear creek N.C.	0.80	19.23	8.25	198.02
Fri	31	7/27/01	7/27/01 9:17	7/27/01 22:00	12.72	24	133	1	3	0	21	Cambell-summer chums still	1.89	45.29	10.46	251.01
Sat	32	7/28/01	7/28/01 10:58	7/28/01 23:07	12.15	14	94	0	1	3	34	overnight drift hit-wheel in	1.15	27.65	7.74	185.68
Sun		7/29/01			#VALUE!								######	#VALUE!	#######	#VALUE!
Mon	33	7/30/01	7/30/01 0:00	7/31/01 0:00	24.00	33	252	1	1	4	143	still summer chums 20% red	1.38	33.00	10.50	252.00
Tue	34	7/31/01	7/31/01 0:00	7/31/01 18:01	18.02	13	160	1	2	1	113	log took out basket (south)	0.72	17.32	8.88	213.14

Table 2. 2001 Summer Video CPUE - Rapids

Start Day	No.	Counting Date	King per hr	King per 24 hr	Chum per hr	Chum per 24 hr	Sheefish per hr	Sheefish per 24 hr	Broad per hr	Broad per 24 hr	Humpback per hr	Humpback per 24 hr	Cisco per hr	Cisco per 24 hr
Mon	1	6/25	0.81	19.46	0.00	0.00	0.08	1.95	0.00	0.00	0.00	0.00	11.84	284.11
Tue	2	6/26	1.53	36.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.46	131.08
Wed	3	6/27	2.39	57.29	0.00	0.00	0.00	0.00	0.16	3.82	0.00	0.00	4.30	103.13
Thu	4	6/28	1.33	32.00	0.00	0.00	0.08	2.00	0.08	2.00	0.08	2.00	7.75	186.00
Fri	5	6/29	2.85	68.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.28	102.72
Sat	6	6/30	4.24	101.74	0.08	1.96	0.08	1.96	0.00	0.00	0.08	1.96	1.79	43.04
Sun	7	7/1	3.55	85.22	0.07	1.74	0.00	0.00	0.00	0.00	0.00	0.00	1.52	36.52
Mon	8	7/2	4.36	104.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.62	38.76
Tue	9	7/3	6.41	153.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	9.39
Wed	10	7/4	7.97	191.24	0.07	1.63	0.07	1.63	0.00	0.00	0.00	0.00	0.61	14.71
Thu	11	7/5	6.51	156.28	0.62	14.88	0.00	0.00	0.00	0.00	0.08	1.86	1.09	26.05
Fri	12	7/6	6.29	150.91	0.53	12.73	0.00	0.00	0.00	0.00	0.00	0.00	1.67	40.00
Sat	13	7/7	4.09	98.18	0.83	20.00	0.00	0.00	0.00	0.00	0.00	0.00	1.89	45.45
Sun		7/8												
Mon	14	7/9	10.38	249.05	1.72	41.20	0.08	1.87	0.08	1.87	0.00	0.00	1.48	35.58
Tue	15	7/10	9.57	229.77	1.46	35.08	0.00	0.00	0.00	0.00	0.00	0.00	0.37	8.77
Wed	16	7/11	6.75	161.95	1.46	35.12	0.00	0.00	0.08	1.95	0.00	0.00	0.49	11.71
Thu	17	7/12	14.19	340.47	2.34	56.08	0.00	0.00	0.08	2.00	0.08	2.00	0.83	20.03
Fri	18	7/13	21.40	513.61	1.66	39.95	0.08	1.90	0.00	0.00	0.00	0.00	0.79	19.02
Sat	19	7/14	20.78	498.81	4.02	96.49	0.00	0.00	0.00	0.00	0.08	1.82	0.61	14.56
Sun	20	7/15	14.44	346.52	9.63	231.02	0.32	7.70	0.08	1.93	0.08	1.93	1.04	25.03
Mon	21	7/16	15.58	373.90	12.30	295.29	0.00	0.00	0.08	1.92	0.00	0.00	0.32	7.67
Tue	22	7/17	16.68	400.30	10.55	253.28	0.07	1.77	0.00	0.00	0.00	0.00	0.15	3.54
Wed	23	7/18	10.48	251.55	10.73	257.50	0.08	1.98	0.08	1.98	0.00	0.00	0.41	9.90
Thu	24	7/19	2.32	55.77	11.45	274.85	0.17	3.98	0.00	0.00	0.25	5.98	0.91	21.91
Fri	25	7/20	1.95	46.81	8.89	213.47	0.16	3.75	0.00	0.00	0.00	0.00	0.78	18.73
Sat	26	7/21	3.96	95.13	12.36	296.58	0.08	1.87	0.08	1.87	0.23	5.60	1.32	31.71
Sun		7/22												
Mon	27	7/23	3.43	82.29	10.37	248.82	0.33	7.84	0.08	1.96	0.00	0.00	1.06	25.47
Tue	28	7/24	2.96	71.04	10.40	249.60	0.24	5.76	0.08	1.92	0.08	1.92	0.64	15.36
Wed	29	7/25	2.05	49.32	11.42	274.19	0.08	1.97	0.00	0.00	0.16	3.95	1.15	27.62
Thu	30	7/26	0.80	19.23	8.25	198.02	0.08	1.92	0.16	3.85	0.00	0.00	1.20	28.84
Fri	31	7/27	1.89	45.29	10.46	251.01	0.08	1.89	0.24	5.66	0.00	0.00	1.65	39.63
Sat	32	7/28	1.15	27.65	7.74	185.68	0.00	0.00	0.08	1.98	0.25	5.93	2.80	67.16
Sun		7/29												
Mon	33	7/30	1.38	33.00	10.50	252.00	0.04	1.00	0.04	1.00	0.17	4.00	5.96	143.00
Tue	34	7/31	0.72	17.32	8.88	213.14	0.06	1.33	0.11	2.66	0.06	1.33	6.27	150.53
Wed	35	8/1	0.83	20.00	8.92	214.00	0.13	3.00	0.00	0.00	0.04	1.00	5.67	136.00

Table 3

. 2002 Video Short Summary-Rapids

Start Day	No.	Counting Date	Start Date/Time	End Date/Time	Run Time (hr)	King	Chum	Shee-fish	Broad WF	Hump back	Cisco WF	Comments	King per hr	King / 24 hr	Chum per hr	Chum / 24 hr
Mon	1	6/17/02	6/17/02 14:07	6/18/02 0:00	9.88	8	0	0	0	0	22	Johnson 3x	0.81	19.43	0.00	0.00
Tue	2	6/18/02	6/18/02 9:21	6/18/02 21:23	12.03	10	0	0	1	0	29	all same as 17th	0.83	19.94	0.00	0.00
Wed	3	6/19/02	6/19/02 9:12	6/19/02 21:23	12.18	32	0	0	0	0	19	all up	2.63	63.04	0.00	0.00
Thu	4	6/20/02	6/20/02 8:18	6/20/02 20:59	12.68	38	0	0	0	0	19	all slowed up	3.00	71.91	0.00	0.00
Fri	5	6/21/02	6/21/02 8:16	6/21/02 21:59	13.72	41	1	0	0	0	45		2.99	71.74	0.07	1.75
Sat	6	6/22/02	6/22/02 9:03	6/22/02 23:10	14.12	23	8	0	0	1	55	all down-nets to	1.63	39.10	0.57	13.60
Sun		6/23/02	1/0/00 0:00	1/0/00 0:00	0.00	0	0	0	0	0	0					
Mon	7	6/24/02	6/24/02 9:29	6/24/02 21:33	12.07	36	1	0	0	0	49		2.98	71.60	0.08	1.99
Tue	8	6/25/02	6/25/02 9:15	6/25/02 21:35	12.33	36	2	1	0	0	32	all down	2.92	70.05	0.16	3.89
Wed	9	6/26/02	6/26/02 9:42	6/26/02 22:02	12.33	26	0	0	0	0	50	all still down	2.11	50.59	0.00	0.00
Thu	10	6/27/02	6/27/02 9:11	6/27/02 22:17	13.10	36	3	0	0	0	32		2.75	65.95	0.23	5.50
Fri	11	6/28/02	6/28/02 11:17	6/28/02 23:59	12.70	38	1	0	0	0	23	moved VCR to tranmit system, late start	2.99	71.81	0.08	1.89
Sat	12	6/29/02	6/29/02 9:44	6/29/02 22:16	12.53	12	1	0	0	0	25	all wheels, nets down- tiny kings, jacks	0.96	22.98	0.08	1.91
Sun	13	6/30/02	6/30/02 11:43	6/30/02 17:52	6.15	11	4	1	0	0	23	9.5lb average for 23 kings, 2 fem., 4 Ich	1.79	42.93	0.65	15.61
Mon	14	7/1/02	7/1/02 9:35	7/1/02 21:49	12.23	53	16	2	1	0	37	new fish- larger	4.33	103.98	1.31	31.39
Tue	15	7/2/02	7/2/02 8:37	7/2/02 21:58	13.35	37	17	0	0	1	22	low catch all wheels, new but still small	2.77	66.52	1.27	30.56
Wed	16	7/3/02	7/3/02 8:58	7/3/02 22:13	13.25	33	20	1	0	0	30	all down more, small	2.49	59.77	1.51	36.23
Thu	17	7/4/02	7/4/02 8:52	7/4/02 21:06	12.23	22	23	1	0	0	9	all wheels down more,couple of 20lb-ders	1.80	43.16	1.88	45.12
Fri	18	7/5/02	7/5/02 9:03	7/5/02 21:40	12.62	31	18	1	0	1	11	red kings, end of pulse, commercial	2.46	58.97	1.43	34.24
Sat	19	7/6/02	7/6/02 8:16	7/6/02 22:18	14.03	22	25	0	0	3	23	4 20-30lb kings at night subsistence run	1.57	37.62	1.78	42.76
Sun	20	7/7/02	7/7/02 8:18	7/7/02 22:09	13.85	16	22	1	0	0	20	down	1.16	27.73	1.59	38.12
Mon	21	7/8/02	7/8/02 8:50	7/8/02 21:58	13.13	32	17	3	1	1	12	new fresh fish and up	2.44	58.48	1.29	31.07
Tue	22	7/9/02	7/8/02 9:15	7/8/02 22:00	12.75	30	20	2	0	2	20	more red fish	2.35	56.47	1.57	37.65
Wed	23	7/10/02	7/9/02 9:22	7/9/02 22:10	12.80	8	28	1	0	3	24	all gear down in Rapids	0.63	15.00	2.19	52.50
Thu	24	7/11/02	7/10/02 8:34	7/10/02 22:23	13.82	15	51	0	0	2	14	nets and wheels all poor	1.09	26.06	3.69	88.59
Fri	25	7/12/02	7/11/02 8:39	7/11/02 21:28	12.82	26	63	0	0	3	15	small, many pale kings	2.03	48.69	4.92	117.97
Sat	26	7/13/02	7/13/02 9:49	7/13/02 21:42	11.88	5	54	1	1	2	10	Johnson 0 in3 hr, hole rock net 1 overnight,	0.42	10.10	4.54	109.06
Sun	27	7/14/02	7/14/02 9:53	7/14/02 23:00	13.12	6	38	1	1	1	11	seems like end of run, mostly jacks	0.46	10.98	2.90	69.53
Mon	28	7/15/02	7/15/02 9:10	7/15/02 21:53	12.72	11	43	0	0	2	9	no fish Ich project ends	0.87	20.76	3.38	81.15
Tue	29	7/16/02	7/16/02 8:44	7/16/02 20:51	12.12	28	48	0	1	2	10	fresh kings but few	2.31	55.46	3.96	95.08
Wed	30	7/17/02	7/17/02 9:03	7/17/02 21:19	12.27	11	51	1	1	3	14	fewer kings and redder (subsistence)	0.90	21.52	4.16	99.78
Thu	31	7/18/02	7/18/02 9:07	7/18/02 21:24	12.28	14	42	0	1	3	8	half nice kings	1.14	27.35	3.42	82.06
Fri	32	7/19/02	7/19/02 10:18	7/19/02 23:30	13.20	17	44	1	0	3	6	larger kings again	1.29	30.91	3.33	80.00
Sat	33	7/20/02	7/20/02 8:34	7/20/02 21:16	12.70	10	49	0	1	5	15	all gear getting larger, better but not numbers	0.79	18.90	3.86	92.60
Sun	34	7/21/02	7/21/02 10:24	7/21/02 22:30	12.10	4	39	0	0	4	38	Cambell down-rock island down	0.33	7.93	3.22	77.36
Mon	35	7/22/02	7/22/02 8:30	7/22/02 21:30	13.00	8	30	1	0	4	47	20% red flesh chums	0.62	14.77	2.31	55.38
Tue	36	7/23/02	7/23/02 9:34	7/23/02 21:55	12.35	8	48	0	0	2	37		0.65	15.55	3.89	93.28
Wed	37	7/24/02	7/24/02 8:15	7/24/02 22:25	14.17	8	55	0	1	8	21	35% red flesh chums - large kings	0.56	13.55	3.88	93.18
Thu	38	7/25/02	7/25/02 8:48	7/25/02 21:57	13.15	11	59	1	1	7	36	45% red flesh chums - kings all poor meat	0.84	20.08	4.49	107.68
Fri	39	7/26/02	7/26/02 9:32	7/26/02 22:32	13.00	8	93	0	3	10	12	**TEK bright fall chums officially here**	0.62	14.77	7.15	171.69
Sat	40	7/27/02	7/27/02 9:09	7/27/02 23:00	13.85	8	125	1	2	10	40	All wheels (4) up + bright fish	0.58	13.87	9.03	216.68
Sun		7/28/02	1/0/00 0:00	1/0/00 0:00	0.00	0	0	0	0	0	0					
Mon	41	7/29/02	7/29/02 9:31	7/29/02 21:42	12.18	0	102	0	4	8	52	Fall chum tagging started	0.00	0.00	8.37	200.93
Tue	42	7/30/02	7/30/02 8:13	7/30/02 21:12	12.98	0	96	0	0	13	52	set up video lights (24 hr)	0.00	0.00	7.39	177.46
Wed	43	7/31/02	7/31/02 0:00	8/1/02 0:00	24.00	3	154	1	0	17	115	fall chums getting darker- main pulse?	0.13	3.00	6.42	154.00
Thu	44	8/1/02	8/1/02 0:00	8/2/02 0:00	24.00	1	149	0	4	19	139	nice chums but main brights have passed	0.04	1.00	6.21	149.00
Fri	45	8/2/02	8/2/02 0:00	8/3/02 0:00	24.00	6	98	3	3	33	172	solidly into fall run now	0.25	6.00	4.08	98.00

Table 4. 2002 Summer Video CPUE - Rapids

Start		Counting	King	King	Chum	Chum	Sheefish	Sheefish	Broad	Broad	Humpback	Humpback	Cisco	Cisco
Day	No.	Date	per hr	per 24 hr	per hr	per 24 hr	per hr	per 24 hr	per hr	per 24 hr	per hr	per 24 hr	per hr	per 24 hr
Mon	1	6/17/02	0.81	19.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.23	53.42
Tue	2	6/18/02	0.83	19.94	0.00	0.00	0.00	0.00	0.08	1.99	0.00	0.00	2.41	57.84
Wed	3	6/19/02	2.63	63.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.56	37.43
Thu	4	6/20/02	3.00	71.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	35.95
Fri	5	6/21/02	2.99	71.74	0.07	1.75	0.00	0.00	0.00	0.00	0.00	0.00	3.28	78.74
Sat	6	6/22/02	1.63	39.10	0.57	13.60	0.00	0.00	0.00	0.00	0.07	1.70	3.90	93.51
Sun		6/23/02												
Mon	7	6/24/02	2.98	71.60	0.08	1.99	0.00	0.00	0.00	0.00	0.00	0.00	4.06	97.46
Tue	8	6/25/02	2.92	70.05	0.16	3.89	0.08	1.95	0.00	0.00	0.00	0.00	2.59	62.27
Wed	9	6/26/02	2.11	50.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.05	97.30
Thu	10	6/27/02	2.75	65.95	0.23	5.50	0.00	0.00	0.00	0.00	0.00	0.00	2.44	
Fri	11	6/28/02	2.99	71.81	0.08	1.89	0.00	0.00	0.00	0.00	0.00	0.00	1.81	43.46
Sat	12	6/29/02	0.96	22.98	0.08	1.91	0.00	0.00	0.00	0.00	0.00	0.00	1.99	47.87
Sun	13	6/30/02	1.79	42.93	0.65	15.61	0.16	3.90	0.00	0.00	0.00	0.00	3.74	89.76
Mon	14	7/1/02	4.33	103.98	1.31	31.39	0.16	3.92	0.08	1.96	0.00	0.00	3.02	72.59
Tue	15	7/2/02	2.77	66.52	1.27	30.56	0.00	0.00	0.00	0.00	0.07	1.80	1.65	39.55
Wed	16	7/3/02	2.49	59.77	1.51	36.23	0.08	1.81	0.00	0.00	0.00	0.00	2.26	54.34
Thu	17	7/4/02	1.80	43.16	1.88	45.12	0.08	1.96	0.00	0.00	0.00	0.00	0.74	17.66
Fri	18	7/5/02	2.46	58.97	1.43	34.24	0.08	1.90	0.00	0.00	0.08	1.90	0.87	20.92
Sat	19	7/6/02	1.57	37.62	1.78	42.76	0.00	0.00	0.00	0.00	0.21	5.13	1.64	39.33
Sun	20	7/7/02	1.16	27.73	1.59	38.12	0.07	1.73	0.00	0.00	0.00	0.00	1.44	34.66
Mon	21	7/8/02	2.44	58.48	1.29	31.07	0.23	5.48	0.08	1.83	0.08	1.83	0.91	21.93
Tue	22	7/9/02	2.35	56.47	1.57	37.65	0.16	3.76	0.00	0.00	0.16	3.76	1.57	37.65
Wed	23	7/10/02	0.63	15.00	2.19	52.50	0.08	1.88	0.00	0.00	0.23	5.63	1.88	45.00
Thu	24	7/11/02	1.09	26.06	3.69	88.59	0.00	0.00	0.00	0.00	0.14	3.47	1.01	24.32
Fri	25	7/12/02	2.03	48.69	4.92	117.97	0.00	0.00	0.00	0.00	0.23	5.62	1.17	28.09
Sat	26	7/13/02	0.42	10.10	4.54	109.06	0.08	2.02	0.08	2.02	0.17	4.04	0.84	20.20
Sun	27	7/14/02	0.46	10.98	2.90	69.53	0.08	1.83	0.08	1.83	0.08	1.83	0.84	20.13
Mon	28	7/15/02	0.87	20.76	3.38	81.15	0.00	0.00	0.00	0.00	0.16	3.77	0.71	16.99
Tue	29	7/16/02	2.31	55.46	3.96	95.08	0.00	0.00	0.08	1.98	0.17	3.96	0.83	19.81
Wed	30	7/17/02	0.90	21.52	4.16	99.78	0.08	1.96	0.08	1.96	0.24	5.87	1.14	27.39
Thu	31	7/18/02	1.14	27.35	3.42	82.06	0.00	0.00	0.08	1.95	0.24	5.86	0.65	15.63
Fri	32	7/19/02	1.29	30.91	3.33	80.00	0.08	1.82	0.00	0.00	0.23	5.45	0.45	10.91
Sat	33	7/20/02	0.79	18.90	3.86	92.60	0.00	0.00	0.08	1.89	0.39	9.45	1.18	28.35
Sun	34	7/21/02	0.33	7.93	3.22	77.36	0.00	0.00	0.00	0.00	0.33	7.93	3.14	75.37
Mon	35	7/22/02	0.62	14.77	2.31	55.38	0.08	1.85	0.00	0.00	0.31	7.38	3.62	86.77
Tue	36	7/23/02	0.65	15.55	3.89	93.28	0.00	0.00	0.00	0.00	0.16	3.89	3.00	71.90
Wed	37	7/24/02	0.56	13.55	3.88	93.18	0.00	0.00	0.07	1.69	0.56	13.55	1.48	35.58
Thu	38	7/25/02	0.84	20.08	4.49	107.68	0.08	1.83	0.08	1.83	0.53	12.78	2.74	65.70
Fri	39	7/26/02	0.62	14.77	7.15	171.69	0.00	0.00	0.23	5.54	0.77	18.46	0.92	22.15
Sat	40	7/27/02	0.58	13.87	9.03	216.68	0.07	1.73	0.14	3.47	0.72	17.33	2.89	69.34
Sun		7/28/02												
Mon	41	7/29/02	0.00	0.00	8.37	200.93	0.00	0.00	0.33	7.88	0.66	15.76	4.27	102.44
Tue	42	7/30/02	0.00	0.00	7.39	177.46	0.00	0.00	0.00	0.00	1.00	24.03	4.01	96.12
Wed	43	7/31/02	0.13	3.00	6.42	154.00	0.04	1.00	0.00	0.00	0.71	17.00	4.79	115.00

Table 5

2003 Video Short Summary-Rapids

Start Day	Counting Date	Start Time	End Time	Run Time (hr)	King Salmon	Percent Jack	Chum Salmon	Shee-fish	Broad WF	Hump back	Cisco WF	Comments	King / 24 hr	Chum / 24 hr
Fri	6/13/03	13:30:57	21:00:04	6.69	3	0.00%	0	0	0	0	16	O'brian net, 3 king on 11th - 7 king on 12th, Dave here	10.76	0.00
Sat	6/14/03	9:20:37	21:54:55	12.57	9	0.00%	0	0	0	1	34	Cambell 3/hr for 5hrs., nice fish, 1 lamprey	17.18	0.00
Sun	6/15/03	9:04:26	17:37:31	8.55	4	0.00%	0	0	0	0	25	Cambell down	11.23	0.00
Mon	6/16/03	9:38:43	21:49:34	12.18	20	0.00%	0	0	0	0	22	all wheels(3)and one net up	39.41	0.00
Tue	6/17/03	8:56:34	21:53:13	12.94	13	7.69%	0	0	0	0	19		24.10	0.00
Wed	6/18/03	9:04:13	21:32:28	12.47	10	0.00%	0	0	0	0	25	all wheels(3)slow - rocks showing on rockisland	19.24	0.00
Thu	6/19/03	9:01:45	21:27:14	12.42	12	8.33%	0	0	0	0	20	all wheels (3)slow and Hugny/Boulding also	23.18	0.00
Fri	6/20/03	8:55:12	21:27:14	12.53	8	0.00%	0	0	0	0	44	30.8" average for 16 random chinook	15.32	0.00
Sat	6/21/03	7:42:30	23:29:14	15.78	5	60.00%	0	1	0	0	72	everyone still slow fishing - some smaller fish now	7.61	0.00
Sun	6/22/03	9:05:26	22:19:52	13.24	4	25.00%	0	0	0	0	37	4 nets+3 wheels very slow, 2x slower than 2000 disaster	7.25	0.00
Mon	6/23/03	9:03:51	21:46:42	12.71	3	33.33%	0	0	1	1	46	Johnson wheel 2 hrs. and no king!	5.66	0.00
Tue	6/24/03	9:27:39	21:46:42	12.32	11	9.09%	0	1	0	1	35	Johnson wheel 2.5 hrs. and 2 king!	21.43	0.00
Wed	6/25/03	8:50:03	21:21:50	12.53	10	20.00%	0	0	0	2	58	Jake Rock net 4 overnight, fish quality redder	19.15	0.00
Thu	6/26/03	8:40:40	21:03:48	12.39	10	20.00%	0	0	1	1	40	continue to fall behind on cummulative vs 2000-2002	19.38	0.00
Fri	6/27/03	8:31:31	22:24:03	13.88	37	18.92%	0	0	0	0	29	wheels(3)all up-water steady-ADFG by	64.00	0.00
Sat	6/28/03	8:48:35	21:04:34	12.27	14	7.14%	0	1	0	0	22	nets all up last night also	27.39	0.00
Sun	6/29/03	9:01:36	22:00:00	12.97	14	35.71%	0	3	1	0	43	wheels(3)all down , NC eddy down	25.90	0.00
Mon	6/30/03	8:50:41	21:15:26	12.41	50	28.00%	1	0	0	1	17	pulse of kings hit Tanana yesterday	96.68	1.93
Tue	7/1/03	9:14:28	21:41:44	12.45	53	18.87%	1	0	0	2	17	Johnson wheel up, 5/hr 2 hrs.	102.13	1.93
Wed	7/2/03	8:45:52	22:00:00	13.24	35	31.43%	1	0	1	2	15	Rockisland net and 3 wheels down	63.47	1.81
Thu	7/3/03	9:00:00	21:18:10	12.30	19	5.26%	3	0	0	1	19	Johnson less than 1/hr-quality bad, (end of pulse type)	37.06	5.85
Fri	7/4/03	8:54:58	22:34:48	13.66	21	14.29%	1	0	0	1	12	COM.-all wheels slow, Frank net 2.5hrs. 8 fish	36.89	1.76
Sat	7/5/03	9:19:36	22:54:33	13.58	16	37.50%	2	0	0	3	24	Cambell,Johnson rates same as test wheel now	28.27	3.53
Sun	7/6/03	9:29:50	21:29:50	12.00	19	31.58%	5	0	0	0	14	some nice fish, size and color	38.00	10.00
Mon	7/7/03	9:11:09	21:36:48	12.43	55	14.55%	2	2	0	1	19	nice fish-new pulse	106.22	3.86
Tue	7/8/03	8:41:36	22:43:54	14.04	42	9.52%	1	1	0	1	25	COM.-all wheels up a bit, lots of Ich now!	71.80	1.71
Wed	7/9/03	8:26:36	22:56:39	14.50	11	36.36%	2	2	0	0	19	end of pulse-red fish, subsist. gear down	18.21	3.31
Thu	7/10/03	8:30:00	21:02:55	12.55	7	42.86%	6	1	0	0	13	everyone slower fishing - Cambell lots of ich	13.39	11.48
Fri	7/11/03	9:31:22	23:28:53	13.96	15	40.00%	2	0	1	1	12	COM., Canadians here, old fish end of pulse	25.79	3.44
Sat	7/12/03	2:30:00	23:37:41	12.33	21	14.29%	1	0	0	3	13	Wind storm in day- used early and late day data	40.88	1.95
Sun	7/13/03	9:00:00	22:00:00	13.00	37	10.81%	9	0	1	2	25	nice fish-new pulse, all also except Peters camp	68.31	16.62
Mon	7/14/03	6:00:00	23:59:59	14.07	53	9.43%	6	0	0	3	25	nice large kings-closure, no sub. Reports, chan2news	90.41	10.23
Tue	7/15/03	8:54:00	22:19:03	13.42	51	9.80%	9	0	0	0	15	19th-21st,22 chum-14% red flesh	91.22	16.10
Wed	7/16/03	9:06:30	21:52:50	12.77	18	27.78%	11	0	0	0	20	Red kings more	33.82	20.67
Thu	7/17/03	9:55:04	22:16:14	12.35	12	25.00%	24	1	0	3	22	large kings still, few jacks, 18 chum-11% red flesh	23.31	46.63
Fri	7/18/03	9:24:14	22:30:00	13.10	26	30.77%	34	0	0	0	45	chums up, king down- all wheels	47.65	62.31
Sat	7/19/03	9:00:00	22:00:00	13.00	14	35.71%	38	0	1	3	34	old kings, many fishermen stopping fishing	25.85	70.15
Sun	7/20/03	8:30:00	21:30:00	13.00	6	33.33%	55	0	0	0	50	stopped fishing kings-old ones	11.08	101.54
Mon	7/21/03	9:01:51	21:43:21	12.69	19	26.32%	39	0	0	1	60	Tevis/tag crew show up, Cambell-summer chums still!	35.93	73.75
Tue	7/22/03	9:00:47	21:59:35	12.98	17	35.29%	45	2	2	0	97	Not many fishing for people food	31.43	83.20
Wed	7/23/03	9:40:34	21:43:13	12.04	8	0.00%	50	0	0	3	114	Autrian film crew film project	15.94	99.63
Thu	7/24/03	9:11:37	21:57:24	12.76	14	7.14%	45	0	0	0	97	19% red flesh chums(32 fish)	26.33	84.62
Fri	7/25/03	9:10:34	22:37:58	13.46	12	8.33%	53	3	2	2	91		21.40	94.53
Sat	7/26/03	8:59:55	21:35:43	12.60	13	0.00%	39	0	0	0	78	Dave Daum, 1st TEK chum pic series, water gauge	24.77	74.31
Sun	7/27/03	0:00:00	0:00:00	0.00	0	0.00%	0	0	0	0	0	trip to Tanana-no run	0.00	0.00
Mon	7/28/03	7:47:42	21:51:33	14.06	3	0.00%	41	1	0	1	58	set up 24 hr lights, Tag crew started-slow	5.12	69.97
Tue	7/29/03	0:00:00	23:59:59	24.00	12	16.67%	55	8	1	0	92	24hr counts start today, 20% red chum (23 fish)	12.00	55.00
Wed	7/30/03	0:00:00	23:59:59	24.00	6	16.67%	105	2	1	1	78	55% red flesh-38 chums, TEK fall chums here	6.00	105.00
Thu	7/31/03	0:00:00	23:59:59	24.00	8	12.50%	116	5	0	1	65	61% red (17)	8.00	116.00

Table 6. 2003 Summer Video CPUE - Rapids

Start Day	Day No.	Counting Date	King per hr	King per 24 hr	Chum per hr	Chum per 24 hr	Sheefish per hr	Sheefish per 24 hr	Broad per hr	Broad per 24 hr	Humpback per hr	Humpback per 24 hr	Cisco per hr	Cisco per 24 hr
Fri	1	6/13/03	0.45	10.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.39	57.40
Sat	2	6/14/03	0.72	17.18	0.00	0.00	0.00	0.00	0.00	0.00	0.08	1.91	2.70	64.91
Sun	3	6/15/03	0.47	11.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.92	70.16
Mon	4	6/16/03	1.64	39.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.81	43.35
Tue	5	6/17/03	1.00	24.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.47	35.23
Wed	6	6/18/03	0.80	19.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	48.11
Thu	7	6/19/03	0.97	23.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.61	38.63
Fri	8	6/20/03	0.64	15.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.51	84.25
Sat	9	6/21/03	0.32	7.61	0.00	0.00	0.06	1.52	0.00	0.00	0.00	0.00	4.56	109.51
Sun	10	6/22/03	0.30	7.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.79	67.07
Mon	11	6/23/03	0.24	5.66	0.00	0.00	0.00	0.00	0.08	1.89	0.08	1.89	3.62	86.83
Tue	12	6/24/03	0.89	21.43	0.00	0.00	0.08	1.95	0.00	0.00	0.08	1.95	2.84	68.20
Wed	13	6/25/03	0.80	19.15	0.00	0.00	0.00	0.00	0.00	0.00	0.16	3.83	4.63	111.10
Thu	14	6/26/03	0.81	19.38	0.00	0.00	0.00	0.00	0.08	1.94	0.08	1.94	3.23	77.51
Fri	15	6/27/03	2.67	64.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.09	50.16
Sat	16	6/28/03	1.14	27.39	0.00	0.00	0.08	1.96	0.00	0.00	0.00	0.00	1.79	43.04
Sun	17	6/29/03	1.08	25.90	0.00	0.00	0.23	5.55	0.08	1.85	0.00	0.00	3.31	79.55
Mon	18	6/30/03	4.03	96.68	0.08	1.93	0.00	0.00	0.00	0.00	0.08	1.93	1.37	32.87
Tue	19	7/1/03	4.26	102.13	0.08	1.93	0.00	0.00	0.00	0.00	0.16	3.85	1.36	32.76
Wed	20	7/2/03	2.64	63.47	0.08	1.81	0.00	0.00	0.08	1.81	0.15	3.63	1.13	27.20
Thu	21	7/3/03	1.54	37.06	0.24	5.85	0.00	0.00	0.00	0.00	0.08	1.95	1.54	37.06
Fri	22	7/4/03	1.54	36.89	0.07	1.76	0.00	0.00	0.00	0.00	0.07	1.76	0.88	21.08
Sat	23	7/5/03	1.18	28.27	0.15	3.53	0.00	0.00	0.00	0.00	0.22	5.30	1.77	42.41
Sun	24	7/6/03	1.58	38.00	0.42	10.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	28.00
Mon	25	7/7/03	4.43	106.22	0.16	3.86	0.16	3.86	0.00	0.00	0.08	1.93	1.53	36.69
Tue	26	7/8/03	2.99	71.80	0.07	1.71	0.07	1.71	0.00	0.00	0.07	1.71	1.78	42.74
Wed	27	7/9/03	0.76	18.21	0.14	3.31	0.14	3.31	0.00	0.00	0.00	0.00	1.31	31.45
Thu	28	7/10/03	0.56	13.39	0.48	11.48	0.08	1.91	0.00	0.00	0.00	0.00	1.04	24.86
Fri	29	7/11/03	1.07	25.79	0.14	3.44	0.00	0.00	0.07	1.72	0.07	1.72	0.86	20.63
Sat	30	7/12/03	1.70	40.88	0.08	1.95	0.00	0.00	0.00	0.00	0.24	5.84	1.05	25.30
Sun	31	7/13/03	2.85	68.31	0.69	16.62	0.00	0.00	0.08	1.85	0.15	3.69	1.92	46.15
Mon	32	7/14/03	3.77	90.41	0.43	10.23	0.00	0.00	0.00	0.00	0.21	5.12	1.78	42.64
Tue	33	7/15/03	3.80	91.22	0.67	16.10	0.00	0.00	0.00	0.00	0.00	0.00	1.12	26.83
Wed	34	7/16/03	1.41	33.82	0.86	20.67	0.00	0.00	0.00	0.00	0.00	0.00	1.57	37.58
Thu	35	7/17/03	0.97	23.31	1.94	46.63	0.08	1.94	0.00	0.00	0.24	5.83	1.78	42.74
Fri	36	7/18/03	1.99	47.65	2.60	62.31	0.00	0.00	0.00	0.00	0.00	0.00	3.44	82.47
Sat	37	7/19/03	1.08	25.85	2.92	70.15	0.00	0.00	0.08	1.85	0.23	5.54	2.62	62.77
Sun	38	7/20/03	0.46	11.08	4.23	101.54	0.00	0.00	0.00	0.00	0.00	0.00	3.85	92.31
Mon	39	7/21/03	1.50	35.93	3.07	73.75	0.00	0.00	0.00	0.00	0.08	1.89	4.73	113.46
Tue	40	7/22/03	1.31	31.43	3.47	83.20	0.15	3.70	0.15	3.70	0.00	0.00	7.47	179.35
Wed	41	7/23/03	0.66	15.94	4.15	99.63	0.00	0.00	0.00	0.00	0.25	5.98	9.47	227.16
Thu	42	7/24/03	1.10	26.33	3.53	84.62	0.00	0.00	0.00	0.00	0.00	0.00	7.60	182.40
Fri	43	7/25/03	0.89	21.40	3.94	94.53	0.22	5.35	0.15	3.57	0.15	3.57	6.76	162.30
Sat	44	7/26/03	1.03	24.77	3.10	74.31	0.00	0.00	0.00	0.00	0.00	0.00	6.19	148.61
Sun		7/27/03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mon	45	7/28/03	0.21	5.12	2.92	69.97	0.07	1.71	0.00	0.00	0.07	1.71	4.12	98.97
Tue	46	7/29/03	0.50	12.00	2.29	55.00	0.33	8.00	0.04	1.00	0.00	0.00	3.83	92.00
Wed	47	7/30/03	0.25	6.00	4.38	105.00	0.08	2.00	0.04	1.00	0.04	1.00	3.25	78.00
Thu	48	7/31/03	0.33	8.00	4.83	116.00	0.21	5.00	0.00	0.00	0.04	1.00	2.71	65.00
Fri	49	8/1/03	0.21	5.00	7.63	183.00	0.08	2.00	0.00	0.00	0.04	1.00	3.00	72.00

Table 7. Secchi disk readings in 2003 used to compare daily water clarity

Date	Reading 1 (cm)	Reading 2 (cm)		Date	Reading 1 (cm)	Reading 2 (cm)		Date	Reading 1 (cm)	Reading 2 (cm)
6/16	15	16		7/18	10	10		8/19	11	11
6/17	16	16		7/19	10	10		8/20	10	10
6/18	17	17		7/20				8/21		
6/19				7/21	9	10		8/22	10	10
6/20	16	17		7/22	9	9		8/23	10	10
6/21				7/23	9	9		8/24	11	11
6/22	16	16		7/24	10	9		8/25	12	12
6/23	15	15		7/25				8/26	12	12
6/24	15	16		7/26	9	9		8/27		
6/25	15	15		7/27	9	8		8/28	12	13
6/26	14	15		7/28	9	8		8/29	13	13
6/27	13	13		7/29	7	7		8/30	15	15
6/28	13	13		7/30	5	6		8/31	19	19
6/29	13	13		7/31				9/1	20	20
6/30	14	14		8/1	6	6		9/2	19	20
7/1	14	14		8/2	6	6		9/3	22	22
7/2	14	14		8/3	6	6		9/4		
7/3	14	13		8/4	6	5		9/5	23	23
7/4				8/5	6	7		9/6	18	18
7/5				8/6	7	7		9/7	16	15
7/6	13	13		8/7	8	7		9/8	22	22
7/7	12	12		8/8				9/9	26	25
7/8				8/9	8	9		9/10	27	27
7/9	11	11		8/10	10	11		9/11	30	30
7/10	11	12		8/11	12	10		9/12		
7/11				8/12	12	12		9/13	31	31
7/12	12	10		8/13	12	13		9/14	31	31
7/13	11	11		8/14				9/15		
7/14				8/15	11	11		9/16	26	26
7/15	10	11		8/16	11	10				
7/16	10	11		8/17	11	11				
7/17	11	11		8/18	12	12				

Table 8. Summer 2001 Final Assessment

Fish found on original VCR tapes or Luminescence capture AVI but missed by video trigger capture system are noted below as missed.

Fish found on original VCR tapes or Luminescence capture AVI and counted by video trigger capture system are noted below as captured.

Fish found on original VCR tapes or Luminescence capture AVI are considered as fish assessed.

Approximately six hours or the first 50 fish, one day each week are used for the assessment samples.

No.	Date	Sample time	Fish assessed		Large fish assessed	Large fish captured		small Cisco assessed	small Cisco captured		Missed (reason)
2	26-Jun	6:00	55		8	8		47	40		7 (cisco)
9	3-Jul	6:00	39		36	36		3	3		0
15	10-Jul	3:40	50		49	49		1	0		1 (cisco)
22	17-Jul	1:54	50		50	49		0	0		1 (king-low frame cap rate)
28	24-Jul	3:43	50		46	46		4	4		0
34	31-Jul	2:44	50		33	33		17	16		1 (cisco)

Table 9. Summer 2002 Final Assessment

Fish found on original VCR tapes or Luminescence capture AVI but missed by video trigger capture system are noted below as missed.

Fish found on original VCR tapes or Luminescence capture AVI and counted by video trigger capture system are noted below as captured.

Fish found on original VCR tapes or Luminescence capture AVI are considered as fish assessed.

Approximately six hours or the first 50 fish, one day each week are used for the assessment samples.

No.	Date	Sample time	Fish assessed		Large fish assessed	Large fish captured		small Cisco assessed	small Cisco captured		Missed (reason)
6	22-Jun	7:35	60		23	23		37	37		0
10	27-Jun	10:38	56		27	27		29	28		1 (cisco)
18	5-Jul	12:07	63		51	51		12	12		0
25	12-Jul	6:56	61		53	53		8	7		1 (cisco)
31	18-Jul	8:31	53		46	46		7	7		0
38	25-Jul	5:12	52		36	36		16	16		0

Table 10. Summer 2003 Final Assessment

Fish found on original VCR tapes or Luminescence capture AVI but missed by video trigger capture system are noted below as missed.

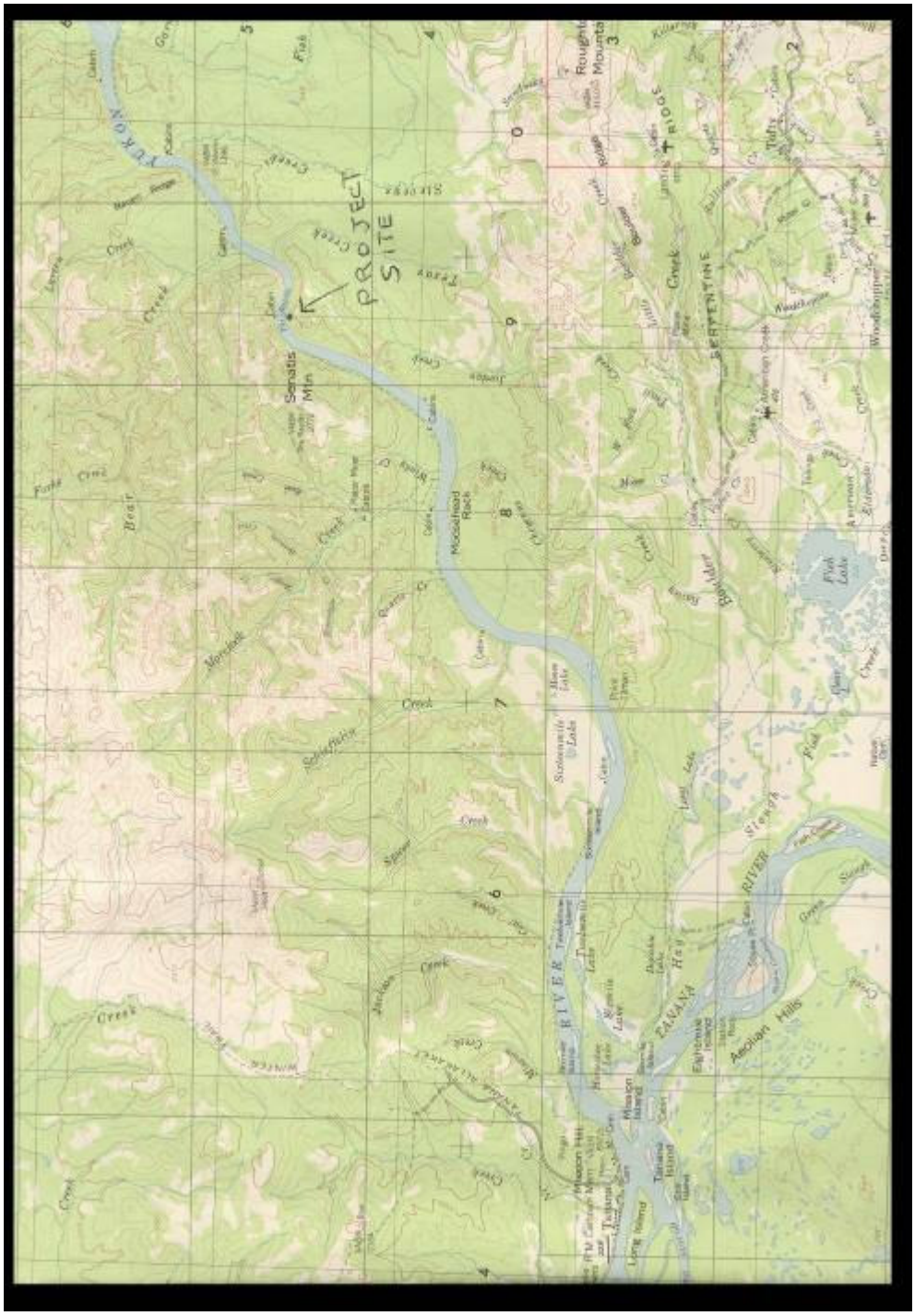
Fish found on original VCR tapes or Luminescence capture AVI and counted by video trigger capture system are noted below as captured.

Fish found on original VCR tapes or Luminescence capture AVI are considered as fish assessed.

Approximately six hours or the first 50 fish, one day each week are used for the assessment samples.

					Large	Large		small	small		
		Sample	Fish		fish	fish		Cisco	Cisco		Missed (reason)
No.	Date	time	assessed		assessed	captured		assessed	captured		
6	18-Jun	6:48	19		7	7		12	12		0
12	24-Jun	4:08	23		9	9		14	14		0
20	2-Jul	7:32	33		26	26		7	7		0
34	16-Jul	8:29	26		13	13		13	12		1 (cisco)
40	22-Jul	4:23	56		23	23		33	32		1 (cisco)
49	1-Aug	4:09	36		25	25		11	7		3 (cisco)

Figure 8. Site map



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