Rampart Rapids Full Season Video Monitoring 2006




Using a Fish Wheel on the Yukon River, Alaska

By Stan Zuray

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Annual Report to the Yukon River Panel, Anchorage, Alaska

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Cover (clockwise from top left): 1. Rapids south bank video fish wheel. 2. Subsistence strips being cut on 4th of July. 3. King commercial 2006. 4. YRDFA technicians taking data from king salmon in partnership with video project (49.5 lb king on table).

Author

Stan Zuray has been a fisherman and trapper in the Tanana area since 1973. The last 11 years he has run fish wheels for a number of monitoring projects at the Rampart Rapids. He is one of the developers of the fish wheel video system currently in use on a number of Yukon River drainage fish wheels.

Sponsorship

This project was funded by a grant from the US/Canada Restoration and Enhancement Fund.

The 2006 Rampart Rapids video project continues a close working relationship with the USFWS Field Office in Fairbanks. They provided a biologist with this office, who has a partnership relationship with this project and this office provides yearly funding contributions for in season computer and assessment assistance and postseason analysis related to the video project data some of which is included in this report.

The Tanana Tribal Council provides fax, copying and message services for the project. They also arrange travel for students who work with projects run by the video project.

Acknowledgments

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Thanks to the USFWS Fairbanks Field Office for use of their Starband internet equipment which makes possible the daily output of data and information from the project.

Thanks to the Yukon River Drainage Fisheries Association for funding the 2006 Student Data Collection Project at Rapids. This adds greatly to the scope of this project.

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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 was 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 fish wheel Chinook salmon catch–per-unit-effort (CPUE) was supplied to the Alaska Department of Fish and Game (ADF&G) by satellite phone from the Rapids. From 2000 to 2004, 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 database that will increase in value as the project continues. The Restoration and Enhancement Fund has been the major source of funding for this project.

The project site at the Rapids has probably been a subsistence fish wheel site since fish wheels came to the Yukon (around 1900). Traditionally, the particular bend in the river where this 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, fish wheels 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.

Fish wheels such as used in the project are a common capture method for management and research activities in the Yukon River drainage. Specifically, fish wheels have provided CPUE data at various locations to fishery managers. Also, fish wheels are used to capture and hold fish for tagging studies. Most of these fish wheels continue to use live boxes to hold fish until the researchers or contractors process and release them, with crowding and holding times greater than four hours common. A growing body of data suggests delayed mortality and reduced traveling rates are associated with holding, crowding, and/or repeated re-capture (Bromaghin and Underwood 2003, 2004; Bromaghin et al. 2004; Underwood et al. 2004). These studies are the reason for the efforts to develop and use video capture techniques by this project.

From 1996 to 2005 the site had been used to run fish wheels for the USFWS Rampart Rapids fall chum salmon tagging project (Apodaca et al. 2004). During these ten years the site fish wheel operated without any down days or days when data were compromised. As the site and wheel size, etc. are the same the CPUE data from this project on salmon and the four whitefish species is comparable to the present 2000 to 2006 video projects. In 1997, 1998 and 1999 a fall chum radio-tagging project was conducted by the National Marine Fisheries Service at this site. During the first year of operation the radio tag project became aware of a possible problem with live box held chum salmon. This problem was studied in 1998 and 1999 and project results (not yet published) showed a significant negative effect on fish held in the live box for 4 to 6 hour (J. Eiler, National Marine Fisheries Service, personal communication).
In the fall of 1999, a development project was undertaken at this site to address the increasing concerns over live box held fish and devise 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 efficiently 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. To transfer this technology to a fish wheel 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 Charge Coupled Device (CCD) camera, mounted above the fish wheel chute. As fish slide down the fish wheel 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 tallied by species and CPUE data were generated (see the methods section of Zuray and Underwood 1999 for a detailed description of the original video methods). Over the years this system has been modified and improved. Also, a specially built fish wheel was used that had many features designed to reduce possible injury to fish. The USFWS Fairbanks Field Office 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 the Restoration and Enhancement Fund (Zuray 2000a and Zuray 2000b). Also, catches of sheefish, humpback whitefish, broad whitefish and cisco spp. were monitored. The Chinook and fall chum salmon video projects were run both years without any live box held fish released back into the river and were the first projects of this kind ever run.

From 2001 to 2003 the USFWS Office of Subsistence Management funded operation of the Chinook salmon video project (Zuray 2003). The 2001 to 2003 Office of Subsistence Management project was a mating of the need for run timing and assessment data and the use of video capture as a means of producing data in a way much less harmful to fish. Restoration and Enhancement Fund monies continued to fund fall chum salmon video projects in 2001 and 2002 (Zuray 2002a and Zuray 2002c)

From 2004 to 2006 the Restoration and Enhancement Fund funded the Chinook and fall chum salmon full season video project at the Rapids (Zuray 2004, Zuray 2005). As requested by the Yukon River Panel these projects provided monitoring of the whole season for all species present.

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Objectives

1. To provide daily fish wheel/video catch-per-unit-effort (CPUE) data on Chinook, summer chum, and fall chum salmon.
2. To provide daily fish wheel/video CPUE data on migratory whitefish.
3. To continue improving fish-friendly fish wheel capture techniques.
4. To continue developing our present method for adjusting raw catch data that takes into account factors such as river discharge, and fish wheel catch efficiency.
5. To use video measuring techniques to separate captured Chinook salmon into small ("jack") and mature age categories.

Study Area

The project was conducted on a fish wheel 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 this area is known for its abundance and variety of fish species. This condition exists because of the currents and steep banks that force fish to migrate through the area relatively concentrated and close to shore. Fish wheel sites have been established for many years in the area so no site conflicts occurred. The unique protection offered by the site, from wind, high water, and spring river drift allow fish wheels to run there with little or no down time.

Methods

In the following methods section I often talk about past years procedures and equipment. While it adds to content and can seem not relevant it is done to provide a history and reason for the improvements that have taken place over the years. The goal is to keep each years report as complete a manual as possible for anyone wanting to look into video capture systems. Also some of what is past to this project is currently in use at other sites out of necessity because of site conditions.

Fish Wheel

A two-basket fish wheel equipped with a video capture system was used to count salmon and other species in 2006. Effort was taken so the operation of the project was consistent from year to year. The fish wheel rotation speed, 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 fish as they were lifted clear of the water. Plastic vinyl covered 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 reducing current inside box.

The fish wheel 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 were mounted on the wheel. By mid-June all of the electronic gear to be used in the video project was mounted on the fish wheel or set up back at camp. This included the surveillance camera, video tape recorder (VCR), portable monitor, laptop and desktop computers, two generators, the data transmitter and receiver.

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 before arrival of Chinook salmon and the applicants own participation in this fishery, monitoring the arrival of the first fish is always easy. Nets were in the water 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 and assembling the data in electronic and graph form (Figures 1 to 4). Collection of chum salmon, sheefish, and broad, humpback and cisco whitefish data started at this time also (Figures 5 to 15).

Secchi disk readings related to fish wheel efficiency testing are started at this time (Table 1) as are the daily fish discharge tables from the Yukon River Bridge (Figure 16) and in season wheel temperature readings. More accurate temperature data loggers (post season available only) were placed on the lead fence at the top and bottom to evaluate any temperature differences throughout the day between the two (Table 1 and Figure 17. This was an attempt to look into the reasons for the diel that exists at the wheel and any possible relation to fish movement.

The schedule for running the wheel during Chinook season 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 fish wheel is not advisable. This was the case in 2000 and 2001 and some of 2006.
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 day.

During the fall season some changes take place in the operation of the project. The date this project used for the official fall chum salmon arrival in 2006 was August 4 (Figures 10 and 11). Traditional ecological knowledge derived from elders in this area and the addition of some scientific principles of data collection is used to determine arrival time. This date is different than the set date used each year by Federal and State managers. The arrival of fall chum salmon is determined by viewing the flesh of the fish as they are cut in the subsistence fishery. As the fall season approaches, the percent of salmon having bright red color in the flesh, a distinguishing characteristic of fall chum, is recorded. When the percentage rises abruptly to 50% or more it is considered that the fall chum run is solidly underway. This method of thinking is prevalent in the subsistence fishery of this area and is used in place of a set date.

Start up date for the fall project is August 1 unless significant numbers of fall chum salmon are detected earlier. The proposed schedule for running is 24 hours per day (minus time needed for normal maintenance, data transfer, etc. each day). Project runs 6 days per week (see below). Project shut down coincides with the declining numbers of the last fall chum pulse

(Sept. 15 – Sept 25) or if icing conditions are severe. Reasons for schedule are as follows:

1. Twenty four hours sampling would maximize the amount of data collection time and be in line with recommendations from ADF&G for operation of the Rapids fall chum CPUE project.
2. Logistics of one person running a site 40 miles from the nearest town necessitate one day a week being needed for a supply trip to Tanana and occasional equipment repairs or changes. As demonstrated during the Chinook and fall chum salmon projects from 2000 to 2006, data are collected on these off days when trips or repairs are not needed (see Figure 18 and 19, project pictures).

Project Specifications

This section provides specifications on fish wheel components and operation so CPUE results in future years may be comparable. Changes in some of these could easily make these comparisons meaningless. Because of shifting silt deposits and unstable banks sites, 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. The specifications listed below are kept as consistent as possible each year and notes were made any year that was not possible.

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 six beam 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 fish wheel raft. The size of the fish wheel 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 assumption appears to be especially true of fall chum salmon, which prefer to run at a very consistent depth range.
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 and is controlled by sets of easily removable paddleboards. Desired rotation is described as “just a little faster than stalled”.

Video System

The video system used consisted of a color CCD camera mounted above the fish wheel chute and directly connected to a wireless microwave transmitter mounted on the back of the fish wheel and aimed back toward the camp site. At camp the wireless receiver is connected to a laptop computer through a video capture card. After the fish wheel captured the fish, they were video recorded as they traveled down a chute, and then re-entered the river. A time-lapse VCR and/or second computer were occasionally linked to the system for assessment work and video recording backup. Twelve-volt batteries powered the system at the fish wheel. During daytime operation, a water-wheel generator charged the batteries. In fall at night, floodlights 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 1999 and 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) to extract 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, developed a new system that improved past limitations of the system (Daum 2005). A camera was mounted directly to a laptop computer on the fish wheel. The computer had a new version of Salmonsoft software (funded by USFWS) that used electronic triggers to initiate capture of fish images as they slid down the fish wheel 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. In the late 2006 season an infrared electronic trigger was tested and installed (see results section).

A plywood shack with wood stove was constructed in 2001 and set up to house the equipment in camp each year since.

Daily Video Procedures

The following is a list of daily 2006 video procedures followed at the fish wheel (this gives a general idea only as these procedures change over the season):

Start up

- Turn on camp laptop, microwave receiver, and start software capture program.
- Arrival at the fish wheel - make sure wheel is adjusted for running (the most complicated part).
- Switch on power to water generator and lower into water. Turn on fish wheel.
- Open electronics cabinet, turn on DC power from batteries, and turn on camera and microwave transmitter.
- Check portable monitor to make sure camera is on, in focus and positioned (rarely changes so this is not done daily).
- Wipe window clean on camera case (splash marks) and clean chute background (for nice pictures).
- Start official counting by manually tripping capture system while holding a start sign in camera view.
- In late season 2006 – wet fingers and wipe infrared lenses of silt and fish spatter.

Shut down

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

- Manually trip capture system while holding a stop sign in camera view.
- Lift water generator out of water and turn off DC current to water generator.
- Turn off fish wheel 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. 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 database by hand.

In 2001, an electronic tally system was developed to facilitate rapid counting and calculating of CPUE data by fish species. This new video counting system, Salmonsoft capture review program, allowed tallying of individual fish species using a computer keyboard and is what was used in 2006. Images could be reviewed at user-defined speeds and played forward or reverse for review. Dave Daum originally did considerable Beta testing of this software.

Fish are enumerated by species and daily CPUE calculated for each species (Figures 20 to 23 and Tables 2 to 5). Catch numbers, comparison graphs and subsistence information were reported daily to the Alaska Department of Fish and Game and emailed to 42 persons requesting the daily updates. These include DFO, USFWS, and ADF&G managers and biologists and subsistence persons. Permanent video CD files are made of all fish caught by the fish wheel for back up, later research needs, and project assessment work. Inseason and past project data is also available on the project web site. From 2003 to 2006 a totally separate luminescence capture program was run one day a week for inseason assessment purposes. The results of each were compared as a means of detecting problems. We decided to drop the daily backup using VCR tapes because lack of system failures warranted less backup effort.

Assessment of Capture Program

As a video capture system assessment, segments of separate luminescence program counts were viewed and compared to the corresponding video capture files generated from the magnetic switch video system. The luminescence program counts contain fish that pass through the chute captured in an entirely different manner than the trigger method, so assessing how many fish, if any, were missed by the trigger method was a fairly straightforward process although rather tedious and boring. Selection of assessment samples was two-parts. A day was selected based mostly on weather, which would optimize the luminescence programs operation. 2. The first six hours or the first 50 fish was selected to review (based on workload in reviewing that much material).

The process was as follows:

1. The luminescence program AVI file for a particular day was played into a computer software program called Salmonsoft review 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 screen the AVI file made by the fish wheel laptop/switch program was opened using Salmonsoft review program

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

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

5. The luminescence program AVI was run forward until a fish appeared and paused.

6. If all went well the trigger AVI fish and the luminescence program AVI fish should be the same and have corresponding times. The operator looked for a fish on one frame and not

the other. This situation would signify a miss by the laptop/switch program or the luminescence program.

7. Each fish reviewed was counted on a tally sheet.

8. Misses are recorded on the tally sheets 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 and the process then repeated.

Note: See assessments in Table 6)

Power Equipment

Aquair UW propeller driven water generator: This generator had very little output for the water speed encountered at the fish wheel (approx. 6-8 ft/sec.). It could only produce 1-2 amps. Because the project was sometimes run in only 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 to be a durable, continuous use piece of equipment, lasted 6 years and had only shaft seals replaced once.

Honda 1000 watt generator (EU1000I): The color video camera running at higher shutter speeds required about 180 watts of light at night (fall time only) 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 efficiency boosted gas economy to 10 hours per .61 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 wired into the generator so the generator would shut off whenever 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 fish wheel spar pole to the equipment enclosure. A number of generators have had to be replaced over the years (about 1 per year) and overall they don't seem to hold up to the long run times the project requires.

Honda 2500-watt generator (EB2500): used at camp to run the desktop computer. It ran all the camp equipment easily and was very quiet.

Batteries: four 6-volt deep cycle batteries supplied the stored 12-volt DC power. Although fewer batteries could be used, a generator shut down could necessitate the use of this much reserve power to keep the video running. 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.

Battery charger: a 10/30/50 amp (Schumacher SE-1250), taper charge, automobile type, charger was used. The charger will run constant at 8 amps at night with lights on. In 2007 plans are to go to a charge controller specifically made for constant use (the auto type chargers are not designed for continuous use).

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 inverters are replaced occasionally because of durability problems. Spares were always on hand.

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.

Fish Wheel 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 refocuses 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 Dave Daum, eliminated the need for all the sunlight and wind blocking structures of the fish wheel chute. The bottom (viewing area) of the chute was lined with white UHMW 3/16’’ thick plastic. It was easily cleaned and stayed white, 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. A bouncing 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 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 to be synchronized. This dampening system was necessary because of 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.

Other Tested Triggering Devices

The magnetic switch has been a reliable triggering device since its initial installation in 2001. But certain environmental conditions have been problematic at times and required innovative fixes. During windy conditions, the door opens prematurely, tripping the switch, and allowing fish to pass by the camera undetected. The door hinge has broken due to stress from large fish slamming into the door frame resulting in the door falling off and fish passing undetected. The mechanical magnetic switch has a limited number of "trips" before the contact points fail and video capture is compromised. Small fish species, especially ciscos do not consistently open the door due to their small size, resulting in missing some small fish. Because of these minor problems, there has been a concerted effort to find another triggering system that is more reliable, less affected by various environmental conditions, and able to detect even the smallest fish. Added incentive for continually looking for better methods is the technology becomes simpler to move to other projects.

<u>Thru-beam ultrasonic sensor.</u> In 2005, a thru-beam ultrasonic sensor was purchased and tested (Figure 20). The sensor consists of one transmit and one receive transducer. After bench testing, the sensor was installed on opposite sides of the chute and field tested. Results were somewhat encouraging, but wind along the surface of either transducer caused the switch to falsely trip. Also, since the sensor was made up of only one narrow beam, depending on placement, some fish could slide under or over the beam undetected. A single-shot timer was installed on the switch so the duration of the electrical output (after being tripped) could be controlled and lengthened. This allowed the software (Salmonsoft) to react consistently when the switch was tripped.

<u>LED light screen sensor.</u> In 2006, a light screen sensor was purchased and tested (Figures 21 and 22). The light screen sensing system consists of two self-contained units: an emitter and receiver. The emitter has multiple infrared LEDs spaced at 9.5 mm increments, and the receiver has corresponding photodiodes. The sensor was installed on opposite sides of the chute, resulting in a cross-hatched optical pattern covering all areas of the chute from the bottom to seven inches above the surface. With this almost complete coverage, target detection issues would hopefully be eliminated. A laser rifle-sighting device was used to align the two units during installation. The lens of each unit was cleaned once per day of fish slime and silt to keep the sensor functioning properly. Silicone had to be applied to each unit to more effectively seam the sensor screen from moisture and prevent lens fogging.

Methods for testing the light screen sensor in-season were developed and implemented. From July 12 through August 21, the sensor was installed in the video chute with a bright red LED attached to the sensor switch. If a fish passed through the light screen, the light would turn on for a set amount of time controlled by the single-shot timer (see above). The red light was installed in the field of view of the video camera. If a fish was video captured by the original video system using the chute door/magnetic switch, the captured picture would also include a record of the red light being tripped by the light screen. During video file review and fish counting, a record was kept to evaluate if the red light from the screen sensor was activated each time a fish was captured by the video system. On August 22, the light screen sensor was installed as the triggering device for the actual video system on the fish wheel, thus removing the chute door/magnetic switch from the system. The new light screen sensor was run from August 22 through September 19. Regular assessment methods were used to evaluate if any fish were missed using the new light sensor during this testing period (see Assessment of Capture Program, Methods). Results from these assessments are reported in the Results section and in Table 6.

Fish Wheel Construction

It is counterproductive to install a video system only to have fish injured by the fish wheel unnecessarily. The fish wheel 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 to 2006. All entrance and exit doors are lined with closed-cell foam. Easily removable paddleboards of different sizes allow much control of the fish wheel 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 to 2006 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 2001-2006 produced noticeably better images than the similar model WV-CP464 used in 2000 and 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) and 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 fish wheel. 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 and is still running fine.

Video Recorders: these are presently used mostly for our backup system. Video cameras are connected to a 12 volt DC video recorder (Panasonic AG-1070dc) with 12 and 24-hour time-lapse capability. The video recorder is placed in a waterproof Pelican case and wires ran to the outside via waterproof connectors. The video recorder stores images on the videotape at a rate of approximately 5 frames per second on the 12 hour setting and it has a date and time stamp feature that is used at all times. A matching, second video recorder at camp is available to play images into the video capture card/computer for final luminescence capture. These VCRs have factory-cleaning recommendations of every 60 hours. This model of VCR is no longer manufactured. These are still running fine and kept available for instant installation in the event of a trigger system failure.

Desktop Computer: a desktop computer was used in camp to download video files from the fish wheel video system, review and tally fish, capture fish from VCR tapes, and organize data in spreadsheets and graphs. The computer had 3.20 GHz Pentium 4 processor, 1024 MB 400 MHz of DDR SDRAM memory, Windows XP operating system, Recordable/Rewriteable DVD RW/ R/CD-RW, analog PCI video capture card, and multiple card reader installed. The card reader was used to download the video files from the IBM micro-drive. All files were backed up on compact disk. This computer is new in 2004 and capable of the video work required by this system.

Laptop: connected directly to a camera on the fish wheel 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 XP operating system, 20 GB hard drive, 500 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.

Capture and video review software: Salmonsoft capture software Vcap 1.4.0 was used to capture fish images off the fish wheel. The software allowed use of a trigger switch to record fish images as they slide down the fish wheel chute. In camp, video files (AVI format) were reviewed and tallied using Salmonsoft viewing software Vcap Rev 1.4.0. 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 fish wheel 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 fish wheel from 2003 to 2006 thereby eliminating the need for having the laptop capture system on the fish wheel. All video capture was done back at camp. This reduced power requirements at the fish wheel, reducing amp/hr usage from approx. 3.4 to around .5 amp/hr. 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 fish wheel would be difficult in many regards. With wireless this experimentation can be done at camp. In the 2004 season we ran 2 trigger systems with different operating systems and one luminescence system for assessment. In 2005 and 2006 the wireless allowed testing of multiple capture triggers (ultrasonic and infrared) while running the main counting system uninterrupted. The wireless video system made this much simpler and is still running fine.

Project Related Areas of Study

Flesh color and fall chum arrival. The summer chum run in this section of the river is relatively small in numbers and is made up of chum whose fat reserves are low (most are close to their spawning areas) and therefore their flesh color is very pale in roughly 90% of the population. These chums are of much lesser value for people and dogs. With the arrival of the fall chum in late July and early August a distinct and unmistakable change takes place. What happens is in a matter of 3-5 days (occasionally longer) after the summer run has been providing people with say consistent 10% red flesh fish, the percent of red fleshed fish will rise progressively to 50 - 75% or as high as 90% (mostly depending on the amount of summer chum still running and mixing in). The "official" start date for the video project begins when the red flesh color passes the 50% point.   This method has supplied Rapids video project with the most accurate date to start counting fall chum each year since 2000. Presently no other method including genetic analysis has replaced it although this project has supported genetic proposals to do so.

Fish wheel efficiency and discharge adjustments. Rapids test fishwheel assessment is made by taking 24 hour video counts and adjusting that number using a formula that takes into account the speed of the current at the fish wheel. It is much more accurate than comparing traditional CPUE each year at this site because of the varied influence of water height and speed. This then gives a number similar to a daily passage estimate. At this site it is possible to do this by monitoring USGS discharge or water height readings taken upriver at the Yukon River Bridge, as those readings have a linear relationship to the site current speed. The basic idea for this is born of fishers' traditional knowledge that as current speed increases fish has the tendency to move closer to the banks (and fishwheels) to avoid the increased flow, and will spread out and away from the wheel as speed decreases. There are two key things that have made this type of assessment easier here. One is that there is never a time when the water does not raise that the speed of current does not increase, or water lower and the current decrease. This was shown by velocity readings taken over two summers and is not the norm for the average fish wheel site which often has periods of faster and slower current speeds unrelated to water discharge. Second is that for 10 years the site was also contracted to catch fall chum for a USFWS tagging project producing a weekly population estimate. This gave the video project many hundreds of daily "efficiency of fish wheel in different water discharges, data points" which with to construct a workable formula. The method is highly suspect among many educated persons. The end result however is a yearly estimate of passage past the Rapids which compares remarkably similar to a combined post season Upper Yukon escapement, harvest, and border passage figure from 1996 to 2005. This yearly figure is the primary method the USFWS uses to evaluate projects such as the Rampart Fall Chum Tagging project.

Water temperature. An Onset StowAway TidbiT© water temperature data loggers were installed at the fish wheel for the duration of the fishing season. The loggers were installed on the fish wheel lead at about 1 m depth and 1 m from bottom. Measurements were taken daily at 1 h intervals and mean daily water temperature was calculated by averaging the hourly readings. These measurements were taken from 2003 to 2006 in an effort to provide more points of temperature data collection on the Yukon River, to explore possible effects on fish wheel efficiency that temperature variations might have and to have temperature correlation data for the *Ichthyophonus* disease studies at the Rapids. The two loggers used (post season data available only) were placed on the lead fence at the top and bottom to evaluate any temperature differences throughout the day between the two. This was an attempt to look into the reasons for the diel that exists at the wheel and any possible relation to fish movement.

A manual readout temperature gauge was also placed on the fish wheel to provide daily readings inseason. While not as accurate it did provide temperature data that was used to correlate with the inseason Ichthyophonus research the project was involved with and provide general temperature trends for the YRDFA teleconferences.

Diel catch patterns. These patterns are not at present available for Chinook salmon due to the lack of sufficient numbers of captured Chinook salmon, large amount of days containing hours with no Chinook salmon captured and 12-hour project run time. While the existing data have 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 has supported 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. It was decided in 2006 that we had run enough years of diel data to prove the existence of a consistent diel pattern at the fish wheel and that no more was necessary at this point. Past years data is included in this report as it is an important consideration of fish movement past the fish wheel. If any need arises in the future, for diel rates from any year, archived video data can be run to produce the diel graphs, etc.

Water turbidity. A standard Secchi 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. Water clarity is known to affect fish capture and this was another area being explored for its effect on catch efficiency at the Rapids fish wheel (Table 1).

Video chute sizing. The similarity in overall Chinook salmon numbers in 2002 and 2003 for the Rapids project drew our attention because the project operator did not feel the 2002 and 2003 runs were similar in strength at all. The overall number was the one most used in the past to measure run strength. 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 fifteen. This accelerated an ongoing investigation into just how extreme the abundance or absence of small Chinook salmon in a population can affect the projects assessment of run strength.

Starting in 2003, length measurement marks in the video chute have allowed classification of Chinook salmon into small or large salmon based on length (< 70 cm total length = small). Though not as accurate as manual measurements, the marked chute provides a way to differentiate between two size-classes of fish. Separating the Chinook salmon run into these two components was believed to 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 salmon video avi files were recounted separating the small and large fish. The results were dramatic and show just how far off a run assessment can be if some small 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 small and large Chinook salmon are separated one sees a catch of large Chinook salmon (= or > 70 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 large fish (females) headed to the spawning grounds emerges (Figures 2 and 3).

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 continue developing the reporting method that includes the accuracies of the separation technique and to continue work on developing a digital measuring method to accurately measure individual fish with the help of Dave Daum (USFWS).

Results and Discussion

The project operated for 96 days in 2006 with no down days or times when project equipment or operation compromised data collection. The project operated on all of the scheduled days off (Sundays). Project started counting on June 16 and continued through the last major chum pulse, ending finally on September 18.

The project's 24-hour CPUE for Chinook salmon, summer chum and whitefish are summarized in Tables 2 to 5. Adjustment of fall chum CPUE based on discharge continued in 2006 with the daily release of graphed adjustments made to fisheries managers.

Dave Daum of the USFWS Fairbanks Field Office again worked closely with the project assessing operations. His help on improvements to the detection ability of the video capture system, which went from beta testing to running the project at its end (infrared light curtain); will be of benefit in the years to come. One such benefit is much easier transfer of the technology to new sites.

The video project's computers and equipment were again donated to assist in the 2006 YRDFA Data Collection Project which collects data on a full season of Chinook salmon.

Chinook salmon.

The project had a cumulative CPUE of 2917 Chinook which is the second highest CPUE in the project's 7 years. The 2006 run was composed of the highest percent of small ("jack") Chinook in the 5 years of doing Chinook video chute sizing (Figure 3).

The primary objective of the project is to collect CPUE data in a consistent manner year to year. The Chinook and chum salmon numbers are presently the ones of most interest to ADF&G, USFWS and the Department of Fisheries and Oceans Canada (DFO). This data is only meaningful in as far as it relates accurately to actual salmon passing through the site area. That actual number is of course not available for comparison so other established Chinook and chum salmon assessment and escapement projects on the river are looked at and compared for indications of project accuracy.

Below, the project is compared to three major Chinook salmon, Yukon River drainage projects having numbers of years running. The video project is only seven years old so only years 2000-2006 are compared.

Table 1

Year	24 hr. expanded Rapids cumulative		Lower River set net cumulative	Pilot Sonar estimates	Canadian Border estimates
	All	Large			
2000	1708		14.12	70,112	16,995
2001	5563		15.23	137,453	54,029
2002	1667	911	20.23	183,505	43,359
2003	1646	1351	27.06	253,774	58,082
2004	2854	2000	20.48	188,874	48,500
2005	2061	1485	17.8	143,997	45,000
2006	2917	1891	* 21.81	* 168,351	* 47,965

*Some 2006 figures are preliminary at this time

Chum salmon.

Chum projects available for comparison are much more numerous; some use relatively accurate weirs and small stream sonar. A comparison technique used by USFWS for looking at upper Yukon chum salmon passage above the Tanana River involves adding together escapement projects, harvest, and border passage to see how that figure compares with in season monitoring projects. This project uses that method to evaluate its yearly discharge adjusted index or estimated passage of chum salmon at the Rapids site. Estimates for years 1996 to 2006 show a relatively close comparison using the projects discharge adjusted formula (Figures 12 and 13). Estimated in this manner, the total fall chum run size past Rapids this year was 455,262 fish. Looking at all project years from 1996 to 2006, only 1996 (728,221) and 2005 (1,459,167) were higher.

Four pulses were identified by ADF&G and to avoid confusion Rapids video goes by those designations. This year the first pulse corresponded nicely to Rapids first pulse. Over the years the fall chum have arrived at different dates here which puts Rapids first fall pulse often before or after the first fall pulse as determined using the ADF&G method (date determined preseason and same each year).

Pulse 1 is always the most valued for people food with dry fish and some strips being made. The fish are their fullest and flesh the richest. Every pulse after has declining amount of these qualities with the front side of each individual pulse being the best and backside having the poorer fish. Catch rates were around 500 per day which traditionally and project wise was good for this site and wheel. The percent of chum Rapids caught during the first pulse relative to Pilot Sonar's estimate 18 days prior was lower than normal which was probably because of a higher than normal amount of summer chum salmon still coming into the river. Relatively few of these summer chum salmon make it up to Rapids.

Pulse 2 was the largest, comprised of approximately 180,000 fish and still of high quality for people food. Pulses 3 and 4 were each about 90,000 and 70,000 respectively.

This year, the later pulses moved upriver from Pilot Sonar at a slower than average travel rate. Chum salmon took almost three days longer to arrive, giving them an average of under 30 miles a day travel speed with the average being about 35. It was thought the extreme high water that was present during much of the chum salmon migration may have been a factor.

Diel catch patterns. Continuation of this study is considered unnecessary at present.. Data potentially capable of producing diel patterns will be taken and archived each year in case there is ever a future need for it. (Figures 7 through 9).

Flesh color and fall chum arrival. In 2006 video project supported efforts by the YRDFA Student Data Collection Project determined a fall chum arrival date of August 4th. The first sign of fall chum arrival was on August 2nd when the catch rate started to rise and the normal summer chum "percent of red flesh" of 5-8% rose to 13%. By August 4th the catches had tripled and red fleshed chum rate was over 50%, which is the point each year, this project starts counting all chum as fall chum (Figures 10 and 11).

Fish wheel efficiency model. Discharge levels are continuing to be explored, the last few years, for their effects on catch efficiency by the Rapids video project and Dave Daum, USFWS. Work by project leader Stan Zuray continues to show a strong linear correlation between discharge and fish wheel efficiency with chum salmon (Figures 12 through 14). From 2004 to 2006 discharge adjusted fall chum data was sent in daily with the normal CPUE data to state and federal managers.

Daily chum numbers are adjusted, using a fish wheel efficiency model related to daily water discharge. This adjusted passage index continues to be worked on as a project objective with formula upgrades each season being made. The results continue to appear to be much more inline with other Yukon run assessment projects than the unadjusted CPUE (Figure 13) although in 2006 there was not much difference between the adjusted and unadjusted passage guess numbers.

Water temperature. Daily mean water temperatures during the 2006 project varied from a high of 18.3 °C on July 25 to 9.5 °C on September 23rd. Within a day, water temperatures varied by around 1 °C during the season. The lowest readings were between 0600 and 1200 each day. Relative to 2003 to 2005 temperatures ran a little cooler during the Chinook season and warmer during the beginning chum season (Figure 17, Table 1). As with other years temperatures varied quite a bit depending on weather.

The comparison testing done using temperature loggers placed on the top and bottom of the fish wheel lead fence showed a thorough mixing of the water throughout the day and season and no indications to suspect that lower bottom water temperature differences at different times during the day were the causes of the diel that exists at the site as both top and bottom temperature readings were the same.

Water turbidity. Secchi Disk readings responded to rises in river levels and early in the season the normal melting of glacial streams from high temperature days. Colder temperatures of advancing fall weather, lowering of the water level and subsequent clearing of the river in are seen in the data too.

Video system components. The video system proved to be very accurate at counting fish that were captured by a fish wheel. Many of the potential fish handling problems associated with fish wheel capture have been eliminated by the development of this method. The video capture system used in 2006 has many improvements over the original system used in 2000. The assessment figures (Table 6) show the consistent video capturing of the medium and large fish species. With the introduction of the infrared sensors for fish video capture in 2006 even the small cisco whitefish can be counted accurately. Cisco capture accuracy assessment figures show only a 98% capture success rate in 2004 and 95% in 2005 for instance. Overall, 2006 assessment figures are a combination of both methods while 2007 will be strictly the infrared method if all goes as planned.

LED light screen sensor. Testing of the new light screen sensor in 2006 was successful. During the first assessment period, July 12 through August 21, the functioning of the switch was tested. Of 20,757 fish frames that were reviewed, all images had the red light on (Figure 22), indicating that the screen sensor was tripped by the passing fish each time. Initially, dirty lens covers and lens fogging affected sensor response, but by keeping lenses clean and sealing the sensor units, these problems were eliminated. The second assessment period, August 22 through September 19, was used to evaluate if any fish passed by the light screen sensor undetected. Of 709 fish assessed, only three were missed (Table 6). These few fish were all missed during multiple capture events (more than one fish passing down the chute at once), indicating that software capture settings were probably the cause, not fish passing the sensor undetected. Unlike the chute door/magnetic switch, no ciscos were missed using the screen sensor; a definite improvement over the old system. Of additional interest, passing flies and moths were video captured using the screen sensor, indicating the extreme sensitivity to small passing objects. Rain events and windy conditions never caused the screen sensor to trigger. The testing and evaluation of the screen sensor has demonstrated that the new sensor is a definite improvement over the chute door/magnetic switch. In 2007, the magnetic switch will be replaced by the new screen sensor.

Finding the best software program settings to control the amount of frames captured before and after the magnetic switch was tripped was a matter of trial and error during test periods prior to the official start date. A setting to capture more frames than was necessary would mean larger than needed file sizes and more time spent reviewing video files. Settings that do not capture enough frames can cause 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 fish wheel captures of multiple fish when the run was the strongest. Software settings are influenced by the goals of each project.

The 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 of small consequence considering the storage capacity of the laptop hard drive, micro drive transfer disk and final storage on CD-R disks. In 2006 the introduction of infrared fish detection and its change in placement to mid video chute of the detector caused adjustment to these settings in the course of experimentation and testing.

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 some years daily chum catches can approach 2000-4000 fish. 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 2006 there was no day data could not be collected. Running longer into the evening or using our backup luminescence video capture system solved the few problems threatening a loss of a day's data. In 2006 the laptop computer capture program was shut down and a luminescence program ran on the desktop computer any time files were transferred. This was to avoid computer "lock up" problems of the past years and worked very well. A more modern laptop would probably solve this also.

The building and maintenance of the fish wheel chute door was greatly simplified in 2001 and 2002. Construction techniques still require attention; because 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 to light could be triggered by gusting winds. The chute door dampening system never had a problem. The magnetic switch experienced no failures in 2006 (no failures in 2002 and 2003 and one failure in 2001, 2004 and 2005).

Figures 18 and 19 show some of our project operation pictures.

Past Video System Testing. The mechanical triggered video system developed during the 2001 to 2004 Rapids video projects has been installed and tested on four fish wheels 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. As of spring of 2004 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) (see Figures 20 through 23 for 2005 whitefish data). 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 fish wheel 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 multi 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 fish wheel live boxes. A total of 357 hours of fish wheel 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

Partnerships and Capacity Development

The Rapids video project continued a close working relationship with the USFWS office in Fairbanks. Dave Daum 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 2006 have also served as a center for research into fish friendly video development, low fish impact fish wheel 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 Field Office.

All years the projects doors were always open to the public and any agency personnel. A number of persons from the USFWS and ADF&G view the workings of the project each summer.

Laurie Boeck was the main contact person at ADF&G for the daily reporting of data from the 2006 project.

In response to a number of persons requesting the project's data I started a list of persons to be emailed daily in 2005. While the project is in a partnership with the USFWS, its operation and results are not always reported by them in their daily summary of projects and same with ADF&G reporting. Hence, the project in the past has mostly relied on YRDFA teleconferences and individual emailing to convey data to the public. The list has been successful and names were continuously added again this summer as requests were received. Presently the daily updates are sent out to 46 persons and include a lot of the graphs and tables seen in this report updated as I get information from other projects. Also there are short text reports on area subsistence and commercial activity. Anyone wanting on the list can email me they want on.

Office of Subsistence Management funding support was withdrawn from the Student Data Collection Project that has operated here since 2001 with the video project as a main partner. The Yukon Drainage Fisheries Association (YRDFA) did fund a smaller collection project to keep this data base going. This information comes from a full season effort on sampling up to 1000 Chinook each year. This data is described as very important at many of the USFWS regional council meetings, YRDFA meetings, and state advisory council meetings that have taken place each year. Video project computers, generators and much other equipment are donated to helping this projects effort. While the mandatory ASL data collection of R&E funded projects does not apply to this project because of its immediate release of the counted fish, the project is directly involved with this effort through the above partnership.

Each year the video project supports a number of research activities by other individuals or agencies. These have included:

1. *Ichthyophonus* research by Dr. Kocan and Paul Herschberger in 2001 and 2002.
2. The contaminants in salmon study by Keith Mueller and Angela Matz with the Fish and Wildlife Service in 2001.
3. A 2003 bering cisco data and otolith sample effort for Randy Brown of the USFWS Fairbanks Field Office.
4. A whitefish radio telemetry by Bill Carter of the USFWS Fairbanks Field Office in 2002 and 2003.
5. In 2004 a Bioelectrical Impedance Analysis project designed to investigate bio-energetic features (body fat, water retention, etc) in migrating salmon (Chinook and Chum) was conducted at Rapids working in conjunction with biologists from the Fairbanks Fish and Wildlife Field Office, Keith Cox (Doctoral student who designed this technique) from West Virginia University, Kyle Hartman (Professor) from West Virginia University, and Joe Margraff (Professor, Co-op

leader) from the University of Alaska, Fairbanks. Testing in 2005 continued with fish out of the video fish wheel.
6. In 2005 with student from the TCO project, genetic samples and data from whitefish species were collected for biologists with the Department of Fisheries and Oceans Canada. This collection was spread over the season.
7. The video system developed at the Rapids project has been transferred to and currently operates on the Tanana River 5A test fish wheel (Fliris, B. 2000), Rampart fall chum tag recapture fish wheel (USFWS ended 2005) and the Nenana test fish wheel (ADF&G) Numerous other inquires have been made from other river systems and the technology has been adjusted to operate at weirs and counting towers.
8. In 2006 the project facilitated Chinook scale and genetic fin clip sampling at Rapids for ADF&G.
9. 2006 Ichthyophonus heart samples for YRDFA's PCR testing.
10. 2006 Radio Tagging of bering cisco whitefish by Randy Brown and Dave Daum (USFWS)

Rapids video project continues to be a major source of development work in video technology and fish wheel monitoring methods.

Figures 18 and 19 in this report show some of this capacity development effort. The site of these projects can be seen in the map provided (Figure 27).

Conclusions

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

Recommendations

1. CPUE data is only valuable if it is a reflection of what is actually happening in the river. To this end the Rapids video project maintains a list of project components that may influence CPUE data (see Project Specifications on page 10). Future projects at this site should incorporate these specifications to aid in more accurate data collection and interpretation.

2. Each year this project provides local fishermen with run timing and run strength information verbally, through bulletin board postings in Tanana and email updates. It is often quite difficult to consistently find the data necessary to do this. We have State, Federal and private projects (such as this one) all with different mechanisms and success for getting the data to the public. I would like to see an Internet web site or someone charged with sending out emails 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, and provide information to YRDFA representatives for weekly teleconferences. I have been recommending this for many years now and would be grateful to see some agency or private project take this on. The above is particularly important for early and midseason Chinook run data which is very difficult for fishers to obtain each year.

Budget Summary

Total Cost: 34,000 (1 year project) Project Dates: June 1 to September 25, 2006:

a. Total Annual Budget	34,000
b. Expenditures Thru December	34,000
c. Balance Thru December	0
d. Anticipated Remaining Expenditures	0
e. Anticipated Final Balance	0

Additional information: No alterations to the budget were necessary.

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Zuray, S., 2005. Rampart Rapids Full Season Video Monitoring, 2005 - Using a Fish Wheel on the Yukon River, Alaska. Annual report to the Yukon River Panel, Anchorage, Alaska.

Figure 1

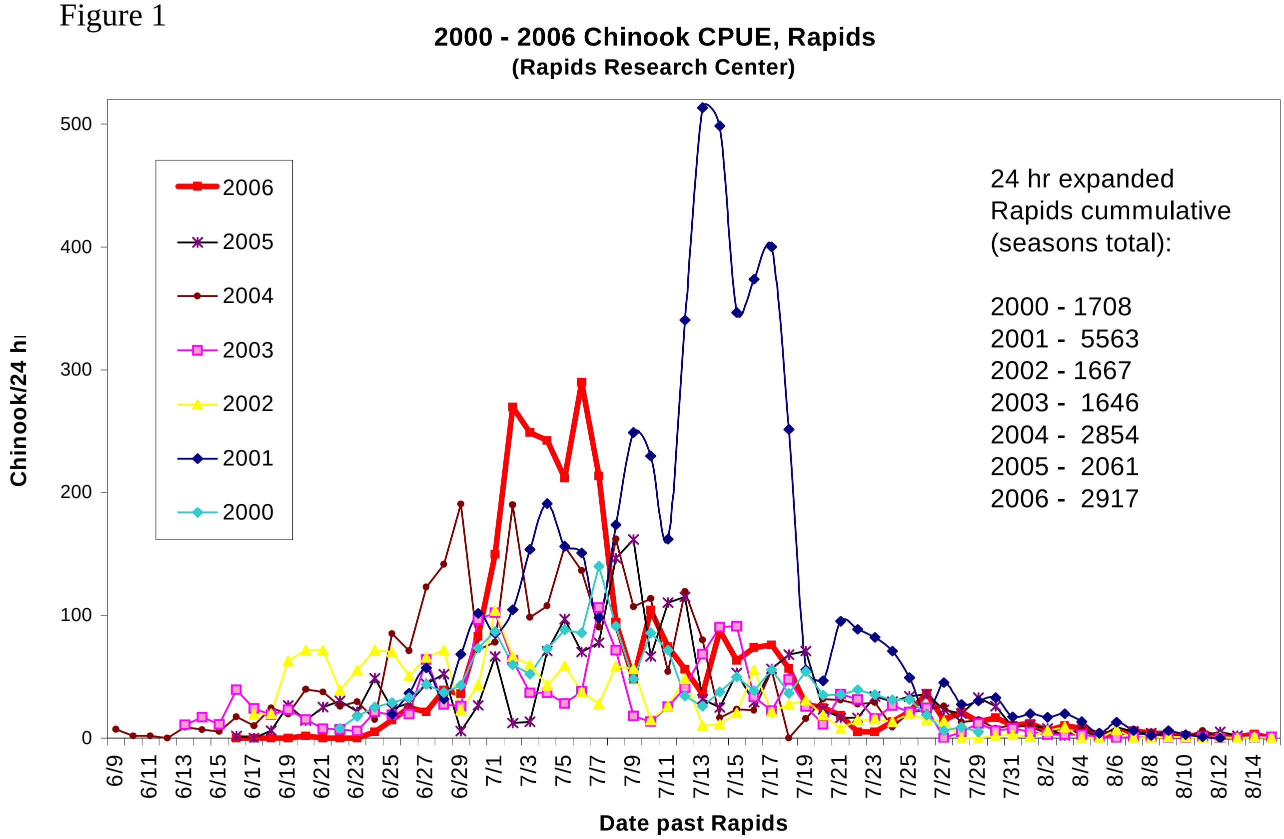


Figure 2 **Rapids Video CPUE Compared to Lower Yukon Set Net CPUE**
Chinook 2006 (Rapids Research Center)

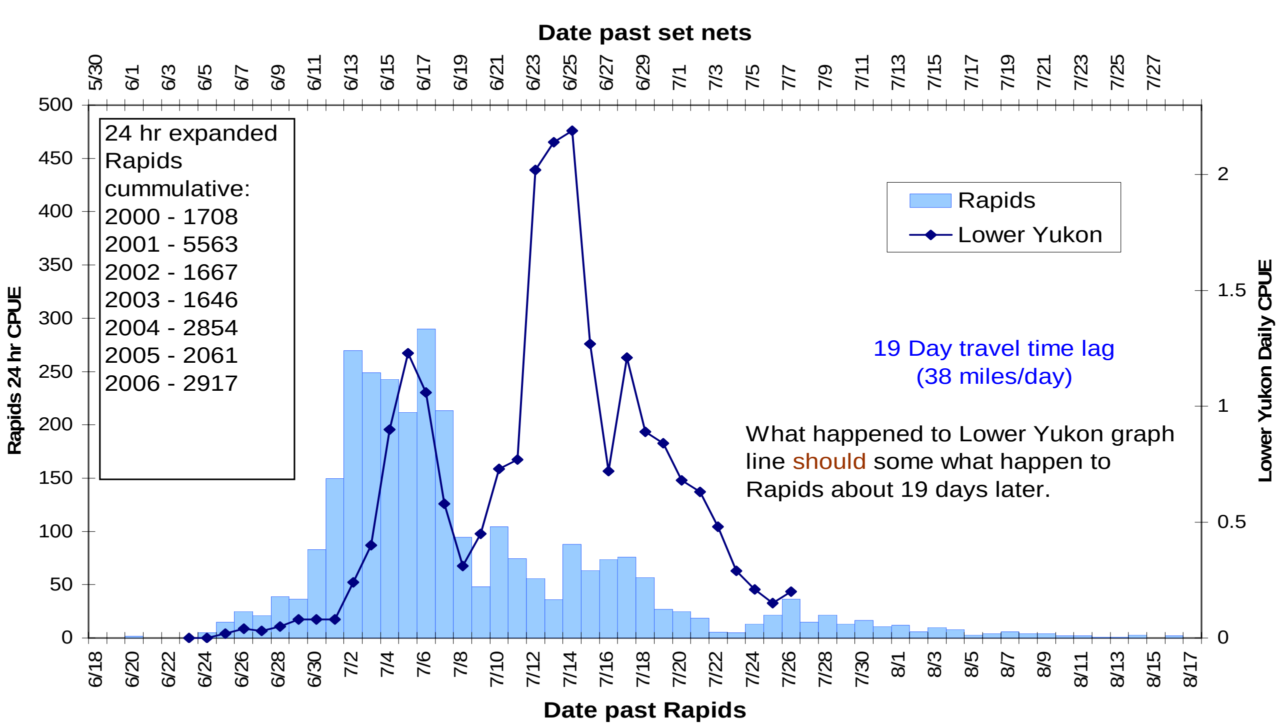


Figure 3

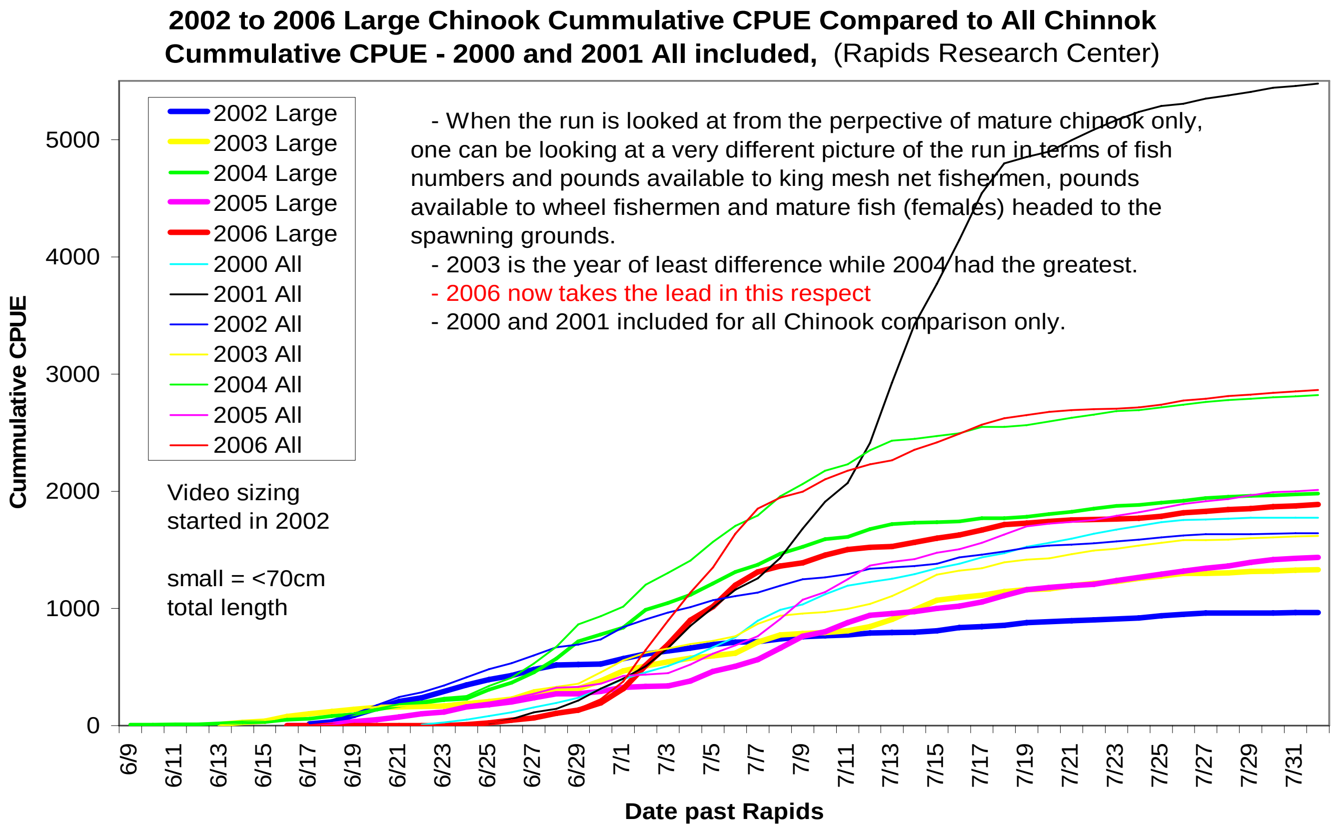


Figure 4

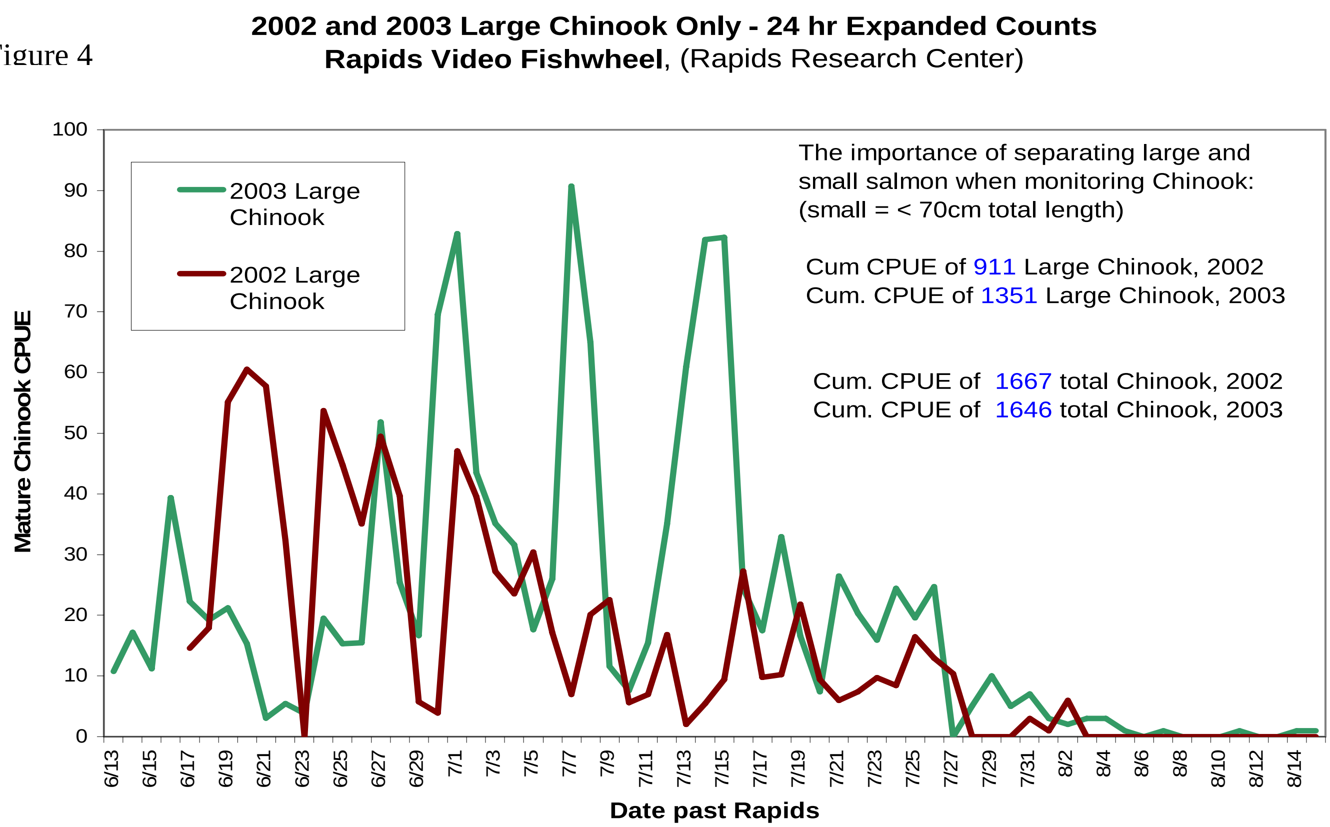


Figure 5

Rapids Video Discharge Adjusted Passage Guess (ZRMC2) **and Pilot Station Sonar Compared, 2006 Chum** (Rapids Research Center)

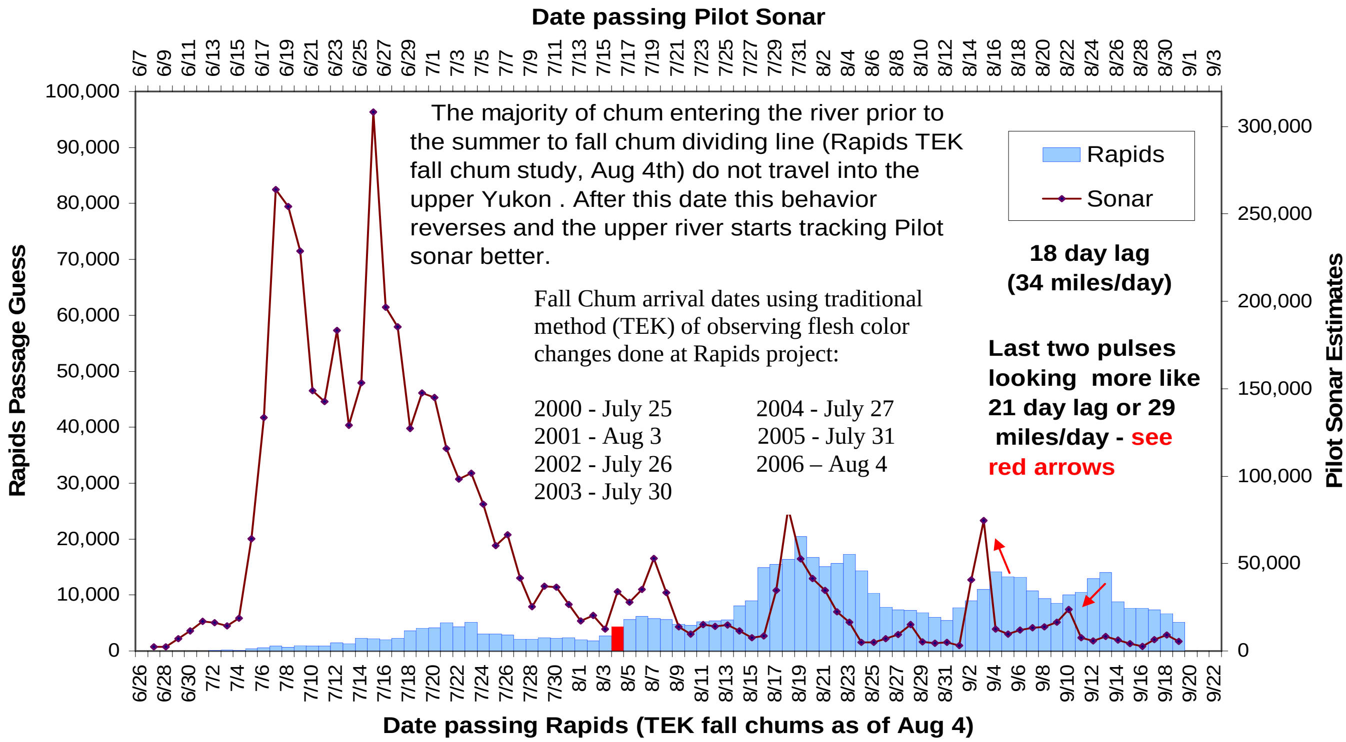


Figure 6

2000 - 2006 Fall Chum 24 hr Counts (Unadjusted for Discharge), Rapids Video (Rapids Research Center)

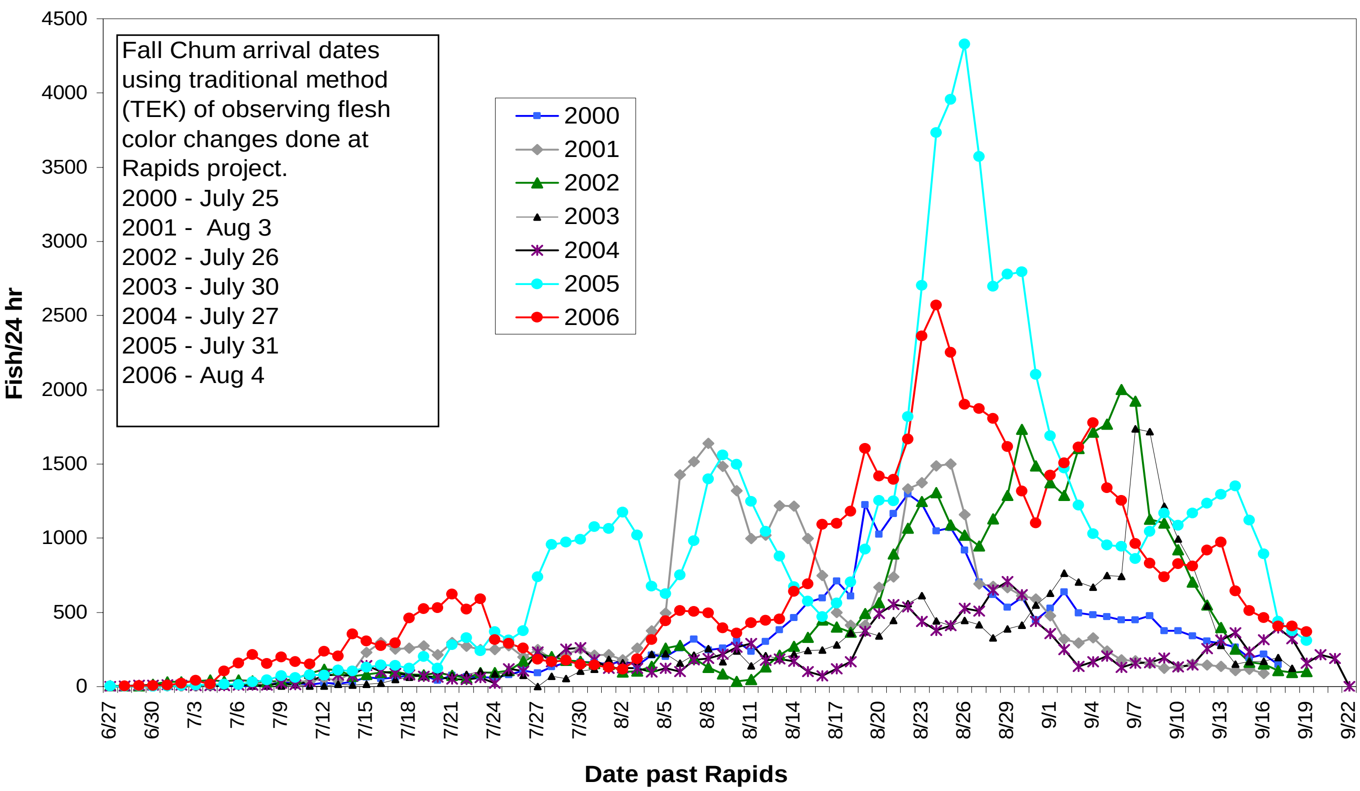
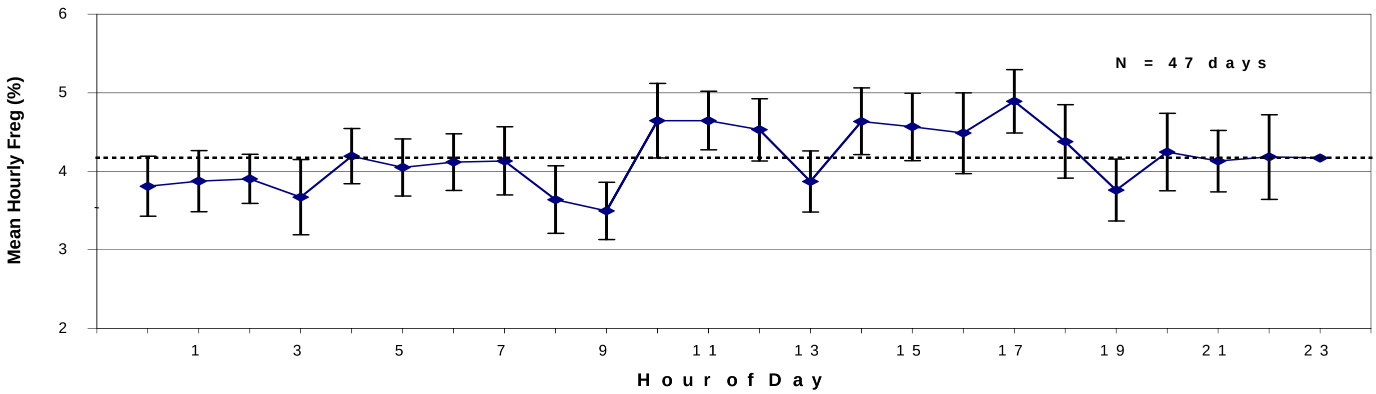


Figure 7. Diel catch patterns of 2003-2005 fall chum (Thanks to Dave Daum, USFWS)

Mean (± 2SE) hourly frequency of fall chum salmon caught at the Rapids test wheel, Yukon River. 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.



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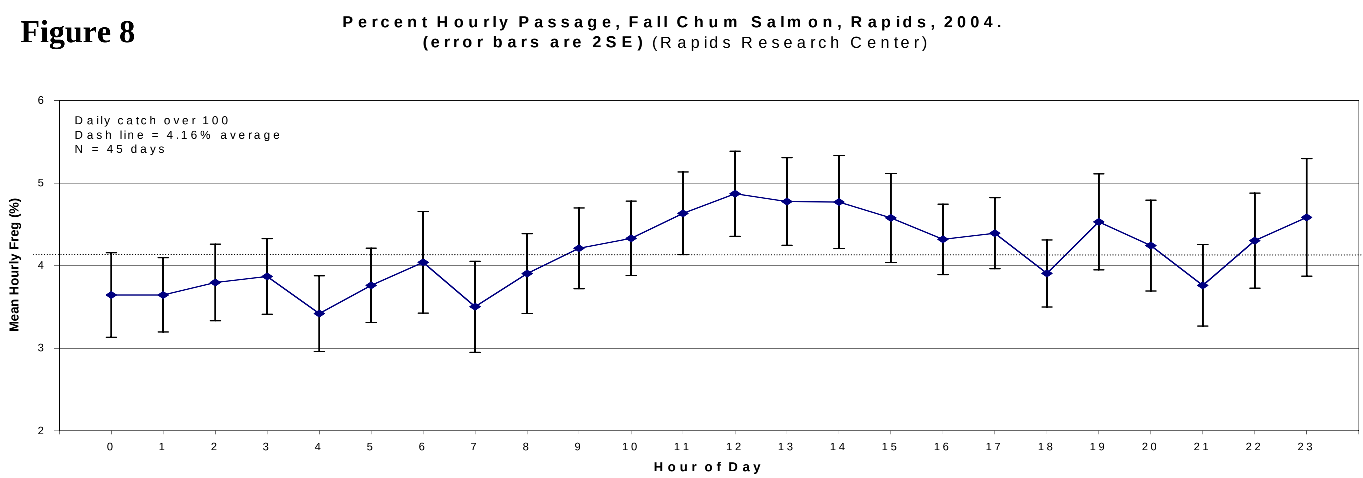

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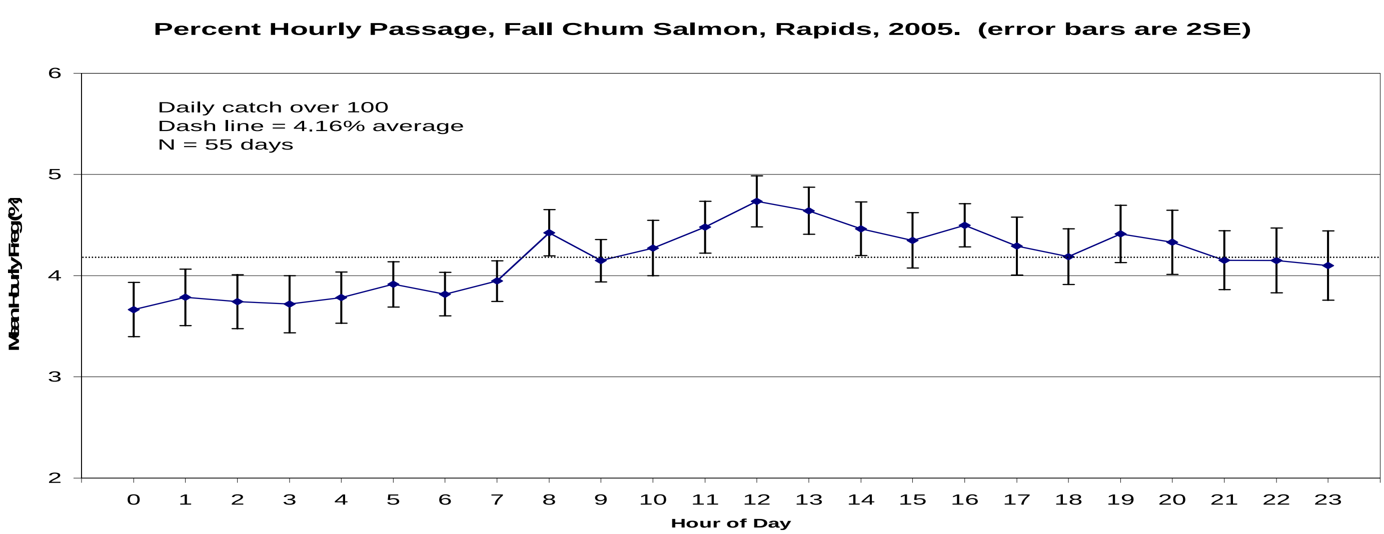
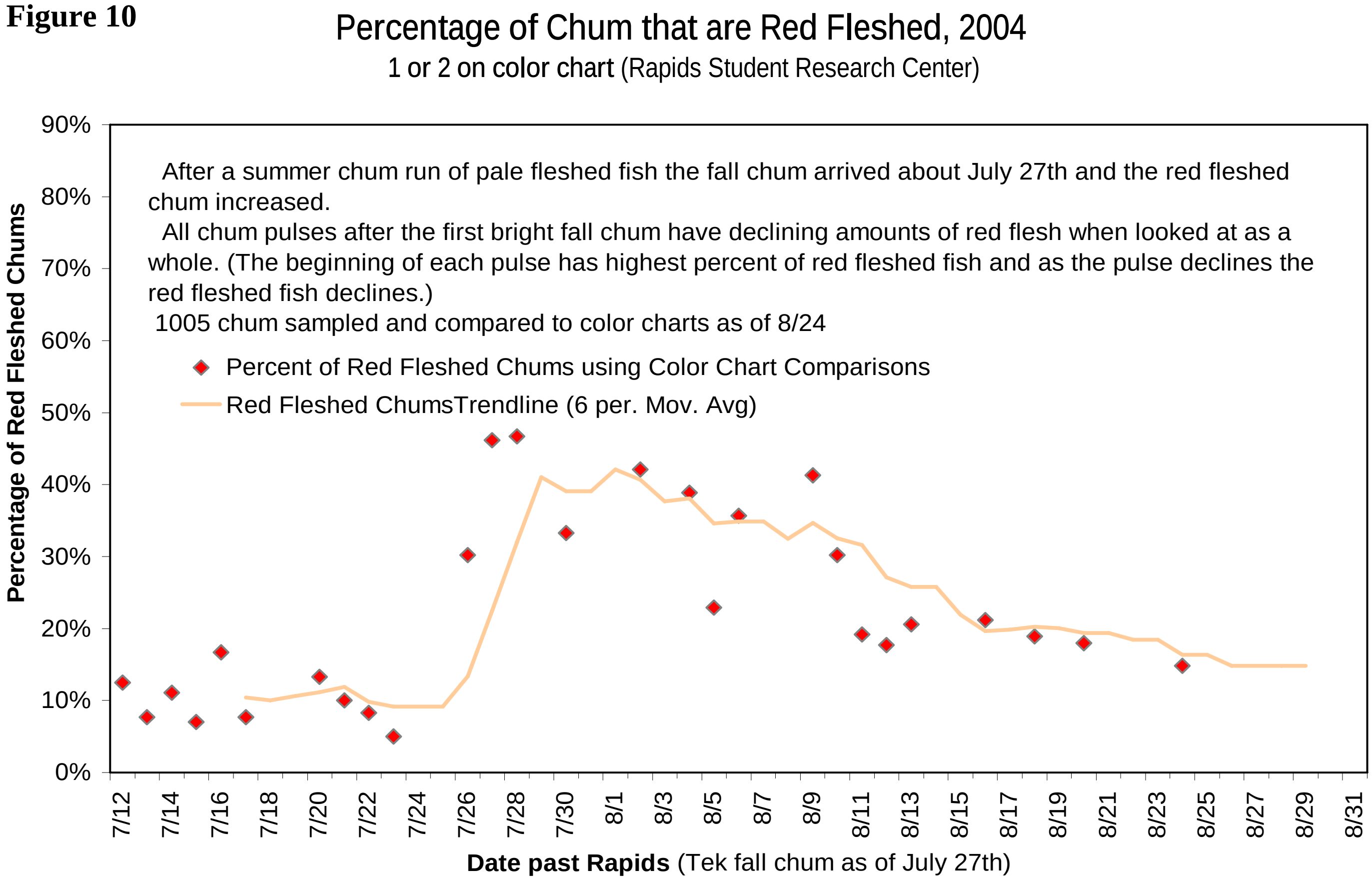


Figure 10



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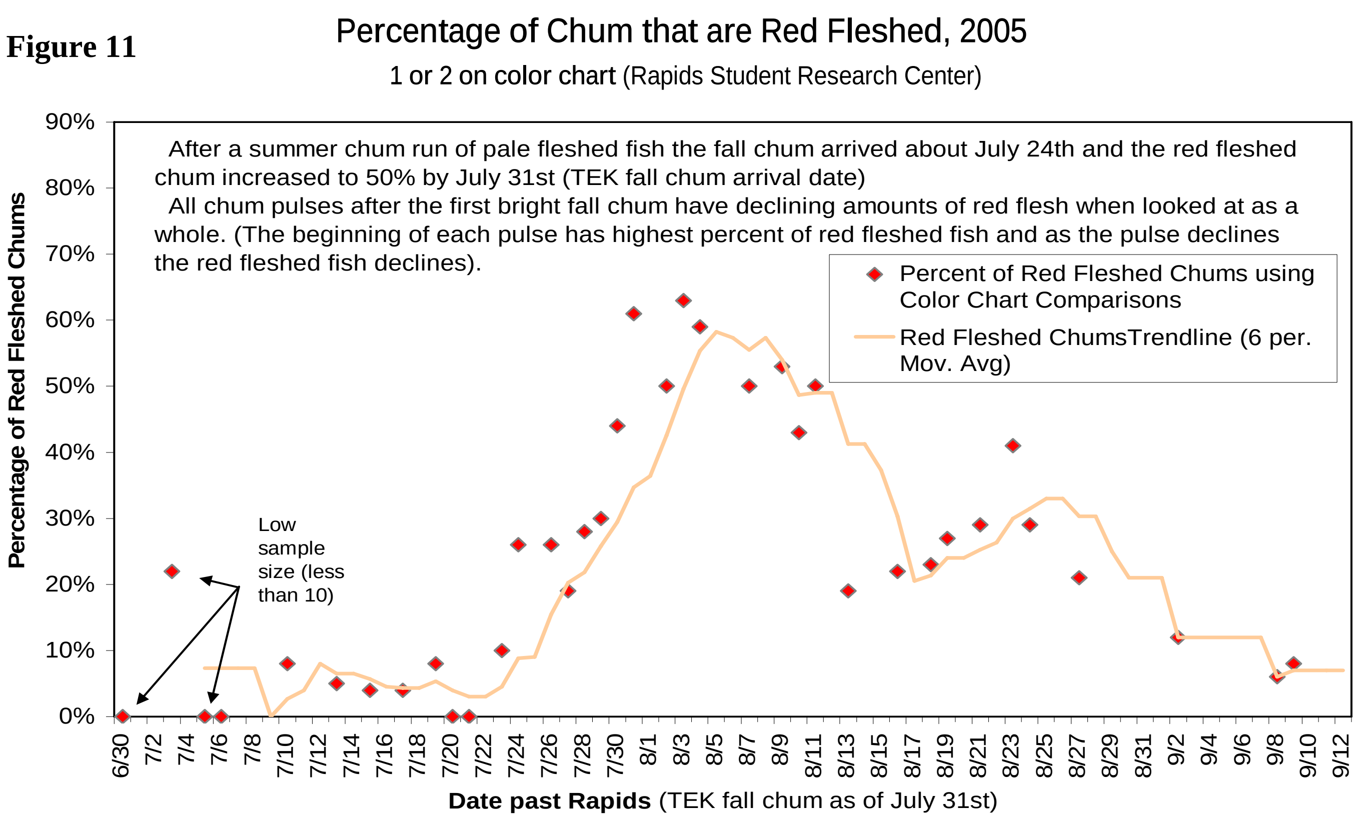

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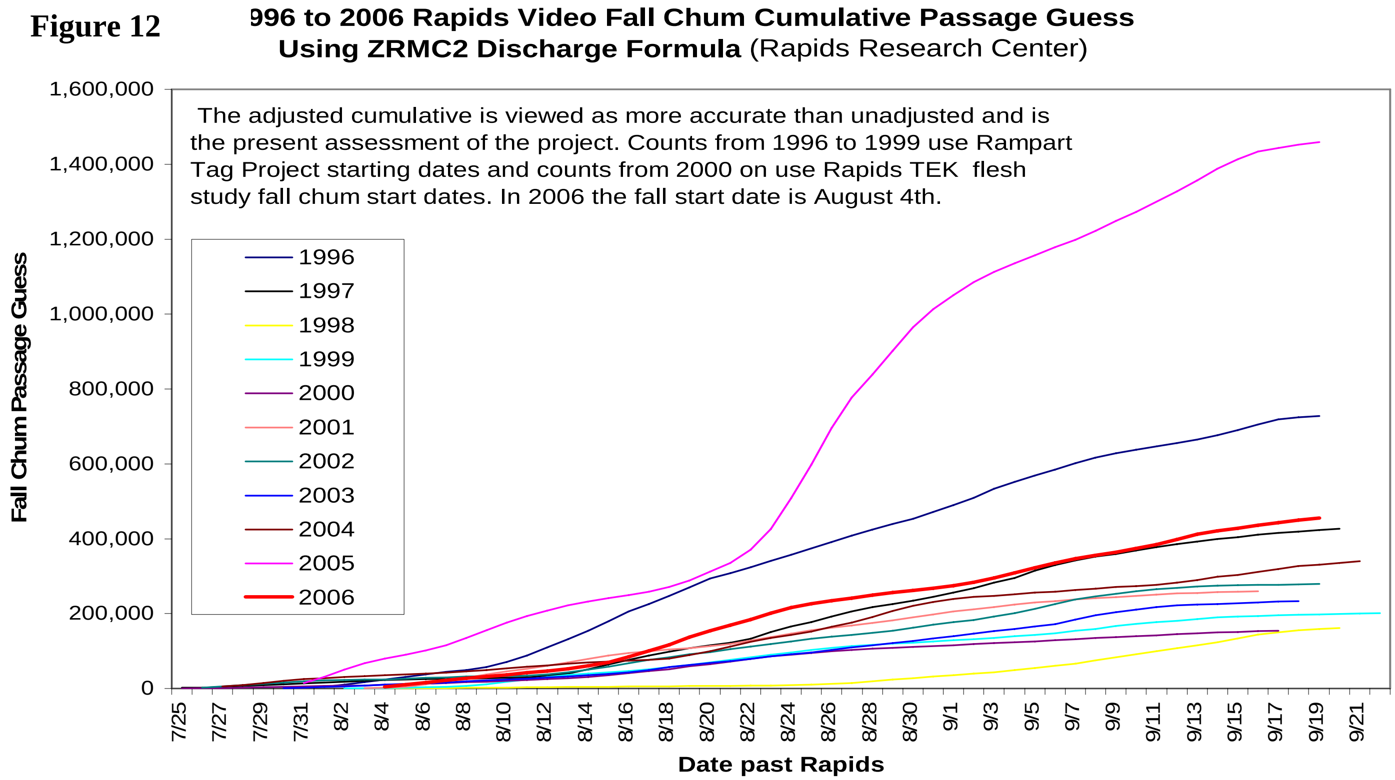

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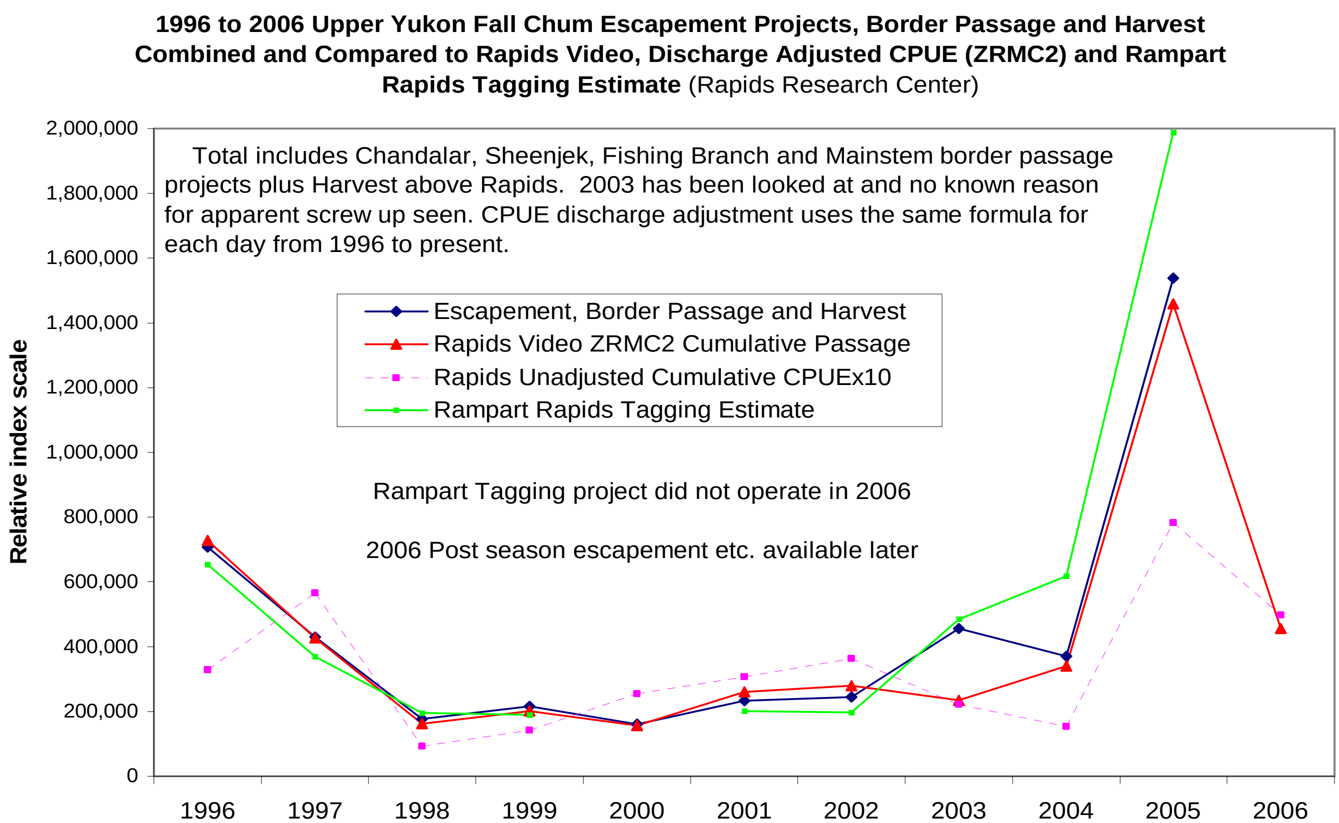
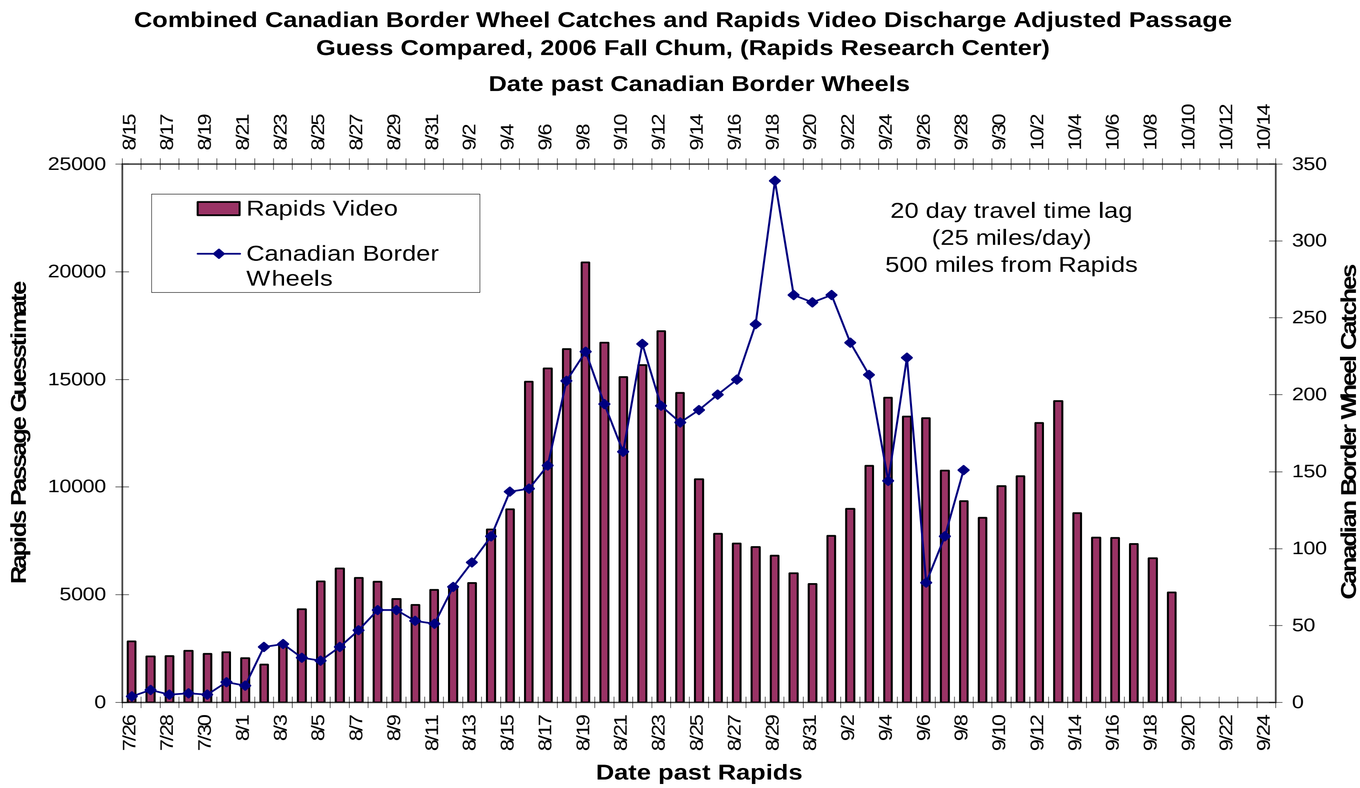


Figure 14



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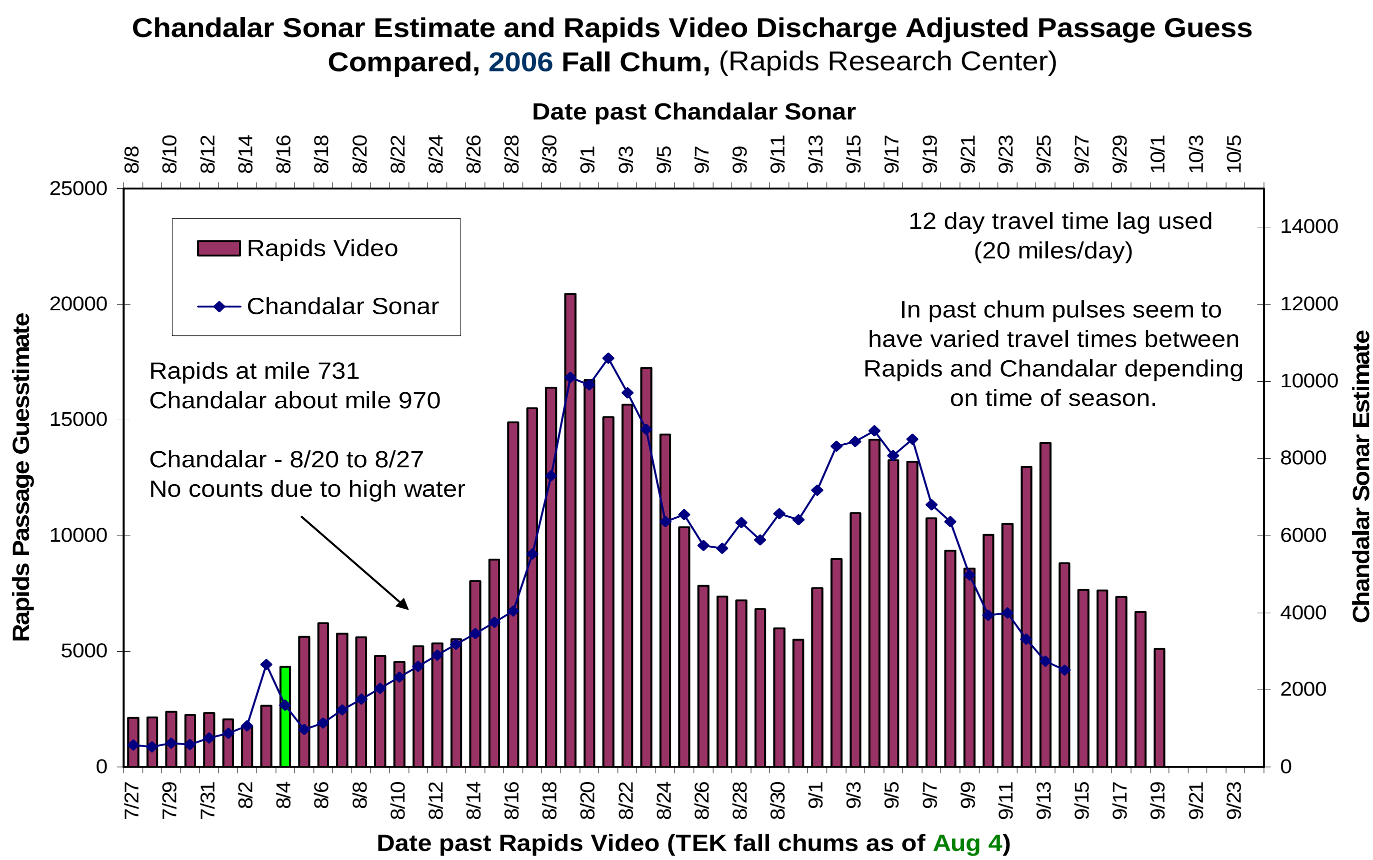

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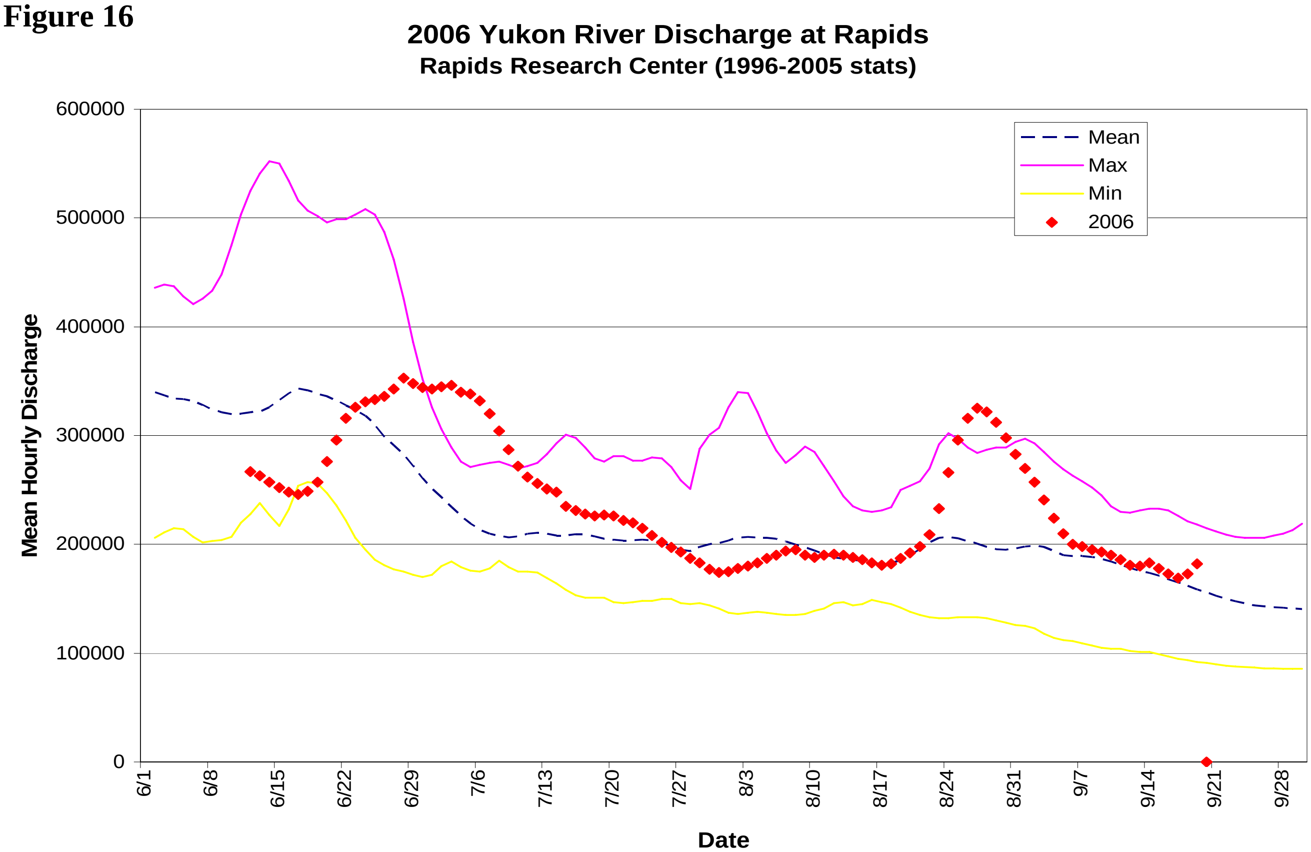


Figure 17

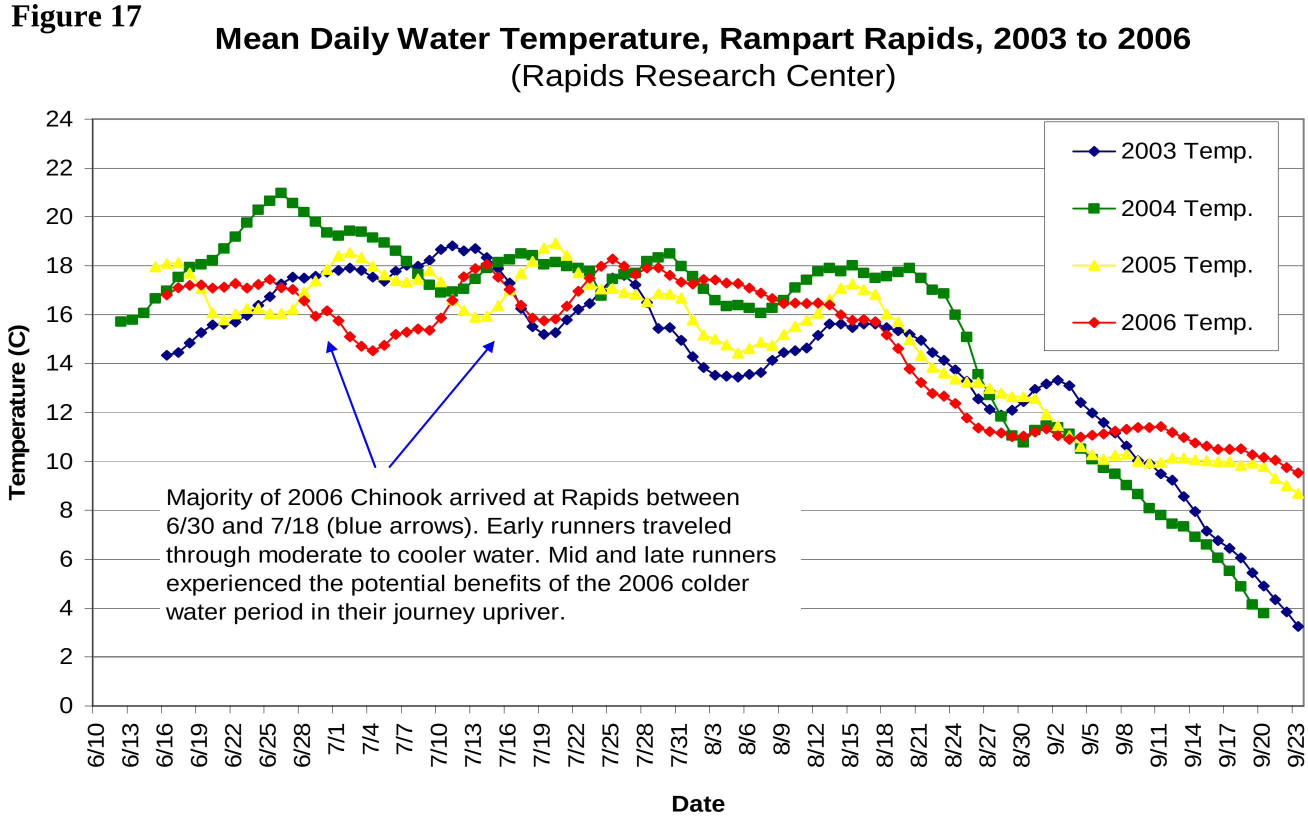
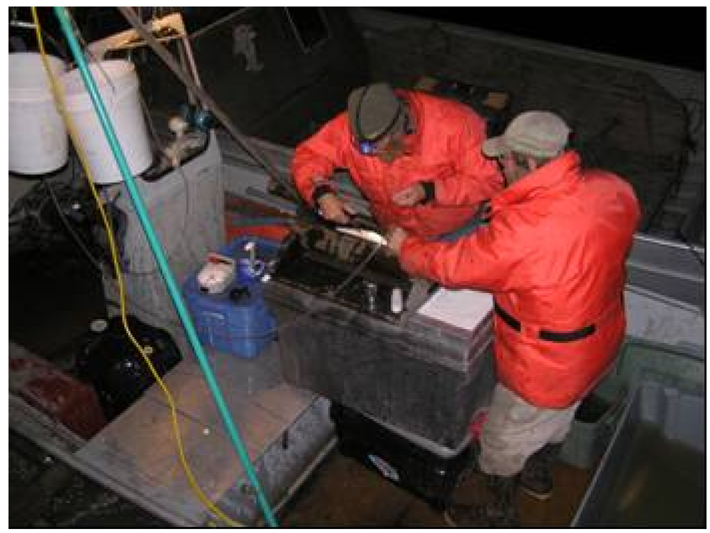


Figure 18

Rapids south bank video fish wheel – getting old – 7 years now.

New south bank wheel to be used in 2007, almost done.

Chum salmon, Bering cisco and sheefish all coming down video chute together.



Randy and Dave (USFWS) doing cisco radio tags at night by video wheel.

Strategic placement of closed cell foam padding reduces injury dramatically to the fish.

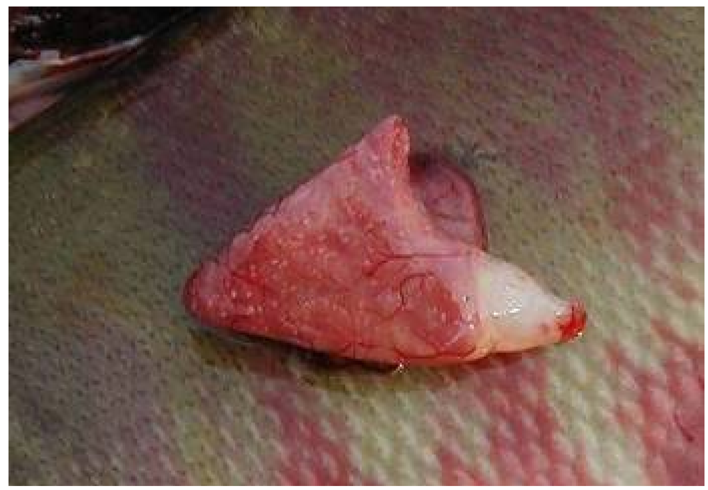
2 chums, 1 month dry, illustrate difference in oil content of the pale and red flesh chum used to determine fall chum arrival at Rapids.

Figure 19

Commercial fish buying going at Rapids video camp.

Video project oversaw student whitefish genetic data collection for Canadian biologists (DFO)

Happy subsistence fishers at Rapids.

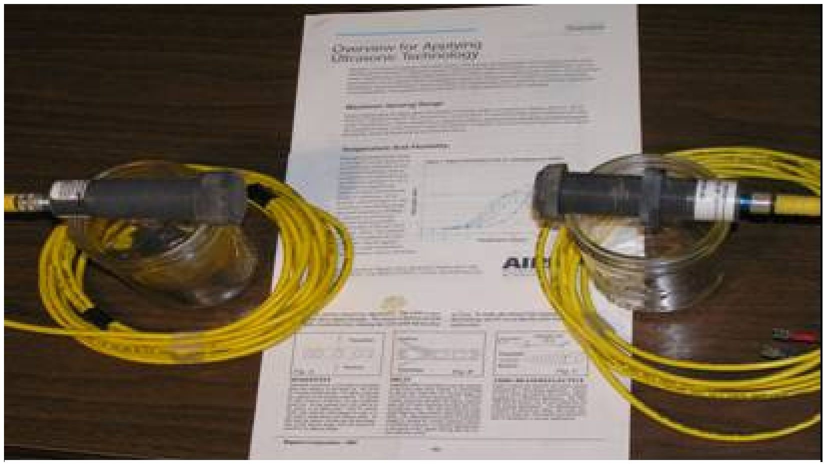


Surface white spots (often mistaken as ICH) on most whitefish, identified as meta cercarial trematode (fluke and harmless to humans and fish)

Showing students the Rapids video equipment.

During commercial openings boats arrive at the video camp and the students get lots of data.

Figure 20



Ultrasound tried unsuccessfully in 2005

Figure 21

Infrared triggered LED testing light going on as fish pass
sensor in slot mid chute (by sheefish dorsal fin).

Figure 22

Infrared transmit and receive arrays and control lunchbox

Figure 23

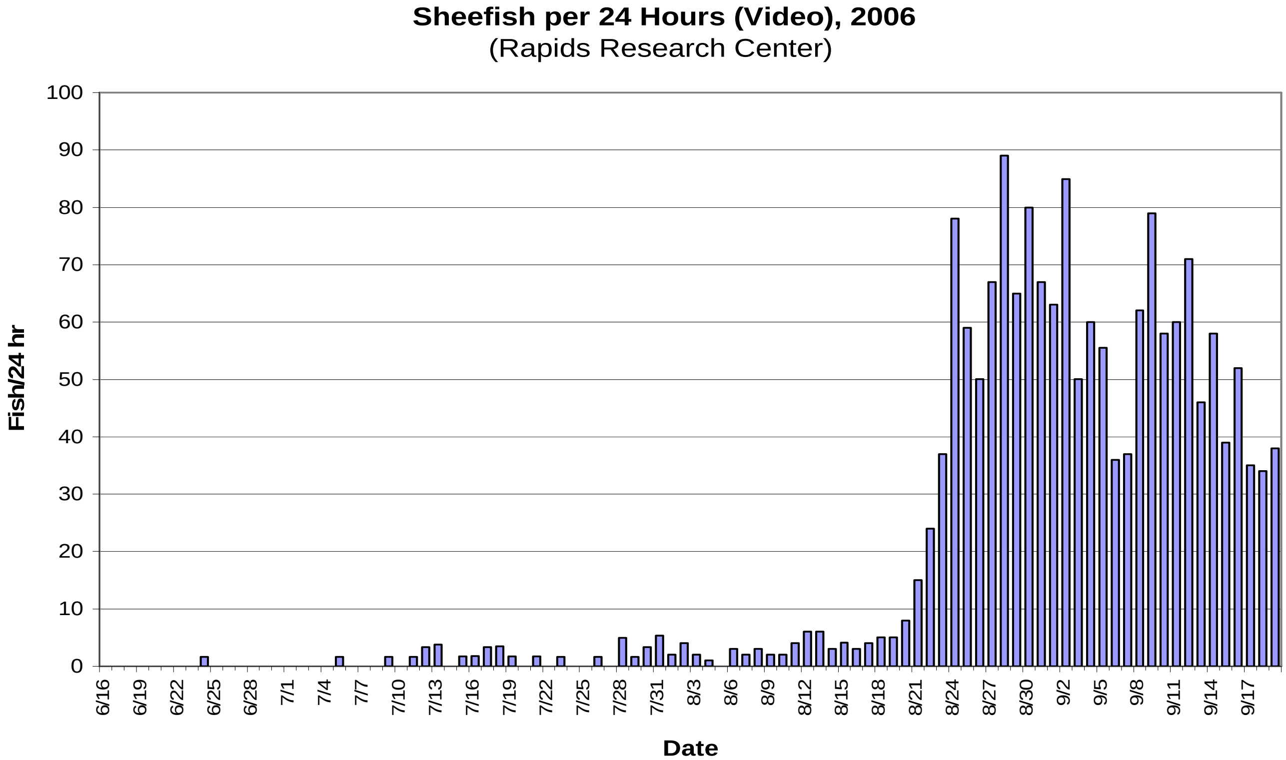


Figure 24

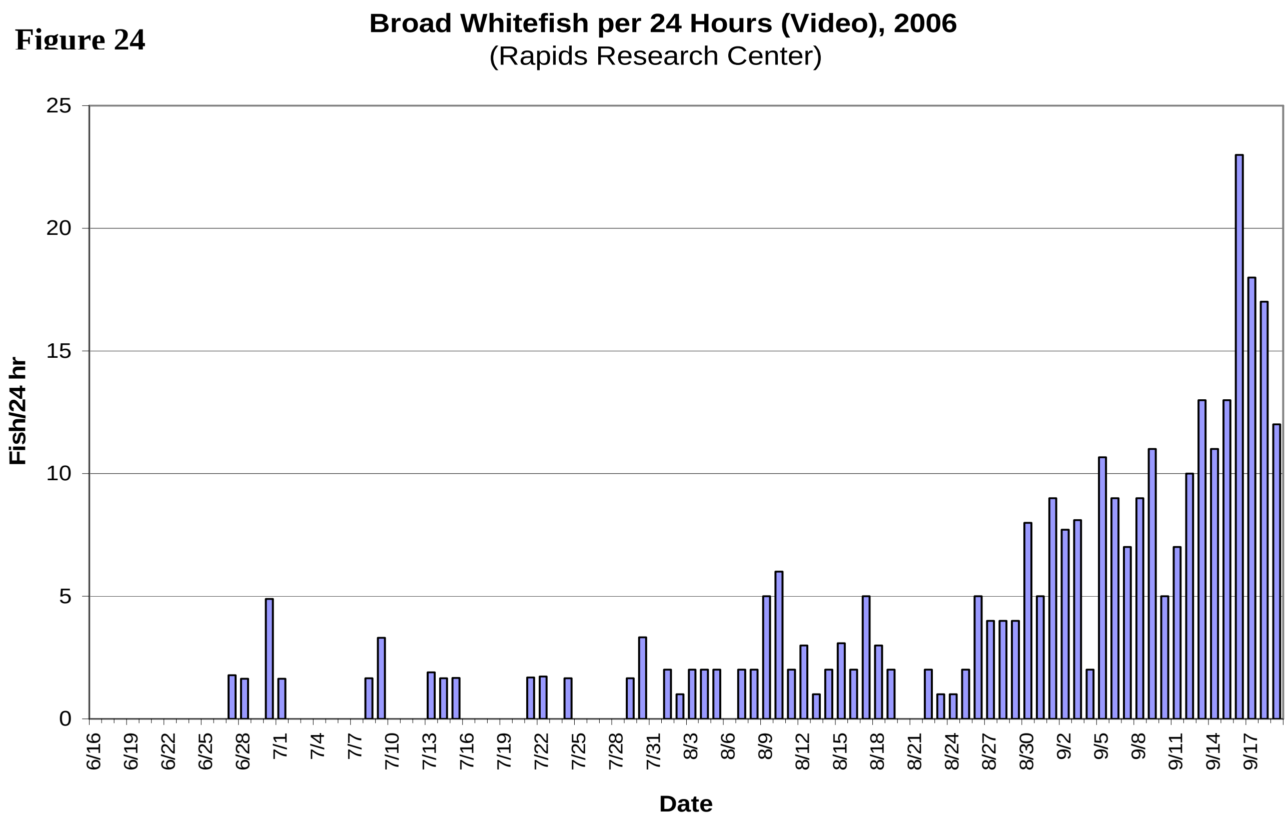


Figure 25

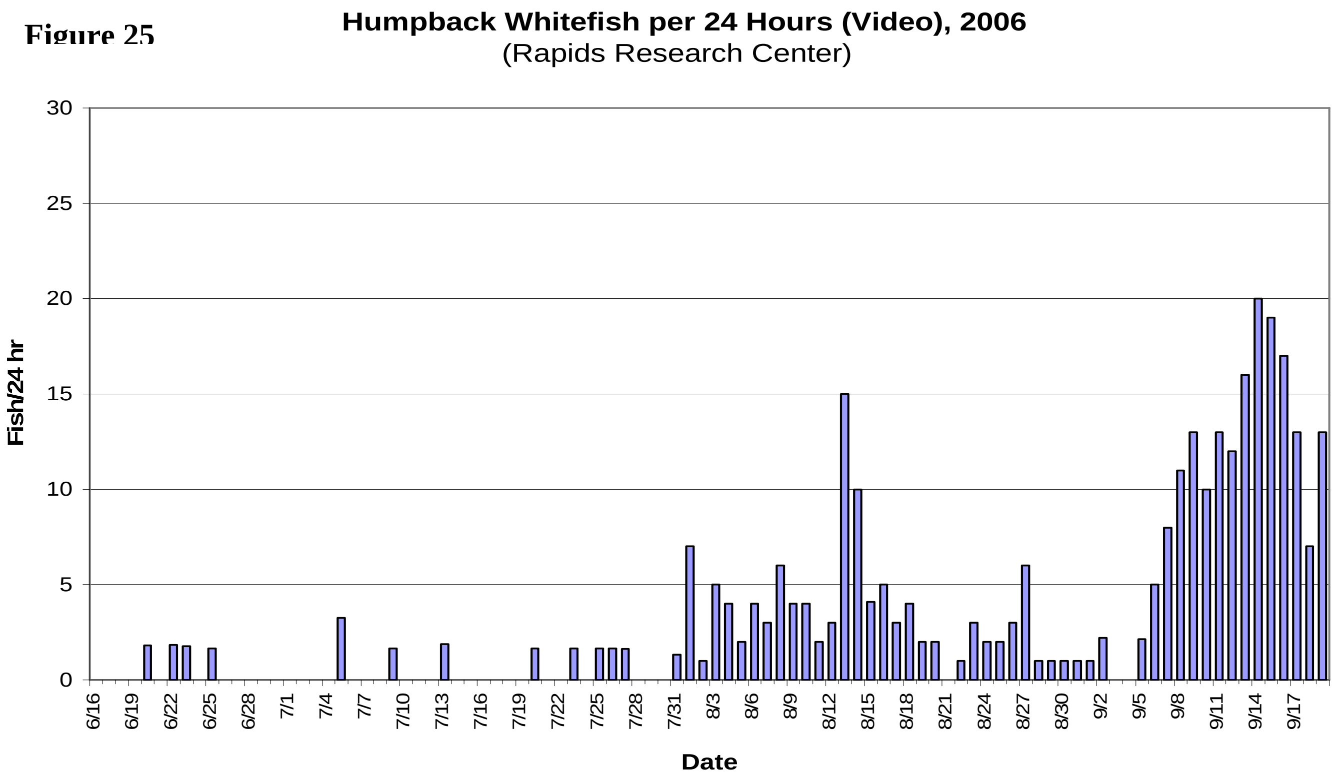


Figure 26

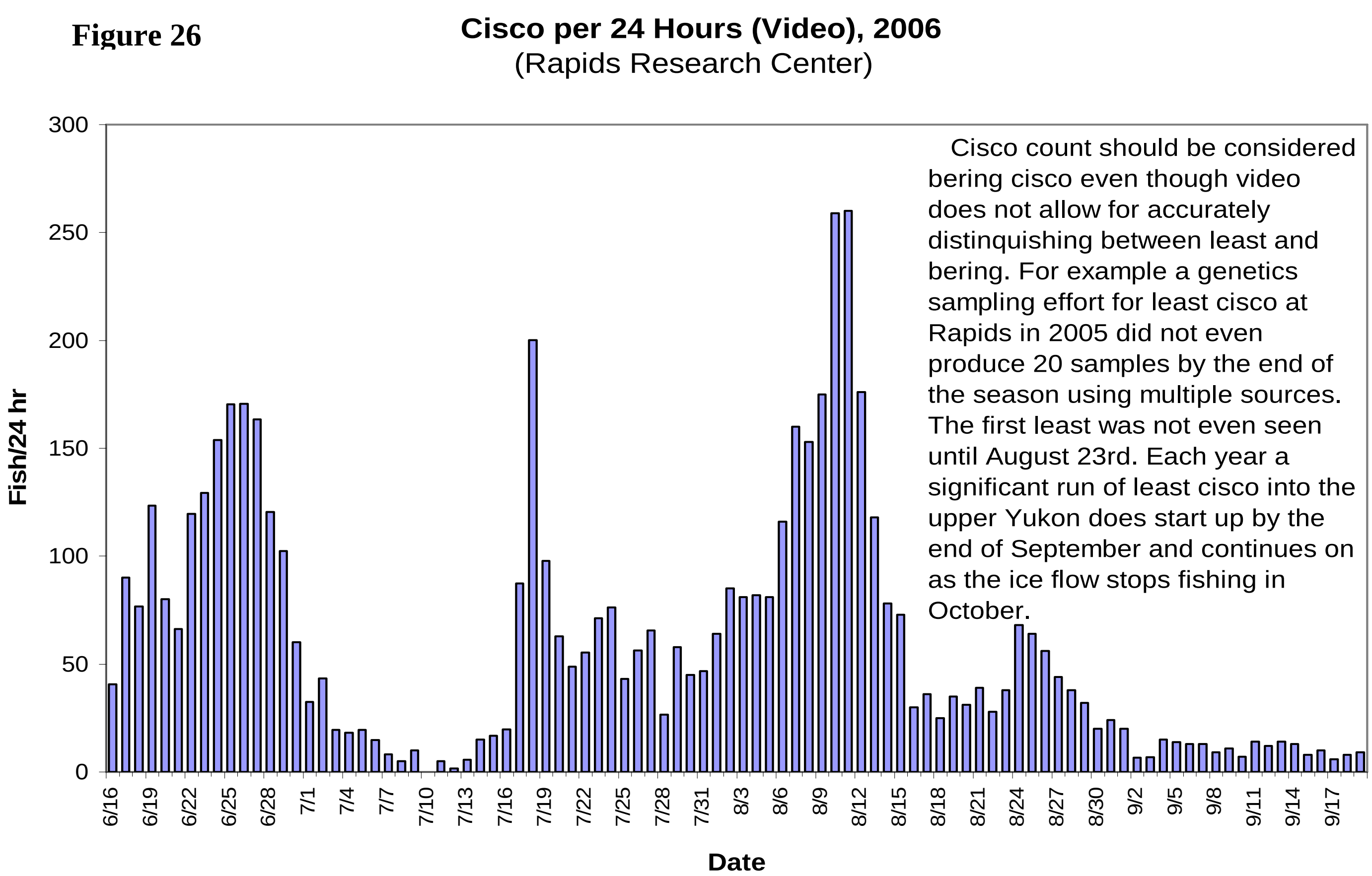


Figure 27 Site map

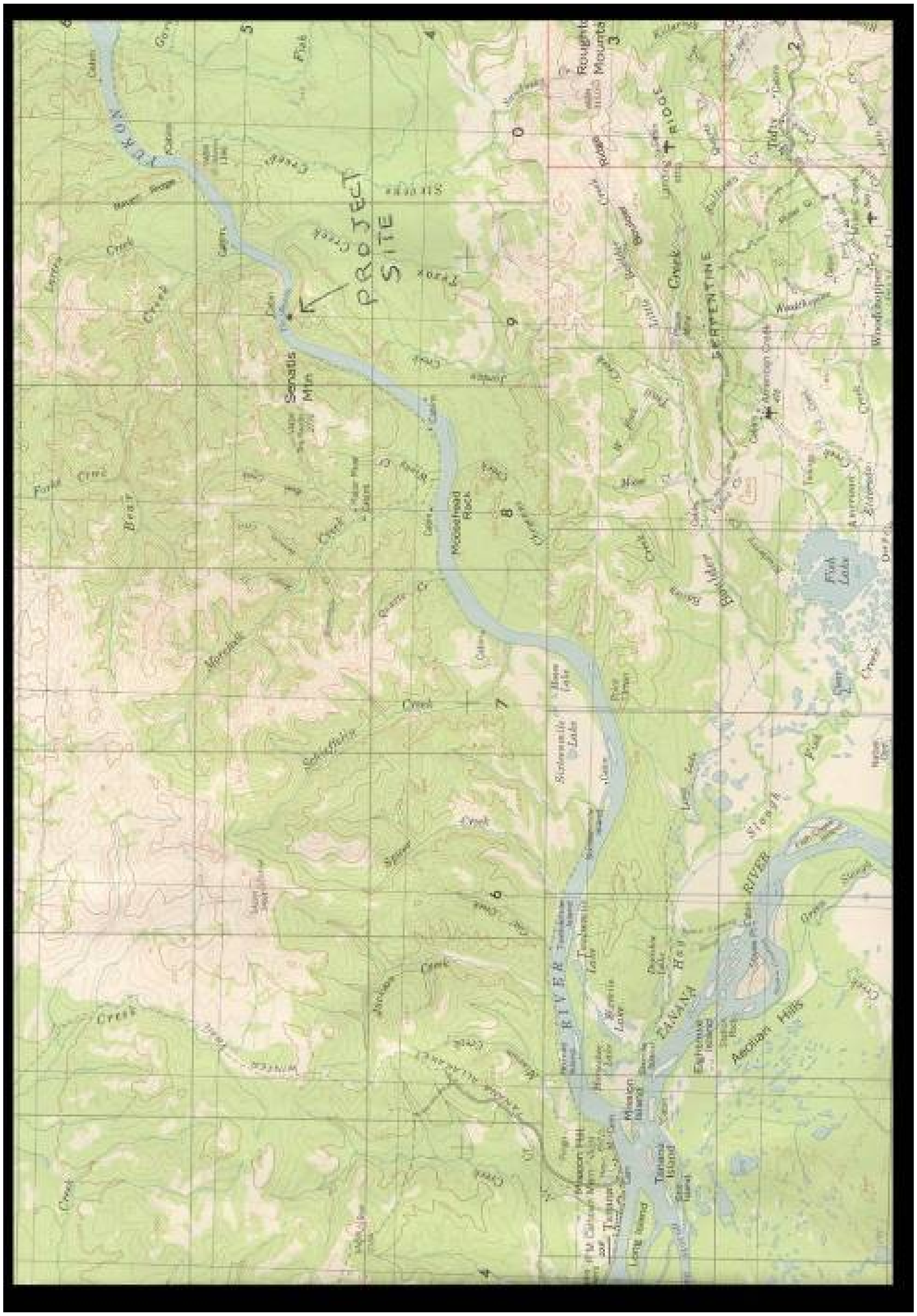


Table 2

2006 Date	Seechi Disk (cm) 1 readings	Water Temp. C
6/15/05		
6/16/05		16.81
6/17/05		17.10
6/18/05	24	17.20
6/19/05	22	17.22
6/20/05	21	17.09
6/21/05	19	17.12
6/22/05	16	17.28
6/23/05	14	17.10
6/24/05	11	17.24
6/25/05	10	17.44
6/26/05	9	17.11
6/27/05	9	17.04
6/28/05	8	16.57
6/29/05	9	15.94
6/30/05	10	16.17
7/1/05	10	15.76
7/2/05	10	15.11
7/3/05	12	14.70
7/4/05	12	14.52
7/5/05	13	14.76
7/6/05	14	15.19
7/7/05	15	15.28
7/8/05	15	15.42
7/9/05	15	15.36
7/10/05	16	15.86
7/11/05	17	16.59
7/12/05	15	17.56
7/13/05	14	17.90
7/14/05	14	18.06
7/15/05	14	17.54
7/16/05	16	17.04
7/17/05	16	16.38
7/18/05	14	15.86
7/19/05	12	15.75
7/20/05	9	15.82
7/21/05	8	16.34
7/22/05	9	16.96
7/23/05	9	17.49
7/24/05	9	17.98
7/25/05	none	18.28
7/26/05	9	17.98
7/27/05	10	17.65
7/28/05	10	17.91
7/29/05	9	17.93
7/30/05	9	17.61
7/31/05	8	17.33
8/1/05	8	17.26
8/2/05	9	17.45
8/3/05	8	17.42
8/4/05	8	17.30

2006 Date	Seechi Disk (cm) 1 readings	Water Temp. C
8/5/05	8	17.28
8/6/05	7	17.08
8/7/05	7	16.88
8/8/05	7	16.66
8/9/05	9	16.45
8/10/05	8	16.48
8/11/05	7	16.45
8/12/05	6	16.47
8/13/05	6	16.40
8/14/05	7	15.99
8/15/05	7	15.77
8/16/05	8	15.80
8/17/05	9	15.71
8/18/05	9	15.18
8/19/05	11	14.62
8/20/05	13	13.79
8/21/05	14	13.22
8/22/05	14	12.79
8/23/05	13	12.66
8/24/05	11	12.37
8/25/05	10	11.79
8/26/05	11	11.36
8/27/05	11	11.22
8/28/05	10	11.16
8/29/05	11	11.01
8/30/05	14	11.03
8/31/05	15	11.19
9/1/05	15	11.33
9/2/05	16	11.05
9/3/05	16	10.91
9/4/05	17	10.99
9/5/05	19	11.08
9/6/05	22	11.13
9/7/05	23	11.24
9/8/05	22	11.31
9/9/05	24	11.39
9/10/05	24	11.39
9/11/05	25	11.43
9/12/05	27	11.18
9/13/05	29	10.98
9/14/05	30	10.76
9/15/05	30	10.63
9/16/05	31	10.49
9/17/05	30	10.50
9/18/05	28	10.52
9/19/05	28	10.26
9/20/05		10.17
9/21/05		10.05
9/22/05		9.75
9/23/05		9.54
9/24/05		

Table 3

2006 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	Water Temp C	Water Temp F	Comments	King / 24 hr	Chum / 24 hr	ZRMC2 Discharge Adjusted Chum Daily
Fri	6/16/2006	16:55:39	23:59:59	7.07	0	0.00%	0	0	0	0	12	14.1	0	2 other king nets-no king either	0.00	0.00	0
Sat	6/17/2006	0:00:00	12:00:00	12.00	0	0.00%	0	0	0	0	45	14.3	0	lots of whitefish and sheefish in small eddies	0.00	0.00	0
Sun	6/18/2006	20:52:10	23:59:59	3.13	0	0.00%	0	0	0	0	10	15.4	0	all Rapids gear has no kings	0.00	0.00	0
Mon	6/19/2006	9:00:00	22:24:49	13.41	0	0.00%	0	0	0	0	69	16.278	61.3	only the large size early cisco running	0.00	0.00	0
Tue	6/20/2006	9:24:53	22:34:46	13.16	1	0.00%	0	0	0	1	44	16.278	61.3	1st video project king- big one	1.82	0.00	0
Wed	6/21/2006	9:50:41	22:53:27	13.05	0	0.00%	0	0	0	0	36	16.278	61.3	all Rapids gear had king last night, only 1 king all day	0.00	0.00	0
Thu	6/22/2006	9:00:00	22:02:18	13.04	0	0.00%	0	0	0	1	65	16.5	61.7	all gear had no king last night except 1 in video wheel	0.00	0.00	0
Fri	6/23/2006	8:30:00	22:02:18	13.54	0	0.00%	0	0	0	1	73	16.556	61.8	2 video king at night, all Rapids running real slow	0.00	0.00	0
Sat	6/24/2006	8:30:00	23:00:00	14.50	3	0.00%	0	1	0	0	93	16.389	61.5	generally all gear picked up a couple more but slow	4.97	0.00	0
Sun	6/25/2006	8:30:00	23:00:00	14.50	9	0.00%	0	0	0	1	103	16.833	62.3	Everyone getting little more king, nice fish	14.90	0.00	0
Mon	6/26/2006	8:30:00	22:59:12	14.49	15	6.67%	0	0	0	0	103	16.5	61.7	Big nice kings coming in (video only as it's closure)	24.85	0.00	0
Tue	6/27/2006	8:32:23	22:03:24	13.52	12	0.00%	0	0	1	0	92	16.278	61.3	Big trees, some nets shut down, wheels in danger	21.31	0.00	0
Wed	6/28/2006	8:30:00	23:15:00	14.75	24	4.17%	1	0	1	0	74	16.611	61.9	all catches up, big tree ripped CC wheel from shore	39.05	1.63	10
Thu	6/29/2006	8:30:00	23:02:50	14.55	22	18.18%	4	0	0	0	62	15.278	59.5	for 2 days-smaller+Jacks, less quality, 1st large ending?	36.30	6.60	40
Fri	6/30/2006	8:30:00	23:15:00	14.75	51	27.45%	3	0	3	0	37	15.389	59.7	#'s up, some nice, some thin and many smaller king	82.98	4.88	30
Sat	7/1/2006	8:30:00	23:15:00	14.75	92	19.57%	6	0	1	0	20	15.556	60	All Rapids gear up, 5 wheels in + about 8 nets now	149.69	9.76	60
Sun	7/2/2006	8:30:00	22:55:11	14.42	162	25.93%	13	0	0	0	26	15.667	60.2	Ran less than 2 hours for enough king for 2 day closure	269.63	21.64	131
Mon	7/3/2006	8:30:00	23:15:00	14.75	153	28.76%	26	0	0	0	12			Nice weather - people cutting fish - closure	248.95	42.31	255
Tue	7/4/2006	8:30:00	21:45:18	13.26	134	14.93%	9	0	0	0	10		0	King Pulse continues to peak at high CPUE	242.63	16.30	101
Wed	7/5/2006	8:30:00	23:15:00	14.75	130	43.85%	64	1	0	2	12	0	0	More chums , backside of king pulse?-more jacks	211.53	104.14	648
Thu	7/6/2006	8:30:00	23:09:00	14.65	177	37.29%	96	0	0	0	9	0	60.5	Kings They keep coming, Chum they keep increasing	289.97	157.27	1002
Fri	7/7/2006	8:30:00	23:00:00	14.50	129	46.51%	129	0	0	0	5	15.833	60.5	just hours before commercial video catches dropped	213.52	213.52	1428
Sat	7/8/2006	8:30:00	23:00:00	14.50	57	49.12%	94	0	1	0	3	15.833	60.7	Generally commercial catches weaker-2nd opening	94.34	155.59	1116
Sun	7/9/2006	8:30:00	23:00:00	14.50	29	41.38%	120	1	2	1	6	15.944	61	King numbers way down, closure so no others fishing	48.00	198.62	1542
Mon	7/10/2006	8:30:00	23:00:00	14.50	63	38.10%	102	0	0	0	0	16.111	61.5	Maybe front runners of 2nd king pulse	104.28	168.83	1414
Tue	7/11/2006	8:30:00	23:00:00	14.50	45	35.56%	91	1	0	0	3	16.389	63	Pulse slow on building for most Rapids gear	74.48	150.62	1331
Wed	7/12/2006	7:56:27	22:30:00	14.56	34	67.65%	144	2	0	0	1	17.222	64.9	Commercial weak and small king,	56.05	237.38	2169
Thu	7/13/2006	8:00:00	20:41:43	12.70	19	68.42%	109	2	1	1	3	18.278	65.1	Percent of small kings up last two days, lots of chum	35.92	206.06	1939
Fri	7/14/2006	8:30:00	23:00:00	14.50	53	60.38%	213	0	1	0	9	18.389	64.9	noticable Chum increase by fishers	87.72	352.55	3377
Sat	7/15/2006	8:30:00	22:52:52	14.38	38	50.00%	183	1	1	0	10	18.278	64.7	Yesterday's little spike hit Tanana day before	63.42	305.40	3172
Sun	7/16/2006	6:00:00	23:30:30	13.33	41	58.54%	152	1	0	0	11	18.167	63	some more color etc. to king now, ICH increasing	73.82	273.67	2919
Mon	7/17/2006	8:33:42	23:07:15	14.56	46	45.65%	179	2	0	0	53	17.222	61.4	closure now, cisco starting up again, 3rd pulse ?	75.83	295.07	3211
Tue	7/18/2006	8:30:00	23:43:22	13.91	33	21.21%	268	2	0	0	116	16.333	61.2	down 1 hr+ for repairs, more chum, poor king quality	56.94	462.40	5102
Wed	7/19/2006	8:30:00	22:44:29	14.24	16	43.75%	311	1	0	0	58	16.222	61	all wheels down a lot,	26.96	524.11	5743
Thu	7/20/2006	8:30:00	23:00:00	14.50	15	46.67%	320	0	0	1	38	16.111	61.5	water turbitity down as glacier water hits (normal)	24.83	529.66	5844
Fri	7/21/2006	8:00:00	22:14:38	14.24	11	36.36%	370	1	1	0	29	16.389	61.5	23 chum + 4% red flesh, 3 wheels quit king fishing	18.53	623.43	7074
Sat	7/22/2006	8:30:00	22:22:02	13.87	3	33.33%	301	0	1	0	32	16.389	63.5	25 chum + 9.4% red flesh,	5.19	520.94	5996
Sun	7/23/2006	8:30:00	23:00:00	14.50	3	33.33%	356	1	0	1	43	17.5	63.7	video wheel through king sampling-livebox open	4.97	589.24	7036
Mon	7/24/2006	8:30:00	23:00:00	14.50	8	25.00%	191	0	1	0	46	17.611	64.2	12.9% red flesh chum, 3 big red king-20lb'ers	13.24	316.14	3983
Tue	7/25/2006	8:30:00	22:59:47	14.50	13	23.08%	176	0	0	1	26	17.889	65	5.6% red	21.52	291.38	3854
Wed	7/26/2006	8:30:00	23:00:00	14.50	22	22.73%	156	1	0	1	34	18.333	64.3	mini pulse hit Tanana day before.	36.41	258.21	3563
Thu	7/27/2006	8:30:00	23:08:14	14.64	9	0.00%	112	0	0	1	40	17.944	64.2	7.6% red - people just waiting for fall chum,	14.76	183.64	2624
Fri	7/28/2006	8:30:00	23:00:00	14.50	13	38.46%	102	3	0	0	16	17.889	64.7	1 wheel ran - opinion - no fall chum yet.	21.52	168.83	2550
Sat	7/29/2006	8:30:00	23:00:00	14.50	8	37.50%	106	1	1	0	35	18.167	64.4	0% red (only 11 chum),	13.24	175.45	2754
Sun	7/30/2006	8:00:00	22:26:10	14.44	10	10.00%	89	2	2	0	27	18	63.7	to Tanana for supplies, closure - no cut chum till Tue.	16.62	147.96	2468
Mon	7/31/2006	6:00:00	23:59:59	18.00	8	25.00%	108	4	0	1	35	17.611	63.3	night lights set up - phase two light curtain testing	10.67	144.00	2479
Tue	8/1/2006	0:00:00	23:59:59	24.00	12	8.33%	130	2	2	7	64	17.389	63.3	to Tanana for supplies, closure - no cut chum till Tue.	12.00	130.00	2215
Wed	8/2/2006	0:00:00	23:59:59	24.00	6	0.00%	118	4	1	1	85	17.389	64	13.1% red chum, no fishing yet except daily dog food	6.00	118.00	1948
Thu	8/3/2006	0:00:00	23:59:59	24.00	10	10.00%	185	2	2	5	81	17.778	63.4	32.4% red with numbers up, the fall chum come	10.00	185.00	2992

Table 4

2006 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	Water Temp C	F	Comments	King / 24 hr	Chum / 24 hr	ZRMC2 Discharge Adjusted Chum Daily
Fri	8/4/2006	0:00:00	23:59:59	24.00	8	25.00%	317	1	2	4	82	17.444	64.2	**55.6% red flesh chum - Fall Chum Start**	8.00	317.00	4975
Sat	8/5/2006	0:00:00	23:59:59	24.00	3	66.67%	441	0	2	2	81	17.889	63.7	fishers cutting nice chum	3.00	441.01	6660
Sun	8/6/2006	0:00:00	23:59:59	24.00	4	0.00%	511	3	0	4	116	17.611	63	Gisasa crew here, Chum and cisco up	4.00	511.01	7504
Mon	8/7/2006	0:00:00	23:59:59	24.00	6	0.00%	504	2	2	3	160	17.222	62.6	Chum steady - cisco up more	6.00	504.01	7139
Tue	8/8/2006	0:00:00	23:59:59	24.00	4	25.00%	496	3	2	6	153	17	62.1	Campbell ran 100/hr - video ran 33/hr -normal	4.00	496.01	6964
Wed	8/9/2006	0:00:00	23:59:59	24.00	4	0.00%	395	2	5	4	175	16.722	62.1	a little more skin color now to chum but nice flesh	4.00	395.00	5801
Thu	8/10/2006	0:00:00	23:59:59	24.00	0	0.00%	361	2	6	4	259	16.722	61.8	only 5 Rapids fishers actve cutting	0.00	361.00	5401
Fri	8/11/2006	0:00:00	23:59:59	24.00	2	0.00%	429	4	2	2	260	16.556	62.2	bad weather drying people food-better see sun soon	2.00	429.00	6300
Sat	8/12/2006	0:00:00	23:59:59	24.00	2	0.00%	446	6	3	3	176	16.778	62.1	rain and chum steady and cisco down some	2.00	446.01	6490
Sun	8/13/2006	0:00:00	23:59:59	24.00	1	0.00%	455	6	1	15	118	16.722	61.7	rain but some clearing, only 5 households left fishing	1.00	455.01	6682
Mon	8/14/2006	0:00:00	23:59:59	24.00	1	0.00%	641	3	2	10	78	16.5	61.8	sunny day but closure, 2nd pulse comes	1.00	641.01	9590
Tue	8/15/2006	0:00:00	23:59:59	23.37	3	100.00%	674	4	3	4	71	16.556	60.8	1st chum commercial	3.08	692.17	10553
Wed	8/16/2006	0:00:00	23:59:59	24.00	0	0.00%	1092	3	2	5	30	16	61.2	Bill and Adam here,	0.00	1092.01	17140
Thu	8/17/2006	0:00:00	23:59:59	24.00	2	0.00%	1098	4	5	3	36	16.222	61	to Tanana for supplies,	2.00	1098.01	17579
Fri	8/18/2006	0:00:00	23:59:59	24.00	0	0.00%	1182	5	3	4	25	16.111	59.2	Rain, Rain, Rain, and more chum, water colder	0.00	1182.01	18736
Sat	8/19/2006	0:00:00	23:59:59	24.00	0	0.00%	1603	5	2	2	35	15.111	59	Laurie and Adam by, big rain	0.00	1603.02	24208
Sun	8/20/2006	0:00:00	23:59:59	24.00	0	0.00%	1417	8	0	2	31	15	57	Water temp falling, Water rising	0.00	1417.02	20433
Mon	8/21/2006	0:00:00	23:59:59	24.00	0	0.00%	1397	15	0	0	39	13.889	57.3	cutting dry dog fish, lesser nice flesh chum	0.00	1397.02	19110
Tue	8/22/2006	0:00:00	23:59:59	24.00	1	0.00%	1668	24	2	1	28	14.056	54.2	Water really coming up and drift hitting wheel	1.00	1668.02	20852
Wed	8/23/2006	0:00:00	23:59:59	24.00	0	0.00%	2361	37	1	3	38	12.333	52.5	water up 18", chum catch up	0.00	2361.03	24848
Thu	8/24/2006	0:00:00	23:59:59	24.00	0	0.00%	2571	78	1	2	68	11.389	54.5	water up 18", Moving fish racks and cut spare pole	0.00	2571.03	22225
Fri	8/25/2006	0:00:00	23:59:59	24.00	2	0.00%	2252	59	2	2	64	12.5	53.7	water up but slowing, chum down, sheefish running	2.00	2252.03	16748
Sat	8/26/2006	0:00:00	23:59:59	24.00	0	0.00%	1902	50	5	3	56	12.056	52.4	water up but cresting tomorrow supposidly	0.00	1902.02	12940
Sun	8/27/2006	0:00:00	23:59:59	24.00	0	0.00%	1873	67	4	6	44	11.333	52.7	Water cresting, chum down, sheefish running good	0.00	1873.02	12272
Mon	8/28/2006	0:00:00	23:59:59	24.00	1	0.00%	1805	89	4	1	38	11.5	52.7	Light sensors running capture, assessments run also	1.00	1805.02	11974
Tue	8/29/2006	0:00:00	23:59:59	24.00	0	0.00%	1618	65	4	1	32	11.5	52.3	Dave and Randy (USFWS) here, sensors good	0.00	1618.02	11199
Wed	8/30/2006	0:00:00	23:59:59	24.00	0	0.00%	1317	80	8	1	20	11.278	52.4	Big sheefish day, Chums down, cisco down	0.00	1317.02	9704
Thu	8/31/2006	0:00:00	23:59:59	24.00	0	0.00%	1103	67	5	1	24	11.333	52.3	Chum continue down,	0.00	1103.01	8732
Fri	9/1/2006	0:00:00	23:59:59	24.00	0	0.00%	1423	63	9	1	20	11.278	52.9	pulse three maybe starting, Dave+Randy left	0.00	1423.02	12041
Sat	9/2/2006	0:00:00	21:45:13	21.75	0	0.00%	1366	77	7	2	6	11.611	52.2	Hunters moving downriver lately	0.00	1507.06	13695
Sun	9/3/2006	6:15:00	23:59:59	17.75	0	0.00%	1195	37	6	0	5	11.222	52.2	Leaves getting yellow, Chum up slowly	0.00	1615.80	16154
Mon	9/4/2006	0:00:00	23:59:59	24.00	0	0.00%	1777	60	2	0	15	11.222	52.4	Campbell ran approx. 100/hr, Cribbing starting CC	0.00	1777.02	19881
Tue	9/5/2006	0:00:00	23:59:59	22.49	0	0.00%	1339	52	10	2	13	11.333	52	Down over 1 hour for repairs, all okay. Chum down	0.00	1428.90	17724
Wed	9/6/2006	0:00:00	23:59:59	24.00	0	0.00%	1253	36	9	5	13	11.111	52.6	CC still cribbing, new video wheel out of water	0.00	1253.01	16851
Thu	9/7/2006	0:00:00	23:59:59	24.00	0	0.00%	994	37	7	8	13	11.444	52.9	Mike, Adam, Laurie by, chum down	0.00	994.01	13597
Fri	9/8/2006	0:00:00	23:59:59	24.00	0	0.00%	829	62	9	11	9	11.611	52.7	Broads and humpies definitely starting now	0.00	829.01	11639
Sat	9/9/2006	0:00:00	23:59:59	24.00	0	0.00%	738	79	11	13	11	11.5	52.7	Log hit basket - broke front - no down time	0.00	738.01	10547
Sun	9/10/2006	0:00:00	23:59:59	24.00	0	0.00%	826	58	5	10	7	11.5	52.4	Pulse 4 maybe, crib raft made	0.00	826.01	12130
Mon	9/11/2006	0:00:00	23:59:59	24.00	0	0.00%	811	60	7	13	14	11.333	52.4	started cc wheel for crib, pulse 4?	0.00	811.01	12365
Tue	9/12/2006	0:00:00	23:59:59	24.00	0	0.00%	919	71	10	12	12	11.333	52.7	CC wheel got I coho (4000 fish about),	0.00	919.01	14713
Wed	9/13/2006	0:00:00	23:59:59	24.00	0	0.00%	973	46	13	16	14	11.5	52.5	1st video coho, 4th pulse still building	0.00	973.01	15736
Thu	9/14/2006	0:00:00	23:59:59	24.00	0	0.00%	645	58	11	20	13	11.389	51.8	Pulse 4 ending, fish slow this year- high water!	0.00	645.01	10124
Fri	9/15/2006	0:00:00	23:59:59	24.00	0	0.00%	513	39	13	19	8	11	51.4	water temp falling slowly - finally, chum down	0.00	513.01	8468
Sat	9/16/2006	0:00:00	23:59:59	24.00	0	0.00%	463	52	23	17	10	10.778	51.2	downriver wheel 1 coho yesterday, water steady	0.00	463.01	8059
Sun	9/17/2006	0:00:00	23:59:59	24.00	0	0.00%	408	35	18	13	6	10.667	51.2	broke main edge of basket on log - no down tied up	0.00	408.00	7425
Mon	9/18/2006	0:00:00	23:59:59	24.00	0	0.00%	406	34	17	7	8	10.667	51.3	1 coho, water up a little,	0.00	406.00	7067
Tue	9/19/2006	0:00:00	23:59:59	24.00	0	0.00%	368	38	12	13	9	10.722		ripped livebox off wheel - me, not a log - on pupose	0.00	368.00	5833

Table 5

2006 All Video CPUE Summary - Rampart 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	6/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	40.7
Sat	2	6/17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	90.0
Sun	3	6/18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	76.7
Mon	4	6/19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	123.5
Tue	5	6/20	0.1	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.8	3.3	80.2
Wed	6	6/21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	66.2
Thu	7	6/22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.8	5.0	119.6
Fri	8	6/23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.8	5.4	129.4
Sat	9	6/24	0.2	5.0	0.0	0.0	0.1	1.7	0.0	0.0	0.0	0.0	6.4	153.9
Sun	10	6/25	0.6	14.9	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.7	7.1	170.5
Mon	11	6/26	1.0	24.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	170.6
Tue	12	6/27	0.9	21.3	0.0	0.0	0.0	0.0	0.1	1.8	0.0	0.0	6.8	163.4
Wed	13	6/28	1.6	39.1	0.1	1.6	0.0	0.0	0.1	1.6	0.0	0.0	5.0	120.4
Thu	14	6/29	1.5	36.3	0.3	6.6	0.0	0.0	0.0	0.0	0.0	0.0	4.3	102.3
Fri	15	6/30	3.5	83.0	0.2	4.9	0.0	0.0	0.2	4.9	0.0	0.0	2.5	60.2
Sat	16	7/1	6.2	149.7	0.4	9.8	0.0	0.0	0.1	1.6	0.0	0.0	1.4	32.5
Sun	17	7/2	11.2	269.6	0.9	21.6	0.0	0.0	0.0	0.0	0.0	0.0	1.8	43.3
Mon	18	7/3	10.4	248.9	1.8	42.3	0.0	0.0	0.0	0.0	0.0	0.0	0.8	19.5
Tue	19	7/4	10.1	242.6	0.7	16.3	0.0	0.0	0.0	0.0	0.0	0.0	0.8	18.1
Wed	20	7/5	8.8	211.5	4.3	104.1	0.1	1.6	0.0	0.0	0.1	3.3	0.8	19.5
Thu	21	7/6	12.1	290.0	6.6	157.3	0.0	0.0	0.0	0.0	0.0	0.0	0.6	14.7
Fri	22	7/7	8.9	213.5	8.9	213.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	8.3
Sat	23	7/8	3.9	94.3	6.5	155.6	0.0	0.0	0.1	1.7	0.0	0.0	0.2	5.0
Sun	24	7/9	2.0	48.0	8.3	198.6	0.1	1.7	0.1	3.3	0.1	1.7	0.4	9.9
Mon	25	7/10	4.3	104.3	7.0	168.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tue	26	7/11	3.1	74.5	6.3	150.6	0.1	1.7	0.0	0.0	0.0	0.0	0.2	5.0
Wed	27	7/12	2.3	56.0	9.9	237.4	0.1	3.3	0.0	0.0	0.0	0.0	0.1	1.6
Thu	28	7/13	1.5	35.9	8.6	206.1	0.2	3.8	0.1	1.9	0.1	1.9	0.2	5.7
Fri	29	7/14	3.7	87.7	14.7	352.6	0.0	0.0	0.1	1.7	0.0	0.0	0.6	14.9
Sat	30	7/15	2.6	63.4	12.7	305.4	0.1	1.7	0.1	1.7	0.0	0.0	0.7	16.7
Sun	31	7/16	3.1	73.8	11.4	273.7	0.1	1.8	0.0	0.0	0.0	0.0	0.8	19.8
Mon	32	7/17	3.2	75.8	12.3	295.1	0.1	3.3	0.0	0.0	0.0	0.0	3.6	87.4
Tue	33	7/18	2.4	56.9	19.3	462.4	0.1	3.5	0.0	0.0	0.0	0.0	8.3	200.1
Wed	34	7/19	1.1	27.0	21.8	524.1	0.1	1.7	0.0	0.0	0.0	0.0	4.1	97.7
Thu	35	7/20	1.0	24.8	22.1	529.7	0.0	0.0	0.0	0.0	0.1	1.7	2.6	62.9
Fri	36	7/21	0.8	18.5	26.0	623.4	0.1	1.7	0.1	1.7	0.0	0.0	2.0	48.9
Sat	37	7/22	0.2	5.2	21.7	520.9	0.0	0.0	0.1	1.7	0.0	0.0	2.3	55.4
Sun	38	7/23	0.2	5.0	24.6	589.2	0.1	1.7	0.0	0.0	0.1	1.7	3.0	71.2
Mon	39	7/24	0.6	13.2	13.2	316.1	0.0	0.0	0.1	1.7	0.0	0.0	3.2	76.1
Tue	40	7/25	0.9	21.5	12.1	291.4	0.0	0.0	0.0	0.0	0.1	1.7	1.8	43.0
Wed	41	7/26	1.5	36.4	10.8	258.2	0.1	1.7	0.0	0.0	0.1	1.7	2.3	56.3
Thu	42	7/27	0.6	14.8	7.7	183.6	0.0	0.0	0.0	0.0	0.1	1.6	2.7	65.6
Fri	43	7/28	0.9	21.5	7.0	168.8	0.2	5.0	0.0	0.0	0.0	0.0	1.1	26.5
Sat	44	7/29	0.6	13.2	7.3	175.4	0.1	1.7	0.1	1.7	0.0	0.0	2.4	57.9
Sun	45	7/30	0.7	16.6	6.2	148.0	0.1	3.3	0.1	3.3	0.0	0.0	1.9	44.9
Mon	46	7/31	0.4	10.7	6.0	144.0	0.2	5.3	0.0	0.0	0.1	1.3	1.9	46.7

Table 6

2006 All Video CPUE Summary - Rampart Rapids (Continued)

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
Tue	47	8/1	0.5	12.0	5.4	130.0	0.1	2.0	0.1	2.0	0.3	7.0	2.7	64.0
Wed	48	8/2	0.3	6.0	4.9	118.0	0.2	4.0	0.0	1.0	0.0	1.0	3.5	85.0
Thu	49	8/3	0.4	10.0	7.7	185.0	0.1	2.0	0.1	2.0	0.2	5.0	3.4	81.0
Fri	50	8/4	0.3	8.0	13.2	317.0	0.0	1.0	0.1	2.0	0.2	4.0	3.4	82.0
Sat	51	8/5	0.1	3.0	18.4	441.0	0.0	0.0	0.1	2.0	0.1	2.0	3.4	81.0
Sun	52	8/6	0.2	4.0	21.3	511.0	0.1	3.0	0.0	0.0	0.2	4.0	4.8	116.0
Mon	53	8/7	0.3	6.0	21.0	504.0	0.1	2.0	0.1	2.0	0.1	3.0	6.7	160.0
Tue	54	8/8	0.2	4.0	20.7	496.0	0.1	3.0	0.1	2.0	0.3	6.0	6.4	153.0
Wed	55	8/9	0.2	4.0	16.5	395.0	0.1	2.0	0.2	5.0	0.2	4.0	7.3	175.0
Thu	56	8/10	0.0	0.0	15.0	361.0	0.1	2.0	0.3	6.0	0.2	4.0	10.8	259.0
Fri	57	8/11	0.1	2.0	17.9	429.0	0.2	4.0	0.1	2.0	0.1	2.0	10.8	260.0
Sat	58	8/12	0.1	2.0	18.6	446.0	0.3	6.0	0.1	3.0	0.1	3.0	7.3	176.0
Sun	59	8/13	0.0	1.0	19.0	455.0	0.3	6.0	0.0	1.0	0.6	15.0	4.9	118.0
Mon	60	8/14	0.0	1.0	26.7	641.0	0.1	3.0	0.1	2.0	0.4	10.0	3.3	78.0
Tue	61	8/15	0.1	3.1	28.8	692.2	0.2	4.1	0.1	3.1	0.2	4.1	3.0	72.9
Wed	62	8/16	0.0	0.0	45.5	1092.0	0.1	3.0	0.1	2.0	0.2	5.0	1.3	30.0
Thu	63	8/17	0.1	2.0	45.8	1098.0	0.2	4.0	0.2	5.0	0.1	3.0	1.5	36.0
Fri	64	8/18	0.0	0.0	49.3	1182.0	0.2	5.0	0.1	3.0	0.2	4.0	1.0	25.0
Sat	65	8/19	0.0	0.0	66.8	1603.0	0.2	5.0	0.1	2.0	0.1	2.0	1.5	35.0
Sun	66	8/20	0.0	0.0	59.0	1417.0	0.3	8.0	0.0	0.0	0.1	2.0	1.3	31.0
Mon	67	8/21	0.0	0.0	58.2	1397.0	0.6	15.0	0.0	0.0	0.0	0.0	1.6	39.0
Tue	68	8/22	0.0	1.0	69.5	1668.0	1.0	24.0	0.1	2.0	0.0	1.0	1.2	28.0
Wed	69	8/23	0.0	0.0	98.4	2361.0	1.5	37.0	0.0	1.0	0.1	3.0	1.6	38.0
Thu	70	8/24	0.0	0.0	107.1	2571.0	3.3	78.0	0.0	1.0	0.1	2.0	2.8	68.0
Fri	71	8/25	0.1	2.0	93.8	2252.0	2.5	59.0	0.1	2.0	0.1	2.0	2.7	64.0
Sat	72	8/26	0.0	0.0	79.3	1902.0	2.1	50.0	0.2	5.0	0.1	3.0	2.3	56.0
Sun	73	8/27	0.0	0.0	78.0	1873.0	2.8	67.0	0.2	4.0	0.3	6.0	1.8	44.0
Mon	74	8/28	0.0	1.0	75.2	1805.0	3.7	89.0	0.2	4.0	0.0	1.0	1.6	38.0
Tue	75	8/29	0.0	0.0	67.4	1618.0	2.7	65.0	0.2	4.0	0.0	1.0	1.3	32.0
Wed	76	8/30	0.0	0.0	54.9	1317.0	3.3	80.0	0.3	8.0	0.0	1.0	0.8	20.0
Thu	77	8/31	0.0	0.0	46.0	1103.0	2.8	67.0	0.2	5.0	0.0	1.0	1.0	24.0
Fri	78	9/1	0.0	0.0	59.3	1423.0	2.6	63.0	0.4	9.0	0.0	1.0	0.8	20.0
Sat	79	9/2	0.0	0.0	62.8	1507.1	3.5	85.0	0.3	7.7	0.1	2.2	0.3	6.6
Sun	80	9/3	0.0	0.0	67.3	1615.8	2.1	50.0	0.3	8.1	0.0	0.0	0.3	6.8
Mon	81	9/4	0.0	0.0	74.0	1777.0	2.5	60.0	0.1	2.0	0.0	0.0	0.6	15.0
Tue	82	9/5	0.0	0.0	59.5	1428.9	2.3	55.5	0.4	10.7	0.1	2.1	0.6	13.9
Wed	83	9/6	0.0	0.0	52.2	1253.0	1.5	36.0	0.4	9.0	0.2	5.0	0.5	13.0
Thu	84	9/7	0.0	0.0	41.4	994.0	1.5	37.0	0.3	7.0	0.3	8.0	0.5	13.0
Fri	85	9/8	0.0	0.0	34.5	829.0	2.6	62.0	0.4	9.0	0.5	11.0	0.4	9.0
Sat	86	9/9	0.0	0.0	30.8	738.0	3.3	79.0	0.5	11.0	0.5	13.0	0.5	11.0
Sun	87	9/10	0.0	0.0	34.4	826.0	2.4	58.0	0.2	5.0	0.4	10.0	0.3	7.0
Mon	88	9/11	0.0	0.0	33.8	811.0	2.5	60.0	0.3	7.0	0.5	13.0	0.6	14.0
Tue	89	9/12	0.0	0.0	38.3	919.0	3.0	71.0	0.4	10.0	0.5	12.0	0.5	12.0
Wed	90	9/13	0.0	0.0	40.5	973.0	1.9	46.0	0.5	13.0	0.7	16.0	0.6	14.0
Thu	91	9/14	0.0	0.0	26.9	645.0	2.4	58.0	0.5	11.0	0.8	20.0	0.5	13.0
Fri	92	9/15	0.0	0.0	21.4	513.0	1.6	39.0	0.5	13.0	0.8	19.0	0.3	8.0
Sat	93	9/16	0.0	0.0	19.3	463.0	2.2	52.0	1.0	23.0	0.7	17.0	0.4	10.0
Sun	94	9/17	0.0	0.0	17.0	408.0	1.5	35.0	0.8	18.0	0.5	13.0	0.3	6.0
Mon	95	9/18	0.0	0.0	16.9	406.0	1.4	34.0	0.7	17.0	0.3	7.0	0.3	8.0
Tue	96	9/19	0.0	0.0	15.3	368.0	1.6	38.0	0.5	12.0	0.5	13.0	0.4	9.0

Table 7

All Season 2006 Final Assessment of Video Capture System

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

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

Fish found on Luminescence capture AVI are considered as fish assessed.

Minimun of six hours or the first 50 fish of each assessment day are used for the assessment samples.

Assessments coincide with times suitible to luminesence capture (cloudy) and available time.

No.	Date	Fish assessed	Large fish assessed	Large fish captured	small Cisco assessed	small Cisco captured	Missed (reason)
4	6/19	55	0	0	55	51	4 (cisco)
9	6/24	71	0	0	71	68	3 (cisco)
14	6/29	81	25	25	56	54	2 (cisco)
29	7/14	72	70	70	2	2	0
58	8/12	50	31	31	19	18	1 (cisco)
66	8/20	82	81	81	1	1	0
Infrared trigger (Barbie) doing the video capture from this point on							
74	8/28	224	223	222	1	1	1 (large) (2nd fish timing)
78	9/1	604	600 fish asssessed		598 captured		2 (2nd fish timing, not sure)
84	9/8	67	67 assessed		67 captured		0
89	9/12	42	42 assessed		42 captured		0

majority of # 74 and 78 assessed post season, small / large separation of fish not needed for infrared assessments

Infrared testing history (code named Barbie): Barbie set for sensing tests (light on - off) on 7/12 at beginning of day. Ran without cleaning or any misses till 7/18 at mid day at which time silt and slime buildup cause erratic behavior. Both lenses cleaned and 1 fogged up probably from cleaning foam or water so unit dried over night. On 7/19 Barbie going again without cleaning or any misses till on 7/26 Barbie got to slimy again and pretty much quit operating. No testing done for 7/26. On 7/27 Barbie was cleaned for second time and testing done. On 7/28 Barbie came out for a silicone seal on one unit and only partial testing that day. On 7/31drying and seal done and Barbie back and testing resumed (all that full day also) with a regular once a day cleaning of lenses using wet fingers (3 fingered swip method). On 8/1 observed the first cisco leap over light array. On 8/4 and 8/16 a chum leaped array. On 8/21 around 6 pm Barbie had fog betwween inner and outer lenses on 1 unit and would not go on anymore. Taken out on 8/22 for drying and seal. On 8/28 with improved method of silicone seals on both units Barbie set up running system using daily wipe cleaning of lenses at 7 pm. Capture frame rates changed (4/9 from 6/7) and did small inseason assessment (no misses) but ran luminescence capture for longer time for a post season evaluation assessment also (#74). Captured a fly on 8/29. On 8/31 went to 2/10 on frame rate. Ran another inseason (0 misses) assessment and longer luminescence capture for second post season evaluation on 9/1(#78). On 9/5 captured a series of fly frames for a short period and a moth on 9/8. Did inseason assessments on 9/8 and 9/12 with no misses.

Initial sensor / light testing prior to running system was done on 20,757 fish. Except for slime problems or fogging no fish going through beams ever failed to light 12 volt testing light. Testing was done in conjunction with counting at times with most attention to CPUE. So slight possibility of failures exist but none were spotted. Test light events numbered approximately 20,757.

Barbie was responsible for finishing out the season to 9/19 and counted 25,111 fish

Disclaimer

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