

Document ID #P111670
Report covers work performed under BPA contract #4826
Report was completed under BPA contract #24594

Duck Valley Reservoirs Fish Stocking and O&M

Annual Progress Report
Performance Period: October 1, 2005 – September 30, 2006

Prepared by:

Jake Sellman, Project Manager

AND

Tim Dykstra, Director

Department of Fish, Wildlife and Parks
Shoshone-Paiute Tribes
P.O. Box 219
Owyhee, NV 89832

Funded by:

U.S. Department of Energy
Bonneville Power Administration
Division of Fish and Wildlife
Portland, OR 97208-3621

BPA Project Number: 1995-015-06
Contract Number: 4826

Abstract/Executive Summary

*The Duck Valley Reservoirs Fish Stocking and Operations and Maintenance (DV Fisheries) project is an ongoing resident fish program designed to enhance both subsistence fishing, educational opportunities for Tribal members of the Shoshone-Paiute Tribes, and recreational fishing facilities for non-Tribal members. In addition to stocking rainbow trout (*Oncorhynchus mykiss*) in Mountain View, Lake Billy Shaw, and Sheep Creek Reservoirs, the program also intends to afford and maintain healthy aquatic conditions for fish growth and survival, to provide superior facilities with wilderness qualities to attract non-Tribal angler use, and to offer clear, consistent communication with the Tribal community about this project as well as outreach and education within the region and the local community.*

Tasks for this performance period are divided into operations and maintenance plus monitoring and evaluation. Operation and maintenance of the three reservoirs include fences, roads, dams and all reservoir structures, feeder canals, water troughs and stock ponds, educational signs, vehicles and equipment, and outhouses. Monitoring and evaluation activities included creel, gillnet, wildlife, and bird surveys, water quality and reservoir structures monitoring, native vegetation planting, photo point documentation, control of encroaching exotic vegetation, and community outreach and education.

The three reservoirs are monitored in terms of water quality and fishery success. Sheep Creek Reservoir was the least productive as a result of high turbidity levels and constraining water quality parameters. Lake Billy Shaw trout were in poorer condition than in previous years potentially as a result of water quality or other factors. Mountain View Reservoir trout exhibit the best health of the three reservoirs and was the only reservoir to receive constant flows of water.

Introduction

The Snake River Basin is estimated to have contained 79% of the stream miles suitable for chinook salmon in the Columbia River Basin (Idaho Department of Fish and Game 1985). Using the stream mile estimate, IDFG estimated that 650,000 - 1,030,000 adult chinook, 117,000 - 229,800 steelhead, and 14,400 - 57,400 sockeye were produced annually in the Snake River and its tributaries above what is now Hells Canyon Dam.

With the completion of the Hells Canyon Complex, anadromous salmonids were extirpated from the upper portion of the Snake River and its tributaries. In the Northwest Power and Conservation Council's (NWPCC) 1994 Columbia River Basin Fish and Wildlife Program (Program), the NWPCC acknowledged that "Salmon and steelhead probably will never be able to return to some areas of the basin because of blockages by dams. These areas include the areas above Chief Joseph and Grand Coulee Dams, the Hells Canyon Complex and other smaller blocked areas." Subsequently, the NWPCC suggested that: 1) mitigation in blocked areas is appropriate where salmon and steelhead were affected by the development and operation of the hydroelectric projects and 2) to treat the Columbia River and its tributaries as a system, resident fish substitutions are reasonable for lost salmon and steelhead in areas where in-kind mitigation cannot occur. This suggestion encompassed the Duck Valley Indian Reservation (DVIR).

The DVIR encompasses approximately 289,820 tribally-owned acres equally straddling the Idaho and Nevada border, and there are approximately 1,800 enrolled Tribal members from the Northern Paiute and the Western Shoshone Tribes. The Reservation is in the Middle Snake Province and both the Bruneau and Owhyee subbasins. As indicated in Figure 1, the Reservation is both remote and isolated; the closest town centers are Elko, Nevada and Mountain Home, Idaho, both approximately 100 miles from the Reservation's small town of Owyhee. These centers are the closest places to obtain supplies.

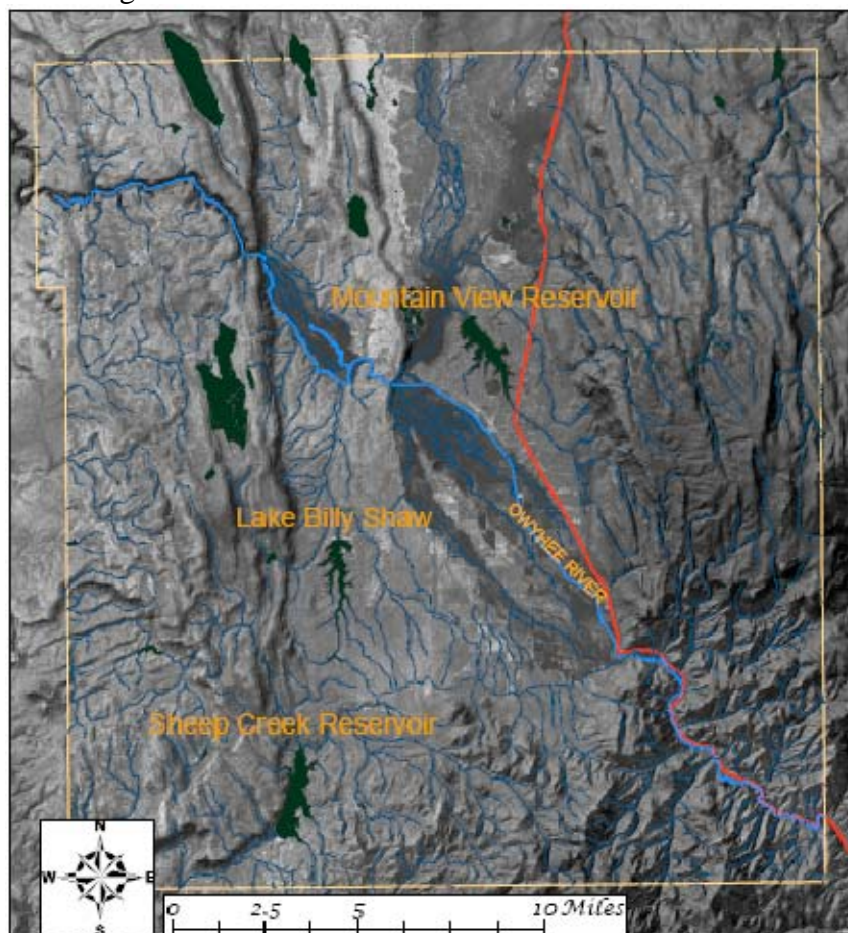
Figure 1: Location of the DVIR in relation to the Pacific Northwest



There are three reservoirs on the DVIR that the project oversees, Sheep Creek, Mountain View, and Lake Billy Shaw (Figure 2). All three water bodies are contained by earthen dams and are dependent on the irrigation system that supports the local agriculture. Vegetation in the drainage basins of all three reservoirs is a mainly xeric, shrub steppe vegetative community with intermittent wetland vegetation. Typical vegetation includes Great Basin shrub cover types including various forbs, sagebrush, rabbitbrush, and grasses such as Idaho fescue. Other herbaceous layers have been eliminated and plant diversity has decreased due to grazing (1997 EA and FONSI). The surrounding habitat supports big game (mainly antelope), carnivores, waterfowl, migratory bird species, raptors, reptiles, and amphibians. The three reservoirs are important elements to the DVIR in terms of providing and protecting large tracts of habitat and providing sustainable resources to the local Tribal members.

Sheep Creek Reservoir (SCR) was built in the mid-50's and is the most southern of the three. It is the largest and has a surface area of approximately 855 acres and a maximum depth of 23 feet. This reservoir is fed from the same canal as Lake Billy Shaw. This reservoir is well known throughout the western states for its highly productive trout fishery. Fly anglers commonly use a fly pattern known as the "Sheep Creek Special," dubbed for its high success at the DVIR reservoirs. Mountain View Reservoir (MVR) was constructed in 1969 and is the only reservoir located on the Idaho side of the Reservation. It is approximately 640 acres and has a maximum depth of 24 feet. This reservoir is well known for its crystal clear water and reliable fishing experience. Both reservoirs were historically stocked through USFWS funding (Burge and Miller, 1990).

Figure 2: Locations of the three reservoirs on the DVIR



The final and most recently built (1998) reservoir is Lake Billy Shaw (LBS) and was built within the Billy Shaw Slough in the south-central portion of the Duck Valley Indian Reservation, 11 km/7 mi west of the town of Owyhee. Construction was completed in 1998 and the first full season took place in 2003. This reservoir is just south of the Idaho and Nevada border and is north of SCR. The slough was an intermittent stream which flowed northward in a wide, gently sloped drainage channel in moderately dissected alluvial terrain that had not been developed for agriculture or settlement (1997 EA and FONSI).

Developed and managed for recreational fishing, Tribal subsistence fishing, and fish and wildlife habitat mitigation by BPA, Lake Billy Shaw is a storage reservoir with 17.5 miles of shoreline and has a maximum pool elevation of 5,351 feet. The reservoir has a 3,300 acre foot volume with 430 acres of surface area, a maximum depth of 36 feet, and a mean depth of 23 feet; 76% of the reservoir is at 15 feet or greater depth. Inflows to the reservoir include water diverted from the East Fork Owyhee River into the Highline canal, which is then diverted into either Sheep Creek Reservoir or Lake Billy Shaw feed canal (beginning in R 51 E, T 46 N, Section 2). Recorded annual fluctuations can be highly variable (Figure 6, page 14).

The feed canal can carry flows up to 30 cubic feet per second (cfs) without causing erosion damage. Inflows to the reservoir fluctuate drastically according to season, to releases from the upstream Wildhorse Reservoir, and to irrigation needs. Outflows generally include only surface spillage from the reservoir, although summer evaporation and bank seepage often exceed inflows. Escapement of fish from the reservoir is restricted by a gated outlet and drum screens with paddle wheels at the inlet.

Lake Billy Shaw Reservoir was completed in 1998 to address measures 10.8C.4 and 10.8C.7 of the NWPCC's 1994 Program and is presently operated per the "Substitution for Anadromous Fish Losses" and "Resident Fish Losses" provisions of the NWPCC's 2000 Program. The NWPCC's June 5, 1998, letter to Chairman Paiva and Mr. Robert Lohn states that the goal of Project 1995-015-06 is "to develop, on the Duck Valley Reservation, an enclosed reservoir rainbow trout 'put and take' fishery at Lake Billy Shaw."

During the Three-Step Review for Lake Billy Shaw and initial deliberations with the NWPCC and BPA, however, artificial production of native redband trout and associated stocking costs for Lake Billy Shaw were included in Project 1995-006-00 titled "*Bannock/Shoshone-Paiute Joint Culture Facility*" as indicated in the NWPCC's May 12, 1998, Decision Memorandum; nevertheless, the Independent Scientific Review Panel (ISRP) (ISRP 2001-3) recommended to the NWPCC that Project 1995-006-00 should not move beyond Step 3 and into construction and suggested that the project sponsors did not adequately address the conditions provided in the NWPCC's Step 2 decision. Despite the ODFW, Montana Department of Fish, Wildlife, and Parks, and IDFG's operation of artificial production programs for redband trout (Klamath Hatchery) and Yellowstone cutthroat trout *O. clarki lewisi* (Bluewater Springs, Yellowstone River, and Big Springs trout hatcheries), respectively, the ISRP (ISRP 2001-3) suggested, without references, that hatchery rearing of redband trout and Yellowstone cutthroat trout would be difficult at best, since a high proportion of these projects have not succeeded. Subsequently, the ISRP (ISRP 2001-3) suggested that non-native rainbow trout should be used to meet the production needs of the Duck Valley Indian Reservation and that those needs could be addressed by contracting with private or state aquaculture facilities in southern Idaho.

In recommending funding for Lake Billy Shaw, the NWPCC included a stipulation that the Shoshone-Paiute Tribes, BPA, IDFG, Nevada Department of Wildlife, and the ODFW identify an approach that would alleviate problems (e.g., introgression with native redband trout *O. m. gairdneri*) that could arise if hatchery-reared coastal rainbow trout escaped from Lake Billy Shaw. Subsequently, negotiations among the management entities resulted in a decision to stock sterile, hatchery-reared coastal rainbow trout; however, in light of the success that the ODFW has experienced in culturing redband trout, the Shoshone Paiute Tribes, NWPCC, and BPA initiated Project 2000-079-00 titled “*Assess Resident Fish Stocks of the Owyhee/Bruneau Basin, D.V.I.R.*” to identify the genetic structure and purity of redband trout populations throughout the East Fork Owyhee River drainage. Results from this study have enabled the Shoshone Paiute Tribes to identify populations that could serve as broodstock sources for the development of a redband trout hatchery program in Lake Billy Shaw reservoir, as well as prioritize habitat for protection and enhancement.

Until then, Lake Billy Shaw will be stocked with sterile rainbow trout utilizing funds from this contract with BPA. Guidelines for stocking rates and size of stocked fish are dependent upon reservoir management and vary among waterbodies; however, objectives of most reservoir management programs, regardless of the fish species and location, are to provide a total catch biomass that exceeds the stocked biomass. In April 2002, the Shoshone Paiute Tribes initiated the stocking of Lake Billy Shaw with BPA funds from the Resident Fish Stocking project (1988-156-00) with the release of 8,000 lbs. of sterile catchable sized (10-14 in.) hatchery-reared rainbow trout. Because Lake Billy Shaw is a new reservoir, it will be essential in this project to initiate a long-term study of stocking density, growth, survivorship, and yield to develop guidelines that are not approximations.

The Lake Billy Shaw Project began in 1988 with a feasibility study (Kleinfelder 1988); an Environmental Assessment was completed with a FONSI and the project proceeded to the design phase, finished in 1997 by CH2MHILL. The dam, reservoir, and associated structures were constructed and completed in 1998 by Western Construction; the project was completed ahead of schedule and with no additional costs for completion. The reservoir was initially filled in the spring of 1999, and the borrow areas were reseeded in the fall of that same year. Water quality and piezometers have been monitored since 1999, and activities to enhance the shorelines have been conducted since 2000 (including native plant transplanting, exotic plant removal, invertebrate sampling and transplanting, exclosure fencing, etc.)

The Lake Billy Shaw Operations and Maintenance (O&M) project went through the peer review with CBFWA (1998) and was recommended for funding in 1999. The project again went through a peer review by CBFWA and the ISRP in 1999 and 2002 and was recommended for funding for the 2000-2002 and 2003-2005 funding cycles.

Lake Billy Shaw reservoir opened October 1, 2002 as a trophy fishery. Previously, funds from BPA project 1988-156-01, Resident Fish Stocking, furnished sterile rainbow trout for Lake Billy Shaw as well as viable rainbow trout for Mountain View and Sheep Creek Reservoirs; however, in August 2003, the Resident Fish Stocking and Lake Billy Shaw O&M (BPA project 1995-015-00) projects were combined. Mid-performance period, the O&M contract title changed to “Duck Valley Reservoirs Fish Stocking and O&M” (still BPA Project 1995-015-00); the contract and performance language were changed to include O&M and fish stocking for all three reservoirs, and a line item to purchase fish for all three reservoirs was added to the budget. This report reflects the above line item, title, and task changes (the Resident Fish Stocking contract was

terminated at the time of the merge). The Duck Valley Reservoirs Fish Stocking and O&M project is referred to as “DV Fisheries.”

Summary of Work by Work Element

Manage and Administer Project:

Metric and location data entered into Pisces for FY06:

Metric and location data were entered for applicable Work Elements in the FY06 Statement of Work. All status reports were submitted and approved. Missing or omitted metric and location data were updated in the final status report (September).

General administrative work performed:

The director and project manager timely submitted purchase orders, payment requests, and invoices. They also addressed employment issues and coordinated with the various Tribal administrative departments.

Keep track of budget:

Detailed account reports were sent by the Finance Department monthly. These reports included expenditures, transfers, and other changes. Microsoft Excel was used to compare and contrast these changes to the approved budget. This spreadsheet was used track money expenditures and monitor remaining money.

Manage sub-contracts with fish suppliers:

The project manager and secretary maintained communication with the two fish suppliers periodically throughout the year. Contracts were revised to match the current fiscal year, reviewed by the Tribal Chairman, and sent to the suppliers. All contracts were approved and accepted by all parties.

Timely and complete submission of invoices:

All invoices were submitted to the Finance Department as soon as they were received. The secretary also retained copies of those invoices.

Lease, maintain, and repair equipment:

A back-hoe and a dump truck were leased for two months. These and other equipment were maintained and repaired as needed.

Accrual estimate (year-end close):

The project manager developed an accrual estimate and forwarded to the Finance Department for review and submission to BPA.

Accrual estimate (simulated year-end close):

The project manager developed an accrual estimate and forwarded to the Finance Department for review and submission to BPA.

FY07 SOW/budget package submitted to BPA:

FY07 SOW and budget pack were submitted in September.

Produce Environmental Compliance Documentation:

Ensure that all environmental compliance requirements have been fulfilled:

All environmental compliance requirements were met.

Outreach and Education:

Volunteer one day environmental education to students:

The project manager spent one afternoon presenting information about Rainbow trout and other fish species to fifth and sixth grade classes.

Volunteer one day with Boy Scout Troop activities:

The project manager coordinated with the Boy Scout Troop leader to try and develop an activity for the youths. However, several of the boys' families moved and insufficient members were available for the task.

Work with local media:

The project manager and director talked with reporters from the Idaho Statesman. They also submitted a report to the Sho-Pai News about the current projects at the Fish, Wildlife, and Parks Department.

Provide information to anglers:

A departmental website was redeveloped and added on to the Shoshone-Paiute Tribes homepage (<http://www.shopaitribes.org/entrymenu.htm>). Fishing pamphlets were updated to reflect changes in rules and regulations for the 2006 fishing season. These pamphlets were distributed to various vendors as needed.

Participate in community gatherings:

The department put on the annual Arbor Day celebration where they raffled prizes, barbequed, and planted trees. The department also helped with the 4th of July Pow-Wow and rodeo as well as the Tribal "Sundance" Ceremony.

Purchase advertisement with flyfishing magazine:

The project purchased advertisements with "Northwest Flyfishing" and "Southwest Flyfishing" magazines. Both magazines are quarterly.

Host youth workers:

The department hosted three summer youth workers. One of these children worked for the Duck Valley Fisheries project.

Plant Vegetation:

Collect willows, bulrushes, and tules:

Willows were collected by the fisheries technician and a laborer. They planted these willows in the Lake Billy Shaw inlet stream. They planted approximately 0.10 miles of stream.

Secure plants using water jet-stinger:

The two employees secured the willows by pushing the willows into the soft mud rather than using the water jet-stinger. They secured the willows in this fashion because of high water flows at time of planting. Later observations showed at least 90% success.

Maintain Vegetation:

Maintain generator at pump house for watering:

The laborers repaired the door jam at the LBS pump house. They also ran the generator pump occasionally to keep it maintained.

Water plants as needed:

One laborer would water trees at Lake Billy Shaw at least once per week, particularly during the hot season.

Trim plants as needed:

The lead laborer and project manager trimmed some trees during the winter to promote better growth.

Remove Vegetation:

Survey Lake Billy Shaw and associated streams for exotic species:

The project manager and several laborers spent several days walking the LBS shoreline. They found Tamarisk plants in varying densities near past Tamarisk locations (Figure 3). All Tamarisk plants were removed by manual efforts.

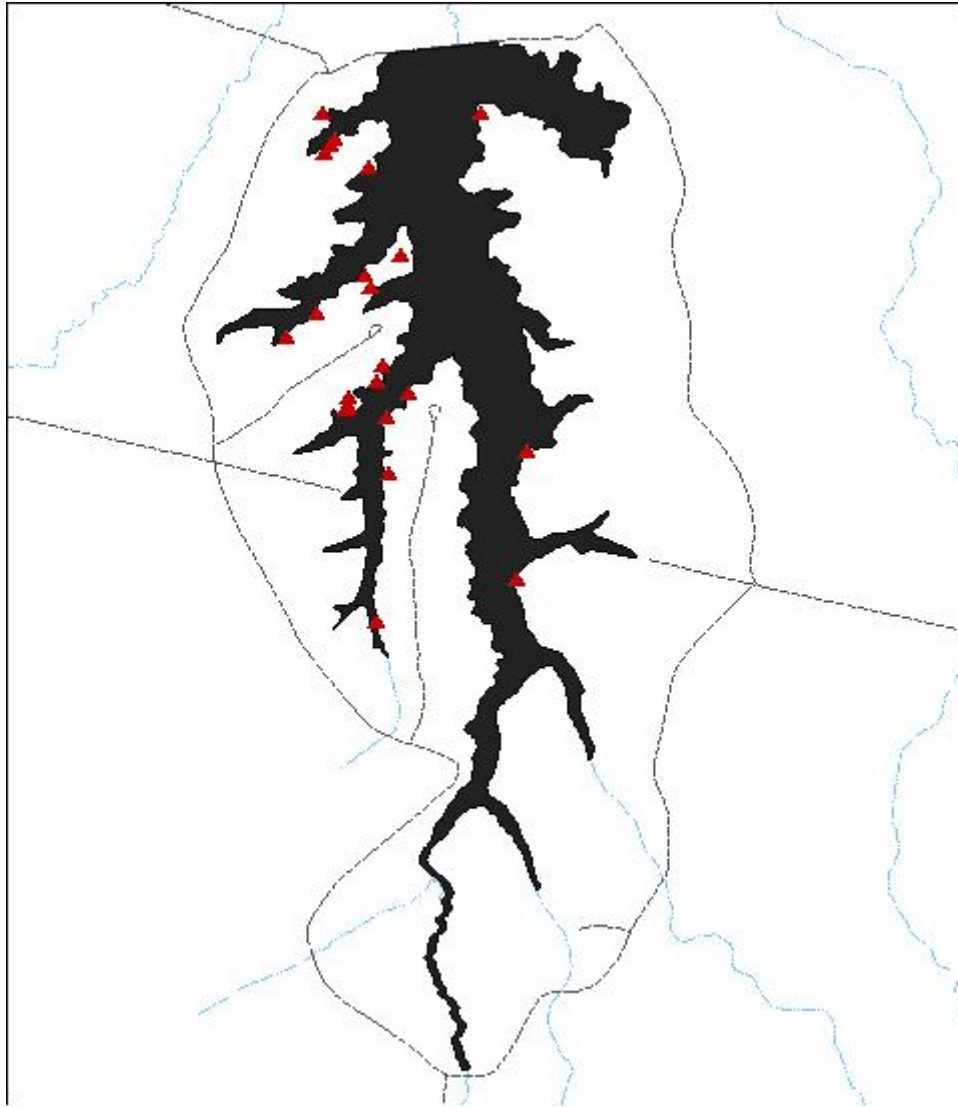
Treat Tamarisk and other exotics with herbicide:

Tamarisk were dug up and pulled rather than sprayed. This method cut the risk of spilling these herbicides in the water.

Remove woody vegetation from Lake Billy Shaw dam:

The fish technician and the laborers burned much of the woody plants off of the earthen dam at LBS.

Figure 3: Tamarisk plant locations at Lake Billy Shaw



Operate and Maintain Habitat/Passage:

Maintain alternative water developments:

The lead laborer placed medium sized cobble in the inlet stream feeding LBS. This section is located at a break in the perimeter fence for stock to cross from the east side of LBS to the west side or vice versa. This gravel will help prevent the stock from stirring up excess sediments.

Monitor and remove stock as needed:

The laborers occasionally spotted stock inside the perimeter fencing. They removed the stock immediately or as soon as they could.

Maintain perimeter and inlet fencing at Lake Billy Shaw:

The perimeter fencing was surveyed several times throughout the year. Several stretches of fencing were tightened as needed and gates were closed when left open by the public.

Put and Take Fisheries (Lake Billy Shaw):

Inspect dam and its associated structures weekly:

Lake Billy Shaw dam was inspected every two weeks. This inspection involved checking water levels in the piezometer wells and checking conditions of the eight toe-drains.

Remove debris from fish screen structures:

The work crews checked and cleaned the fish screens and paddle-wheel structures as needed. This sometimes involved multiple inspections per day during high flow seasons. Mormon crickets were a large debris source at these structures during the summer months.

Repair or replace paddle wheels at Boyle Creek:

The crew installed a new trash rack at Highline Canal. The trash rack collapsed due to high flows and high amounts of debris. The crew also replaced the paddle-wheels at Boyle Creek fish screens. The metal used in the paddle-wheels was soft and the crew was forced to remove them to re-weld the arms on and install support beams.

Stock hatchery-reared Rainbow trout:

The fish suppliers delivered and stocked all loads of fish in the spring and fall months.

Install 5 portable restrooms:

The crew installed 4 portable toilets at LBS. The fifth toilet was damaged beyond repair in FY05 due to a transportation mishap. This toilet also was significantly weakened by severe wind.

Maintain 5 portable restrooms:

The crew periodically cleaned the restrooms and replaced toilet paper supplies. They also facilitated septic pumping through the Tribal water and sanitation department.

Remove 5 portable restrooms:

The 4 restrooms were pumped, removed, and stored for the winter.

Check boat ramps and maintain as needed:

The crew would inspect the boat ramps during water quality sampling as they utilized the ramps at these times. No repairs nor maintenance were needed.

Maintain roads around Lake Billy Shaw:

The lead laborer dug drainage ponds alongside the perimeter road at sections consistently flooded by pools of water. He also added gravel to a road section in the southwest portion. The local BIA road crew could not grade the roads this year due to budget constraints.

Maintain water pump at Lake Billy Shaw:

The crew started and used the water pump and generator periodically. No propane was added this year.

Remove aquatic vegetation:

The crew did not remove any aquatic vegetation at MVR due to time constraints and infeasible methods of removal. Their efforts most likely would not impact the reservoir significantly. This is a complex issue that has been looked at by other agencies for over 30 years.

Put and Take Fisheries (Sheep Creek Reservoir):

Stock SCR with hatchery-reared Rainbow trout:

The fish suppliers delivered and stocked all loads of fish in the spring and fall months.

Removal of aquatic vegetation:

The crew did not remove any aquatic vegetation at MVR due to time constraints and infeasible methods of removal. Their efforts most likely would not impact the reservoir significantly. This is a complex issue that has been looked at by other agencies for over 30 years.

Put and Take Fisheries (Mountain View Reservoir):

Stock MVR with hatchery-reared Rainbow trout:

The fish suppliers delivered and stocked all loads of fish in the spring and fall months.

Removal of aquatic vegetation:

The crew did not remove any aquatic vegetation at MVR due to time constraints and infeasible methods of removal. Their efforts most likely would not impact the reservoir significantly. This is a complex issue that has been looked at by other agencies for over 30 years.

In regards to aquatic vegetation removal at all three reservoirs, Burge and Miller (1993) suggested several methods to manage the aquatic macrophytes in the DVIR reservoirs. These methods were mechanically removing plants using an aquatic weed harvester, using biological control measures such as grass carp (*Ctenopharyngodon idella*), or drawing down water to desiccate and kill the plants. Mechanical removal may prove to be costly in terms of labor and equipment costs. Grass carp may prove to be a poor choice as colder water temperatures decrease ingestion rates, these fish do not prefer milfoil and will forage on native species of plants first, and risk of exotic establishment to other ecosystems runs high. Finally, water draw downs may decrease the reservoirs' ability to sustain Rainbow trout fisheries.

Collect/Generate/Validate Field and Lab Data:

Take photo-points of LBS shoreline and canal to monitor annual changes: The fish technician updated the photopoints in June.

Take GPS locations of plants: The project manager and several laborers mapped shoreline vegetation in conjunction with Tamarisk surveys (Figures 4 and 5).

Figure 4: Shoreline vegetation densities at Lake Billy Shaw

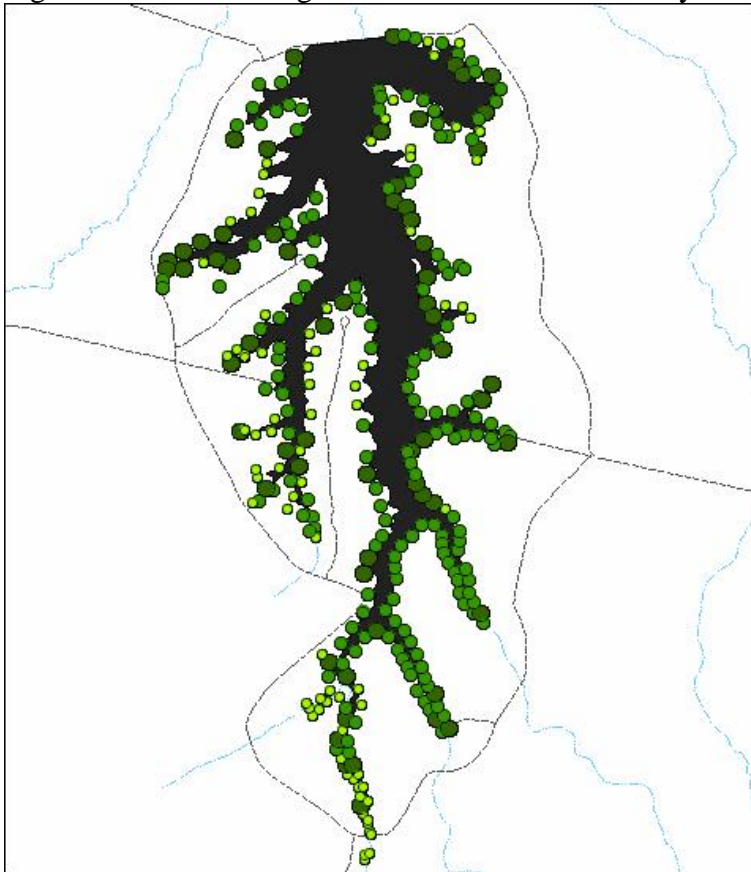
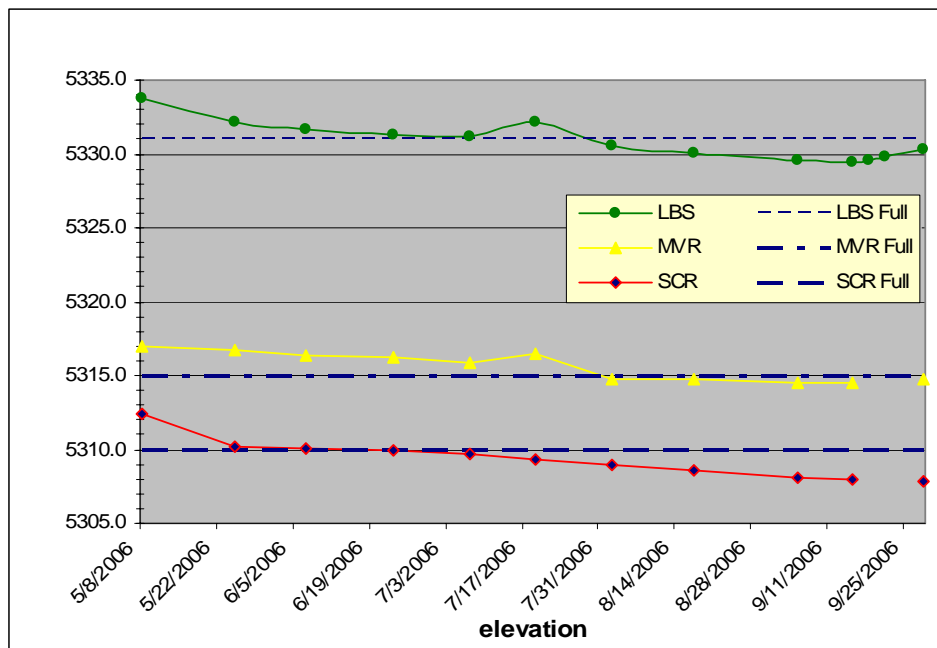


Figure 5: Aerial photograph of LBS shoreline vegetation



Record piezometer, toe-drain, and water levels at LBS: The fish technician and the crew recorded piezometer, toe-drain, and water levels every two-weeks. Figure 6 shows changes in water levels at all three reservoirs.

Figure 6: Changes in water levels over time.



Monitor water quality at reservoirs: The fish technician sampled water quality every two weeks using an instrument built by YSI. The primary characters sampled were dissolved oxygen, temperature, pH, turbidity, and chlorophyll-a. These characters are shown in Figures 7a-f.

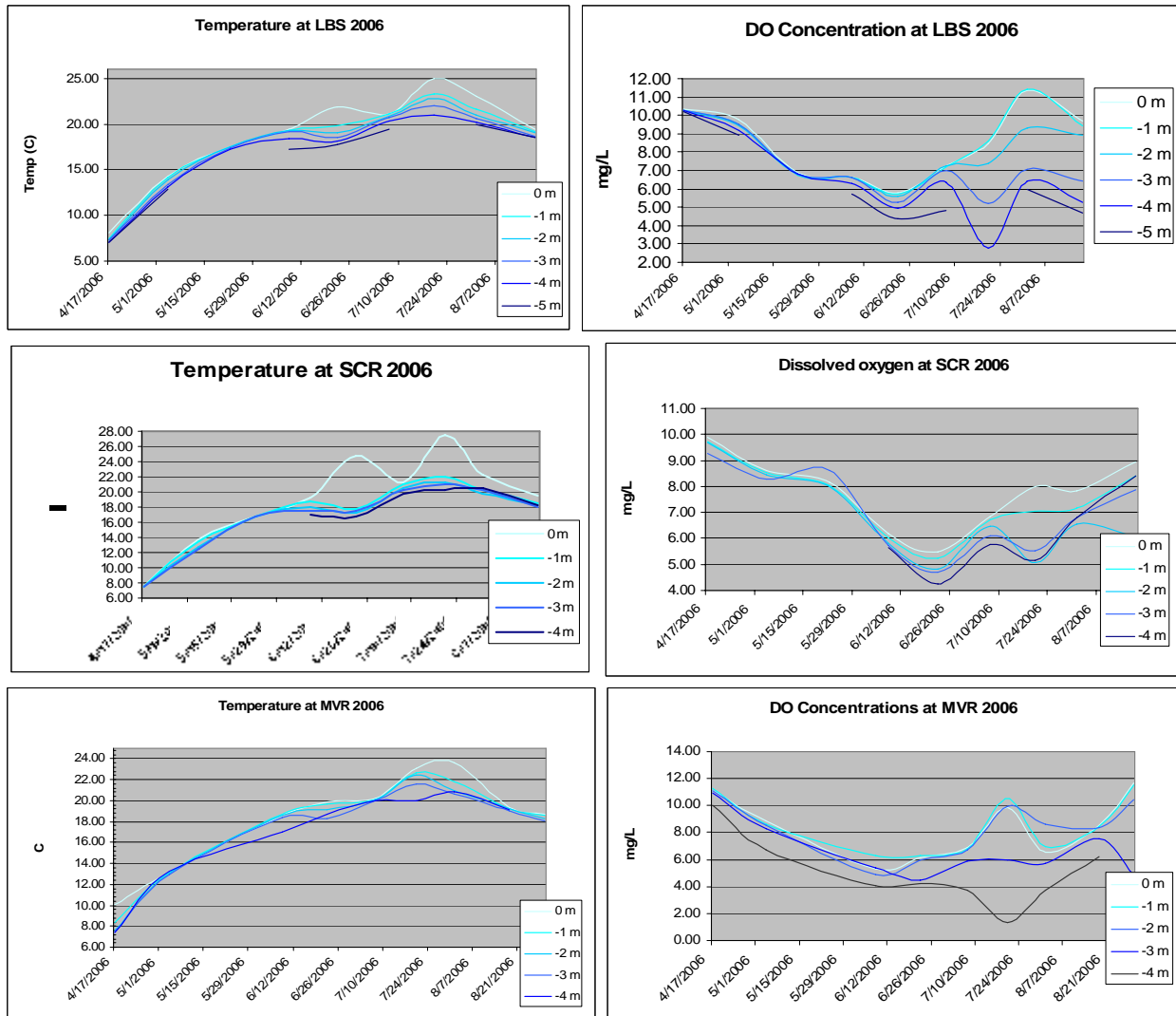
At the three reservoirs, the temperature and dissolved regimes mostly exhibit the typical seasonal changes seen in years past. The reservoirs undergo a turning over period in the spring, followed by a stratification period beginning in early to mid-summer and lasts until late August.

This stratification is very evident in LBS and SCR dissolved oxygen from the beginning of July throughout August. When the climate begins to cool down in the autumn months, the reservoirs begin going through another mixing process. In 2006, this stratification has been more pronounced than in prior years at LBS and SCR. This is most likely due to several factors.

The first is that the summer climate was very hot and calm. A low incidence of thunderstorms led to sunnier days and subsequent higher thermal input into the water column. Furthermore, the lack of these storms reduced the amount of wind caused waves that may stir the depths below the surface. The other main factor leading to this higher degree of stratification may be due to lower input of fresh water. New irrigation system management reduced the amount of water pushed into the LBS and SCR system as demand by irrigators took precedence.

This reduction in fresh, stirred water increased the ability of the reservoirs to stratify. In both LBS and SCR, the dissolved oxygen became an important factor for trout growth during the late spring and early summer. Dissolved oxygen levels came near minimum critical levels (5 mg/L) particularly in most depths at Sheep Creek Reservoir and the lower depths at Lake Billy Shaw. These lower levels of dissolved oxygen can preclude trout from residing in those depths.

Figures 7a-f: Temperature and dissolved oxygen at three reservoirs.



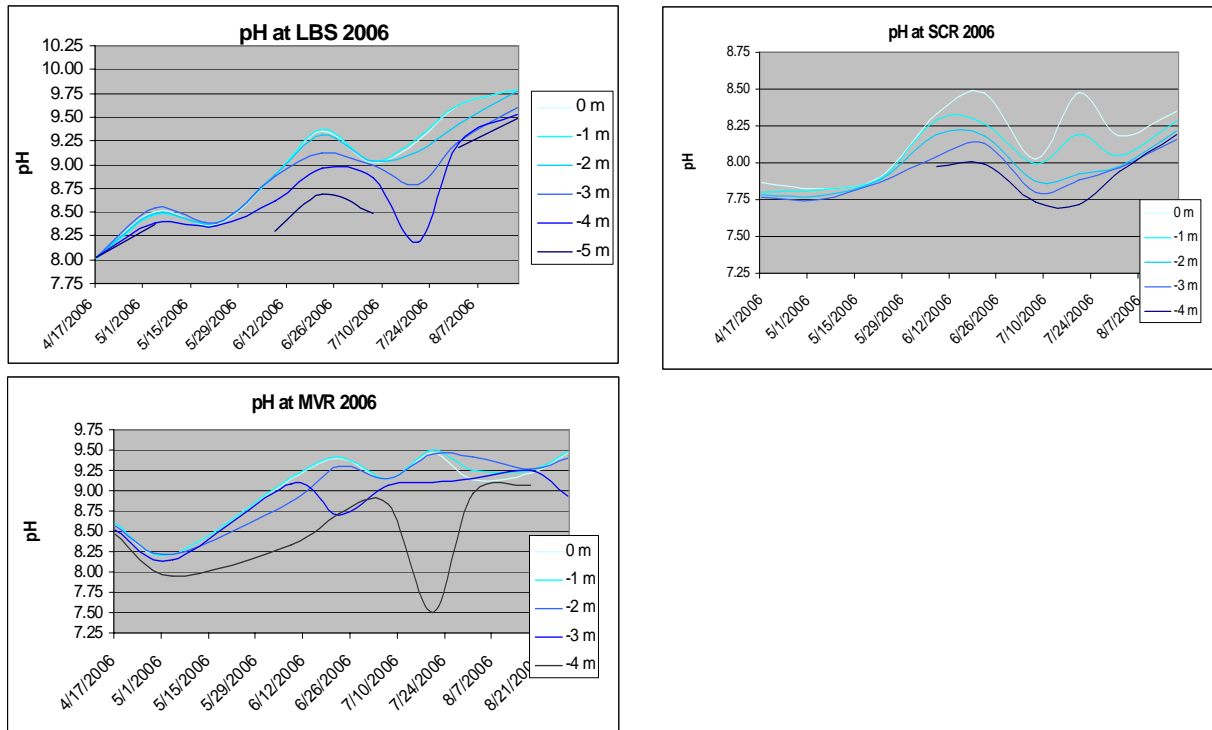
Both of these reservoirs also held water temperatures over 20 Celsius through July and August. Even though these temperatures do not reach critical thermal maximum they do fall outside of the optimal growing temperatures. Between the high temperatures and the low dissolved oxygen levels in July and August, these two months are critical months for trout survival.

In MVR, stratification also occurred and dissolved oxygen levels became low in late spring but not to the same degree as the other two reservoirs. The upper depths regain oxygen soon and do not approach critical levels again. This difference in MVR may be due to the fact that water was constantly added to the reservoir to compensate for irrigation to local alfalfa fields.

The pH levels (Figure 8a-c) at LBS and MVR exhibit typical behaviors. The water that is fed into these reservoirs is typically alkaline (>7.0 pH) and the pH increases throughout the summer months as photosynthesis increases due to the chemical processes of photosynthesis. This phenomenon is also more prevalent in shallower depths. The pH in these two reservoirs can range from 8.0 in the early spring up to 9.5 in the summer months. SCR on the other hand had

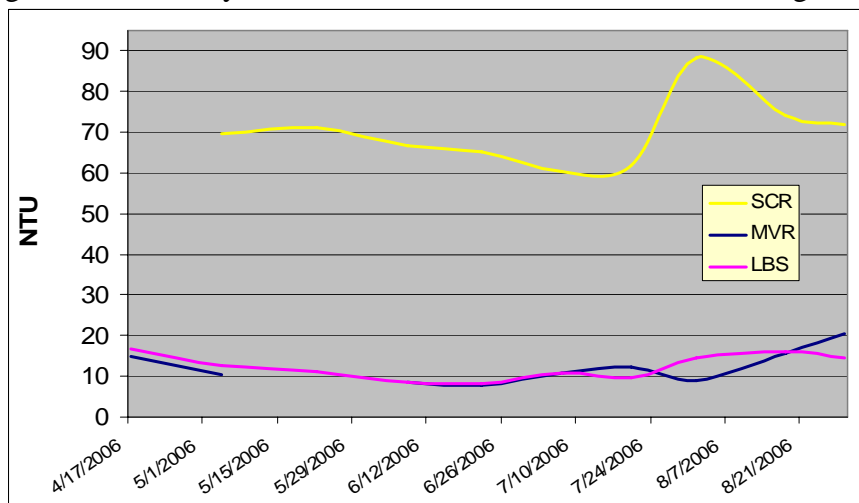
lower pH values throughout the work season and a smaller range of values. This lower variability was also amplified by depth.

Figure 8a-c: pH values at the three reservoirs.



These lower pH values and lower variability is probably due to lower levels of photosynthesis in macrophytes and planktonic algae and due to inorganic suspended sediments. These organisms have been constricted in their ability to photosynthesize due to the significantly higher turbid water at SCR (Figure 9).

Figure X: Turbidity measurements of the three reservoirs through the work season.



The turbid water, suspected to be caused by animated inorganic soil particles, prevents sunlight from penetrating the water column. Turbidity in SCR has traditionally been higher than the other two reservoirs in the past. However, the water in SCR seemed higher than in previous years.

Record high detail water quality: The fisheries technician and the crew assisted the local TEPP department with high detail water quality sampling. The TEPP released the water quality details to the project (Table 1).

Table 1: High detailed water quality sampling performed by TEPP

Sample ID	Date Sampled	NO3/NO2 mg/L	NO3 mg/L	NO2 mg/L	Ortho-P mg/L	T-Phos mg/L	NH3 mg/L	TKN mg/L	CO3 mg/L	HCO3 mg/L	SO4 mg/L	Cl mg/L	Ca mg/L
Sheep Creek Reservoir Near Dam	7/5/2006	0.04	0.02	0.02	0.097	0.162	0.04	0.77	0	75	7.6	2.2	14.5
Sheep Creek Reservoir Nr Middle	7/5/2006	0.04	0.02	0.02	0.101	0.159	0.06	0.88	0	75	7.5	2.2	14.5
Sheep Creek Reservoir Near Inlet	7/5/2006	0.02	0.01	0.01	0.102	0.171	0.06	0.84	0	76	7.6	2.3	14.3
Sheep Creek Reservoir Near Inlet (Replicate)	7/5/2006	0.02	0.01	0.01	0.099	0.162	0.06	0.86	0	76	7.4	2.2	14.7
Billy Shaw Reservoir Near Dam	7/5/2006	< 0.01	< 0.01	< 0.01	< 0.003	0.02	0.02	0.79	7.18	66	8.6	3.4	15.9
Billy Shaw Reservoir Near Middle	7/5/2006	< 0.01	< 0.01	< 0.01	< 0.003	0.017	0.03	0.68	5.75	70	8.5	3.4	15.9
Billy Shaw Reservoir Near Inlet	7/5/2006	< 0.01	< 0.01	< 0.01	0.012	0.066	0.04	1.22	10.5	45	7.9	3.3	11.2
Mountain View Reservoir Near Dam	7/5/2006	< 0.01	< 0.01	< 0.01	< 0.003	< 0.01	0.02	0.62	6.22	105	7.7	5.1	19.1
Mountain View Reservoir @ Middle	7/5/2006	< 0.01	< 0.01	< 0.01	< 0.003	< 0.01	0.02	0.81	21.1	52	7.2	4.7	11.7
Mountain View Reservoir Nr Inlet	7/5/2006	< 0.01	< 0.01	< 0.01	< 0.003	< 0.01	0.02	0.65	20.6	55	6.4	3.8	13.2

Sample ID	Date Sampled	Mg mg/L	Na mg/L	K mg/L	Hardness mg/L	TDS SUM mg/L	SiO2 mg/L	Alkalinity mg/L	Fecal ct/100m L	E. coli ct/100m L	Chl a mg/m3	TSS mg/L	Lab pH SU
Sheep Creek Reservoir Near Dam	7/5/2006	3.9	8.2	4.5	52	101	22.2	61.5	< 4	< 4		4	8.1
Sheep Creek Reservoir Nr Middle	7/5/2006	3.9	8.2	4.5	52	101	22.4	61.5	4	4	8.1	5	8.1
Sheep Creek Reservoir Near Inlet	7/5/2006	3.6	8.2	4.3	51	99.8	20.9	62.3	< 4	< 4		6	8.2
Sheep Creek Reservoir Near Inlet (Replicate)	7/5/2006	3.7	8.2	4.3	52	101	21.9	62.3	4	< 4		3	8.2
Billy Shaw Reservoir Near Dam	7/5/2006	3.8	8.7	2.7	55	93.3	9.3	66.1	< 2	< 2		5	8.9
Billy Shaw Reservoir Near Middle	7/5/2006	3.8	8.7	2.7	55	93.5	9	67	< 2	< 2	12.9	2	8.9
Billy Shaw Reservoir Near Inlet	7/5/2006	3.5	8.9	2.5	42	78.1	7.1	54.4	< 2	< 2		6	9.4
Mountain View Reservoir Near Dam	7/5/2006	6.9	13.4	3.4	76	118	2.5	96.5	< 2	< 2		4	9
Mountain View Reservoir @ Middle	7/5/2006	6.7	13.6	2.6	57	95.9	1.2	77.8	< 2	< 2	4.3	2	9.9
Mountain View Reservoir Nr Inlet	7/5/2006	6.4	12.2	2.1	59	95.2	1.9	79.5	< 2	< 2		1	9.7

Sample ID	Date Sampled	Lab EC uS/cm	Turbidity NTU	Hg ug/L	Cu ug/L	Field Temp C	DO mg/L	Field pH SU	Field EC uS/cm	ORP mv	BP mm Hg	Field NTU
Sheep Creek Reservoir Near Dam	7/5/2006	141	53	2.6	7	20	6.5	8.67	142	56	630	47
Sheep Creek Reservoir Nr Middle	7/5/2006	142	51	0.71	8	20.7	6.9	8.13	131	75	631	50
Sheep Creek Reservoir Near Inlet	7/5/2006	143	47	0.34	7	20.8	6.4	7.9	143	89	631	46
Sheep Creek Reservoir Near Inlet (Replicate)	7/5/2006	142	48	0.21	8	20.8	6.4	7.6	143	89	631	46
Billy Shaw Reservoir Near Dam	7/5/2006	156	3	0.34	3	22.2	7.9	8.32	157	59	630	5
Billy Shaw Reservoir Near Middle	7/5/2006	156	3	0.59	< 2	21.7	7.2	8.73	157	60	633	3
Billy Shaw Reservoir Near Inlet	7/5/2006	134	4	0.41	3	20.9	7.3	8.97	137	36	631	3
Mountain View Reservoir Near Dam	7/5/2006	213	2	1.1	< 2	22	7.5	8.78	212	60	630	2
Mountain View Reservoir @ Middle	7/5/2006	187	1	0.42	< 2	20.9	9.5	9.44	187	67	624	2
Mountain View Reservoir Nr Inlet	7/5/2006	176	2	0.3	< 2	21.1	6.6	9.34	184	0	622	2

Conduct wildlife surveys: Bird inventories were conducted in the fall, winter, and early spring to catch the main migratory season (Table 2). Pitfall traps were installed in May for several weeks and the wildlife list was updated (Table 3).

Table 2: Bird species identified at LBS to date.

Common Name	Scientific Name	Common Name	Scientific Name
1 American Avocet	<i>Recurvirostra americana</i>	33 Killdeer	<i>Charadrius vociferus</i>
2 American Coot	<i>Fulica americana</i>	34 Lesser Scaup	<i>Aythya affinis</i>
3 American Kestrel	<i>Falco sparverius</i>	35 Mallard	<i>Anas platyrhynchos</i>
4 American White Pelican	<i>Pelicanus erythrorhynchos</i>	36 Marsh Wren	<i>Cistothorus palustris</i>
5 American Wigeon	<i>Anas americana</i>	37 Northern Harrier	<i>Circus cyaneus</i>
6 Bald Eagle	<i>Haliaeetus leucocephalus</i>	38 Northern Pintail	<i>Anas acuta</i>
7 Black-billed Magpie	<i>Pica hudsonia</i>	39 Northern Shoveler	<i>Anas clypeata</i>
8 Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	40 Osprey	<i>Pandion haliaetus</i>
9 Black-necked Stilt	<i>Himantopus mexicanus</i>	41 Pied-billed Grebe	<i>Podilymbus podiceps</i>
10 Blue-winged Teal	<i>Anas discors</i>	42 Prairie Falcon	<i>Falco mexicanus</i>
11 Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	43 Common Raven	<i>Corvus corax</i>
12 Bufflehead	<i>Bucephala albeola</i>	44 Redhead	<i>Aythya americana</i>
13 Burrowing Owl	<i>Athene cunicularia</i>	45 Red-tailed Hawk	<i>Buteo jamaicensis</i>
14 Canada Goose	<i>Branta canadensis</i>	46 Red-winged Blackbird	<i>Agelaius phoeniceus</i>
15 Canvasback	<i>Aythya valisineria</i>	47 Ring-billed Gull	<i>Larus delawarensis</i>
16 Caspian Tern	<i>Sterna caspia</i>	48 Ring-necked Duck	<i>Aythya collaris</i>
17 Cinnamon Teal	<i>Anas cyanoptera</i>	49 Ruddy Duck	<i>Oxyura jamaicensis</i>
18 Clark's Grebe	<i>Aechmophorus clarkii</i>	50 Sage sparrow	<i>Amphispiza belli</i>
19 Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	51 Sage Thrasher	<i>Oreoscoptes montanus</i>
20 Common Loon	<i>Gavia immer</i>	52 Short-eared Owl	<i>Asio flammeus</i>
21 Common Merganser	<i>Mergus merganser</i>	53 Song Sparrow	<i>Melospiza melodia</i>
22 Common Raven	<i>Corvus corax</i>	54 Snowy Egret	<i>Egretta thula</i>
23 Double-crested Cormorant	<i>Phalacrocorax auritus</i>	55 Tree Swallow	<i>Tachycineta bicolor</i>
24 European Starling	<i>Sturnus vulgaris</i>	56 Turkey Vulture	<i>Cathartes aura</i>
25 Forster's Tern	<i>Sterna forsteri</i>	57 Tundra Swan	<i>Cygnus columbianus</i>
26 Gadwall	<i>Anas strepera</i>	58 Vaux's swift	<i>Chaetura bauxi</i>
27 Golden Eagle	<i>Aquila chrysaetos</i>	59 Vesper sparrow	<i>Pooecetes gramineus</i>
28 Great Blue Heron	<i>Ardea herodias</i>	60 Western Grebe	<i>Aechmophorus occidentalis</i>
29 Great Egret	<i>Ardea alba</i>	61 Western Meadowlark	<i>Sturnella neglecta</i>
30 Greater Sage-grouse	<i>Centrocercus urophasianus</i>	62 White-faced Ibis	<i>Plegadis chihi</i>
31 Green-winged Teal	<i>Anas crecca</i>	63 Willet	<i>Cataporphorus semipalmatus</i>
32 Horned Lark	<i>Eremophila alpestris</i>	64 Wilson's Phalarope	<i>Phalaropus tricolor</i>
		65 Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>

Table 3: Wildlife species identified at LBS to date

Common Name	Scientific Name
1 American Badger	<i>Taxidea taxus</i>
2 American Beaver	<i>Castor canadensis</i>
3 Coyote	<i>Canis latrans</i>
4 Deer mouse	<i>Peromyscus maniculatus</i>
5 Least Chipmunk	<i>Tamias minimus</i>
6 Long-tailed Weasel	<i>Mustela frenata</i>
7 Meadow vole?	<i>Microtus pennsylvanicus</i>
8 Montane vole	<i>Microtus montanus</i>
9 Mountain (Nuttall's) Cottontail	<i>Sylvilagus nuttallii</i>
10 Mule Deer	<i>Odocoileus hemionus</i>
11 Muskrat	<i>Ondatra zibethicus</i>
12 Night Snake	<i>Hypsiglena torquata</i>
13 Northern grasshopper mouse?	<i>Onychomys leucogaster</i>
14 Pronghorn	<i>Antilocapra americana</i>
15 Racer	<i>Coluber constrictor</i>
16 Sagebrush Lizard	<i>Sceloporus graciosus</i>
17 Striped Whipsnake?	<i>Masticophis bilineatus</i>
18 Western Fence Lizard	<i>Sceloporus occidentalis</i>
19 Western Rattlesnake	<i>Crotalis viridis</i>
20 White-tailed Jackrabbit	<i>Lepus townsendii</i>

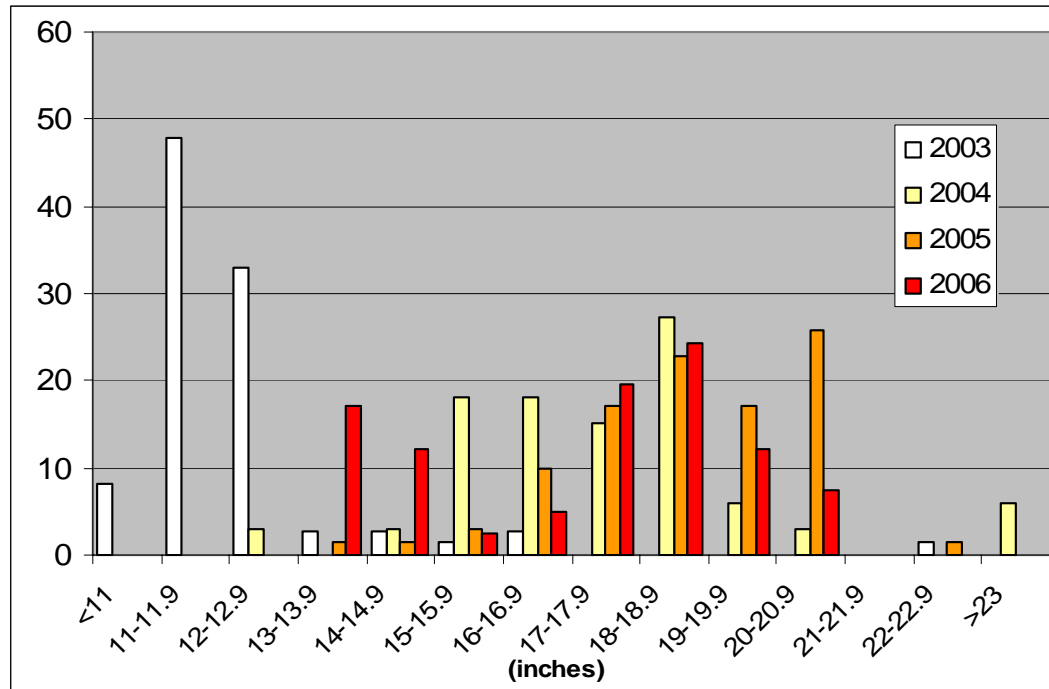
Monitor fisheries at all reservoirs: The three reservoir fish populations were monitored through length and weight indices. Length and weight data on Rainbow trout were collected through two means, gill netting and creel surveys.

Because Lake Billy Shaw is managed as catch-and-release fishery, gill net sampling is the only means to acquire data on fish condition. The crew set three gill nets in the spring and in the fall for 24 hours each sample. The total sample effort caught 41 trout for a catch-per-unit-effort (CPUE) of 0.337 which was slightly higher than previous years but showed a large discrepancy between the spring (0.417) and the fall (0.258). The lower catch rate in the fall may

be due to some fish mortalities observed in August and September and was suspected to be caused by simultaneous high temperatures and low dissolved oxygen levels.

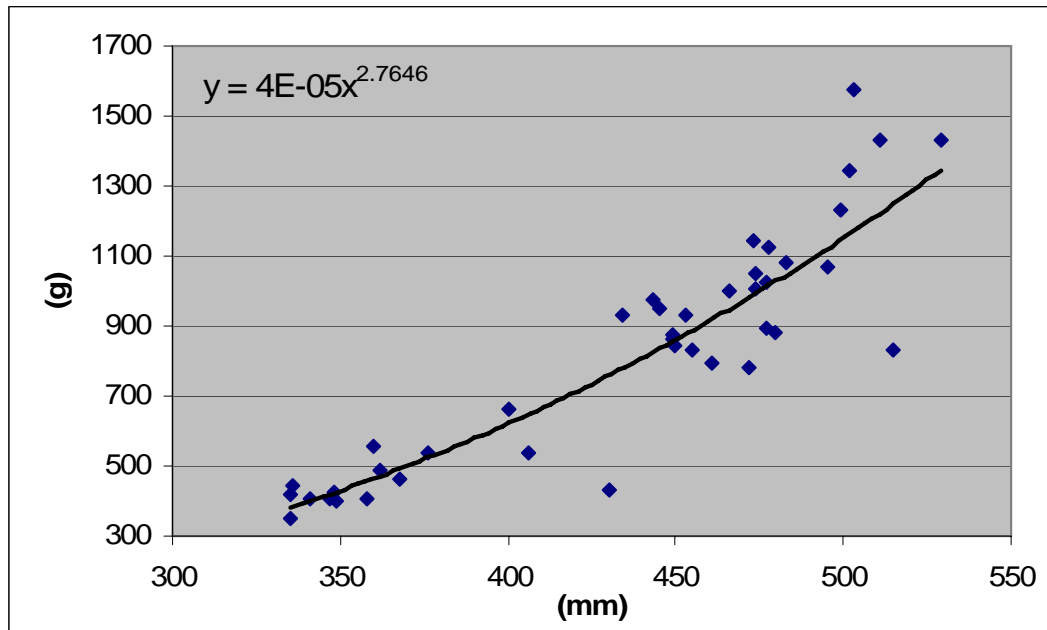
LBS is consistently producing high numbers of fish in the 17 to 19 inch range (appx. 44%) and a good percentage (appx. 20%) of fish larger than 19 inches (Figure 10). This is advantageous as anglers can expect to catch many fish larger than 17 inches. Fish over 22 inches were not captured in the gill net sample but some anglers reported 24 to 26 inch trout.

Figure 10: Length frequencies by percent at LBS



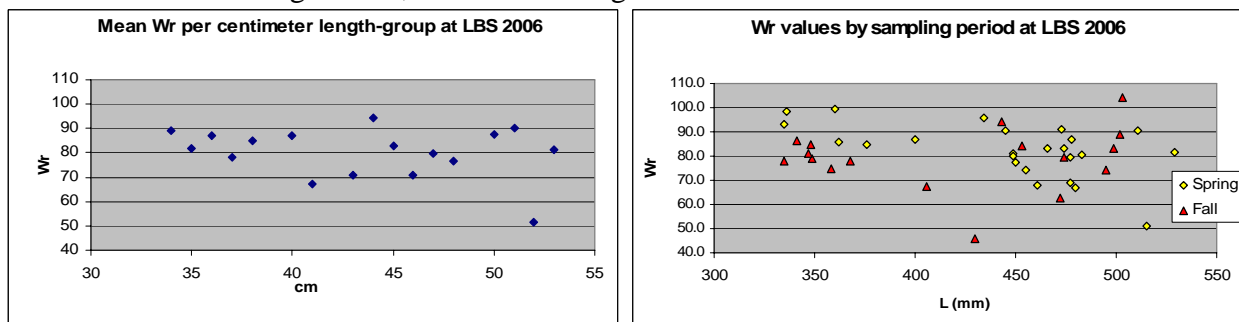
As the trout grow and age in LBS, their growth rate becomes more isometric. When younger, these fish put growth energy into lengthening their bodies. As the fish age, energy begins to be put into mass and the fish become more rotund. Anglers have described this phenomenon by dubbing fish at DVIR as “football fish.” Figure 11 demonstrates how growth changes as fish age in LBS.

Figure 11: Length-Weight Regression of Rainbow trout at LBS 2006



As previously mentioned, observed mortalities at LBS were suspected to be as a result of a combination of high water temperatures and low dissolved oxygen levels due to the timing of all these events. The relative weight (Wr), which can be an index of condition, seems to confirm these suspicions at first glance. The mean Wr was 81.1 in 2006, down from 98.6 in 2005 and 99.8 in 2004 indicating a decrease in condition and health in 2006. But considering that these mortalities were observed in August and September, one would suspect that the fish were in better condition in the spring than in the fall. When split, the spring Wr mean was 82.5 while the fall was 79.2, which indicates some reduction in condition but not the large discrepancy that was expected (Figure X). Every length group fell below the 100 Wr mark which indicates that whatever is affecting the fishery is not discriminating against any particular length group (Figure 12a,b).

Figure 12a,b: Relative weights of Rainbow trout at LBS



This overall limitation in condition may be due to three possible scenarios or combinations of these scenarios: 1) Water quality (i.e. temperature and dissolved oxygen) limited trout condition, 2) Overwhelming intra-specific and inter-specific competition largely reduced available prey and forage, and 3) A large Mormon cricket (*Anabrus simplex*) infestation and control methods polluted the LBS waters to the extent that trout condition was inhibited (Figure 13).

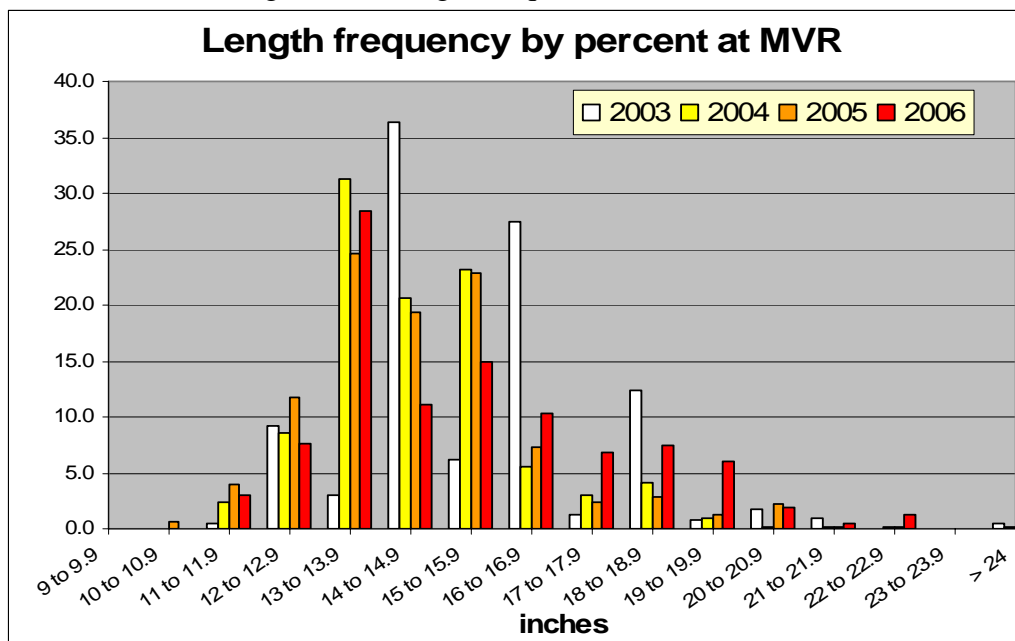
Figure 13: Mormon cricket infestations clogged waterways that feed LBS



At MVR and SCR, morphometric data on trout were collected throughout the fishing season via creel surveys. The two creel surveyors would interview anglers about various demographics, effort, catch and harvest rates, and measure fish harvested by anglers.

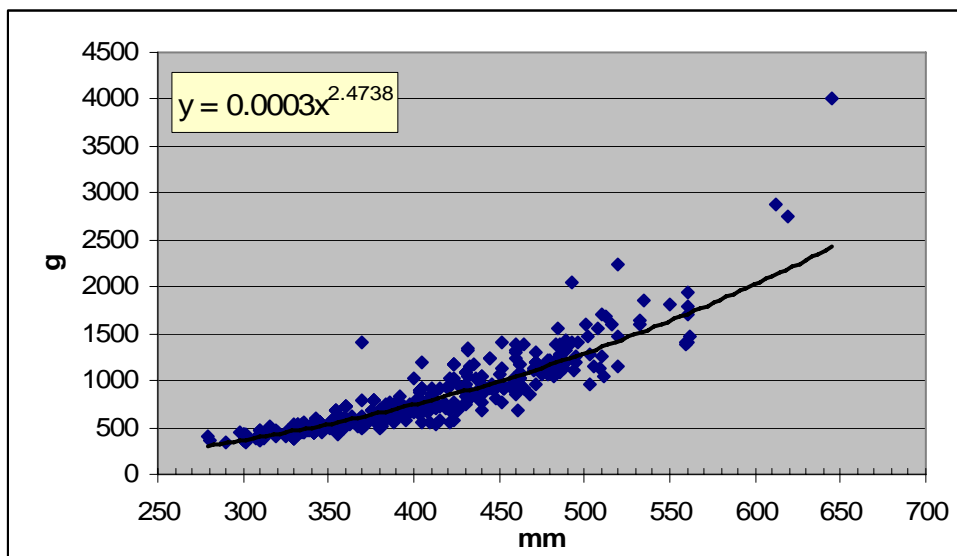
In MVR, the length frequencies show that over half of the fish caught were in the 13 to 16 inch range and a good number of trout (appx. 31%) were making it to sizes larger than 16 inches. Overall MVR is producing less larger fish than LBS but considering that many trout are harvested the reservoir still produces quality sized fish (Figure 14).

Figure 14: Length frequencies of trout at MVR



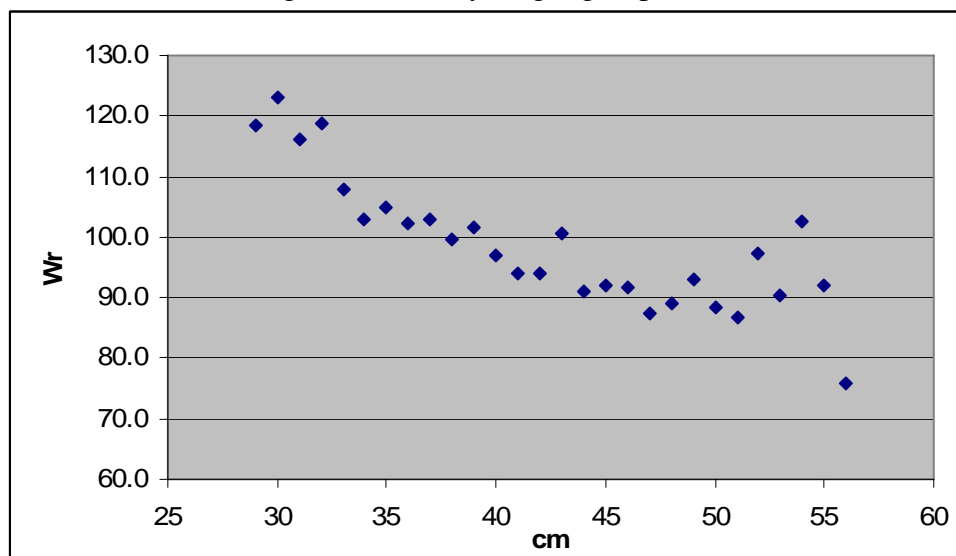
Trout in MVR grow less isometrically than LBS. Figure 15 shows that fish continue lengthening rather than becoming more rotund. The exponent in the equation also indicates this (2.4738). This difference in growth pattern may be a function of sampling techniques, sample size, and extensive harvest removing competitors.

Figure 15: Length-weight regression of trout at MVR



The overall health of these fish is good the mean W_r for all trout was 100.8. Smaller fish (<40 cm) enjoy W_r values at 100 or above. This suggests that there is adequate forage and environmental conditions are promoting good condition. As the trout in MVR become longer, their condition gradually declines (Figure 16). This reduction in W_r is mild and does not indicate any problems with the fishery. Metabolic processes and foraging behavior may influence W_r . It may be possible that as fish become larger than 40 cm, they begin to switch prey such as switching from primarily zooplankton and macroinvertebrates to fish species.

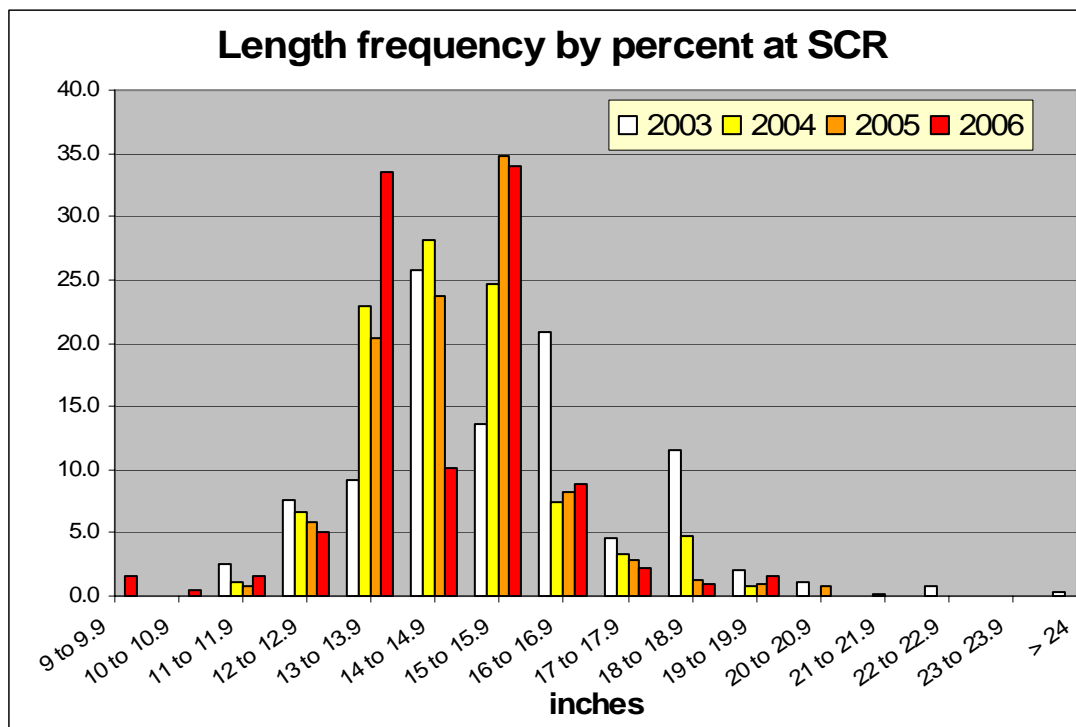
Figure 16: W_r by length group at MVR



Before discussing the results of the morphometric data at SCR, it should be noted that the creel data differed significantly from the gill net data. The gill net data, in terms of relative weights, is bleaker. This may be due to sample size or anglers selecting bigger and fatter fish. The two relative weights results will be discussed later.

At SCR, almost every fish caught was in two length groups, 13 to 13.9 and 15 to 15.9 inches. Few fish are making into bigger groups. This indicates that there is high mortality in trout once they reach the 15 inch range. This is also evidenced in the 2004 and 2005 years. With the high percentages of fish in these groups, one would expect that greater numbers would make it to larger size classes. But instead of a gradual decrease that we expect to see, a dramatic 70 to 72% drop in fish numbers occurs (Figure 17).

Figure 17: Length frequency of trout at SCR



The growth of trout at SCR is the most anemic of the three reservoirs with an exponent value of 2.1999 (Figure 18). This low value states that trout at the reservoir continue to grow in length but do not become as rotund as the trout in the other two reservoirs. The relative weight values also confirm poor weights in these fish (Figure 19). The creel data provided us with high variable W_r values. Smaller fish started in excellent condition but as size increased the W_r decreased which indicates deteriorating condition as fish age. However, the data obtained from gill net samples indicate that fish are in much poorer condition. This discrepancy may be attributed to three potential causes. The first is that small gillnet sample size did not represent the true population. The second potential reason may be due to season long creel surveys provided discreet, continuous data rather than instantaneous data. The third potential reason for the discrepancy may be attributed to the creel surveyor error in sampling and bias.

Figure 18: Length-weight regression of trout at SCR

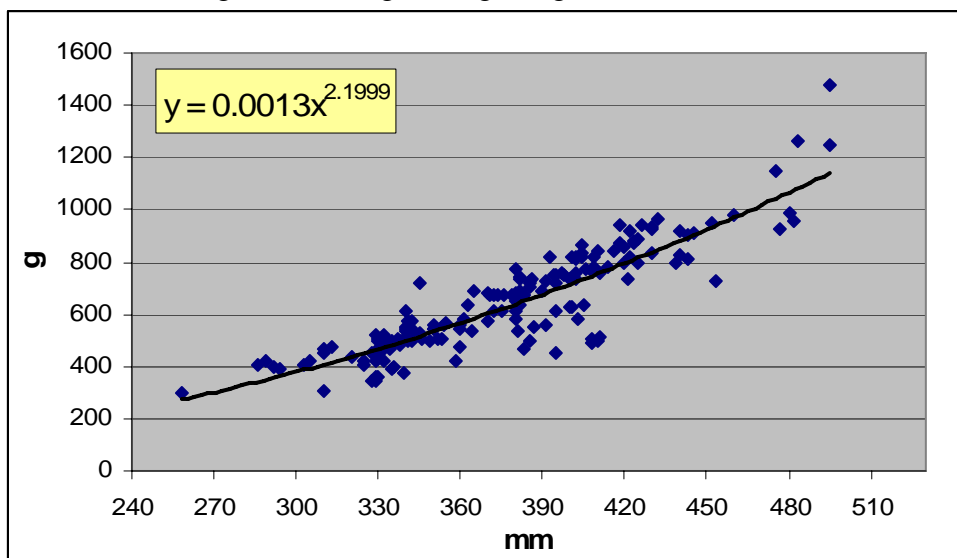
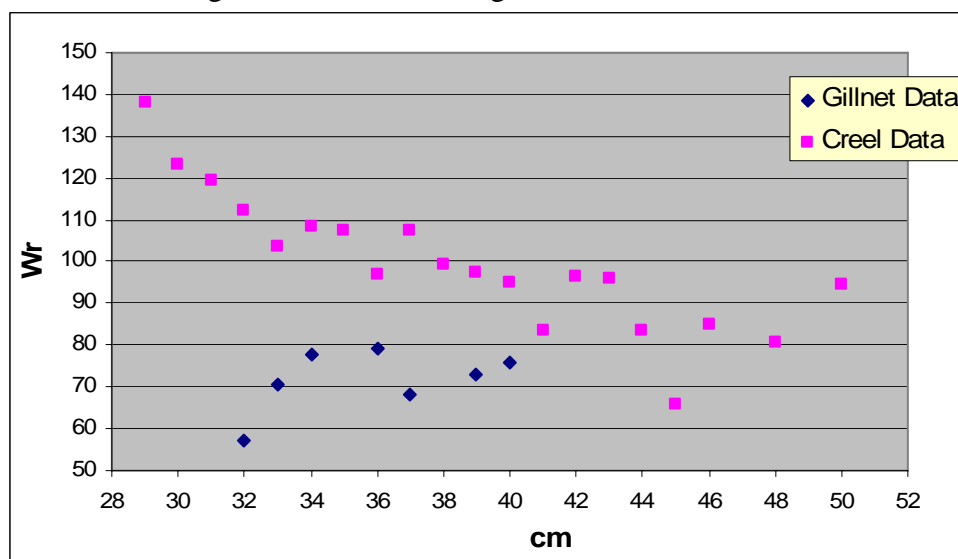


Figure 19: Relative weight values for trout at SCR.



Despite the discrepancy of gillnet data and creel data, one bit of information is clear. The fish at SCR are in poorer health than those at MVR and SCR. Most likely this poorer health and condition may be attributed to the high turbidity at SCR. The high turbidity can alter the entire fishery through limnological characters, food web changes, inter-specific competition, and foraging efficiency. In terms of management, this issue needs to be addressed and mitigated within the next couple of years.

The creel data collected by the employees provided an overview of the fishing pressure, success, and enjoyment. Table 4 shows averages of these characters for weekends and weekdays at the three reservoirs. Overall, MVR received the high angler visitation and SCR the least. LBS received the highest rating in terms of fishing enjoyment which coincides with the high catch-per-unit-effort. MVR and SCR had similar CPUE values.

Table 4: Creel data summary and averages

	# IN GROUP	SHO-PAI? (Y=1)	BOAT(1) SHORE(2) BOTH(1.5)	STAY (DAYS)	NUMBER OF FIRST VISITS	EFFORT	FISH CAUGHT	FISH KEPT	CPUE	HPUE	MEAN DAILY EFFORT (E)	HARMONIC E	TOTAL E	TOTAL ANGLERS PER DAY	RATING (1=poor, 2=fair, 3=good, 4=very good, 5=excellent)
MVR															
Weekday	2.33	1.96	1.39	2.20	41	12.17	7.95	1.84	0.54	0.25	7.81	5.61	70.47	9.47	2.50
Weekend	2.81	1.93	1.50	2.18	33	15.06	7.46	2.80	0.67	0.36	8.02	5.93	166.61	26.02	2.61
TOTAL ESTIMATED ANGLER-DAYS SPENT AT MOUNTAIN VIEW: 3,053															
LBS															
Weekday	2.19	1.96	1.07	2.07	39	13.25	23.91	0.03	1.84	0.01	8.20	5.84	67.22	8.16	2.89
Weekend	2.26	1.87	1.13	2.20	42	14.97	22.61	0.03	1.65	0.01	7.86	5.24	94.10	13.88	2.84
TOTAL ESTIMATED ANGLER-DAYS SPENT AT LAKE BILLY SHAW: 2,101															
SCR															
Weekday	2.60	1.95	1.57	2.77	11	13.03	6.51	2.96	0.60	0.32	6.67	4.82	37.61	4.83	2.56
Weekend	3.37	1.94	1.59	0.91	3	15.46	6.55	2.81	0.54	0.18	6.32	5.18	89.15	13.39	2.08
TOTAL ESTIMATED ANGLER-DAYS SPENT AT SHEEP CREEK: 1,565															

Submit/Acquire Data:

Submit data to data agency:

Water quality data submitted to StreamNet.

Produce Inventory or Assessment:

Inventory reservoirs for aquatic plants and algal blooms:

Brief surveys of the reservoirs showed that aquatic macrophytes commonly found were Coontail (*Ceratophyllum demersum*), Claspingleaf Pondweed (*Potamogeton richardsonii*), and Milfoil (*Myriophyllum spp.*).

Produce Plan:

Work with regional biologists and CBFWA to update plans:

No Resident Fish Committee meetings were attended.

Produce Pisces Status Report:

Status reports for the twelve months were completed and submitted to BPA.

Produce Annual Report:

Submit draft of FY06 annual report to BPA for review:

The FY06 annual report rough draft was worked on and completed in October.

Finalize FY06 annual report and post on BPA's website:

The finalized version of the FY06 annual report was submitted and posted on BPA's website.

References:

- Anderson, R.O. and R.M. Neumann. 1996. Length, weight, and associated structural indices. Pages 454-463 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- Burge, H.L. and W. H. Miller. 1993. Fishery Management on the Duck Valley Indian Reservation, Shoshone-Paiute Tribe. USFWS 1992 Annual Report. 12 pp.
- Ney, J.J. 1999. Practical Use of Biological Statistics. Pages 171-172 in C.C. Kohler and W.A. Hubert, editors. Inland fisheries management in North America, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- Cooperrider, A.Y., R.J. Boyd, and H.R. Stuart, eds. 1986. Inventory and monitoring of wildlife habitat. U.S. Dept. Inter., Bur. Land Manage. Service Center, Co. xviii, 858pp.
- Bookhout, T.A., Editor. 1996. Research and management techniques for wildlife and habitats. Fifth ed., rev. The Wildlife Society, Bethesda, Md. 740pp.