FISHERY MANAGEMENT INVESTIGATIONS

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2004 Southwest Region (Nampa) Annual Fishery Management Report

Lowland Lake Surveys

ABSTRACT

We surveyed five reservoirs during 2004. Arrowrock Reservoir was sampled using the lowland lakes survey method excluding overnight gill net sets to avoid killing Endangered Species Act (ESA) listed bull trout *Salvelinus confluentas*. Blacks Creek Reservoir was sampled using two floating and two sinking gill nets fished overnight to identify species present following several years of low water. Yellow perch *Perca flavescens* and bluegill *Lepomis macrochirus* were the only fish species captured in Blacks Creek Reservoir. Fairchild Reservoir was sampled using two floating and two sinking gill nets and two trap nets fished overnight to determine fish species present. Two largemouth bass *Micropterus salmoides* were captured in Fairchild Reservoir but land ownership questions prevent this water from being developed for public use. Little Blue Creek Reservoir was sampled using three floating and three sinking gill nets fished overnight to determine status of hatchery origin Lahontan cutthroat trout *Oncorhynchus clarkii henshawi*. Numbers of Lahontan cutthroat have decreased in recent years coincident with increases in bridgelip sucker *Catostomus columbianus* numbers and size. Paddock Valley Reservoir was sampled in May using the standard lowland lakes survey method. Absence of small bass, bluegill and crappie (*Pomoxis sp.*) indicate recruitment failure in recent years.

Kokanee salmon *O. nerka* spawner escapement monitoring was conducted on tributaries to Deadwood Reservoir. An adult trap was operated on the Deadwood River near the mouth of Basin Creek to monitor adult escapement and collect eggs for statewide stocking. Adult surveys were conducted on other tributaries to the reservoir. We estimated that 4,000 adults spawned in Trail Creek and 2,500 spawned upstream of the kokanee weir on the Deadwood River resulting in 2 million eggs deposited in Trail Creek and the Deadwood River.

Standard Zooplankton sampling was repeated this year in August on Lucky Peak, Arrowrock, C.J. Strike, and Deadwood reservoirs. Additional zooplankton sampling was conducted on Arrowrock Reservoir in May prior to the maintenance draw-down. Zooplankton ratios were higher than 2003 values for C.J. Strike, Lucky Peak and Arrowrock and substantially below 2003 values for Deadwood. Zooplankton quality indices were higher than 2003 values for all waters sampled. Fingerling trout stocking densities for Southwest Region waters are considered conservative based on observed zooplankton quality indices.

OBJECTIVES

1. Use standardized sampling methods to describe fish population trends in regional waters.

2. Evaluate size structure, estimate escapement and egg deposition for kokanee in Deadwood Reservoir.

3. Use standardized methods to assess zooplankton size structure trends in C.J. Strike, Lucky Peak, Arrowrock, and Deadwood reservoirs.

METHODS

The Idaho Department of Fish and Game (IDFG) Lowland Lake Survery program was started in 1992 to provide a standardized multi-gear fish community survey approach. Three sampling methods are used in the standard survey methods; gill netting, trap netting and electrofishing. Crane Creek Reservoir was surveyed using the Lowland Lake methods on June 13-14, 2005.

Gill net surveys were conducted with floating and sinking experimental gill nets 45.7 m long by 1.8 m deep composed of six -7.6 m long panels of 1.9, 2.5, 3.2, 3.8, 5.2, and 6.4 cm bar mesh. Nets are set by tying or anchoring one end of the net near on shore in water less than 0.5 m deep and extending the net perpendicular to shore. Nets are fished overnight. When more than one floating or one sinking net was used per water, nets were set to alternate large and small mesh ends next to the shore. Gill net catch-per-unit of effort (CPUE) was calculated as the combined catch of one floating and one sinking experimental net fished over night. Crane Creek Reservoir was sampled with two-pair of floating/sinking gill nets (two units of effort). Hereafter, gill net catch refers to combined catch from one floating and one sinking experimental gill net.

Six standard trap nets are 1.9 cm mesh with a 22.8 m lead with 0.9 by 1.8 m frame with crowfoot throats on first and third of five hoops were used to sample Crane Creek Reservoir. The CPUE for a trap net is calculated as catch of one net fished overnight.

Electrofishing was conducted from a boom mounted electrofishing boat with one or two netters. Sampling was along shorelines at night for 0.79 h. Attempts were made to collect all immobilized fish. Electrofishing CPUE was calculated as catch, by both number and weight, per hour of activated electrode time.

Proporational Stock Density (PSD) and relative weights (Wr) were calculated using methods described in Anderson and Neumann (1996). Values for Wr that were greater than 250 were assumed to be errors and were eliminated prior to analysis.

To examine trends in regional fisheries, historic survey data were retrieved from the Region 3 Lowland Lake Survey database. Historic fish stocking information was retrieved from the IDFG Fish Stocking Database (http://fishandgame.idaho.gov/fish/stocking/).

Arrowrock Reservoir

Arrowrock Reservoir was almost drained completely for valve replacements on the dam from October 2003 to March 2004. The reservoir was sampled June 3-4, 2004 using the standard sampling methods excluding gill nets (nine trap nets, 0.84 electrofishing) to evaluate changes in CPUE and species composition following the drawdown. Gill nets were excluded from the sampling methods to prevent incidental mortality of ESA listed bull trout present in the reservoir.

Blacks Creek Reservoir

Blacks Creek Reservoir was sampled on July 9 using gill nets (two pair) to determine if any fish remained following low water in 2003 and evaluate temperature and dissolved oxygen conditions.

Fairchild Reservoir

Fairchild Reservoir was sampled on July 20, 2004 using standard methods excluding electrofishing (two gill net pairs, two trap nets) and water temperature and dissolved oxygen conditions were also evaluated. The reservoir was sampled to determine fish species present and assess whether the fishery could be developed for public use.

Little Blue Creek Reservoir

Little Blue Creek Reservoir was sampled using gill nets (three pair) on June 15, 2004 to investigate whether the introduced Lahontan cutthroat trout survived the winter and to describe the size structure and species composition changes over time.

Paddock Reservoir

Standard lowland lake sampling methods (three trap nets, three gill net pairs and 1.08 h electrofishing) were used on Paddock Reservoir May 17, 2004. Three locations were sampled (north-end of the reservoir, mid-reservoir, and near the dam) to assess fish populations following continued drought conditions.

Deadwood Reservoir Kokanee Monitoring

Southwest Region fisheries personnel assisted Nampa Fish Hatchery personnel with installation of a picket weir on the Deadwood River on August 10, 2004. The weir was located just downstream from the mouth of Basin Creek to collect adult kokanee migrating upstream in the Deadwood River. The weir served multiple purposes; 1) collect early spawning kokanee eggs for statewide kokanee management needs 2) control escapement during most of the spawning run on the main Deadwood River, Basin and Wild Buck creeks and 3) provide a capture point for evaluating population characteristics of the kokanee spawning population. Length and fecundity data were collected during egg take operations. Eggs were counted from a subset of females spawned for hatchery production to estimate length-fecundity relationships. The escapement goal for the Deadwood River and tributaries upstream of the trap is zero kokanee. High water breached the trap on the evening of August 19 allowing kokanee to pass.

The mainstem and tributaries upstream of the weir were surveyed for adult kokanee immediately following weir installation.

Idaho Department of Fish and Game records indicates that kokanee spawn in numerous tributaries of Deadwood Reservoir. Spawning surveys are conducted generally by foot and included single and multiple pass efforts. Survey information indicates that Trail Creek is the largest kokanee spawning area not currently controlled by the weir on the Deadwood River. Beaver, Middle Fork of Beaver, South Fork of Beaver, and Habit creeks are known kokanee spawning streams. Beaver and South Fork Beaver creeks have had notable kokanee escapements in the 1980's and early 1990's.

Regional fisheries personnel performed tributary spawning surveys to estimate kokanee escapement between August 11 and September 23, 2004. Tributaries were surveyed by walking from the mouth upstream with one or two observers. Trail, Moulding, South Fork Beaver, Beaver and Habit creeks were surveyed twice during the kokanee spawning season. If kokanee were observed spawning in an uncontrolled tributary then a count was repeated within a week. Efforts were made to survey all major tributaries. Based on prior observations Trail Creek was expected to have the largest escapement of any of the uncontrolled tributaries. Trail Creek, Moulding, South Fork Beaver, Beaver, Basin and Wild Buck creeks were surveyed initially on August 11. The Deadwood River (upstream of the trap) and Habit Creek were surveyed initially on August 12. Maps and global positioning system (GPS) coordinates describing survey beginning and endpoints are in Appendix A-B.

Salmon spawning escapement is commonly estimated using the Area-Under-the-Curve (AUC) methodology. The AUC estimate is determined by plotting fish numbers over time and dividing by residence time (Irvine et al. 1992). Fish numbers are determined by multiple surveys enumerating adult spawners conducted over the spawning season. Three types of data are critical for this technique, fish counts, and estimates of residence time and observer efficiency (Hilborn et al. 1999). The AUC method is sensitive to residence time of adults in the spawning area and to the efficiency of observers in viewing adults. The Trapezoidal approximation method (equation 1 in Hilborn et al. 1999) was used to calculate AUC. Because adults were present during our final survey the final survey period was adjusted using equation 3 in Hilborn et al. 1999.

Trail Creek is the largest (currently uncontrolled) kokanee spawning tributary on Deadwood Reservoir. Estimating kokanee abundance and ultimately egg deposition is important to balance our kokanee stocking efforts with natural reproduction. The AUC method described above was used to estimate spawner escapement to Trail Creek. We estimated residence time of adult kokanee spawning in Trail Creek by tagging adult kokanee. On August 25, 2004, a single trap net was set overnight in a pool 100 m upstream from the mouth of the creek with the mouth opening downstream centered in the thalweg and the trap end stretched and anchored upstream. The lead was stretched across the right side of the channel. The mouth and the lead blocked most (>98%) of the stream width. The following morning 57 adult kokanee were removed from the trap and tagged using 2.54 cm yellow Petersen disk tags and released 50 m upstream of the trap (41 kokanee were released untagged). Length and sex of kokanee were recorded prior to release. Subsequent surveys on Trail Creek recorded the number of tagged and untagged kokanee observed. Residence time and escapement was calculated using methods described in Hillborn et al. (1999). We assumed that observer efficiency was 99% based on water clarity and available cover.

Kokanee were observed in Habit Creek on August 31, 2004. Habit creek is a small tributary (<1 m wetted width) with substantial bank vegetation and undercut banks in the lower section which provide good cover for kokanee. The upper section is more open with less cover provided by overhanging banks and vegetation. In order to estimate observer efficiency a reach approximately 50 m long in each section was selected and block nets were installed at the upstream and downstream boundaries. Each section was surveyed with two people walking upstream and all kokanee observed were counted. After surveying the section was sampled with a backpack electrofishing unit which we assumed captured 100% of the kokanee present.

Gill netting, hydroacoustic and limnology surveys of Deadwood Reservoir were conducted by IDFG Fisheries Research Personnel during 2004. Results of these surveys appear in a separate report.

Zooplankton Surveys

The Southwest Region has been conducting standardized zooplankton surveys since 1999 as an index of reservoir productivity and to evaluate year to year variation in productivity. Zooplankton samples were collected from C.J. Strike Reservoir on August 2; Lucky Peak and Arrowrock reservoirs August 3; and Deadwood Reservoir on August 6, 2004. Arrowrock Reservoir was also sampled on May 13 to compare spring and fall zooplankton abundance. Samples were collected with standard Wisconsin-type nets (0.5m mouth,1.5 m deep, mesh sizes 153µ, 500µ and 750µ) vertically retrieved from a depth of 9.1 m to the surface. Processing was done according to methods described in Teuscher (1999). The Deadwood Reservoir 2004 sample was a mean of two net tows in 2004.

RESULTS AND DISCUSSION

Arrowrock Reservoir

The electrofishing survey on Arrowrock Reservoir captured nine fish species (Figure 1). Sportfish (smallmouth bass *Micropterus dolomieu*, hatchery rainbow trout *O. mykiss* and yellow perch) made up 17% of the total catch. Trap net surveys captured five fish species (Figure 2) with hatchery rainbow trout the only sportfish species captured. The PSD for smallmouth bass captured in electrofishing surveys was 27. Trap net catches in 2004 were compared with 1997 efforts that were focused on capturing bull trout for a population estimate and radio tagging. Comparisons showed a reduction in number of species captured after the drawdown. Bull trout, mountain whitefish *Prosopium williamsoni*, black bullhead *Ameiurus melas*, yellow perch and redside shiner *Richardsonius balteatus* were captured in 1997 and absent in 2004 (Figure 3). While not an ideal pre-post survey design, there were changes to the fish community following drawdown.

Blacks Creek Reservoir

Yellow perch were the most numerous fish captured during sampling on Blacks Creek Reservoir representing 98% of the 52 fish captured. A single bluegill (145 mm total length) was the only other fish captured. Most yellow perch were less than 180 mm, but multiple age classes appeared to be present (Figure 4). Yellow perch PSD was 2.0.

Blacks Creek Reservoir is drained frequently and rarely has enough water to carry fish through the winter. During sampling, dissolved oxygen declined rapidly at 5 meters below the surface and water temperatures were between 18 and 21 ^{o}C (Figure 5). The last time the reservoir was surveyed in 1997 and 1999 white crappie *Pomoxis annularis* made up 100% of the catch. The fish community in the reservoir was the result of an unauthorized introduction. The perch will continue to provide a fishery unless the reservoir goes dry.

Fairchild Reservoir

Only two largemouth bass were captured in gill nets on Fairchild Reservoir. The only bass measured had a total length of 203 mm length and weight of 170 g (Wr= 152). Trap nets captured no fish.

No records of historical sampling or fish stocking exist for Fairchild Reservoir. The reservoir was over 13 m deep with water temperatures of 14 ^{o}C at 6 m (Figure 6). The boundaries of the land (and therefore ownership) under and immediately adjacent to the reservoir is ambiguous because a legal description of the boundaries is unattainable due to a previous land sale involving an unknown (or lost) benchmark which was used for the original surveying.

Little Blue Creek Reservoir

Lahontan cutthroat trout (LCT, n = 29) and bridgelip sucker (BLS, n = 99) were the only fish captured in gill nets on Little Blue Creek Reservoir. Length of LCT captured was between 195 and 495 mm (Figure 7). The percentage of LCT captured and gill net CPUE have declined to the lowest levels observed since 1993 (Figure 8), while BLS gill net CPUE increased for the second year in a row. The percentage of BLS in the catch reached an all time high (Figure 9). Recent sampling indicated an increase in percent catch by weight of BLS relative to LCT catch (Figure 10). Stocking rates of LCT have been increasing in recent years (Figure 11). Relative weight values have remained consistent, but have a wider variation than previous years (Figure 12). The PSD value for 2004 was among the lowest calculated since 1993 (Table 1). Size structure of LCT has remained relatively stable, but reductions in number of fish in most size classes became apparent in 2002 and again in 2004 (Figure 13). The abundance of BLS over 300 mm began increasing in 1999, and continued to increase in 2002 and 2004 relative to samples from 1993, 1994, and 1995 (Figure 14). This pattern suggests an environmental change is influencing these populations, most likely the result of water management and drought.

Paddock Reservoir

Notice from irrigators that the reservoir would be drained in 2002 resulted in a salvage order enacted September 21, 2002. The reservoir was not completely drained and an electrofishing sampling conducted in 2003 indicated fish survived the draw down. Paddock Reservoir was again nearly drained through the winter of 2003-2004. In 2004, the lowland lake survey captured 164 gamefish and zero nongame fish. The number of fish captured was only 34% of the number captured in 2002; despite a slight increase in sampling effort (one additional trap net was used in 2004). By number, largemouth bass (45%) were the dominant fish species captured with black crappie *Pomoxis nigromaculatus* (20%), bluegill (18%), and brown bullhead (15%), hatchery rainbow trout (1%) and pumpkinseed sunfish *Lepomis gibbosus* (1%)

represented (Figure 15). By weight, largemouth bass (38%) and brown bullhead *Ameiurus nebulosus* (35%) dominated the sample, while other species individually made up less than 15% of the catch by weight; black crappie (13.7%), bluegill (10.7%), hatchery rainbow trout (1.9%), pumpkinseed (0.9%).

The three sampling methods used captured fish in different ratios. Electrofishing catch was dominated by largemouth bass (Figure 16). The trap net sample was dominated by black crappie (Figure 17) and the gill net sample was dominated by brown bullhead (Figure 18). Despite the differential species capture by gear type the PSDs for largemouth bass calculated from trap net and electrofishing samples using seven years of data were highly correlated (r^2= 0.83).

Fish populations in Paddock Reservoir have survived the extended drought period. However significant population declines have occurred. Largemouth bass CPUE (from electrofishing) for fish >200 mm has steadily declined since 1999, but PSD has improved since 2003 (Figure 19). The absence of small largemouth bass indicates recruitment failure for several years (Figure 20). Low numbers of small bluegill and black crappie also indicate recruitment limitations. This fishery will be severely depressed, possibly for several years until sufficient water returns to allow successful spawning.

Deadwood Reservoir Kokanee Salmon Monitoring

The fish trap on the Deadwood River was operated from August 10 to September 11, 2004. Average kokanee lengths were 325 mm for males (n=794) and 312 mm for females (n=710; Figure 21). We trapped 8,966 adult kokanee at the Deadwood River trap with the peak occurring August 22 (Figure 22). Eggs from 41 kokanee spawned at Deadwood Trap were counted to establish a length fecundity relationship (Figure 23).

Tributary monitoring for kokanee spawning was initiated immediately after the trap was installed. Survey dates and results are presented in Table 2. During the initial monitoring kokanee were observed above the trap in Wild Buck Creek and the Deadwood River. Subsequent monitoring in other uncontrolled tributaries found kokanee in Trail, Beaver, and Habit creeks. Only one kokanee was observed in Beaver Creek during three surveys. Kokanee surveying on Trail Creek continued weekly through September 9 and a final survey was conducted on September 23. Kokanee arrival in Trail Creek corresponded to arrival of kokanee at the Deadwood River trap (Figure 22).

During spawning surveys on Trail Creek, tagged and untagged kokanee were recorded separately to allow calculation of residence time. The initial survey conducted 1 d post release counted 34 tagged kokanee in the stream (Table 3). This was the largest number of tagged fish observed during any single count period. The last tagged kokanee was observed on September 9.

Two stream sections were sampled on Habit Creek to determine observer efficiency at detecting adult kokanee in habits with varying amounts of cover. Observers expected a difference between the two sections based on observable habitat features, but the magnitude of the difference was unknown. Adult kokanee sightability (measured by efficiency of observers in counting adult kokanee) was substantially lower in the section that held more cover compared to the more open upper section (Table 4). In the more open habitat observer efficiency was still less than 90%.

Tributaries to Deadwood Reservoir provide abundant spawning habitat for kokanee. In the late 1980's and early 1990's kokanee were overabundant in Deadwood Reservoir resulting in maturation at small sizes. Numerous factors (predation, rain on snow events resulting in egg loss, and chemical removal) contributed to a decrease in kokanee densities in the mid 1990's resulting in low densities of large (>16") kokanee. The decrease in kokanee numbers in the mid 1990s resulted in the initiation of kokanee stocking in 1997. Fingerling kokanee have been stocked in Deadwood Reservoir regularly since 2001. No evaluation of survival of stocked kokanee or contribution to the fishery or egg take has been done.

We estimated approximately 4,000 kokanee spawned naturally in Trail Creek. This was based on a residence time of 11.8 d. This residence time assumes that the number of tagged kokanee observed on the first survey date (34) represented the number of tags available to be sighted during the remainder of the survey. If we assume that all 57 kokanee initially tagged were available throughout the survey the estimate of residence time decreases to 7.2 days resulting in an escapement estimate of approximately 6,000 kokanee. Without knowing the fate of the unsighted tags on the first date, we assume that escapement based on a residence time of 11.8 days is closest to the actual value. (See Appendix C for escapement and residence time calculations).

We monitored naturally spawning kokanee in tributaries and above the weir on the Deadwood River to estimate potential kokanee egg deposition. We estimated an average female (312 mm) would produce approximately 630 eggs based on fecundity observed at the weir. Using our escapement estimate of 4, 000 adults and an estimated 50% female run composition, over 1,259,000 kokanee eggs were deposited in Trail Creek. We counted 2,300 adult kokanee in the Deadwood River that escaped above the weir and 157 adults prior to installing the weir, resulting in a minimum of 2,457 adult kokanee spawning in the Deadwood River. Assuming 50% female run composition average female length of 312 mm, approximately 773,000 eggs were deposited in the Deadwood River. Although kokanee were observed spawning in Habit Creek the creek was nearly dry on the final survey conducted September 23. Based on the water conditions observed we assume Habit Creek will not provide any natural recruitment to the kokanee population.

Deadwood Reservoir is intermediate in productivity compared to other Idaho kokanee waters based on secchi depths of 7.1 to 6.4 m observed in August 2003 (Butts 2005). Rieman and Maiolie (1995) compared catch rates, effort, and yield for kokanee fisheries in Idaho and determined catch rates of kokanee increased with increased fish density up to 50 fish/ha for kokanee > 170 mm. Kokanee catchability also increased with length although, their observations were limited for kokanee greater than 270 mm. Adult kokanee density in Deadwood Reservoir (based on adult escapement and trap counts) was 5 fish/ha. This represents a minimum density as it represents only spawning adults in tributaries and excludes fish that attempted to spawn in the reservoir, immature fish > 170 mm and fish harvested by anglers. Additionally, all of the adults we measured in Deadwood Reservoir were over 170 mm and 98% of adults were larger than 270 mm indicating that Deadwood is operating well outside the size range of kokanee used by Rieman and Maiolie for their analysis.

Zooplankton Surveys

The zooplankton quality index (ZQI) has been used in Idaho to evaluate hatchery trout stocking potential in waters throughout the state (Teuscher 1999). The ZQI values for Southwest region waters sampled during 2004 would be classified as high productivity (ZQI >

1.0 g/m) except for Deadwood Reservoir which would be classified as moderate (ZQI from 0.1 to 1.0 g/m; Figure 4). Overall ZQI values have increased from 2003 values and were the highest values observed since 1999 for Arrowrock and Lucky Peak reservoirs. The Southwest Region waters sampled were most often as having moderate productivity, with the exception of C.J. Strike which was classified equally as moderate and high productivity.

Stocking guidelines based on ZQI are 0 fingerlings/acre in low productivity waters, 75-150 fingerlings/acre in moderate productivity reservoirs, and 150-300 fingerlings/acre in high productivity waters (Teuscher 1999). Based on the August ZQI value and normal stocking rates all Southwest Region reservoirs sampled were stocked at conservative densities (Table 5). In 2004 Arrowrock Reservoir received a fish plant as mitigation for fish losses from reservoir withdrawl. Although the 329,000 fingerlings planted in 2004 was twice the normal stocking rate the value was still classified as a moderate stocking density.

A seasonal comparison was conducted on Arrowrock Reservoir to evaluate differences in zooplankton abundance between the traditional sampling which is conducted in August and the spring when fingerlings are planted and zooplankton values would be expected to be lower. The ZQI value for Arrowrock Reservoir in May would classify the reservoir as moderate productivity (Figure 25).

MANAGEMENT RECOMMENDATIONS

1) Continue to monitor Little Blue Creek Reservoir; chemical renovation may be warranted if declining trends continue.

2) Continue limiting kokanee spawning on Deadwood River, continue estimating escapement and egg deposition in tributaries, and supplement reservoir sampling with midwater trawl to estimate recruitment from natural spawning.

3) Increase fingerling stocking in Lucky Peak, Arrowrock and C.J. Strike reservoirs as availability of hatchery fingerling trout allows.

Table 1. Proportional Stock Density (PSD) for Lahontan cutthroat trout in Little Blue Creek Reservoir from 1993 to 2004.

	Number sampled		
Year	**Stock (>200 mm)**	**Quality (>350 mm)**	**PSD**
1993	13	6	46
1994	119	56	47
1995	90	3	3
1999	42	28	67
2002	8	8	100
2004	28	10	36

Table 2. Adult kokanee on spawning tributaries to Deadwood Reservoir during 2004. Numbers are actual counts of adults observed for spawning tributaries and adults trapped at Deadwood Trap, ND = no data. No surveys were conducted between September 10 and September 22.

date	Deadwood River	Trail Creek	Moulding	S. Fork Beaver	Beaver	Habit	Basin	Wild Buck	Deadwood Trap
10-Aug	trap install								
11-Aug		0	0	0	0		0	31	5
12-Aug	157					0			5
13-Aug									31
14-Aug									61
15-Aug									206
16-Aug				0					306
17-Aug		1,351							703
18-Aug									765
19-Aug									ND
20-Aug									525
21-Aug									564
22-Aug									781
23-Aug									241
24-Aug									740
25-Aug			0		1				470
26-Aug		1,878							351
27-Aug									488
28-Aug									500
29-Aug									203
30-Aug		1,805							354
31-Aug					0	147			310
1-Sep									360
2-Sep		1,827				204			255
3-Sep	2,304								61
4-Sep									82
5-Sep									60
6-Sep									133
7-Sep									110
8-Sep									115
9-Sep		729							115
10-Sep									35
11-Sep									31
23-Sep		153				0			
24-Sep									

Table 3. Adult kokanee counts for Trail Creek in 2004 by survey date and section. Section location description are in Appendix A. NC = no count. Total is section 1, 2, and 3 only.

	Section 1	Section 2	Section 3	Total*	Section 4
			8/11/2004		
untagged	0	0	0	0	NC
			8/17/2004		
untagged	0	22	1,329	1,351	NC
			8/26/2004		
untagged	2	51	1,791	1,844	NC
tagged	0	14	20	34	NC
			8/30/2004		
untagged	3	16	1,754	1,773	171
tagged	0	3	29	32	0
			9/2/2004		
untagged	0	9	1,787	1,796	NC
tagged	0	1	30	31	NC
			9/9/2004		
untagged	0	2	724	726	NC
tagged	0	1	2	3	NC
			9/23/2004		
untagged	0	0	153	153	4
tagged	0	0	0	0	0

Table 4. Efficiency of observers in counting adult kokanee for two reaches of Habit Creek. Numbers are actual counts of adult kokanee by visual survey and electrofishing.

Reach	Visual	Electrofishing	Efficiency
Lower	6	13	46.2%
Upper	15	17	88.2%

Table 5. Fingerling stocking rates, reservoir surface area and stocking density for Southwest Region waters.

	Fingerling Trout stocked	Surface Area (acres)	Stocking density (Fingerlings/Acre)
Deadwood	10,000	3,000	3
Lucky Peak	274,000	2,850	96
Arrowrock	150,000	3,100	48
CJ Strike	152,000	7,500	20

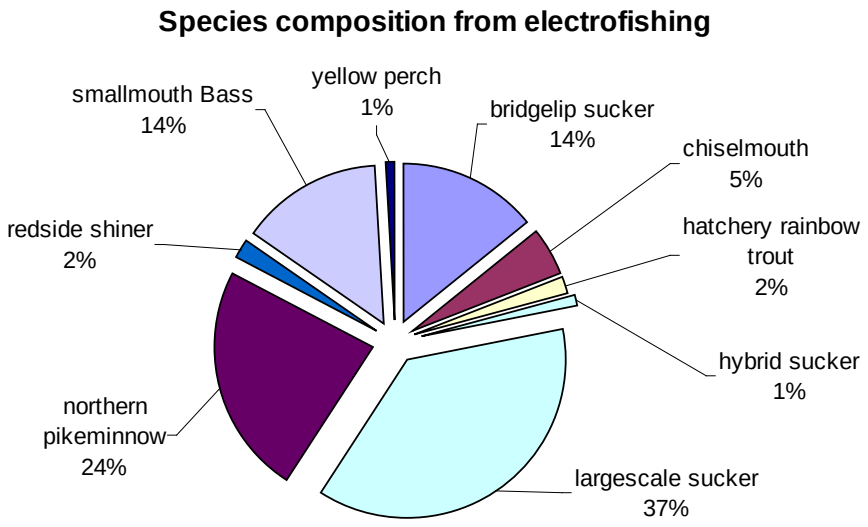


Figure 1. Species composition from 2004 electrofishing sampling on Arrowrock Reservoir by species and percentage captured (n = 105) with 0.84 hours effort.

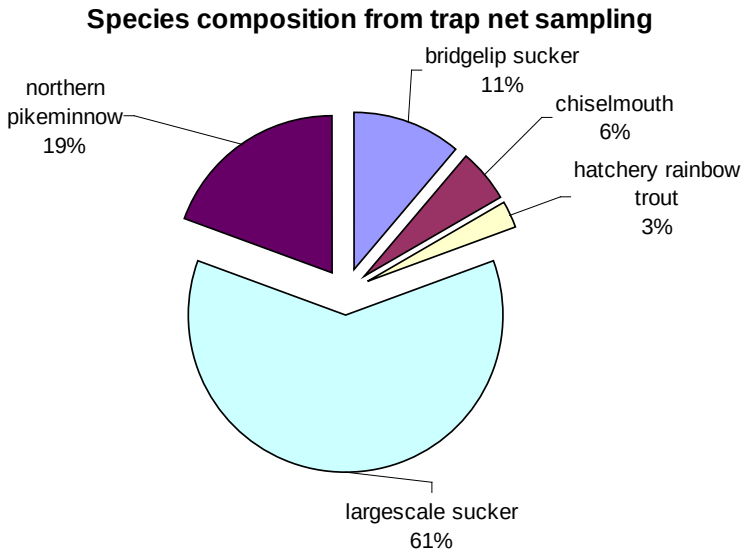


Figure 2. Species composition from 2004 trap net sampling on Arrowrock Reservoir by species and percentage of catch (n = 36) with 9 trap nets of effort.

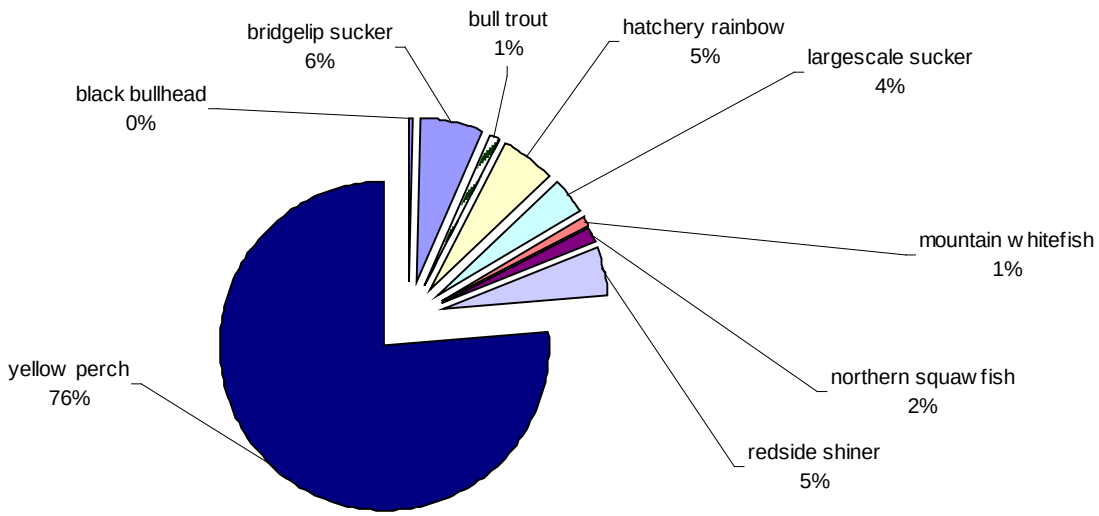


Figure 3. Species composition from May 1997 trap net sampling on Arrowrock Reservoir by species and percentage of catch (n = 311); 10 trap nets effort.

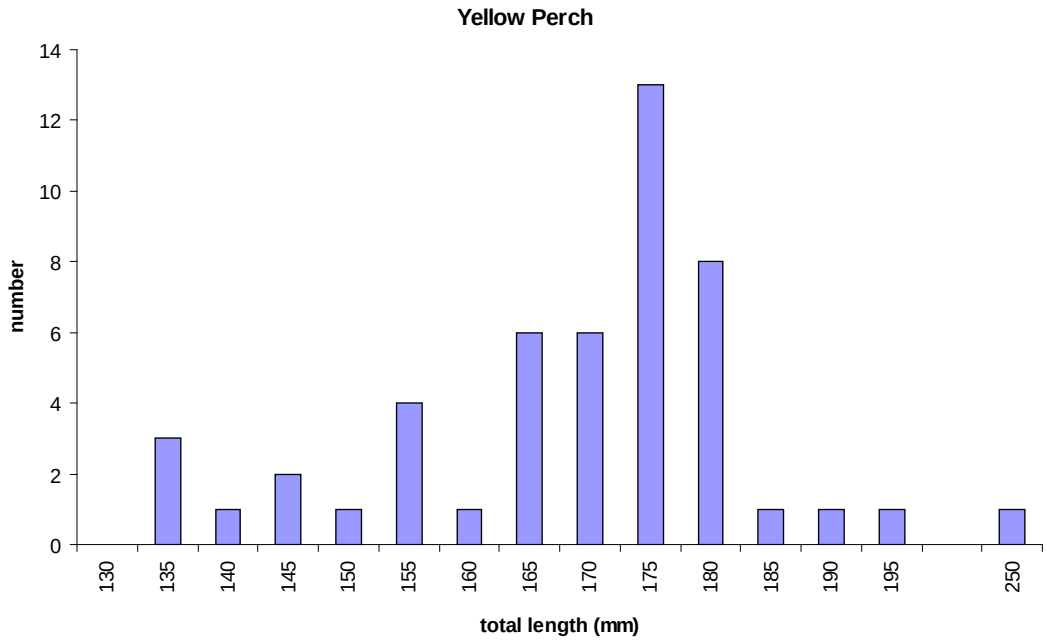


Figure 4. Length frequency distribution of yellow perch (n = 49) captured in gill nets on Blacks Creek Reservoir in 2004.

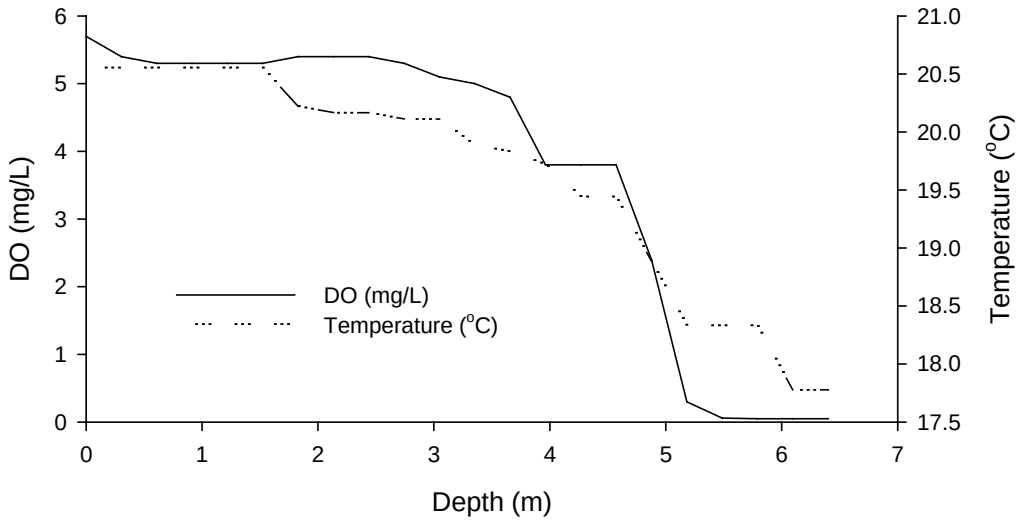


Figure 5. Temperature and dissolved oxygen profile from Blacks Creek Reservoir on July 9, 2004.

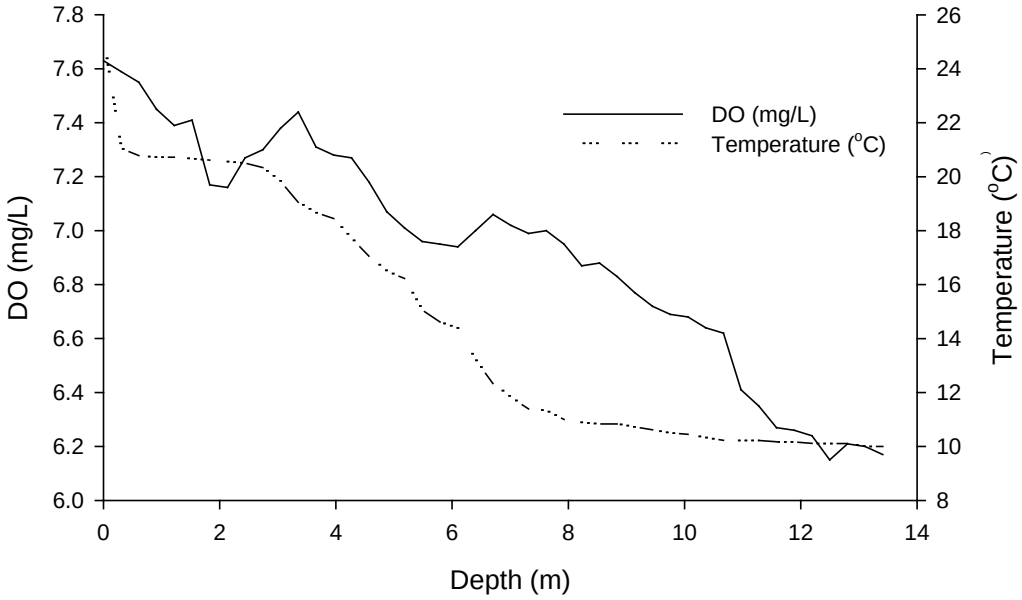


Figure 6. Temperature and dissolved oxygen profile from Fairchild Reservoir on July 20, 2004.

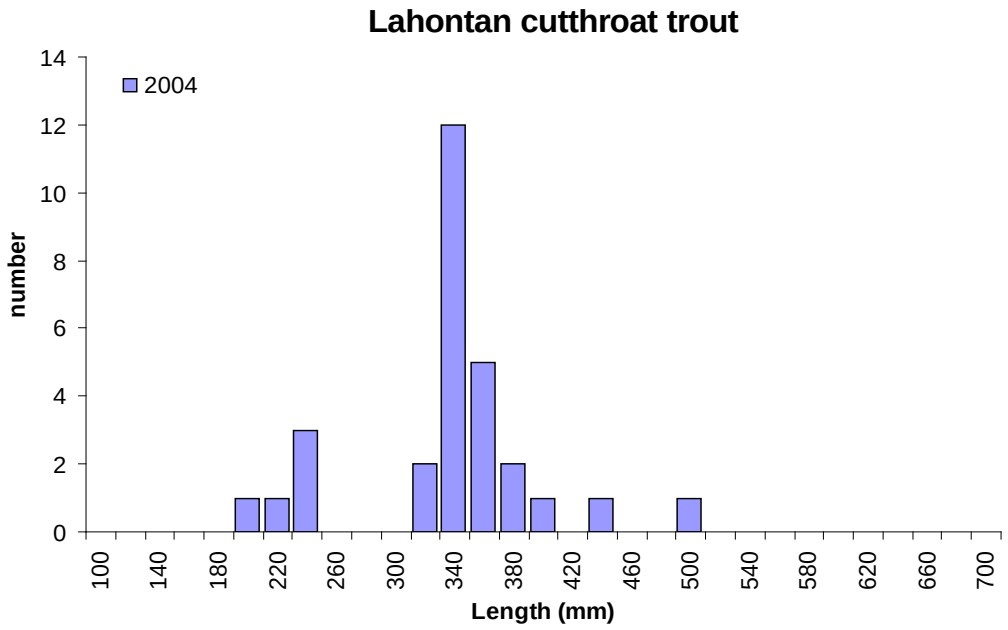


Figure 7. Length frequency distribution of Lahontan cutthroat trout (n= 29) captured in gill nets on Little Blue Creek Reservoir in 2004.

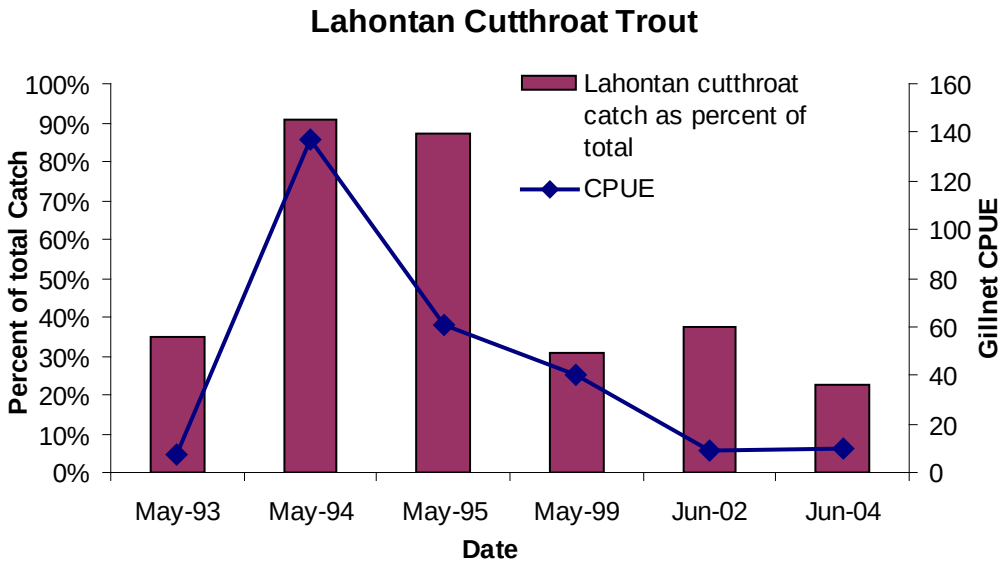


Figure 8. Catch per unit effort (CPUE) and relative abundance of Lahontan cutthroat trout captured in gill nets on Little Blue Creek Reservoir from 1993 to 2004.

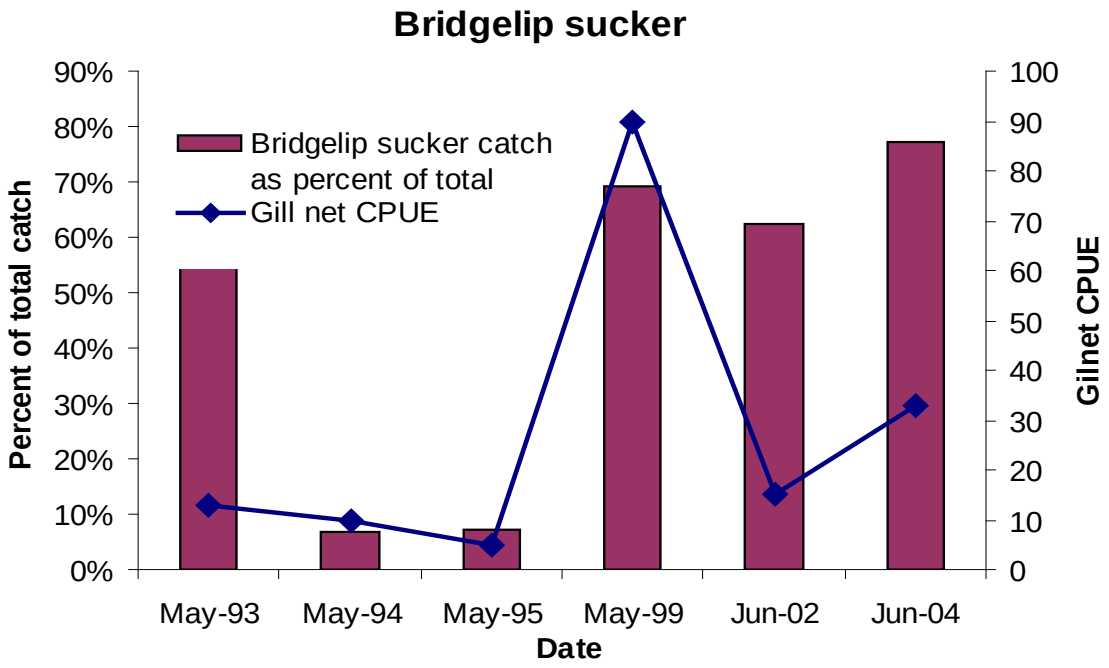


Figure 9. Catch per unit effort (CPUE) and relative abundance of bridgelip sucker captured in gill nets on Little Blue Creek Reservoir from 1993 to 2004.

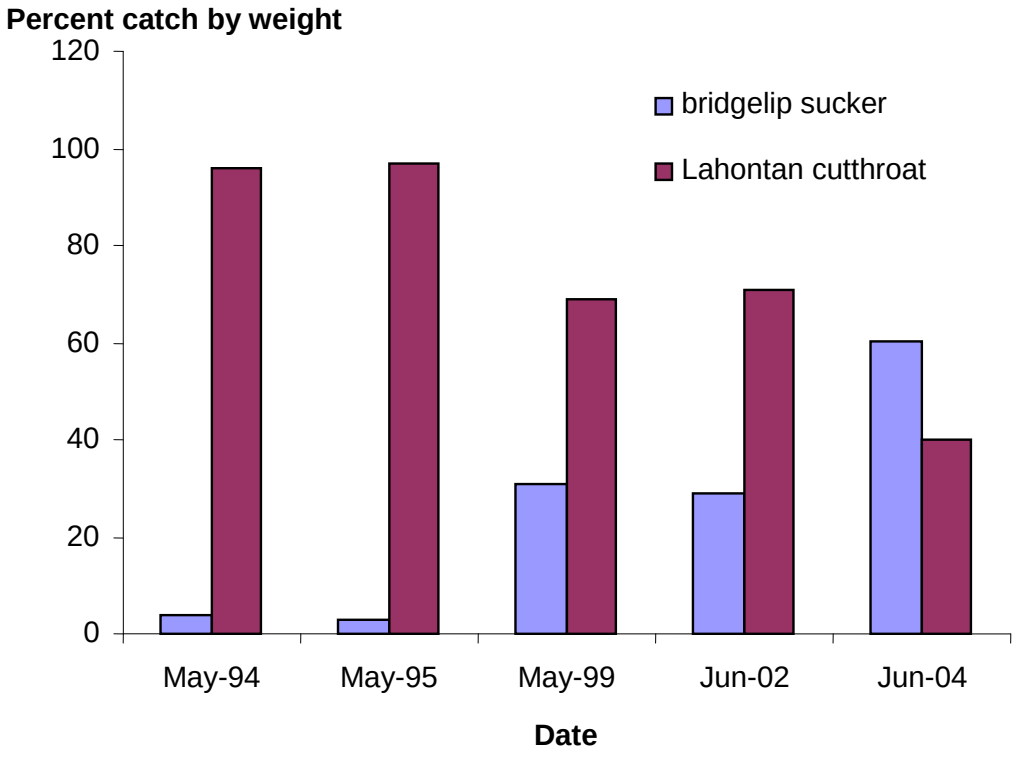


Figure 10. Relative catch by weight in gill nets for Lahontan cutthroat trout and bridgelip sucker in Little Blue Creek Reservoir from 1994 to 2004.

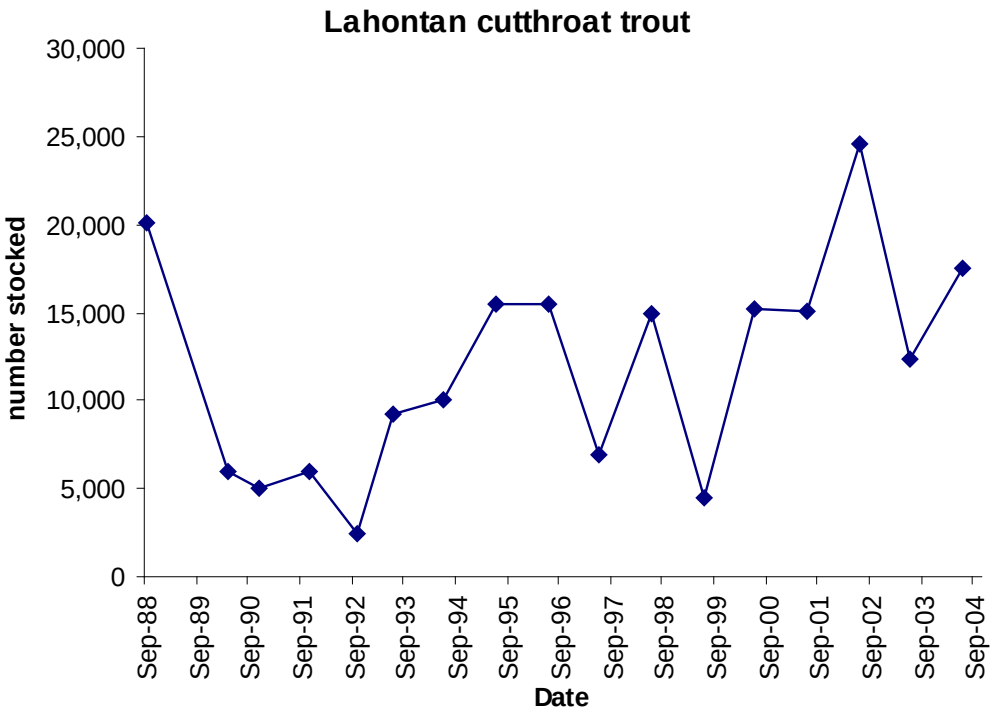


Figure 11. Stocking numbers for Lahontan cutthroat trout in Little Blue Creek Reservoir from 1988 to 2004. Trout were stocked as fingerlings from 1988 to 1992 and fry from 1993.

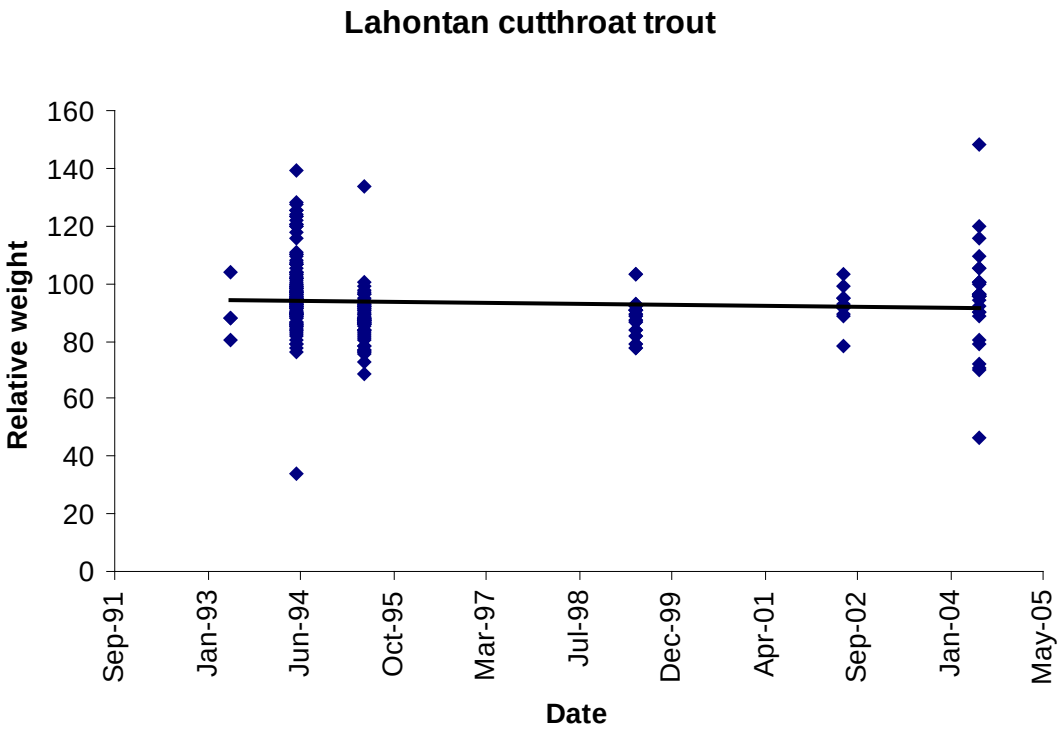


Figure 12. Relative weight of Lahontan cutthroat trout in Little Blue Creek Reservoir by sampling date from 1993 to 2004.

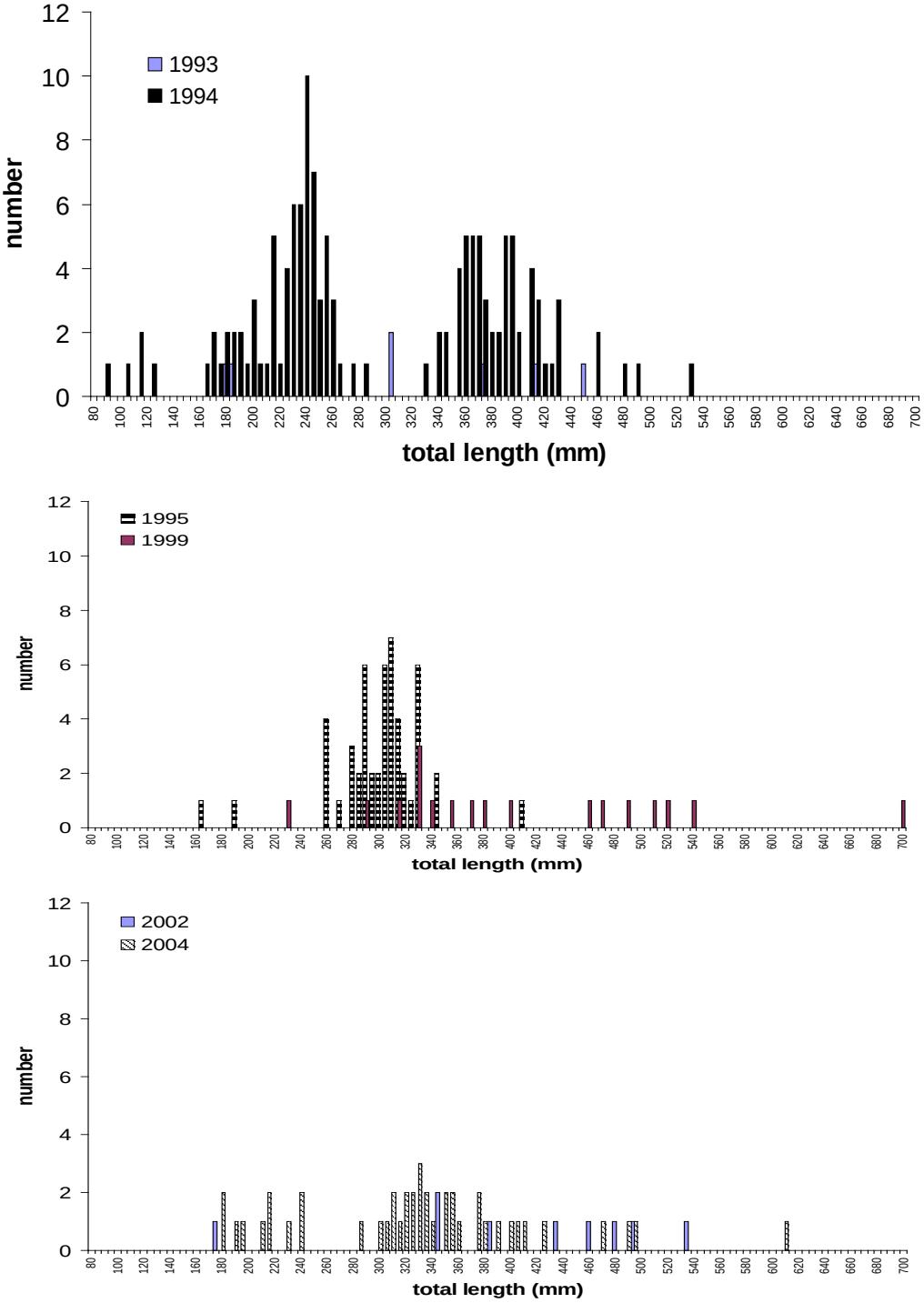
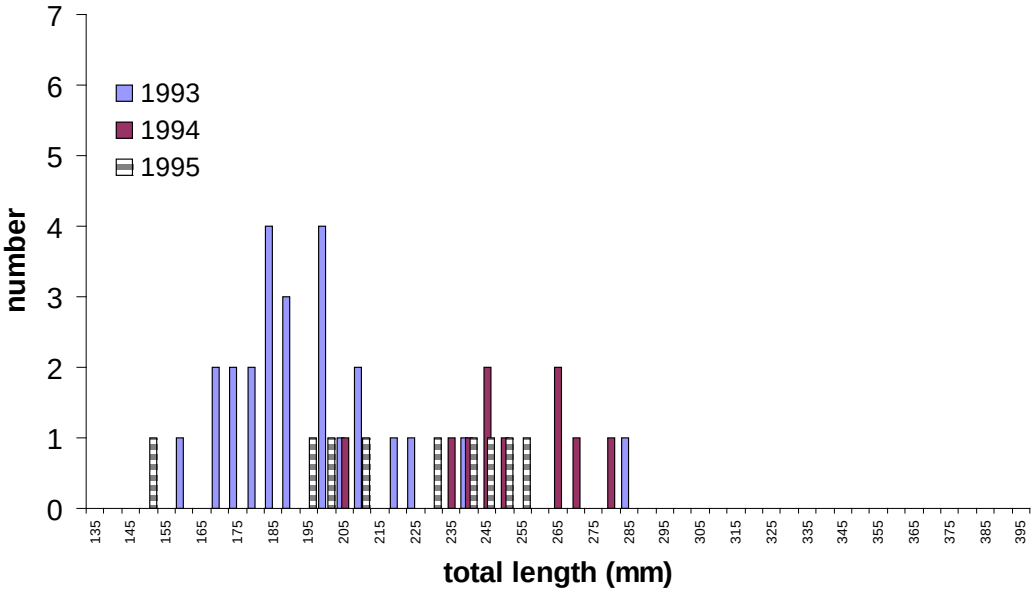


Figure 13. Length frequency of Lahontan cutthroat trout from Little Blue Creek Reservoir sampled by gill net from 1992 to 2004.



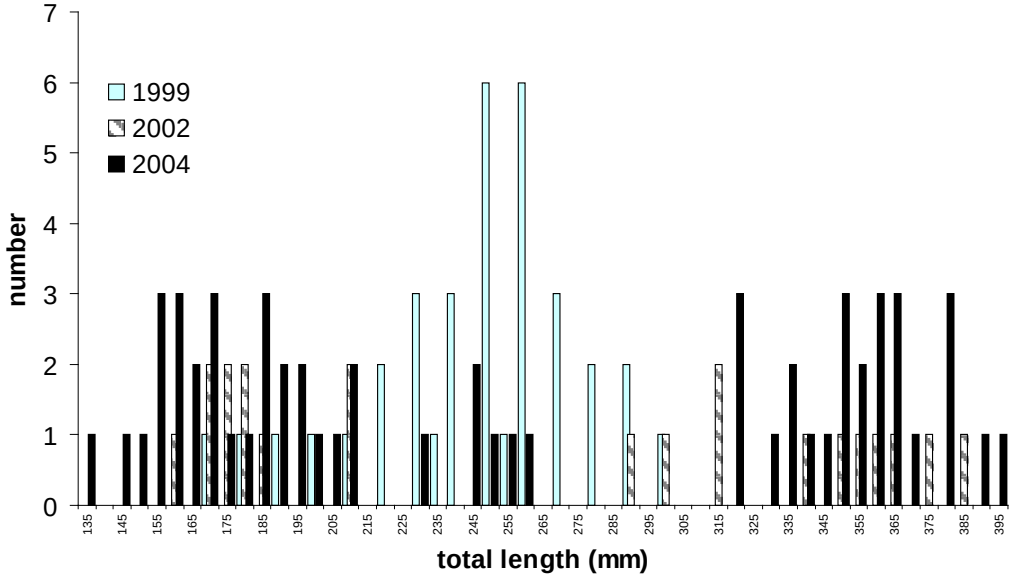


Figure 14. Length frequency of bridgelip suckers captured in Little Blue Creek Reservoir from 1993 to 2004. Netting effort was one pair gill nets for 1993 to 2002 and three pair in 2004.

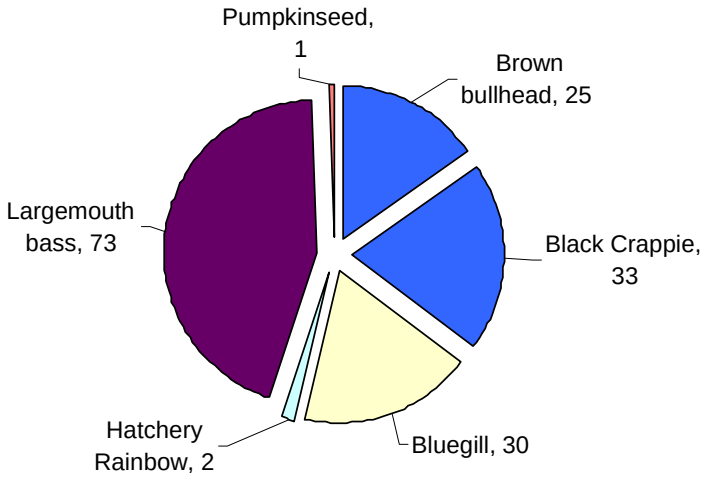


Figure 15. Species composition and number of fish captured from 2004 gill net, trap net and electrofishing surveys on Paddock Reservoir.

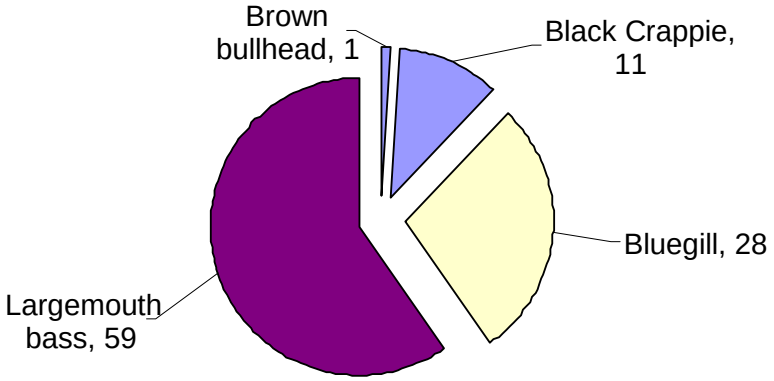


Figure 16. Species composition of electrofishing sample and number of fish captured from 2004 electrofishing survey on Paddock Reservoir.

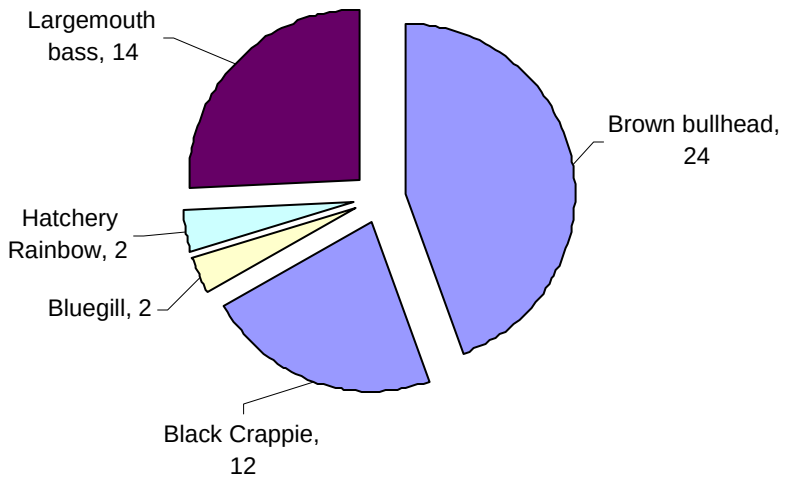


Figure 17. Species composition and number of fish captured from 2004 gill net survey on Paddock Reservoir.

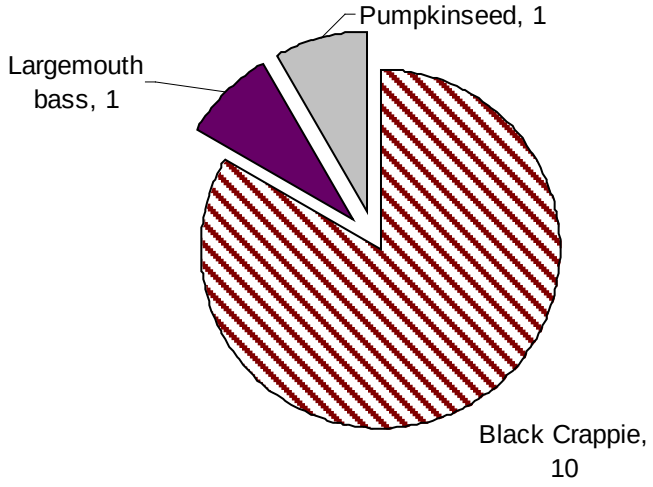


Figure 18. Species composition and number of fish captured from 2004 trap net survey on Paddock Reservoir.

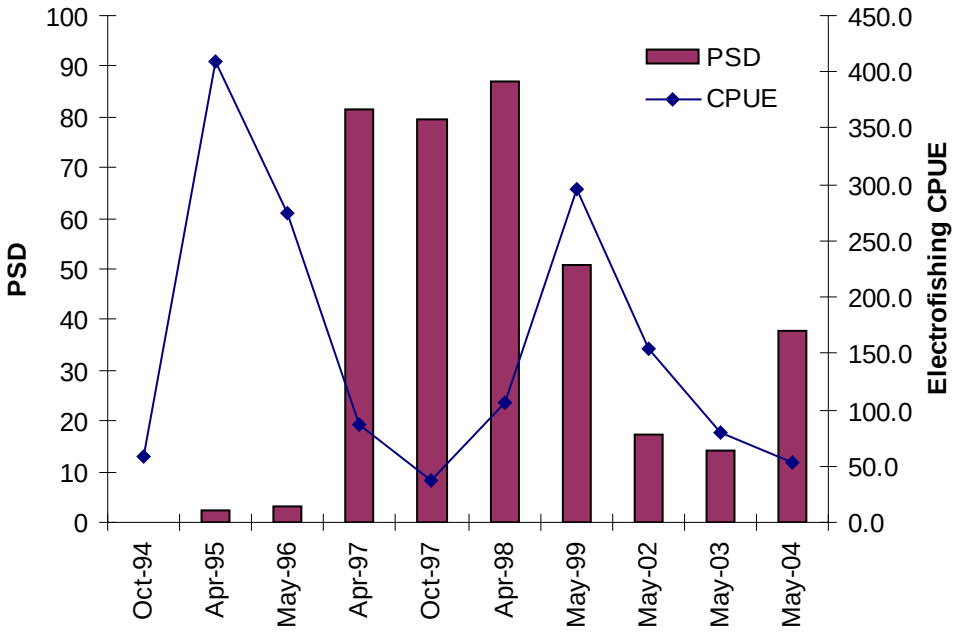


Figure 19. Proportional stock density (PSD) and catch per unit effort (CPUE) of largemouth bass ≥ 200 mm sampled by electrofishing in Paddock Reservoir from 1994 to 2004.

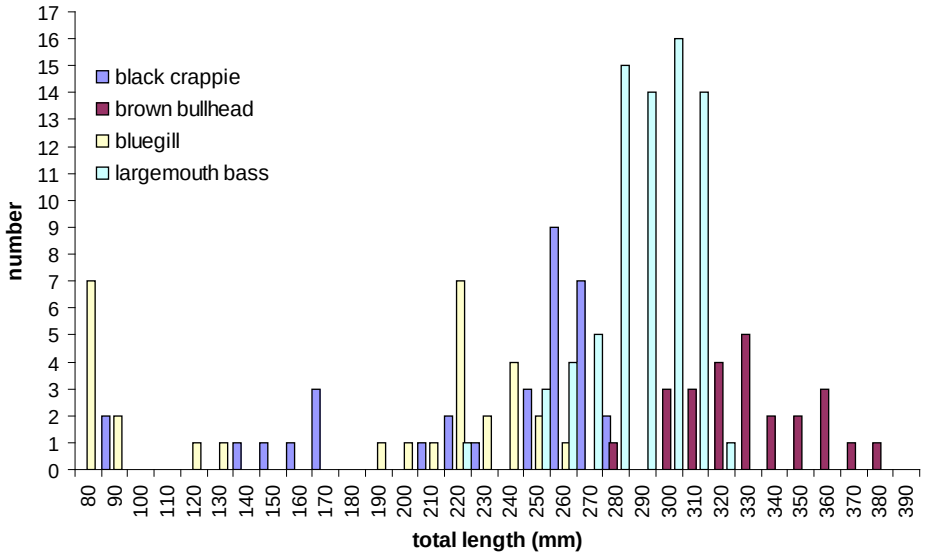


Figure 20. Length frequency distribution of black crappie (n = 33), brown bullhead (n = 25), bluegill (n = 30) and largemouth bass (n = 73) captured on Paddock Reservoir in 2004.

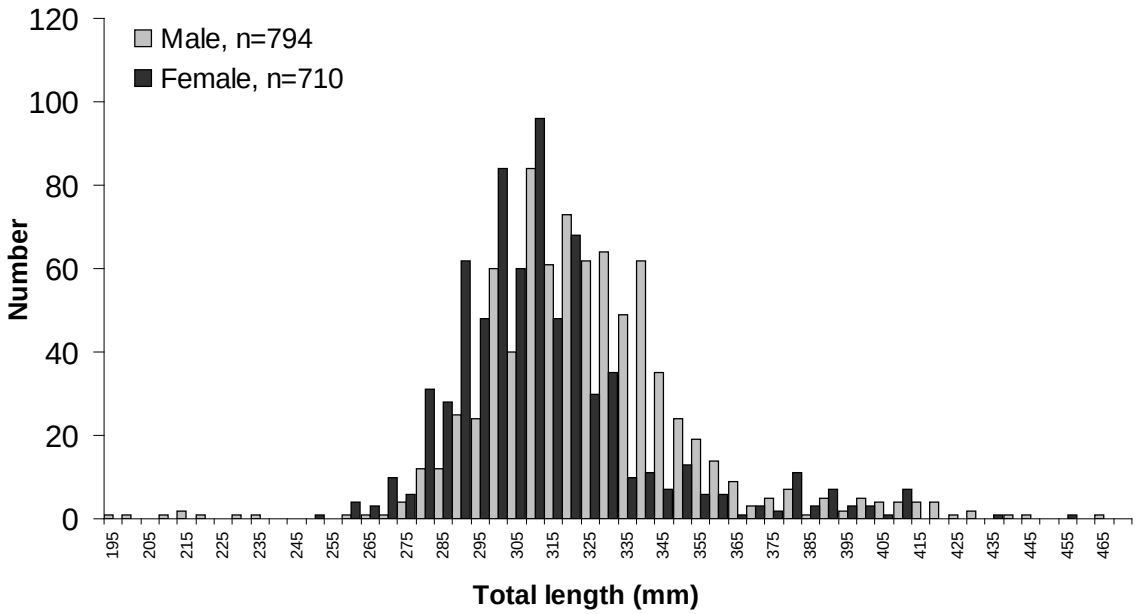


Figure 21. Length frequency of kokanee captured at the Deadwood River kokanee trap during 2004.

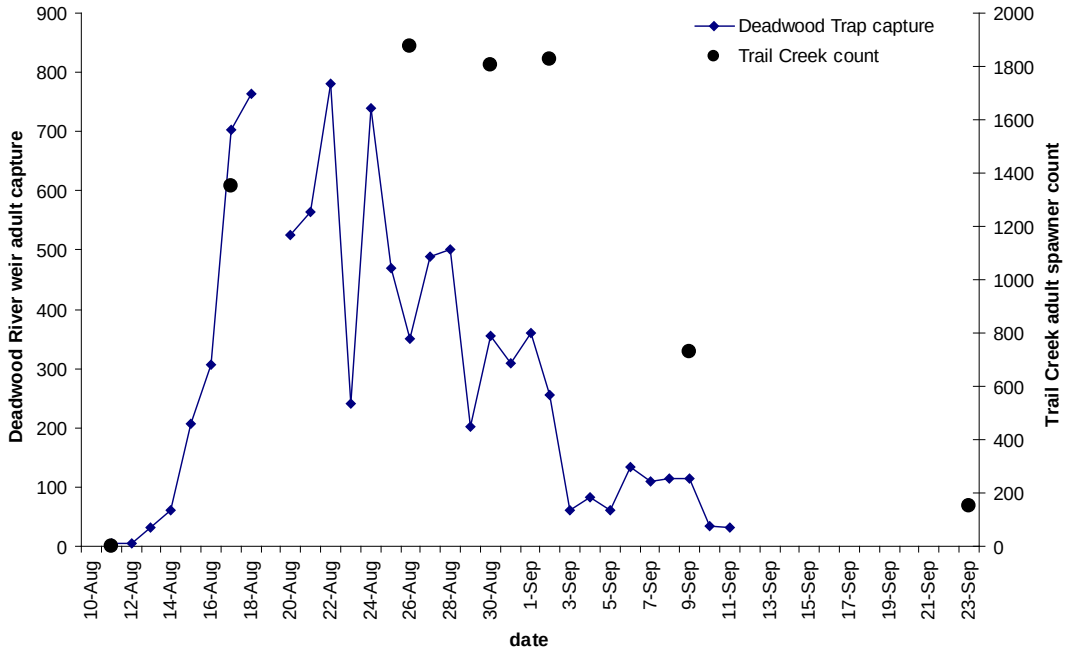


Figure 22. Capture of adult kokanee at the Deadwood River weir for 2004 and count of adult kokanee observed in Trail Creek during kokanee spawner surveys.

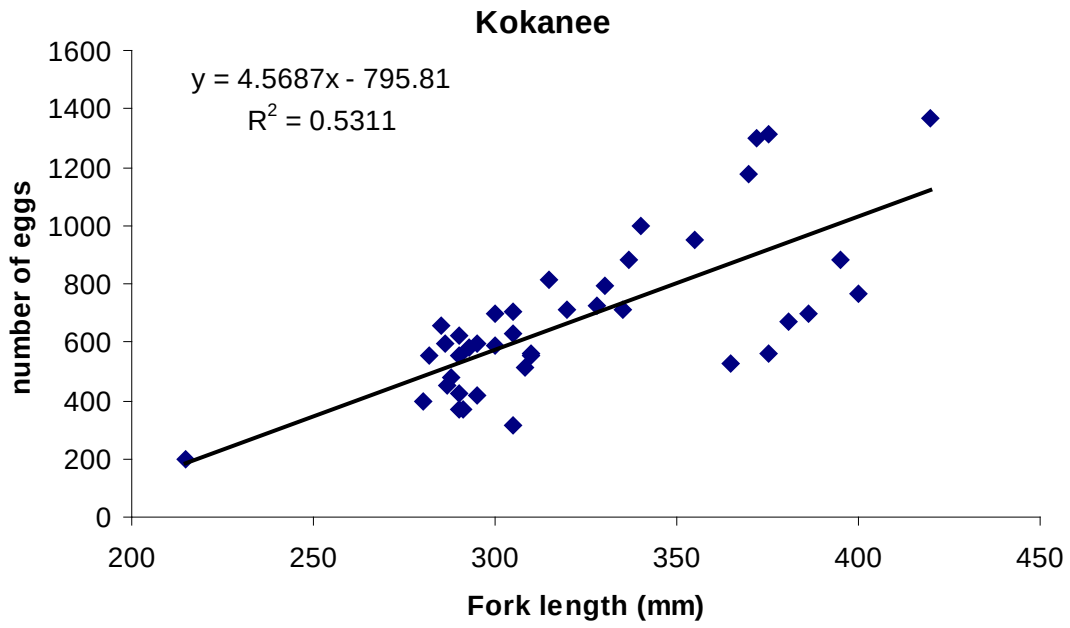


Figure 23. Length fecundity relationship for kokanee (n = 41) captured and spawned at Deadwood River trap in 2004.

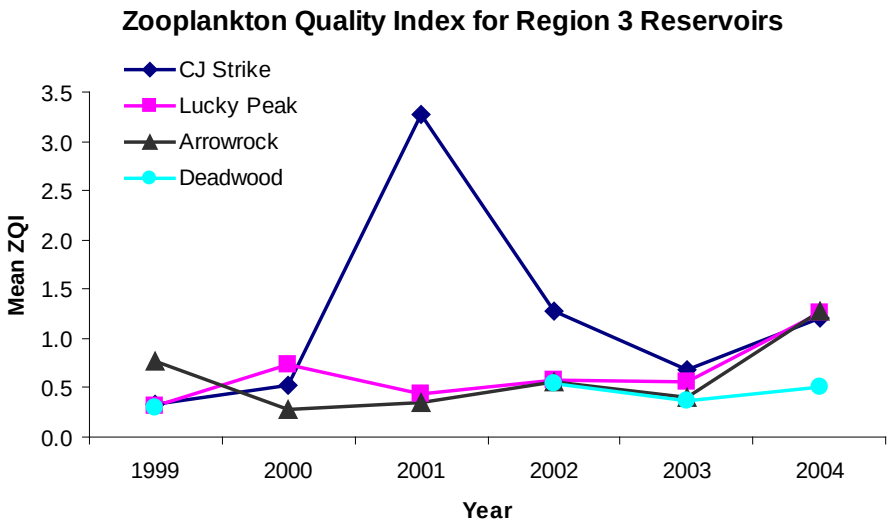


Figure 24. Mean zooplankton quality index for Southwest Region waters from 1999 to 2004.

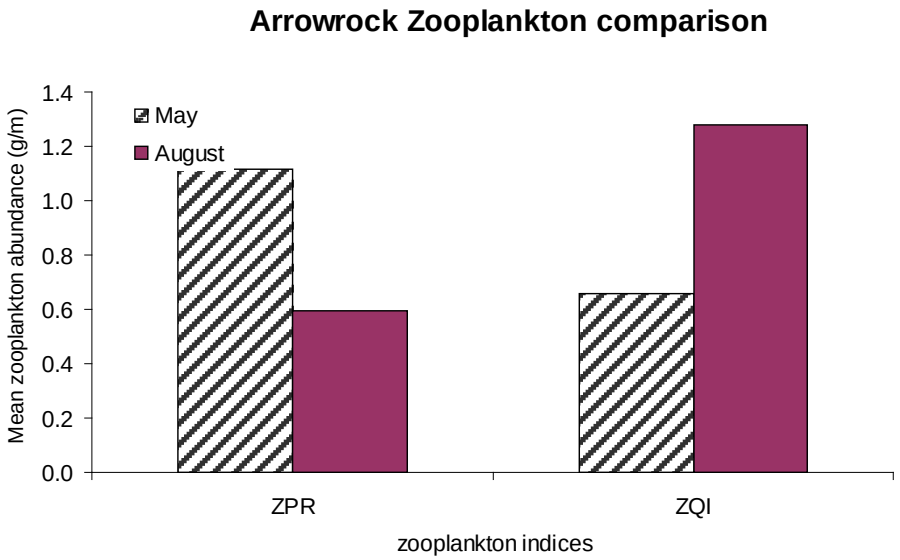


Figure 25. Seasonal comparison of zooplankton indices for Arrowrock Reservoir in 2004.

2004 Southwest Region (Nampa) Annual Fishery Management Report

High Mountain Lakes Surveys

ABSTRACT

Two mountain lakes were surveyed in 2004 by regional fishery staff to monitor fish populations: Sheepherder Lake in the Deadwood River drainage and Bernard Lake in the Bear Valley Creek drainage. Six westslope cutthroat trout *Oncorhynchus clarkii lewisi* (207 to 405 mm) were captured by gill net and five cutthroat trout were captured by angling (76 to 356 mm) in Bernard Lake. Twenty westslope cutthroat trout (175 to 460 mm) were captured by gill net and six cutthroat trout were captured by angling (102 to 406 mm) in Sheepherder Lake. Both lakes sampled in 2004 have westslope cutthroat trout size structures that should provide acceptable fisheries. Current stocking rates and species should be maintained.

OBJECTIVE

1. Obtain current information for fishery management decisions on mountain lakes, include angler use and success, fish population characteristics, spawning potential, stocking success, limnology, morphology, and notes on other aquatic life and develop appropriate management recommendations.

2. Alter fish stocking recommendations based on current information regarding natural reproduction, stocking rates and stocking success.

METHODS

Two mountain lakes were surveyed in 2004 by regional fishery staff to monitor fish populations: Sheepherder Lake in the Deadwood River drainage and Bernard Lake in the Bear Valley Creek drainage (Figure 26). Angling and overnight gill netting (one gill net set overnight/lake) surveys were conducted. Gill nets were 30.5 m long with 7.6 m panels of 19, 25, 32, and 38 mm square mesh monofilament. All fish captured in gill nets or by angling were measured for total length (TL) to the nearest mm and weighed to the nearest g when possible. Maximum depth of each lake was measured by lowering a weighted and marked cord from a float tube. Data from these sampling efforts are stored in the Southwest Region mountain lake database and regional files.

RESULTS AND DISCUSSION

Six westslope cutthroat trout (207 to 405 mm) were captured by gill net and five cutthroat trout were captured by angling (76 to 356 mm) in Bernard Lake (Figure 27). Westslope cutthroat trout have been stocked yearly since 1995 and stocking rates have remained consistent at 178 fish/ha since 1996. Fish species and sizes captured in gill net and angling surveys are consistent with stocking efforts.

Twenty westslope cutthroat trout (175 to 460 mm) were captured by gill net and six cutthroat trout were captured by angling (102 to 406 mm) in Sheepherder Lake (Figure 28). Westslope cutthroat trout have been stocked every two years since 1999. Stocking rates were doubled from 588 fish/ha to 1,176 fish/ha in 2001. Fish species and sizes captured in gill net and angling surveys are consistent with stocking efforts.

MANAGEMENT RECOMMENDATIONS

1) Both lakes sampled in 2004 have westslope cutthroat trout size structures that should provide acceptable fisheries. Current stocking rates and species should be maintained.

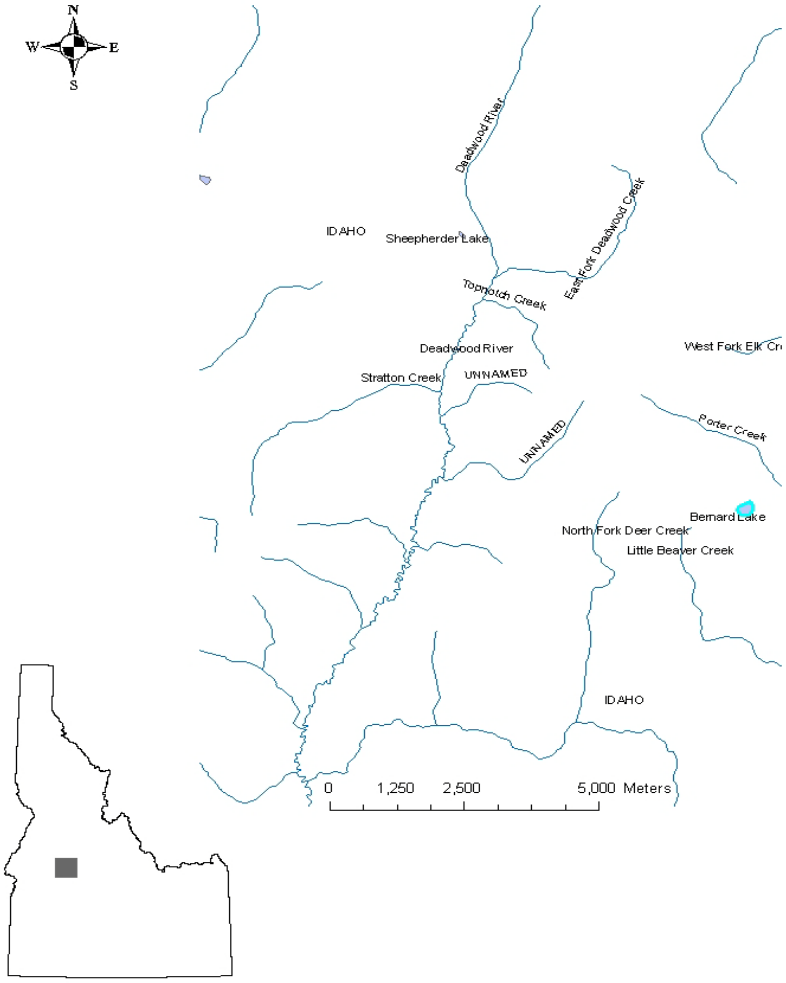


Figure 26. Location of lakes surveyed by Southwest Region fisheries crews in 2004. Sheepherder Lake is in the Deadwood River drainage and Bernard lake is in the Bear Valley Creek drainage in central Idaho.

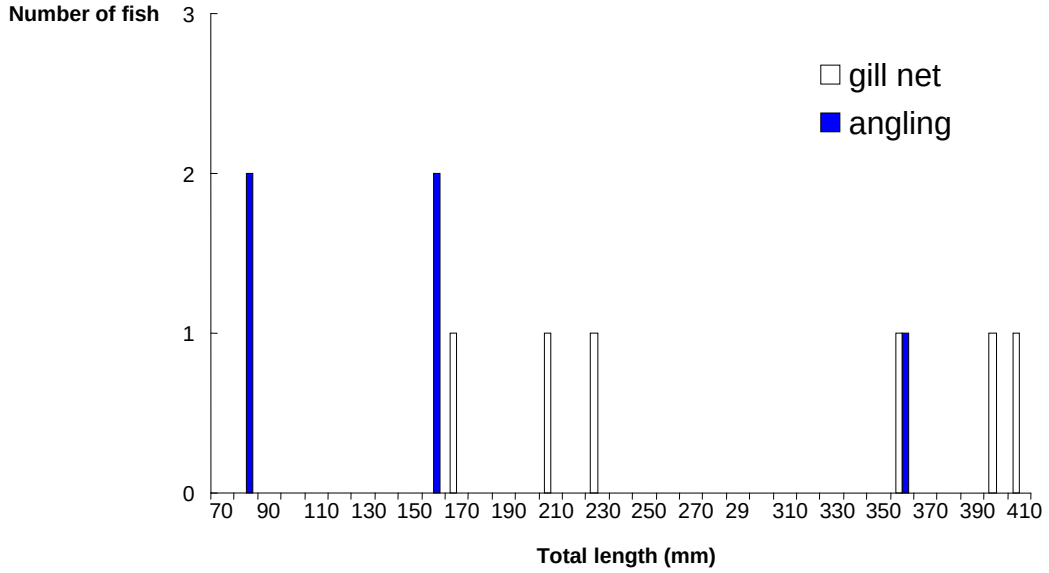


Figure 27. Length frequency of westslope cutthroat trout sampled by gill net (n = 6) and angling (n = 5) in Bernard Lake by Southwest Region fisheries crews in August 2004.

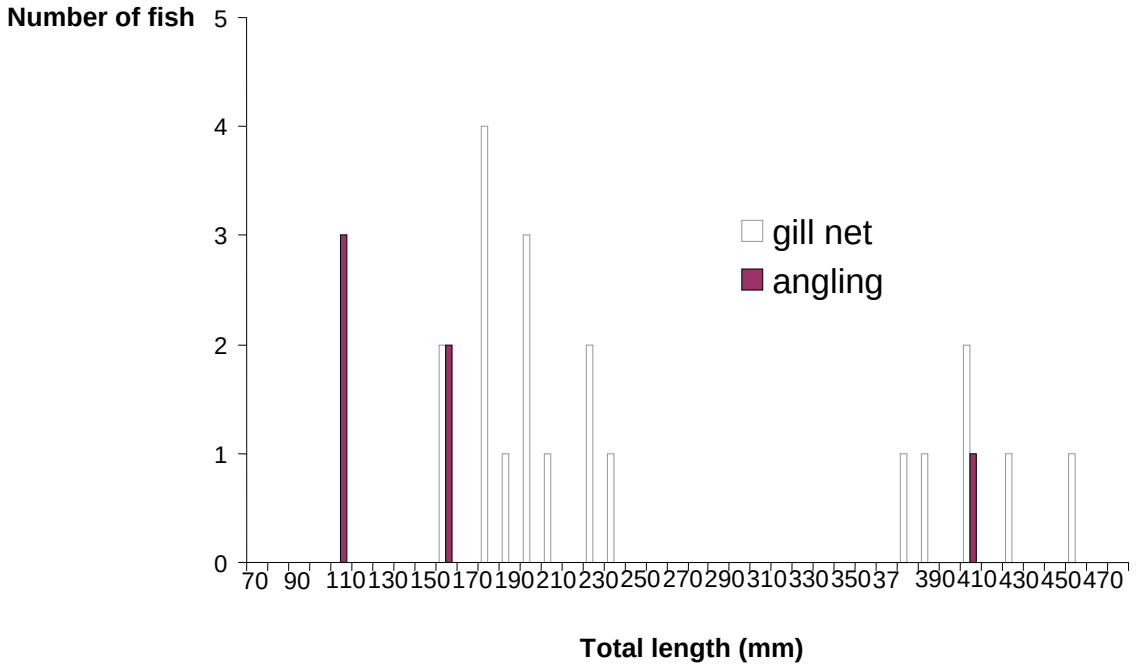


Figure 28. Length frequency of westslope cutthroat trout sampled by gill net (n = 20) and angling (n = 6) in Sheepherder Lake by Southwest Region fisheries crews in August 2004.

2004 Southwest Region (Nampa) Annual Fishery Management Report

River and Stream Investigations

ABSTRACT

A total of seven transects were electrofished in tributaries to Sage Hen Reservoir on July 13 and 14, 2004. Crews completed depletion population estimates for redband trout *O. mykiss gairdneri* >100 mm. Fish populations in these tributaries had not been previously sampled. Redband trout were only found in two areas, lower Joe's Creek and Lower Sage Hen Creek. The density of redband trout in Joe's Creek was 23 fish/100 m^2, and the fish ranged in length from 50 - 150 mm. No redband trout were found in the pre-established Lower Sage Hen Creek site, but we did find fish approximately 500 m downstream from the surveyed transect (in the last 80 m above the mouth).

On July 14, 2004, crews attempted to sample a site established in 1994 on Second Fork Squaw Creek. The water depth and velocity resulted in poor sampling conditions, therefore, a population estimate and habitat parameters were not gathered. A total of 31 putative redband trout were collected for future genetic testing to assess introgression with hatchery rainbow trout. Although the observed densities of redband trout have decreased since 1994, we collected considerably more size groups in 2004 than in 2001, and most of the larger size classes collected in 1994 were represented in 2004. Very few fish < 100 mm were sampled, suggesting very recruitment during the drought.

From June 28 to June 30, 2004, crews conducted depletion estimates of redband trout at five sites in the Mann Creek drainage. Data were compared to previous surveys conducted in 1995 and 2001. Four of the sites had densities very comparable to 2001, two were considerably higher than 2001 but were similar to 1995. Two sites had redband trout >160 mm, most fish in other areas were between 70-159 mm. The redband trout size structure in most areas suggested that recruitment has decreased since 2001. Tissue samples were taken from redband trout for future genetic testing to assess introgression with hatchery rainbow trout.

Snorkel survey methods were used to identify and count fish species and numbers in the roadless sections of the North Fork Boise River upstream from Deer Park during July and August 2004. A total of four transects were snorkeled between Deer Park and Silver Creek. Mean densities for redband trout and mountain whitefish were compared to similar surveys completed in 1996, 1997, and 2000. Fish densities for most species and sizes declined from previous years. The only observed density increase was for bull trout in one transect, from 0 fish/100 m^2 in 1997 and 2000, to 0.14 fish/100 m^2.

A fish trap was operated in the Kirby Dam fish ladder during August to document bull trout migration patterns. A total of two bull trout were trapped. Insufficient attraction flows during August continue to plague the fish ladder.

Three sections of the lower Boise River between Barber Park and the Parkcenter Bridge were electrofished in November to compare species composition, abundance, and size structure. Sections were chosen to allow for upstream and downstream comparisons of fish populations with the Quality Management regulation section. Wild rainbow trout abundance estimates were very similar between sections. The estimates for wild rainbow trout ≥100 mm ranged from 735 to 1,387 fish/km. Wild rainbow trout QSD estimates ranged from 3% to 5%. Our density estimate of wild rainbow trout ≥100 mm in one section was 2.5 times higher than

the highest historical survey. Abundance estimates for brown trout ≥100 mm ranged from 96/km to 199/km. Very few brown trout between 170 and 240 mm were caught. Brown trout QSD estimates ranged from 19% to 42%. Brown trout were observed spawning in the river and side channels. Mountain whitefish density was 5.5 fish≥100 mm/100 m^2, which was about one-third of the observed density in 1995. Our results indicate that there was little difference between the size structure or density of wild rainbow trout and brown trout in the special regulation section when compared to adjacent areas of the river with similar habitat.

Snorkel surveys were conducted in Elk and Sulphur creeks trend areas August 11-13, 2004. Densities of juvenile Chinook salmon *O. tshawytscha* ranged from 6.2 to 41.3 fish/100 m^2 in Elk Creek and from 26.1 to 41.9 fish/100 m^2 in Sulphur Creek. Chinook densities were greater than observed in 2003 in all Elk Creek sites, and in one out of three sites in Sulphur Creek.

Chinook salmon spawning ground surveys were conducted in Bear Valley, Elk, and Sulphur creeks trend areas August 27-28, 2004. Salmon redds numbered 109, 72, and 7 in Bear Valley, Elk, and Sulphur creeks, respectively. The overall counts were significantly lower than for 2003.

OBJECTIVES

1. To obtain current information for fishery management decisions on rivers and streams, including angler use, success, harvest and opinions, fish population characteristics, spawning success, habitat characteristics, return-to-the-creel for hatchery trout and develop appropriate management recommendations.

2. Use standardized methods to monitor stream and river fish populations in permanent trend sites.

3. Monitor use of the Kirby Dam fish ladder in August by bull trout and other fish species in the Middle Fork Boise River.

METHODS

Standardized Stream Surveys

A Smith-Root model 15-B backpack electrofishing unit was used for conducting two-pass depletion population estimates of redband trout >100 mm. Estimates and confidence intervals were calculated by utilizing the MicroFish 3.0 program developed by Van Deventer and Platts (1989). Fish densities were calculated by dividing the population estimate by the area sampled and reported as fish/100 m^2. Fish from each pass were kept separate and alive in holding pens. Each game fish was measured to the nearest millimeter and weighed to the nearest gram. Twenty DNA fin clips of redband trout were taken from each transect and placed in vials containing denatured ethyl alcohol. When funding becomes available, the samples will be analyzed to determine if and what level of introgression with hatchery rainbow trout has occurred.

Habitat measurements were taken at a minimum of four cross sections through each survey transect for width, depth, and substrate composition. Global Position System (GPS) coordinates (NAD27 Conus, in UTM's) were collected at the upstream endpoint of electrofishing sites using a Garmin model 12 handheld GPS receiver. Amphibian presence was noted when observed. Data were entered into the regional stream database.

Tributaries to Sage Hen Reservoir

A total of seven sites were sampled in three tributaries to Sage Hen Reservoir on July 13 and 14 (Figure 29). Crews attempted depletion population estimates for redband trout >100 mm. None of the fish populations in any of the tributaries had been sampled prior to our survey.

Second Fork Squaw Creek

On July 14, 2004, we attempted to sample a transect established in 1994 (Allen et al. 2000a) on Second Fork Squaw Creek (Figure 29). The water depth and velocity resulted in poor sampling conditions. Therefore, a population estimate and habitat parameters were not gathered. DNA samples of redband trout were obtained by electrofishing approximately 0.8 km

of the creek immediately downstream of the existing transect. The total stream length sampled in 2004 was approximately fifteen times greater than the distance covered in previous surveys (800 m and 50 m, respectively).

Mann Creek and Tributaries

From June 28 to June 30, 2004 a pair of two-man crews conducted depletion estimates of redband trout in five transects in the Mann Creek drainage (Figure 30). Data were compared to 1995 (Allen et al. 1998) and 2001 (Flatter et al. 2003). All sites were established as permanent monitoring locations in 1995.

Stream Snorkel Surveys

Snorkel counts were conducted with two snorkelers moving upstream through the snorkel section identifying fish species, sizes, and numbers. A third person recorded data. Snorkel sections were measured (length and minimum of four widths) using a hand-held laser range finder (Leica model LRF 800) to calculate area surveyed. Physical habitat measurements recorded included habitat type, substrate particle size, width, length, depth, and water temperature. GPS coordinates (NAD27 Conus, in UTM's) were collected at all snorkel sites using a Garmin Rino model 120 handheld GPS receiver.

North Fork Boise River

Snorkel survey methods were used to identify and count fish species and numbers in the roadless sections of the North Fork Boise River (NFBR) upstream from Deer Park during July and August 2004. A total of four transects were snorkeled between Deer Park and Silver Creek (Figure 31**)**. These transects were attempted July 21 and 22; data were disregarded due to poor stream visibility (approximately 1 m). When we returned in August, snorkeling visibility had improved to 3.4 m. Mean densities (all sites combined) for redband trout and mountain whitefish were compared to similar surveys completed in 1996 (Allen et al. 1999), 1997 (Allen et al. 2000a), and 2000 (Flatter et al. 2003). Site descriptions can be found in Appendix D.

Kirby Dam Fish Ladder

In July 1999 the construction of a slot-type fish ladder was completed at Kirby Dam on the Middle Fork Boise River, near the town of Atlanta. Prior to the completion of the fish ladder, Kirby Dam blocked upstream fish passage for approximately 90 years. Water flows in the ladder were monitored periodically between April and July 2004. A fish trap was installed in the ladder during the month of August in an attempt to capture adfluvial bull trout migrating upstream from Arrowrock Reservoir.

The trap consisted of two steel grates, each installed in a vertical slot of the fish ladder. The grate on the downstream side of the trap contained a 75 x 205 mm opening to allow fish to enter the trap; the upstream side grate allowed only water passage. The trap was located within 40 feet of the downstream entrance to the ladder. The trap was checked for fish twice daily, in the morning and evening. Daily water levels in the ladder were measured by recording the number on the permanent staff gauge at the upstream end of the ladder that corresponded with

the water surface. The trapping period was chosen to approximately coincide with bull trout migratory movements documented in July 1998 and 1999 (Flatter 1998, 1999). When fish were captured, a third grate was installed which covered the opening in the downstream grate, and fish were removed with long handled dip nets. All collected fish were identified to species, weighed (g), measured (mm), and released in the Kirby Dam forebay. The ladder will be monitored for a final year in 2005.

Lower Boise River Electrofishing

Three sections of the lower Boise River between Barber Park and the Parkcenter Bridge were electrofished to compare species composition, abundance, and size structure. Our results were compared to previous estimates and we also evaluated the special regulation section. The sections were defined as the upper, the middle, and the Municipal Park section (hereafter referred to as the lower section). The upper and lower sections are managed using general regulations, while only two trout≥355 mm may be kept each day in the middle section (Quality Management regulation). The upper, middle, and lower sections were 0.97, 1.1, and 1.3 km long, respectively. The lower section had been sampled previously in 1988 (Mabbot and Holubetz 1990), 1992 (Allen et al. 1995), 1994 (Allen et al. 2000b**)**, and 1995 (Allen et al. 1998). Sections were chosen to allow for upstream and downstream comparisons of fish populations with the Quality Management regulation section. Other than a slight boundary change in 2002 to help clarify the special regulation area, the Quality Management regulation has been in effect since 1996.

Previous Boise River fishery surveys used drift boats (Holubetz and Mabbott 1990, Allen et al. 1995), gang probes (Allen et al. 2000b and 1998), and rafts (Allen et al. 1999). Sampling efforts with these gears were typically inefficient and labor intensive. For sampling efforts in 2004 we used an aluminum canoe fitted with two throwable probes. The canoe served as the cathode and carried our generator, VVP-15, a plastic garbage can for holding fish, and all of our other equipment. Crews consisted of four netters, two probe operators, and one canoe/dead man switch operator. The area for each section was calculated by using maps to determine section length, and mean widths (six measurements per section) were calculated using measurements taken with a hand-held laser range finder. GPS coordinates (NAD27 Conus, in UTM's) were collected at the upper and lower boundaries of each section using a Garmin Rino model 120 handheld GPS receiver.

Mark and recapture runs were completed by making a single downstream pass through each section. The first mark run was completed on November 8 in the upper and middle sections, and November 9 in the lower section. Recapture runs were completed on the upper and middle sections on November 15 and the lower section on November 16. Boise River flows (below Lucky Peak Dam) were 275 cfs during the mark and recapture runs.

Fish were marked using a paper punch in the upper, middle, and lower area of their caudal fin to correspond with the section in which they were collected. We used the different marks to detect general movements between sections. All mountain whitefish, rainbow trout, and brown trout *Salmo trutta* were marked. The total length of all rainbow and brown trout were measured to the nearest millimeter, as were a subsample of mountain whitefish from all sections. Fish recaptured in a section differing from where they were initially marked were removed from the pool of fish used to calculate population estimates, and deleted from total marked where they came from.

Population estimates for rainbow and brown trout were calculated using MarkRecapture 5.0 for Windows (MDFWP 1994). The program calculated estimates based on log likelihood and Modified Peterson methods. Chi-square analysis was used to determine if log likelihood estimates were valid. If not, the Modified Peterson method was used. Population estimates and 95% confidence intervals were calculated by 100 mm length groups (recaptures permitting) and summed for estimates of fish 100 mm and larger. Population estimates were used to calculate fish/ha, fish/100 m^2, and standardized by MarkRecapture to fish/km. Quality stock density (QSD) estimates were calculated for wild rainbow and brown trout by section using ≥406 mm for the quality length, and ≥ 203 mm for the stock length. Because only a subsample of the mountain whitefish collected was measured, population estimates were generated by hand using Modified Peterson calculations.

Chinook Salmon Surveys

Parr Monitoring

Chinook salmon *O. tshawytscha* parr monitoring was conducted using snorkel survey methods on August 11-13, 2004 in five established sites in Elk Creek and three in Sulphur Creek (Figure 32). Two snorkelers moved upstream through the trend sections identifying fish species and sizes while a third individual recorded information from the shore. Physical habitat measurements recorded included habitat type, substrate particle size, width, length, depth, and water temperature. The snorkel site descriptions can be found in Appendix B.

Redd Counts

Chinook salmon redds were enumerated on established sections of Bear Valley, Elk, and Sulphur creeks from August 25-26, 2004. GPS coordinates were taken at each identified redd according to criteria described in the draft Idaho Redd Counting Manual (IDFG unpublished). Carcasses encountered were identified as to sex and measured (fork length, and MEPS length) where possible. Scale samples were taken along with otoliths when possible to age fish. Live fish observed were visually identified as to sex and approximate ocean age (jacks, II, or III) when possible.

RESULTS AND DISCUSSION

Standardized Stream Surveys

Tributaries to Sage Hen Reservoir

Redband trout were only found in two areas, lower Joe's Creek and Lower Sage Hen Creek. The density of redband trout in Joe's Creek was 23 fish/100 mm^2, and the fish ranged in length from 50-150 mm (Figure 33). No redband trout were found in the Lower Sage Hen Creek transect, but we did find fish approximately 500 m downstream from the surveyed transect (in the last 80 m above the mouth). All fish in lower Sage Hen Creek ranged in length from 55-115 mm (Figure 34). Out of all the areas without fish, upper Sage Hen Creek appeared the most likely capable of supporting fish due to water quantity, excellent riparian canopy cover, and

instream fish habitat. Considerable effort was put into searching for fish in upper Sage Hen Creek (approximately 300 m upstream and downstream from transect) but no fish were observed or collected. The only historical data that exists for lower Joe's and Sage Hen creeks is spot creel data collected in 1988. In Joe's Creek, 13 anglers had fished for 39 h and caught 42 rainbow trout (1.08 fish/h). Twenty-two anglers in Sage Hen Creek fished for 64 h and caught 74 rainbow trout for a overall catch rate of 1.16 fish/h (Holubetz and Mabbott 1990).

All areas we sampled where no fish were collected or observed (except upper Sage Hen Creek) appeared to go dry or very low after spring runoff, and had instream substrate dominated by sand. Judging by the angler litter in and around lower Joe's Creek, use of the area is currently very high.

Second Fork Squaw Creek

The difficult sampling conditions we encountered at the monitoring site were less severe as we worked downstream towards areas with greater stream width. With persistence, we were able to collect 31 redband trout for future genetic testing. Unlike the fish sampled in the tributaries to Sage Hen Reservoir, all of the redband trout collected in Second Fork Squaw Creek were >100 mm. The size distribution ranged from 100 to 239 mm and none of the fish appeared to be of hatchery origin (Figure 35). A comparison of the redband trout size structure from this general area reveals a trend of very few fish < 100 mm collected since 1994 (Figure 35). Although the observed densities of redband trout have decreased since 1994, we collected considerably more size groups in 2004 than in 2001 and most of the larger size classes collected in 1994 were represented in 2004. The trend of very few fish < 100 mm suggests very poor recruitment during the drought, or perhaps that most spawning and early rearing occurs elsewhere in the drainage. Approximately forty sculpin *Cottus* spp. were observed.

The original sampling date for this area was mid-October. In 1994, the sampling date was moved to late June to correspond with other stream sampling in the area. It would be beneficial to resurvey the area in mid-October to clarify if the trends mentioned above are a function of sampling timing or actual changes in the population.

Mann Creek and Tributaries

Adams, Mann, and Bear creeks had redband trout densities very comparable to 2001, Fourth of July and Hitt creeks were considerably higher than 2001 but were similar to 1995 results (Table 6). The redband trout size structure in most areas suggests recruitment has decreased since 2001 (Figures 36-41). Most fish were between 70-159 mm. Only the Mann Creek and Hitt Creek sites had redband trout >160 mm (Figures 37, 38, and 41). The observed variability in recruitment is expected, given the drought conditions these populations have been experiencing since 2001. The results of the genetic analysis will be included in a future job completion report when the results are available. Numerous sculpin were observed at each site. Each transect should be resampled in 2009 to monitor the population trends.

Stream Snorkel Surveys

North Fork Boise River

Overall, fish densities for all species and sizes have declined from previous years (Table 7). The declining abundance of all species is likely the result of reduced recruitment caused by

five consecutive years of drought. Other than the quantity of annual precipitation, little else appears to have changed in the upper North Fork Boise River drainage. The only observed density increase in abundance was for bull trout in the Blue Jay Creek transect, an increase from 0 fish/100 m^2 to 0.14 fish/100 m^2. When comparing the densities of fish we observed with the results from 2001 (Flatter et al. 2004) and 2003 (Flatter et al. 2006) in another section of roadless NFBR (between Rabbit Creek and the MFBR), our results were very similar (Table 7).

Kirby Dam Fish Ladder

Only four fish were caught while trapping in August, two redband trout and two bull trout (Table 8**)**. Although trapping conditions in 2004 were very similar to previous years (very hot and dry), no bull trout were trapped until August 30. In previous years, all bull trout had been collected prior to August 22 (Figure 42). Water levels dropped below 0.6 on August 9 and remained there until extremely heavy thundershower events on August 18 and 19 (Table 9). Although the ladder is designed to pass fish at very low water levels, it appears that a gauge height of < 0.6 dramatically reduces the likelihood of successful fish passage.

There is one structural improvement to Kirby Dam that could be made to alleviate some of the inherent problems with operating the ladder in August. A common problem since the ladder construction is the use of a piece of plywood near the Kirby Dam penstock intake to control the quantity of water used to bolster the ladder attraction flow. This design greatly limits our ability to incrementally adjust attraction flows and is a potential safety hazard to operate. In fact, if any changes in attraction flow are desired, we can only call upon one person (Dave Gill, responsible for Kirby Dam operations and maintenance) to make adjustments. Logistically, having only one individual capable of making adjustments is not acceptable. The current process and design of the system could be improved significantly by installing a Waterman valve. This change would provide a user friendly system to adjust the attraction flows, could be secured to prevent tampering or vandalism, and would be much safer to operate than the present design.

Another point of concern is the installation of screens used to prevent the entrainment loss (death, injury, etc.) of downstream migrating bull trout and other fish in the intake of the powerhouse penstock. The agreement between the U.S. Forest Service, the Fish and Wildlife Service, the State of Idaho, IDFG, and Atlanta Power clearly states that the power company is responsible for the annual installation and maintenance of the fish screens. The screens have not been consistently installed each year in a timely fashion. In some years, such as 2004, the screens have not been installed at all. Both the ladder and fish screen operation are scheduled for review and modification in 2005. It will be important to clarify dates of operation to ensure their effectiveness.

The long term success of this ladder is dependent on sufficient flows and timely communication between all responsible parties when problems or concerns arise. If a few relatively simple structural and operational changes are made, the improved operational flexibility and efficiency should result in more reliable passage conditions for all fish.

Lower Boise River Electrofishing

Mark recapture data for mountain whitefish, brown trout, and rainbow trout by centimeter size group are provided in Appendix E. Physical descriptions of the electrofishing sites can be found in Appendix F.

Wild rainbow trout abundance estimates were very similar between sections. The estimates for fish ≥100 mm were 1,387, 735, and 1,149 fish/km in the upper, middle, and lower sections, respectively (Table 10). QSD estimates were 3%, 4%, and 5% in the upper, middle, and lower sections, respectively. The lower section held an estimated 19 wild rainbow trout ≥406 mm/km, 27% higher than the middle (special regulation) section. There was an average of 11 wild rainbow trout ≥406 mm/km when the catch from all sections was combined (Table 11). Very few wild rainbow trout were caught between 140 and 220 mm (Figure 43). Our density estimates for wild rainbow trout ≥100 mm were 4, 2, and 3 fish/100 m^2 in the upper, middle, and lower sections, respectively (Table 10).

Abundance estimates for brown trout ≥100 mm in the middle and lower sections were 199/km and 96/km, respectively. There were insufficient recaptures in the upper section to calculate a brown trout estimate. There were 41 and 33 brown trout ≥406 mm/km in the middle and lower sections, respectively (Table 11). Very few brown trout between 170 and 240 mm were caught (Figure 44). QSD estimates ranged from 19% in the upper site, to 42% in the lower section (Table 11). The brown trout density in the lower section was 0.3 fish ≥100 mm/100 m^2, which was slightly lower than in 1995 but higher than other surveys (Table 12). Brown trout redds were observed in the river adjacent to Municipal Park and the Warm Springs Golf Course, and in the Goodwin Ditch near Warm Springs Mesa. A total of eight redds were observed. The GPS locations of the spawning areas can be found in Appendix G.

Abundance estimates for mountain whitefish were 1,739, 2,070, and 1821 fish/km in the upper, middle, and lower sections, respectively (Table 10). All fish collected were used in the estimate and none less than 120 mm were caught (Figure 45). Mountain whitefish density in the lower section was 5.5 fish ≥100 mm/100 m^2, which was about one-third of the observed density in 1995 and slightly higher than the upper and middle sections (Tables 10 and 12).

In addition to the above mentioned species, we observed one 187 mm kokanee many largescale sucker and bridgelip sucker, several chiselmouth *Acrocheilus alutaceus*, and many sculpin.

Previous surveys of the Boise River have used a variety of gear with little similarity or comparable results to our work. Past sampling efforts either focused on very short reaches with limited sampling in deeper habitats, or floated through long sections covering a very small portion of the available fish habitat. Our equipment allowed us to sample most of the river and obtain a very good snapshot of the fish populations, and should be easy to duplicate in the future. However, it made comparisons with past work very difficult. At best, the only long term comparison we were able to make was the density and size structure of fish in the lower section. Our density estimate of wild rainbow trout ≥100 mm in the lower section was 2.5 times higher than the highest previous survey (Table 12). The low densities observed in surveys conducted between 1988 and 1995 were likely the result of the extended drought southwestern Idaho had been experiencing since the late 1980's. Although we are still experiencing a drought, Boise River winter flows were considerably higher between 1995 and 2000 than in the previous twelve years and have likely resulted in better over winter survival of all fish (Figure 46). What we saw in 2004 was probably not influenced by the 1995-2000 winter flows. The winter flows of 2001-2003 were considerably higher (189-296 cfs; 255 cfs average) than occurred in the three years preceding the 1995 estimate (124-283 cfs; 186 cfs average).

The length frequencies of wild rainbow trout, brown trout, and whitefish in the lower Boise River all indicate multiple missing year classes. In the case of wild rainbow and brown

trout, fish between 150 - 210 mm and 170 - 250 mm, respectively, are essentially nonexistent (Figures 47 and 49). This may be a result of unsuccessful spawning in the spring of 2002, limited spawning due to poor adult survival during the fall/winter of 2001-2002, or simply the size gap between age-1 and age-2 fish. Growth data needs to be collected before concluding we are missing an age class. During this time frame, winter flows were lower than they had been in the previous six years (Figure 46). In very similar winter conditions between 1988 and 1996, a total of five wild rainbow trout and 12 brown trout >210 mm (6% and 29% of the total from all five surveys, respectively) were collected in five surveys of the lower section (Figures 47 and 48). Although few mature wild rainbow and brown trout were collected between 1988 and 1996 (assuming maturity at 305 mm for females and 250 mm for males), the length frequencies from those surveys indicate that there was recruitment in those exceptionally dry years. In contrast, 73% of the wild rainbow and 70% of the brown trout in our survey of the same section were >210 mm following seven out of eight years with winter flows ≥ 290 cfs. The length frequency for mountain whitefish revealed a similar trend. There were more mountain whitefish ≥330 mm in 2004 than any previous survey (Figure 49).

Another notable feature of the observed size structure for wild rainbow and brown trout was the rapid decline in abundance after approximately 270 mm. This is likely due to a combination of angler harvest and one or more limiting environmental factor, such as low winter flows. Higher than anticipated natural mortality may have contributed to the decline, however we collected no age and growth data to evaluate. Although we are unsure what the optimal winter flow should be, we know that the river conditions between October 1999 and March 2003 resulted in improved populations of rainbow and brown trout. Given the size structure and densities of wild rainbow trout currently in the river, the population has and will persist with a few years of lost recruitment. As the missing year classes move through the populations, the likely noticeable difference will be fewer large fish in the size structure (lower QSD) for a few years until the stronger year classes move in to fill the void. Because previous sampling was so different than ours, it is very difficult to make conclusions based on a comparison of our work and historical efforts. However, we suspect that persistent low winter flows will further change the size structure of the population we observed in 2004. This conclusion should be validated with standardized sampling in the future.

Overall, the wild rainbow trout QSD's were very low but increased slightly as we worked downstream. The QSD was highest in the lower section, and for comparison, was slightly higher than measured in the Big Wood River (near Hailey) in 2003. Much like the lower Boise River, the Big Wood River is very productive, contains brown trout, and has had a Quality Trout regulation in effect for more than eight years (Table 13). The gradient of QSD values observed in wild rainbow trout was also apparent with brown trout (Table 11). Although a QSD of 19 is considered good, the upper section held considerably fewer large brown trout than the other sections, resulting in a 45% lower QSD. The gradient of QSD values may be explained by the most noticeable difference in fish habitat between the three sections, water depth. The upper section consisted of sporadic deep pools and woody debris, and predominantly gradually sloping shorelines. As a result, the upper section was more suited for juvenile rearing than for adults. As we moved downstream, the water depth, in general, gradually increased to the point of exceeding the limits of our equipment and crew. Most pools in the upper section were relatively easy to sample thoroughly, as were many in the middle section. The lower section proved to be the most problematic, with pools frequently exceeding 2.4 m in depth. Many of our larger rainbow and brown trout were collected from, or in close proximity to, these deep areas. Our sampling and observations suggests that while the upper river is well suited for juvenile rearing, fish likely move downstream to occupy deeper habitats as they grow larger.

Wild rainbow trout abundance (fish/km ≥100 mm) in the middle section was very similar to the South Fork of the Boise River (SFBR) near Cow Creek. The lower section was 40% higher than the SFBR (Table 13). For fish ≥300 mm, the SFBR had abundance 48% and 69% higher per km than the middle and lower sections, respectively. When comparing the middle and lower sections to the Big Wood River, abundance was 82% and 73% higher in the Big Wood River, respectively. For wild rainbow trout ≥300 mm, the Big Wood River had 52% and 71% higher abundance than the middle and lower sections, respectively.

There has been considerable debate in the local angling community about the effectiveness of the special regulation area (middle section) in the lower Boise River. Our results indicate that there is little difference between the size structure and density of wild rainbow trout in the special regulation section when compared to adjacent areas of the river with similar habitat (the lower section). Length frequencies indicate that recruitment is occurring and there are very similar densities of wild rainbows and brown trout ≥356 mm in the middle and lower sections (Table 11). The main difference in size structure between the sections was the density of fish ≥305 mm. The densities of wild brown and rainbow trout ≥305 mm in the lower section were 38% and 45% lower than the middle section, respectively (Table 11).

Chinook Salmon Surveys

Parr Monitoring

Juvenile Chinook salmon densities ranged from 6.2 to 41.3 fish/100 m^2 in Elk Creek and from 26.1 to 41.9 fish/100 m^2 in Sulphur Creek (Table 15). When compared to 2003 results, densities increased in all Elk Creek sites and two out of three sites decreased in Sulphur Creek (Flatter et al. 2006). Habitat information was forwarded to IDFG anadromous research staff for incorporation into the Idaho Salmon and Steelhead Investigations report (Idaho Salmon and Steelhead Investigations 2004, Idaho Department of Fish and Game, in press).

Redd Counts

Trend areas surveyed in 2004 were the same as surveyed in the past. The number of redds counted were 109, 72 and 7, for Bear Valley, Elk, and Sulphur Creeks, respectively (Table 15). The overall counts were significantly lower than counted in 2003. Specifically, Bear Valley, Elk, and Sulphur creeks were 71%, 78%, and 91% lower than in 2003, respectively.

Live fish observed in Bear Valley Creek totaled 18 two-ocean males, 35 two-ocean females, and 2 three-ocean females. In Elk Creek we observed 11 two-ocean males, 6 three-ocean males, 14 two-ocean females, and 1 three-ocean female. We saw only one live adult, a two-ocean female, in Sulphur Creek (Table 15).

MANAGEMENT RECOMMENDATIONS

Second Fork Squaw Creek

1. Resurvey the area in mid-October to clarify if the trend of decreasing density and reduced size structure is a function of sampling timing or actual changes in the population.

Mann Creek and Tributaries

1. Complete the genetic analysis as soon as funds become available. Resurvey all sites in 2009 to monitor the population trends.

North Fork Boise River

1. Each of the four sites near Graham should be resampled in 2007.

Kirby Dam Fish Ladder

1. Investigate options to modify the penstock bypass pipe to provide a user friendly system to adjust the attraction flows.

2. Continue August fish trap operations through 2005. Engage with Atlanta Power, FERC, USFWS, and OSC to develop a long-term operations plan for the fish ladder and screens with clear roles and responsibilities and appropriate oversight.

Lower Boise River Electrofishing

1. Present the information learned from the 2004 survey to angling groups.

2. Repeat the survey in 2007. Collect scales/otoliths to determine age structure of brown trout, wild rainbow trout, and mountain whitefish. Duplicate population surveys every 3-4 years to monitor trends.

3. Populations of wild trout appear to have improved since 1995, possibly due to increases in average winter flows in recent years. The Department should continue to advocate the highest possible winter flows to protect or further enhance populations.

4. Brown trout may be recruitment limited due to the lack of suitable spawning areas. Areas such as the Goodwin Diversion may be improved with of the addition of spawning gravels.

Table 6. Redband trout population and density estimates (trout >100 mm) in the Mann Creek drainage, 1995-2004.

Section Name	UTM Coordinates	Year	Population estimate (90% CI)	S.E.	Density trout/100 m^2
Adams Creek	0503909/4926218	2004	15	0.06	24
		2001	16 (14 - 18)	0.70	27
		1995	62	4	57
Mann Creek					
Lower	0504291/4933568	2004	28	2	20
		2001	17 (16 - 18)	0.7	15
		1995	33	1	22
Upper	0503926/4935727	2004	32	1.06	20
		2001	26 (20 - 32)	2.9	21
		1995	53	2	40
4th of July Creek	0501016/4932586	2004	37	0.12	48
		2001	25 (23 - 27)	1.2	34
		1995	36	0	46
Bear Creek	0503907/4932729	2004	14.0	0.63	16
		2001	9 (9 - 10)	0.4	11
		1995	40	0	37
Hitt Creek	0505670/4930423	2004	38	0.9	71
		2001	30 (26 - 34)	1.7	30
		1995	53	0	64

Table 7. Comparison of fish densities (number/100 m2) for the roadless sections of the North Fork Boise River, 1996–2004.

Section	Year	Wild rainbow trout length group (mm) 0-100	100-200	200-300	Bull trout	Mountain whitefish	Hatchery rainbow trout
NFBSIL (Silver Creek)	2000[A]	2.2	1.47	1.65	1.1	9.52	0
	2004	0.21	1.03	0	0.21	1.86	0
NFBGRB (Graham)	2000	0.73	3.28	1.46	2.91	12.8	0
	2004	0	1	0.84	0	7.89	0
NFBHOR (Horsefly Creek)	1996[B]	0.84	4.76	3.92	0.56	1.68	0.84
	1997[C]	0.41	2.24	1.43	0.41	0.1	0
	2000	0.64	2.35	1.49	0.11	1.49	0
	2004	0.41	0.93	0.21	0.1	0.72	0
NFBBLJ (Blue Jay Creek)	1996	0.19	2.3	1.73	0.34	0	0.77
	1997	0.11	0.95	0.85	0	0	0
	2000	0.15	1.6	1.74	0	2.76	0.15
	2004	0	0.56	0.42	0.14	2.4	0

Table 7. Continued.

Section	Year	Wild rainbow trout length group (mm) 0-100	100-200	200-300	Bull trout	Mountain whitefish	Hatchery rainbow trout
Between Rabbit Creek and the Middle Fork of the Boise River (roadless)	2001[E]	0.18[D]	0.70[D]	0.70	0.09[D]	1.35[D]	0
	2003[F]	0.15[D]	0.31[D]	0.67	0.03[D]	1.55[D]	0

[A] Flatter et al. 2003 .
[B] Allen et al. 1999
[C] Allen et al. 2000a
[D] Listed densities are the average from five transects
[E] Flatter et al. 2001 in press
[F] Flatter et al. 2003 in press

Table 8. Fish captured in Kirby Dam fish ladder trap August 1 – August 31, 2004.

Species	Total length (mm)	Weight (g)	Date Collected	Time Collected
WRB	245	190	8 / 22	0820 hrs
BLT	284	190	8 / 30	1945 hrs
BLT	224	72	8 / 30	1945 hrs
WRB	190	50	8 / 30	1945 hrs

BLT = bull trout
WRB = redband trout

Table 9. Kirby dam temperature and water levels for 2004.

Date	Temperature (˚C)	Gauge height (Feet)
4/27/2004	-	0.60
5/10/2004	-	0.70
5/28/2004	-	1.30
7/6/2004	-	0.70
8/1/2004	14	0.78
8/2/2004	14	0.66
8/3/2004	13	0.66
8/4/2004	14	0.66
8/5/2004	13	0.64
8/6/2004	14	0.66
8/7/2004	13	0.64
8/8/2004	14	0.62
8/9/2004	12	0.54
8/10/2004	12	0.50
8/11/2004	13	0.50
8/12/2004	12	0.46
8/13/2004	12	0.44
8/14/2004	13	0.42
8/15/2004	14	0.42
8/16/2004	14	0.44
8/17/204	14	0.46
8/18/2004	14	0.72
8/19/2004	13	0.78
8/20/2004	13	0.74
8/21/2004	13	0.74
8/22/2004	13	0.74
8/27/2004	-	0.78
8/30/2004	18	0.75
8/31/2004	11	0.75

Table 10. Population and density estimates for rainbow trout, brown trout, and mountain whitefish ≥100 mm in the Boise River, 2004.

Species	Section	Regulations	$\hat{N}$ ± 95% CI	/100m^2	/km	/ha	/mile
Wild rainbow trout	Upper	General	1,340 ± 734	4	1,387	353	2,233
	Middle	2 Trout None < 14"	807 ± 130	2	735	188	1,187
	Lower	General	1,477 ± 346	3	1,149	352	1,846
All rainbow trout*	Upper	General	2,056 ± 839	5.5	2,128	541	3,427
	Middle	2 Trout None < 14"	809 ± 225	2	737	188	1,190
	Lower	General	1,549 ± 350	4	1,205	369	1,936
Brown trout	Upper	General	-	Insufficient Recaptures			-
	Middle	2 Trout None < 14"	218 ± 75	0.5	199	51	321
	Lower	General	124 ± 21	0.3	96	30	155
Mountain whitefish	Upper	General	1,680 ± 206	4.5	1,739	442	2,800
	Middle	2 Trout None < 14"	2,273 ± 205	5.3	2,070	529	3,343
	Lower	General	2,342 ± 332	5.5	1,821	558	2,928

* Includes wild and hatchery rainbow trout

Table 11. Boise River rainbow trout and brown trout density estimates by section and size group, November 2004.

Species	Site	Regulations	Abundance ≥305mm /km	Abundance ≥356mm/km	Abundance ≥406mm /km	QSD 406mm/ 203mm
Wild rainbow trout	Upper	General	20	16	No recaptures	3%
	Middle	2 Trout None < 14"	51	25	11	4%
	Lower	General	28	24	19	5%
	Total		31	19	11	
All rainbow trout*	Upper	General	33	24	No recaptures	4%
	Middle	2 Trout None < 14"	45	25	12	5%
	Lower	General	34	18	12	2%
	Total		41	22	14	
Brown trout	Upper	General	**	**	**	19%
	Middle	2 Trout None < 14"	65	47	41	41%
	Lower	General	40	42	33	42%
	Total		31	23	20	

* Includes wild and hatchery rainbow trout
** No estimate due to low recaptures

Table 12. Comparison of fish densities (≥100 mm/100 m2) in the Municipal Park area of the Boise River, 1988-2004.

	3 Pass Removal Electrofishing[a]				Mark-Recapture[b]
Species	Jan 1988	Mar 1992	Mar 1994	Mar 1995	Nov 2004
Wild rainbow trout	0.3	1.2	0.5	1.4	3.5
All rainbow	0.4	1.2	0.5	1.5	3.7
Brown trout	0.08	0.2	0.07	0.5	0.3
Mountain whitefish	4.1	11.3	0.8	14.8	5.5

[a]Population estimate calculated using Microfish 3.0
[b]Population estimate calculated using Mark Recapture 5.0 (log-likelihood and Modified-Peterson)

Table 13. Comparison of wild rainbow trout densities in three southern Idaho rivers.

Site	Sample date	Regulation	Size class	fish/km	fish/100m^2	fish/ha	QSD
South Fork Boise River (near Cow Creek Bridge)	10/03	2 Trout none < 20"	≥ 100mm	822	2	188	26%
			≥ 300mm	99	0.23	23	
Big Wood River (Near Hailey)	10/03	2 Trout none 12"-16"	≥ 100mm	4,167	18	1,786	4%
			≥ 300mm	106	0.46	46	
Boise River Middle section	11/04	2 Trout none < 14"	≥ 100mm	735	2	188	4%
			≥ 300mm	51	0.13	13	
Lower section	11/04	General	≥ 100mm	1,149	3	352	5%
			≥ 300mm	31	0.09	9	

Table 14. Number of age 0 Chinook salmon in general parr monitoring sections, August, 2004 in Elk and Sulphur Creeks.

Stream	Strata/Section	Number Observed	Area Sampled (m^2)	Density Fish/100 m^2
Elk Creek	1-A	392	1306.04	30.15
	1-B	160	1041.6	15.4
	2-A	517	2164	23.9
	2-B	170	2764.8	6.2
	2-C	634	1536.6	41.3
Sulphur Creek	2-3A	135	516.88	26.1
	2-4A	360	1001.22	36
	2-4B	673	1606.5	41.9

Table 15. Chinook salmon redds counted August 25-26, 2004 in Bear Valley, Elk, and Sulphur Creek trend areas.

TRANSECT Date Sampled	TRANSECT DESCRIPTION	# REDDS	# TEST DIGS	LIVE FISH WILD SPRING CHINOOK			
BEAR VALLEY CREEK TREND AREA 8/26/04				2 OCEAN FISH		3 OCEAN FISH	
				MALE	FEMALE	MALE	FEMALE
WS-9a	Mine exclosure area	4			1		
WS-9b	Mine exclosure to Cub Creek	6	1				1
WS-9c	Cub Creek to Sack Creek	22	1		1		
WS-9d	Sack Creek to Elk Creek	46		4	15		
WS-10a	Elk Creek to Poker Bridge	28	4	11	16		1
WS-10b	Poker Bridge to Fir Creek	3		3	1		
TOTAL FOR BEAR VALLEY CREEK		**109**	**6**	**18**	**35**		**2**
ELK CREEK TREND AREA 8/25/04							
WS-11a	West Fork Elk Creek to Twin Bridges	48		5	11		
WS-11b	Twin Bridges to Guard Station	20		5	3	5	
WS-11c	Guard Station to Bear Valley Creek	4	1	1		1	1
TOTAL FOR ELK CREEK		**72**	**1**	**11**	**14**	**6**	**1**
SULPHUR CREEK TREND AREA 8/25/04							
WS-12	Rockslide to Sulphur Cr. Ranch	7	2		1		
OS-4	Sulphur Cr. Ranch to 1.5 miles upstream	0		No adults observed			
TOTAL FOR SULPHUR CREEK		**7**	**2**		**1**		

Table 15. Continued.

TRANSECT Date Sampled	TRANSECT DESCRIPTION	LIVE FISH WILD SPRING CHINOOK				
BEAR VALLEY CREEK TREND AREA 8/26/04		1 OCEAN FISH MALE	FEMALE	Sex Unknown 2 Ocean	Sex unknown 3 Ocean	Unknown SEX and AGE
WS-9a	Mine exclosure area					
WS-9b	Mine exclosure to Cub Creek					
WS-9c	Cub Creek to Sack Creek			3		1
WS-9d	Sack Creek to Elk Creek					
WS-10a	Elk Creek to Poker Bridge	1			2	1
WS-10b	Poker Bridge to Fir Creek					
TOTAL FOR BEAR VALLEY CREEK		**1**	**0**	**3**	**2**	**2**
ELK CREEK TREND AREA 8/25/04						
WS-11a	West Fork Elk Creek to Twin Bridges	1		6		
WS-11b	Twin Bridges to Guard Station					24
WS-11c	Guard Station to Bear Valley Creek					2
TOTAL FOR ELK CREEK		**1**	**0**	**6**	**0**	**26**
SULPHUR CREEK TREND AREA 8/25/04						
WS-12	Rockslide to Sulphur Cr. Ranch		1			
OS-4	Sulphur Cr. Ranch to 1.5 miles upstream					
TOTAL FOR SULPHUR CREEK		**0**	**1**	**0**	**0**	**0**

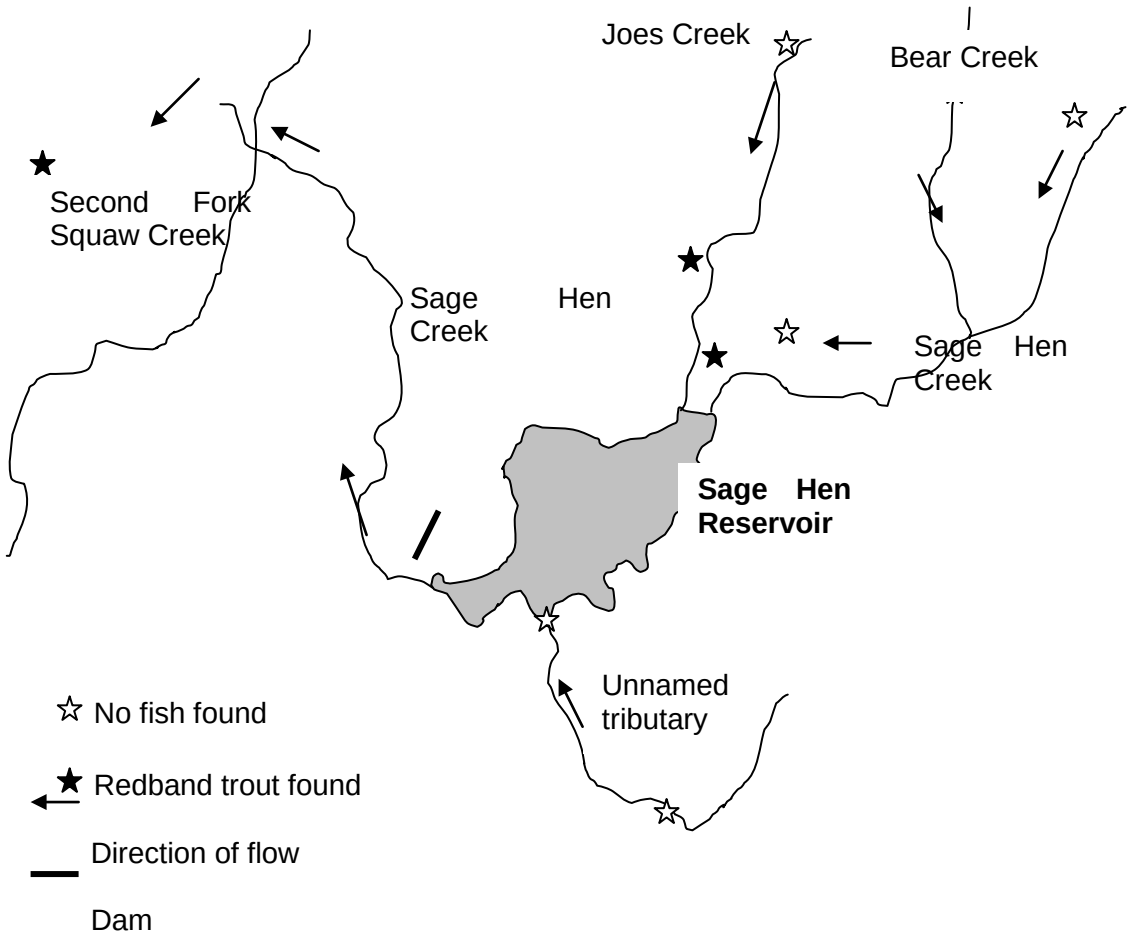


Figure 29. Locations of stream electrofishing sites near Sage Hen Reservoir, 2004.

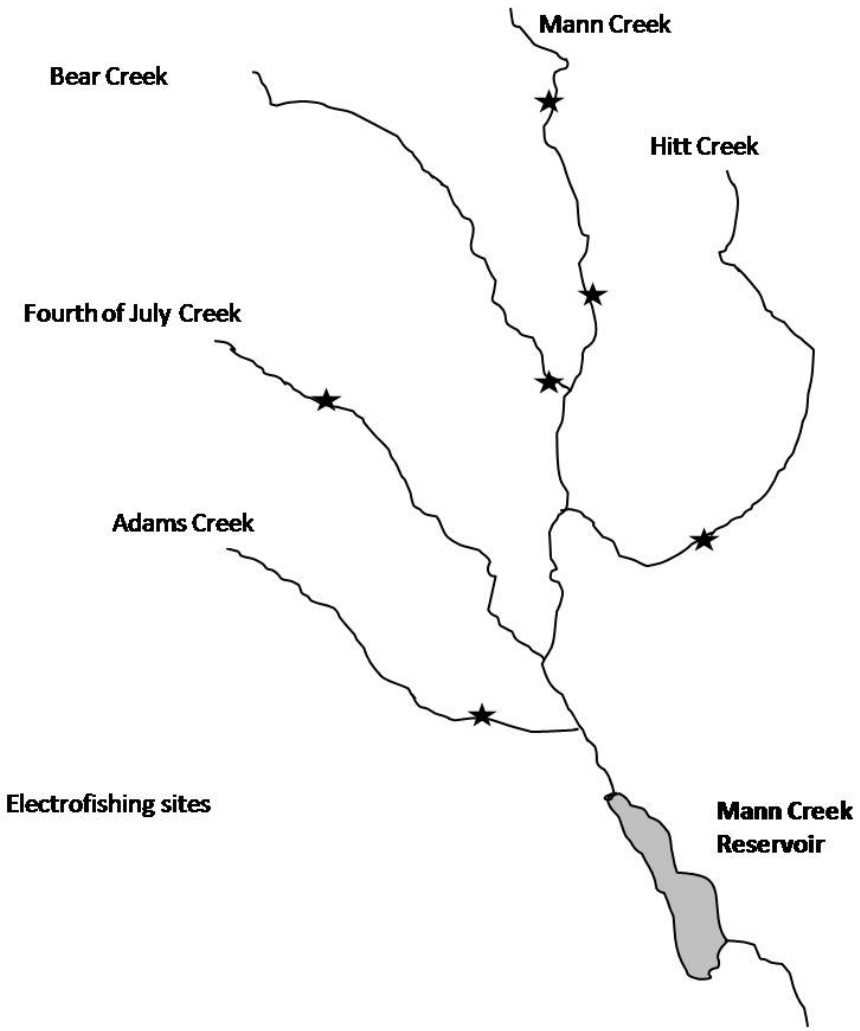


Figure 30. Electrofishing sites in the Mann Creek drainage, 2004.

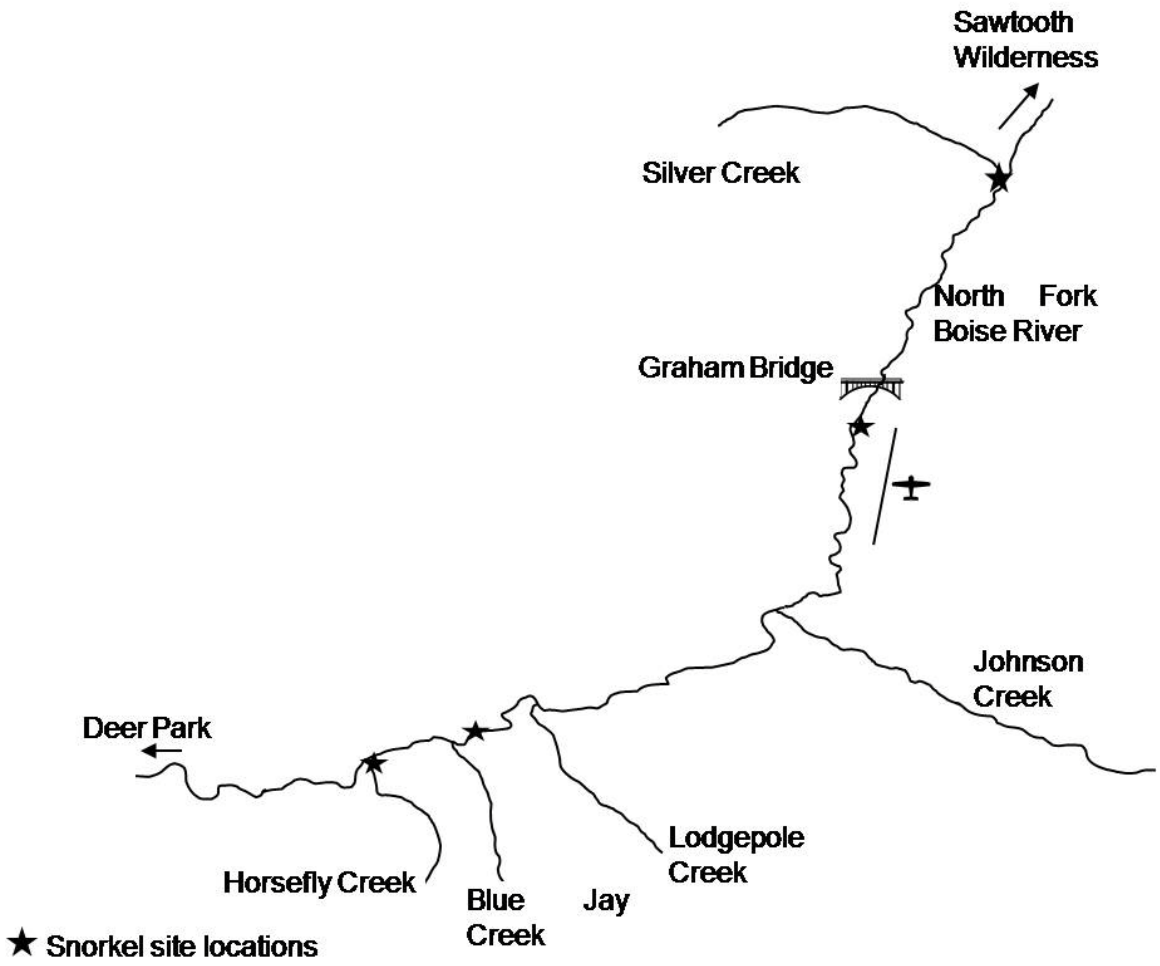


Figure 31. Locations of snorkel sites in the North Fork Boise River, 2004.

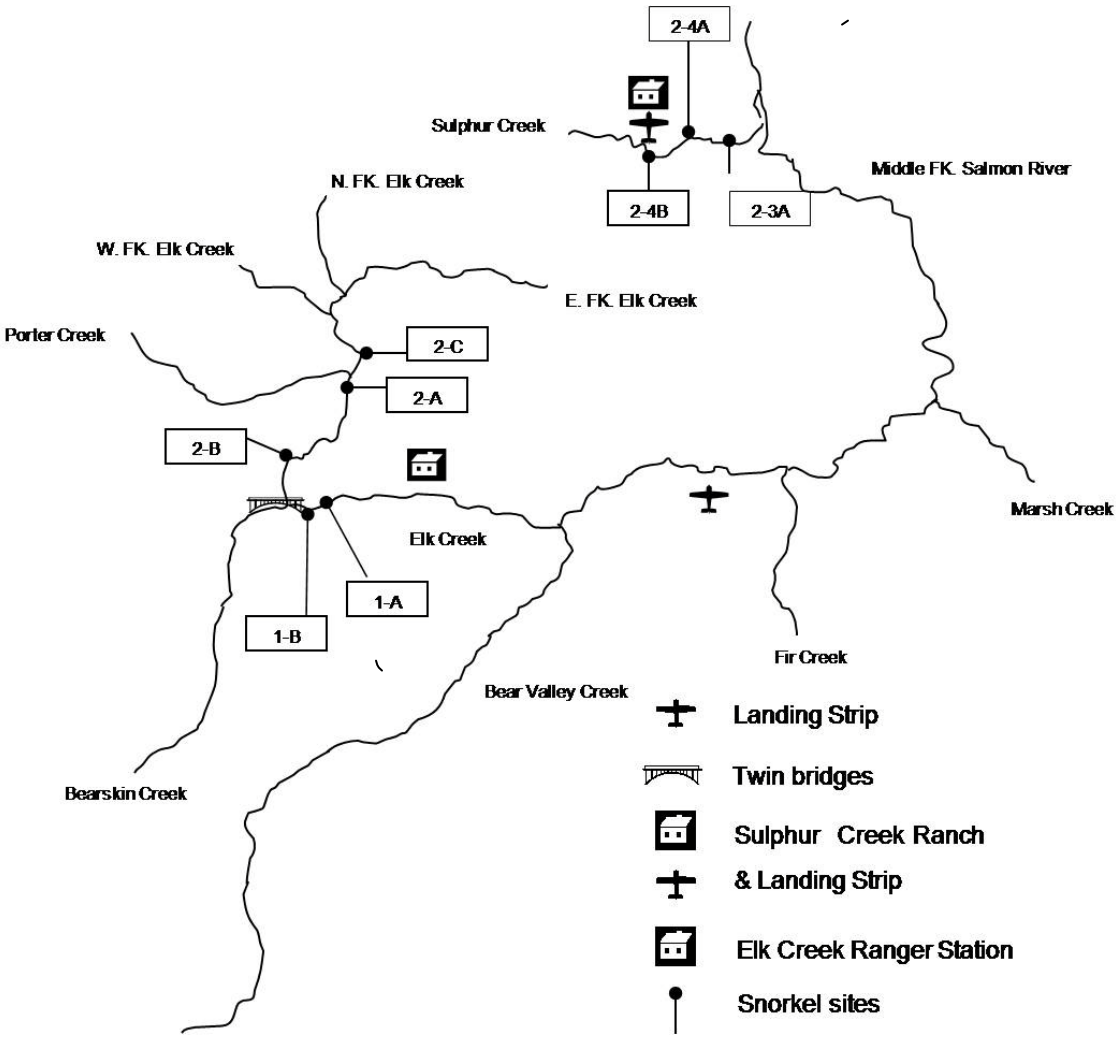


Figure 32. Chinook Parr monitoring snorkel sites in Elk and Sulphur creeks, 2004.

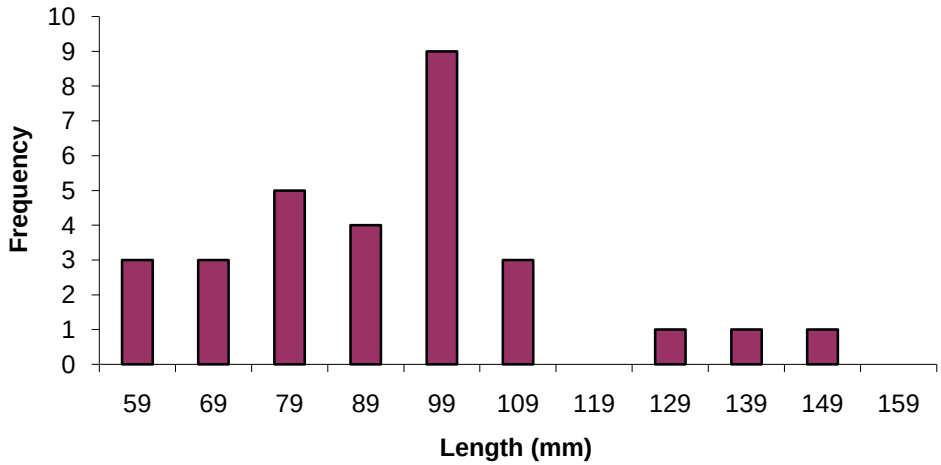


Figure 33. Length frequency of redband trout collected from lower Joe's Creek, 2004.

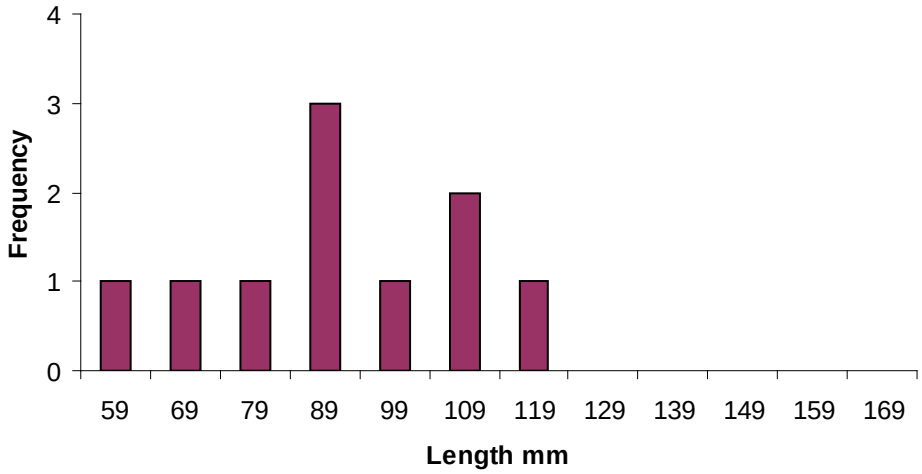


Figure 34. Length frequency of redband trout collected from lower Sage Hen Creek, 2004.

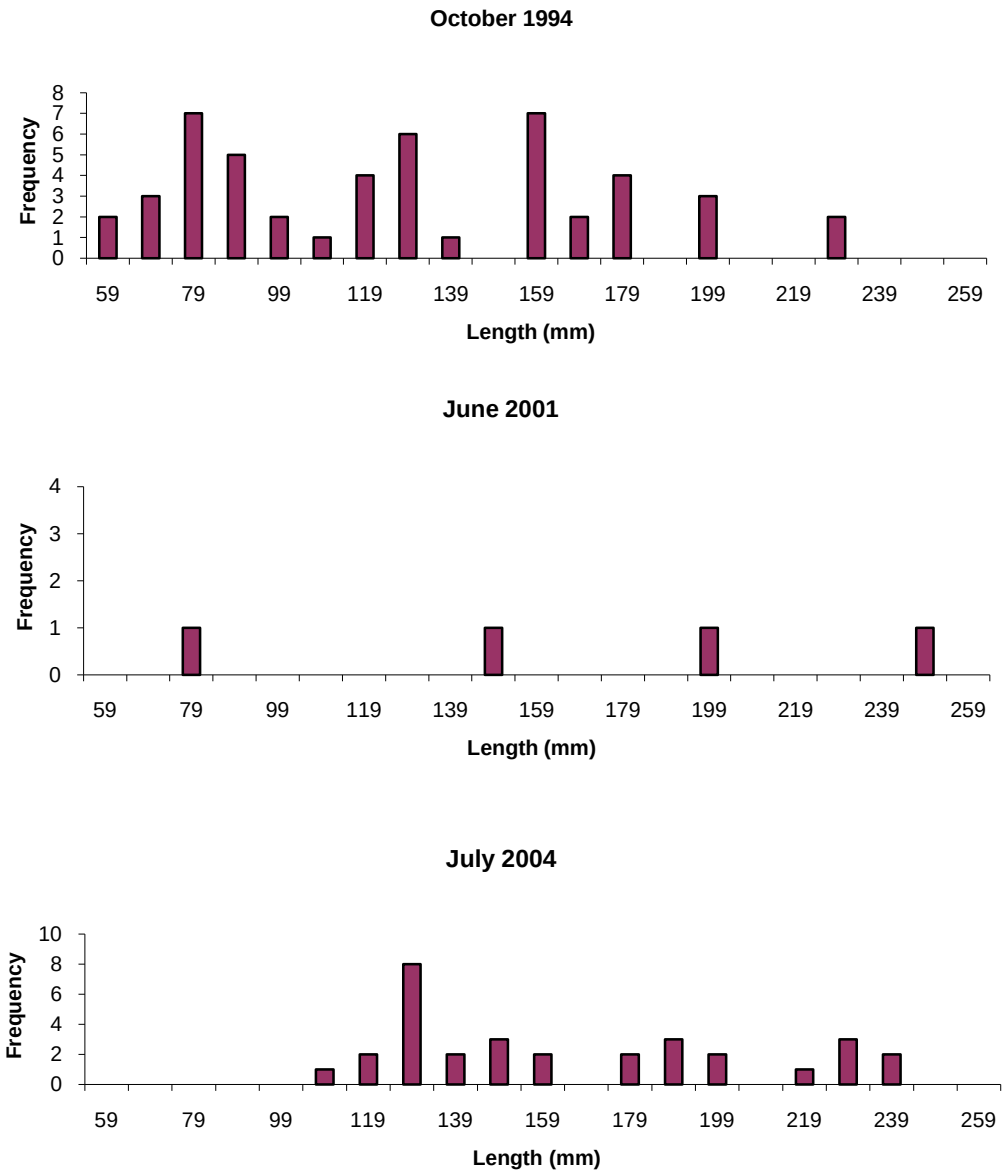


Figure 35. Length frequencies of redband trout collected from Second Fork Squaw Creek, 1994-2004.

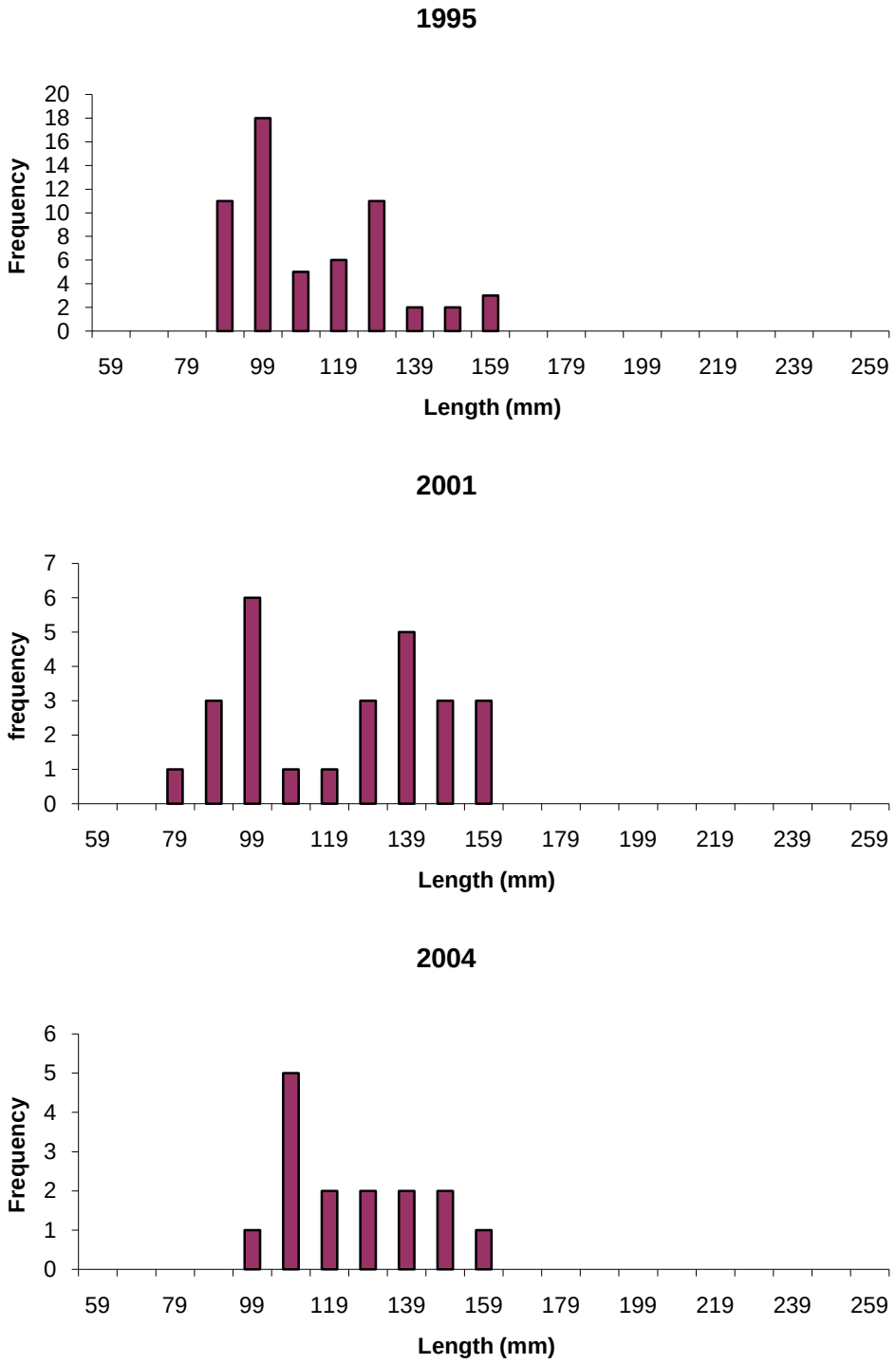


Figure 36. Length frequencies of redband trout collected from Adams Creek, 1995-2004.

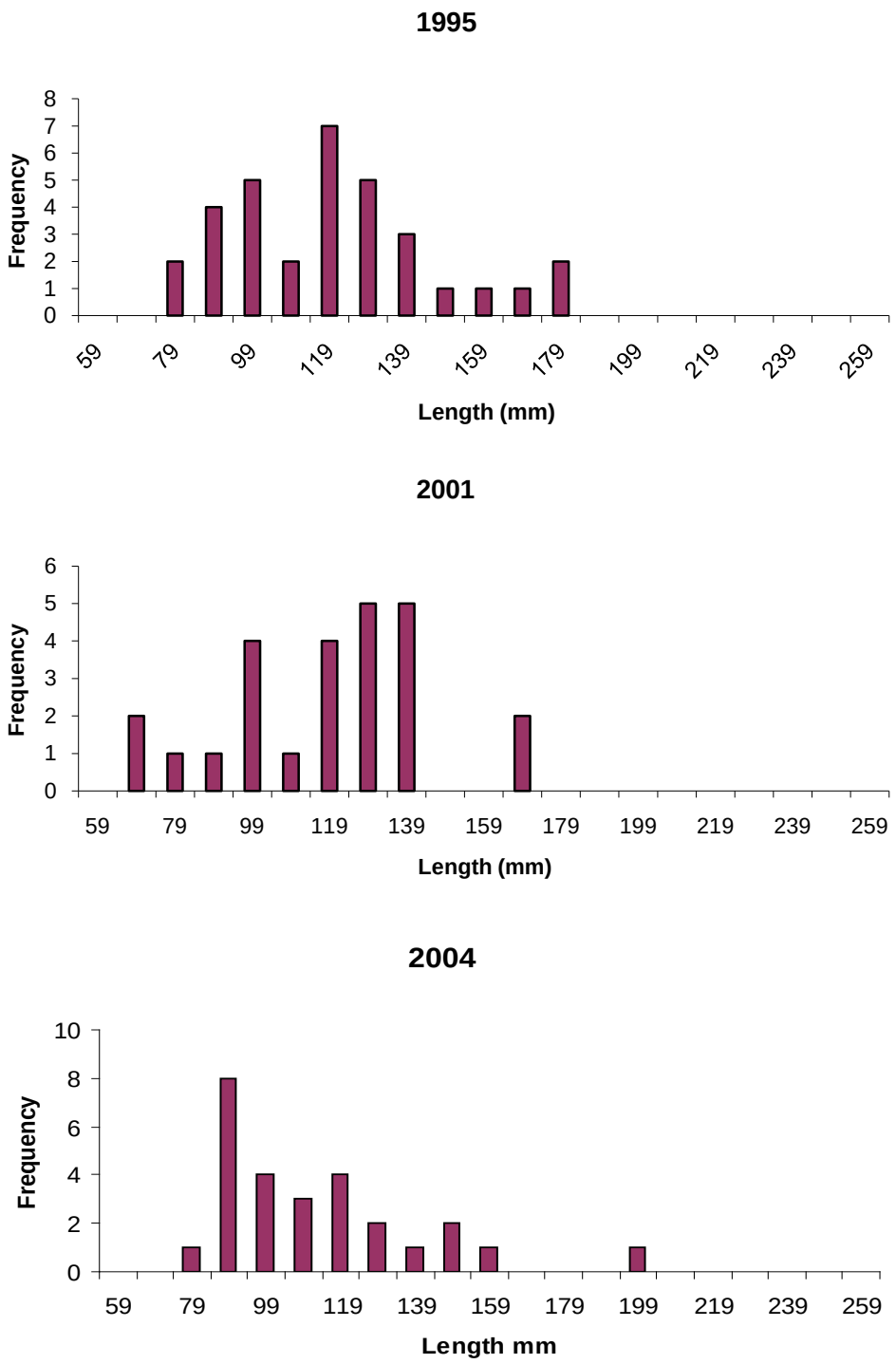


Figure 37. Length frequencies of redband trout collected from lower Mann Creek, 1995-2004.

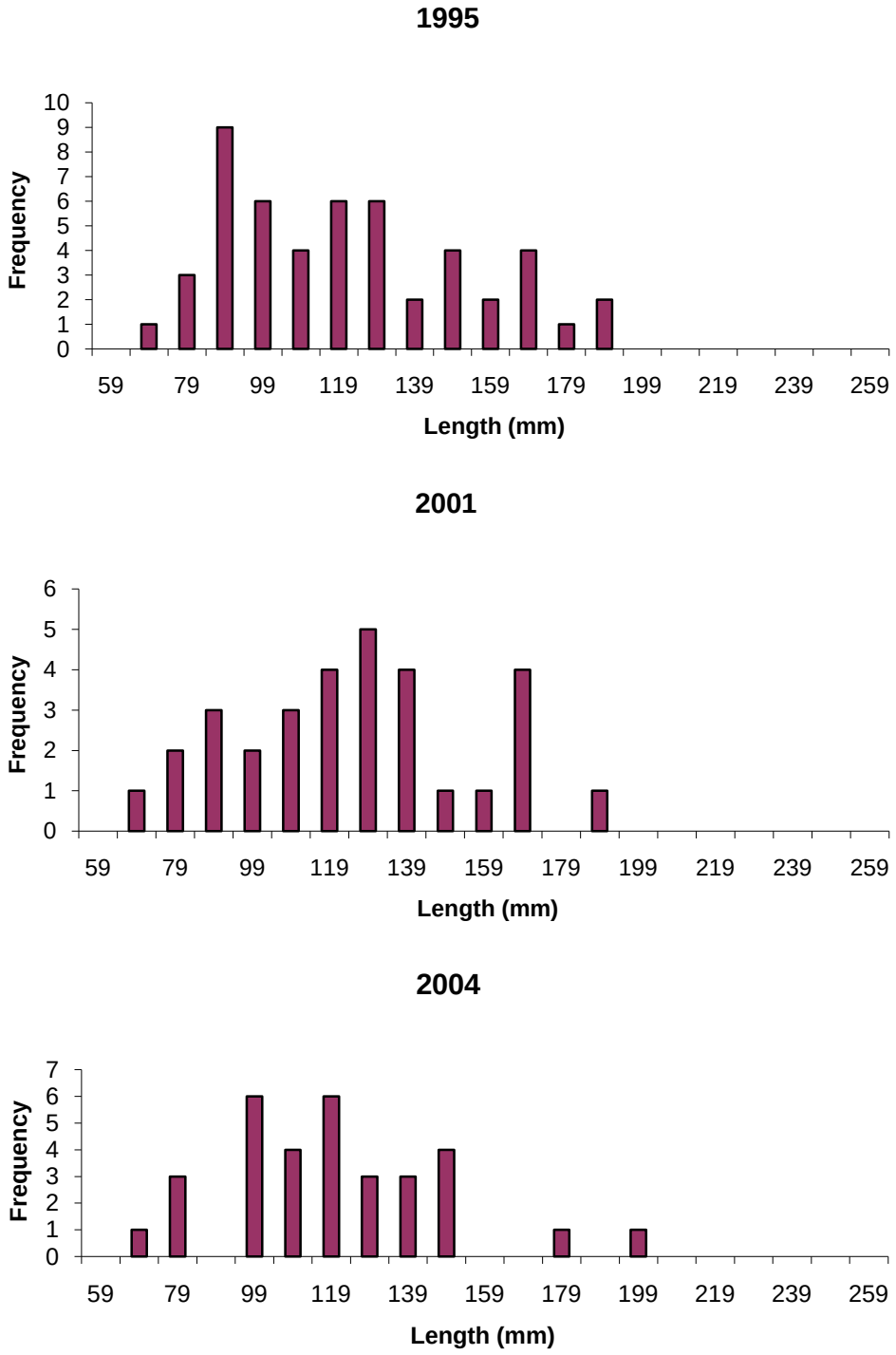


Figure 38. Length frequencies of redband trout collected from upper Mann Creek, 1995-2004.

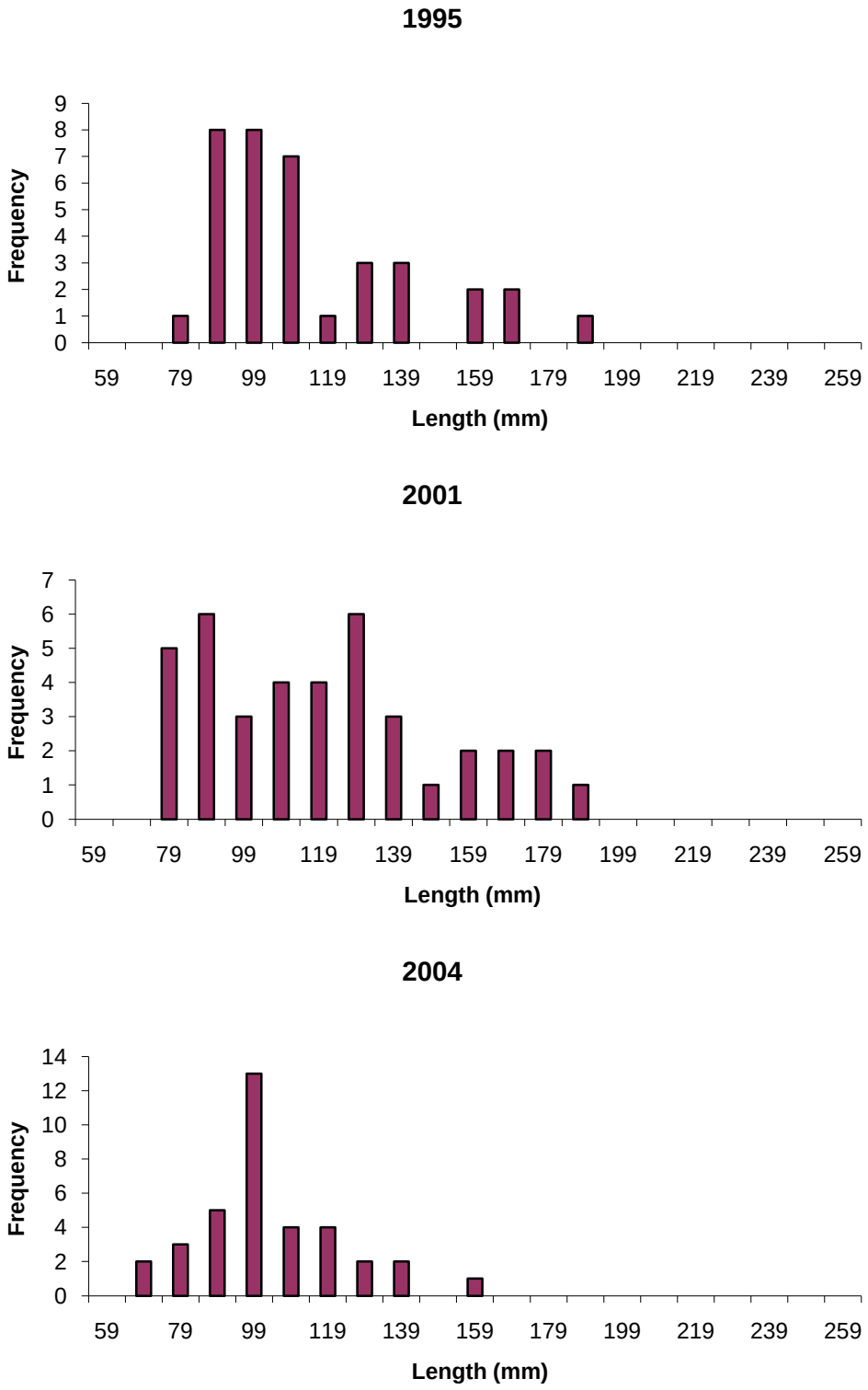


Figure 39. Length frequencies of redband trout collected from upper 4th of July Creek,1995-2004.

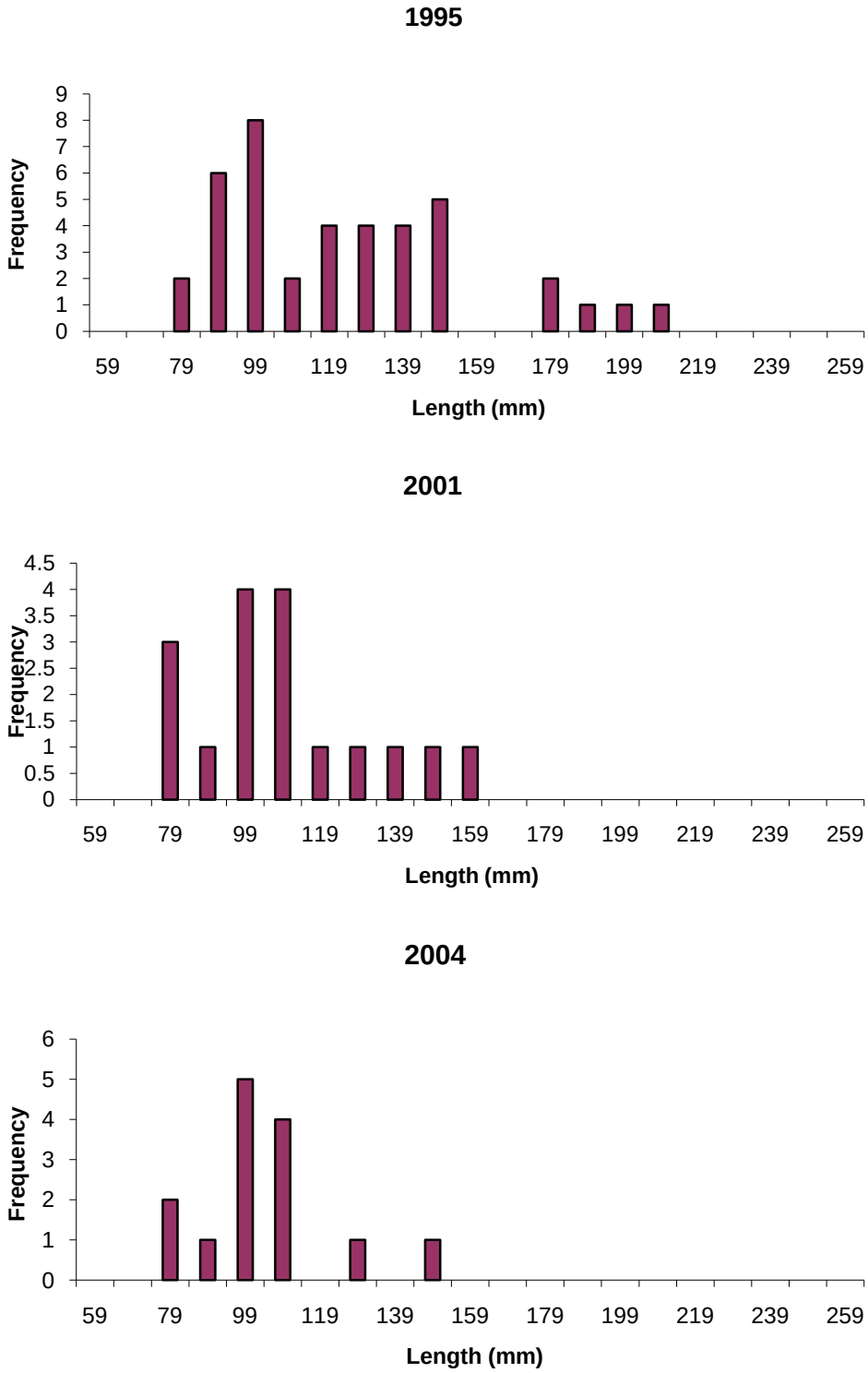


Figure 40. Length frequencies of redband trout collected from Bear Creek, 1995-2004.

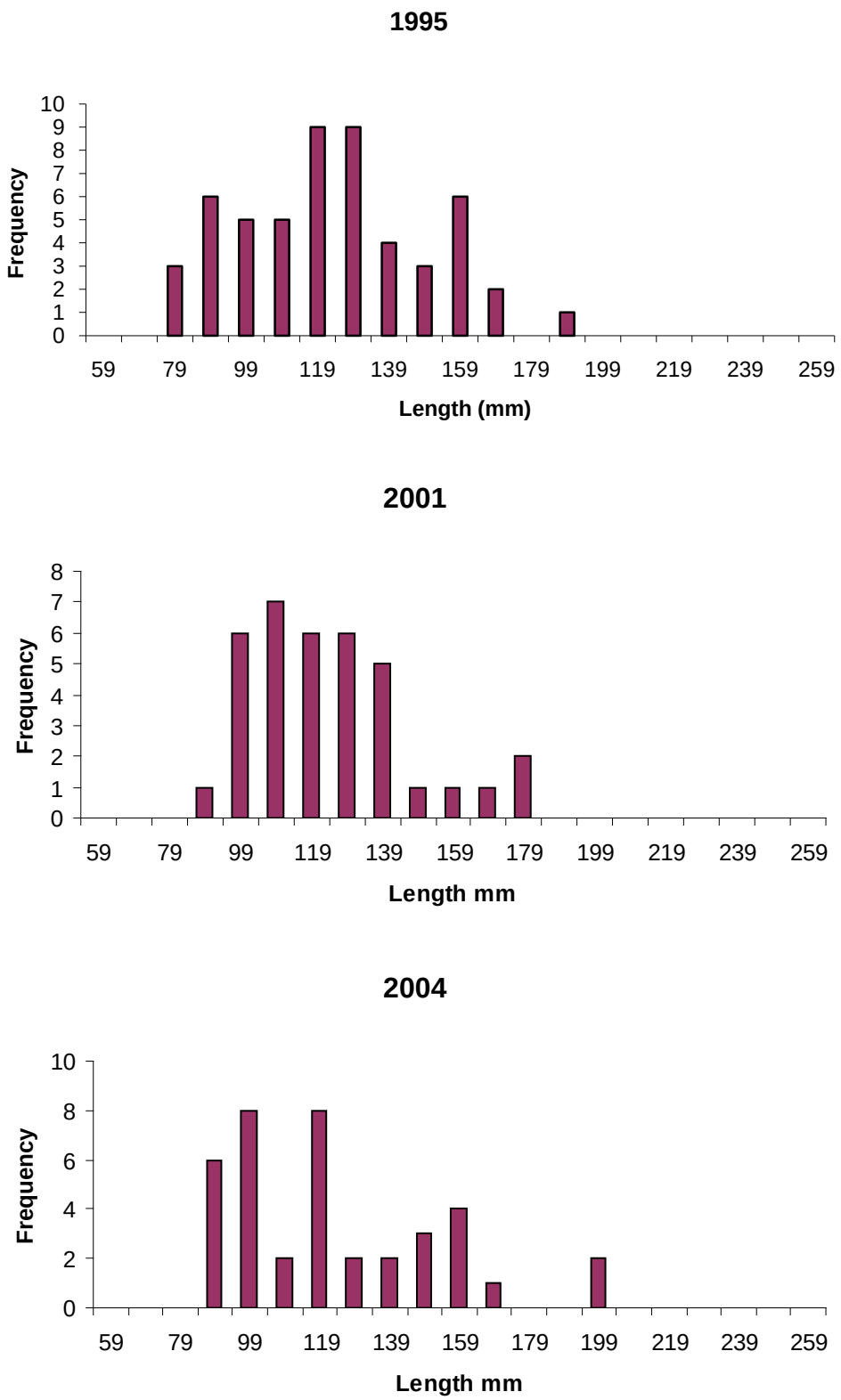
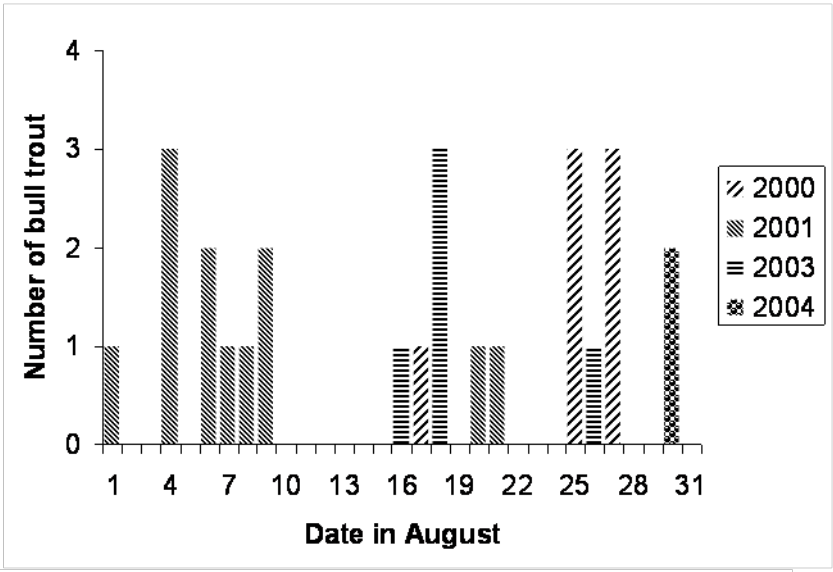


Figure 41. Length frequencies of redband trout collected from Hitt Creek, 1995-2004.



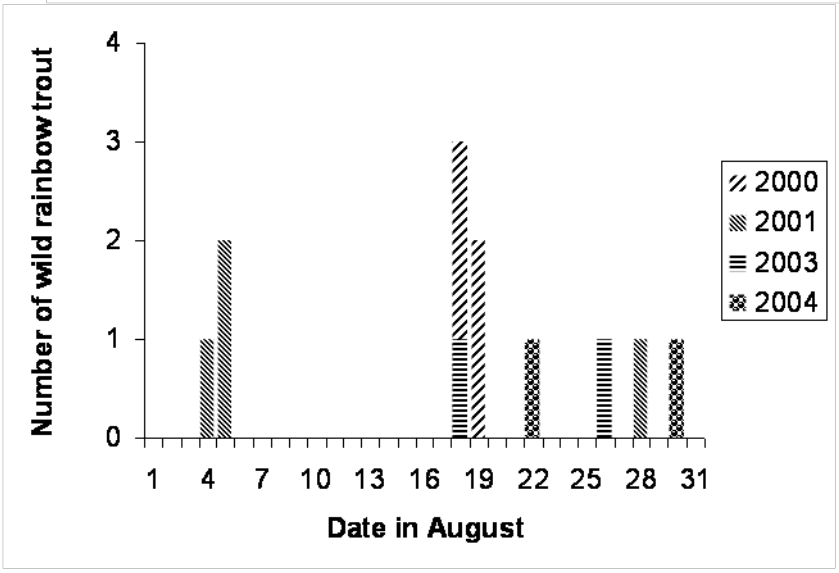


Figure 42. Catch of bull trout and wild rainbow trout in the Kirby Dam fish trap during the month of August, 2000-2004. No fish were captured in 2002.

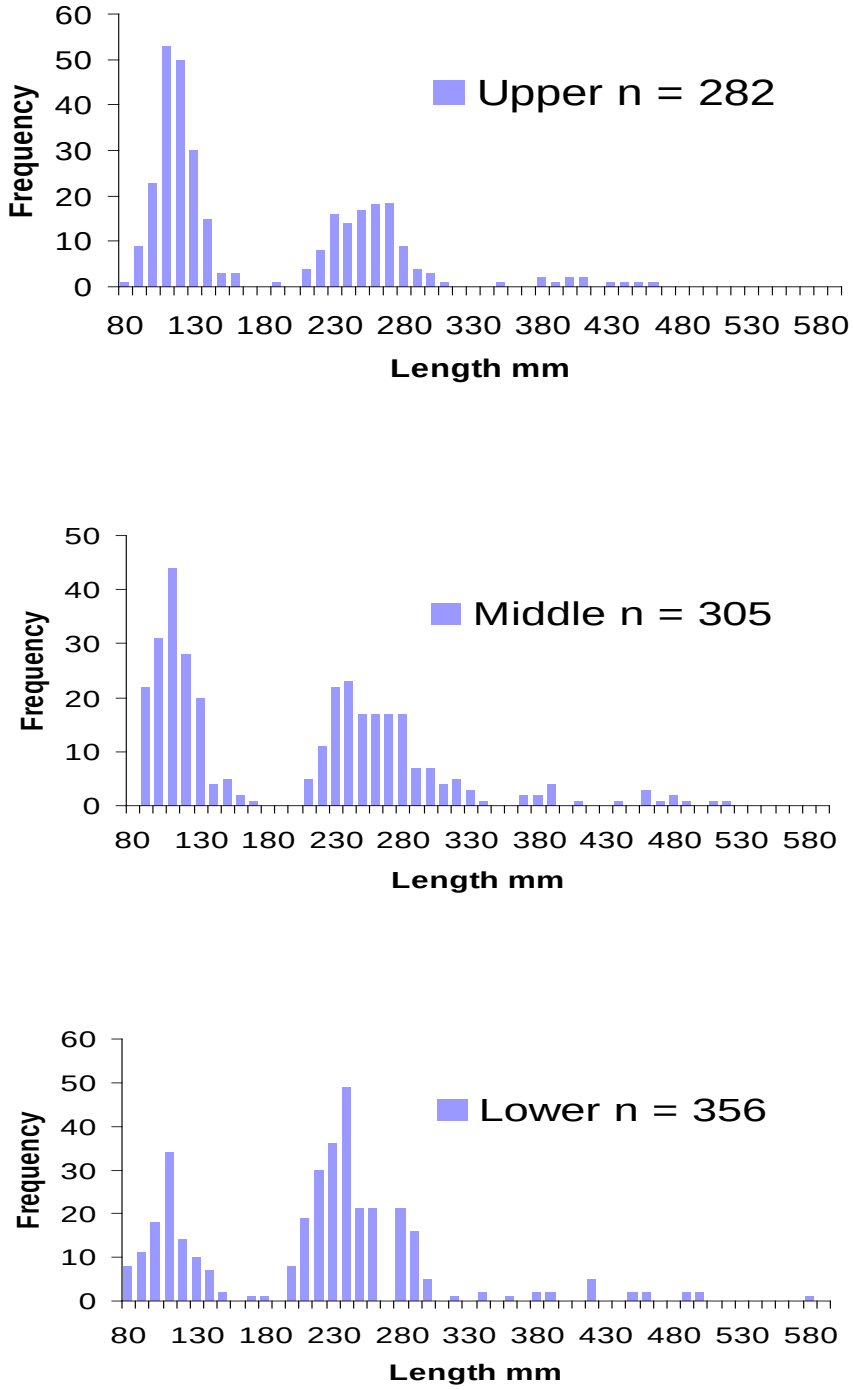


Figure 43. Lower Boise River wild rainbow trout length frequency by section, November 2004.

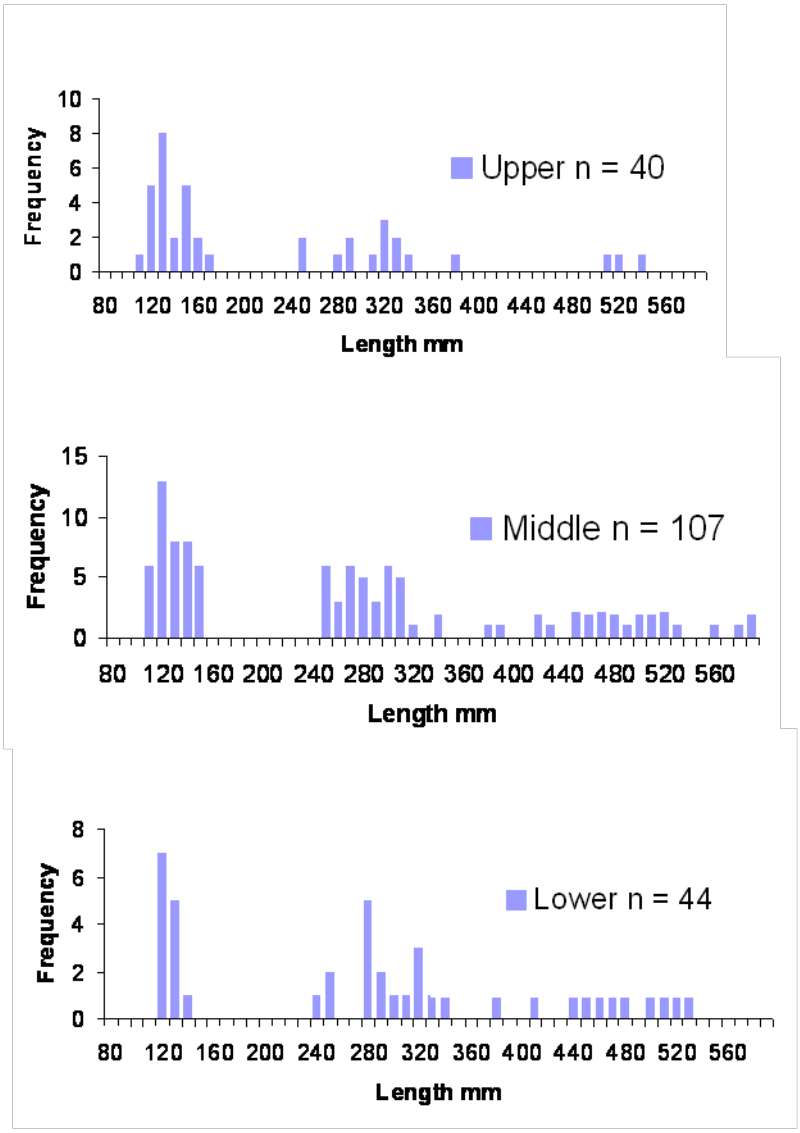


Figure 44. Lower Boise River wild brown trout length frequency by section, November 2004.

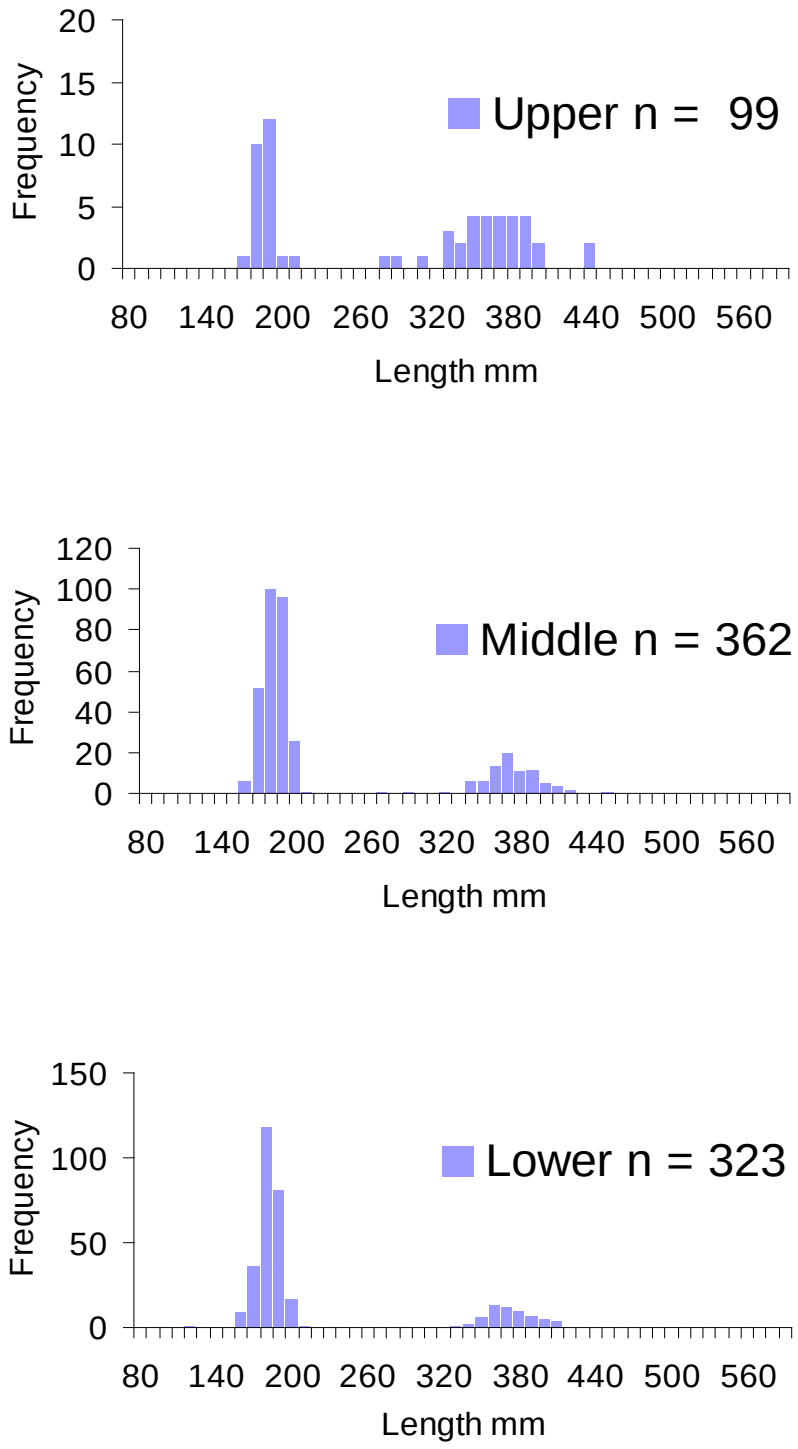


Figure 45. Lower Boise River mountain whitefish length frequency by section, November 2004.

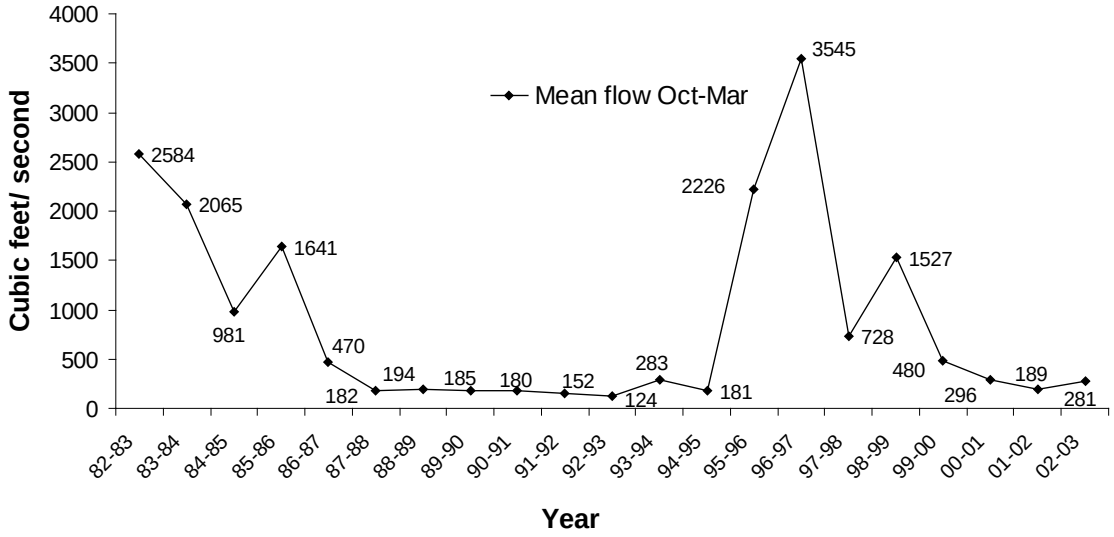


Figure 46. Lower Boise River mean winter stream flow at Glenwood Bridge, 1982-2003.

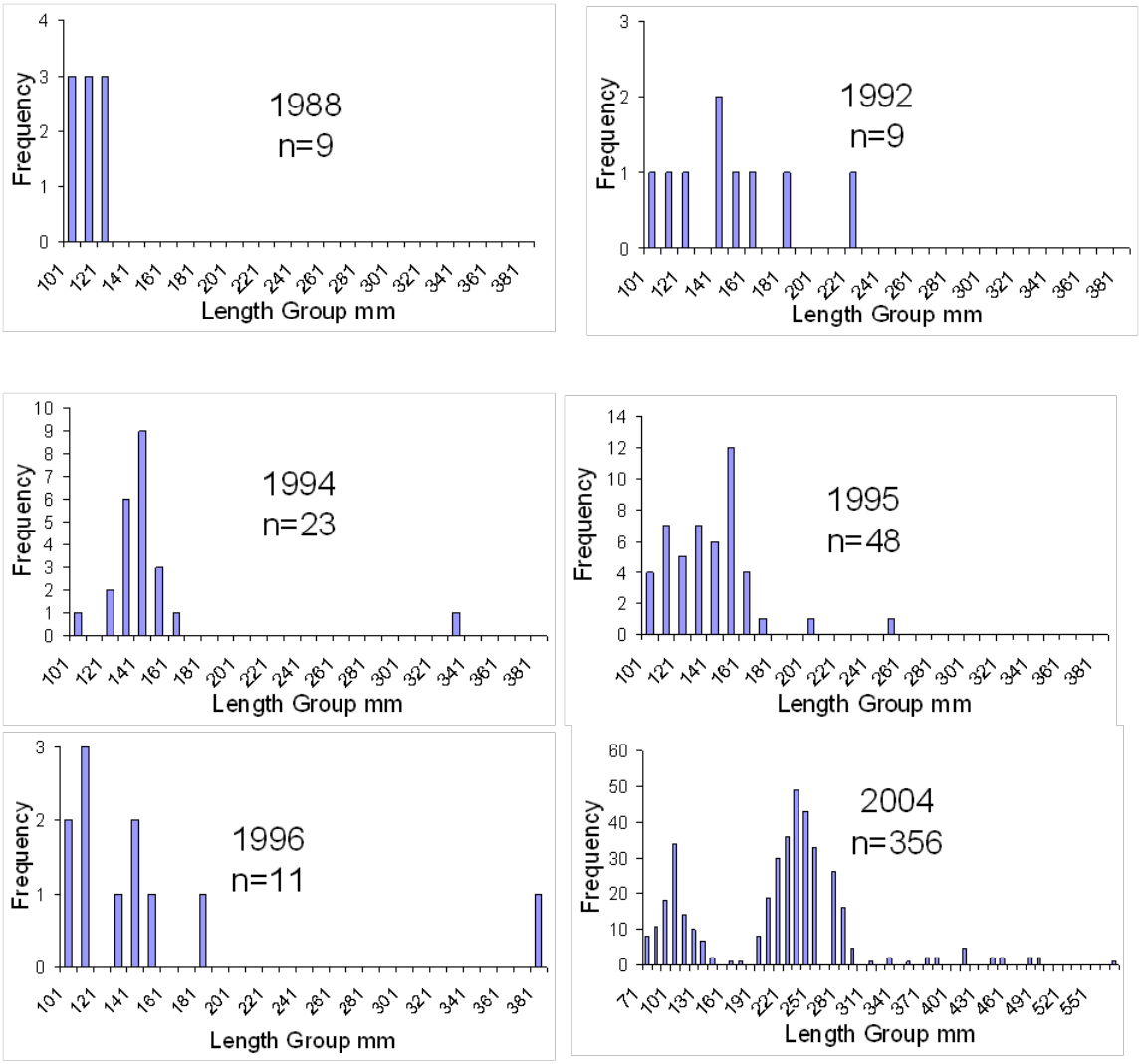


Figure 47. Boise River wild rainbow trout length frequencies for Municipal Park area, 1988-2004.

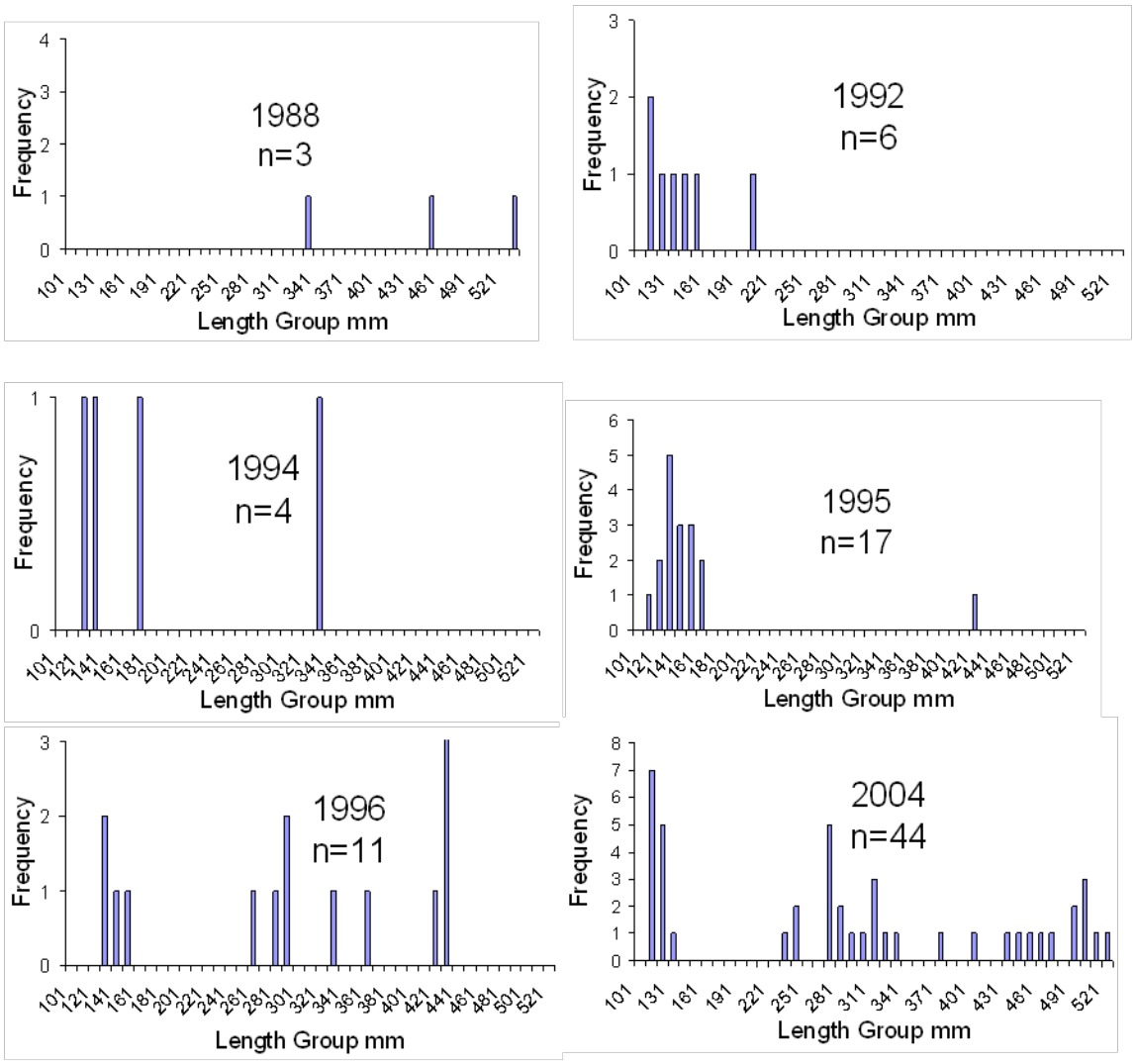


Figure 48. Lower Boise River wild brown trout length frequencies for Municipal Park area, 1988-2004.

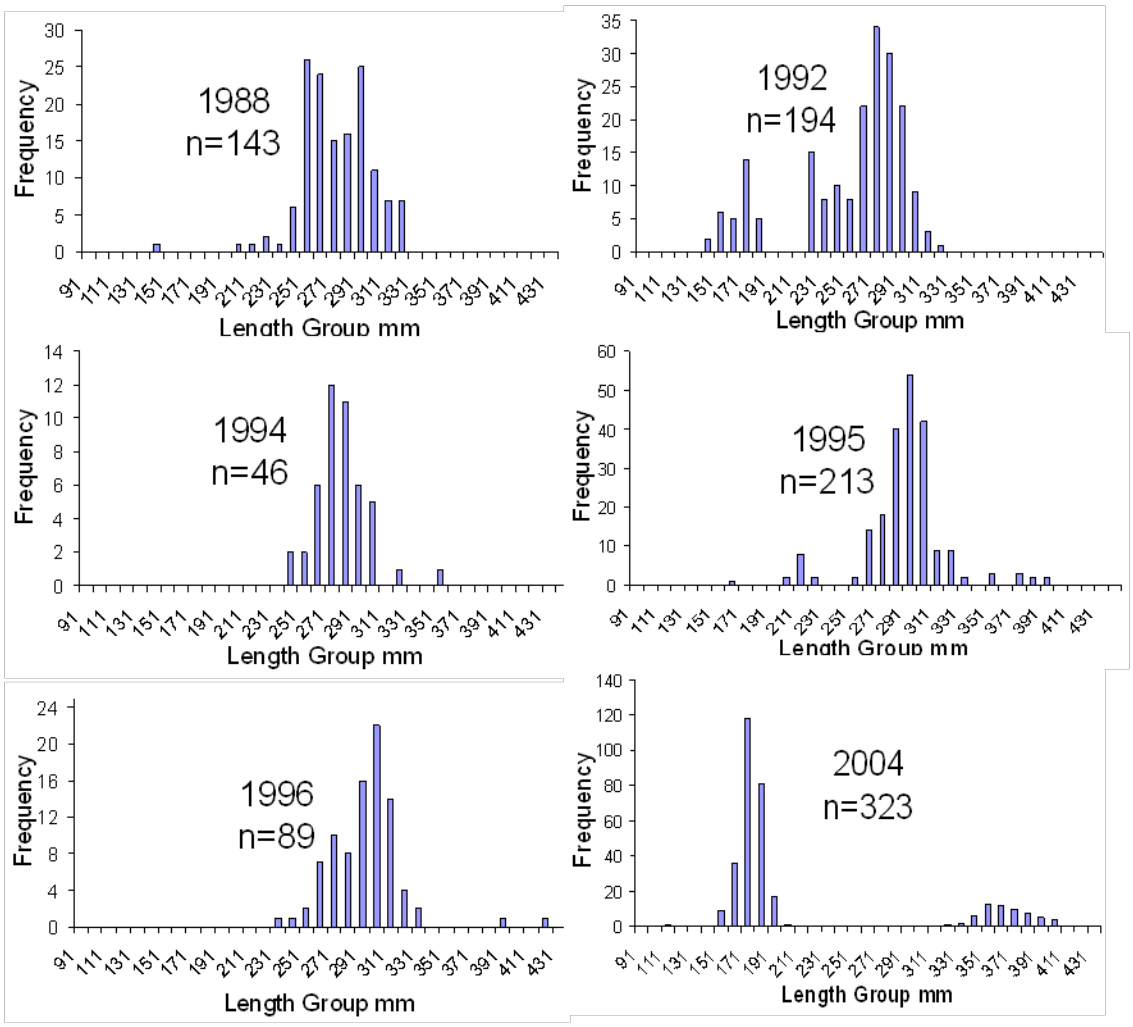
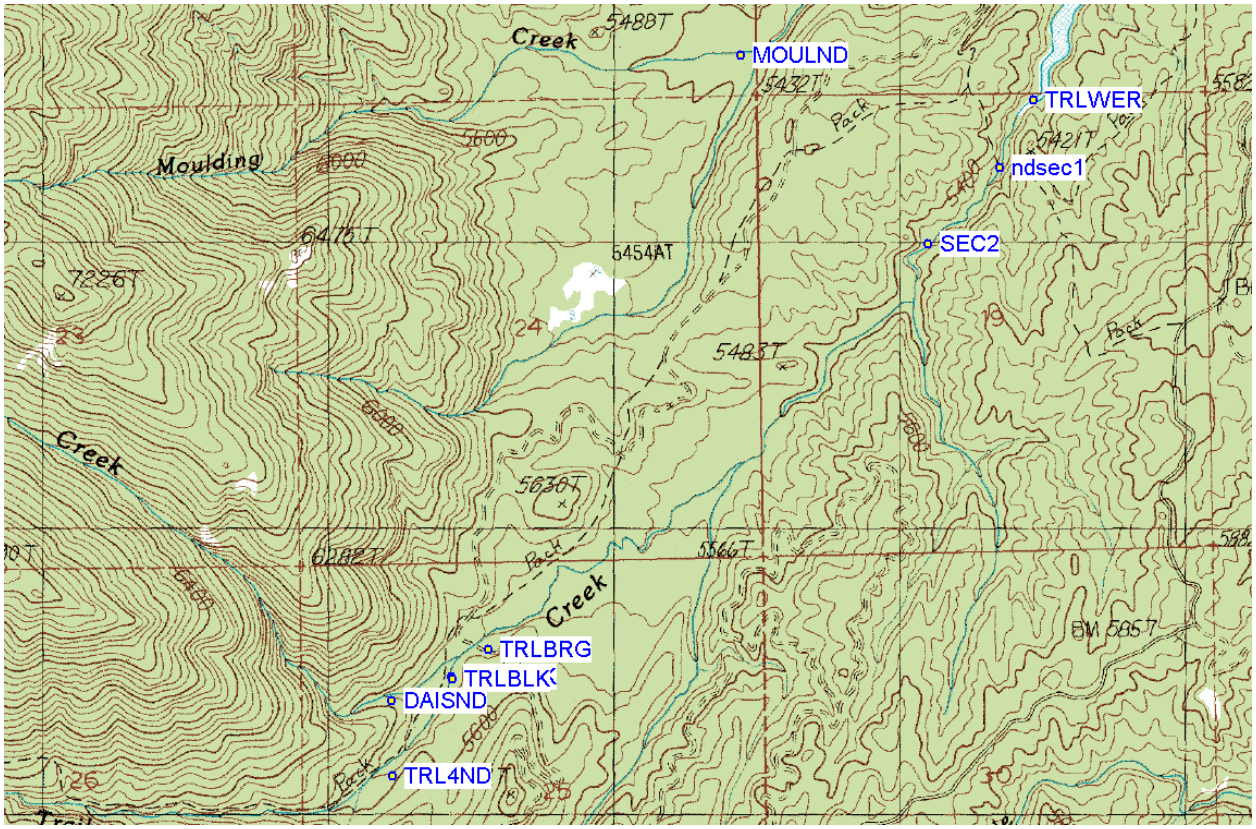


Figure 49. Lower Boise River mountain whitefish length frequencies for Municipal Park area, 1988-2004.

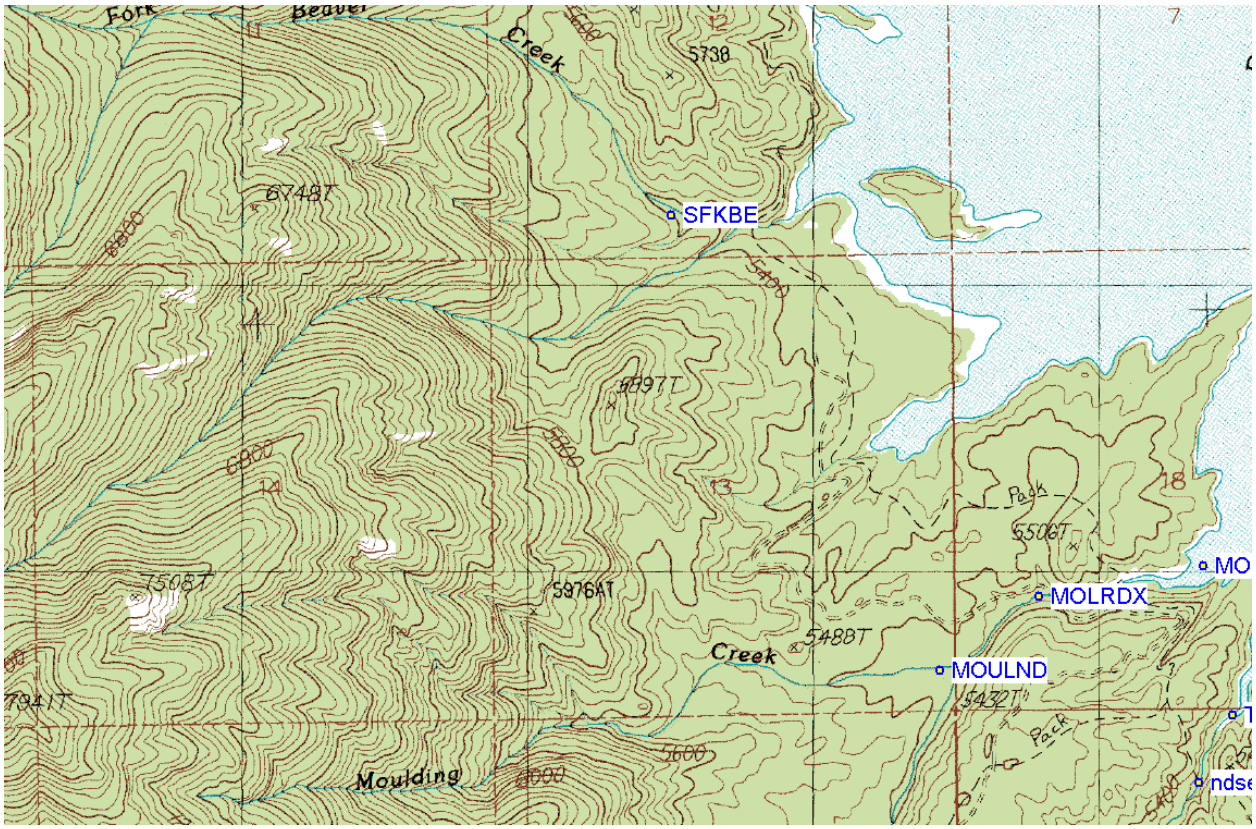
APPENDICIES

Appendix A. Deadwood Reservoir kokanee spawning survey site maps (Figures 1, 2, 3, 4) and GPS coordinates (Table 1).

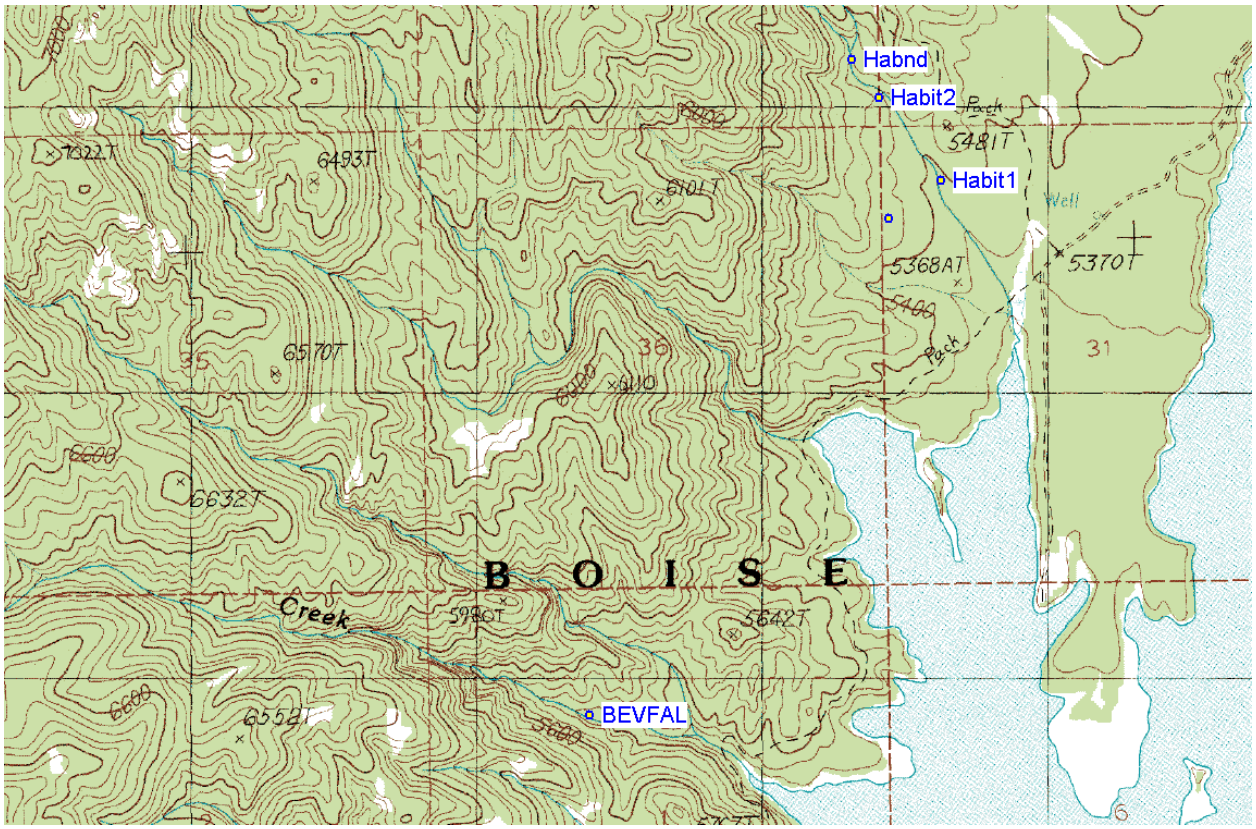
Appendix A-1. Overview of kokanee spawning sites surveyed in 2004 on Deadwood Reservoir. Detailed maps follow in Appendices A-2, A-3 and A-4.



Appendix A-2. Kokanee spawning survey transects from 2004 on Trail Creek.



Appendix A-3. Endpoints of survey locations for kokanee spawning surveys on Moulding and South Fork Beaver Creek for 2004.



Appendix A-4. Endpoints of survey locations for kokanee spawning surveys on Beaver and Habit Creek for 2004. Habit Creek sightability estimates were conducted at Habit1 and Habit2.

Appendix B. Kokanee spawner survey sections description, map codes, and GPS coordinates from 2004. Lengths were measured from 1:24k topographic map from mouth of stream or closest downstream waypoint.

					GPS coordinates for locations in decimal degrees	
Stream	Map code	Section/endpoint	description	length (m)	Northing	Easting
Trail	TRLWER	section 1 start	start at old Trail Creek Weir site	342	44.278931	115.665802
	NDSEC1	section 2 start	ends where pack trail crosses creek	418	44.274457	115.670534
	SEC2	section 3 start	from end section 2 to Forest Road 572 bridge	3,070	44.274457	115.670534
	TRLBRG	section 4 start	section 4 from FR 572 to no fish	644	44.261948	115.690130
	DAISND	daisy Creek	upstream end of survey	330	44.260365	115.694405
	TRLBLK3		Upstream end of kokanee distribution	167	44.261100	115.691776
	TRL4ND	section 4 end	upstream end of survey	646	44.257994	115.694389
Moulding	MOLRDX		Road crossing	321	44.282778	115.674246
	MOULND	endpoint	upstream end of survey	1,000	44.294966	115.690124
S. Fork Beaver	SFKBE	endpoint	upstream end of survey	540	44.294966	115.690124
Beaver	BEVFALS	endpoint	surveyed to falls	743	44.318602	115.690890
Habit	Habit1	lower sightability site	site has lots of overhead fish cover	863	44.335282	115.675087
	Habit2	upper sightability site	site has very little overhead fish cover	467	44.337915	115.677750
	HABND	endpoint	upstream end of survey	1,544	44.339126	115.678927

Appendix C. Escapement estimate methods for kokanee on Trail Creek, 2005.

Methods for calculating spawning escapement are paraphrased below (actual equations are in Hilborn et al. 1998)

Area was calculated as # days between counts multiplied by (# tagged fish observed on first count added to # tagged fish observed on second day) divided by 2. Residence time is the sum of the area calculations divided by number of tagged fish on first count day.

Trapezoidal area estimation for tagged fish

date	numerical date	tagged fish alive	Area
8/25/2004	04238	57	
8/26/2004	04239	34	45.5
8/30/2004	04243	32	132
9/2/2004	04246	31	94.5
9/9/2004	04253	3	119
9/23/2004	04267	0	21
Total			**412**
Estimated residence time of tagged fish assuming 57 tags (rt)=		**7.2**	

Trapezoidal area estimation for tagged fish

date	numerical date	tagged fish alive	Area
8/25/2004	04238	34	
8/26/2004	04239	34	34
8/30/2004	04243	32	132
9/2/2004	04246	31	94.5
9/9/2004	04253	3	119
9/23/2004	04267	0	21
Total			**400.5**
Residence time of tagged fish assuming only 34 tags (rt)=		**11.8**	

Escapement calculations. Area calculations are the same for estimating escapement (as for residence time) except that all kokanee observed are used (tagged+untagged). Because kokanee were observed on the final count day the last time period must be extrapolated to account for the nonzero final count. The extrapolation uses the number of fish observed on the final day multiplied by the estimated residence time divided by 2. The total area is then summed and divided by residence time to get an estimate of escapement. The escapement estimate is then adjusted by observer efficiency which was assumed to be .99.

Appendix C. Cont.

Trapezoidal area estimation for all kokanee (tagged and untagged) using 7.2 days residence time

date	numerical date	adult kokanee	area
8/11/2004	04224	0	
8/17/2004	04230	1,351	4,053
8/26/2004	04239	1,878	14,531
8/30/2004	04243	1,805	7,366
9/2/2004	04246	1,827	5,448
9/9/2004	04253	729	8,946
9/23/2004	04267	153	6,174
extrapolated uncounted			553
Total fish days (area)			47,070
total area / residence time			6,538
Escapement (using 7.2 days residence time and 0.99 observer efficiency=			6,604

Trapezoidal area estimation for all kokanee (tagged and untagged) using 11.8 days residence time

date	numerical date	adult kokanee	area
8/11/2004	04224	0	
8/17/2004	04230	1,351	4,053
8/26/2004	04239	1,878	14,531
8/30/2004	04243	1,805	7,366
9/2/2004	04246	1,827	5,448
9/9/2004	04253	729	8,946
9/23/2004	04267	153	6,174
extrapolated uncounted			901
Total fish days (area)			47,419
total area / residence time			4,019
Escapement (using11.8 days residence time and 0.99 observer efficiency=			4,059

Appendix D. Descriptions for North Fork Boise River snorkel sites located between Deer Park and Graham.

Section: NFBSIL (Silver Creek)

Site Description – The site is located just downstream from the mouth of Silver Creek and is 48 m long. The GPS coordinates of the site are UTM 11T 639049 4781864.

Section: NFBGRB (Graham)

Site Description – The site is located approximately 350 m downstream from the bridge crossing the river at Graham and is 47 m long. The GPS coordinates of the site are UTM 11T 638487 4868874.

Section: NFBHOR (Horsefly Creek)

Site Description – The site begins at the mouth of Horsefly Creek and ends 66 m upstream. The GPS coordinates of the site are UTM 11T 633652 4864568.

Section: NFBBLJ (Bluejay Creek)

Site Description – The site begins 90 m upstream from the mouth of Bluejay Creek and ends 47 m upstream. The GPS coordinates of the site are UTM 11T 634578 4864785.

Appendix E. Mark-recapture data for rainbow trout, brown trout, and mountain whitefish in the Boise River, November 2004.

All rainbow trout		Upper Section					
Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)	Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)
<10	19	16	1	43	0	1	0
10	26	19	3	44	0	1	0
11	34	21	2	45	1	1	0
12	31	4	0	46	0	2	0
13	15	3	1				
14	2	1	0				
15	3	1	0				
16	0	0	0				
17	0	0	0				
18	1	0	0				
19	0	0	0				
20	1	1	0				
21	4	2	0				
22	11	7	1				
23	14	8	2				
24	15	9	1				
25	15	13	0				
26	12	15	2				
27	9	15	4				
28	4	4	0				
29	7	7	1				
30	1	2	0				
31	1	1	1				
32	0	0	0				
33	0	0	0				
34	0	0	0				
35	1	0	0				
36	0	0	0				
37	1	0	0				
38	1	1	1				
39	1	1	1				
40	0	3	0				
41	1	0	0				
42	0	1	0				

Appendix E. Continued.

All rainbow trout		Middle Section					
Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)	Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)
<10	24	15	0	45	2	0	0
10	25	15	4	46	1	2	1
11	22	11	2	47	1	1	0
12	18	2	0	48	1	1	1
13	7	2	0	49	0	1	1
14	4	2	1	50	0	0	0
15	2	0	0	51	1	0	0
16	0	1	0	52	0	1	0
17	0	0	0				
18	0	0	0				
19	0	0	0				
20	1	1	0				
21	8	2	1				
22	19	4	0				
23	17	8	3				
24	20	15	4				
25	20	11	4				
26	17	14	6				
27	12	11	2				
28	4	6	1				
29	6	6	2				
30	6	2	1				
31	4	1	1				
32	2	1	0				
33	1	1	0				
34	0	0	0				
35	0	0	0				
36	1	1	0				
37	0	2	0				
38	1	2	0				
39	1	1	1				
40	1	0	0				
41	0	0	0				
42	0	0	0				
43	1	0	0				
44	0	1	1				

Appendix E. Continued.

All rainbow trout		Lower Section					
Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)	Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)
<10	12	18	1	45	2	2	2
10	15	16	0	46	0	1	1
11	11	5	0	47	2	0	0
12	3	9	0	48	1	2	2
13	3	7	1	49	1	1	0
14	2	0	0	50	0	0	0
15	0	0	0	51	0	0	0
16	0	1	0	52	0	0	0
17	0	1	0	53	0	0	0
18	0	0	0	54	0	0	0
19	3	2	0	55	0	0	0
20	11	9	3	56	0	0	0
21	24	11	4	57	0	0	0
22	22	20	3	58	1	0	0
23	26	33	5				
24	28	26	2				
25	33	34	8				
26	29	26	5				
27	36	34	12				
28	14	15	2				
29	16	7	2				
30	4	4	0				
31	1	2	0				
32	1	0	0				
33	2	1	0				
34	0	0	0				
35	0	0	0				
36	0	1	0				
37	1	2	1				
38	0	0	0				
39	2	2	1				
40	0	0	0				
41	2	3	3				
42	2	2	1				
43	0	0	0				
44	1	1	0				

Appendix E. Continued

Wild trout	rainbow	Upper Section					
Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)	Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)
<10	19	16	1	45	0	0	0
10	26	19	3	46	0	1	0
11	34	21	2				
12	31	4	0				
13	15	3	1				
14	2	1	0				
15	3	1	0				
16	0	0	0				
17	0	0	0				
18	1	0	0				
19	0	0	0				
20	1	1	0				
21	4	2	0				
22	11	6	1				
23	14	7	2				
24	13	7	1				
25	10	7	0				
26	9	14	2				
27	4	9	3				
28	1	2	0				
29	3	3	1				
30	0	1	0				
31	0	0	0				
32	0	0	0				
33	0	0	0				
34	0	0	0				
35	1	0	0				
36	0	0	0				
37	1	0	0				
38	1	1	1				
39	1	1	1				
40	0	3	0				
41	1	0	0				
42	0	1	0				
43	0	0	0				
44	0	1	0				

Appendix E. Continued.

Wild trout	rainbow	Middle Section					
Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)	Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)
<10	24	15	0	45	2	0	0
10	49	15	4	46	1	2	1
11	22	11	2	47	1	1	0
12	18	2	0	48	1	1	1
13	7	2	0	49	0	1	1
14	4	2	1	50	0	0	0
15	2	0	0	51	1	0	0
16	0	1	0	52	0	1	0
17	0	0	0				
18	0	0	0				
19	0	0	0				
20	1	1	0				
21	8	2	1				
22	18	4	0				
23	17	8	3				
24	20	15	4				
25	20	11	4				
26	14	12	5				
27	11	9	1				
28	3	6	1				
29	3	5	1				
30	4	1	0				
31	4	0	0				
32	2	1	0				
33	1	1	0				
34	0	0	0				
35	0	0	0				
36	1	1	0				
37	0	2	0				
38	0	2	0				
39	1	1	1				
40	1	0	0				
41	0	0	0				
42	0	0	0				
43	1	0	0				
44	0	1	1				

Appendix E. Continued.

Wild trout	rainbow	Lower Section					
Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)	Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)
<10	12	18	1	45	2	2	2
10	14	16	0	46	0	1	1
11	11	4	0	47	2	0	0
12	3	9	0	48	1	2	2
13	3	6	1	49	1	1	0
14	2	0	0	50	0	0	0
15	0	0	0	51	0	0	0
16	0	1	0	52	0	0	0
17	0	1	0	53	0	0	0
18	0	0	0	54	0	0	0
19	3	2	0	55	0	0	0
20	11	9	3	56	0	0	0
21	22	9	3	57	0	0	0
22	17	20	3	58	1	0	0
23	23	29	5				
24	21	22	2				
25	20	27	5				
26	14	14	4				
27	14	18	6				
28	4	8	1				
29	7	4	0				
30	0	1	0				
31	0	1	0				
32	0	0	0				
33	2	0	0				
34	0	0	0				
35	0	0	0				
36	0	1	0				
37	1	2	1				
38	0	0	0				
39	1	2	1				
40	0	0	0				
41	2	0	3				
42	2	2	1				
43	0	0	0				
44	1	1	0				

Appendix E. Continued.

brown trout		Upper Section					
Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)	Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)
<10	0	0	0	45	0	0	0
10	1	0	0	46	0	0	0
11	2	3	0	47	0	0	0
12	4	3	1	48	0	0	0
13	2	1	0	49	0	0	0
14	3	2	0	50	0	1	0
15	1	0	0	51	0	1	0
16	1	1	0	52	0	0	0
17	0	0	0	53	0	1	0
18	0	0	0	54	0	0	0
19	0	0	0	55	0	0	0
20	0	0	0				
21	0	0	0				
22	0	0	0				
23	0	0	0				
24	1	1	0				
25	0	0	0				
26	0	0	0				
27	0	0	0				
28	2	0	0				
29	0	1	0				
30	0	0	0				
31	2	1	0				
32	2	2	1				
33	0	1	0				
34	0	0	0				
35	0	0	0				
36	0	0	0				
37	1	0	0				
38	0	0	0				
39	0	0	0				
40	0	0	0				
41	0	0	0				
42	0	0	0				
43	0	0	0				
44	0	0	0				

Appendix E. Continued.

brown trout		Middle Section					
Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)	Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)
<10	0	0	0	45	5	0	0
10	3	2	1	46	1	4	2
11	10	1	0	47	1	1	0
12	7	7	3	48	2	0	0
13	7	1	0	49	1	1	0
14	4	1	0	50	1	0	0
15	1	1	0	51	3	0	0
16	0	0	0	52	2	0	0
17	0	0	0	53	0	1	1
18	0	0	0	54	0	0	0
19	0	0	0	55	1	0	0
20	0	0	0	56	0	0	0
21	0	0	0	57	1	0	0
22	0	0	0	58	0	1	0
23	0	0	0	59	1	0	0
24	4	1	0				
25	2	3	1				
26	1	4	1				
27	4	4	1				
28	1	3	1				
29	2	2	0				
30	5	0	0				
31	1	3	1				
32	0	0	0				
33	1	1	0				
34	0	0	0				
35	0	0	0				
36	0	0	0				
37	0	1	0				
38	1	0	0				
39	0	0	0				
40	0	0	0				
41	1	0	0				
42	1	0	0				
43	0	1	0				
44	0	1	1				

Appendix E. Continued.

brown trout		Lower Section					
Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)	Length group (cm)	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)
<10	0	0	0	45	0	0	0
10	0	0	0	46	1	1	0
11	1	2	0	47	1	0	0
12	5	4	2	48	0	0	0
13	0	1	0	49	0	2	0
14	0	0	0	50	0	3	0
15	0	0	0	51	0	1	0
16	0	0	0	52	1	0	0
17	0	0	0	53	0	0	0
18	0	0	0	54	0	0	0
19	0	0	0	55	0	0	0
20	0	0	0	56	0	0	0
21	0	0	0	57	0	0	0
22	0	0	0	58	0	0	0
23	0	1	0				
24	0	1	0				
25	0	2	0				
26	0	1	0				
27	2	3	0				
28	1	2	1				
29	1	0	0				
30	0	0	0				
31	2	1	0				
32	0	2	1				
33	0	1	0				
34	0	0	0				
35	0	0	0				
36	0	0	0				
37	1	0	0				
38	0	0	0				
39	0	0	0				
40	0	1	0				
41	0	0	0				
42	0	0	0				
43	0	0	0				
44	0	2	0				

Appendix E. Continued.

mountain whitefish Section	Mark Sample (M)	Recapture Sample (C)	Recaptures (R)
Upper	400	544	129
Middle	708	711	221
Lower	432	616	113

Appendix F. Physical descriptions of electrofishing sites in the lower Boise River, 2004.

Section name	Boundaries (UTM's) Upstream	Downstream	Length (km)	Mean Width (m)	Comments
Upper	569169 E 4824250 N	568563 E 4824912 N	0.97	39	Starts at first diversion below Barber Park and ends where Park Center Blvd meets the Boise River (Bown Crossing).
Middle	567798 E 4826101 N	566943 E 4826753 N	1.1	39	Starts at Warm Springs Diversion (near Warm Springs Mesa) and ends at Cottonwood Condominium riffle.
Lower	566671 E 4827277 N	565650 E 4827512 N	1.3	33	Starts at first riffle upstream of the East Boise River Footbridge and ends at first riffle upstream from the Parkcenter Bridge (near the MK Nature Center).

Appendix G. Locations of brown trout spawning activity in the Boise River, 2004.

Location	UTM	Comments
Near Municipal Park	565979 E 4827650 N	On the opposite side of the river from the park, three large redds approximately 1 m wide each near the bank.
Near Warm Springs Golf Course	567076 E 4826606 N	Three large redds near the bank on the golf course side of the river; two were occupied by adults.
Goodwin Diversion	567560 E 4826149 N	Two redds located immediately downstream from large concrete diversion structure near Warm Springs Boulevard.

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