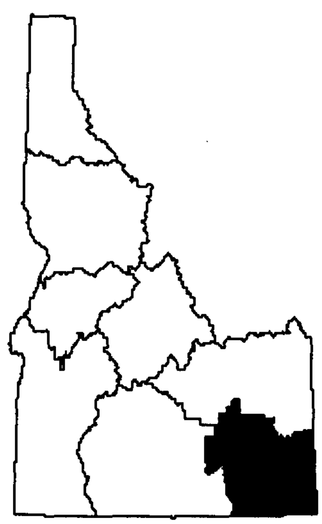
FISHERY MANAGEMENT INVESTIGATIONS

# IDAHO DEPARTMENT OF FISH AND GAME

## FISHERY MANAGEMENT ANNUAL REPORT

Cal Groen, Director



## SOUTHEAST REGION

## 2004

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## SOUTHEAST REGION 2004 FISHERY MANAGEMENT ANNUAL REPORT

## EXECUTIVE SUMMARY

Major projects completed in 2004 included the development of a draft Idaho management plan for Bonneville cutthroat trout (BCT), estimating age and survival of smallmouth bass in the Snake River, testing preliminary methods to reduce American white pelican predation on Yellowstone cutthroat trout populations in the Blackfoot River, completing a radio telemetry study of spawning cutthroat trout, and renovating Montpelier Reservoir to remove illegally introduced walleye.

The draft BCT management plan documents relevant biology, describes current status, identifies potential threats, and provides a prioritized list of conservation strategies for BCT in Idaho. Currently, BCT occupy an estimated 65% (555 miles) of the potential habitat. BCT status for the remaining Idaho streams was classified as 28% unknown, 6% extirpated, and 1% non-fish bearing. Priority conservation streams and potential limiting factors were identified for each of five separate management units. The management plan is an extensive document published separate from this annual progress report. A two page summary, however, is included in Appendix A.

Habitat conditions, population declines, and pelican foraging behavior dictated that actions be taken to reduce pelican predation on Yellowstone cutthroat trout where the Blackfoot River enters Blackfoot Reservoir. Hazing efforts included the following: zon guns, cracker shells, chasing birds away from the confluence with an airboat, and placing flagged monofilament lines across the river channel. The flagged monofilament line was the only technique that appeared to deter pelican foraging behavior. Despite our hazing efforts, the cutthroat trout run declined for the third straight year. Only 125 cutthroat trout were observed at the trap, of which 70% had bird scars. Bird scaring rates were lower for Utah suckers (36%).

Illegally introduced walleye were discovered in Montpelier Reservoir during adult perch capture efforts for Cascade Reservoir. Those walleye posed a potential threat to the upper portion of the Bear River important to fluvial BCT. To prevent walleye expansion in the Bear River, Montpelier Reservoir was treated with rotenone on September 15$^{th}$. On September 16$^{th}$, two walleye were found on shore (660 mm and 744 mm total length).

Twenty eight Yellowstone cutthroat trout from the Blackfoot River were implanted with radio telemetry tags and tracked during their spawning migrations. Spawning occurred the last week of May and first week of June. Twenty one (75%) of the cutthroat trout performed upstream migrations. The remaining seven fish dropped below the electric barrier and back into the reservoir or were removed by pelican predation. For the upstream migrants, fourteen of the fish spawned near the confluence of Lanes and Diamond creeks. Pelicans captured two of the upriver migrants. None of the tagged trout spawned in Sheep, Timothy, Bacon, or the upper Diamond creeks, where adfluvial cutthroat trout have been observed spawning in past surveys.

In 2004, we began surveying smallmouth bass in the Snake River. Our objective was to better understand angling impacts on the bass population. During the past five years, fishing pressure has increased markedly in the open boating zones at Massacre Rocks State Park, Gifford Springs, and Smith Springs. Preliminary investigations focused on estimating length-at-age and total annual mortality. Preliminary results show that Snake River smallmouth bass are growing much faster and have higher condition factors than largemouth bass populations from other Southeast Region waters. Age-6 smallmouth bass averaged 409 mm and weighed 1,000 grams. Similar aged largemouth from southeast Idaho average about 250 mm and weight 180 grams. Mean relative weight from a sample of 109 Snake River smallmouth bass was 145. Estimated total annual mortality using catch curve data was 37%.

## CUTTHROAT TROUT AND AMERICAN WHITE PELICAN INTERACTIONS IN THE BLACKFOOT RIVER: POPULATION TRENDS, PREDATION, AND MANAGEMENT ACTIVITIES

## INTRODUCTION

During the past four years, fisheries and wildlife crews have been investigating interactions between American White Pelicans *Pelecanus erythrorhynchos* and Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri* (YCT) in the Blackfoot River system. Summaries of bird diet analyses and consumption estimates as well as population trends for both species are available in Teuscher and Scully (2003) and Teuscher et al. (2004). Those studies focused on bird predation impacts on hatchery stocked rainbow trout. In 2004, we focused research on pelican interactions with native YCT during spawning migrations. Specifically, we estimated bird scarring rates on migrating fish, enumerated prey and predator abundance, and completed a fish telemetry study. Findings from 2004 led to the development of a preliminary strategy for managing pelican predation (Appendix B).

## METHODS

### American White Pelican Population Trends

Adult bird abundance was estimated using active nest counts. An active nest was defined as one that contained eggs or chicks. The adult bird population was estimated by doubling the active nest counts (VanDeValk et al. 2002). To complete the counts, two or three observers walked parallel transects along the edge of the island's plateau. The counting method was developed after a preliminary survey was completed to determine manpower and time requirements needed to canvas the entire Island.

### Cutthroat Trout Escapement

An electric fish migration barrier was installed in the Blackfoot River in 2003. The barrier includes a trap box designed using specification obtained from Smith Root Inc.. The barrier components include 4 flush mounted electrodes embedded in Insulcrete, four BP-X.X.-POW pulsators, and a computer control and monitoring system. The computer system can be operated remotely, records electrode outputs, and has an alarm system that triggers during power outages. Detailed descriptions of these components and their function can be obtained at www.smith-root.com.

The location of the trap is approximately 1 mile upriver of the confluence of the Blackfoot River with Blackfoot Reservoir. In 2004, we operated the adult migration trap from 25 April through 27 May.

### Bird Scars

A sample of migrating cutthroat trout captured at the trap was observed for bird scars. A fish was determined to have a bird scar if it had a puncture hole or deep slash mark. Figure 1 shows an example of a fish demonstrating bird scar marks. Scar rates were also recorded from a sample of Utah suckers *Catostomus ardens*.

**Radio Telemetry**

The objective of the radio telemetry study was to document spawning locations, post-spawning behavior, and mortality of cutthroat trout in the Blackfoot River. Fish movements were followed May through August, 2004.

Radio transmitters were surgically implanted in 28 Yellowstone cutthroat trout. All cutthroat trout used in the telemetry study were caught at the adult migration trap. The radio transmitters were Advanced Telemetry Systems model F1300. Transmitters weighed about 11 grams and were implanted in fish at least 600 grams. The transmitter carried mortality signals that would deploy if held stationary for more than 24 hours. The mortality indicators help determine mortality date, mortality location, and cause of mortality.

Figure 1. Bird scars on Yellowstone cutthroat trout collected at the migration trap on the Blackfoot River.

Surgery began by anesthetizing fish. Incisions were approximately 35 mm long, centered between the pectoral fins and pelvic fins. A grooved directional tool approximately 100 mm long was inserted into the incision and slid anteriorly, close to the flesh to prevent any contact with the internal organs. A 100 mm long catheter needle was inserted behind the pelvic fins and slid up the direction tool until it exits the opening of the incision. The antenna was inserted into the catheter needle and directed out the hole created behind the pelvic fins. The body of the tag is then gently inserted into the 35 mm incision. Incisions were closed with three or four stitches. Surgery times ranged from 6-8 minutes. Fish were placed in live wells filled with fresh water to recover and released about 100 m above the fish trap.

Tracking was completed using aerial, manual and stationary receivers. Manual tracking by truck was the primary method of locating fish. Manual tracking was completed weekly during the migration period. Aerial tracking was used to locate fish that we were unable to locate by ground tracking. GPS locations were recorded for each tracked fish. In addition to the mobile tracking systems, a fixed receiver was placed at the migration trap. The fixed receiver continually monitored fish movement past that point in the river from May through October 2004. The fixed receiver records fish radio frequency, direction of movement (up or downriver), and swimming speed.

## RESULTS

### American White Pelican Population Trends

We counted a total of 874 pelican nests on Gull Island. The nest count estimate expands to a total adult population of 1,748 pelicans. Since 2002, the pelican nesting population has increased by 30%. In addition to nest counts on Gull Island, observations of feeding pelicans were made at the confluence of the Blackfoot River. Those birds are drawn to the confluence by migrating Utah sucker and Yellowstone cutthroat trout. The largest concentration observed during spot checks was an estimated 500 pelicans counted on 8 May 2004. The pelicans fed in coordinated groups of 10 to 40 birds. During the fish migration period, it was a common occurrence to observe between 200 and 300 pelicans feeding at the confluence.

### Cutthroat Trout Escapement

A total of 125 cutthroat trout were caught in the migration trap. That is the lowest escapement estimated reported for YCT on the Blackfoot River. Escapement declined by 97% since continuous monitoring began in 2001.

### Bird Scars

Approximately 70% of the cutthroat trout and 36% of Utah suckers sustained bird scars. Bird scars appeared on all sizes of fish captured at the trap. For Utah suckers, mean lengths were similar for fish with (mean total length = 487 mm) and without bird scars (mean total length = 476 mm; $P = 0.11$, $n = 241$). Not enough cutthroat trout were captured to complete a similar length comparison test.

### Radio Telemetry

Of the 28 fish tagged, 9 spawned in Lanes and Diamond Creeks, 12 spawned in the mainstem Blackfoot River, one fish died at the release site, and 6 fish moved downriver post surgery. Upriver migrants concentrated in three spawning locations. The locations were at the confluence of Lanes and Diamond creeks, 0.8 kilometers up Lanes Creek, and 4.5 kilometers up Diamond Creek. A few fish appeared to spawn in the upper narrows (Figure 2).

Most of the post-surgery fish that dropped downriver (fish numbers 433; 452; 606; 652; 474) were tracked one or two times before disappearing from all subsequent ground or aerial tracking. The downriver movement placed those fish in the area where hundreds of pelicans were feeding. Those fish may have been removed from the study area by pelicans. Alternatively, they could have traveled into the reservoir and selected water too deep to be tracked by radio telemetry. One of those fish (# 474), however, was received while standing on Gull Island on June 12. The reception of that transmitter occurred for about one minute and then disappeared. That transmitter may have been inside a pelican that flew by Gull Island.

Mortality of spawning cutthroat trout was very high (Table 1). Of the 23 cutthroat trout that migrated upriver, 19 (83%) died. Bird predation accounted for 5 (26%) of 19 mortalities. Bird predators included four confirmed pelican mortalities and one osprey *Pandion haliaetus* mortality. Those mortalities were confirmed by recovering tags from pelican nests on Gull Island and on an osprey nest near the headwaters of Lanes Creek.

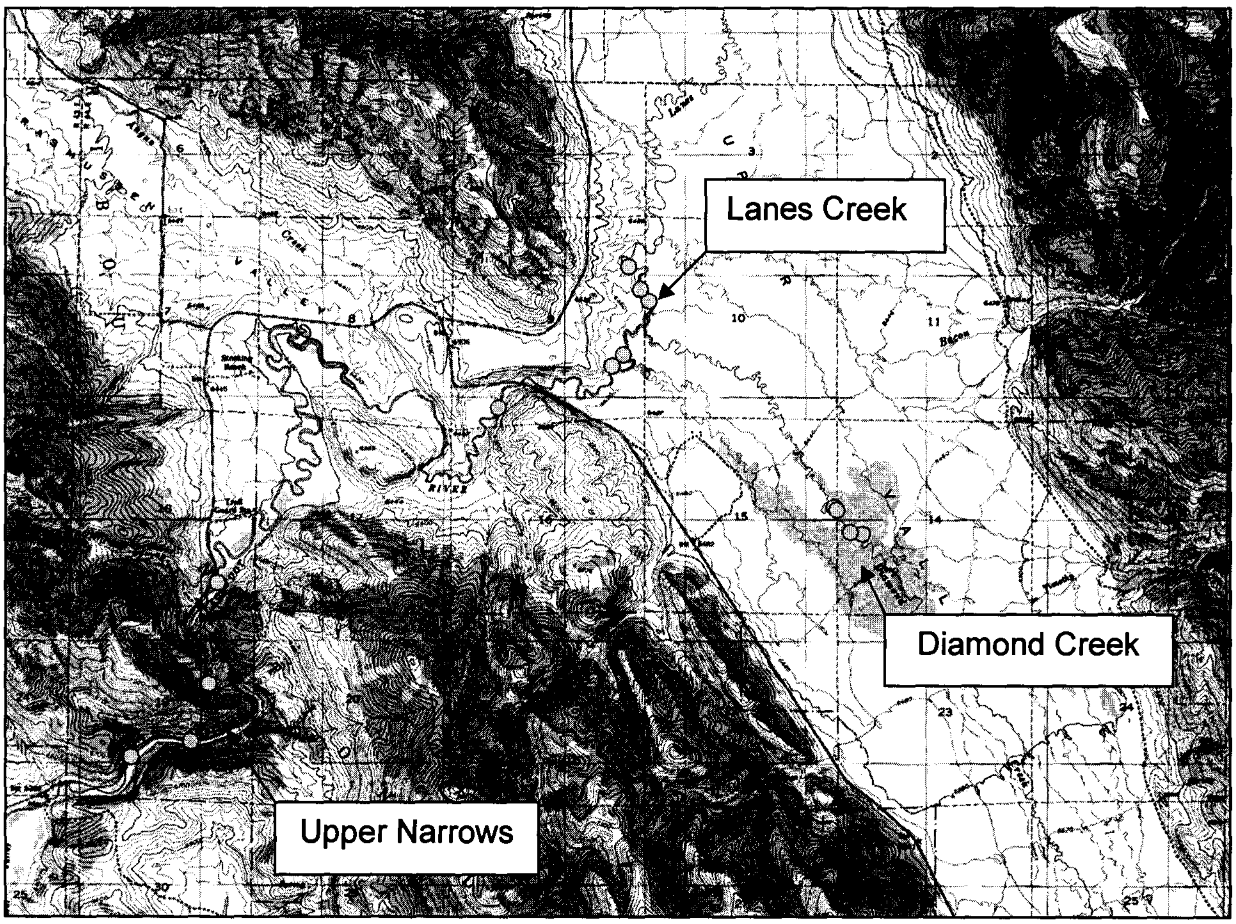



Figure 2. Spawning location of Yellowstone cutthroat trout on the Blackfoot River.

Of the remaining 14 mortalities, 10 radio transmitters were recovered on land, two were recovered from the river, and three mortality tags were never recovered. Most of the tags that were recovered either in river or on land were no longer attached to a fish carcass.

Pelicans preyed on cutthroat trout residing in the Blackfoot River and Reservoir. Fish number 234 was taken by a pelican from its spawning bed on Lanes Creek. That fish was tracked to the same location three times between May 27 and June 7. On June 8, the radio transmitter passed the fixed receiver site traveling at approximately 48 km / hour (30 miles / hour). On June 12, that fish was tracked to an unfledged pelican chick on Gull Island.

Fish 373 was tracked moving progressively downriver during the last week of May and first week of June. On June 12, transmitter 373 was recovered on Gull Island. Fish number 954 was tracked several times in the reservoir near Henry Bay and was also recovered on Gull Island. Surprisingly, that transmitter was found in 2005 by an observer counting pelican nests without the aid of a receiver.

With the exception of bird nest recoveries, we could not identify the type of predator for most of the fish transmitters found on land. Only one of the transmitters found on land was associated with a mesopredator den (i.e., fox, skunk, or coyote). One of the transmitters was located at the access parking area commonly used by anglers and may have been illegally harvested. One of the transmitters not recovered was reported to have been illegally harvested on Lanes Creek. The remaining eight transmitters were unclassified predator losses.

The electric fish barrier shortstopped two telemetry tagged cutthroat trout. After surgery, fish numbers 192 and 315 moved downriver over the electric barrier. Those fish remained close to the trap for about two weeks until the electric barrier was shut off. Within minutes of turning off the electric barrier, the fixed receiver recorded one of those fish moving upriver past the trap site. The second fish moved upriver past the shut off electric barrier the following day. The immediate movement upriver, once the trap was turned off, indicates that those fish were unsuccessfully challenging the electric barrier frequently, but did not find or choose to enter the trap's collection box.

Table 1. Summary of Yellowstone cutthroat trout telemetry results from the Blackfoot River.

| Tag # | Sex | Length (mm) | Weight (g) | Spawning or Furthest Upstream Location | UTM E | UTM N | Final Tracking Location or Fish Fate | Mortality Date |
|---|---|---|---|---|---|---|---|---|
| 134 | M | 555 | 1735 | Below Diamond Ck Rd. Bridge | 473462 | 4740915 | Stationary Receiver | |
| 373 | F | 448 | 1000 | Below Hunsaker's Weir | 467643 | 4735933 | Mortality (Gull Island) | 12-Jun |
| 234 | F | 560 | 1475 | Diamond-Lanes Confluence | 474640 | 4741873 | Mortality (Gull Island) | 12-Jun |
| 192 | M | 547 | 1700 | Diamond-Lanes Confluence | 474404 | 4741256 | Mortality (Land) | 16-Jul |
| 713 | M | | 705 | Diamond-Lanes Confluence | 474710 | 4741780 | Mortality (Tree) | 1-Jun |
| 334 | F | 452 | 970 | Diamond-Lanes Confluence | 474494 | 4741347 | Mortality (Land) | 7-Jul |
| 412 | F | 482 | 1240 | Diamond-Lanes Confluence | 474538 | 4742068 | Mortality (River) | 29-Jun |
| 923 | M | 526 | 1520 | Diamond-Lanes Confluence | 474640 | 4741882 | Mortality (Land) | 13-Jul |
| 395 | M | 515 | 1335 | Diamond Creek | 476242 | 4740096 | Mortality (Land) | 5-Aug |
| 894 | M | 554 | 1485 | Diamond Creek | 476478 | 4739878 | Mortality (Land) | 7-Jul |
| 293 | M | 505 | 1160 | Diamond Creek | 476379 | 4739889 | Mortality (River) | 13-Jul |
| 534 | F | 488 | 1210 | Diamond Creek | 476260 | 4740076 | Stationary Receiver | |
| 586 | M | 550 | 1420 | Lanes Creek | 474567 | 4749937 | Lanes Creek | |
| 623 | M | 490 | 1150 | Lanes Creek | 474526 | 4746445 | Mortality (River) | 5-Aug |
| 544 | M | 502 | 1300 | Lanes Creek | 474599 | 4746206 | Mortality | 11-Jun |
| 562 | F | 515 | 1330 | Lanes Creek | 474557 | 4746928 | Lanes Creek | |
| 315 | M | 530 | 1520 | Lower Narrows | 457115 | 4740094 | Mortality (Land) | 31-Aug |
| 595 | F | 480 | 1230 | Tagging location | 454828 | 4740848 | Mortality (River) | 17-May |
| 606 | F | 415 | 685 | Tagging location | 454840 | 4740990 | Mouth of reservoir | |
| 954 | F | 404 | 600 | Tagging location | 454817 | 4740807 | Mortality (Gull Island) | 2005 |
| 474 | | 452 | 950 | Tagging location | 454823 | 4740955 | Below electric trap | |
| 433 | M | 530 | 1360 | Tagging location | 454820 | 4740915 | Tagging location | |
| 452 | M | 520 | 1520 | Tagging location | 454814 | 4740848 | Tagging location | |
| 652 | M | 555 | 1440 | Tagging location | 454904 | 4741034 | Tagging location | |
| 513 | M | 578 | 1735 | Upper Narrows | 471077 | 4738642 | Mortality (Land) | 7-Jun |
| 743 | M | 464 | 905 | Upper Narrows | 470924 | 4738168 | Mortality | 24-Aug |
| 113 | F | 575 | 1340 | Upper Narrows | 470426 | 4738046 | Mortality (Land) | 29-Jun |
| 212 | F | | 1020 | Upper Narrows | 471141 | 4739473 | Mortality (Land) | 11-Jun |

## GROWTH AND SURVIVAL OF SMALLMOUTH BASS IN THE SNAKE RIVER

## INTRODUCTION

Smallmouth bass *Micropterus dolomieu* were introduced to the upper Snake River system in 1985. Since then, smallmouth bass have experienced rapid population growth in American Falls Reservoir and the Snake River below American Falls Dam. Angling pressure has increased commensurate with the bass population. Because of the increased fishing pressure, some angler groups have asked for more restrictive harvest regulations to protect quality size smallmouth bass. The current harvest regulations allow take of six bass over 12 inches. In response to angler requests, in 2003, the Department scoped a rule change to reduce the daily bag to 2 smallmouth bass with a minimum size restriction of 406 mm. Scoping included sending a random mail survey to 1,000 anglers that purchased their fishing licenses in the southeast Idaho region. Public meeting were held in Pocatello, Montpelier, Soda Springs, Malad, and Blackfoot. A total of 354 anglers responded to the potential rule changes. Forty one percent rejected and 28% supported the rule change. During that scoping process, however, it was determined that angling trends and smallmouth population parameters should be monitored. Monitoring goals include estimating growth, annual mortality, and angler exploitation.

## METHODS

Smallmouth bass were collected using night-time shoreline electrofishing. The area sampled was between Gifford and Smith Springs in an area of the Snake River closed to boating by the United States Fish and Wildlife Service. Samples were collected with boat-mounted electrofishing equipment. All electrofishing effort was completed between 2100 and 0400 hours. Lengths and weights were recorded for each fish. To develop length-at-age data otoliths were removed from smallmouth bass and placed in scale envelopes. Age analysis was completed using sectioned otoliths. Otolith sections were prepared and cut using the following steps:

1. Cut a drinking straw horizontally in half
2. Seal the ends of the straw by taping them to a sheet of paper
3. Fill the straw with ACE extra strength slow drying epoxy
4. Label the straw and paper for otolith identification
5. Place the otolith in the epoxy in a horizontal aspect
6. Allow the otoliths to set in epoxy for 24 hours
7. Mark the nucleus of the otolith by holding the epoxy and otoliths up to a bright light so that the center of the otolith can be marked with a Sharpie
8. Cut on both sides of the Sharpie line leaving the center of the otolith embedded in a thin section of the epoxy. A standard Dremel™ tool with a 0.5 mm cutting blade is a sufficient cutting devise.
9. Store otolith sections in original scale envelopes

Sectioned otoliths were read using a dissecting microscope. To finish the otoliths for reading, the sections were lightly sanded with 400 and 600 grit wet-dry sandpaper. The otolith sections were placed in glycerin and read with translucent light at 20 to 35 X magnification. Annuli were identified as the dark regions of the otolith. Pooled age information was used to create a catch curve and to estimate total annual mortality using FAST 1.0 software.

## RESULTS

A total of 109 smallmouth bass were collected during 2 hours of electrofishing. Size distributions of those bass are shown in Figure 3. Smallmouth bass condition in the Snake River was excellent. The average relative weight was 145. Growth rates in the river were also high. Age-6 smallmouth bass averaged 409 mm and weighed about 1,000 grams (Figure 4). Those growth rates are much faster than largemouth bass from surrounding waters. Average length for age-6 largemouth bass in southeast Idaho is 254 mm (Teuscher and Scully 2003). Total annual mortality using catch curve data was an estimated 37%. That catch information, however, was collected in one area of the Snake River closed to boating. We attempted to sample bass in some of the open boating areas, but unsafe weather conditions prevented completion. Collecting smallmouth bass population parameters from open boating areas should be included in future sampling efforts.

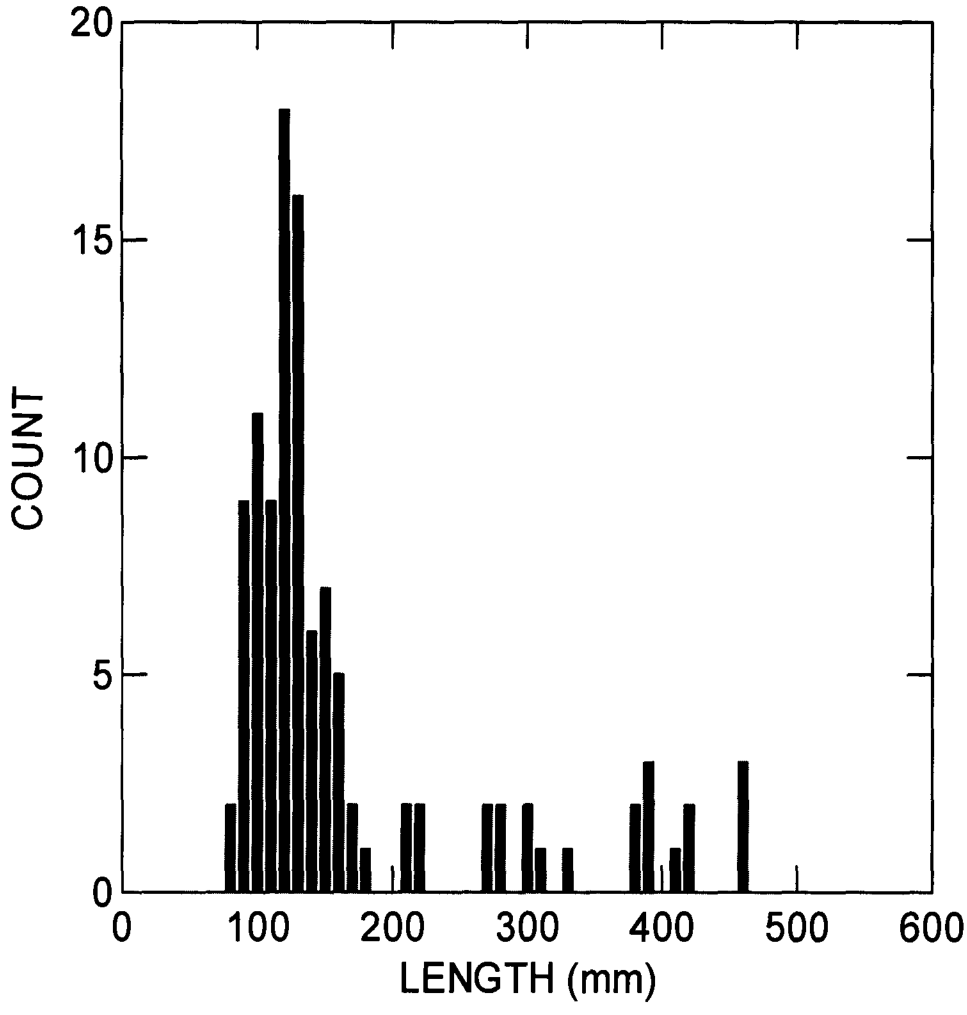



Figure 3. Smallmouth bass length data from Smith Springs area of the Snake River.

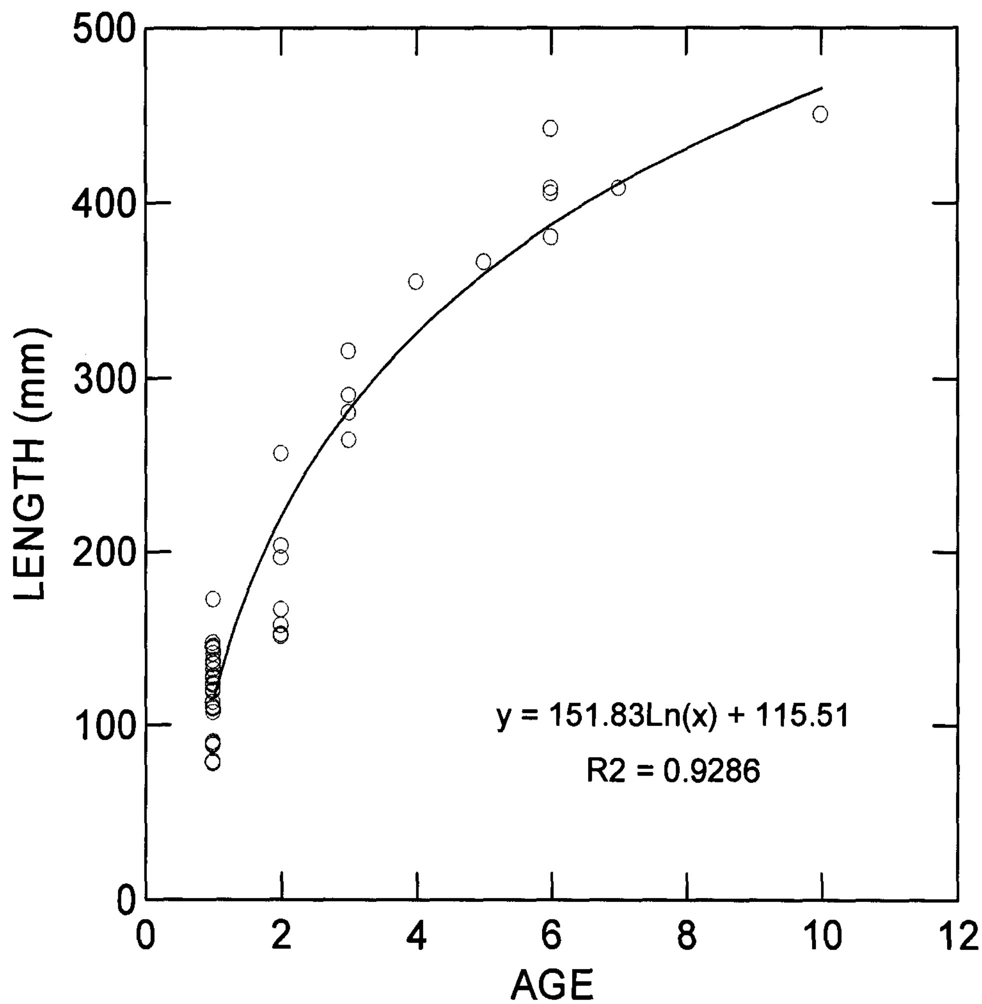



Figure 4. Smallmouth bass length at age estimates. Age estimates were made by reading annuli from sectioned otoliths.

# GENETIC EVALUATION OF BONNEVILLE CUTTHROAT IN BEAR LAKE AND ITS TRIBUTARIES

## INTRODUCTION

Past reports of the genetic status of cutthroat trout in Bear Lake range from extensively introgressed with rainbow trout *Oncorhynchus mykiss* to pure native Bonneville cutthroat trout *Oncorhynchus clarkii utah*. In one of the earliest reports, McConnel et al. (1957) suggested that few if any pure cutthroat trout remained in Bear Lake. In 1973, a project biologist at Bear Lake reported early returning trout at the Swan Creek trap included rainbow trout and hybrids. Nielson and Archer (1977) caught cutthroat trout, rainbow trout, and rainbow X cutthroat hybrids in Swan Creek spawning traps. Those phenotypic observation, however, are contradicted by genetic results. In 1983, 24 cutthroat trout used in a Bear Lake broodstock programs were found to be pure cutthroat trout using electrophoresis (Shiozawa, unpublished letter). Nielson and Lentsch (1988) sampled cutthroat trout from the Swan Creek spawning trap and found no hybridization with rainbow trout. In an unpublished memo, Powell (1999) reported similar findings from a sample of 35 fish. Despite the genetic results, biologists continue reporting wild rainbow trout and hybrids while sampling St Charles Creek (Burnett 2003; IDFG Bonneville cutthroat trout database).

The objective of this study was to document the current genetic status of cutthroat trout within Bear Lake and its two major spawning tributaries (St Charles and Swan Creeks).

## METHODS

Genetic samples were collected from *Oncorhynchus sp.* collected in Bear Lake, Swan Creek, and St Charles Creek. The lake samples were collected using gillnets set by Utah State University in December 2003 and January 2004. The Swan Creek samples were collected at the spawning trap in May and June 2004. The samples represent adfluvial fish migrating from Bear Lake to Swan Creek to spawn. Samples from St Charles Creek represent a random sample of fish taken from its headwaters to the confluence of Bear Lake. Unlike Swan Creek, non-migratory and migratory populations were mixed in the random sample. Figure 5 shows sample size and locations where fish were collected from St Charles Creek. It is very important to note that all genetic samples were collected randomly. Fish were not sorted based on phenotypic differences (i.e., all fish that were visually determined to be cutthroat trout, rainbow trout or hybrids were included in the genetic sample).

Total genomic DNA was extracted from a 1 mm piece of fin clip following methods described by Paragamian et al. (1999), adapted from protocols by Sambrook et al. (1989) and Hillis et al. (1996). DNA was re-suspended in 100 µl TE. Restriction Fragment Length Polymorphism analyses were conducted using one mitochondrial DNA marker digested with Hinf I (Cytochrome b; Mays 2002) and three nuclear intron markers: Recombination Activation Gene-RAG3' digested with Dde I enzyme (New England Biolabs), Ikaros Gene-IK digested with Hinf I (New England Biolabs), and Protoncogene 53-p53 digested with Alu I (New England Biolabs; Baker et al. 2002, Campbell et al. 2002). A simple sequence repeat (SSR) nuclear DNA marker, Occ16, diagnostic between rainbow trout and Yellowstone cutthroat trout was also amplified for each sample. Currently, no diagnostic markers for Bonneville cutthroat trout exist.

Digests were electrophoresed on 3% agarose gels and visualized as band patterns when fluoresced under UV-light (Figures 1a, 1b). Each unique band pattern generated by each marker/restriction enzyme pair was assigned a letter.

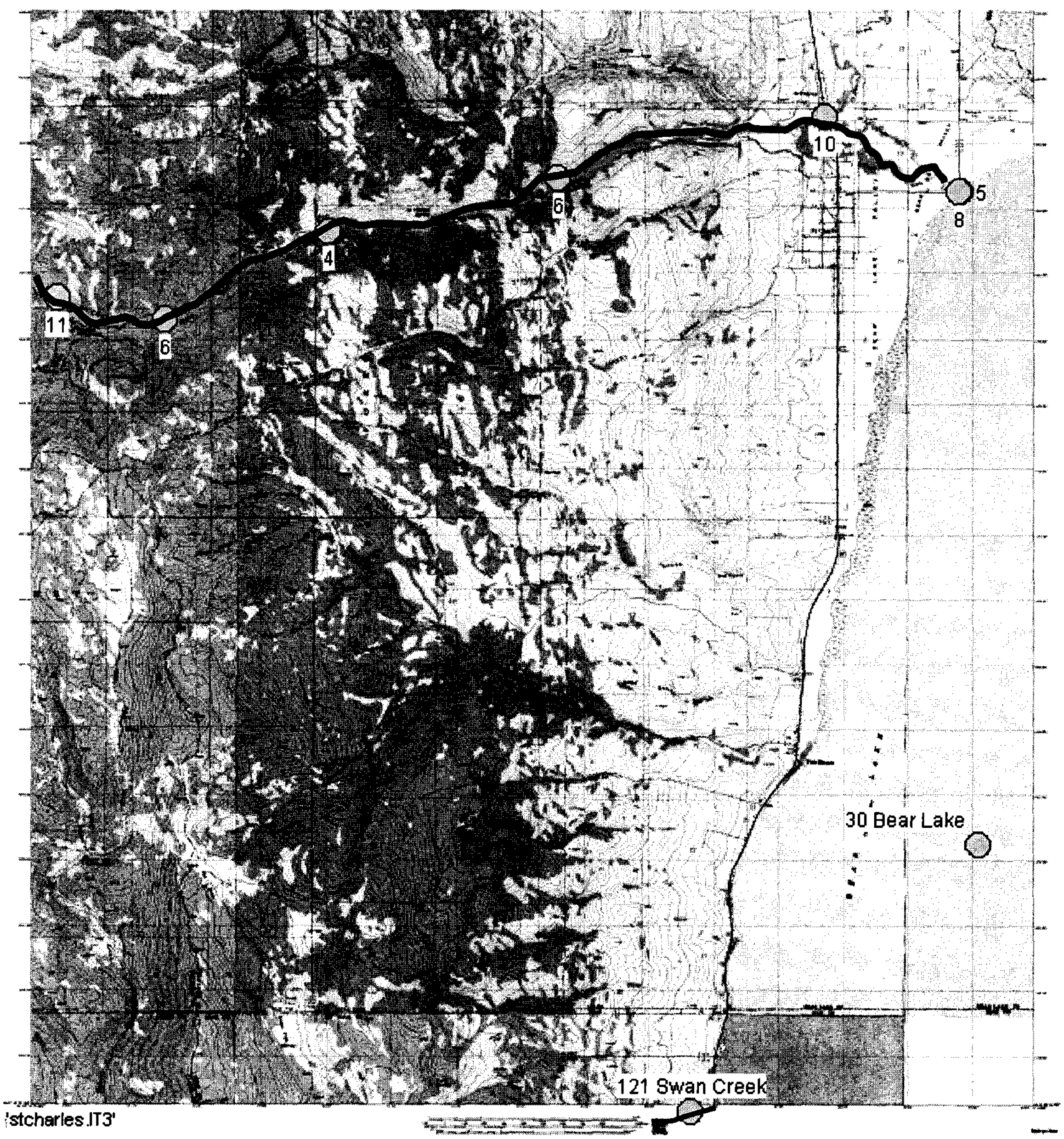



Figure 5. Genetic sample locations from St Charles Creek, Swan Creek, and Bear Lake. The numbers indicate sample size. A total of 50 fish were sampled from St Charles Creek. The Bear Lake samples were collected using gillnet set from several locations in the lake (Appendix C). The Swan Creek samples were collected at the spawning trap located in Utah.

Alphabetic designations were assigned to each unique allele, in the case of nDNA, or each unique polymorphism in the case of mtDNA. For the markers used in this study, "A" usually refers to a banding pattern unique to rainbow trout whereas "B" or "C" typically refers to a banding pattern unique to Yellowstone cutthroat trout. For the nDNA markers the genotype "AA" refers to an individual that is homozygous for rainbow trout alleles, "BB", "BC", or "CC" refers to an individual that is homozygous for cutthroat alleles, and "AB" or "AC" refers to an individual that is heterozygous with both a rainbow trout and cutthroat trout allele. The letter designations for each of the five marker/restriction enzyme pairs were later combined to infer if a sample was putatively pure or hybridized.

## RESULTS

Hybridized trout were observed in Bear Lake, St Charles, and Swan Creeks. Except for St Charles Creek, most of the hybrids were indicative of first generation hybrids ($F_1$). In St Charles most of the hybrids were greater than $F_1$ hybrids and demonstrate significant population introgression (Table 2).

Table 2. Genetic results from Bear Lake, St Charles and Swan Creeks.

| Population | Year | N | Hybrids Detected | % hybrids | $F_1$ | $> F_1$ |
|---|---|---|---|---|---|---|
| Bear Lake | 2003 | 30 | 2 | 7% | 2 | 0 |
| St Charles | 2003 | 19 | 13 | 68% | 4 | 9 |
| St Charles | 2004 | 31 | 18 | 58% | 4 | 14 |
| Swan Creek | 2004 | 121 | 4 | 3% | 3 | 1 |
| | totals | 201 | 37 | | 13 | 24 |

Samples of cutthroat trout were collected at the spawning facility on Swan Creek on four different dates: May 20 (N=6), May 27 (N=47), June 3 (N=34), and June 17 (N=40). Of the 47 fish sampled on May 27, two (#19 and #22) were identified as F1 hybrids (both with cutthroat mtDNA). The remaining 45 fish had genotypes indicative of pure cutthroat trout (homozygous for cutthroat alleles at every locus examined). Of the 34 fish sampled on June 3, one (#9) was identified as an F1 hybrid and one (#33) has been tentatively identified as a backcross hybrid (2 loci homozygous for cutthroat alleles and 3 heterozygous with both cutthroat and rainbow alleles). Two loci for this sample did not amplify and will have to be re-run). All 40 fish sampled on June 17 had genotypes indicative of pure cutthroat. Unfortunately, the four hybrids identified here were included in spawning operations at the Swan Creek trap and will contribute to second generation hybrid stocking in Bear Lake in 2005.

In addition to the random sampling from Swan Creek described above, six fin clips were provided by Utah Division of Natural Resources. Those samples were not randomly sampled from the run and were fish caught early in the run. Of the six fish sampled on May 20, two had genotypes indicative of cutthroat, three (#48, 50, and 52) were identified as hybrids (all with genotypes indicative of F1 hybrids, all with cutthroat mtDNA), and one individual (#49) was identified as a rainbow trout (homozygous for RBT alleles at every locus examined).

There are two possible origins of the $F_1$ fish caught in the Swan Creek trap. First, trap operators could have spawned a rainbow trout with cutthroat trout and the offspring were subsequently stocked in Bear Lake and returned to Swan Creek to spawn. Secondly, the $F_1$ hybrids are produced from natural mating events between rainbow and cutthroat trout in one of the tributaries. St Charles Creek is a likely source of hybridization. Surveys completed since 1987, show the majority of *Oncorhynchus* sampled in St Charles Creek have been rainbow trout and hybrids. Additionally, Burnett (2003) reported catching mature adfluvial rainbow trout, cutthroat trout, and hybrid trout in spawning traps operated at the mouth of the little and big arms of St Charles Creek (Burnett 2003).

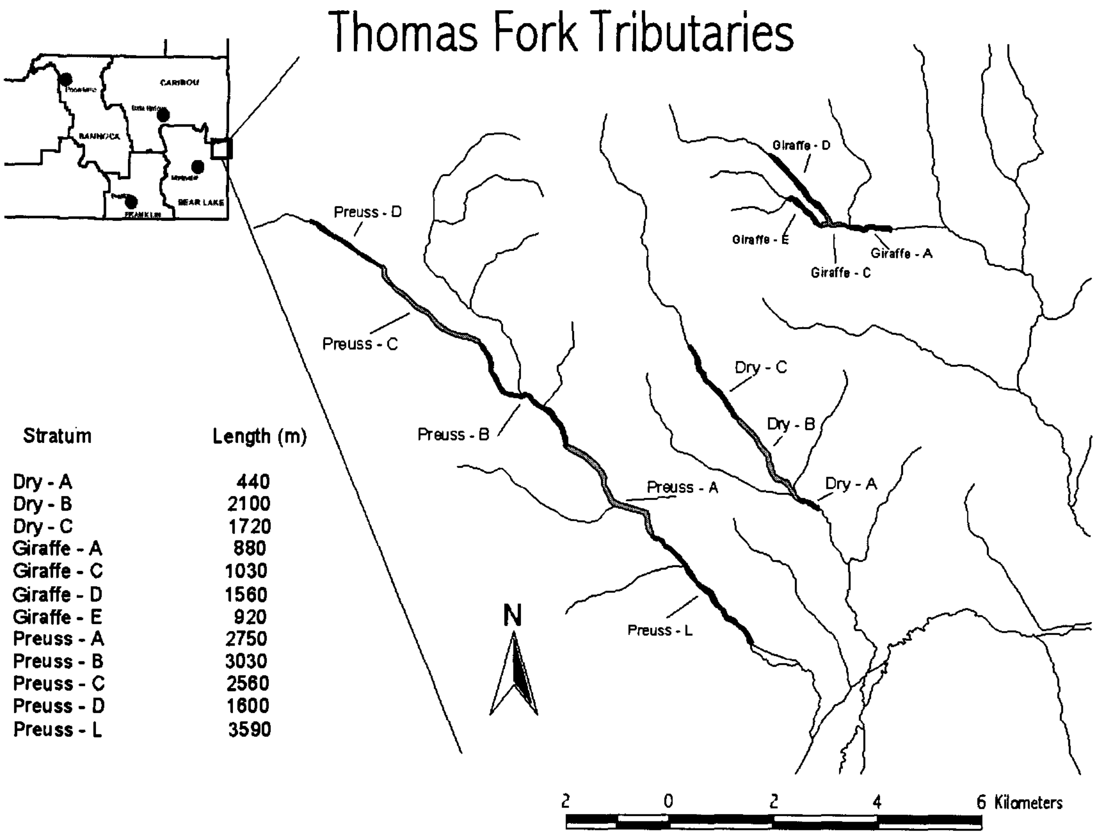
Identifying hybrids in the Bear Lake populations contradict findings from past reports. One possible explanation is that past genetic sampling efforts were not random. In past genetic surveys, only fish that "exhibited typical Bear Lake cutthroat trout characteristics were included in genetic sampling" (unpublished memo 1983; Nielson and Lentsch 1988). In this report, all *Oncorhynchus* were sampled.

## BONNEVILLE CUTTHROAT TROUT MONITORING IN THE THOMAS FORK TRIBUTARIES

### INTRODUCTION AND METHODS

Wallace (1978) and Behnke (1979) determined that essentially pure Bonneville cutthroat trout populations inhabited the Thomas Fork of the Bear River and its tributaries (Preuss, Dry, and Giraffe creeks). Due to increased concern over the status of this sensitive species, in 1994 a Conservation Agreement for the protection and enhancement of the Bonneville cutthroat trout was developed for the Thomas Fork tributaries on Forest Service land. In addition, cattle exclosures were constructed on selected reaches of each stream.

Department personnel have monitored age-1 and older cutthroat trout densities in the Thomas Fork tributaries since 1981. Annual monitoring was completed during the mid 1980s, but was reduced to alternate year sampling in 1991. In general, cutthroat trout densities were estimated using multiple pass removal techniques sampled with Smith-Root backpack electrofishing equipment. In these tributary streams, however, fish catch from the first pass explained 96% of the variation in total fish densities (Teuscher and Scully 2003). Therefore, to optimize use of personnel time, sampling effort was reduced to single pass runs. Sample sites were approximately 100 m long. Measurements of length, width, and depth were made for each site. In 2004, we sampled 6 sites on Preuss Creek, four sites on Giraffe Creek, and three sites on Dry Creek (Figure 6).




| Stratum | Length (m) |
|---|---|
| Dry - A | 440 |
| Dry - B | 2100 |
| Dry - C | 1720 |
| Giraffe - A | 880 |
| Giraffe - C | 1030 |
| Giraffe - D | 1560 |
| Giraffe - E | 920 |
| Preuss - A | 2750 |
| Preuss - B | 3030 |
| Preuss - C | 2560 |
| Preuss - D | 1600 |
| Preuss - L | 3590 |

Figure 6. Map of the Thomas Fork Tributaries. Sites sampled in 2004 were within strata A, B, C, and D in Preuss Creek, A and B in Dry Creek; and E and C in Giraffe Creek.

## RESULTS AND DISCUSSION

Bonneville cutthroat trout densities increased in Preuss and Giraffe Creeks and declined in Dry Creek. The Dry Creek population crashed from a mean of 24.9 cutthroat trout per 100 $m^2$ in 2000 to zero in 2004 (Figure 7). In Preuss and Giraffe Creeks densities are moderately higher compared to 2002, but remain low compared to populations observed in the mid 1980s (Table 3).

Population trends in the Thomas Fork tributaries appear to follow variations in water cycles. Rainfall totals were above average in the mid 1980s and 1990s and fish densities peaked during those periods. Given the sensitive status of Bonneville cutthroat trout and recent petitions to list the species under the Endangered Species Act, it is very important to included variation that appears to be associated with changes in annual precipitation. For example, population status reviews completed in 1986 or 2000 would yield very different conclusions than if a status review was based on densities observed in 1991 (Figure 7).

The Thomas Fork monitoring program needs to be expanded to other Bonneville cutthroat trout waters in Idaho. A recent Idaho status review of Bonneville cutthroat trout showed that there are about 50 tributaries occupied by Bonneville cutthroat trout and about 20 additional waters with unknown or extirpated status (see Appendix A). Monitoring just three of those populations is inadequate to assess long-term population trends. Developing a systematic monitoring program with geographic and temporal factors is necessary to adequately monitor Bonneville cutthroat trout trends in Idaho.

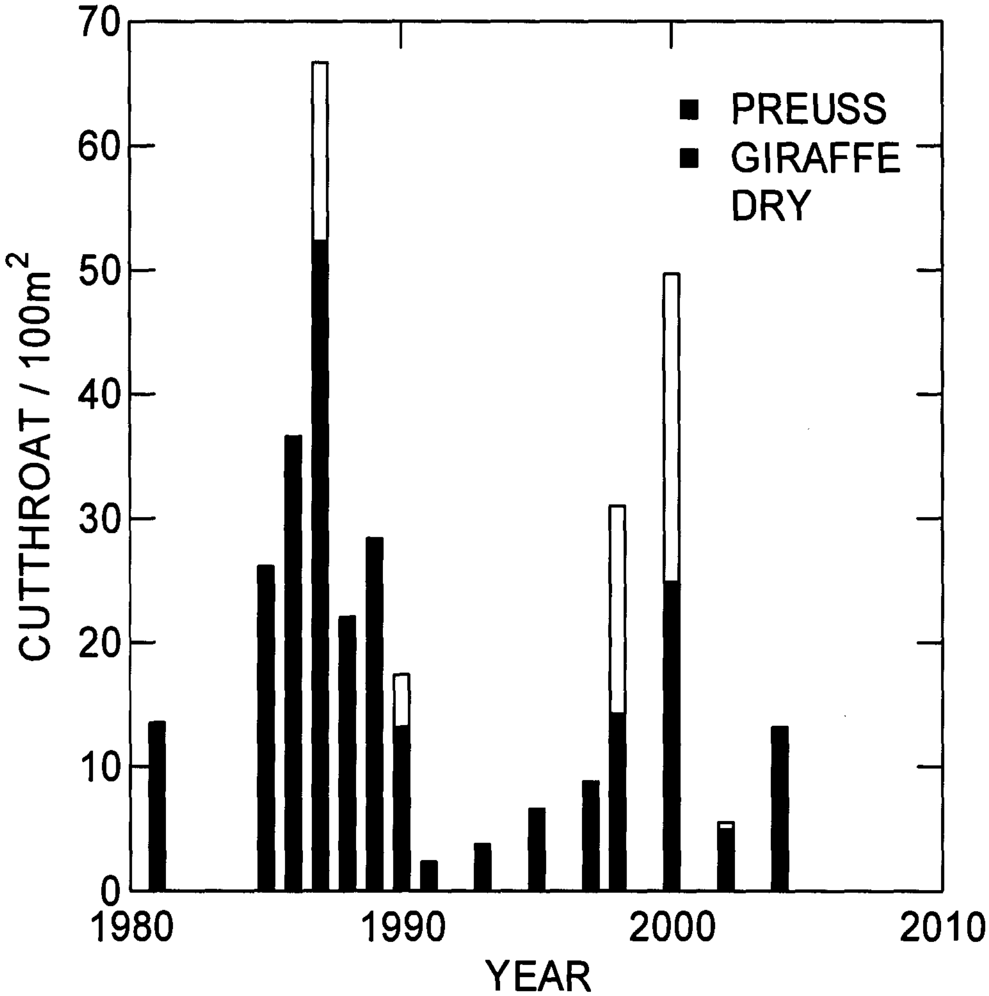



Figure 7. Bonneville cutthroat trout trends in three tributaries of the Thomas Fork Bear River.

Table 3. Bonneville cutthroat trout densities (numbers/100 $m^2$) in Preuss, Giraffe, and Dry creeks from 1981 through 2004. Only fish greater than 75 mm are shown. The 2004 density estimates are based on catch from a single pass.

| Year | min | max | mean | SE |
|---|---|---|---|---|
| **Preuss Creek** | | | | |
| 1981 | 6.2 | 16.3 | 11.3 | 5.1 |
| 1985 | 20.5 | 31.6 | 26.1 | 5.5 |
| 1986 | 15.0 | 17.5 | 16.3 | 1.3 |
| 1987 | 9.7 | 21.0 | 15.2 | 3.3 |
| 1988 | 22.0 | 22.0 | 22.0 | |
| 1989 | 1.0 | 2.6 | 1.9 | 0.5 |
| 1990 | 3.1 | 3.5 | 3.3 | 0.2 |
| 1991 | 0.3 | 3.6 | 2.3 | 0.8 |
| 1993 | 0.3 | 6.3 | 3.4 | 1.5 |
| 1995 | 1.7 | 5.9 | 3.2 | 0.9 |
| 1997 | 4.9 | 14.0 | 8.8 | 2.2 |
| 1998 | 3.2 | 3.2 | 3.2 | |
| 2000 | 5.6 | 10.7 | 7.9 | 1.5 |
| 2002 | 1.6 | 4.6 | 3.1 | 0.6 |
| 2004 | 0.9 | 21.4 | 9.1 | 3.3 |
| **Giraffe Creek** | | | | |
| 1981 | 0.2 | 4.2 | 2.2 | 2.0 |
| 1986 | 19.1 | 21.4 | 20.3 | 1.2 |
| 1987 | 32.7 | 41.5 | 37.1 | 4.4 |
| 1989 | 19.0 | 33.9 | 26.5 | 7.5 |
| 1990 | 5.5 | 14.1 | 9.8 | 4.3 |
| 1993 | 0.0 | 0.5 | 0.3 | 0.3 |
| 1995 | 0.0 | 5.0 | 3.4 | 1.2 |
| 1998 | 5.9 | 17.3 | 11.0 | 2.4 |
| 2000 | 3.1 | 38.6 | 16.9 | 8.2 |
| 2002 | 0.0 | 3.7 | 1.8 | 1.0 |
| 2004 | 2.4 | 5.4 | 4.0 | 0.8 |
| **Dry Creek** | | | | |
| 1987 | 14.4 | 14.4 | 14.4 | |
| 1990 | 4.3 | 4.3 | 4.3 | |
| 1993 | 0.0 | 0.0 | 0.0 | |
| 1998 | 11.2 | 24.8 | 16.8 | 4.1 |
| 2000 | 22.6 | 27.2 | 24.9 | 2.3 |
| 2002 | 0.3 | 0.9 | 0.6 | 0.3 |
| 2004 | 0.0 | 0.0 | 0.0 | |

## RENOVATION OF MONTPELIER RESERVOIR

### INTRODUCTION

In May 2005, a walleye *Sander vitreus* was captured in a trap net set in Montpelier Reservoir. That fish was the first documented occurrence of walleye in the Montpelier Creek Drainage. Walleye in the reservoir must have been illegally introduced because the department did not stock them. Walleye present a potential threat to native cutthroat trout. To prevent expansion of walleye, Montpelier Reservoir was treated with rotenone in September 2005. This illegal introduction followed an illegal introduction of yellow perch *Perca flavescens* that occurred sometime during the 1980s, and possibly again in the 1990s following a chemical renovation in 1993.

In 1992, to remove yellow perch, Montpelier Reservoir was renovated with 1.25 ppm of 5% rotenone. The management decision to renovate the reservoir was supported by 65% of Bear Lake county anglers (Scully et al. 1995). Unfortunately, yellow perch were either not completely removed by the treatment or were once again illegally introduced. Yellow perch were observed in the reservoir the year after renovation.

Similar to the first renovation, we asked local anglers to comment on the proposed renovation plans. Most of the attendees (84%) supported the department recommendation to remove walleye.

### METHODS

To estimate reservoir volume, a bathymetric map of the reservoir was constructed. An Eagle™ depth finder and a Garmin™ Global Positioning System were used to develop a bathymetric map of Montpelier Reservoir. Depth soundings and associated UTM coordinates were entered into SURFER 8 software to generate reservoir volume.

A survey of the fish community was completed using gillnets and electrofishing. The purpose of the survey was to document pre-treatment fishery conditions and catch and transport any native Bonneville cutthroat trout collected during the survey work. Three gillnets and approximately 2 hours of electrofishing were completed.

### RESULTS

A total of 1,325 depths were recorded to estimate total water volume in Montpelier Reservoir. The volume estimate was 893,081 $m^3$ (235,927,000 gallons; Figure 8). About 1.25 $m^3$ (330 gallons) liquid rotenone were distributed, at a concentration of approximately 1.4 parts per million.

Prior to the rotenone application, yellow perch dominated catch in gillnets. A total of 119 yellow perch, 3 Bonneville cutthroat trout, 2 kokanee, and 4 rainbow trout were captured. Yellow perch and rainbow trout were collected by electrofishing. No cutthroat trout were capture in electrofishing the entire shoreline area of the reservoir. All of the rainbow trout sampled were less than 300 mm total length.

Post-renovation shoreline pickup surveys were completed the day of and one day after the application of rotenone. The day of the treatment, 64 rainbow trout and 2 brown trout *Salmo trutta* were observed. The day after treatment, a selection of dead fish other than rainbow trout included 15 brown trout, 8 Bonneville cutthroat trout, and 2 walleye. No efforts were made to count abundant yellow perch.

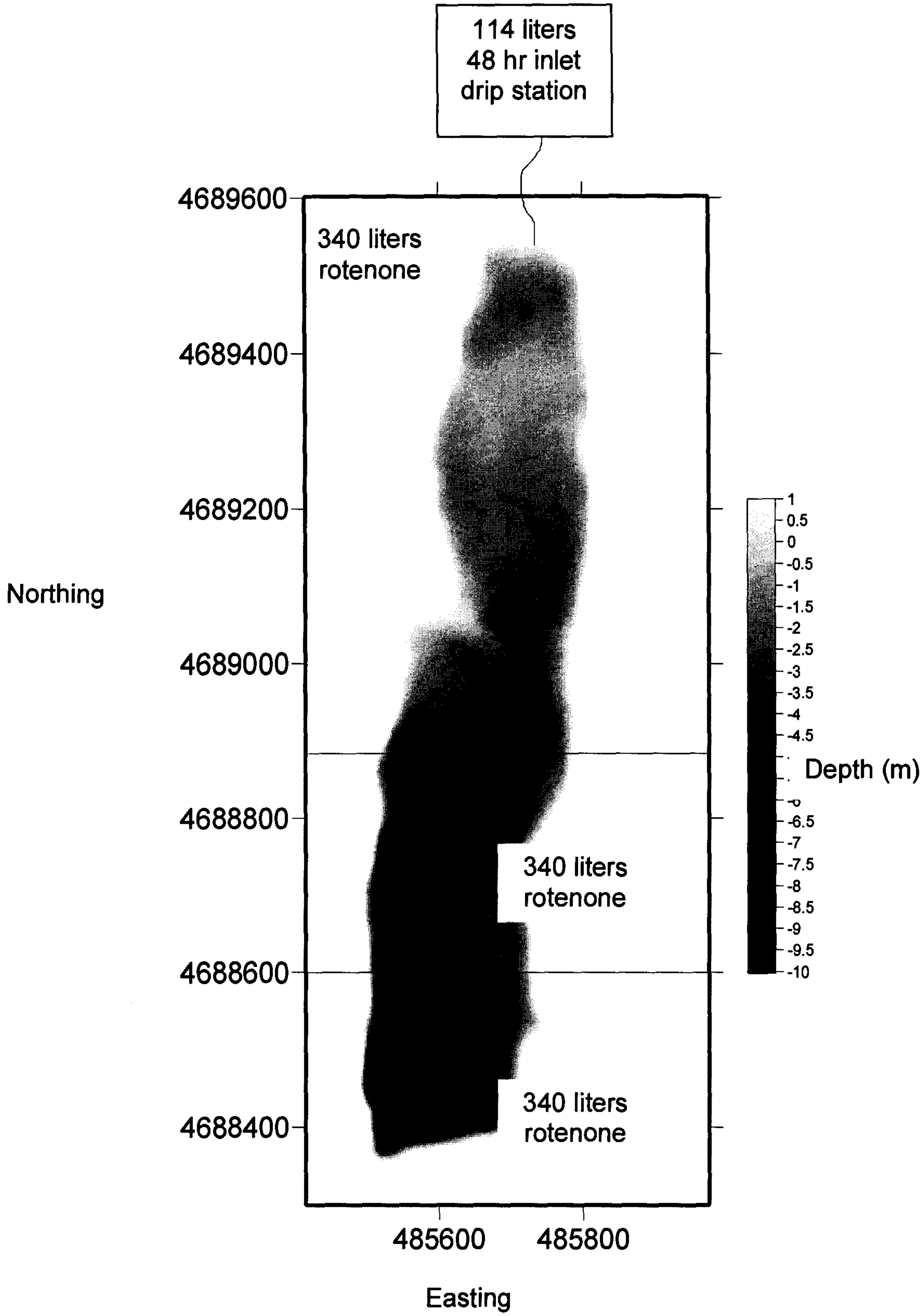



Figure 8. Bathymetric map of pool treated in Montpelier Reservoir in 2004. Liters of rotenone applied to each region are shown.

## MANAGEMENT RECOMMENDATIONS

1. Work with the Utah Division of Wildlife Resources to aggressively cull rainbow trout and hybrids captured in the Swan Creek spawning trap.

2. Open harvest of rainbow trout in St Charles Creek to reduce the potential for hybridization with Bear Lake cutthroat trout.

3. Develop a Bonneville cutthroat trout monitoring plan for the Bear River Drainage.

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# APPENDICES

## Appendix A. Executive Summary of the Idaho Bonneville Cutthroat Trout Management Plan

The historic range of BCT covers parts of Idaho, Wyoming, Utah, and Nevada. About 13% (855 miles) of the historic river and stream habitat occurs in Idaho. Considering just the Idaho portion, BCT currently occupy an estimated 65% (555 miles) of the potential habitat (Figure 9). BCT status for the remaining Idaho streams were classified as 28% unknown, 6% extirpated, and 1% non-fish barring. The unknown status describes waters that have not been sampled in the past five years or at all. Most of those systems are very small and likely do not support BCT.

A detailed status review was completed by pooling existing information from state, federal, and private entities. General conclusions from that review are: 1) BCT occupy most of the available tributary habitat in the Bear River Drainage, 2) the most abundant and well distributed BCT populations occur in the Logan, Cub, and Thomas Fork River tributaries, 3) many of the remaining tributaries are described as supporting BCT at relatively low densities, 4) localized extirpations appear to have occurred in five tributaries of the Bear River, 5) existing data and monitoring efforts describe primarily resident (or isolated) populations, and 6) future monitoring should incorporate fluvial populations that occur in larger river systems.

Conservation strategies focus on preserving genetic integrity, reducing impacts of non-native fish, improving critical habitat, and enhancing self-sustaining populations. This report concludes with an action plan of prioritized conservation measures that will contribute to the long-term persistence and enhancement of Bonneville cutthroat trout populations in Idaho.

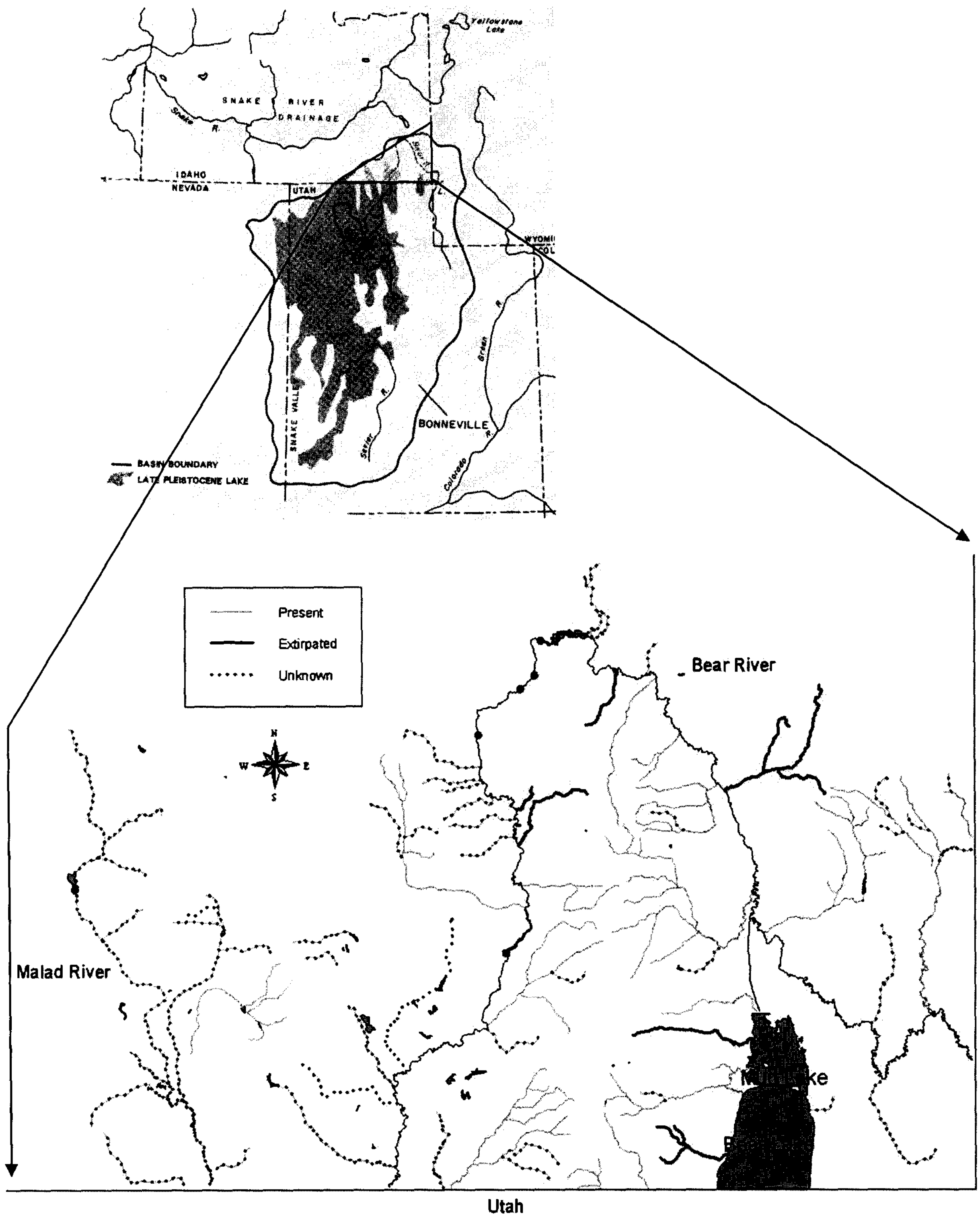


Figure 9. The historic range of Bonneville cutthroat trout covers parts of Wyoming, Idaho, Nevada, and Utah. About 13% (855 miles) of the historic river and stream miles occur in Idaho. Considering just the Idaho portion, Bonneville cutthroat trout occupy an estimated 65% (555 miles) of the potential habitat.

**Appendix B. 2005 Pelican Management Plan**

Predation by American white pelicans is threatening a genetically unique population of Yellowstone cutthroat trout in the Blackfoot River system. Factors contributing to the threat include: an expanding pelican population, a collapse in adfluvial cutthroat trout abundance, and a change in reservoir habitat creating ideal foraging conditions for fish eating birds. The adult pelican population at Blackfoot Reservoir increased from a few hundred in 1993 to over 1,700 in 2004. This pelican population represents one of only two breeding colonies in Idaho. Conversely, the adult population of Yellowstone cutthroat trout declined from 4,747 in 2001 to about 120 in 2004. Both pelicans and Yellowstone cutthroat trout are classified by IDFG as species of special concern. In addition to special concern status, recent genetic work showed that Blackfoot River cutthroat trout carry unique genetic markers not found in any other Yellowstone cutthroat trout population (Campbell et al., in press).

Recent drawdown of the Blackfoot Reservoir has created optimal foraging conditions for pelicans. Over the past four years, the reservoir's water level during peak cutthroat trout migration (~ May 15) dropped by 4 m. The decline in water level exposed approximately 4.8 km of old river channel. Water flowing through the old river channel is generally less than 0.5 m deep, and has no protective cover for migrating fish. In 2004, bird scars were observed on 70% of the 120 migrating cutthroat trout. Additionally, a small percentage of the pelican population foraged upstream on the Blackfoot River on cutthroat trout spawning grounds. In our 2004 telemetry study, three of 14 (21%) cutthroat trout carrying radio transmitters were eaten by pelicans about 30 miles upstream of the reservoir.

To protect migrant Yellowstone cutthroat trout, IDFG began hazing pelicans. Hazing methods included zon guns, cracker shells, chasing birds away from the confluence area with an air boat, and placing flagged monofilament "bird lines" across the river. The monofilament lines produced the desired affect of making the treated river reach inaccessible to feeding pelicans.

In 2005, we plan to expand the area covered by bird lines to include the lower three km of the Blackfoot River where it flows into the Blackfoot Reservoir. We will use volunteers from the local community and conservation groups to help install the lines. If bird lines prove to be ineffective, we will use lethal methods in conjunction with hazing to deter pelicans from concentrating and feeding on the river above the reservoir. Shooting birds with shot guns, in conjunction with hazing (i.e., cracker shells and zon guns), is intended to condition the birds to avoid the portions of the river where trout are most vulnerable to bird predation. Pelican behavior will be monitored to determine if the desired effect is being achieved.

The objective of this adaptive management program is to reduce pelican predation on cutthroat trout using non-lethal methods whenever possible. If lethal methods are used, no more than 3% of the breeding population will be taken. With the current pelican population levels this could result in up to 50 birds being removed. We do not feel this will significantly reduce the reproductive capacity of this population. We will continue to monitor the breeding population to insure that our actions do not negatively impact the nesting birds on Gull Island.

The following summarizes proposed action for the 2005 management of pelicans in the Blackfoot River system.

1. Install bird lines to make the river sections where cutthroat trout are highly vulnerable to bird predation inaccessible to foraging pelicans.

2. In the event the above action is not effective, we will incorporate intense hazing with lethal methods to keep pelicans off river sections where trout are especially vulnerable.

3. Monitor pelican behavior to evaluate effectiveness of hazing and lethal methods.

4. Make qualitative observations of pelican abundance at the confluence of the river and reservoir and upriver near cutthroat trout spawning areas. This will be used to determine if pelicans are displaced from the confluence upstream to spawning grounds.

5. Continue nest counts on Gull Island to monitor the breeding population's response to lethal methods.

6. Monitor abundance of cutthroat trout and incidence of bird scaring.

## Appendix C. Genetic data collected from Bear Lake, Swan Creek, and St Charles Creek.

| | | | | | | | | | ND12 mtDNA | | nDNA | nDNA | Occ | Occ | Occ | OM | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Random | Fish # | Date Collected | Length (mm) | Location | Fin Clips | Dpn-II | Hinf-I | Msp-I | Rsa-I | RAG 3' | p53/Alu-I | 36 | 38 | 42 | 55 | Genotype |
| Bear Lake | YES | 1 | 12/19/2003 | 446 | North Side | rt pect | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 2 | 12/19/2003 | 486 | North Side | ad clip | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 3 | 12/19/2003 | 474 | North Side | no clip | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 4 | 12/18/2003 | 312 | East Side | ad clip | C | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 5 | 12/18/2003 | 444 | East Side | no clip | E | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 6 | 12/16/2003 | 474 | Vegetation | ad clip | E | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 7 | 12/16/2003 | 466 | Vegetation | ad clip | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 8 | 12/16/2003 | 456 | Vegetation | ad clip | C | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 9 | 12/16/2003 | 419 | Vegetation | lt pect | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 10 | 12/17/2003 | 497 | Rockpile | ad clip | B | A | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 11 | 12/17/2003 | 462 | Rockpile | ad clip | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 12 | 12/18/2003 | 517 | East Side | ad clip | E | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 13 | 12/18/2003 | 519 | East Side | ad clip | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 14 | 12/18/2003 | 462 | East Side | ad clip | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 15 | 12/17/2003 | 425 | Rockpile | ad clip | C | C | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 16 | 12/17/2003 | 411 | Rockpile | ad clip | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 17 | 12/17/2003 | 474 | Rockpile | ad clip | C | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 18 | 12/17/2003 | 439 | Rockpile | lt pelv | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 19 | 12/17/2003 | 524 | Rockpile | ad clip | E | C | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 20 | 12/19/2003 | 446 | North Side | no clip | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 21 | 12/19/2003 | 480 | North Side | ad clip | C | C | C | C | cC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 22 | 12/16/2003 | 449 | Vegetation | ad clip | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 23 | 12/16/2003 | 498 | Vegetation | ad clip | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 24 | 12/23/2003 | 529 | Rockpile | no clip | C | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 25 | 12/15/2003 | 460 | North Side | no clip | B | A | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 26 | 12/8/2003 | 454 | Rockpile | no clip | B | A | C | A | | | | BB | BB | BB | BCT |
| Bear Lake | YES | 27 | 12/11/2003 | 457 | East Side | no clip | B | A | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | YES | 28 | 12/8/2003 | 590 | Rockpile | no clip | B | A | C | A | | | | BB | BB | BB | BCT |

Appendix C. Continued.

| | | | | | | | ND12 mtDNA | | | | nDNA | nDNA | Occ | Occ | Occ | OM | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Random | Fish # | Date Collected | Length (mm) | Location | Fin Clips | Dpn-II | Hinf-I | Msp-I | Rsa-I | RAG 3' | p53/Alu-I | 36 | 38 | 42 | 55 | Genotype |
| Bear Lake | YES | 29 | 12/11/2003 | 475 | East Side | no clip | B | A | C | A | AC | | | AB * | AB | AB | $F_1$ |
| Bear Lake | YES | 30 | 12/11/2003 | 405 | East Side | no clip | B | A | C | A | AC | | | AB * | AB | AB | $F_1$ |
| Bear Lake | Unknown | 1 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 2 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 3 | 1998 | | | | C | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 4 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 5 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 6 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 7 | 1998 | | | | C | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 8 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 9 | 1998 | | | | C | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 10 | 1998 | | | | E | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 11 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 12 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 13 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 14 | 1998 | | | | MISS | MISS | MISS | MISS | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 15 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 16 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 17 | 1998 | | | | C | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 18 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 19 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 20 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 21 | 1998 | | | | C | C | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 22 | 1998 | | | | B | A | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 23 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 24 | 1998 | | | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 25 | 1998 | | | | B | A | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 26 | 1998 | | | | B | A | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 27 | 1998 | | | | B | A | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 28 | 1998 | | | | B | A | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 29 | 1998 | | | | B | A | C | A | BC | | | BB | BB | BB | BCT |

Appendix C. Continued.

| | | | | | | | | | ND12 mtDNA | | nDNA | nDNA | Occ | Occ | Occ | OM | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Random | Fish # | Date Collected | Length (mm) | Location | Fin Clips | Dpn-II | Hinf-I | Msp-I | Rsa-I | RAG 3' | p53/Alu-I | 36 | 38 | 42 | 55 | Genotype |
| Bear Lake | Unknown | 30 | 1998 | | | | B | A | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 31 | 1998 | | | | B | A | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 32 | 1998 | | | | B | A | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 33 | 1998 | | | | C | C | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 34 | 1998 | | | | B | A | C | A | BC | | | BB | BB | BB | BCT |
| Bear Lake | Unknown | 35 | 1998 | | | | C | C | C | A | BC | | | BB | BB | BB | BCT |
| SwanCreek | YES | 1 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 2 | 6/3/2004 | | SpawningTrap | | | | | MISS | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 3 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 4 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 5 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 6 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 7 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 8 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 9 | 6/3/2004 | | SpawningTrap | | | | | [redacted] | AB | AB | AB | AB | AB | AB | $F_1$ |
| SwanCreek | YES | 10 | 6/3/2004 | | SpawningTrap | | | | | MISS | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 11 | 6/3/2004 | | SpawningTrap | | | | | MISS | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 12 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 13 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 14 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 15 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 16 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 17 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 18 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 19 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 20 | 6/3/2004 | | SpawningTrap | | | | | BCT | MISS | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 21 | 6/3/2004 | | SpawningTrap | | | | | BCT | MISS | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 22 | 6/3/2004 | | SpawningTrap | | | | | BCT | MISS | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 23 | 6/3/2004 | | SpawningTrap | | | | | BCT | MISS | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 24 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 25 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |

Appendix C. Continued.

| | | | | | | | ND12 mtDNA | | | | nDNA | nDNA | Occ | Occ | Occ | OM | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Random | Fish # | Date Collected | Length (mm) | Location | Fin Clips | Dpn-II | Hinf-I | Msp-I | Rsa-I | RAG 3' | p53/Alu-I | 36 | 38 | 42 | 55 | Genotype |
| SwanCreek | YES | 26 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 27 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 28 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 29 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 30 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 31 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | MISS | BB | BB | BB | BCT |
| SwanCreek | YES | 32 | 6/3/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 33 | 6/3/2004 | | SpawningTrap | | | | | MISS | AC | [redacted] | AB | AB | [redacted] | MISS | $>F_1$ |
| SwanCreek | YES | 34 | 6/3/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 1 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 2 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | MISS | BB | BB | BCT |
| SwanCreek | YES | 3 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 4 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 5 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 6 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 7 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 8 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 9 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 10 | 6/17/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 11 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 12 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 13 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 14 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 15 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 16 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 17 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 18 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 19 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 20 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 21 | 6/17/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 22 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |

Appendix C. Continued.

| | | | | | | | | | ND12 mtDNA | | nDNA | nDNA | Occ | Occ | Occ | OM | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Random | Fish # | Date Collected | Length (mm) | Location | Fin Clips | Dpn-II | Hinf-I | Msp-I | Rsa-I | RAG 3' | p53/Alu-I | 36 | 38 | 42 | 55 | Genotype |
| SwanCreek | YES | 23 | 6/17/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 24 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 25 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 26 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 27 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 28 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 29 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 30 | 6/17/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 31 | 6/17/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 32 | 6/17/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 33 | 6/17/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 34 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 35 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 36 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 37 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 38 | 6/17/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 39 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 40 | 6/17/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 1 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 2 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 3 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 4 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 5 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 6 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 7 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 8 | 5/27/2004 | | SpawningTrap | | | | | BCT | BB | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 9 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 10 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 11 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | MISS | BB | BB | BCT |
| SwanCreek | YES | 12 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 13 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |

Appendix C. Continued.

| | | | | | | | | | ND12 mtDNA | | nDNA | nDNA | Occ | Occ | Occ | OM | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Random | Fish # | Date Collected | Length (mm) | Location | Fin Clips | Dpn-II | Hinf-I | Msp-I | Rsa-I | RAG 3' | p53/Alu-I | 36 | 38 | 42 | 55 | Genotype |
| SwanCreek | YES | 14 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 15 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 16 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 17 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 18 | 5/27/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 19 | 5/27/2004 | | SpawningTrap | | | | | [redacted] | AB | AB | AB | AB | AB | AB | $F_1$ |
| SwanCreek | YES | 20 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 21 | 5/27/2004 | | SpawningTrap | | | | | MISS | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 22 | 5/27/2004 | | SpawningTrap | | | | | [redacted] | AB | AB | AB | AB | AB | AB | $F_1$ |
| SwanCreek | YES | 23 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 24 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 25 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 26 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 27 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 28 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 29 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 30 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 31 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 32 | 5/27/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 33 | 5/27/2004 | | SpawningTrap | | | | | BCT | MISS | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 34 | 5/27/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 35 | 5/27/2004 | | SpawningTrap | | | | | MISS | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 36 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 37 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 38 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 39 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 40 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 41 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 42 | 5/27/2004 | | SpawningTrap | | | | | MISS | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 43 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 44 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |

Appendix C. Continued.

| | | | | | | | ND12 mtDNA | | | | nDNA | nDNA | Occ | Occ | Occ | OM | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Random | Fish # | Date Collected | Length (mm) | Location | Fin Clips | Dpn-II | Hinf-I | Msp-I | Rsa-I | RAG 3' | p53/Alu-I | 36 | 38 | 42 | 55 | Genotype |
| SwanCreek | YES | 45 | 5/27/2004 | | SpawningTrap | | | | | MISS | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 46 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | YES | 47 | 5/27/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | NO | 1 | 5/20/2004 | | SpawningTrap | | | | | [redacted] | AB | AB | AB | AB | AB | AB | $F_1$ |
| SwanCreek | NO | 2 | 5/20/2004 | | SpawningTrap | | | | | RBT | AA | AA | AA | AA | AA | AA | RBT |
| SwanCreek | NO | 3 | 5/20/2004 | | SpawningTrap | | | | | [redacted] | AB | AB | AB | AB | AB | AB | $F_1$ |
| SwanCreek | NO | 4 | 5/20/2004 | | SpawningTrap | | | | | BCT | BC | BB | BB | BB | BB | BB | BCT |
| SwanCreek | NO | 5 | 5/20/2004 | | SpawningTrap | | | | | [redacted] | AB | AB | AB | AB | AB | AB | $F_1$ |
| SwanCreek | NO | 6 | 5/20/2004 | | SpawningTrap | | | | | BCT | CC | BB | BB | BB | BB | BB | BCT |
| St Charles | YES | 1 | 8/14/2003 | 220 | 3 | | D | D | A | E | AB | | | AB | AB | AB | $F_1$ |
| St Charles | YES | 2 | 8/14/2003 | 227 | 3 | | D | D | A | E | AB | | | AB | AA | AB | $>F_1$ |
| St Charles | YES | 3 | 8/14/2003 | 185 | 3 | | D | D | A | E | AC | | | AB | AB | AB | $F_1$ |
| St Charles | YES | 4 | 8/14/2003 | 210 | 3 | | D | D | A | E | AB | | | AB | AA | AB | $>F_1$ |
| St Charles | YES | 5 | 8/14/2003 | 240 | 3 | | D | D | A | E | AB | | | AA | AA | AB | $>F_1$ |
| St Charles | YES | 6 | 8/14/2003 | 245 | 3 | | MISS | MISS | MISS | MISS | AA | | | AB | [redacted] | AA | $>F_1$ |
| St Charles | YES | 7 | 8/14/2003 | 190 | 3 | | [redacted] | [redacted] | [redacted] | [redacted] | AB | | | AB | AB | AB | $F_1$ |
| St Charles | YES | 8 | 8/14/2003 | 220 | 3 | | D | D | A | E | AA | | | AB | AB | AA | $>F_1$ |
| St Charles | YES | 9 | 8/14/2003 | 210 | 3 | | D | D | A | E | AC | | | AB | AA | AB | $>F_1$ |
| St Charles | YES | 10 | 8/14/2003 | 230 | 3 | | D | D | A | E | AB | | | AB | AA | AB | $>F_1$ |
| St Charles | YES | 11 | 8/14/2003 | 285 | 3 | | [redacted] | [redacted] | [redacted] | [redacted] | AC | | | AB | AB | AB | $F_1$ |
| St Charles | YES | 12 | 8/14/2003 | 130 | 1 | | D | D | A | E | AA | | | AA | AA | AA | RBT |
| St Charles | YES | 13 | 8/14/2003 | 160 | 1 | | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | | | [redacted] | [redacted] | [redacted] | [redacted] |
| St Charles | YES | 14 | 8/14/2003 | 225 | 1 | | D | D | A | E | AA | | | AA | AA | AA | RBT |
| St Charles | YES | 15 | 8/14/2003 | 205 | 1 | | D | D | A | E | AA | | | AA | AA | AA | RBT |
| St Charles | YES | 16 | 8/14/2003 | 135 | 1 | | D | D | A | E | AC | | | AA | AB | AB | $>F_1$ |
| St Charles | YES | 17 | 8/14/2003 | 135 | 1 | | D | D | A | F | AA | | | AA | AB | MISS | $>F_1$ |
| St Charles | YES | 18 | 8/14/2003 | 145 | 1 | | D | D | A | F | AA | | | AA | AA | AA | RBT |
| St Charles | YES | 19 | 8/14/2003 | 105 | 1 | | B | A | C | A | CC | | | BB | BB | BB | BCT |
| St Charles | YES | 1 | 10/14/2004 | 320 | 1 | | | | | | CC | BB | | BB | BB | | BCT |
| St Charles | YES | 2 | 10/14/2004 | 370 | 1 | | | | | | AA | AB | | AA | AA | | RBT |

Appendix C. Continued.

| | | | | | | | | | | | nDNA | nDNA | Occ | Occ | Occ | OM | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Random | Fish # | Date Collected | Length (mm) | Location | Fin Clips | Dpn-II | Hinf-I | ND12 mtDNA Msp-I | Rsa-I | RAG 3' | p53/Alu-I | 36 | 38 | 42 | 55 | Genotype |
| St Charles | YES | 3 | 10/14/2004 | 230 | 1 | | | | | | AC | BB | | BB | BB | | $>F_1$ |
| St Charles | YES | 4 | 10/14/2004 | 225 | 1 | | | | | | CC | BB | | BB | BB | | BCT |
| St Charles | YES | 5 | 10/14/2004 | 215 | 1 | | | | | | CC | BB | | BB | BB | | BCT |
| St Charles | YES | 6 | 10/14/2004 | 80 | 2 | | | | | | AA | BB | | AA | AA | | RBT |
| St Charles | YES | 7 | 10/14/2004 | 227 | 2 | | | | | | MISS | AB | | AB | AA | | $>F_1$ |
| St Charles | YES | 8 | 10/14/2004 | 335 | 2 | | | | | | AA | BB | | AA | AA | | $>F_1$ |
| St Charles | YES | 9 | 10/14/2004 | 245 | 2 | | | | | | MISS | BB | | AB | AB | | $F_1$ |
| St Charles | YES | 10 | 10/14/2004 | 210 | 2 | | | | | | MISS | AB | | AB | AB | | $F_1$ |
| St Charles | YES | 11 | 10/14/2004 | 122 | 2 | | | | | | CC | BB | | BB | BB | | BCT |
| St Charles | YES | 12 | 10/14/2004 | 154 | 2 | | | | | | CC | BB | | BB | BB | | BCT |
| St Charles | YES | 13 | 10/14/2004 | 160 | 2 | | | | | | CC | BB | | BB | BB | | BCT |
| St Charles | YES | 14 | 10/14/2004 | 120 | 2 | | | | | | MISS | AA | | AB | AA | | $>F_1$ |
| St Charles | YES | 15 | 10/14/2004 | 80 | 2 | | | | | | MISS | MISS | | AB | AB | | $F_1$ |
| St Charles | YES | 16 | 10/14/2004 | 395 | 3 | | | | | | AA | AA | | AA | AA | | RBT |
| St Charles | YES | 17 | 10/14/2004 | 285 | 3 | | | | | | AA | BB | | AA | AA | | RBT |
| St Charles | YES | 18 | 10/14/2004 | 320 | 3 | | | | | | AB | AB | | BB | AA | | $>F_1$ |
| St Charles | YES | 19 | 10/14/2004 | 230 | 3 | | | | | | AA | AA | | AA | AA | | $>F_1$ |
| St Charles | YES | 20 | 10/14/2004 | 255 | 3 | | | | | | AA | AB | | AA | AA | | RBT |
| St Charles | YES | 21 | 10/14/2004 | 225 | 3 | | | | | | MISS | AB | | AA | AA | | RBT |
| St Charles | YES | 22 | 10/14/2004 | 325 | 4 | | | | | | MISS | BB | | AB | AB | | $F_1$ |
| St Charles | YES | 23 | 10/14/2004 | 270 | 4 | | | | | | AA | BB | | AB | AB | | $>F_1$ |
| St Charles | YES | 24 | 10/14/2004 | 330 | 4 | | | | | | MISS | BB | | AA | BB | | $>F_1$ |
| St Charles | YES | 25 | 10/14/2004 | 296 | 4 | | | | | | AA | MISS | | AA | AA | | RBT |
| St Charles | YES | 26 | 10/14/2004 | 315 | 5 | | | | | | AB | MISS | | AB | AA | | $>F_1$ |
| St Charles | YES | 27 | 10/14/2004 | 293 | 5 | | | | | | MISS | MISS | | AB | BB | | $>F_1$ |
| St Charles | YES | 28 | 10/14/2004 | 295 | 5 | | | | | | AA | MISS | | BB | AB | | $>F_1$ |
| St Charles | YES | 29 | 10/14/2004 | 300 | 5 | | | | | | AA | [illegible] | | BB | AA | | $>F_1$ |
| St Charles | YES | 30 | 10/14/2004 | 275 | 5 | | | | | | AB | MISS | | BB | AA | | $>F_1$ |
| St Charles | YES | 31 | 10/14/2004 | 210 | 5 | | | | | | AB | MISS | | BB | BB | | $>F_1$ |

**Submitted by:**

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**Regional Fishery Biologist**

**Richard Scully**
**Regional Fishery Manager**

**Approved by:**

**Bill Hutchinson, Acting Chief**
**Fisheries Bureau**

**William D. Horton**
**State Fishery Manager**