Section 3

Fisheries Monitoring Report for Rush, Lee Vining, Parker, and Walker Creeks 2007-08

FINAL DRAFT

Executive Summary

This report presents the results of the eleventh year of fish population monitoring for Rush, Lee Vining, Parker and Walker creeks pursuant to State Water Resources Control Board (SWRCB) Decision #1631 and the ninth year following SWRCB Orders #98-05 and #98-07. Pilot studies were conducted in 1997 and 1998 to determine appropriate methods for generating statistically valid population estimates with 1999 being the first year estimates were generated for all study sections.

The 2007 electro-fishing sampling occurred between September 5th and 17th. Mark-recapture electro-fishing techniques were utilized to estimate trout populations in three sections of Rush Creek and two sections of Lee Vining Creek. Fish population estimates for the Lower Lee Vining Creek side-channel (the Upper side-channel was dry) Parker Creek and Walker Creek were made using electro-fishing depletion methods. The MGORD section of Rush Creek was sampled for the purpose of generating RSD-values and condition factors; no population estimates were generated for this section. An additional nine radio tags were implanted in brown trout within the MGORD section to continue tracking movements in and out of the MGORD.

Density Estimates of Age-1 and older Brown Trout

Estimated densities (number per hectare) of age-1 and older brown trout in Rush Creek for 2007 increased in all three annually-sampled sections (Upper, Lower and County Road). The greatest increase occurred in the County Road section where the density of age-1 and older brown trout more than doubled between 2006 and 2007, from 912 fish/ha to 1,895 fish/ha.

Estimated densities (number per hectare) of age-1 and older brown trout in the Lee Vining Creek Lower side channel section increased by 14.5% between 2006 and 2007. In the main channel, both the Upper and Lower sections experienced large decreases in estimated densities between the 2005 and 2007 sampling seasons (these sections were not sampled in 2006 due to high flows). The Upper side-channel section was dry and not sampled in 2007.

Estimated densities (number per hectare) of age-1 and older brown trout in Parker Creek decreased by 18.2% between 2006 and 2007. In Walker Creek the 2007 density estimate of age-1 and older brown trout was 38% greater than the 2006 estimate. Since 2002 Walker Creek has annually had the highest density estimates of age-1 and older brown trout for all sample sections

Density Estimates of Age-0 Brown Trout

In 2007, age-0 brown trout density estimates (number per hectare) in the Rush Creek County Road and Lower sections experienced large increases compared to 2006 estimates. The 2007 density estimate for the Rush Creek Upper section was nearly the same as the 2006 estimate with less than a 0.5% increase.

In Walker Creek the increase between the 2006 and 2007 density estimates was nearly five-fold to the highest density (22,571 fish/ha) ever estimated for any of the sample sections. Parker Creek experienced a 30% increase in density estimates between 2006 and 2007.

Age-0 brown trout density estimates (number per hectare) in the Lee Vining Creek main channel sections had not been made since 2004 because of insufficient numbers of fish sampled in 2005 and too high of flows to permit sampling in 2006. In 2007, the Lower main channel section density estimate of 2,330 age-0 brown trout/ha was the second highest value ever recorded for this section. In 2007, the Upper main channel section density estimate was the highest value ever recorded for this section.

Density Estimates of Age-1 and older Rainbow Trout

In all Rush Creek sections and the Lee Vining Creek Lower main channel section, insufficient numbers of age-1 and older rainbow trout were captured to generate population estimates, thus no densities were calculated for 2007.

In contrast, the Lee Vining Creek Upper main channel and Lower side channel section both experienced large increases in estimated densities of age-1 and older rainbow trout. In the Upper main channel the increase between the 2005 and 2007 density estimates was more than ten-fold.

Density Estimates of Age-0 Rainbow Trout

In Rush Creek, the Lower section was the only sample section where sufficient numbers of age-0 rainbow trout were captured to generate estimates. This section had an estimated 131 age-0 rainbow per hectare in 2007.

In Lee Vining Creek, the Lower main channel section supported an estimated 1,200 age-0 rainbow trout per hectare, the Lower side channel supported an estimated 20.5 age-0 rainbow trout per hectare and the Upper main-channel section supported an estimated 1,429 age-0 rainbow trout per hectare.

Standing Crop Estimates of Brown Trout

In Rush Creek, brown trout standing crop estimates decreased from 2006 to 2007 in the Lower and Upper study sections and increased in the County Road section. The County Road section experienced a 13.3% increase in standing crop estimates from 2006 to 2007, due mainly to the increased population estimate of brown trout in the 125-199 mm size class. The Lower Rush Creek section experienced a nearly 21% drop in standing crop from 2006 to 2007, due mainly to a 42% decrease in the population estimate of brown trout in the >200 mm size class.

Walker Creek experienced a second straight year of increased brown trout standing crop estimates with an increase of 16% from 2006 to 2007. Parker Creek experienced a third straight year of increased brown trout standing crop with an increase of 4.3% from 2006 to 2007.

The Lee Vining Creek Lower section experienced a 65.2% drop in total (brown and rainbow trout combined) standing crop estimates from 2005 to 2007. The Upper section experienced a 10.7% drop in total standing crop from 2005 to 2006. The Lee Vining Creek Lower side channel's standing crop estimate increased by 9.3% from 2006 to 2007 (Table 10). For the past two years, rainbow trout have comprised more than 50% of the Lower side channel's estimated standing crop.

Relative Weight and Condition Factor of Brown Trout >150 mm in Length

During 2007, the condition factors of brown trout captured in all Rush Creek study sections were the lowest ever recorded for the nine seasons of annual sampling. In Parker Creek, the condition factor for brown trout increased from 0.96 in 2006 to 1.06 in 2007, the first increase after three consecutive years of decreasing values. In Walker Creek, the condition factor for brown trout increased slightly from 0.99 in 2006 to 1.00 in 2007.

Condition factors for brown trout (150 to 250 mm in total length) in the three Lee Vining sections sampled in 2007 were greater than 1.00. Both Lee Vining main-channel sections (not sampled in 2006 due to high flows) had condition factors in 2007 that were less than the 2005 values, yet were comparable to values in the years 2002-2004.

Relative Stock Densities (RSD's)

RSD-225 values for brown trout in all Rush Creek sample sections decreased between 2006 and 2007, especially in the County Road and Lower sections where decreases were more than 50%. RSD-300 values remained low in Rush Creek, with no change between 2006 and 2007 in the Upper section and a decrease from 3 to 1 between 2006 and 2007 in the Lower section. The Rush Creek County Road section has had an RSD-300 value of 0 since 2002.

The RSD-225 and RSD-300 values in the MGORD section of Rush Creek dropped between 2006 and 2007 however remain much higher than any of the other sample sections. The RSD-375 value of 4 in 2007 was the same as in 2006.

In both Lee Vining Creek sections, the RSD-225 values in 2007 were less than the values computed in 2005, the last time these sections were fully sampled. In 2007, the Lee Vining Creek Lower section had a RSD-300 value of 0 for the first time in seven sampled years. Conversely, the Upper section had a RSD-300 of 7, the highest RSD-300 value recorded in Lee Vining Creek over seven sampled years.

Termination Criteria

In Rush Creek, none of the annually sampled sections met the target of meeting four out of five termination criteria. The County Road and Upper sections met two of the five the termination criteria, whereas the Lower section failed to meet any of the termination criteria.

Because the Lee Vining Creek main channel sections were not sampled in 2006, the most recent three-year running average was comprised of data collected in 2007, 2005 and 2004. In Lee Vining Creek, neither of the sections met the target of meeting three out of four termination criteria. The Lower section met two of the five termination criteria (biomass and condition factor) and the Upper section met two of the five termination criteria (condition factor and RSD-225).

The MGORD section of Rush Creek met all three RSD termination criteria for the three most recent years that data were available. The RSD-375 value is right at the cut-off point of failing to meet termination criteria due to two low (less than 5) values recorded in 2007 and 2006.

Introduction

This report presents the results of the eleventh year of fish population monitoring for Rush, Lee Vining, Parker and Walker creeks pursuant to State Water Resources Control Board (SWRCB) Decision #1631 and the ninth year following SWRCB Orders #98-05 and #98-07. As required, fish population monitoring will continue until the streams have met termination criteria included in the Settlement Agreement. These termination criteria describe the presumed pre-project conditions for fish population structure:

1. Rush Creek fairly consistently produced brown trout weigh ¾ to two pounds. Trout averaging 13 to 14 inches were also regularly observed.

2. Lee Vining Creek sustained catchable brown trout averaging eight to 10 inches in length. Some trout reached 13 to 15 inches.

In addition to these criteria, Order 98-07 states the monitoring team will develop and implement a means for counting or evaluating the number, weights, lengths and ages of fish present in various reaches of Rush Creek, Lee Vining Creek, Parker Creek and Walker Creek. No specific termination criteria were set forth for Parker and Walker creeks, tributaries to Rush Creek.

The Settlement Agreement states that the monitoring team will consider young-of-year (age-0) production, survival rates between age classes, growth rates, total fish per mile and any other quantified forms as possible termination criteria, although the Settlement Agreement does not compel the choice of any one form.

This report provides fish population data mandated by the Orders and the Settlement Agreement. Fish length data are reported in millimeters (mm) in this report. For those not used to working in the metric system, an easy numerical reference point is 200 mm which is approximately eight inches. An eight-inch trout is often referred to as the minimum size of a "catchable" trout.

Study Area

For population estimates three study sections in Rush Creek (County Road, Lower and Upper), three Lee Vining Creek sections (Lower main, Upper main and Lower side-channel aka B-1) and the Parker and Walker Creek sections were sampled between September 5th and 17th of 2007 (Figure 1). The Lee Vining Creek Upper side-channel was dry and not sampled in 2007. The MGORD section of Rush Creek was sampled for several purposes: collecting length and weight data for calculating RSD values and conditions factors; as well as obtaining brown trout to implant with nine remaining large radio tags.

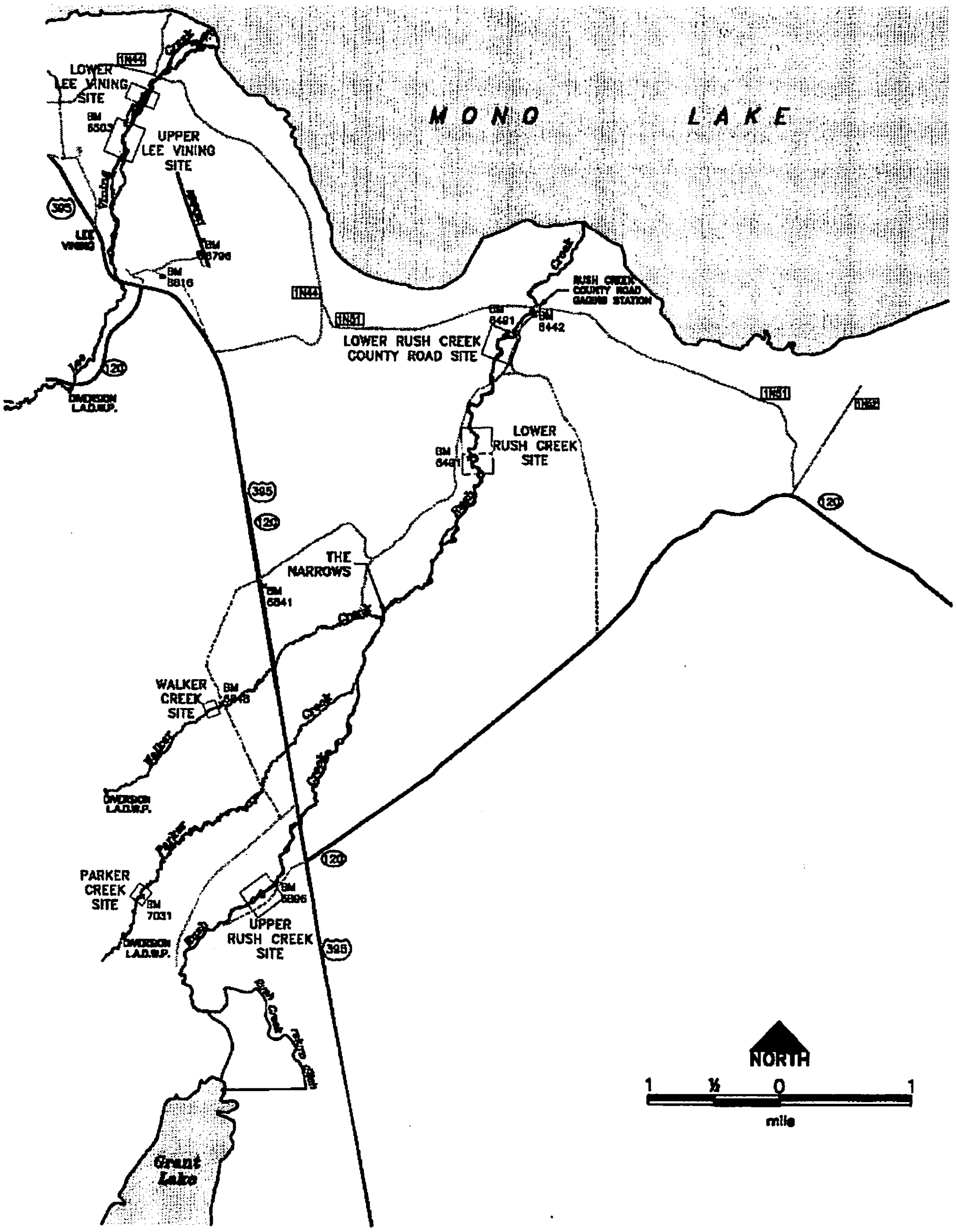


Figure 1. Map of Mono Basin study area with fish sampling sites displayed (modified from McBain and Trush 2000).

After two successive seasons of above-average snow-pack and run-off (2005 and 2006) the 2007 run-off in the Mono Basin was extremely low. The 2007 Runoff Year Forecast made in April-07 was 52% and was the first officially designated "Dry" Runoff Year (April 1 - March 31 under 68.5%) since the 1994 SWRCB Decision 1631. No peak flow releases are required in a dry run-off year, which is evident in the Rush and Lee Vining hydrographs (Figures 2 and 3).

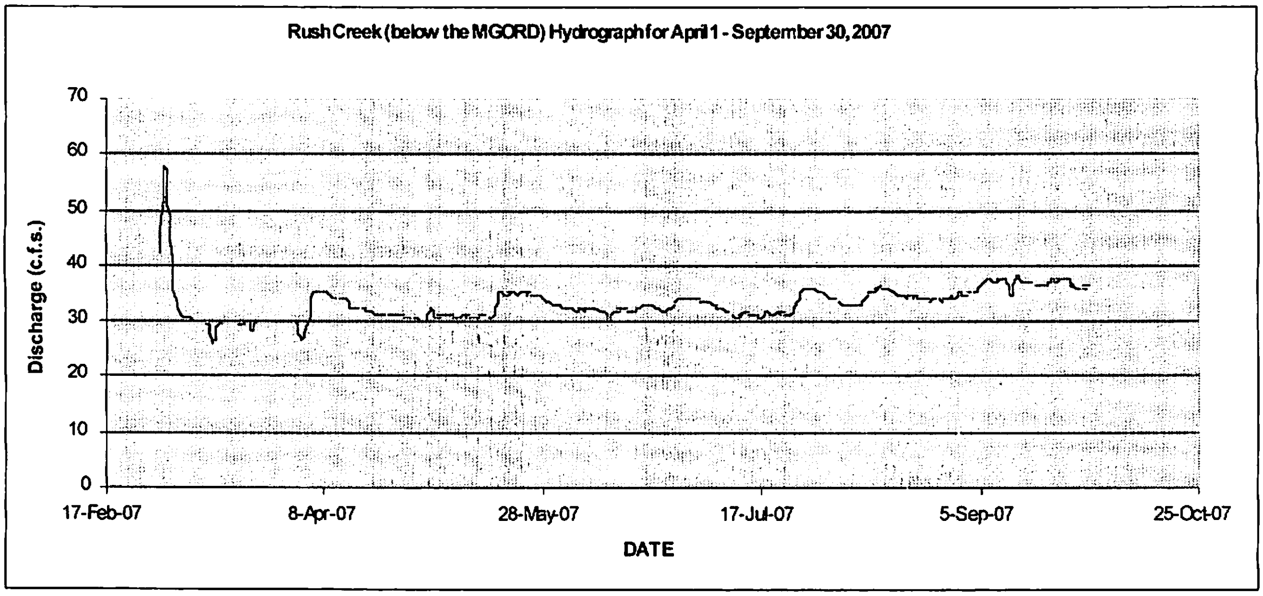


Figure 2. Daily stream flows (cubic feet per second, c.f.s.) in Rush Creek below the MGORD between March and September 2007. Data were provided by LADWP.

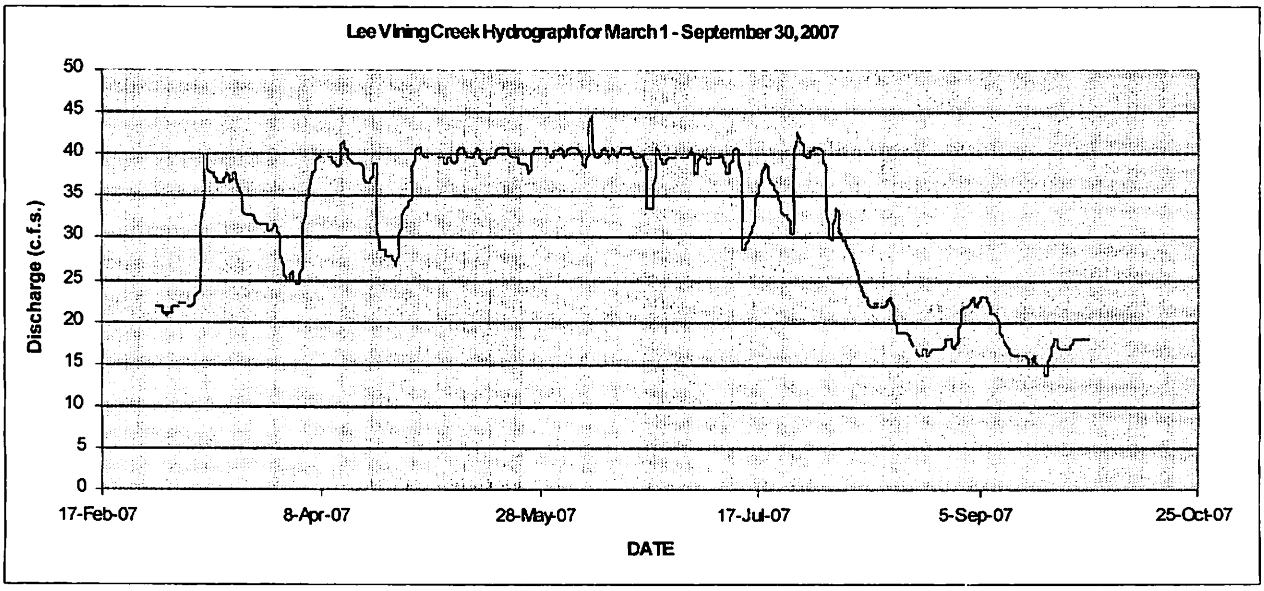


Figure 3. Daily stream flows (cubic feet per second, c.f.s.) in Lee Vining below the diversion between March and September 2007. Data were provided by LADWP.

Methods

Field sampling for generating fish population estimates occurred during the late summer between September 5th and 17th, 2007. Mark-recapture estimates were made in the County Road, Lower and Upper sections of Rush Creek and in the Lower and Upper main channel sections of Lee Vining Creek.

For all mark-recapture sampling efforts in Rush Creek, fish were captured using a Smith-Root® 2.5 GPP electro-fishing system that consisted of a Honda® generator powering a variable voltage pulsator (VVP) that had a rated maximum output of 2,500 watts. This unit was contained in a six-foot long fiberglass barge that was walked down the Rush Creek channel. A sampling run consisted of a single downstream pass starting at the upper block fence and terminating at the lower block fence. During mark-recapture electro-fishing an insulated cooler with several battery-powered aerators was also carried in the barge to transport captured fish. A pair of two-person teams consisting of an anode operator and a dip netter fished each half of the channel as the barge moved in a downstream direction. The fifth crew member skillfully maneuvered the barge downstream, monitored the condition of the captured fish in the live-well and acted as the crew's safety officer. All netted fish were placed in the insulated cooler shortly after capture. In all sections of Rush Creek, frequent stops were made to work-up fish as the cooler became full.

A drift boat was utilized to capture fish in the MGORD and required a five-person crew to operate. The electro-fishing barge was tied-off to the starboard side of the drift boat and two persons walked the drift boat downstream with the boat perpendicular to the channel with the port side facing downstream. An anode was thrown back and forth across the width of the MGORD by a crewmember in the drift boat. Another crewmember netted stunned fish from the drift boat and placed them in the insulated cooler. A third person sat in the stern of the drift boat, monitored the electro-fishing equipment and was responsible for the safety of other crew members. Usually no more than several hundred meters of the MGORD could be sampled before the cooler was full of fish. At these sub-stops, all captured fish were transferred to net-pens. A separate team of three people was required to work-up captured fish and record data.

Mark-recapture sampling on the Lee Vining Creek main-channel sections was accomplished with two Smith-Root® backpack electro-fishers (models12-B and SR-20). A sampling run consisted of two passes through the study section, first an upstream pass from the lower block fence to the upper block fence, immediately followed by a downstream pass back to the lower block fence. This technique also required five persons: two electro-fisher operators, two dip netters and a bucket carrier.

Depletion estimates were made in one sample section within each of Parker Creek and Walker Creek and in the Lee Vining Creek Lower side-channel (aka B-1 channel). For all depletion estimates the Smith-Root® backpack electro-fishers were used to capture fish. Two backpack electro-fishers were used when sampling the Lee Vining Creek side-channel, whereas a single backpack electro-fisher was used when sampling the

Parker Creek and Walker Creek sections. At least one dip-netter per electro-fisher netted fish stunned by that electro-fisher. An extra crew member served as a backup dip-netter and carried a five-gallon live bucket equipped with an aerator in which all captured fish were placed immediately after capture.

To meet the assumption of closed population for sampling purposes, all sample sections were blocked at both ends (upper and lower boundaries) prior to sampling. In past years (1999-2006) no block fence was used at the downstream boundary of the Rush Creek – County Road section. However due to a gradual deepening of the channel upstream of the lower boundary we decided to install a lower block fence in 2007. For all sections sampled for mark-recapture estimates 12 mm mesh hardware cloth fences were installed at the upper and lower boundaries of the sections. These hardware cloth fences were installed by driving metal t-posts at approximately two-meter intervals through the bottom portion of the hardware cloth approximately 15 cm from its bottom edge. Rocks were hand-placed along the bottom edge of the hardware cloth to prevent fish from passing underneath the block fence. Rope was then strung across the top of each t-post and anchored to either t-posts or trees on each stream bank. The hardware cloth was held vertically by wiring the top of the cloth to this rope with baling wire. These fences were installed prior to the marking run and maintained in place until after the recapture effort was completed. Fences were cleaned and checked twice daily to ensure they remained in place and for enumerating any dead fish caught on the fences between the mark and recapture sampling period (duration of seven days).

For the three sections (Lee Vining Creek Lower side-channel, Parker Creek and Walker Creek) where depletion estimates were made, the upper and lower boundaries were temporarily blocked with 12 mm mesh seine nets. These nets were in place only for the duration of the multiple passes required to generate estimates, usually no more than several hours.

All captured fish were anesthetized, measured to the nearest mm (total length) and most were weighed to the nearest gram on a digital scale. Data were entered onto data sheets (hard copies) and into a hand-held personal computer (Compaq iPAC®) in the field.

All fish captured in study sections employing the mark-recapture estimator methodology were fin-clipped for identification during the recapture electro-fishing run. The anal fin was clipped to mark fish in the Upper Rush Creek, County Road Rush Creek and Upper Lee Vining Creek sections. The lower caudal fin was clipped to mark fish in the Lower Rush Creek and Lower Lee Vining Creek sections. When clipping a fin, scissors were used to make a straight vertical cut from the top, or bottom, of the fin approximately 1-3 mm deep at a location about 1-3 mm from the posterior edge of the fin.

For calculating biomass and density estimates, channel lengths and widths were re-measured. Wetted widths were measured with a tape along the entire length of each study reach at approximately 10 meter intervals. The annual re-measurement also provided insight into potential changes in channel geometry within the study reaches.

Population and biomass estimates were made for all mark-recapture estimates using Montana Fish, Wildlife and Parks' Fisheries Plus analysis package (version 1.10). All estimates were generated using this program and employed the modified Peterson estimator (Chapman 1951, as cited in Ricker 1975).

Length-Weight Regression

Length-weight regressions (Cone 1989) were calculated for brown trout in each section of Rush Creek by year to assess differences in length-weight relationships between sections and years. Log_{10} transformations were made on both length and weight prior to running regressions. Methods for calculating relative condition factors were consistent with those initially developed by LeCren (1951) and expanded by Swingle (1965) and Swingle and Shell (1971).

Due to the difficulty of accurately sexing most brown trout captured during our annual sampling, no attempt was made to determine separate condition factors for male and female fish. However our sampling occurs at the same time every year (early to mid-September), thus any changes in condition factor would not be due to seasonal differences.

Fin Clips and Growth Estimates

During the 2007 sampling period age-0 brown trout were not given permanent clips to estimate future growth due to several reasons. First of all, after four previous seasons of clipping fish and looking for previously clipped fish, we determined that the adipose clip was the only viable clip to use because pelvic fin clips often regenerated and were difficult to identify. Secondly, age-0 brown trout were given adipose clips in 2006 and we did not want to use the same clip two years in a row. Lastly, other methods of marking or tagging age-0 trout was discussed (such as PIT tags), but none was deployed during the final field season of the existing fisheries monitoring contract.

During the 2007 field sampling, all captured fish were carefully examined to see if they had been clipped in the previous four years, as follows:

Year 2003 = Adipose fin clip – identifying them as age-0 fish in 2003 and age-4 fish in 2007.

Year 2004 = Left pelvic clip – identifying them as age-0 fish in 2004 and age-3 fish in 2007.

Year 2005 = Right pelvic clip – identifying them as age-0 fish in 2005 and age-2 fish in 2007.

Year 2006 = Adipose clip – identifying them as age-0 fish in 2006 and age-1 fish in 2007.

All recaptured brown trout that were clipped as age-0 fish were noted on the data sheets and their lengths and weights were averaged by stream and sample section to derive empirical growth rates.

Relative Stock Density (RSD) Calculations

Relative stock density (RSD) was introduced as a new parameter in 2006 as a quantitative termination criterion. RSD's are numerical descriptors of length-frequency data and given representative samples of a population, RSD's are easily calculated and can provide insight or predictive ability about population dynamics. Please refer to the 2006 Mono Basin Fisheries Report for a more detailed literature review regarding RSD concepts and relevance as a quantifiable form of termination criteria (Hunter et al. 2007).

RSD values are simply reported as the proportions (percentage x 100) of the total number of brown trout ≥150 mm (6") in length that in turn are ≥225 mm or 9" (RSD-225), ≥300 mm or 12" (RSD-300) and ≥375 mm or 15" (RSD-375). These three RSD values are calculated by the following equations:

RSD-225 = # of brown trout ≥225 mm ÷ # of brown trout ≥150 mm x 100
RSD-300 = # of brown trout ≥300 mm ÷ # of brown trout ≥150 mm x 100
RSD-375 = # of brown trout ≥375 mm ÷ # of brown trout ≥150 mm x 100

Termination Criteria Calculations and Analyses

In Decision-1631, the agreed upon termination criteria for Lee Vining Creek is to sustain a fishery for naturally-produced brown trout that average eight to 10 inches in length (200 to 250 mm) with some fish reaching 13 to 15 inches (330 to 375 mm). The agreed upon termination criteria for Rush Creek states that Rush Creek fairly consistently produced brown trout weighing from 0.75 to two pounds. Trout averaging 13 to 14 inches (330 to 350 mm) were also allegedly observed on a regular basis prior to the 1941 diversion of this stream.

The termination criteria provided in this report are based on the recommended changes to the fisheries criteria as submitted by Chris Hunter to the SWRCB in 2007. The rationale for replacing the current termination criteria is to evaluate brown trout populations with metrics derived from quantifiable methodologies that are generally accepted as standards by fisheries professionals. As stated in our nine previous annual reports no data were available that provided a scientifically quantitative picture of trout populations that these streams supported on a self-sustaining basis prior to 1941 (Hunter et al. 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007).

Mr. Hunter, with the assistance of his sub-consultants, proposed employing four repeatable and quantifiable metrics as termination criteria to evaluate the brown trout populations in the Upper, Lower, and County sections of Rush Creek – biomass, density, condition and relative stock density (RSD) of catchable trout (≥225 mm or ≥9") in the populations. The same four criteria will be applied to all trout (brown and rainbow combined) in both study sections of Lee Vining Creek. A fifth metric for Rush Creek sections only was RSD-300 of brown trout (proportion of brown trout ≥300 mm or ≥12").

Finally, Mr. Hunter proposed that three termination criteria metrics of RSD are applied to the Rush Creek MGORD only – the RSD of brown trout ≥225 mm (RSD-225), ≥300 mm (RSD-300) and ≥375 mm (RSD-375).

Rush Creek Termination Criteria for Upper, Lower and County Road Sections

Termination Criterion #1 – Biomass: Total brown trout standing crop estimates based on kilograms per hectare of biomass. Total standing crop estimates will also be reported to reflect contribution by two age-classes (age-0 and ≥age-1). The termination criterion for biomass estimate is **≥ 175 kg/ha**. Trends in brown trout standing crop data are assessed with three-year moving averages by computing the average of the three most-current years of data and that average should meet the termination criteria of at least **175 kg/ha**.

Termination Criterion #2 – Density: Total number of brown trout per unit length (km) of stream channel. The termination criterion for total number of trout per kilometer is **≥3,000 trout/km**. Trends in total number of trout per kilometer are assessed with three-year moving averages by computing the average of the three most-current years of data and that average should meet the termination criteria of at least **3,000 trout/km**.

Termination Criterion #3 – Condition: Condition factor of brown trout ≥age-1+ is computed and should not drop below **1.00**. Values below 1.0 should be of concern to managers. When standing crop values drop, fishery would be considered in "good condition" if condition factors remain stable or increase. It is possible that higher densities (# of fish/ha) will result in lower condition factors for individual groups of trout due to density dependent competition. Trends in condition factor are assessed with three-year moving averages by computing the average of three most-current years of data. That average should meet the termination criteria of condition factor **≥1.00**.

Termination Criterion #4 – RSD-225: RSD-225 values of brown trout are computed for all sections of Rush Creek and should not drop below **35**. Trends in RSD-225 are assessed with three-year moving averages by computing the average of the three most-current years of data. That average should meet the termination criteria RSD-225 value of at least **35**.

Termination Criterion #5 – RSD-300: RSD-300 values of brown trout are computed for all sections of Rush Creek and should not drop below **5**. Trends in RSD-300 are assessed with three-year moving averages by computing the average of the three most-current years of data. That average should meet the termination criteria RSD-300 value of at least **5**.

Lee Vining Creek Termination Criteria for Upper and Lower Sections

Termination Criterion #1 – Biomass: Total trout (brown and wild rainbow combined) standing crop estimates based on kilograms per hectare of biomass. Total standing crop estimates will also be reported to reflect contribution by two age-classes (age-0 and ≥age-1). The termination criterion for biomass estimate is **≥ 150 kg/ha**. Trends in total trout standing crop data are assessed with three-year moving averages by computing the average of the three most-current years of data and that average should meet the termination criteria of at least **150 kg/ha**.

Termination Criterion #2 – Density: Total number of trout per unit length (km) of stream channel. The termination criterion for total number of trout per kilometer is **≥1,400 trout/km**. Trends in total number of trout per kilometer are assessed with three-year moving averages by computing the average of the three most-current years of data and that average should meet the termination criteria of at least **1,400 trout/km**.

Termination Criterion #3 – Condition: Condition factor of trout ≥age-1+ is computed and should not drop below **1.00**. Trends in condition factor are assessed with three-year moving averages by computing the average of three most-current years of data. That average should meet the termination criteria of condition factor **≥1.00**.

Termination Criterion #4 – RSD-225: RSD-225 values of all trout (brown and wild rainbow) are computed for both Lee Vining Creek study sections and should not drop below **30**. Trends in RSD-225 are assessed with three-year moving averages by computing the average of the three most-current years of data. That average should meet the termination criteria RSD-225 value of at least **30**.

Rush Creek Termination Criteria for the MGORD Sections

For the Rush Creek MGORD study section three termination criteria metrics of RSD are utilized – the RSD of brown trout ≥225 mm (≥9"), ≥300 mm (≥12") and ≥375 mm (≥15").

RSD-225 value in the MGORD is computed and should not drop below **60**.

RSD-300 value in the MGORD is computed and should not drop below **30**.

RSD-375 value in the MGORD is computed and should not drop below **5**.

Trends in RSD-225, RSD-300 and RSD-375 were assessed with three-year moving averages by computing the average of the three most-current years of data. The averages should meet the termination criteria of **60**, **30** and **5**, respectively.

The rationale for assessing these "large trout" metrics specifically for the MGORD is that this human-constructed section below Grant Reservoir has unique spring creek-like characteristics that support the growth of large brown similar to the pre-1941 productivity of the human-influenced springs below the Rush Creek Narrows. Two years of movement study data have demonstrated that approximately 40 to 50% of the large (>300 mm) radio-tagged brown trout migrated between the MGORD and lower reaches of Rush Creek, especially during autumn and winter. To most accurately evaluate the status of large brown trout in the Rush Creek system immediately downstream of Grant Reservoir, data for computing RSD values of MGORD brown trout should be collected in September, prior to the onset of the fall spawning season when migrations occur.

How to use the Quantifiable Termination Criteria

1. With the most-current data set, calculate the biomass, density, condition factor and RSD-225 values for each section of Rush Creek and Lee Vining Creek. Calculate the RSD-300 values for Rush Creek sections only.

2. For Upper and Lower Lee Vining Creek, the biomass estimates from the main and side (if watered) channels were combined for a total value. For densities and condition factors, the values from the main and side (if watered) channels were averaged.

3. For the current year and the two previous years, calculate the three-year running averages of biomass, density, condition factor and RSD-225 for each section of Rush Creek and Lee Vining Creek. Calculate the three-year running averages of RSD-300 for Rush Creek sections only. *Five years of data are necessary to compute a complete set of three, three-year running averages.*

4. For the Upper, Lower and County Road sections of Rush Creek, a section of would considered "recovered" if it met four of the five termination for three consecutive years that the three-year running averages were calculated. The rationale is that in years of high young-of-year (age-0) recruitment, densities will be high with fairly low biomass estimates. Conversely, in years of low age-0 recruitment densities will probably drop, but biomass of older trout should increase. Years of high densities may also exhibit lower condition factors due to density-dependent competition for available food and/or habitat.

5. For Lee Vining Creek, a section would be considered "recovered" if it met three of the four termination criteria for three consecutive years that the three-year running averages were calculated.

Results

Channel Lengths and Widths

In 2007, three of the nine sample sections had narrower wetted channel widths and reduced surface area compared to 2006 widths and areas (Table 1). Two sections, Upper Rush Creek and Walker Creek, had slightly increased wetted widths and surface in 2007 (Table 1). The largest year-to-year difference (0.6 m) occurred in the Lee Vining Creek Lower side-channel section and was probably a function of the low flow (<20 c.f.s.) in Lee Vining Creek. There was visibly less flow through the Lower side-channel at the time of sampling.

In past reports we have expressed concerns about the dynamic nature of the stream channels (particularly in lower Rush Creek) making sample sections subject to change (Hunter et al. 2007). Although the 2007 run-off did not have a peak flow, subtle changes were visually noted in both the County Road and Lower sections of Rush Creek. These changes included deepening of some pools, scour and under-cutting of stream banks and lateral movement of the channel.

Table 1. Total length (m), average wetted width (m), and total surface area (m^2) of sample sections in Rush, Lee Vining, Parker, and Walker creeks sampled between September 6 -17, 2007. Values for 2006 provided for comparisons. **Bold font** designates changes in average channel widths between 2006 and 2007.

Section	Length (m) 2006	Width (m) 2006	Area (m^2) 2006	Length (m) 2007	Width (m) 2007	Area (m^2) 2007
Rush – Co. Road	813	**7.7**	6,260	813	**7.4**	6,016
Rush - Lower	405	**6.6**	2,673	405	**6.2**	2,511
Rush – Upper	430	**8.2**	3,526	430	**8.5**	3,655
Rush - MGORD	2,230	12.0	26,760	2,230	12.0	26,760
LV – Lower main	N/A	N/A	N/A	155	5.7	884
LV - Lower-B1	195	**3.9**	760.5	195	**2.5**	488
LV– Upper main	N/A	N/A	N/A	330	6.3	2079
LV - Upper-A4	191	3.8	726	Dry	Dry	N/A
Parker	98	2.2	216	98	2.2	216
Walker	100	**1.8**	180	100	**2.1**	210

Fish Population Abundance

Rush Creek – County Road Section

In 2007 a majority (61%) of the 2,236 brown trout captured in the County Road section of Rush Creek were young-of-the-year (or age-0) fish between 50 and 123 mm and the longest brown trout captured was 292 mm (Figure 4). This section supported an estimated 2,871 age-0 and 1,124 age-1 and older brown trout (Table 2). Estimates of brown trout were relatively precise with standard errors ranging from 3.3% to 5.2% of the estimates.

For rainbow trout, 17 fish were sampled in 2007, a large increase from the four fish sampled in 2006 (Figure 5). No population estimates were generated for rainbow trout due to insufficient numbers of recaptures.

Rush Creek – Lower Section

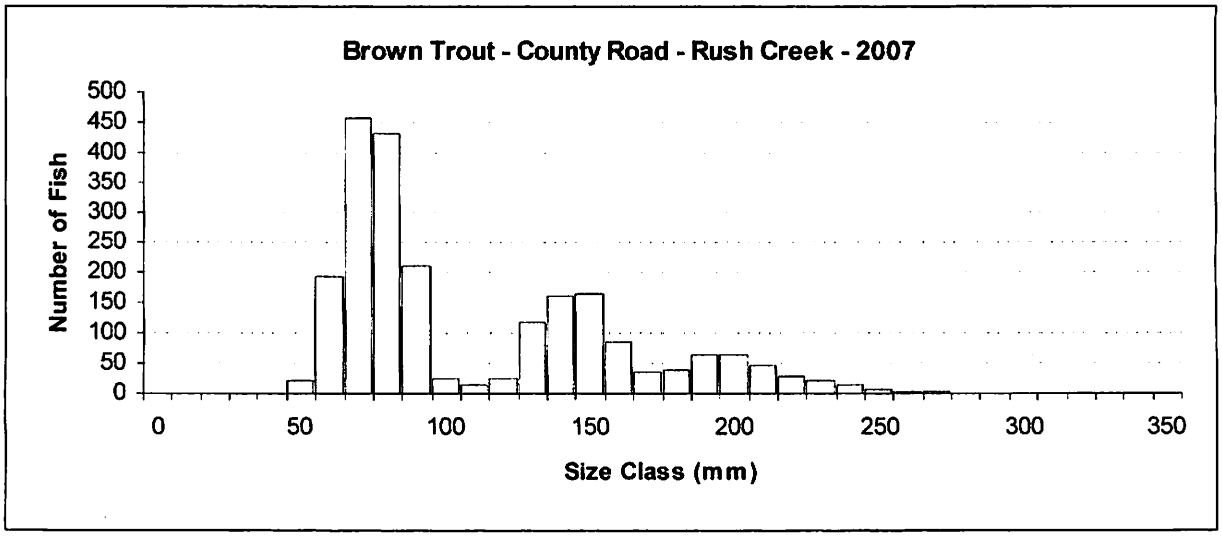
In 2007 a majority (77%) of the 994 brown trout captured in the Lower section of Rush Creek were young-of-the-year (or age-0) fish between 55 and 110 mm and the longest brown trout captured was 385 mm (Figure 4). This section supported an estimated 1,424 age-0 and 269 age-1 and older brown trout (Table 2). Estimates of brown trout were relatively precise with standard errors ranging from 6.3% to 6.6% of the estimates.

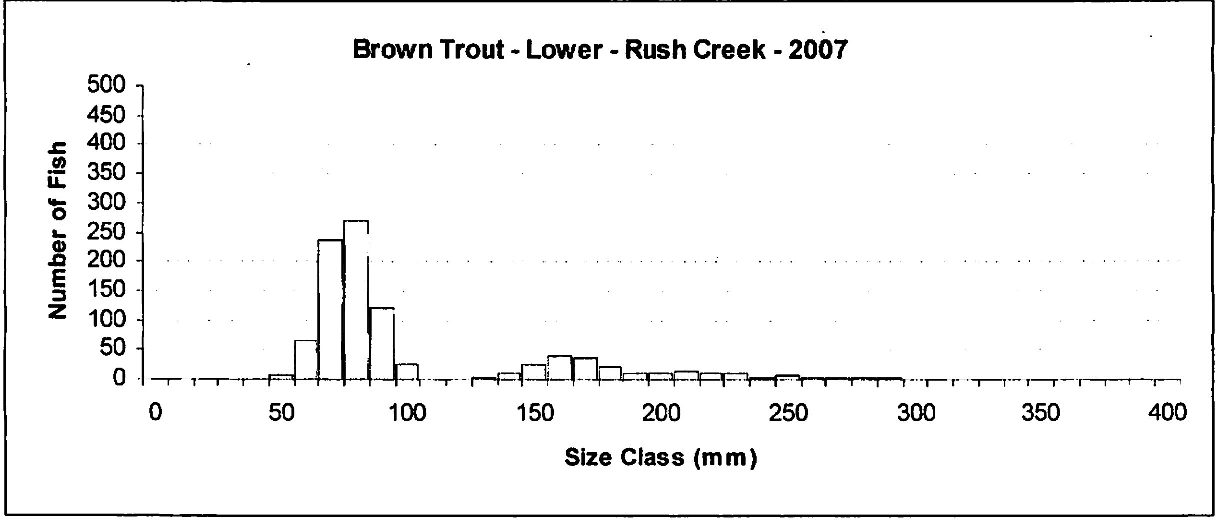
For rainbow trout, 20 fish were sampled in 2007, nearly double the 13 fish sampled in 2006 (Figure 5). This section supported an estimated 33 age-0 rainbow trout (Table 2). No population estimates were generated for age-1 and older rainbow trout due to insufficient numbers of recaptures.

Rush Creek – Upper Section

In 2007 a majority (65%) of the 1,190 brown trout captured in the Upper section of Rush Creek were young-of-the-year (or age-0) fish between 49 and 124 mm and the longest brown trout captured was 403 mm (Figure 4). Eleven brown trout greater than 300 mm were sampled in 2007, including four fish greater than 350 mm. This section supported an estimated 2,985 age-0 and 675 age-1 and older brown trout (Table 2). Estimates of brown trout in Upper Rush Creek were less precise than the other two study sections with standard errors ranging from 8.7% to 12.3% of the estimates.

For rainbow trout, 35 fish were sampled in 2007, a large increase from the four fish sampled in 2006 (Figure 5). No population estimates were generated for rainbow trout due to insufficient numbers of recaptures.





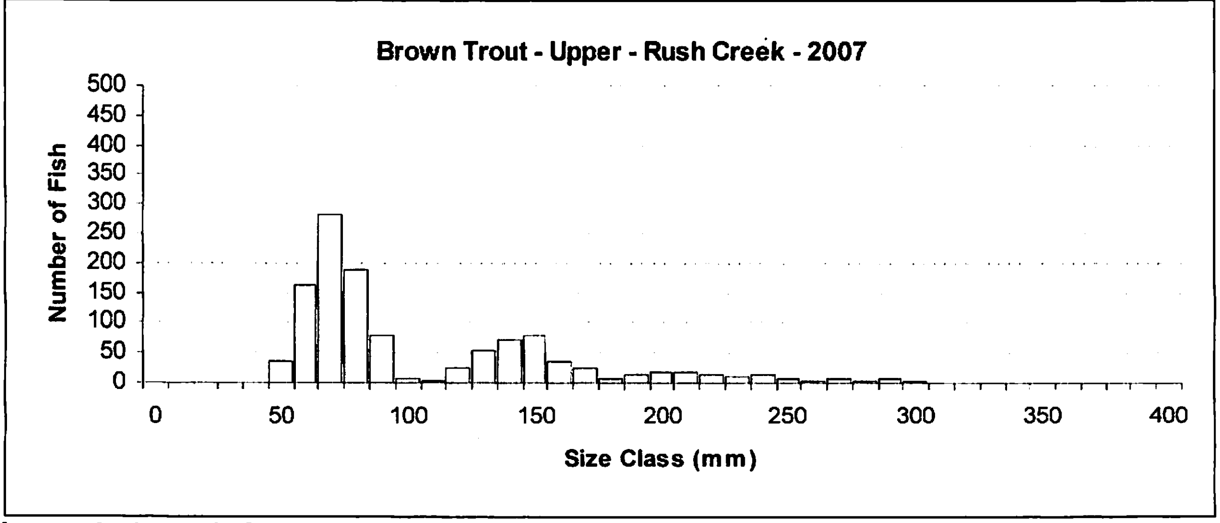
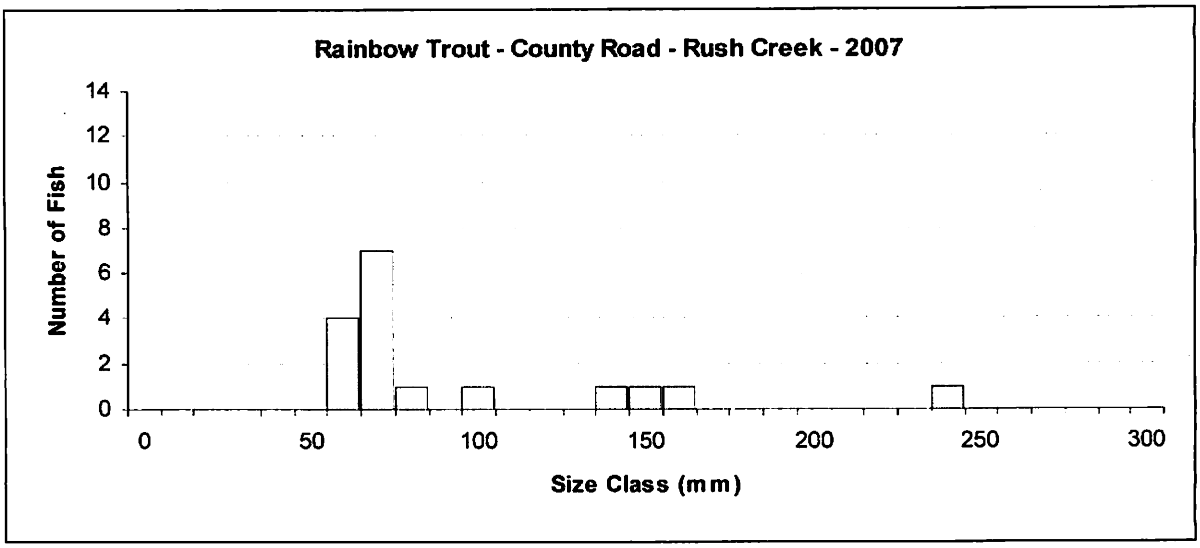
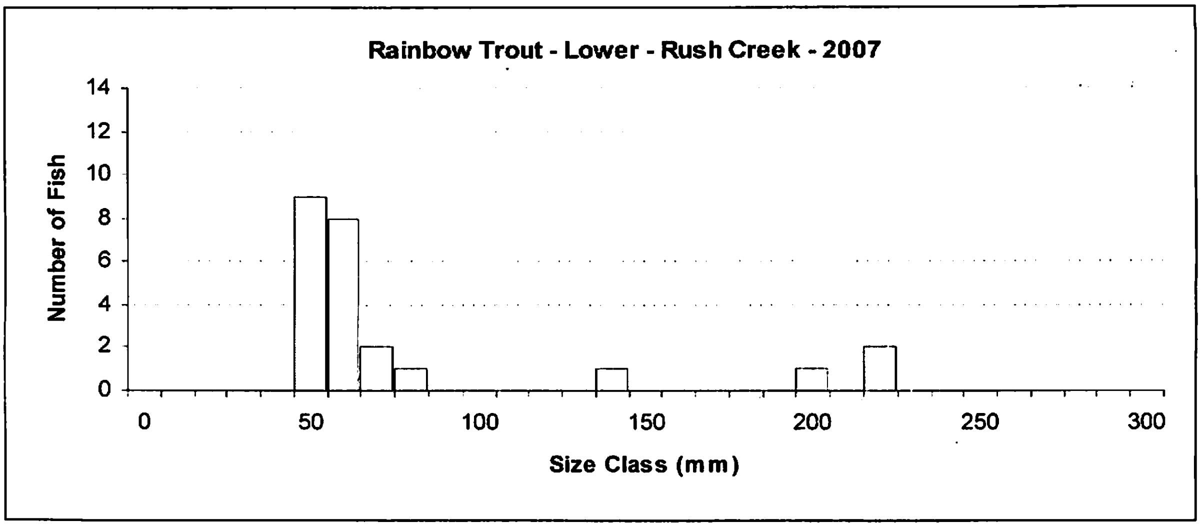


Figure 4. Length-frequency histograms of brown trout captured in the County Road (top), Lower (middle) and Upper (bottom) sections of Rush Creek between September 5th and 17th, 2007.





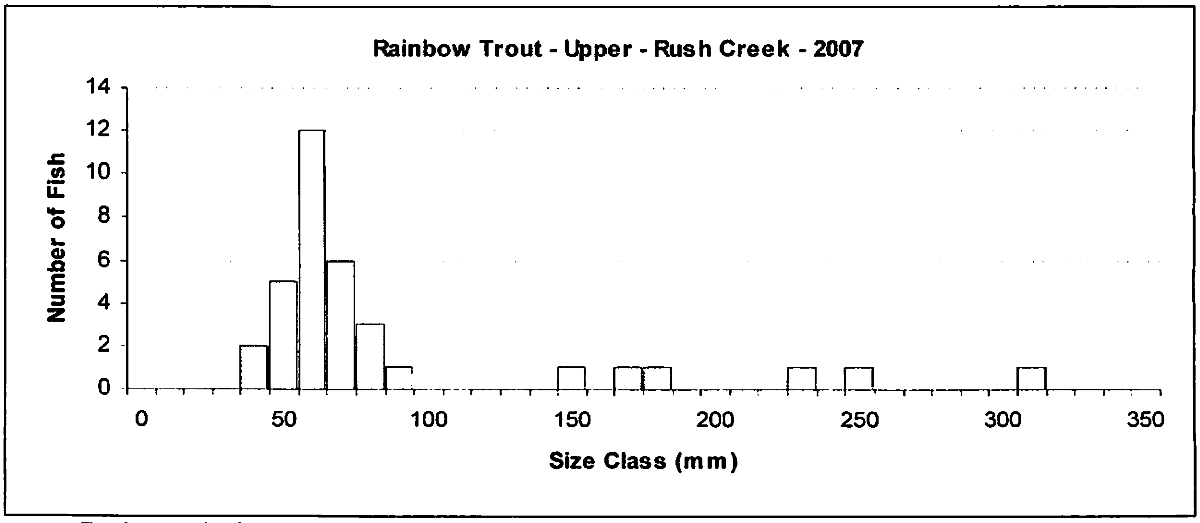


Figure 5. Length-frequency histograms of rainbow trout captured in the County Road (top), Lower (middle) and Upper (bottom) sections of Rush Creek between September 5th and 17th, 2007.

Table 2. Rush Creek and Lee Vining Creek mark-recapture estimates for 2007 showing total number of fish marked (M), total number captured on the recapture run (C), total number recaptured on the recapture run (R), and total estimated number and its associated standard error (S.E.) by stream, section, date, species and size class. Mortalities (Morts) were those fish that were captured during the mark run, but died prior to the recapture run. Mortalities were not included in mark-recapture estimates and should be added to estimates for accurate total estimates. NP = estimate not possible.

Stream / Section / Date / **Species**	Size Class (mm)	M	C	R	Morts	**Estimate**	S.E.
		Mark - recapture estimate parameter values					
Rush Creek							
County Road							
09/07/2007							
Brown Trout							
	0 - 124 mm	706	791	194	63	**2871**	151.5
	125 - 199 mm	456	438	226	14	**883**	28.9
	200 - 324 mm	137	141	80	2	**241**	11.3
Rainbow Trout							
	0 - 124 mm	4	9	0	0	**NP**[a/]	30.0
	125 - 199 mm	2	2	1	1	**NP**[a/]	0.0
	200 - 274 mm	0	1	0	0	**NP**[a/]	0.0
Lower Rush							
09/10/2007							
Brown Trout							
	0 - 124 mm	411	428	123	15	**1424**	89.9
	125 - 199 mm	100	97	52	2	**186**	11.9
	200 - 424 mm	55	47	31	0	**83**	5.5
Rainbow Trout							
	0 - 124 mm	11	13	4	0	**33**[b/]	8.4
	125 - 199 mm	1	0	0	0	**NP**[a/]	0.0
	200 - 274 mm	2	1	0	0	**NP**[a/]	0.0
Upper Rush							
09/06/2007							
Brown Trout							
	0 - 124 mm	385	378	48	58	**2985**	368.1
	125 - 199 mm	191	154	56	19	**521**	45.7
	200 - 449 mm	90	57	33	3	**154**	13.4
Rainbow Trout							
	0 - 124 mm	10	18	2	3	**NP**[a/]	27.3
	125 - 199 mm	3	1	1	0	**NP**[a/]	0.0
	200 - 349 mm	2	1	1	1	**NP**[a/]	0.0

Table 2 (continued). Rush Creek and Lee Vining Creek mark-recapture estimates for 2007.

Stream / Section / Date / **Species**	Size Class (mm)	M	C	R	Morts	**Estimate**	S.E.
		Mark - recapture estimate parameter values					
Lee Vining Creek							
Lower Main Channel							
09/09/2007							
Brown Trout							
	0 - 124 mm	73	71	26	1	**196**	23.5
	125 - 199 mm	8	6	5	0	**10**[b/]	0.9
	200 - 324 mm	5	4	3	0	**6**[b/]	0.9
Rainbow Trout							
	0 - 124 mm	42	56	22	0	**106**	11.5
	125 - 199 mm	1	0	0	0	**NP**[a/]	0.0
	200 - 324 mm	2	5	1	0	**NP**[a/]	0.0
Upper Main Channel							
09/08/2007							
Brown Trout							
	0 - 124 mm	96	69	24	0	**271**	36.8
	125 - 199 mm	10	9	7	0	**13**	1.1
	200 - 324 mm	14	8	6	0	**18**[b/]	2.3
Rainbow Trout							
	0 - 124 mm	110	136	50	0	**297**	24.1
	125 - 199 mm	7	9	4	0	**15**[b/]	2.8
	200 - 424 mm	16	20	11	0	**29**	2.9

[a/] "NP" indicates an estimate was not possible due to too few recaptures.
[b/] These estimates have fewer than 7 recaptures.

Lee Vining Creek – Lower Main Channel Section

In 2007 a majority (89%) of the 134 brown trout captured in the Lower main channel section of Lee Vining Creek were young-of-the-year (or age-0) fish between 82 and 123 mm and the longest brown trout captured was 298 mm (Figure 6). This section supported an estimated 196 age-0 and 16 age-1 and older brown trout (Table 2). Estimates of brown trout were relatively precise with standard errors ranging from 9.0% to 15% of the estimates.

For rainbow trout, 83 fish were sampled in 2007 and 76 were age-0 fish that ranged from 75 to 120 mm in length (Figure 7). This section supported an estimated 106 age-0 rainbow trout (Table 2). Insufficient numbers of rainbow trout ≥125 mm were sampled to generate population estimates for the larger size classes. Estimate of age-0 rainbow trout was relatively precise with a standard error equal to10.9% of the estimates.

Lee Vining Creek – Upper Main Channel Section

In 2007 a majority (83%) of the 169 brown trout captured in the Upper main channel section of Lee Vining Creek were young-of-the-year (or age-0) fish between 73 and 124 mm and the longest brown trout captured was 294 mm (Figure 6). This section supported an estimated 271 age-0 and 31 age-1 and older brown trout (Table 2). Estimates of brown trout were relatively precise with standard errors ranging from 8.5% to 13.6% of the estimates.

For rainbow trout, 233 fish were sampled in 2007 and 196 (84%) were age-0 fish that ranged from 66 to 124 mm in length (Figure 7). Four rainbow trout were greater than 300 mm in length and the longest rainbow trout captured was 380 mm (approximately 15"). This section supported an estimated 297 age-0 and 44 age-1 and older rainbow trout (Table 2). Estimates of rainbow trout were relatively precise with standard errors ranging from 8.1% to 18.7% of the estimates.

Lee Vining Creek – Lower Side Channel Section

In 2007, only 12 brown trout were captured in the Lower side channel section of Lee Vining Creek and nine were age-0 fish between 92 and 118 mm (Figure 6). The longest brown trout captured was 245 mm (Figure 6). All fish were captured on the first of two electro-fishing depletion passes. This section supported an estimated nine age-0 and three age-1 and older brown trout (Table 3).

For rainbow trout, only 10 fish were sampled in 2007 and four were age-0 fish between 64 and 122 mm in length (Figure 7). The longest rainbow trout captured in this side-channel was 208 mm (Figure 7). All fish were captured on the first of two electro-fishing depletion passes. This section supported an estimated none age-0 and nine age-1 and older rainbow trout (Table 3). **NOTE:why are the size classes so different on Table?**

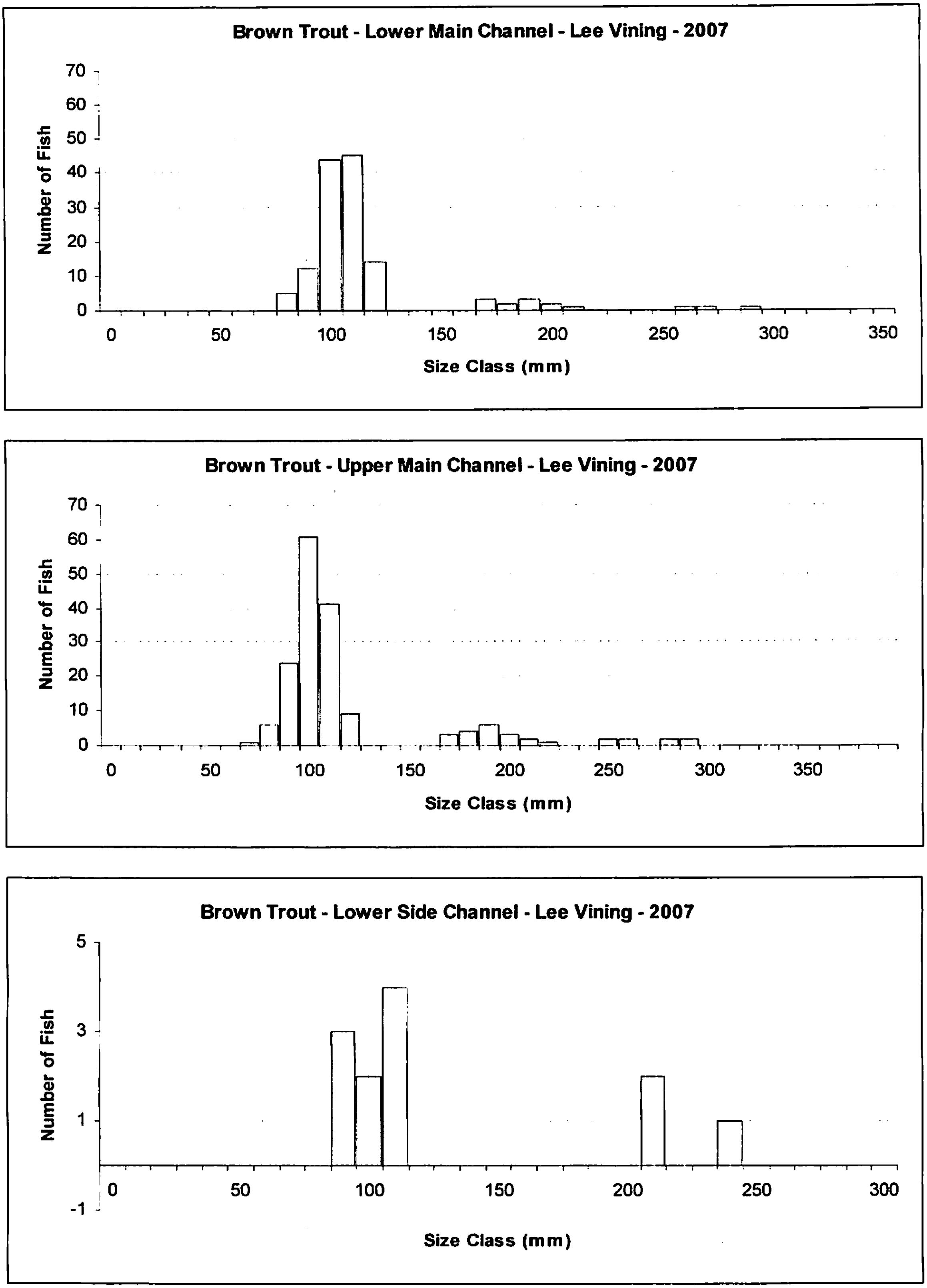


Figure 6. Length-frequency histograms of brown trout captured in the Lower main-channel (top), Upper main-channel (middle) and Lower side-channel (bottom) sections of Lee Vining Creek between September 5th and 17th, 2007. Note the different scale on the vertical axis for the Lower side-channel histogram.

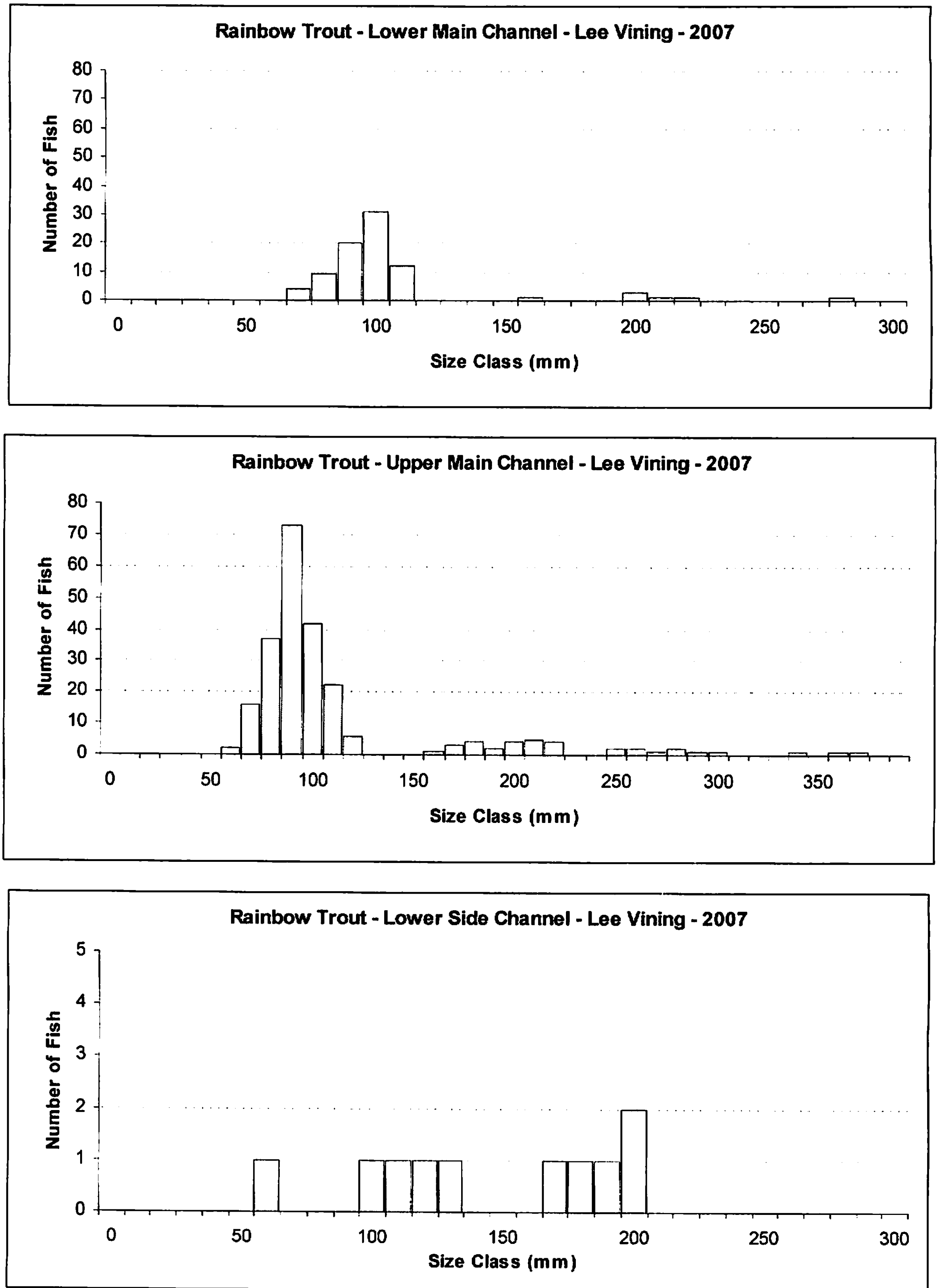


Figure 7. Length-frequency histograms of rainbow trout captured in the Lower main-channel (top), Upper main-channel (middle) and Lower side-channel (bottom) sections of Lee Vining Creek between September 5th and 17th, 2007. Note the different scale on the vertical axis for the Lower side-channel histogram.

Table 3. Depletion estimates made in the Lower side channel section of Lee Vining Creek, Parker Creek and Walker Creek during September 2007 showing number of fish captured in each pass, estimated number and standard deviation (S.D.) by species and length group.

Stream - Section / **Species**	Size Class (mm)	Removals	Removal Pattern	**Estimate**	S.E.
Lee Vining Creek - Lower - B1 Channel					
Brown Trout					
	0 - 124 mm	2	9 0	**9**	0.0
	125 - 199 mm	2	0 0	**0**	0.0
	200 + mm	2	3 0	**3**	0.0
Rainbow Trout					
	0 - 99 mm	2	1 0	**1**	0.0
	100 - 174 mm	2	4 0	**4**	0.0
	175 + mm	2	5 0	**5**	0.0
Parker Creek - Monitor Section					
Brown Trout					
	0 - 124 mm	3	71 32 13	**125**	5.2
	125 - 199 mm	3	1 0 0	**1**	0.0
	200 + mm	3	7 1 0	**8**	0.1
Walker Creek - Walker above road near Cane Ranch					
Brown Trout					
	0 - 124 mm	2	333 100	**474**	12.4
	125 - 199 mm	2	33 3	**36**	0.5
	200 + mm	2	24 0	**24**	0.0

Parker Creek

As in the past 11 years of annual sampling, only brown trout were captured in Parker Creek (Figure 8). A total of 125 brown trout were captured in three electro-fishing passes in 2007 (up from totals of 86 fish in 2006, 31 fish in 2005 and 53 fish in 2004). In 2007, Parker Creek supported an estimated 125 age-0 brown trout and nine age-1 and older brown trout (Table 3).

Walker Creek

In 2007, 493 brown trout were captured in two electro-fishing passes and 433 of these brown trout were age-0 fish (Figure 9). For the past four years, age-0 brown trout numbers have fluctuated widely in Walker Creek. For comparison, in 2006, 80 age-0 brown trout were captured, in 2005 only four age-0 brown trout were captured and in 2004, 203 age-0 brown trout were captured. In 2007, Walker Creek supported an estimated 474 age-0 and 60 age-1 and older brown trout (Table 3). As in 2006, a noticeable number of larger brown trout were sampled in 2007. Ten brown trout >250 mm (approximately 10") in length were captured in Walker Creek in 2007, and one of these fish was >300 mm (12") in length (Figure 9).

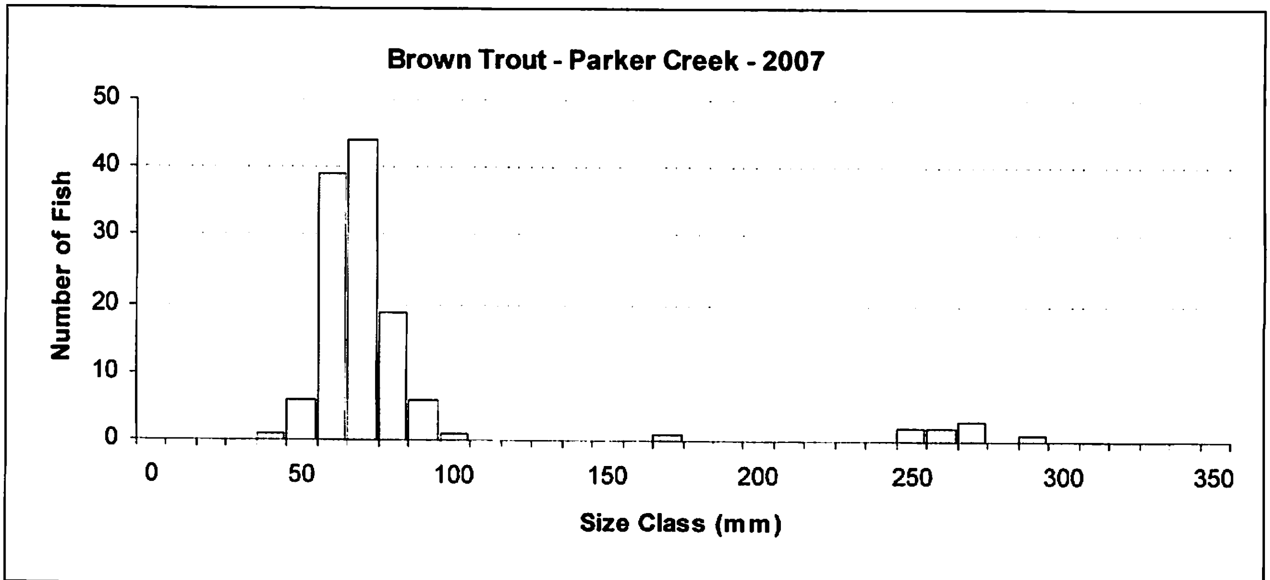


Figure 8. Length-frequency histogram of brown trout captured in Parker Creek on September 11, 2007.

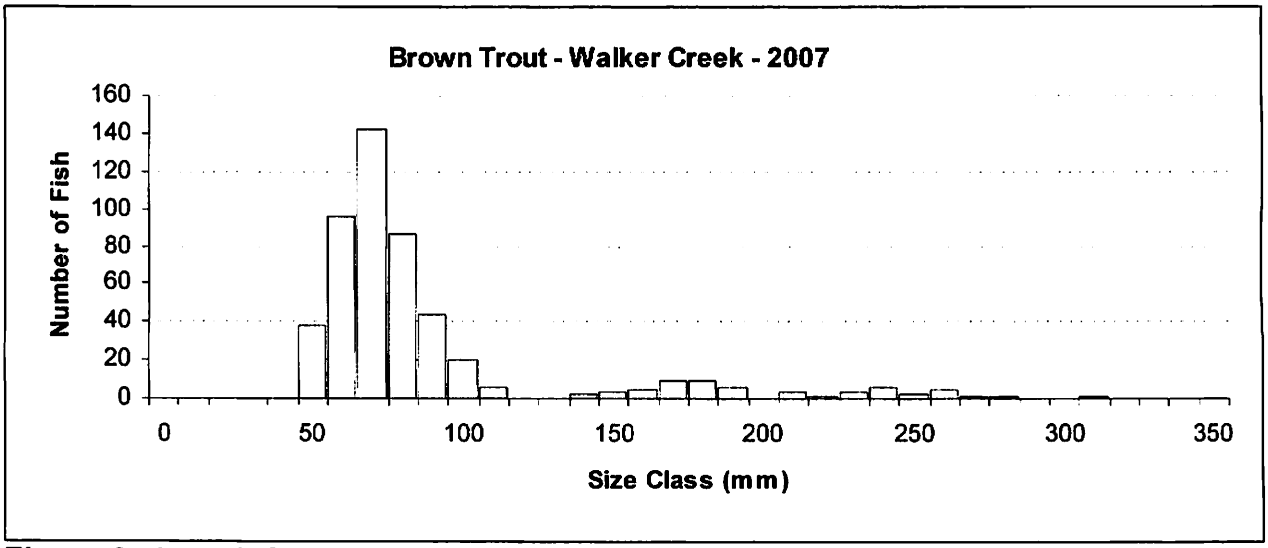


Figure 9. Length-frequency histogram of brown trout captured in Walker Creek on September 11, 2007.

Relative Condition of Brown Trout

Log_{10} transformed length-weight regressions for captured brown trout ≥100 mm had R^2-values over 0.98 for almost all sample events, indicating that weight was strongly correlated to length (Table 4). A condition factor of 1.00 is considered average and in Rush Creek condition factors were less than 1.00 in 2007, indicating that brown trout condition was poor. Regression data for 2007 indicated that condition was similar among the three Rush Creek sample sections (Table 4).

The relative conditions of brown trout captured in all Rush Creek study sections during 2007 were the lowest recorded for the nine seasons of annual sampling (Figure 10). During the measuring and weighing of fish, many brown trout were obviously thin and in poor condition.

In Parker Creek, the condition factor for brown trout (150 to 250 mm in total length) increased from 0.96 in 2006 to 1.06 in 2007, the first increase after three consecutive years of decreasing values (Figure 10). In Walker Creek, the condition factor for brown trout (150 to 250 mm in total length) increased slightly from 0.99 in 2006 to 1.00 in 2007 (Figure 10).

Condition factors for brown trout (150 to 250 mm in total length) in the three Lee Vining sections sampled in 2007 were greater than 1.00 (Figure 11). Both Lee Vining main-channel sections (not sampled in 2006 due to high flows) had condition factors in 2007 that were less than the 2005 values, yet were comparable to values in the years 2002-2004 (Figure 11).

NOTE: Why do we <u>not</u> report condition factor of rainbow trout? The condition factor of bubbas in LV was higher than brown trout.

Table 4. Regression statistics for log_{10} transformed length (L) to weight (WT) for brown trout 100 mm and longer captured in Rush Creek by sample section and year. The 2007 regression equations are in **bold** type.

Section	Year	N	Equation	R^2	P
County Road	2000	412	$Log_{10}(WT) = 2.94*Log_{10}(L) - 4.83$	0.99	< 0.01
	2001	552	$Log_{10}(WT) = 2.91*Log_{10}(L) - 4.81$	0.98	< 0.01
	2002	476	$Log_{10}(WT) = 2.95*Log_{10}(L) - 4.88$	0.99	< 0.01
	2003	933	$Log_{10}(WT) = 3.00*Log_{10}(L) - 5.01$	0.99	<0.01
	2004	655	$Log_{10}(WT) = 2.97*Log_{10}(L) - 4.94$	0.99	<0.01
	2005	257	$Log_{10}(WT) = 2.97*Log_{10}(L) - 4.90$	0.98	<0.01
	2006	373	$Log_{10}(WT) = 3.00*Log_{10}(L) - 5.00$	0.99	<0.01
	2007	**912**	$\mathbf{Log_{10}(WT) = 2.789*Log_{10}(L) - 4.565}$	**0.98**	**<0.01**
Lower	1999	314	$Log_{10}(WT) = 3.03*Log_{10}(L) - 5.08$	0.99	< 0.01
	2000	230	$Log_{10}(WT) = 2.97*Log_{10}(L) - 4.90$	0.98	< 0.01
	2001	350	$Log_{10}(WT) = 2.97*Log_{10}(L) - 4.94$	0.99	< 0.01
	2002	250	$Log_{10}(WT) = 2.91*Log_{10}(L) - 4.78$	0.99	< 0.01
	2003	348	$Log_{10}(WT) = 3.00*Log_{10}(L) - 5.02$	0.99	<0.01
	2004	215	$Log_{10}(WT) = 2.93*Log_{10}(L) - 4.84$	0.99	<0.01
	2005	189	$Log_{10}(WT) = 3.06*Log_{10}(L) - 5.14$	0.99	<0.01
	2006	271	$Log_{10}(WT) = 3.00*Log_{10}(L) - 4.99$	0.99	<0.01
	2007	**235**	$\mathbf{Log_{10}(WT) = 2.905*Log_{10}(L) - 4.815}$	**0.99**	**<0.01**
Upper	1999	317	$Log_{10}(WT) = 2.93*Log_{10}(L) - 4.84$	0.98	< 0.01
	2000	309	$Log_{10}(WT) = 3.00*Log_{10}(L) - 4.96$	0.98	< 0.01
	2001	335	$Log_{10}(WT) = 2.99*Log_{10}(L) - 4.96$	0.99	< 0.01
	2002	373	$Log_{10}(WT) = 2.94*Log_{10}(L) - 4.86$	0.99	< 0.01
	2003	569	$Log_{10}(WT) = 2.96*Log_{10}(L) - 4.89$	0.99	<0.01
	2004	400	$Log_{10}(WT) = 2.97*Log_{10}(L) - 4.94$	0.99	<0.01
	2005	261	$Log_{10}(WT) = 3.02*Log_{10}(L) - 5.02$	0.99	<0.01
	2006	485	$Log_{10}(WT) = 2.99*Log_{10}(L) - 4.98$	0.99	<0.01
	2007	**436**	$\mathbf{Log_{10}(WT) = 2.867*Log_{10}(L) - 4.715}$	**0.99**	**<0.01**
MGORD	2000	82	$Log_{10}(WT) = 2.909*Log_{10}(L) - 4.733$	0.98	<0.01
	2001	769	$Log_{10}(WT) = 2.873*Log_{10}(L) - 4.719$	0.99	<0.01
	2004	449	$Log_{10}(WT) = 2.984*Log_{10}(L) - 4.973$	0.99	<0.01
	2006	593	$Log_{10}(WT) = 2.956*Log_{10}(L) - 4.872$	0.98	<0.01
	2007	**643**	$\mathbf{Log_{10}(WT) = 2.914*Log_{10}(L) - 4.825}$	**0.98**	**<0.01**

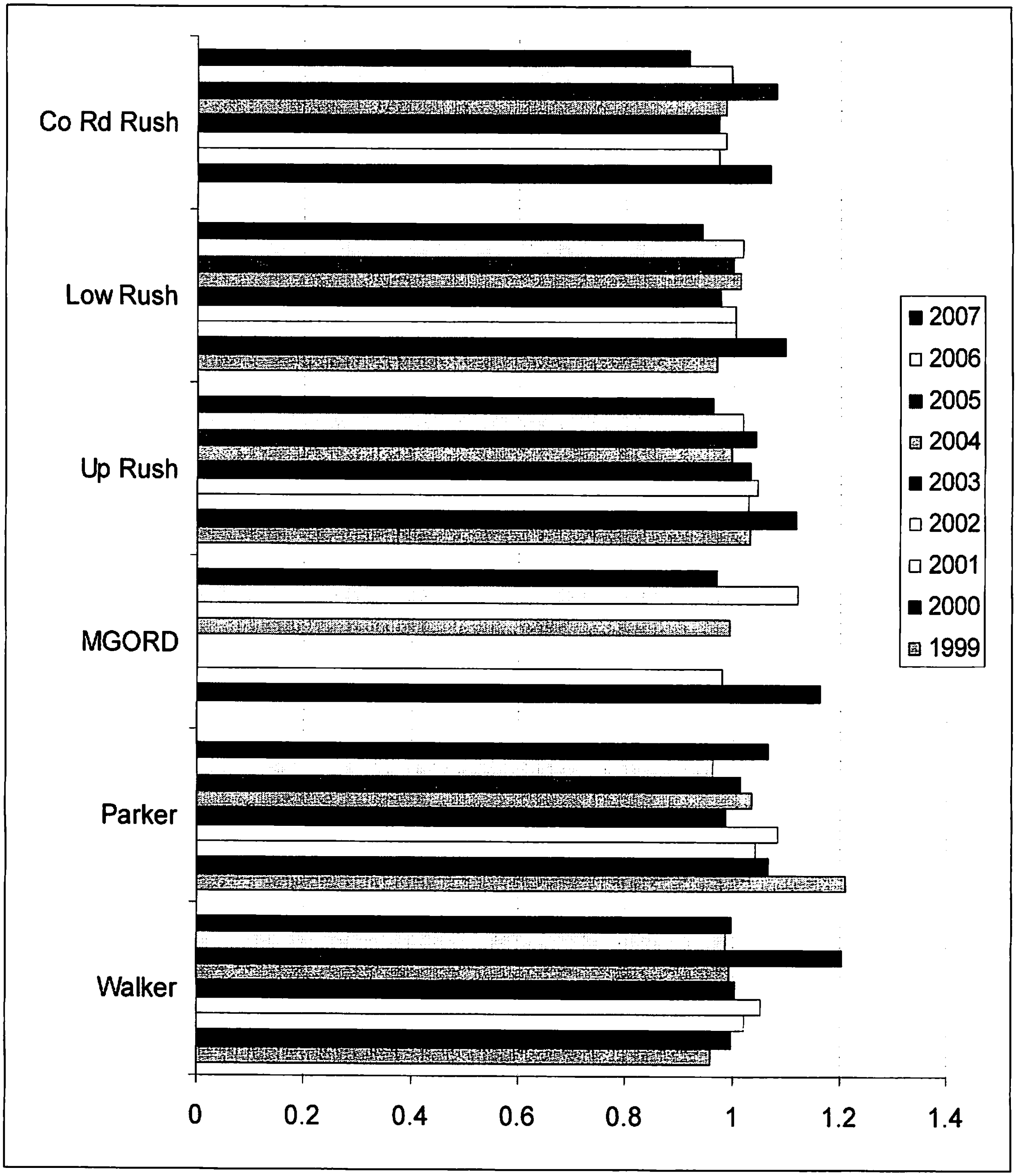


Figure 10. Condition factors for brown trout 150 to 250 mm long in Rush Creek and its tributaries (Parker and Walker creeks) from 1999 to 2007.

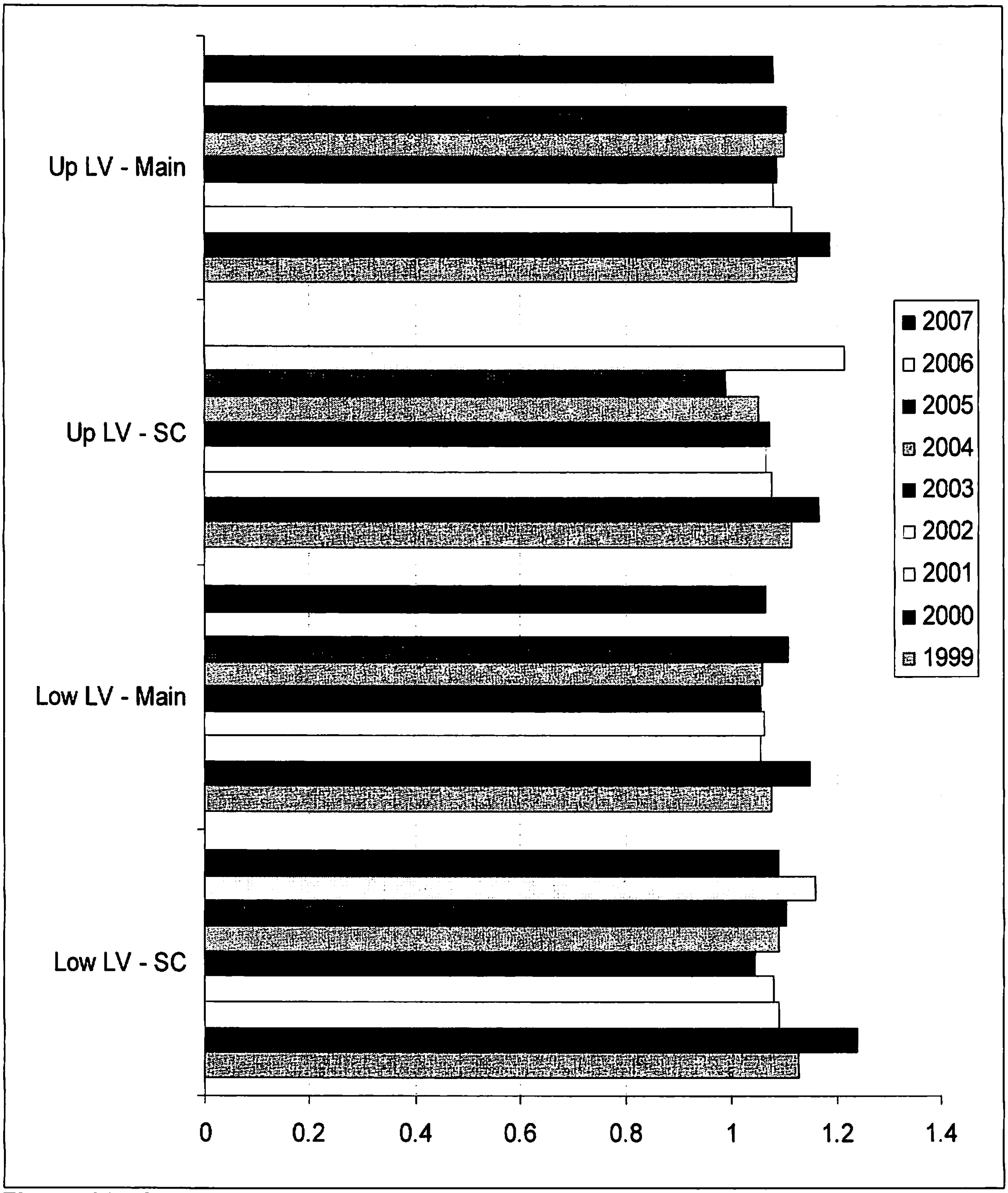


Figure 11. Condition factors for brown trout 150 to 250 mm long in Lee Vining Creek from 1999 to 2007.

Fin Clips and Growth Estimates of Brown Trout

During the 2006 sampling season 1,753 age-0 brown trout and 75 age-0 rainbow had their adipose fin removed so that growth of this cohort of fish could be tracked in subsequent years (Table 5). In 2007, 186 of these adipose fin-clipped fish were re-captured as age-1 fish and only two of these fish were captured in Lee Vining Creek (Table 6). The remaining three brown trout captured in 2007 with adipose fin clips were mostly like age-4 fish that were clipped as age-0 fish in 2003 (Table 7). Although only two adipose fin-clipped brown trout were recaptured in Lee Vining Creek, the average growth of these two fish between age-0 and age-1 was much greater than growth rates within any of the Rush Creek sections (Table 6).

The growth rates of age-0 to age-1 brown trout in Rush Creek between 2006 and 2007 were much lower than the growths rates documented between 2003 and 2004. Between 2003 and 2004, brown trout in the County Road section exhibited an average growth of 84 mm and 42 g, compared to an average growth of 59 mm and 25 g between 2006 and 2007. Brown trout in the Lower Rush Creek section exhibited an average growth of 99 mm and 61 g between 2003 and 2004, compared to an average growth of 59 mm and 25 g between 2006 and 2007. In the Upper Rush Creek section, the length that brown trout grew between the two sampling periods was similar, 74 mm between 2003 and 2004 and 75 mm between 2006 and 2007. However, the weight gained was quite different. Between 2003 and 2004, the average weight gained by age-0 to age-1 brown trout was 45 g compared to an average of 32.5g between 2006 and 2007.

Table 5. Total number (1,828 fish) of age-0 trout that received adipose fin clips during the 2006 sampling season, by stream reach. Number in (#) denotes rainbow trout.

Collection Location	Number of Fish Clipped	Average Total Length (mm)	Minimum Total Length (mm)	Maximum Total Length (mm)	Average Weight (g)
Rush Creek - County Road	607	91	65	119	8.1
Rush Creek – Lower	345 (6)	95 (74)	56 (63)	121 (84)	9.2 (4.2)
Rush Creek – Upper	560 (3)	80 (61)	56 (58)	124 (65)	5.5 (2.0)
Rush Creek - MGORD	62	96	76	112	9.3
Lee Vining – Lower Main	NS	-	-	-	-
Lee Vining – Lower Side	11 (66)	86 (52)	78 (43)	99 (70)	6.5
Lee Vining – Upper Main	NS	-	-	-	-
Lee Vining – Upper Side	16	77	57	92	4.6
Walker Creek	77	95	72	115	8.9
Parker Creek	75	72	54	94	3.8

NS = not sampled due to high flow.

Table 6. Age-1 brown trout captured in 2007 with adipose fin clips administered during the 2006 sampling season, by stream reach.

Collection Location	Number of Fish Recap.	Ave. Total Length (mm)	Min. Total Length (mm)	Max. Total Length (mm)	Ave. Weight (g)	Percent Recap.	Growth Ave. Length (mm)	Growth Ave. Weight (g)
Rush - Co. Road	95	150	110	179	33.1	15.7%	59	25.0
Rush - Lower	26	169	150	188	45.5	7.5%	74	36.3
Rush - Upper	51	155	125	187	38	9.1%	75	32.5
LV – Low Side	2	216.5	215	218	110.5	18.2%	130.5	104.0
Walker Creek	11	181	152	195	59.1	14.3%	86	50.2
Parker Creek	1	177	177	177	59.0	1.3%	105	55.2

Table 7. Age-4 brown trout captured in 2007 with adipose fin clips administered during the 2003 sampling season, by stream reach.

Collection Location	Number of Fish Recap.	Ave. Total Length (mm)	Min. Total Length (mm)	Max. Total Length (mm)	Ave. Weight (g)	Percent Recap.	Growth Ave. Length (mm)	Growth Ave. Weight (g)
Rush - Co. Road	1	252	252	252	152.0	0.10%	165	145
Rush - Upper	2	275	247	303	173.0	0.37%	171	161

Estimated Trout Density Comparisons

Trout populations were dominated by brown trout in most sample sections during 2007, similar to past years (Figure 12; Hunter et al. 2000; 2001; 2002; 2003; 2004; 2005; 2006; 2007). The one exception in 2007 was the Upper main channel section of Lee Vining Creek where the number of rainbow trout sampled was 64 fish more than the number of brown trout. The higher proportion of brown trout to rainbow trout in all Rush Creek sections and two of three Lee Vining Creek sections is typical of most trout streams in the Mono Basin and the Owens River watershed. Studies by the California Department of Fish and Game documented brown trout as the dominant trout species in all 130 electro-fishing reaches sampled within 52 different Mono Basin and Owens River tributaries (Deinstadt et al. 1985; 1986; 1997). Kondolf et al. (1991) also suggested that periodic mobility of the streambed may explain why brown trout are more abundant than rainbow trout in many eastern Sierra streams where high flows typically occur in May and June due to snow melt when rainbow trout eggs (or alevin) are on the gravel, and thus, more vulnerable to scour during larger snowmelt flows.

Lee Vining Creek's rainbow trout population, especially age-0 production, appears to fluctuate according to run-off type, with increases in fish during average to low run-off years and decreases during high run-off years (such as 2004-06). This pattern is consistent with the theory of streambed scour during high run-off years and streambed stability in low run-off years as suggested by Kondolf et al. (1991). Fausch et al. (2001) examined the influences of flood regimes on rainbow trout invasion success and concluded that success was best explained by a match between timing of fry emergence and months of low flood probability.

In 2007, estimated densities (number per hectare) of age-1 and older brown trout in Rush Creek increased (from 2006 values) in all annually-sampled sections (Figure 13). The greatest increase occurred in the County Road section where the density of age-1 and older brown trout more than doubled between 2006 and 2007, from 912 fish/ha to 1,895 fish/ha (Figure 13).

Estimated densities of age-1 and older brown trout in Parker Creek decreased by 18.2% between 2006 and 2007, after experiencing a decrease of 50% between 2005 and 2006 (Figure 13). For nine years, Parker Creek has generally exhibited an annually alternating up-and-down pattern in density estimates (Figure 13).

In Walker Creek the 2007 density estimate was 38% more than the 2006 estimate (Figure 13). The 2007 density estimate was the first increase after declines between 2004 and 2006 (Figure 13). Since 2002 Walker Creek has annually had the highest density estimates of age-1 and older brown trout for all sample sections (Figure 13).

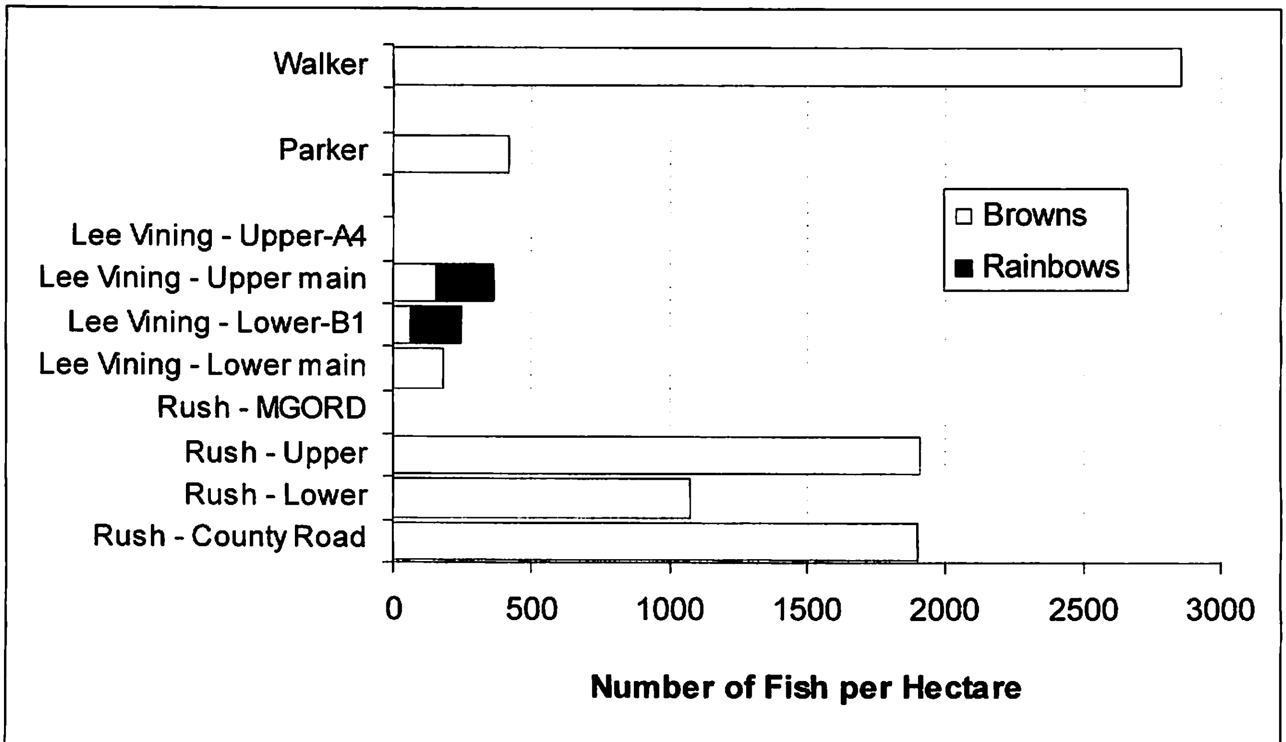


Figure 12. Densities (number/hectare) of age-1 and older brown and rainbow trout in selected Mono Lake tributaries in 2007.

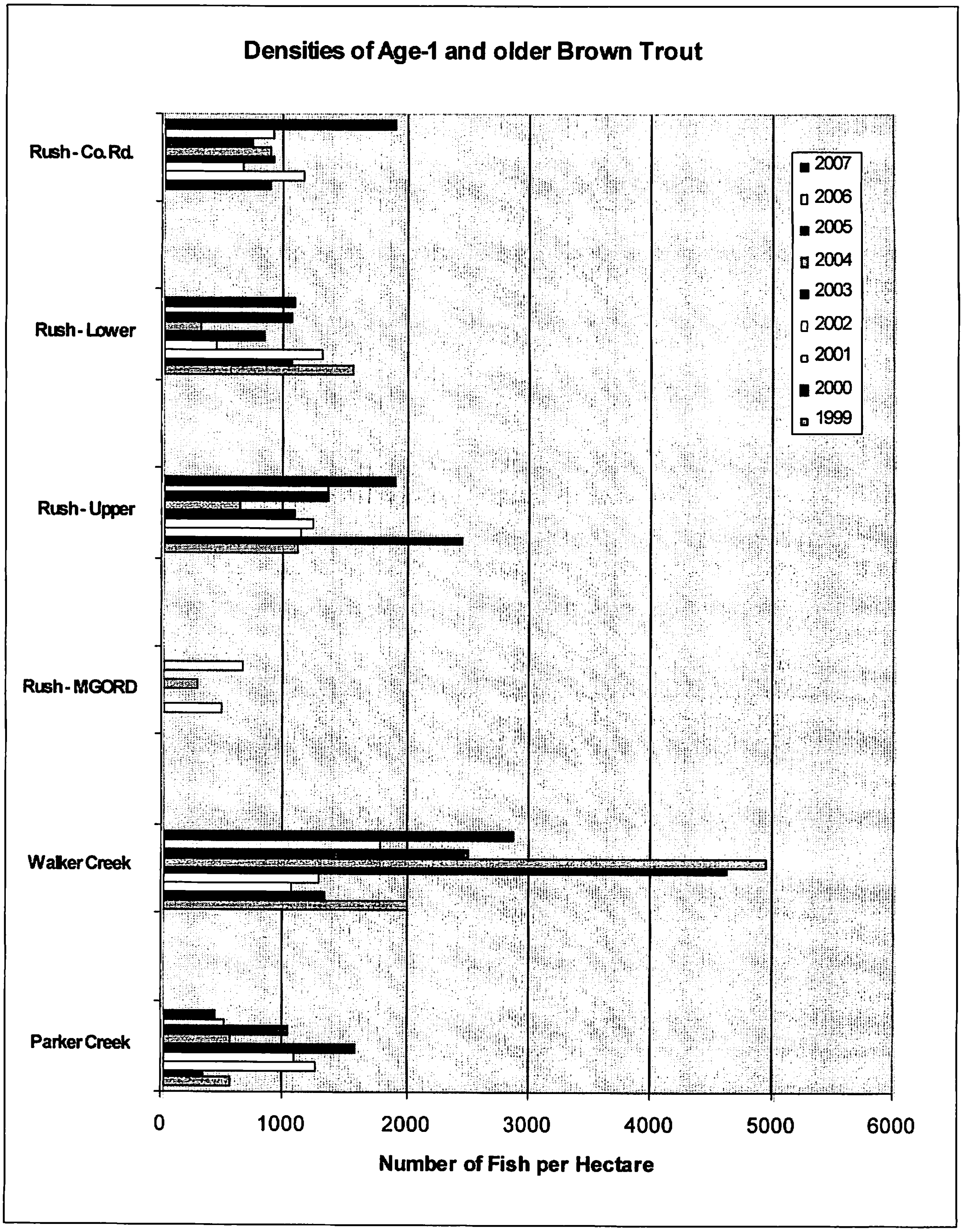


Figure 13. Estimated number of age-1 and older brown trout per hectare in sections of Rush, Walker and Parker creeks from 1999 to 2007.

Estimated densities (number per hectare) of age-1 and older brown trout in the Lee Vining Creek Lower side channel section increased by 14.5% between 2006 and 2007 (Figure 14). In the main channel of Lee Vining Creek, both the Upper and Lower sections experienced large decreases in estimated densities between the 2005 and 2007 sampling seasons (Figure 14).

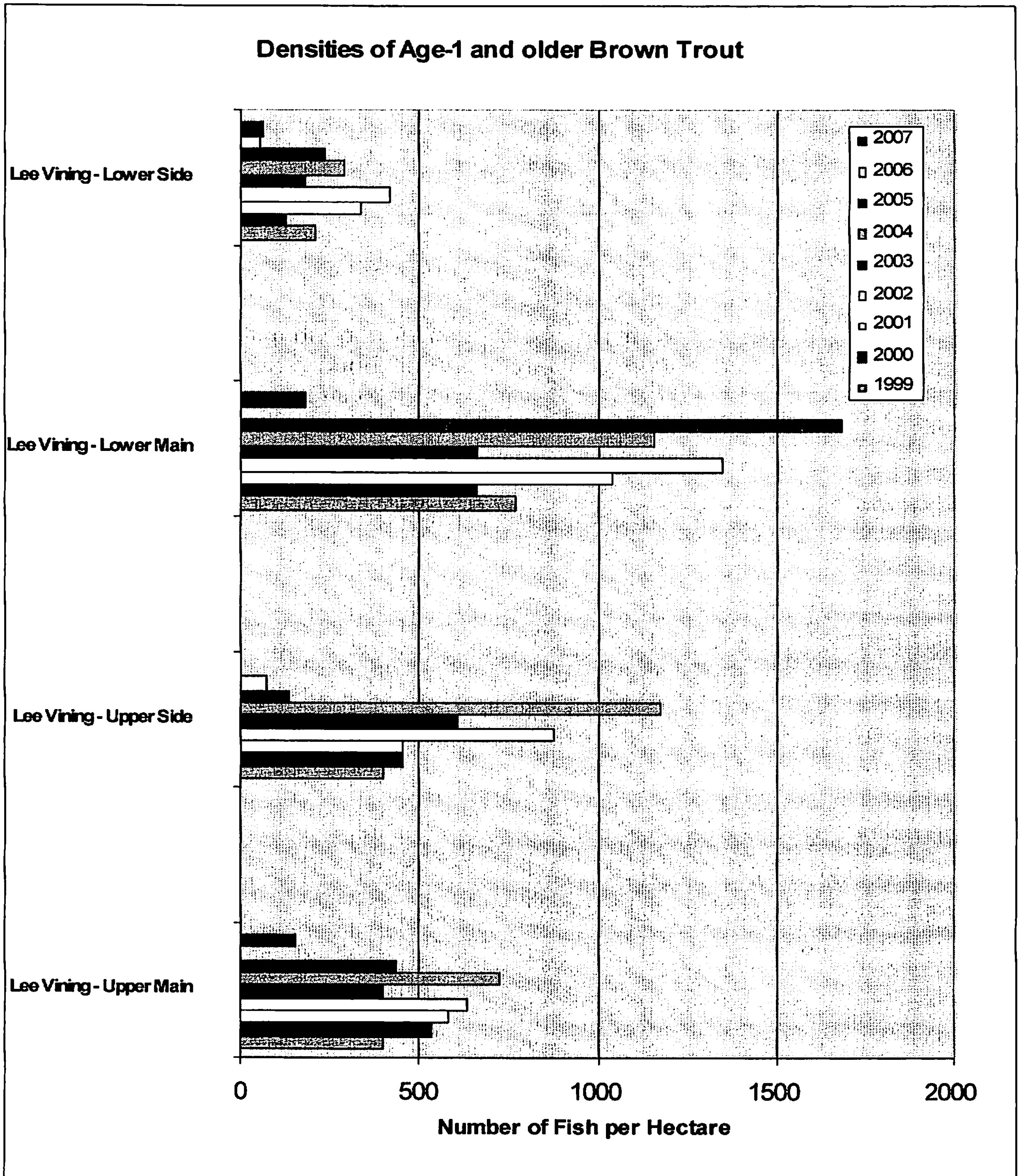


Figure 14. Estimated number of age-1 and older brown trout per hectare in sections of Lee Vining Creek from 1999 to 2007.

In all Rush Creek sections and the Lee Vining Creek Lower main channel section, insufficient numbers of age-1 and older rainbow trout were captured to generate population estimates, thus no densities were calculated for 2007 for these sections. In contrast, the Lee Vining Creek Upper main channel and Lower side channel section both experienced large increases in estimated densities of age-1 and older rainbow trout (Figure 15). In the Upper main channel the increase between the 2005 and 2007 density estimates was more than ten-fold (Figure 15).

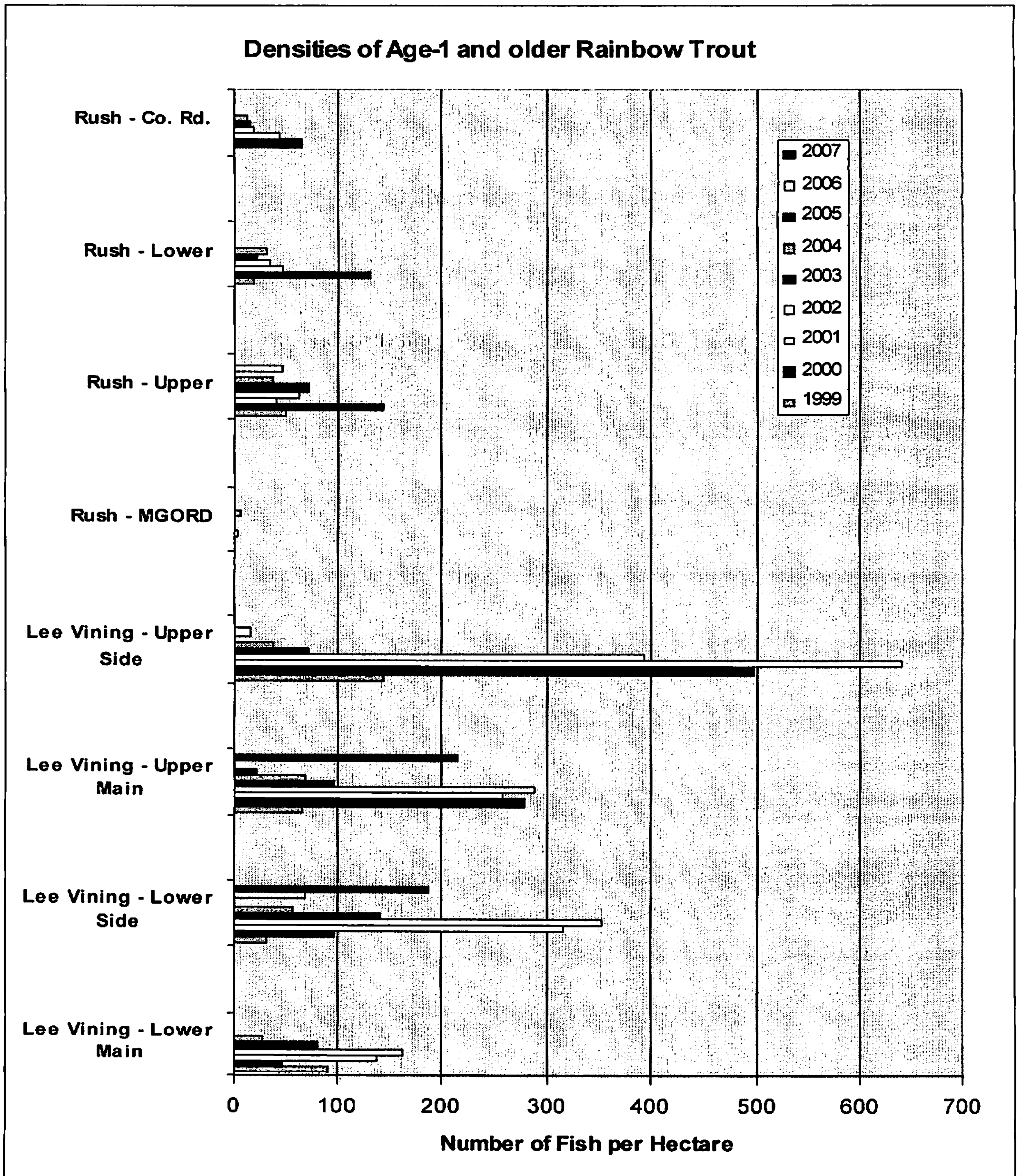


Figure 15. Estimated number of age-1 and older rainbow trout per hectare in sections of Rush and Lee Vining creeks from 1999 to 2007.

In 2007, age-0 brown trout density estimates (number per hectare) in the Rush Creek County Road and Lower sections experienced large increases compared to 2006 estimates (Figure 16). The 2007 density estimate for the Rush Creek Upper section was nearly the same as the 2006 estimate with less than a 0.5% increase (Figure 16). In Walker Creek the increase between the 2006 and 2007 density estimates was nearly five-fold to the highest density (22,571 fish/ha) ever estimated for any of the sample sections (Figure 16). Parker Creek experienced a 30% increase in density estimates between 2006 and 2007 (Figure 16).

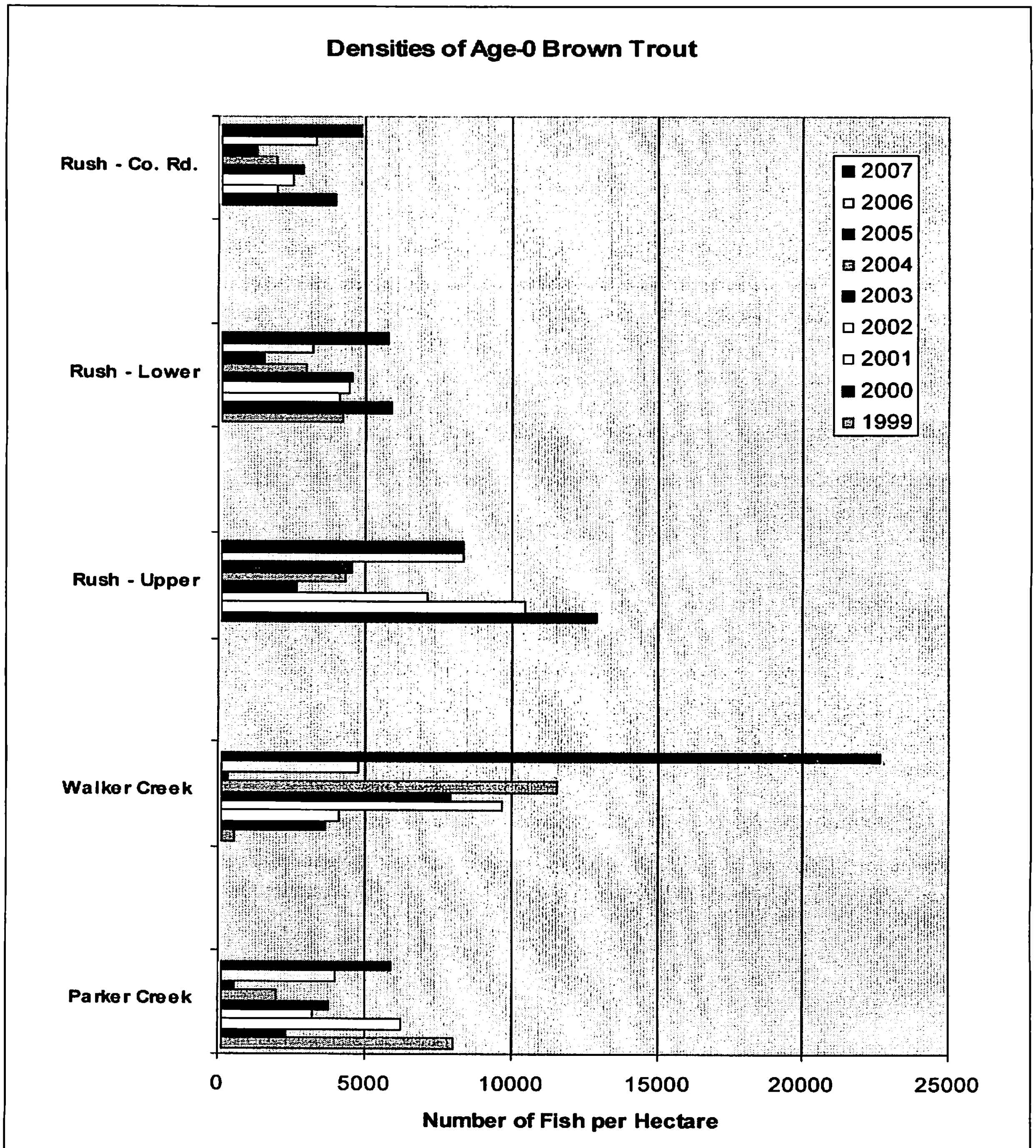


Figure 16. Estimated number of age-0 brown trout per hectare in sections of Rush, Walker and Parker creeks from 1999 to 2007.

Age-0 brown trout density estimates (number per hectare) in the Lee Vining Creek main channel sections had not been made since 2004 because of insufficient numbers of fish sampled in 2005 and too high of flows to permit sampling in 2006. In 2007, the Lower main channel section density estimate of 2,330 age-0 brown trout/ha was the second highest value ever recorded for this section (Figure 17). In 2007, the Upper main channel section density estimate was the highest value ever recorded for this section (Figure 17).

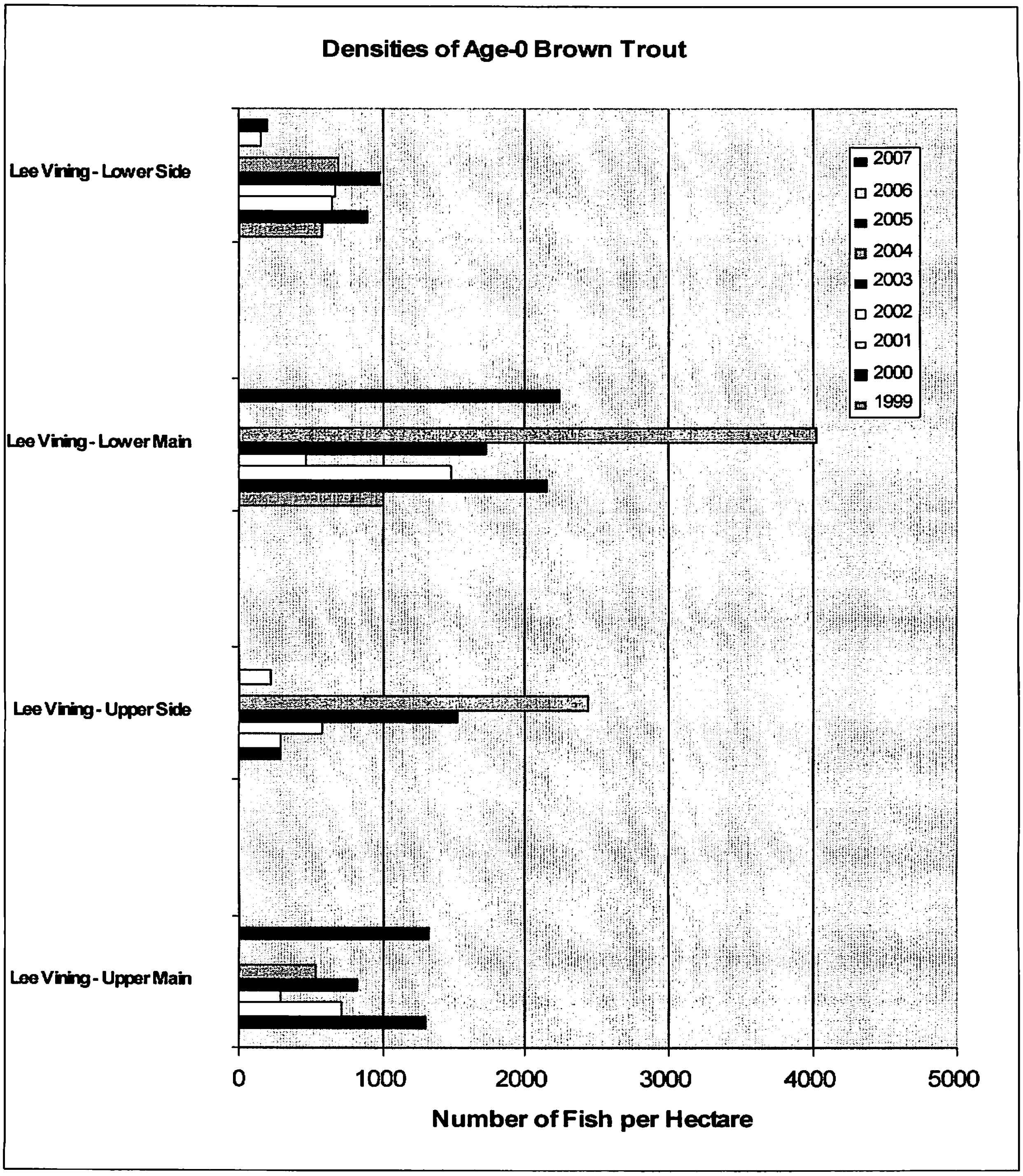


Figure 17. Estimated number of age-0 brown trout per hectare in sections of Lee Vining Creek from 1999 to 2007.

In Rush Creek, the Lower section was the only section where sufficient numbers of age-0 rainbow trout were captured to generate estimates. This section had an estimated 131 age-0 rainbow per hectare in 2007. In Lee Vining Creek, the Lower main channel section supported an estimated 1,200 age-0 rainbow trout per hectare, the Lower side channel supported an estimated 20.5 age-0 rainbow trout per hectare and the Upper main-channel section supported an estimated 1,429 age-0 rainbow trout per hectare.

Estimated Trout Densities Expressed in Numbers per Unit Length

For termination criteria purposes, trout density estimates were also calculated by number of fish per kilometer of stream channel. In the Rush Creek sections the numbers of fish per kilometer were estimated for brown trout only (Table 8). In the Lee Vining Creek sections the numbers of fish per kilometer were estimated for brown and rainbow trout combined (Table 9).

Table 8. Total number of brown trout per kilometer of stream channel for Rush Creek sample sections, 2000 - 2007. The value within (#) denotes the number of age-1 and older trout per kilometer.

Collection Location	2000 Total Number of Brown Trout per Km	2001 Total Number of Brown Trout per Km	2002 Total Number of Brown Trout per Km	2003 Total Number of Brown Trout per Km	2004 Total Number of Brown Trout per Km	2005 Total Number of Brown Trout per Km	2006 Total Number of Brown Trout per Km	2007 Total Number of Brown Trout per Km
Rush Ck - Co. Rd	3,804 (697)	2,467 (920)	2,620 (539)	3,136 (764)	2,095 (641)	1,712 (618)	3,242 (702)	5,011 (1,402)
Rush Ck - Lower	3,728 (563)	2,877 (704)	3,348 (296)	3,642 (578)	2,182 (212)	1,731 (716)	2,684 (637)	4,222 (669)
Rush Ck - Upper	11,326 (1,819)	8,544 (837)	6,137 (900)	2,740 (791)	3,881 (495)	5,032 (1,167)	7,905 (1,100)	8,698 (1,621)

Table 9. Total number of brown and rainbow trout per kilometer of stream channel for Lee Vining Creek sample sections, 2000 – 2007. The value within (#) denotes the number of age-1 and older trout per kilometer.

Collection Location	2000 Total Number of Brown and Rainbow Trout per Km	2001 Total Number of Brown and Rainbow Trout per Km	2002 Total Number of Brown and Rainbow Trout per Km	2003 Total Number of Brown and Rainbow Trout per Km	2004 Total Number of Brown and Rainbow Trout per Km	2005 Total Number of Brown and Rainbow Trout per Km	2006 Total Number of Brown and Rainbow Trout per Km	2007 Total Number of Brown and Rainbow Trout per Km
LV Upper – Main Channel	1,055 (306)	745 (333)	531 (364)	706 (227)	724 (415)	318 (318)	NS	1,815 (94)
LV Upper - Side Channel	308 (189)	308 (189)	612 (368)	886 (254)	1,513 (493)	60 (60)	NS	NS
LV Upper Section Averaged	682 (248)	527 (261)	572 (366)	796 (241)	1,119 (908)	189 (189)	-	1,815 (94)
LV Lower – Main Channel	1,343 (316)	1,203 (497)	871 (645)	1,142 (316)	2,484 (555)	871 (871)	NS	2,057 (103)
LV Lower – Side Channel	504 (65)	492 (168)	523 (200)	559 (87)	467 (139)	108 (108)	-	112 (61)
LV Lower Section Averaged	924 (191)	848 (333)	697 (423)	851 (202)	1,476 (347)	490 (490)	-	1,085 (82)

Estimated Trout Standing Crop Comparisons

In Rush Creek, brown trout standing crop estimates decreased from 2006 to 2007 in the Lower and Upper study sections and increased in the County Road section (Table 10 and Figure18). The County Road section experienced a 13.3% increase in standing crop from 2006 to 2007, due mainly to the increased population estimate of brown trout in the 125-199 mm size class (Table 10). The 2007 value of 120.9 kg/ha was the highest standing crop estimate for the County Road section over the past eight years (Figure 18). The Lower Rush Creek section experienced a nearly 21% drop in standing crop from 2006 to 2007, due mainly to a 42% decrease in the population estimate of brown trout in the >200 mm size class (Table 10).

Walker Creek experienced a second straight year of increased brown trout standing crop estimates with an increase of 16% from 2006 to 2007 (Table 10). Parker Creek experienced a third straight year of increased brown trout standing crop with an increase of 4.3% from 2006 to 2007 (Table 10).

Because of high stream flows, the main channel study sections on Lee Vining Creek were not sampled in 2006. The high spring run-off in 2006 probably had a negative impact on age-0 recruitment of both brown and rainbow trout which is reflected in the decreases of standing crop estimates between 2005 and 2007 in the main channel sections. The Lee Vining Creek Lower section experienced a 65.2% drop in total standing crop from 2005 to 2007 (Table 11). The Upper section experienced a 10.7% drop in total standing crop from 2005 to 2006 (Table 11). The Lee Vining Creek Lower side channel's standing crop estimate increased by 9.3% from 2006 to 2007 (Table 11). For the past two years, rainbow trout have comprised more than 50% of the Lower side channel's estimated standing crop (Figure 18).

Total standing crops (all age classes and species combined) have been estimated since 1999 to determine potential trends (Figure 18). Total standing crop takes into account the total biomass of fish per unit area, not necessarily the age-class structure of the trout populations. In Rush Creek, where brown trout have dominated the fish community, the County Road section's standing crop remained fairly constant from 2000 through 2005, with two straight seasons of increased production in 2006 and 2007 (Figure 18). In the Rush Creek Lower and Upper sections, standing crop estimates generally declined from 2000 to 2004, followed by increased values for the past three seasons (Figure 18). In Parker and Walker creeks, standing crop estimates have generally increased since annual sampling started in 1999 (Figure 18). In Lee Vining Creek, standing crop estimates have been most variable in regards to contributions of rainbow trout biomass (Figure 18). Variability in naturally reproducing trout populations is common. During an 18 year-long study of an unexploited brown trout population in a relatively pristine Pennsylvania watershed, Carline (2006) found that numbers of brown trout 150-225 mm in length, as well as fish greater than 225 mm in length, varied about five-fold, primarily due to differences in annual stream discharge amounts and patterns, along with other natural (non-human influenced) variables.

Table 10. Comparison of 2005-2007 brown trout standing crop (kg/ha) estimates in Rush Creek study sections.

Collection Location	2006 Total Standing Crop (kg/ha)	2007 Total Standing Crop (kg/ha)	Percent Change Between 2006 and 2007
Rush Creek - County Road	106.7	120.9	+13.3%
Rush Creek – Lower	138.4	109.9	-20.6%
Rush Creek – Upper	167.5	162.5	-3.0%
Walker Creek	331.0	384.0	+16.0%
Parker Creek	94.9	99.0	+4.3%

Table 11. Comparison of 2005-2007 total (brown and rainbow trout) standing crop (kg/ha) estimates in Lee Vining Creek study sections.

Collection Location	2005 Total Standing Crop (kg/ha)	2006 Total Standing Crop (kg/ha)	2007 Total Standing Crop (kg/ha)	Percent Change Between Last Two Sampled Years
Lee Vining Creek - Lower Main	187.5	**NP**	65.3	-65.2%
Lee Vining Creek - Lower Side	29.3	24.7	27.0	+9.3%
Lee Vining Creek - Upper Main	89.8	**NP**	80.2	-10.7%

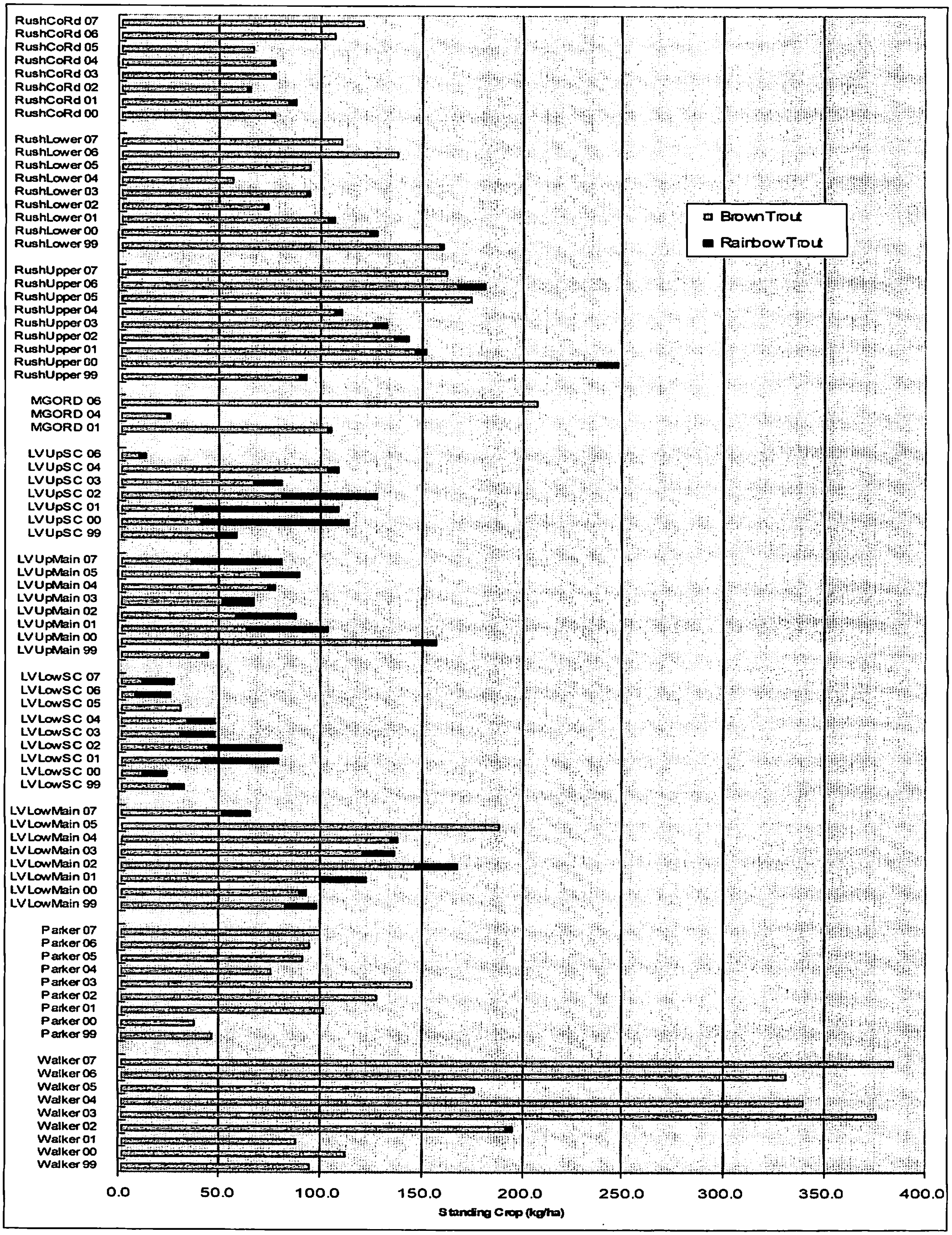


Figure 18. Estimated total standing crop (kilograms per hectare) of brown trout and rainbow trout in all sample sections, 1999 – 2007.

Relative Stock Density (RSD) Results for Rush and Lee Vining Creeks

RSD-225 values for brown trout in all Rush Creek sample sections decreased between 2006 and 2007, especially in the County Road and Lower sections where decreases were more than 50% (Table 12). This drop in RSD-225 values during a low run-off year appears consistent with the relatively low RSD-225 values recorded between 2000 and 2003 in Rush Creek. Conversely in 2004-2006, which were years with relatively high stream run-off volumes, RSD-225 values were typically greater than 30.

RSD-300 values remained low in Rush Creek, with no change between 2006 and 2007 in the Upper section and a decrease from 3 to 1 between 2006 and 2007 in the Lower section (Table 12). The Rush Creek County Road section has had an RSD-300 value of 0 since 2002 (Table 12).

The RSD-225 and RSD-300 values in the MGORD section of Rush Creek dropped between 2006 and 2007 however remain much higher than any of the other sample sections (Table 12). The RSD-375 value of 4 in 2007 was the same as in 2006 (Table 12). For the Termination Criteria Recommendations document, a preliminary comparison of the MGORD's RSD-300 and RSD-375 values with other eastern Sierra streams has shown that this Rush Creek section is capable of supporting a catch-and-release fishery for trophy-sized wild brown trout on par with the Upper Owens River and Hot Creek (Hunter 2007).

In both Lee Vining Creek sections, the RSD-225 values in 2007 were less than the values computed in 2005, the last time these sections were fully sampled (Table 13). In 2007, the Lower Lee Vining Creek section had a RSD-300 value of 0 for the first time in seven sampled years (Table 13). Conversely, the Upper section had a RSD-300 of 7, the highest RSD-300 value recorded in Lee Vining Creek over seven sampled years (Table 13).

Table 12. RSD values for brown trout in Rush Creek study sections, for 2000-2007.

Sampling Location	Sample Year	Number of Fish ≥150 mm	Number of Fish ≥150-224 mm	Number of Fish 225-299 mm	Number of Fish 300-374 mm	Number of Fish ≥375 mm	RSD-225	RSD-300	RSD-375
Rush Ck – Co Rd	2007	591	518	73	0	0	12	0	
Rush Ck – Co Rd	2006	264	189	75	0	0	28	0	
Rush Ck – Co Rd	2005	206	175	29	0	0	14	0	
Rush Ck – Co Rd	2004	407	358	49	0	0	12	0	
Rush Ck – Co Rd	2003	447	383	63	1	0	14	0	
Rush Ck – Co Rd	2002	302	269	32	1	0	11	0	
Rush Ck – Co Rd	2001	421	380	38	3	0	10	1	
Rush Ck – Co Rd	2000	319	276	43	0	0	13	0	
Rush Ck – Lower	2007	205	163	39	3	0	20	1	
Rush Ck – Lower	2006	152	85	63	4	0	44	3	
Rush Ck – Lower	2005	140	123	17	0	0	12	0	
Rush Ck – Lower	2004	79	54	24	1	0	32	1	
Rush Ck – Lower	2003	209	185	24	0	0	11	0	
Rush Ck – Lower	2002	107	87	20	0	0	19	0	
Rush Ck – Lower	2001	199	189	10	0	0	5	0	
Rush Ck – Lower	2000	165	147	18	0	0	11	0	
Rush Ck – Upper	2007	282	210	61	9	2	26	4	
Rush Ck – Upper	2006	231	154	67	10	0	33	4	
Rush Ck – Upper	2005	202	141	54	5	2	30	3	
Rush Ck – Upper	2004	179	115	57	2	1	34	2	
Rush Ck – Upper	2003	263	217	44	2	0	17	1	
Rush Ck – Upper	2002	217	176	37	2	2	19	2	
Rush Ck – Upper	2001	221	188	27	6	0	15	3	
Rush Ck – Upper	2000	178	156	20	2	0	12	1	
Rush Ck - MGORD	2007	621	144	191	259	27	77	46	4
Rush Ck - MGORD	2006	567	77	186	279	25	86	54	4
Rush Ck - MGORD	2004	424	144	184	65	31	66	23	7
Rush Ck - MGORD	2001	744	374	202	126	99	55	30	13

Table 13. RSD values for brown and rainbow trout in Lee Vining Creek study sections, for 2000-2007.

Sampling Location	Sample Year	Number of Fish ≥150 mm	Number of Fish ≥150-224 mm	Number of Fish 225-299 mm	Number of Fish 300-374 mm	Number of Fish ≥375 mm	RSD-225	RSD-300
Lee Vining Ck - Lower	2007	29	21	8	0	0	28	0
Lee Vining Ck – Lower	2006	NS	NS	NS	NS	NS	-	-
Lee Vining Ck – Lower	2005	74	46	27	1	0	38	1
Lee Vining Ck – Lower	2004	95	84	9	2	0	12	2
Lee Vining Ck – Lower	2003	60	34	25	1	0	43	2
Lee Vining Ck – Lower	2002	167	126	38	3	0	25	2
Lee Vining Ck – Lower	2001	109	90	16	3	0	17	3
Lee Vining Ck – Lower	2000	55	35	19	1	0	36	2
Lee Vining Ck - Upper	2007	62	40	18	3	1	35	7
Lee Vining Ck - Upper	2006	NS	NS	NS	NS	NS	-	-
Lee Vining Ck - Upper	2005	81	42	39	0	0	48	0
Lee Vining Ck - Upper	2004	193	157	35	1	0	19	1
Lee Vining Ck - Upper	2003	110	76	34	0	0	31	0
Lee Vining Ck - Upper	2002	224	167	57	0	0	25	0
Lee Vining Ck - Upper	2001	117	97	19	1	0	17	1
Lee Vining Ck - Upper	2000	86	59	27	0	0	31	0

NS = not sampled due to high flow.

Termination Criteria Results

The following six tables summarize the termination criteria analyses of three-year running averages for the Rush Creek and Lee Vining Creek sample sections (Tables 14-19). In Rush Creek, none of the annually sampled sections met the target of meeting four out of five termination criteria (Tables 14-16). The County Road and Upper sections met two of the five the termination criteria, whereas the Lower section failed to meet any of the termination criteria (Tables 14-16).

Table 14. Termination criteria analyses for the County Road section of Rush Creek.

Termination Criteria	**2007 – 2005 Average**	**2006 – 2004 Average**	**2005 – 2003 Average**
Biomass (≥175 kg/ha)	98.1	83.1	74.1
Density (≥3,000 fish/km	**3,321.7**	2,349.7	2,314.3
Condition Factor (≥1.00)	**1.00**	**1.02**	**1.01**
RSD-225 (≥35)	18	18	13
RSD-300 (≥5)	0	0	0
Conclusion	**Met two of five TC**	**Met one of five TC**	**Met one of five TC**

Table 15. Termination criteria analyses for the Lower section of Rush Creek.

Termination Criteria	**2007 – 2005 Average**	**2005 – 2003 Average**	**2004 – 2002 Average**
Biomass (≥175 kg/ha)	84.1	80.9	73.4
Density (≥3,000 fish/km	2,879.0	2.518.3	**3,057.3**
Condition Factor (≥1.00)	0.99	**1.00**	**1.00**
RSD-225 (≥35)	25	18	21
RSD-300 (≥30)	1	1	0
Conclusion	**Failed to meet any TC**	**Met one of four TC**	**Met two of four TC**

Table 16. Termination criteria analyses for the Upper section of Rush Creek.

Termination Criteria	2007 – 2005 Average	2006 – 2004 Average	2005 – 2003 Average
Biomass (≥175 kg/ha)	168.1	149.4	135.1
Density (≥3,000 fish/km	**7,211.7**	**5,606.0**	**3,884.3**
Condition Factor (≥1.00)	**1.01**	**1.02**	**1.02**
RSD-225 (≥35)	30	32	27
RSD-300 (≥5)	4	2	2
Conclusion	**Met two of five TC**	**Met two of five TC**	**Met two of five TC**

Because the Lee Vining Creek main channel sections were not sampled in 2006, the most recent three-year running average was comprised of data collected in 2007, 2005 and 2004. In Lee Creek, neither of the sections met the target of meeting three out of four termination criteria (Tables 17 and 18). The Lower section met two of the five termination criteria (biomass and condition factor) and the Upper section met two of the five termination criteria (condition factor and RSD-225) (Tables 17 and 18).

The MGORD section of Rush Creek met all three RSD termination criteria for the three most recent years that data were available (Table 19). The RSD-375 value is right at the cut-off point of failing to meet termination criteria due to two low (less than 5) values recorded in 2007 and 2006 (Table 19).

Table 17. Termination criteria analyses for the Lower section of Lee Vining Creek.

Termination Criteria	2007/2005/2004 Average	2005 – 2003 Average	2004 – 2002 Average
Biomass (≥150 kg/ha)	**157.1**	**173.9**	**169.2**
Density (≥1,400 fish/km	1,017.0	939.0	1,008.0
Condition Factor (≥1.00)	**1.08**	**1.08**	**1.07**
RSD-225 (≥30)	26	**31**	**33**
Conclusion	**Met two of four TC**	**Met three of four TC**	**Met three of four TC**

Table 18. Termination criteria analyses for the Upper section of Lee Vining Creek.

Termination Criteria	2007 – 2005 Average	2005 – 2003 Average	2004 – 2002 Average
Biomass (≥150 kg/ha)	122.7	144.7	144.7
Density (≥1,400 fish/km	1,041.0	701.3	829.0
Condition Factor (≥1.00)	**1.09**	**1.07**	**1.08**
RSD-225 (≥30)	**34**	**33**	25
Conclusion	**Met two of four TC**	**Met two of four TC**	**Met one of four TC**

Table 19. Termination criteria analyses for the MGORD section of Rush Creek.

Termination Criteria	2007/2006/2004 Average	2006/2004/2001 Average
RSD-225 (≥60)	76	69
RSD-300 (≥30)	41	36
RSD-375 (≥5)	5	8
Conclusion	**Met TC for all three RSD values**	**Met TC for all three RSD values**

Discussion

Methods Evaluation

Mark-recapture electro-fishing has provided relatively reliable estimates and having a field technician dedicated to maintaining block fences reduced the frequency of block fence failures in 2003-2007 compared to previous years, and is probably providing better estimates. During the 2007 field season there was one block fence failure (over-night) of the lower block fence on the County Road section of Rush Creek.

There were no major changes to the stream channel within the annual sample sections, as would be expected during a dry run-off year with no large peaks in hydrographs. However; continued subtle changes were observed in lower Rush Creek, especially in the County Road section and the upper end of the Lower section. While these channel changes were expected because of the changes in the flow regime, Mono Lake levels and maturing riparian vegetation; they make sampling challenging and we have proposed to LADWP reducing the number of sampling sections in Rush and Lee Vining creeks. Starting in 2008, the fisheries stream scientist (Chris Hunter) has recommended that the Lower Rush Creek section is dropped due to the unstable nature of the upper end of this section. Hunter has also recommended abandoning the Upper Lee Vining Creek sections (main-channel and side-channel) and increasing the length of the Lower main-channel section in a downstream direction approximately 75 meters to the confluence of the main-channel and the side-channel study sections.

The changing channel configurations within sample sections could change the amount of habitat sampled, especially if the creek were to abandon its current main channel and occupy a completely new channel. While the recent changes have probably not yet been significant enough to render annual comparisons invalid, it is possible that future channel changes following major high-flow events may be significant enough to make annual comparisons difficult. The upstream and downstream boundaries of all sample sections have been permanently marked. Regardless of noticeable channel changes, channel lengths and widths are re-measured annually.

The clipping of age-0 trout for tracking empirical growth has provided data by recapturing marked fish to estimate annual growth. However, altering methods for marking age-0 fish should be considered and a change made for the 2008 sampling period. As previously mentioned, the adipose fin is the only fin clip that is reliably recognized in subsequent years, however it is not feasible to use this clip annually because of problems distinguishing older trout (age-2 and older) due to potentially varying growth rates.

In the 2006 Fisheries Monitoring Report the use of passive integrated tags (PIT tags) in conjunction with adipose fin clips was suggested as another means to track growth. The advantage of injecting PIT tags into age-0 fish would be that when these fish are re-captured, individuals could be identified and the growth for specific fish determined. PIT tags also have indefinite life (no batteries), are relatively inexpensive, are easily applied, are well retained and can be implanted in juvenile salmonids as small as 60 mm in length (Gries and Letcher 2002; Zydlewski et al. 2003). Pit-tagged fish would also provide additional information on movement, depending on location of re-capture, as well as allow the opportunity of installing receiving stations at critical locations along Rush Creek (i.e. lower end of the MGORD).

Because 2007 was a dry run-off year there were no safety issues in wading and sampling the Rush Creek and Lee Vining Creek sections. However, to avoid potential problems caused by last-minute requests in reducing flows to safely sample during high run-off years, the Fisheries Stream Scientist recommends that maximum flow criteria are set for both creeks in September to ensure that electro-fishing sampling is safe and efficient. We recommend that flows in Rush and Lee Vining creeks not exceed 40 c.f.s. (± 5 c.f.s.) during the annual sampling period (two week-period of September starting the Wednesday after Labor Day holiday).