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PROJECT I. SURVEYS AND INVENTORIES
Job a. Upper Snake Region Mountain Lakes Investigations
Job b. Upper Snake Region Lowland Lakes Investigations
Job c. Upper Snake Region Rivers and Streams Investigations
PROJECT II. TECHNICAL GUIDANCE
PROJECT III. HABITAT MANAGEMENT
PROJECT IV. LAKE RENOVATIONS

By

Dan Garren, Regional Fishery Biologist
William C. Schrader, Senior Fishery Research Biologist
Damon Keen, Assistant Fish Hatchery Manager
Jim Fredericks, Regional Fishery Manager

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2003 ANNUAL PERFORMANCE REPORT

State of:	Idaho	Program:	Fisheries Management F-71-R-28
Project:	I-Surveys and Inventories	Subproject:	I-G Upper Snake Region
Job No.:	a	Title:	Mountain Lakes Investigations

ABSTRACT

We surveyed seventeen mountain lakes throughout the Upper Snake River region during 2003 to assess the fisheries and evaluate current stocking rates. Eleven of the seventeen lakes sampled (Airplane, Arrowhead, Betty, Big Fall Creek, Boulder, Boulder # 2, Goat, Kane, North Fork Bellas, Washington and Wildhorse Lake #8) meet our management objective of catching one fish per hour or better. Four of the remaining lakes (Boulder Lake # 1 and Wildhorse Lakes 5, 6 and 7) did not meet objective and are not stocked by the Idaho Department of Fish and Game (Department). The remaining two lakes (Bellas Lake # 1 and Baptie Lake) do not meet our objective, and would benefit from an increase in stocking numbers. Most lakes meeting our objective do so with supplemental stockings; only one lake (North Fork Bellas Lake) met our catch rate objective with natural reproduction. We recommend maintaining current stocking levels in nine lakes, and increasing stocking levels in two lakes. Two lakes can be removed from the stocking rotation. We do not recommend stocking the four fishless lakes surveyed.

Authors:

Dan Garren
Regional Fishery Biologist

Jim Fredericks
Regional Fishery Manager

INTRODUCTION

Fishing is a popular attraction at many of the mountain lakes in the Upper Snake River Region of Idaho. However, current data pertinent to gauging the success and management of these fisheries is limited. Prior to the 2002 sampling season, we met with the Salmon/Challis United States Forest Service (USFS) fisheries biologist and added to the standard methodology used by the Department in sampling mountain lakes. Goals were established by both agencies cooperatively for mountain lakes sampling, and include the following:

1. Maximize the effective use of hatchery introductions
2. Manage for a diversity of species within given drainages
3. Maintain catch rates of one fish per hour or better
4. Maintain some lakes as fishless for native aquatic species
5. Coordinate management activities with appropriate state and federal agencies.

OBJECTIVE

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

METHODS

Sampling methodology largely followed the standard Department mountain lakes protocol. In addition, the timing of surveys was scheduled to correspond to the third year following stocking and prior to the current year's stocking. This provides the best opportunity to determine if natural reproduction is occurring by analyzing length frequencies and visually observing fish. If recruitment were strictly dependent on stocking, only one or possibly two size classes of fish should be present. We gathered catch rate information by fishing and interviewing anglers during our surveys to assess our catch rate goal of at least one fish per hour. Where appropriate, we also incorporated gill nets to obtain size classes and fish species that may not have been sampled with other methods. Amphibian presence/absence data was collected by walking shoreline areas and recording species encountered.

RESULTS AND DISCUSSION

Survey results indicate the management objective of one fish per hour is being met on Airplane Lake, Arrowhead Lake, Betty Lake, Big Fall Creek Lake, Boulder Lake, Boulder Lake #2, Goat Lake, Kane Canyon Lake, North Fork Bellas Lake, Washington Lake and Wildhorse Lake #8 (Appendix A). The catch rate objective is not being met on Baptie Lake, Bellas Lake #1, Boulder Lake #1 and Wildhorse Lakes # 5, 6 and 7 (Appendix A). Natural reproduction was

found in Bellas Lake #1, Boulder Lake #2, Kane Canyon Lake, North Fork Bellas Lake and Washington Lake, and to a lesser extent in Airplane Lake (Appendix A). One possible unintentional stocking occurred in Wildhorse Lake #8, which is not on the Department stocking list. Sampling revealed one year-class of golden trout, which have been stocked in an adjacent lake in the past. We believe volunteers unintentionally stocked the wrong lake. Amphibian populations were only found in Boulder Lake #1.

RECOMMENDATIONS

1. Maintain current stocking rates in Airplane Lake, Arrowhead Lake, Betty Lake, Big Fall Creek Lake, Boulder Lake, Boulder Lake #2, Goat Lake, Kane Canyon Lake.

2. Evaluate natural reproduction and angler use in Kane Canyon Lake to assess the potential for removing from the stocking list. Reproduction is occurring, but may not be sufficient to maintain a quality fishery in the presence of significant angler use.

3. Stop stocking grayling in North Fork Bellas Lake. Several years of stocking have not created a fishery. Cutthroat trout are naturally reproducing, and providing a quality fishery.

4. Stop stocking Washington Lake. Natural reproduction is occurring, and angler use is low. Evaluate in 2006 and adjust management as necessary.

5. Continue to stock Wildhorse Lake #8 on a three-year rotation with golden trout, or as these fish become available.

6. Increase stocking rate in Baptie Lake from 1,500 grayling to 2,500 grayling. The moderate access and desirable location could provide a quality fishery if catch rates improve.

7. Stop stocking cutthroat trout in Bellas Lake # 1, and stock 1,500 golden trout as they become available. Evaluate the fishery and catch rates after these fish become established.

8. Maintain Wildhorse Lakes # 5, 6 and 7 and Boulder Lake #1 as fishless. Care should be used when stocking Boulder Lake #2 to ensure fish are not added to Boulder Lake #1 by accident.

Appendix A. Mountain lake report summaries.

Airplane Lake

Location: 11 07 31 361 E 48 49 070 N

Airplane Lake is located in the headwaters of Wildhorse Creek in the Big Lost River drainage near Mackay Idaho. The lake measures 850 m in circumference (4.4 ha), and sits at an elevation of 3,092 meters. Conductivity measured 20.5 μS/cm, with a gravel/boulder/bedrock substrate. Surrounding habitat is mainly boulders and rock, with some open meadow and brush nearby. There was no trail to or around the shoreline, very little litter and no fire rings. As a result, we believe only a handful of anglers visit annually. There were two inlets and one outlet that provided approximately 27 m^2 of potential spawning habitat at the time of sampling. Access is difficult, and consists of several km of two-track four-wheel drive trail up Wildhorse Creek, followed by a two km hike on a maintained trail and three km of trailblazing.

On July 21, 2003, we surveyed the fishery and physical characteristics of Airplane Lake. The fishery survey consisted of an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations. Gill nets captured a mix of rainbow trout (one fish), golden trout (six fish), cutthroat trout (one fish) and cutthroat x rainbow trout hybrids (one fish, Figure 1). We fished for four hours, and caught six golden trout and one cutthroat trout. We also observed numerous trout in the 200 - 500 mm range. No amphibians were observed during our shoreline survey.

Our survey indicates Airplane Lake meets the fishery objective of one fish per hour (actual catch rate 1.8 fish/h). Although access is difficult, we observed several anglers leaving the area, which shows the fishery is used. Our length frequency information combined with the presence of some spawning habitat suggests natural reproduction occurs. However, we don't know if this reproduction could sustain our catch rate goals. Therefore, we recommend no change to our current management plans. Airplane Lake has been stocked with as many as 1,200 fingerling golden trout, although recent stockings have been 300 golden trout. This stocking rate should be continued as scheduled.

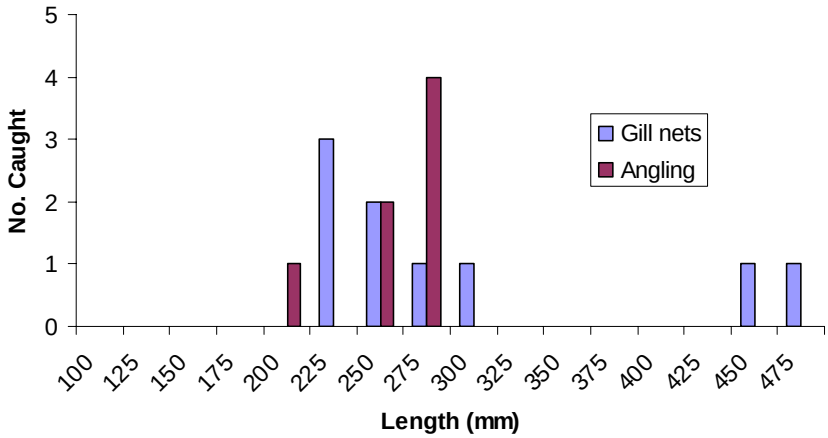

Figure 1. Length frequency for trout captured in Airplane Lake, Idaho during 2003 fisheries surveys.

Arrowhead Lake

Location: 11 07 34 030 E 48 47 397 N

Arrowhead Lake is located in the headwaters of Wildhorse Creek in the Big Lost River drainage near Mackay. The lake measures 834 m in circumference (2.9 ha), and sits at an elevation of 3,016 meters. Conductivity measured 35.7 μS/cm, with a boulder substrate. Surrounding habitat is mainly boulders and rock, with little open meadow and brush. No trail to or around the shoreline exists, but we saw two fire rings and a small amount of litter. There were no inlets and one outlet, and we found no suitable trout spawning habitat. Access is difficult, and consists of several km of two-track four-wheel drive trail up Wildhorse Creek, followed by a two km hike on a maintained trail followed by about three km of trailblazing.

On July 22, 2003, we surveyed the fishery and physical characteristics of Arrowhead Lake. The fishery survey was an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations. Gill nets captured a mix of rainbow trout (three fish) and cutthroat trout (three fish, Figure 1). We fished for five and a half hours and caught 11 cutthroat trout and one rainbow trout. We only saw five trout during our visual survey, all of which were approximately 300 mm. No amphibians were found during our shoreline survey.

Our survey indicates Arrowhead Lake meets the fishery objective of one fish per hour (actual catch rate 2.2 fish/h). Although access is difficult, evidence of human use exists, suggesting some angling effort. The lack of smaller fish in our survey combined with the lack of spawning habitat suggests no natural reproduction occurs. It is more likely that fish are surviving as much as six years or more post-stocking. We recommended no change to our current management plans of stocking 2,000 fingerling cutthroat trout every three years.

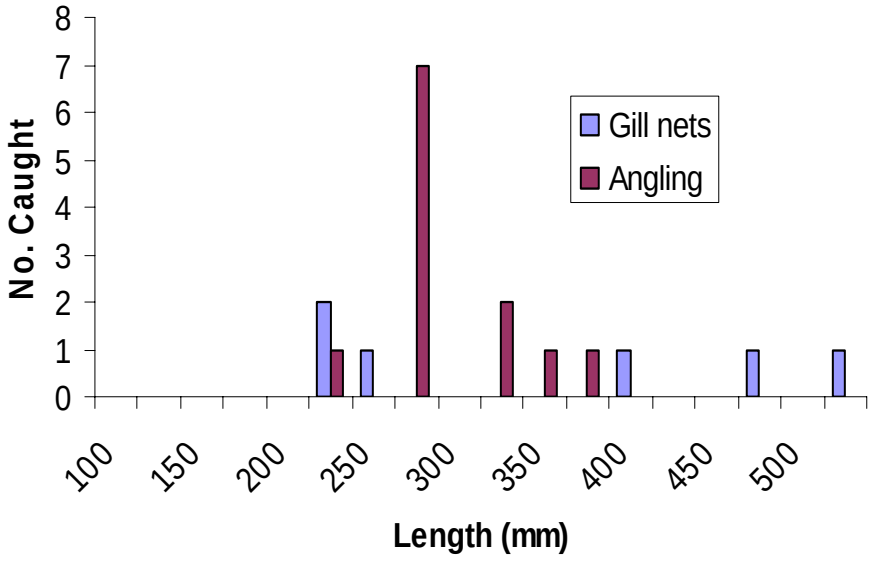

Figure 1. Length frequency of fish caught in Arrowhead Lake, Idaho in 2003 surveys.

Baptie Lake

Location: 11 07 40 297 E 48 51 162 N

Baptie Lake is located in the headwaters of Broad Canyon Creek in the Big Lost River drainage near Mackay, Idaho. The lake is 520 m in circumference (1.7 ha), and sits at an elevation of 3,090 meters. Conductivity measured 54 μS/cm, with a sand and gravel substrate. The surrounding habitat is mainly coniferous forest and rocky scree. Access is moderately difficult, and consists of a one km drive up a gravel road up Broad Canyon, followed by a six km hike on a maintained trail with an elevation gain of about 610 meters followed by 1/2 km of rougher trail.

On August 6, 2003, we surveyed the fishery and physical characteristics of Baptie Lake. The fishery survey was an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations. Gill nets captured both arctic grayling (five fish) and cutthroat trout (one fish, Figure 1). We fished for two and a half hours, and caught one fish. We also saw several unidentified fish rising. No amphibians were found during the shoreline survey.

Our survey shows Baptie Lake falls below the fishery objectives of catching one fish per hour (actual catch rate 0.4 fish/h). The lack of smaller fish in the survey suggests that successful natural reproduction does not occur even though we observed fish eggs along the shoreline. Therefore, we recommend stocking continue on a three-year rotation, but at elevated stocking levels or perhaps with an experimental stocking of golden trout. Baptie Lake has been stocked with as many as 1,500 grayling fry. This stocking rate should be increased to 2,500 grayling or 1,500 golden trout and planted as fry are available.

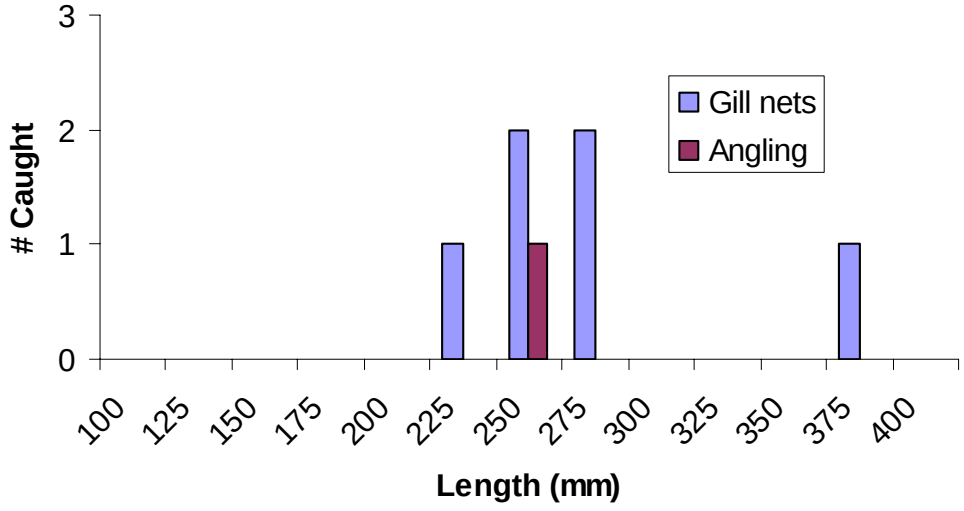

Figure 1. Length frequency of fish caught in Baptie Lake, Idaho in 2003 surveys.

Bellas Lake # 1

Location: 12 02 60 150 E 48 51 622 N

Bellas Lake #1 is located in the headwaters of Bellas Canyon in the Big Lost River drainage near Mackay Idaho. The lake is 514 m in circumference (1.7 ha), and sits at an elevation of 2,872 meters. The surrounding countryside is mainly coniferous forest. There is a partial trail around the shoreline, four campfire rings, and a moderate amount of litter suggesting moderate to high use. We found three inlets and one outlet that provided approximately 70 m^2 of trout spawning habitat. Access is easy, and consists of approximately four km of good trail originating at the Bellas Canyon Recreation Site off the Copper Basin Loop road.

On August 11, 2003, we surveyed the fishery and physical characteristics of Bellas Lake #1. The fishery survey was an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations. We captured three hybrid trout in our gill net (Figure 1). We caught no fish in two and a half hours of fishing. We did see several unidentified fish along the shoreline, as well as fry in the inlets and outlet. No amphibians were observed during our shoreline survey.

Our survey indicates Bellas Lake #1 is not meeting our catch rate objective of one fish per hour (actual catch rate 0 fish/h). Access is easy, and anglers are using the area. Our fry observations indicate natural reproduction occurs, although recruitment to the fishery is questionable. Length frequency information suggests that our stockings primarily support the fishery. Therefore, we recommended that stocking continue on a three-year rotation, with an additional evaluation of catch rates.

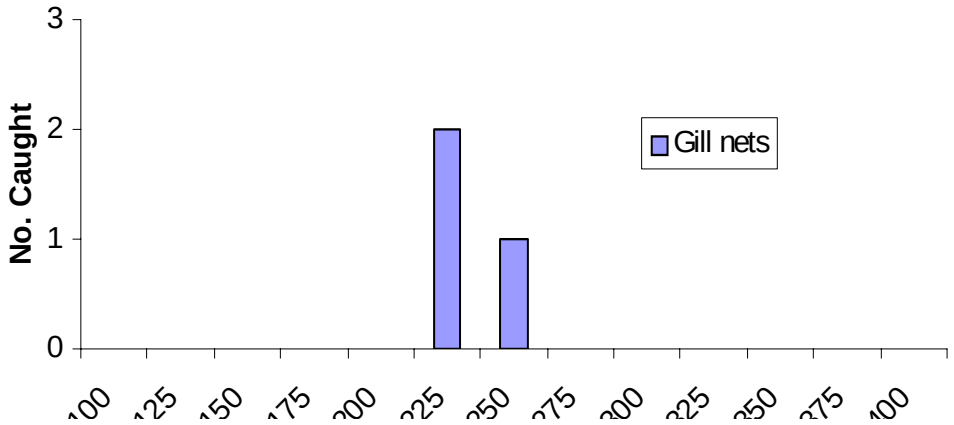

Figure 1. Length frequency of fish caught in Bellas Lake #1 during 2003 surveys.

Betty Lake

Location: 11 07 40 461 E 48 52 310 N

Betty Lake is located in the headwaters of Broad Canyon in the Big Lost River drainage near Mackay Idaho. The lake is approximately 1,000 m in circumference (7.2 ha), and sits at an elevation of 3,164 meters. Conductivity measured 35.0 μS/cm. Surrounding habitat is mainly rocky moraine with few trees. We found a limited trail around the shoreline, three campfire rings and a moderate amount of litter. We found no suitable trout spawning habitat in the inlet or outlet. Access is relatively easy, and consists of seven km of good trail originating at the Broad Canyon Recreation Site off the Copper Basin Loop road.

On August 5, 2003, we surveyed the fishery and physical characteristics of Betty Lake. Our fishery survey consisted of an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations of fish. Gill nets captured two cutthroat trout (Figure 1). We fished for five and a half hours and caught 37 cutthroat trout. We also saw numerous large (25-27 cm) cutthroat trout along the shoreline. No amphibians were observed during our shoreline survey.

Our results show Betty Lake is exceeding the fishery objectives of one fish per hour (actual catch rate 6.7 fish/h). With a little effort, anglers can easily access the lake. As a result, we believe angling effort is likely moderate. The lack of smaller fish encountered in the survey in combination with the lack of trout spawning habitat suggests natural reproduction is not occurring, and that only stocked fish are surviving. We recommend no changes to our current management plan of stocking 2,500 cutthroat trout on a three-year rotation.

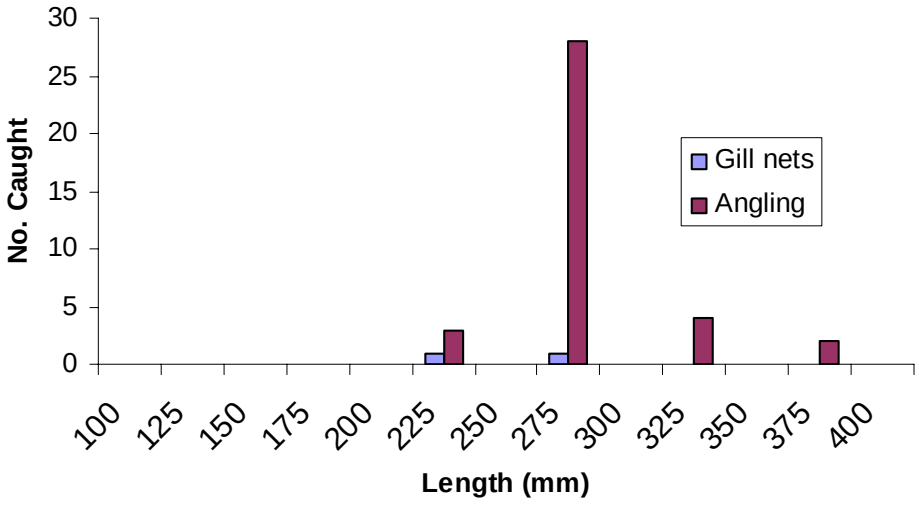

Figure 1. Length frequency distribution of fish captured in Betty Lake, Idaho during 2003 surveys.

Big Fall Creek Lake

Location: 11 07 21 241 E 48 61 312 N

Big Fall Creek Lake is located in the headwaters of Big Fall Creek in the Big Lost River drainage near Mackay Idaho. The lake is small, measuring 400 m in circumference (1.12 ha), with an elevation of 2,760 meters and a conductance of 45.3 μS/cm. The substrate was mainly silt and mud, while the surrounding habitat is mainly rocky moraine with few trees. A shoreline trail is present, and we observed four fire rings and moderate amounts of litter. There were no inlets or outlet, and we found no adequate trout spawning habitat. Access is easy, and consists of a one km hike on a good trail following a four km drive on a dirt road up Big Fall Creek off of the Trail Creek road.

On July 23, 2003, we surveyed the fishery and physical characteristics of Big Fall Creek Lake. The fishery survey consisted of an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations of fish. Gill nets captured one cutthroat trout (Figure 1). We fished for four hours and caught seven cutthroat trout. We also saw numerous large (25-27 cm) cutthroat trout along the shoreline. No amphibians were found during the shoreline survey.

Our survey results show Big Fall Creek Lake is meeting the fishery objective of one fish per hour (actual catch rate 1.8 fish/h). Access is easy, and angler effort is likely high. The relative size of fish in combination with the lack of trout spawning habitat suggests no natural reproduction, and that only stocked fish are surviving. Therefore, we recommend no changes to our current management plans. Big Fall Creek Lake is stocked with 1,500 Yellowstone cutthroat trout on a three-year rotation. This stocking rate should be maintained, as it appears to be providing an adequate fishery.

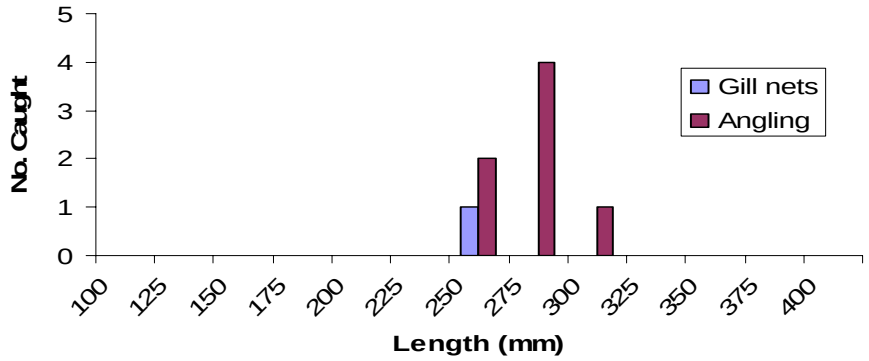

Figure 1. Length frequency distribution of fish captured in Big Fall Creek Lake, Idaho during 2003 surveys.

Boulder Lake # 1 and # 2

11 07 29 935 E	48 54 124 N	(#1)
11 07 29 568 E	48 53 682 N	(#2)

Boulder Lake # 1 is located in the headwaters of Boulder Creek in the Big Lost River drainage near Mackay Idaho. The lake measures 434 m in circumference (0.9 ha), and sits at 3,005 meters elevation. Shoreline habitat is a mix of rocky moraine and a few trees, while the substrate is mainly silt and mud with somewhat cloudy water. The lake is devoid of fish, in spite of an attempted stocking of golden trout in 1996. However, a robust population of long-toed salamanders exists. Both adults and juveniles were observed during the July 30th survey.

Boulder Lake # 2 is located in the same general vicinity of #1, and measures 317 m in circumference (0.7 ha) and has a conductivity of 26.0 μS/cm. On July 23, 2003, we surveyed the fishery and physical characteristics of Boulder Lake # 2. The fishery survey was an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations of fish. Gill nets captured one cutthroat trout and one golden trout (Figure 1). We fished for two hours, and caught 26 cutthroat trout. We also saw numerous large (25-30 cm) cutthroat trout along the shoreline. No amphibians were found during the shoreline survey.

Our survey shows Boulder Lake #1 meets our objective of providing a fishless area for amphibian habitat. The survey of Boulder Lake #2 indicates it exceeds our catch objective, with anglers catching about 13 fish per hour. Access is difficult, but we believe anglers are using this resource as evident from nearby campfire rings. The high density of fish encountered combined with a limited amount of spawning habitat suggests some natural reproduction. Boulder Lake #2 received 500 Yellowstone cutthroat trout starting in 2000. This stocking rate should be continued for another cycle, as it appears to be providing an adequate fishery, and to add a second year-class of cutthroat trout. However, if natural reproduction is successful in the coming years, it may not be necessary to continue stocking.

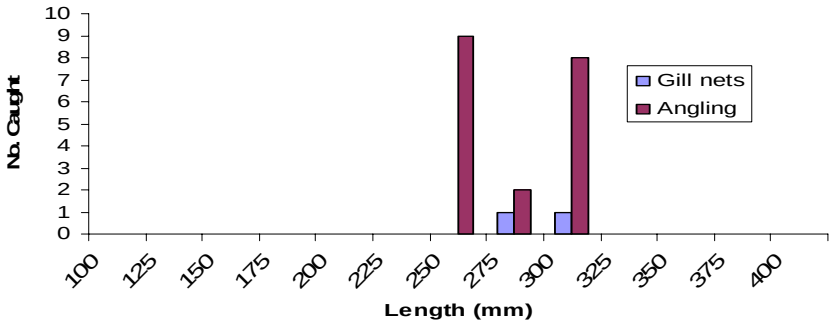

Figure 1. Length frequency distribution for fish caught in Boulder Lake #2 during 2003 surveys.

Boulder Lake

Location: 11 07 30 941 E 48 53 226 N

Boulder Lake is located at the headwaters of Boulder Creek in the Big Lost River drainage near Mackay Idaho. The lake measures 889 m in circumference (4.1 ha), at an elevation of 2,908 meters. Shoreline habitat is mainly rock and boulder, with some open meadow and brush. There is a well-defined trail to and around the shoreline as well as a small amount of litter and eight campfire rings. We believe angler effort is probably significant. We found one inlet and one outlet, but neither provided adequate trout spawning habitat at the time of sampling. Access is moderate, and consists of six km of moderately graded trail originating just below Wildhorse Campground on Wildhorse Creek.

On July 30, 2003, we surveyed the fishery and physical characteristics of Boulder Lake. The fishery survey consisted of an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations of fish. Gill nets captured four cutthroat trout (Figure 1) ranging in size from 240 to 280 mm. We fished for three hours and caught 14 cutthroat trout. No amphibians were found during our shoreline survey.

Our survey results show Boulder Lake is meeting the fishery objective of one fish per hour (actual catch rate 4.7 fish/h). The well-defined trail leading to Boulder Lake and other impacts from human use suggest angling effort is high. The lack of spawning habitat and uniform size of fish caught shows that natural reproduction does not occur. Therefore, we recommend no changes to our current management plans. Boulder Lake is stocked with 1,500 fingerling cutthroat trout every three years. This stocking rate should be continued as scheduled.

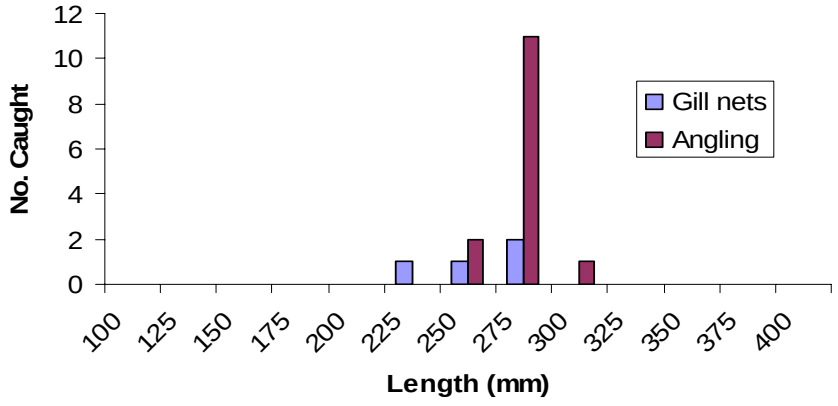

Figure 1. Length frequency distribution for fish captured in Boulder Lake, Idaho during 2003 surveys.

Goat Lake

Location: 11 07 39 846 E 48 51 399 N

Goat Lake is located in the headwaters of Broad Canyon in the Big Lost River drainage near Mackay Idaho. The lake measures 1,400 m in circumference (7.2 ha), and sits at an elevation of 3,182 meters with a conductivity of 57.0 μS/cm. The lake substrate is gravel, while shoreline habitat is mainly rocky moraine with few trees. We found a trail around the shoreline, and small amounts of litter. We found no inlets and only one outlet that provided no suitable trout spawning habitat. Access is difficult, and consists of approximately five km of good trail originating at the Broad Canyon Recreation Site off the Copper Basin Loop road followed by about two km of cross-country travel and a total elevation gain of 790 meters.

On August 6, 2003, we surveyed the fishery and physical characteristics of Goat Lake. The fishery survey consisted of an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations of fish. Gill nets captured six cutthroat trout (Figure 1). We fished for seven and a half hours and caught 18 cutthroat trout. We observed cutthroat trout in the 250 to 270 mm range along the shoreline. No amphibians were found during the shoreline survey.

The survey results show Goat Lake is meeting the fishery objective of one fish per hour (actual catch rate 2.3 fish/h). Access is difficult, but we believe anglers are using this resource. The lack of smaller fish in combination with the lack of spawning habitat suggests no natural reproduction occurs, and that only stocked fish are surviving. Therefore, we recommend no changes to the current management plans. Goat Lake receives 2,000 Yellowstone cutthroat trout on a three-year rotation. This stocking rate should be maintained, as it appears to be providing a quality fishery.

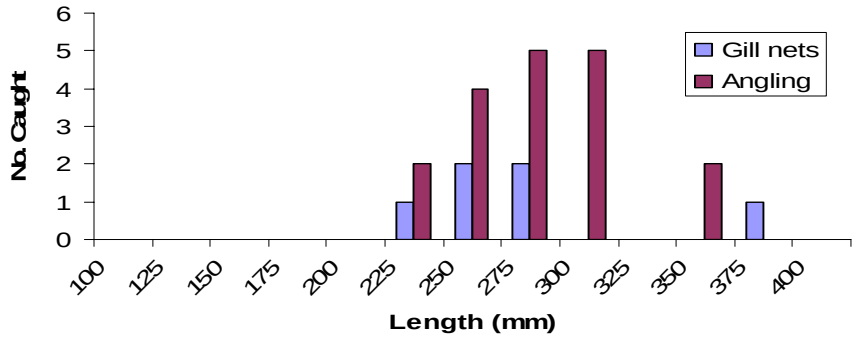

Figure 1. Length frequency distribution of fish captured in Goat Lake, Idaho during 2003 surveys.

Kane Canyon Lake

Location: 11 07 28 704 E 48 51 748 N

Kane Canyon Lake located in the headwaters of Kane Creek in the Big Lost River drainage near Mackay Idaho. The lake measures 1,100 m in circumference (5.3 ha), and sits at an elevation of 2,813 meters. We measured conductivity at 23.0 μS/cm, and found a sand/boulder substrate. Shoreline habitat is mainly rocky moraine with coniferous trees along the North shore. We found a trail around the shoreline, and five campfire rings. There were two inlets and two outlets that provided 220 m^2 of spawning habitat. Access is moderate along a good trail of approximately five km that starts at the end of the Kane Creek Road off the Trail Creek Road.

On July 22, 2003, we surveyed the fishery and physical characteristics of Kane Canyon Lake. The fishery survey consisted of an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations of fish. Gill nets captured five cutthroat trout (Figure 1). A total of six hours were spent angling, and resulted in 18 cutthroat trout being captured. We observed numerous (150-350 mm) cutthroat trout along the shoreline. No amphibians were found during the shoreline survey.

The survey indicated Kane Canyon Lake is meeting the fishery objective of one fish per hour (actual catch rate 3 fish/h). Because of the scenic quality of the area and moderate access, we expect angling effort is high. The presence of small fish and abundant spawning habitat suggest that natural reproduction is occurring. Cutthroat trout are typically stocked in Kane Canyon Lake but in 2003, rainbow trout were stocked as part of a research project. Due to the probable heavy angler use, we recommend continuing the stockings of 1,500 fish on a three-year rotation. However, if in the future it is determined this lake can sustain itself with natural reproduction, supplemental stocking may not be needed.

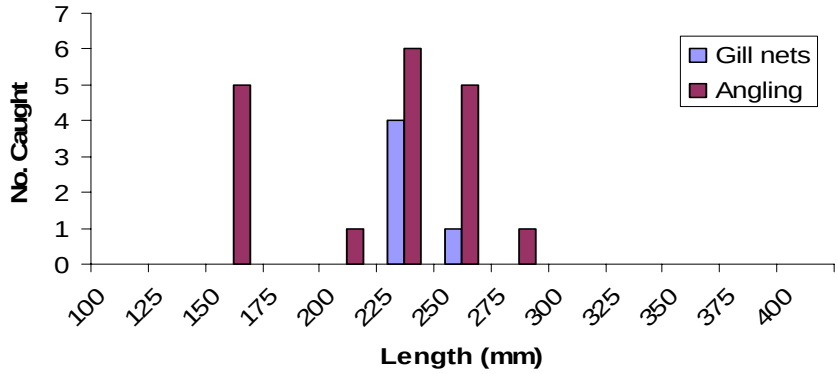

Figure 1. Length frequency distribution of fish caught in Kane Canyon Lake, Idaho during 2003 surveys.

North Fork Bellas Lake

Location: 12 02 59 733 E 48 52 399 N

North Fork Bellas Lake is located in the headwaters of Bellas Canyon in the Big Lost River drainage near Mackay Idaho. The lake measures 450 m in circumference (1.3 ha), and sits at an elevation of 3,011 meters. Shoreline habitat is a mix of rocky moraine and a few trees, with an incomplete trail around the shoreline. We found no litter, and only one campfire ring. We found one inlet and one outlet at the time of sampling, which provided approximately 50 m^2 of spawning habitat. Access is somewhat difficult, and consists of two km of good trail originating at the Bellas Canyon Recreation Site off the Copper Basin Loop road followed by about two and a half km of cross-country travel with a total elevation gain of 615 meters.

On August 11, 2003, we surveyed the fishery and physical characteristics of North Fork Bellas Lake. The fishery survey consisted of an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations of fish. Gill nets captured eight cutthroat trout (Figure 1). We fished for three hours 15 minutes and caught 13 cutthroat trout. We also observed numerous small (25-100 mm) fish in the outlet. No amphibians were found during the shoreline survey.

Our survey indicates North Fork Bellas Lake is meeting the fishery objective of one fish per hour (actual catch rate 4 fish/h). Evidence suggests that angling effort is low. The presence of smaller fish and suitable spawning habitat show natural reproduction is occurring. Further, cutthroat trout were the only fish encountered, and have not been stocked since 1989. Grayling have been stocked since 1990, but were not found, suggesting poor survival. Therefore, we recommend grayling stocking be discontinued in North Fork Bellas Lake. Natural reproduction is currently providing a quality fishery that meets management goals – no additional supplementation is necessary.

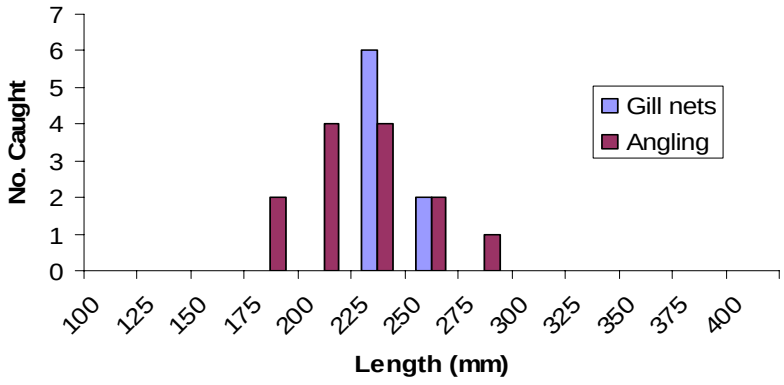

Figure 1. Length frequency distribution of fish caught in North Fork Bellas Lake during 2003 surveys.

Washington Lake

Location: 11 07 29 723 E 48 53 184 N

Washington Lake is located in the headwaters of Boulder Creek in the Big Lost River drainage near Mackay Idaho. The lake measures 657 m in circumference (1.34 ha), and sits at an elevation of 3,156 meters. We measured conductivity at 22.5 μS/cm, and found a silt/boulder substrate. Shoreline habitat is mainly rocky moraine. We found no trails to or around the shoreline, no litter and no campfire rings nearby. We found no inlets and one outlet at the time of sampling, which provided approximately 5 m^2 of potential spawning habitat. Access is difficult, and consists of four km of good trail originating near the Wildhorse Campground followed by two and a half km of cross-country travel with a total elevation gain of 1,046 meters.

On July 30, 2003, we surveyed the fishery and physical characteristics of Washington Lake. The fishery survey consisted of an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations of fish. Gill nets captured five rainbow trout and one cutthroat trout (Figure 1). We fished for three hours and caught 16 rainbow trout and two cutthroat trout. No amphibians were found during the shoreline survey.

The survey indicates Washington Lake is exceeding the fishery objective of one fish per hour (actual catch rate 6 fish/h). Access is difficult, and angling effort appears to be light. The wide range of sizes of fish combined with the existing spawning habitat suggests natural reproduction is occurring. Cutthroat trout have not been stocked since 1989, but are still present. We recommend the current stocking rate of 500 rainbow trout every three years be discontinued, and the lake surveyed again in 2006.

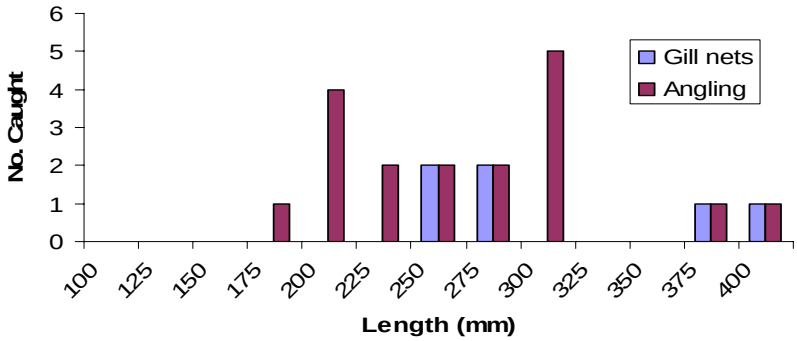

Figure 1. Length frequency distribution for fish captured in Washington Lake, Idaho during 2003 surveys.

Wildhorse Lakes # 5, 6 and 7

Location: 11 07 32 037 E 48 50 276 N

Wildhorse Lakes #5, 6 and 7 are located in the headwaters of Wildhorse Creek in the Big Lost River drainage near Mackay Idaho. The lakes are small and shallow, and connected to each other. Surrounding habitat is marshy forested land, with some rocky moraine along the western shore. We found no trail to or around the shoreline, and the inlets and outlets provide only marginal spawning habitat. Access is difficult, and consists of approximately two km of cross-country travel originating five km above the Wildhorse Campground off of Wildhorse Creek.

On July 22, 2003, we surveyed the physical characteristics and assessed the potential for developing fisheries in Wildhorse Lakes #5, 6 and 7. The fishery survey consisted of visual observations only. Gill nets were not set because of time constraints, and because the probability of observing fish if they were present was high due to the shallow nature of the lakes. We saw no fish in any of the three lakes sampled. No amphibians were found during our shoreline survey, either. Forage in the form of scuds, mayflies, caddis and stoneflies were present in at least one of the three lakes sampled, and may provide an adequate food base for either fish or amphibians.

The results of the preliminary surveys indicate Wildhorse Lakes #5, 6 and 7 do not meet our catch rate objective. Access is difficult, and we expect anglers are occasionally traveling through the drainage to reach Wildhorse Lake #8. While it is possible Wildhorse Lake # 6 is deep enough to sustain trout, current protocol for managing mountain lakes requires that some lakes in each drainage remain fishless to provide habitat for amphibians. We recommend these areas remain fishless.

Wildhorse Lake # 8

Location: 11 07 30 961 E 48 50 456 N

Wildhorse Lake #8 is located in the headwaters of Wildhorse Creek in the Big Lost River drainage near Mackay Idaho. The lake measures 555 m in circumference (1.4 ha), and sits at an elevation of 3,040 meters. Shoreline habitat is mainly rocky moraine. We found no trail to or around the shoreline, no litter and no campfire rings nearby. There were four inlets and one outlet, but no significant trout spawning habitat. Access is difficult, and consists of approximately three km of cross-country travel originating slightly below the Wildhorse Campground off of Wildhorse Creek.

On July 21, 2003, we surveyed the fishery and physical characteristics of Wildhorse Lake #8. The fishery survey consisted of an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling and visual observations. Gill nets captured six golden trout (Figure 1). We fished for three hours and caught nine more golden trout. We also saw several adult fish along the shoreline. No amphibians were found during the shoreline survey.

The survey indicates Wildhorse Lake #8 is meeting the fishery objective of one fish per hour (actual catch rate 3 fish/h). Access is difficult, and angler effort appears to be minimal. The uniform size of fish encountered and lack of spawning habitat suggests that natural reproduction doesn't occur. However, no stocking records exist, and the origin of these fish is questionable. We suspect volunteers used to stock high mountain lakes misidentified Wildhorse Lake # 8 for Airplane Lake, located in the adjacent drainage. Fish intended for Airplane Lake in 2001 were likely stocked in Wildhorse Lake # 8. We recommend Wildhorse Lake #8 be added to the stocking rotation, and be stocked on a three-year rotation with golden trout. A survey should be conducted again in 2006 to document the longevity of trout stocked in Wildhorse Lake # 8.

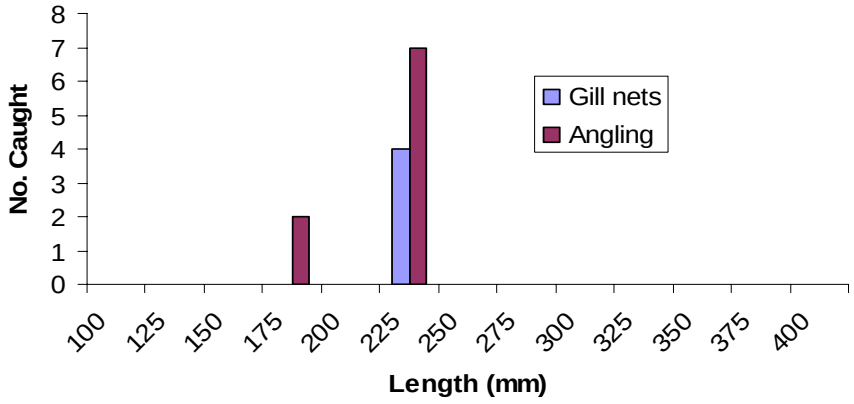

Figure 1. Length frequency distribution of fish captured in Wildhorse Lake #8, Idaho during 2003 surveys.

2003 ANNUAL PERFORMANCE REPORT

State of: Idaho Program: Fisheries Management F-73-R-28

Project :I-Surveys and Inventories Subproject: I-G Upper Snake Region

Job No. : b Title: Lowland Lake Investigations

ABSTRACT

We used seventeen standard experimental gillnets (nine sinking, eight floating) to assess fish populations and relative abundance in Henrys Lake during May 2003. We captured brook trout *Salvelinus fontinalis*, Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri*, hybrid trout (rainbow trout *O. mykiss* x Yellowstone cutthroat trout) and Utah chub *Gila atraria*. Catch rates for all trout combined were not statistically different from previous years. We then separated catch rates by species and found no statistical differences over the past ten years for all species except brook trout. Brook trout have not been stocked since 1998 and showed a significant decline from a peak in abundance found in 2000. Although catch rates of Utah chub are close to the peaks in abundance found in 1993 and 2000, the change in catch rates were not statistically significant from past years. Age and growth information collected during 2003 shows fast growth and a relatively high mortality rate, and was similar to results from 2002. We conducted a creel survey during 2003 and found catch rates well below the management goal of 0.7 fish per hour. Clerks interviewed 964 anglers, and estimated our seasonal catch rate at 0.17 fish per hour. Harvest composition was 45% cutthroat trout, 50% hybrid trout, and 5% brook trout. We monitored dissolved oxygen levels to assess the possibility of a winterkill event. Oxygen concentrations remained at adequate levels for trout survival. Consequently, no winter aeration was required. We conducted a diet analysis of trout to assess predation rates on Utah chub. We analyzed 319 stomachs collected between May and October, and showed fish to be an insignificant portion of trout diets. Further analysis showed overlap between trout and chub diet, but we believe this does not limit trout abundance due to the large quantities of available forage. The 2003 spawning operations at Henrys Lake produced 2,112,498 eyed cutthroat trout eggs, 406,855 eyed hybrid trout eggs and 133,065 eyed brook trout eggs. Cutthroat trout in the Hatchery Creek run averaged 464 mm, hybrid trout averaged 561 mm, and brook trout averaged 484 mm. No viral or bacterial presence was detected from any of the ovarian samples taken from either the spring or fall spawning operations.

We conducted a creel survey on Ririe Reservoir to obtain angler effort, catch and harvest information. We found no anglers during the winter ice-fishing season (December 1 through March 31), because the lake never froze. From May 1 through the end of November, anglers fished 25,981 hours (95% CI 22,387 – 29,575) on the reservoir. This represents a 46% decline in effort compared to our 1993 survey. The overall season catch rate was 0.65 fish per hour, while the harvest rate was 0.25 fish per hour. Catch rates have doubled over 1993 levels. Species encountered included Yellowstone cutthroat trout (0.06 fish/hour), rainbow trout (0.07 fish/hour), kokanee salmon *O. nerka* (0.06 fish/hour), yellow perch *Perca flavescens* (0.04 fish/hour), smallmouth bass *Micropterus dolomieui* (0.31 fish/hour) and crayfish *Procambarus spp.* (0.06 per hour). Catch rates on kokanee salmon, cutthroat trout and smallmouth bass

have improved over rates recorded in 1993, while rainbow trout and yellow perch have declined. We estimated 5,020 fish were harvested from Ririe Reservoir during 2003.

We assisted fisheries research personnel with a hydroacoustics survey on Palisades Reservoir to estimate abundance of Yellowstone cutthroat trout during May, 2003 We set gill nets to verify data collected with hydroacoustics equipment, and used the data to monitor fish populations in the reservoir. We set nets throughout the reservoir, and estimated relative abundances of Utah chub (54%), Utah sucker *Catostomus ardens* (27%), brown trout *Salmo trutta* (15%), Yellowstone cutthroat trout (3%), kokanee (<1%) and lake trout *S. namaycush* (<1%). Catch rates for all sport fish combined were 2.4 fish per net night, whereas nongame fish were 9.5 fish per net night. Palisades Reservoir supports a low-density recreational fishery that is limited by severe annual reservoir fluctuations and low recruitment.

On July 8, 2003 we conducted a one-hour nighttime electrofishing survey on Gem Lake to collect catch rate information and to estimate relative abundances of fish. We used a Smith-Root boat electrofisher along the shoreline, and collected, measured and released all fish encountered. Catch rates for all species were low, and we estimated relative abundance of sucker *Catostomus spp*. At 41%, smallmouth bass 12%, rainbow trout 12%, brown trout 12%, carp *Carassius carpio* 12% and yellow perch 6%.

Authors

Dan Garren
Regional Fishery Biologist

Damon Keen
Assistant Hatchery Manager

Jim Fredericks
Regional Fishery Manager

OBJECTIVE

To obtain current information for fishery management decisions on lowland lakes and reservoirs, including angler use and success, harvest and opinions, fish population characteristics, stocking success, return-to-the-creel for hatchery trout, and limnology, and to develop appropriate management recommendations.

HENRYS LAKE

METHODS

Population Monitoring

As part of routine population monitoring, we collected gill net samples from six standardized locations (Appendix A) for a total of seventeen net nights in Henrys Lake on May 12, 14, and 22, 2003. Nets were set at dusk and retrieved the following morning. We recorded set and pull times, identified captured fish to species and recorded lengths (total length – mm). We calculated catch rates as fish per net night and also calculated 95% confidence intervals. We assumed a non-normal distribution to our data and used a Kruskal-Wallis one-way nonparametric analysis of variance to detect differences in population trends among data collected from 1993 to present. As part of a hydroacoustics research survey, 16 additional experimental gill nets were set on May 3, 14 and 15. These nets encompassed one additional large mesh size (75 mm bar), and were four times the area of the Department's standard gill nets. Catch from these nets was incorporated into age and growth analysis as well as the diet study explained below. The hydroacoustics work and net dimensions are explained in detail in the 2003 Fisheries Research Report (A. Butts, IDFG, in press).

We obtained age and growth information by analyzing otoliths removed from captured fish. Otoliths were stored in envelopes and aged using a dissecting scope. Otoliths were read in whole view if distinct growth rings were present. All otoliths that gave conflicting results when aged twice were sectioned, polished and read in cross section. Mortality was estimated by catch curve analysis on ages three to five.

Creel Survey

Henrys Lake hatchery personnel conducted a creel survey throughout the fishing season to collect effort, catch and harvest information. We stratified the sample into seven periods to account for unequal angler effort through the season and to comply with previously used methodology. Strata consisted of a three-day period on the opening weekend, a 14-day period following the opener, four 28-day periods and a 14-day period at the end of the season. We conducted interviews on 30% of days in each stratum. We generated instantaneous counts using randomly selected dates and times, and counted anglers twice per day from a point overlooking the lake with the aid of binoculars and spotting scopes. A boat was subsequently used to count any anglers not visible from shore. Counts were completed within one half hour. Anglers were interviewed at random throughout the day using roving methods and a boat, and

occasionally at boat ramps. Creel clerks intercepted anglers during their fishing trip to obtain method of fishing, time spent fishing, and number, species and length of fish both caught and released. We analyzed data using standard methodology and the Idaho Department of Fish and Game creel census program (McArthur 1993).

Water Quality

We measured winter dissolved oxygen concentrations, snow depth, ice thickness and water temperatures at established sampling sites on Henrys Lake. Holes were drilled in the ice with a gas-powered ice auger prior to sampling. We used a YSI model 95 oxygen probe to collect dissolved oxygen samples and estimated total g/m^2 of oxygen. We sampled each site at ice bottom and subsequent one-meter intervals to the bottom. Similar methods were used for summer oxygen monitoring from mid-June through the end of October.

Diet Analysis

We analyzed the stomach contents of fish collected during gill net samples set throughout the fishing season (May through October) to determine predation rates on Utah chub *Gila atraria* by trout, and to assess possible interactions between trout and chubs. Fish were collected during standard population monitoring, hydroacoustics work and additional nets set specifically for the diet study. Stomachs were removed, stored in individually labeled plastic bags, and immediately frozen. For each stomach, we identified individual food items, separated items by genus and then counted and weighted each genus to the nearest gram. In instances where extremely high densities were encountered (i.e., Daphnia and occasionally scuds), we randomly analyzed a sub-sample of contents and expanded the results to represent total content.

Spawning Operation

We opened the Hatchery Creek fish ladder for the spring spawning run on February 12, and kept it open through April 30. Fish ascending the ladder were identified as Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri* or hybrid trout (rainbow trout *O. mykiss x* Yellowstone cutthroat trout) and counted. We measured a sub-sample (10%) of each group for total length (mm). Yellowstone cutthroat trout were produced using ripe females spawned into seven-fish pools and fertilized with pooled milt from four to seven males. Hybrid trout were produced with Yellowstone cutthroat trout eggs and Kamloops rainbow trout milt obtained from Hayspur Hatchery. Hybrid trout were sterilized by placing fertilized eggs in 28°C water for 20 minutes to induce triploidy. Eggs were shipped to Ashton and Mackay Hatcheries for hatching, rearing and subsequent release back into Henrys Lake and other local waters. Yellowstone cutthroat trout eggs were shipped to Mackay and American Falls Hatcheries for hatching, rearing and release back into Henrys Lake.

We opened the fish ladder for the fall run of brook trout *Salvelinus fontinalis* on October 10th. Low water condition prevented brook trout from successfully ascending the ladder, so we installed trap nets at the mouth of the Hatchery Creek to collect trout. Brook trout eggs were shipped to Ashton Hatchery for hatching, rearing, and release back into Henrys Lake.

We took disease samples from the spring and fall spawning runs. Ovarian fluids were collected from Yellowstone cutthroat trout and brook trout during spawning. Ovarian samples were taken from egg pools of seven females in the spring run and six females in the fall run. All female egg pools were tested. Random viral samples were taken from 25 seven-female egg pools in the spring run and six-fish egg pools in the fall run. We sacrificed a mixed-sex group of 60 adult Yellowstone cutthroat trout during the spring run and 30 adult brook trout during the fall run for disease testing. All samples were sent to the Eagle Fish Health Laboratory (EFHL).

RESULTS

Population Monitoring

We collected 167 fish in 17 net nights with standard Henrys Lake experimental gill nets (Figure 1). Catch composition was 33% cutthroat trout, 17% hybrid trout, 5% brook trout, and 46% Utah chub. Cutthroat trout ranged from 105 to 511 mm total length, hybrid trout 265 to 646 mm, and brook trout 238 to 490 mm. Brook trout catch rates in gill nets have declined significantly from 2000 levels ($p < 0.001$, Kruskal-Wallis Nonparametric AOV; Figure 2). Catch rates for both hybrid trout and cutthroat trout were lower than previous years (Figures 3 and 4), but showed no statistical difference compared to the long-term (10 year) average. However, hybrid trout catch rates have declined significantly compared to recent (2001-2003) years ($p = 0.001$, Kruskal-Wallis). Further analysis showed that catch of age two and three cutthroat trout were below the five-year mean for these age classes (Figures 5 and 6). Catch rates on hybrid trout followed the same trend. These weak year classes are contributing to the decline in catch observed in the creel survey. Utah chub catch rates are higher than previous years samples (Figure 7). However, the difference in these catch rates are not significant ($p = 0.4$, Kruskal-Wallis test). Mean length at age five for Yellowstone cutthroat trout is 504 mm (Figure 8) compared to 571 mm for hybrid trout (Figure 9). Mortality estimates derived from catch curve analysis estimate mortality from age three to five for Yellowstone cutthroat trout at 55%. We estimated hybrid trout mortality at 64% for the same age group. We did not estimate mortality from cohort analysis because the additional large mesh size used this year with the hydroacoustic research captured larger, older fish and were not comparable to data collected during 2002. Mortality estimates for brook trout were not possible due to low sample size.

The hydroacoustic study estimated a population of around 40,000 trout which is about half of what anglers catch annually, and an order of magnitude lower than population estimates conducted in 1995-96. Technical difficulties were encountered, and included interference with signal reception from vegetation, and the inability of the gear to sample shallow water. Results were considered inaccurate, so a repeated attempt was conducted in the fall. This second attempt was also considered inconclusive. As a result, the hydroacoustics estimate was abandoned.

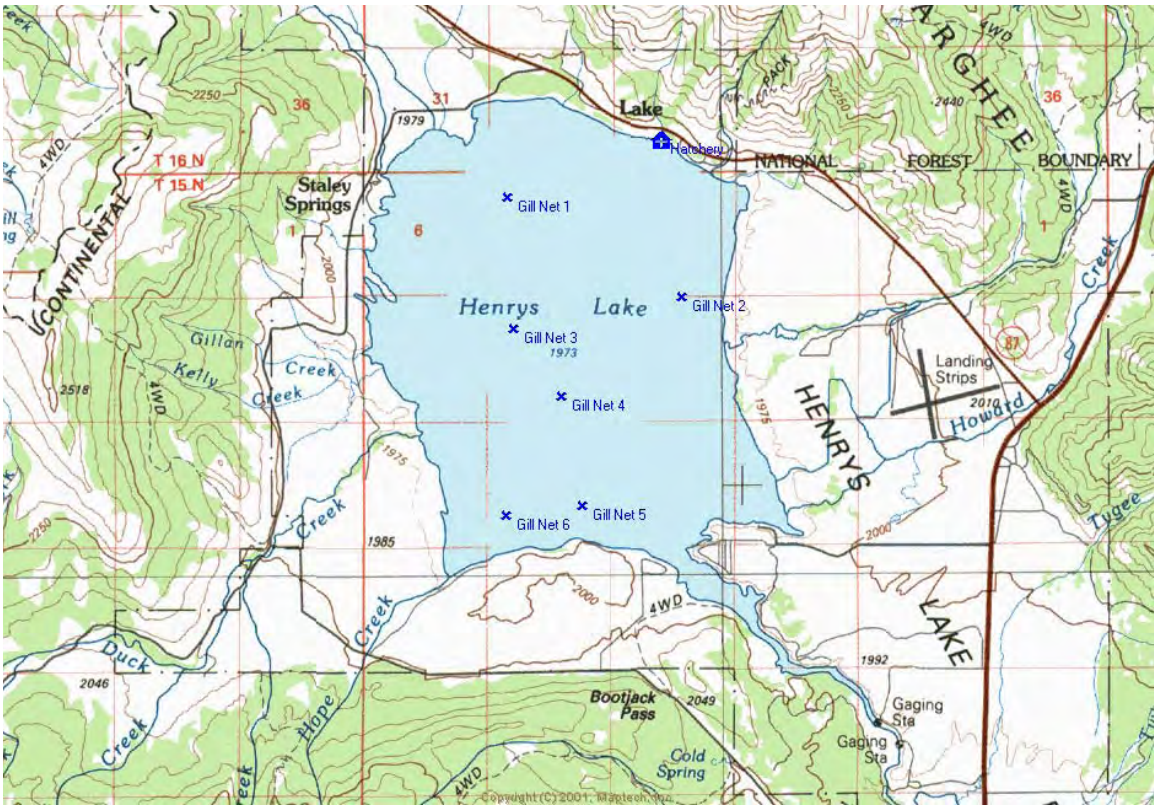

Figure 1. Spatial distribution of gill net locations used in population monitoring in Henrys Lake, Idaho.

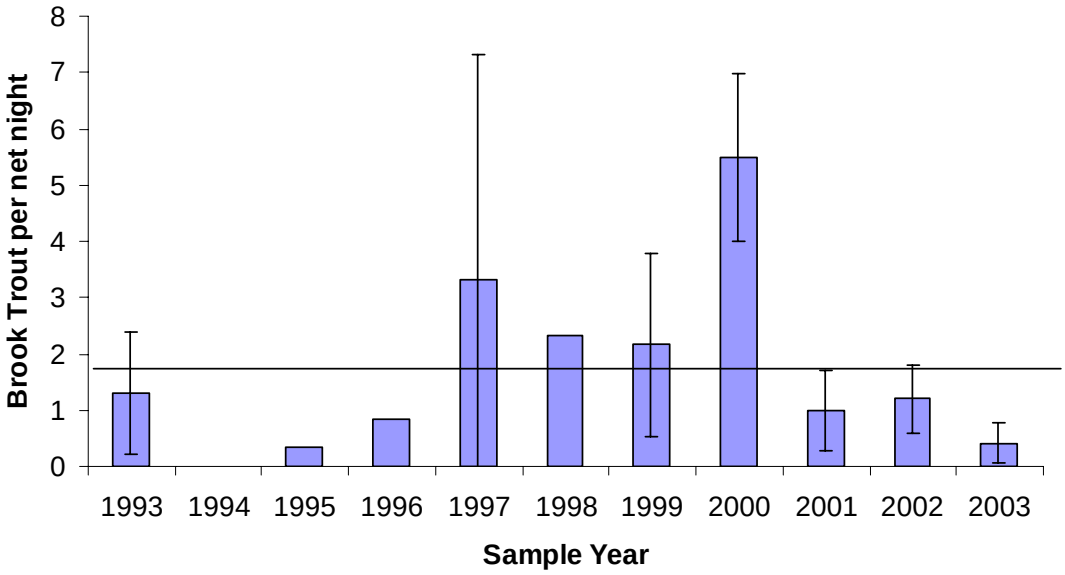

Figure 2. Brook trout catch rates in gill nets set in Henrys Lake, Idaho, 1993 to present. Mean brook trout catch rates were 1.7 fish per net over the 10-year period. Error bars represent 95% confidence intervals.

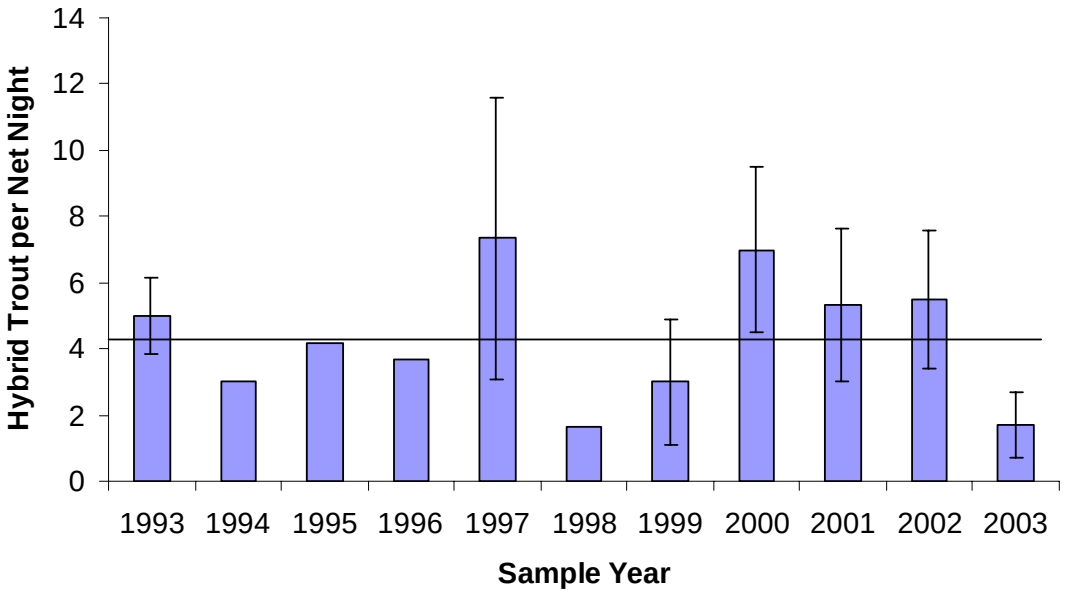

Figure 3. Hybrid trout catch rates in gill nets set in Henrys Lake, Idaho, 1993 to present. Mean catch rate for hybrid trout was 4.3 fish per net over the 10-year period. Error bars represent 95% confidence intervals.

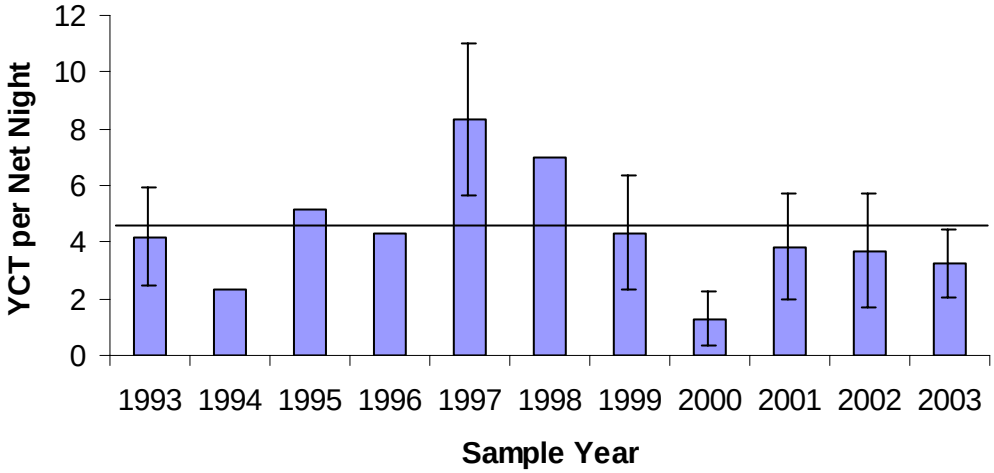

Figure 4. Yellowstone cutthroat trout catch rates in gill nets set in Henrys Lake, Idaho, 1993 to present. Mean catch rate for cutthroat trout was 4.3 fish per net over the 10-year period. Error bars represent 95% confidence intervals.

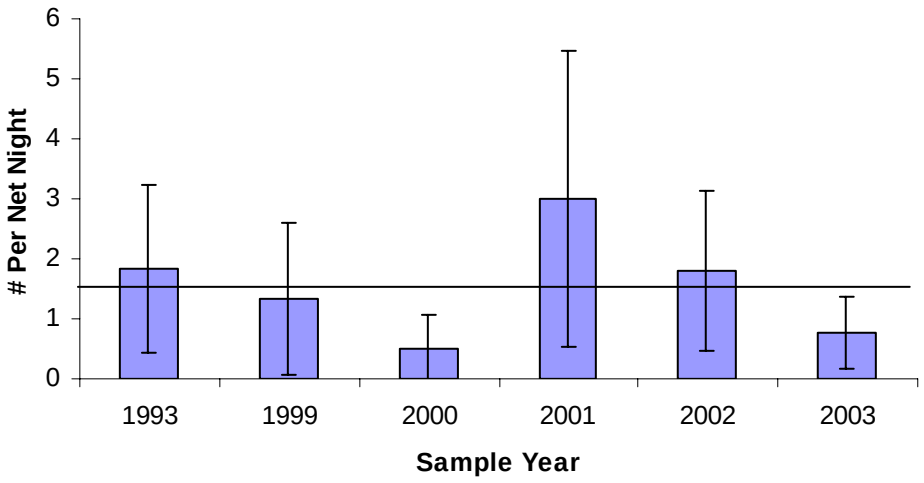

Figure 5. Catch per unit effort (number per net night) of age-2 Yellowstone cutthroat trout in Henrys Lake, Idaho. Horizontal bar represents a mean catch of 1.5 fish per net night. Error bars indicate 95% confidence intervals.

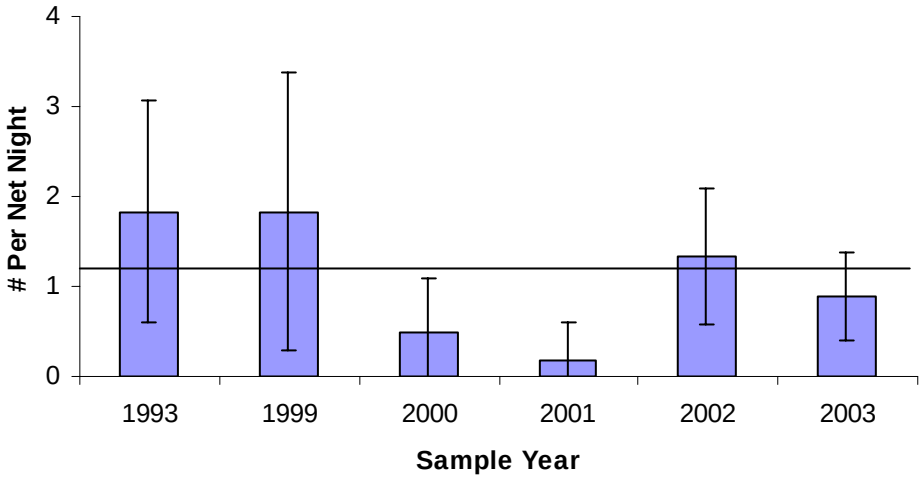

Figure 6. Catch per unit effort (number per net night) of age-3 Yellowstone cutthroat trout in Henrys Lake, Idaho. Horizontal bar represents a mean catch of 1.2 fish per net night. Error bars indicate 95% confidence intervals.

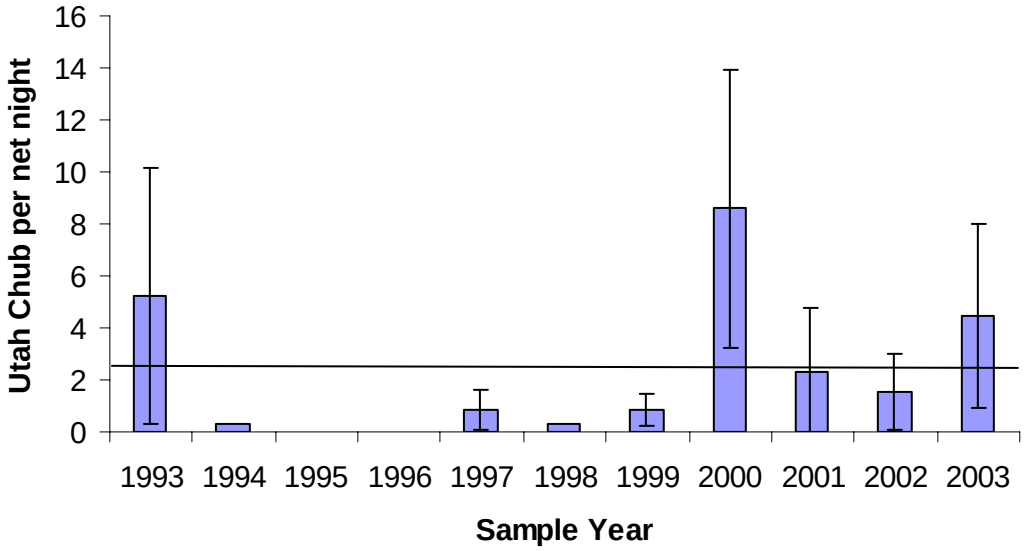

Figure 7. Utah chub catch rates in gill nets set in Henrys Lake, Idaho, 1993 to present. Mean catch rate was 2.2 chub per net over the 10-year period. Error bars represent 95% confidence intervals.

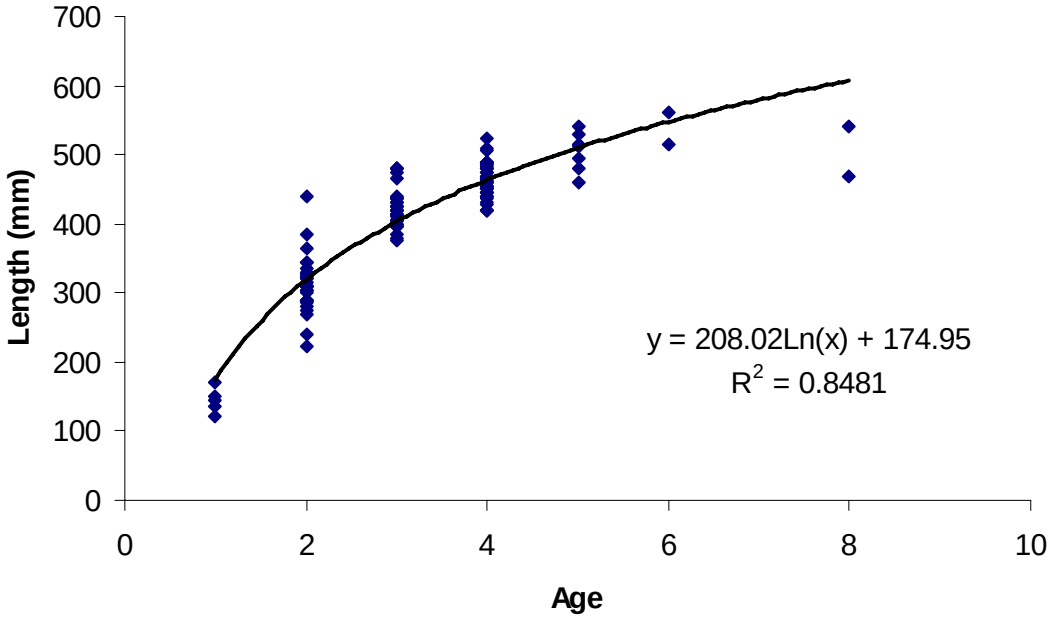

Figure 8. Yellowstone cutthroat trout length at age for trout captured with gill nets set in Henrys Lake Idaho, May 2003.

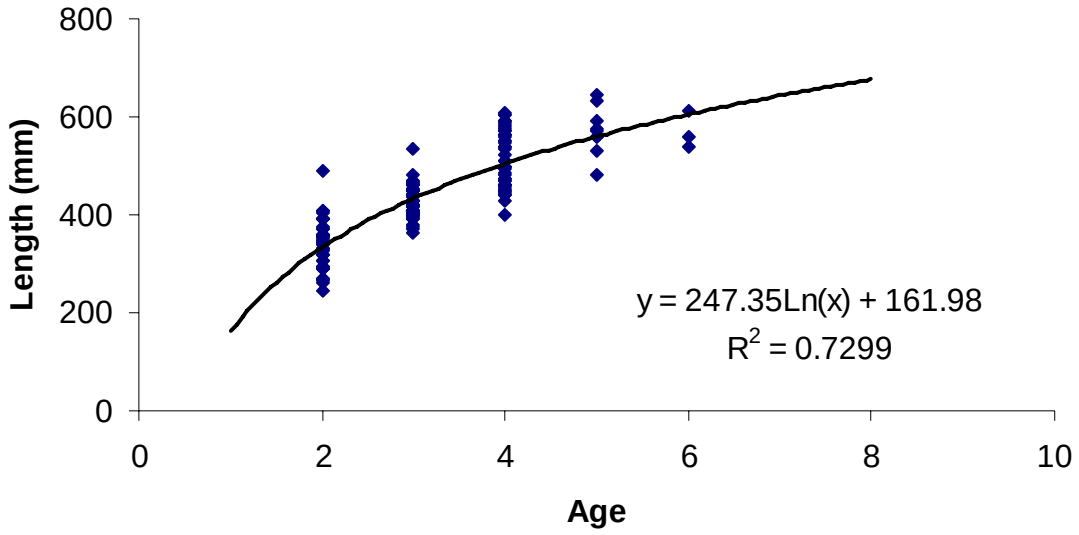

Figure 9. Hybrid trout length at age for trout captured with gill nets set in Henrys Lake Idaho, May 2003.

Creel Survey

Creel clerks conducted 964 interviews From May 24 through October 31. We used the department creel program to extrapolate and summarize estimates (McArthur, 1993). We estimated catch rates at 0.17 fish per hour for the season, which falls below the 10-year average of 0.5 fish per hour and well below our management goal of 0.7 fish per hour. Separate intervals ranged from a low of 0.09 fish per hour during the fourth interval to a high of 0.23 fish per hour in the fifth interval (Table 1).

We attempted to correlate abiotic factors to catch rates obtained from annual creel data. Specifically, we used lake volume in July (storage in acre-feet) as a surrogate to represent the water year. During years of abundant water, more water remains in storage than during drought years when irrigation demands result in a lower lake level. Catch rates were regressed against lake levels to examine the relationship between drought years and catch rates. We used data from 1992 to 2002, but did not include 2003 data in the regression. During 2003, water managers held more water in the lake despite the drought year. Therefore, the 2003 lake level was not a good surrogate for the drought conditions experienced that year. The regression showed a fairly strong relationship between these factors overall ($r^2 = 0.51$, $p = 0.045$ Figure 10), with poor water years resulting in poor catch rates.

Additional information obtained from the creel survey included the ratio of fin clips from fish marked prior to stocking (Table 2). These fin clips are used to estimate the percent contribution of our stocking to the overall population. Ten percent of all stocked fish receive an adipose fin clip prior to stocking. All fish encountered over the course of the year are observed, and fin clips recorded. If the ratio of clipped fins is at or above 10%, we assume that stocked fish constitute the majority of the population. Over the past five years, the ratio of fin clips has exceeded 10% on four occasions, indicating that during drought years, natural reproduction does not contribute significantly to the fishery.

Water Quality

We recorded oxygen profiles during January and February 2003 at three standard sites (Pittsburgh Creek, County Boat Dock and Wild Rose), as well as a new station at the Hatchery. Total oxygen diminished from 21.2 g/m^2 to 20.1 g/m^2 at the Pittsburgh Creek site, 19.2 g/m^2 to 8.6 g/m^2 at the County dock, 24.4 g/m^2 to 13.5 g/m^2 at the Wild Rose site, and 15.0 g/m^2 to 10.4 g/m^2 at the new hatchery site. We encountered slushy ice conditions throughout most of the winter and could only monitor our standard site at the Outlet once (December 30$^{th)}$ and found 11.0 $g/m^{2.}$ The level of concern of 10g/m^2 was reached briefly at only one site (County Boat Dock, Table 3).

Summer dissolved oxygen levels were monitored on 30 days from June 12 through October 26. Temperatures exceeded 22°C for a period of one week at the end of July, and dropped below 20°C by the middle of August. We never observed stratification within the lake. Dissolved oxygen levels remained above the level of concern (5 mg/l) in all areas throughout the fishing season.

Table 1. Annual estimates of angler effort, catch and harvest collected from creel surveys on Henrys Lake, Idaho.

Year	Effort (h *1,000)	Catch (*1,000)	Harvest (*1,000)	Catch Rate (f/h)	Catch Composition		
					YCT	HYB	BKT
2003	108	17	5	0.17	45	51	4
2002	--	--	--	0.41	42	49	9
2001	165	92	17	0.56	35	58	7
1999	228	148	27	0.65	22	65	13
1997	228	123	32	0.54	51	46	3
1995	172	99	20	0.58	37	60	3
1994	177	116	21	0.66	52	43	5
1993	114	73	26	0.64	76	21	3
1992	115	51	12	0.45	38	52	10
1979	94	30	18	0.32	35	42	23
Mean	**156**	**83**	**20**	**0.50**			

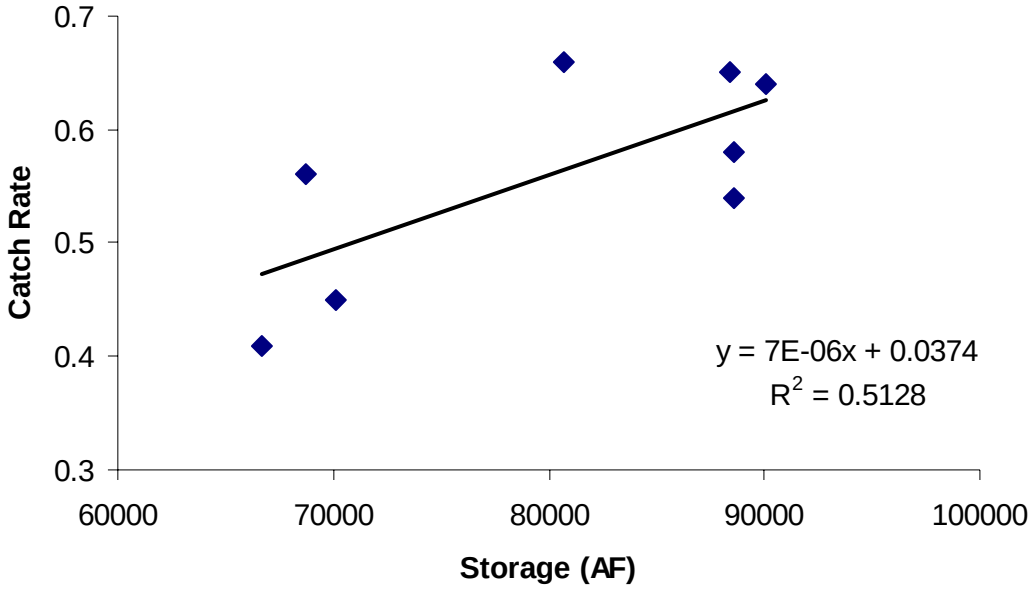

Figure 10. Mean reservoir storage (in acre-feet) for Henrys Lake, Idaho in July regressed against annual catch rates. Catch data obtained from creel surveys completed from 1992-2002.

Table 2. Fin clipping data from trout stocked in Henrys Lake, Idaho observed in annual creel surveys. Ten percent of all stocked Yellowstone cutthroat trout and brook trout receive an adipose fin clip annually.

	Yellowstone cutthroat trout				Brook trout			
Year	No. Clipped	No. of fish observed	No. of clipped fish observed	Percent clipped	No. Clipped	No. of fish observed in creel	No. clipped fish observed	Percent clipped
2003*	163,389	324	50	15%	--	--	--	--
2003	163,389	106	37	35%	--	--	--	--
2002	110,740	38	7	18%	--	6	2	33%
2001	99,110	116	22	19%	--	30	6	20%
2000	100,000	14	1	7%	--	3	0	0%
1999	124,920	160	20	13%	--	48	5	10%
1998	104,740	--	--	--	2,067	--	--	--
1997	123,690	178	5	3%	2,044	11	1	9%
1996	100,290	--	--	--	1,961	1	0	0%

*Obtained from gill net samples.

Table 3. Dissolved oxygen (DO) readings (mg/l) recorded in Henrys Lake, Idaho wintertime monitoring 2003.

Location	Date	Snow depth (mm)	Ice depth (mm)	DO Ice bottom	DO 1 meter	DO 2 meters	DO 3 meters	Total g/m^2
Pittsburg Creek	Dec 30	25	400	8.9	8.7	6.7	5.7	21.2
	Jan 14	175	400	12.2	10.4	8.4	7.7	27.4
	Feb 7	200	450	11.3	9.5	5.6	5.0	21.0
	Feb 13	125	450	11.2	8.7	5.2	5.0	20.1
County Boat Dock	Dec 30	250	325	11.3	9.7	6.2	2.5	19.2
	Jan 14	250	325	10.4	7.1	5.4	3.1	17.3
	Feb 7	75	450	10.1	6.8	3.2	2.2	13.9
	Feb 25	225	450	6.5	4.6	1.7	1.3	8.6
Wild Rose	Dec 30	250	325	12.4	11.1	9.0	3.6	24.4
	Jan 14	125	400	11.5	11.3	8.5	2.6	22.5
	Feb 7	175	475	12.7	9.2	6.6	2.7	20.3
	Feb 25	225	575	8.6	6.7	4.2	1.6	13.5
Outlet	Dec 30	300	325	5.8	5.6	3.1	2.2	11.0
Hatchery	Jan 14	125	325	8.3	7.1	4.7	2.6	15.0
	Feb 7	0	350	10.5	6.9	5.3	2.0	16.0
	Feb 13	125	450	11.0	6.9	4.4	1.7	15.1
	Feb 25	175	525	8.5	4.9	2.4	1.3	10.4

Diet Analysis

We collected and analyzed 319 stomachs over four collection periods (May, July, August and October), and found that currently, trout rarely consumed fish. We also looked for possible competition interactions by comparing contents of stomachs from chubs to those from trout and found partial dietary overlap. However, the overlap comes from consumption of daphnia and scuds, both of which we believe are highly abundant. By number, scuds (68%), daphnia (23%) and chironomids (5%) made up the bulk of all fish diets, with leeches, caddis, snails, clams and various other items contributing a minor portion to the overall diet (< 1% each). By weight, the most important food items were scuds (62%), chironomids (11%), daphnia (5%), damselfly nymphs (5%), caddis larvae (5%), leeches (4%) and other items (8%). Only one fish was found in 319 stomachs (Tables 4 through 7).

Spawning Operation

Between February 12 and April 30, 3,599 Yellowstone cutthroat trout ascended the hatchery spawning ladder. Of these, 62% were males and 38% were females and averaged 469 and 459 mm, respectively with a combined mean length of 464 mm. Hybrid trout totaled 2,332 fish and consisted of 49% males and 51% females with mean lengths of 548 mm and 573 mm, respectively.

We collected 2,617,050 green eggs from 1,033 Yellowstone cutthroat trout females for a mean fecundity of 2,533 eggs per female (Table 8). Eyed Yellowstone cutthroat trout eggs totaled 2,112,498 for an overall eye-up rate of 81%. We shipped 1% of eyed Yellowstone cutthroat trout eggs to American Falls Hatchery for hatching, rearing and subsequent release back into Henrys Lake in the spring of 2004 as holdovers. The remaining 99% were shipped to Mackay Hatchery where they were hatched, reared, and subsequently released back into Henrys Lake in the fall of 2003 as fingerlings. We committed fourteen days to Yellowstone cutthroat trout spawning.

We collected 657,900 green eggs from 258 female Yellowstone cutthroat trout for hybrid trout production (Table 9). Hatchery personnel raised 62% of these eggs to the eye-up stage. Seventeen percent of eyed hybrid eggs were shipped to the Ashton Hatchery for hatching, rearing, and release into local area waters while the remaining 83% were shipped to the Mackay Hatchery for hatching, rearing, and subsequent release into Henrys Lake in the fall of 2003. We stocked 263,900 sterile hybrids during 2003. We devoted three days to production of hybrid eggs during 2003.

We collected 108 brook trout in trap nets or ascending the hatchery ladder in the fall of 2003. The 12 males and 96 females had a combined length of 484 mm. We collected 216,000 green eggs from 80 ripe females for a mean fecundity of 2,700 eggs per female (Table 10). Our eye-up rate was 62%. All brook trout eggs were shipped to the Ashton facility for hatching, rearing, and subsequent release back into Henrys Lake in the fall of 2004. We marked 54,312 sterile brook trout with an adipose fin clip before release, and an additional 44,399 fertile brook trout with a left pelvic fin clip before release. We devoted three days to production of brook trout eggs during 2003.

Table 4. Diet composition for brook trout collected in Henrys Lake, Idaho, 2003. Figures presented are percent of contents by weight.

	Sample Month				
Food Type	May (n = 12)	July (n = 3)	Aug	Oct	Total (n = 15)
Scuds	60	5	--	--	33
Vegetation	10	0	--	--	5
Leech	2	0	--	--	1
Chironomids	10	0	--	--	5
Mayfly	0	0	--	--	0
Daphnia	3	0	--	--	2
Damsel	0	0	--	--	0
Fish	0	0	--	--	0
Fish egg	0	0	--	--	0
Bivalve	2	0	--	--	1
Snail	5	0	--	--	2
Caddis	2	95	--	--	49
Other	5	0	--	--	2

Table 5. Diet composition for Yellowstone cutthroat trout collected in Henrys Lake, Idaho, 2003. Figures presented are percent of contents by weight.

	Sample Month				
Food Type	May (n = 59)	July (n =51)	Aug (n = 11)	Oct (n = 54)	Total (n = 175)
Scuds	46	49	25	88	52
Vegetation	4	1	0	1	2
Leech	3	1	0	1	1
Chironomids	15	12	32	2	15
Mayfly	3	1	0	0	1
Daphnia	13	13	29	0	14
Damsel	7	6	7	6	7
Fish	0	0	0	0	0
Fish egg	3	0	0	0	1
Bivalve	1	0	0	0	0
Snail	2	1	0	0	1
Caddis	2	15	0	1	5
Other	0	2	7	0	2

Table 6. Diet composition for Utah chubs collected in Henrys Lake, Idaho, 2003. Figures presented are percent of contents by weight.

	Sample Month				
Food Type	May (n = 10)	June	Aug	Oct	Total (n = 10)
Scuds	32	--	--	--	32
Vegetation	5	--	--	--	5
Leech	11	--	--	--	11
Chironomids	21	--	--	--	21
Mayfly	0	--	--	--	0
Daphnia	11	--	--	--	11
Damsel	0	--	--	--	0
Fish	0	--	--	--	0
Fish egg	11	--	--	--	11
Bivalve	5	--	--	--	5
Snail	5	--	--	--	5
Caddis	0	--	--	--	0
Other	0	--	--	--	0

Table 7. Diet composition for hybrid trout collected in Henrys Lake, Idaho, 2003. Figures presented are percent of contents by weight.

	Sample Month				
Food Type	May (n = 58)	July (n =17)	Aug (n = 12)	Oct (n = 32)	Total (n = 119)
Scuds	40	73	20	83	54
Vegetation	4	2	0	1	2
Leech	12	6	0	1	5
Chironomids	24	3	36	2	16
Mayfly	0	0	0	0	0
Daphnia	6	2	12	0	5
Damsel	2	4	4	8	5
Fish	0	0	0	1	0
Fish egg	3	0	0	0	1
Clam	2	1	0	0	1
Snail	3	3	12	2	5
Caddis	3	8	16	1	7
Other	0	1	0	1	1

Table 8. 2003 Henrys Lake Yellowstone cutthroat trout spawning summary.

Spawn Date	Lot Number	Females Spawned	No. of Green Eggs	Mean Fecundity	No. of Eyed Eggs	Disease Status	Percent Eye-up
Feb 20	1	61	152,500	2,500	105,645	Neg.	69
Feb 27	2	104	260,000	2,500	241,935	Neg.	93
Mar 14	6	78	198,900	2,550	166,935	Neg.	84
Mar 17	7	103	262,650	2,550	250,806	Neg.	96
Mar 20	8	74	188,700	2,550	168,952	Neg.	90
Mar 24	9	97	247,350	2,550	205,242	Neg.	83
Mar 27	10	76	193,800	2,550	173,387	Neg.	90
Mar 31	11	77	196,350	2,550	125,806	Neg.	64
Apr 7	12	121	308,550	2,550	262,500	Neg.	85
Apr 10	13	65	165,750	2,550	114,516	Neg.	69
Apr 14	14	46	115,000	2,500	86,290	Neg.	75
Apr 17	15	29	72,500	2,500	25,806	Neg.	36
Apr 21	16	35	87,500	2,500	81,452	Neg.	93
Apr 24	17	67	167,500	2,500	103,226	Neg.	62
Total		**1,033**	**2,617,050**	**2,533**	**2,112,498**		**81**

Table 9. 2003 Henrys Lake hybrid trout spawning summary.

Spawn Date	Lot Number	No. of Females Spawned	No. of Green Eggs	Mean Fecundity	No. of Eyed Eggs	Disease Status	Percent Eye-up
Mar 3	3	135	344,250	2,550	223,790	Neg	65
Mar 6	4	75	191,250	2,550	115,323	Neg	60
Mar 10	5	48	122,400	2,550	67,742	Neg	55
Total		**258**	**657,900**	**2,550**	**406,855**		**62**

Table 10. 2003 Henrys Lake brook trout spawning summary.

Spawn Date	Lot Number	No. of Females Spawned	No. of Green Eggs	Mean Fecundity	No. of Eyed Eggs	Disease Status	Percent Eye-up
Oct 27	1	32	86,400	2,700	62,903	Neg	73
Nov 3	2	24	64,800	2,700	50,807	Neg	78
Nov 6	3	24	64,800	2,700	19,355	Neg	30
Total		**80**	**216,000**	**2,700**	**133,065**		**62**

Disease sampling was completed on adult spawning fish during the spring and fall runs. Results and discussion are included in the resident fisheries pathologist report (Idaho Department of Fish and Game, in press). All viral and bacterial disease samples taken during spawning were negative in both the spring and fall runs.

DISCUSSION

The catch rates we observed during our 2003 creel survey were lower than any rates we've encountered, and persisted throughout the fishing season. This prompted speculation by many that fish populations had declined significantly over the past year. We reviewed dissolved oxygen data from winter and summer as well as gill net catch and anecdotal information to assess the likelihood of a large scale decline in fish populations that would have resulted in the poor catch rates observed, and attempted to address other (abiotic) factors that may have contributed to the poor fishing.

We monitor annual population trends with gill nets set in standard locations at the same time each year. Overall, there was a decline in catch rates during 2003 sampling compared to previous years. However, this decline was not statistically different from our 10-year average, with our catch per unit effort falling within the normal range of variation expected. However, when viewed in more recent terms (the past three years), gill net catch rates on hybrid trout have declined, and are likely contributing to the depressed catch rates experienced by anglers. Gill net catch rates also show age two and three cutthroat trout were caught at rates below the expected mean. These fish support the bulk of anglers catch during the year, and were noticeably absent from the creel this season. These year classes will be depressed in 2004, and may result in additional slow fishing next season.

Dissolved oxygen data collected during the winter of 2002-2003 showed high levels of oxygen (> 10 g/m^2) were present throughout the winter. The only sampling location lacking sufficient oxygen was at the County Boat Dock, and this was only one occurrence (late February). Our oxygen estimates never showed levels low enough to kill trout. As a result, we did not use the aeration system. During the winterkill event of 1992, numerous trout were observed crowding lake tributaries as oxygen diminished. These streams provide a refuge against anoxic conditions. During the 2002-2003 winter, we did not observe any fish crowding tributaries, indicating adequate oxygen was present. Further, no dead fish were observed during the winter or after ice-out, which would be expected if a significant winterkill event occurred. We also discounted a significant summer kill, as monitoring through the summer showed sufficient oxygen lake-wide, and no dead fish were reported or observed.

Mortality estimates from catch-curve analysis show a relatively high mortality rate for both Yellowstone cutthroat trout and hybrid trout. Mortality is higher on fish once they reach spawning size (typically age three or greater). We attempted to estimate mortality using cohort analysis, but were unable to compare data from 2002 to our data from 2003 because of the different gill nets used. Nets used in 2003 had larger mesh, which captured larger (older) fish than in 2002, and inflated survival estimates. As a result, we used catch-curve analysis again in 2003, and found similar results to those in 2002. Additional work to assess individual cohorts will strengthen mortality estimates.

Utah chub catch rates increased over past years samples, but show no statistical increase in population growth. Gill net catch rates were highest in 2000 (> 8 fish per net night), and have varied since. Compared to other local water bodies with high chub abundance (Mud Lake, 47 fish / net night; Island Park Reservoir, 48 fish / net night), densities in Henrys Lake are low. Based on diet analysis conducted this past year, we don't believe predation is a controlling factor on chub abundance. No chubs were recovered from stomachs, suggesting trout rarely feed on fish in Henrys Lake. Chub length frequency and age and growth information also reflect this, with a well-balanced size structure and numerous older fish. Heavy predation should alter the size structure, making larger or older fish less common. All chubs we were able to age were five years old or older, and greater than 200 mm. To some extent, this was influenced by otolith size, with smaller (younger) fish being extremely difficult to age. Comparison of diet information collected this year to historical data shows that brook trout have been effective predators on fish in the past. Fish was the most important feature of brook trout diets in both Irving's 1952 study and Jeppson's 1972 study. Scuds and chironomids in Spateholt's 1984 study overshadowed the importance of fish to brook trout, although this could have been influenced by collection method. Spateholt's stomachs were donated by anglers who had caught their fish by hook and line, which would select for hungry fish. We did not encounter brook trout in abundance (only 15 fish), and could not draw adequate conclusions as to diet composition or potential impacts to the chub population. We hypothesize that the reinstatement of the brook trout stocking program may increase predation on chubs. Chubs also appeared to have a partial dietary overlap with trout. Scuds and daphnia made up a significant amount of the overall diet of all fish analyzed, and constituted the majority of the diet overlap among species. We believe this overlap is inconsequential at present, as scuds are found in extreme abundance, and daphnia are assumed to be in high densities as well.

RECOMMENDATIONS

1. Increase annual gill net sampling to a minimum of 30 net nights to decrease variation in samples.

2. Collect otolith samples from all trout species; use for cohort analysis and estimates of mortality/year class strength.

3. Use multi-year data collection to model effects of possible regulation changes.

4. Continue winter dissolved oxygen monitoring, and implement aeration when necessary.

5. Monitor Utah chub densities.

RIRIE RESERVOIR

METHODS

We conducted a stratified random creel survey on Ririe Reservoir from May 1 through the end of November 2003 to estimate angler use and success. We stratified sample days into weekdays and weekend and holidays to better represent angler use. One weekday and one weekend/holiday day were randomly selected each week to obtain effort estimates and interview anglers. Effort information was obtained by counting anglers from a fixed-wing aircraft that circled the reservoir two times daily, twice per week. Count times were randomly selected and started no earlier than ½ hour after sunrise, and were completed no later than ½ hour before sunset. We obtained catch and harvest information, residency information and gear type used using direct interviews. A creel clerk traveled the entire reservoir in a motorboat and interview all anglers encountered. We analyzed our data using standard methodologies and the department creel census program (McArthur, 1993). We also estimated the number of fish caught by multiplying catch rate estimates for each species by the total effort estimate.

RESULTS

We interviewed 633 anglers in 271 parties over the course of the survey. Average party size was 2.3 anglers, and average trip length was 2.7 hours. We estimated overall season effort at 25,981 hours (Table 11), which represents a 46% decline from 1993 estimates. Residents made up the bulk of anglers interviewed (96%), while gear type was split between bait (45%) and lures (55%). Few anglers fly fished on Ririe Reservoir (<1%). Thirty-five percent of parties fishing during 2003 caught no fish, while 39% caught between one and three fish, and 25% of anglers caught four or more fish. Catch rates (fish caught per hour) have nearly doubled over 1993 estimates to 0.65 fish per hour (Table 11). Anglers caught smallmouth bass *Micropterus dolomieui* (8,054 fish), rainbow trout (1,819 fish), Yellowstone cutthroat trout (1,559 fish), kokanee *O. nerka* (1,559 fish), and yellow perch *Perca flavescens* (1,039 fish). Catch rates on rainbow trout and yellow perch have declined from 1993 rates, while catch rates for Yellowstone cutthroat trout, smallmouth bass and kokanee have increased. Anglers in pursuit of crayfish added to our effort estimates in 2003, and maintained a catch rate of 0.06 per hour. Unlike catch rates, harvest rates have declined compared to 1993 data. Harvest rates for all species were lower than past estimates with the exception of cutthroat trout and crayfish (Figure 11), both of which were not represented in the 1993 survey.

DISCUSSION

Overall effort has declined on the reservoir in spite of an increase in catch rates. Catch rates were nearly double our 1993 estimates, while the total number of fish harvested decreased by 70%. In our 1993 survey, anglers harvested rainbow trout more than any other fish. Starting in 2003, we replaced catchable rainbow trout stockings with similar numbers of catchable Yellowstone cutthroat trout. We anticipated the drop in rainbow trout catch would be compensated by an equal increase in cutthroat trout catch. However, this did not occur. One possible explanation for this discrepancy is our fingerling stocking program. During the early

Table 11. Angler statistics recorded for Ririe Reservoir, Idaho during 2003 creel survey.

Parameter		2003	1993
Total Effort		25,981	56,612
Residency (Percent)	Resident	96	98
	Nonresident	4	2
Angler Type (Percent)	Bank	61	55
	Boat	39	45
	Shore	<1	0
Percent of Anglers Catching	0 fish	36	52
	1 to 3 fish	39	31
	4 or more fish	25	17
Gear Type Used (Percent)	Bait	45	100
	Lure	55	0
	Fly	<1	0
Catch Rate (Fish Per Hour)	All Fish	0.65	0.33
	YCT	0.06	0.00
	RBT	0.07	0.19
	KOK	0.06	0.04
	YEP	0.04	0.08
	SMB	0.31	0.02
	CRF	0.06	0.00
Number Harvested	All Fish	5,020	17,600
	YCT	875	17
	RBT	1,138	11,009
	KOK	1,106	2,268
	YEP	841	3,697
	SMB	111	496
	CRF	949	0

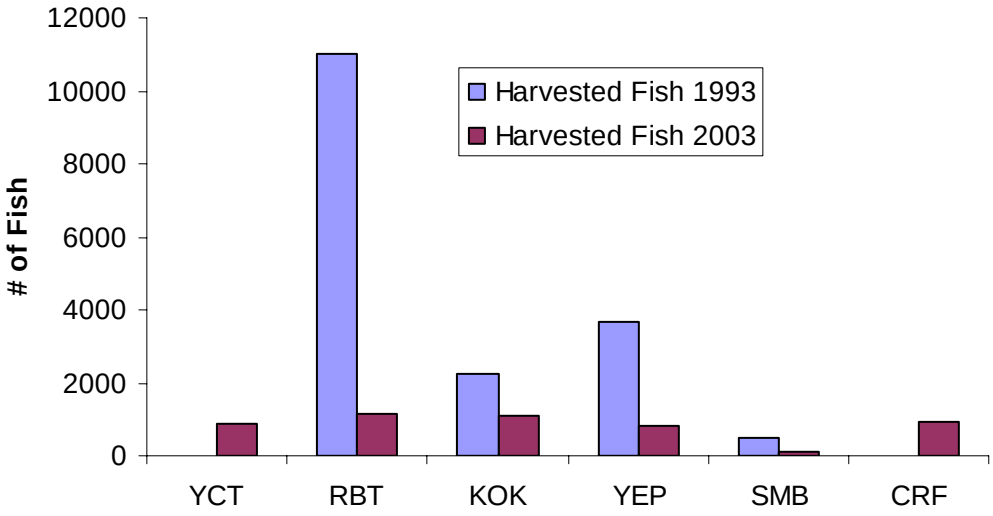

Figure 11. Harvest estimates for Ririe Reservoir, Idaho during 1993 and 2003. YCT – Yellowstone cutthroat trout; RBT – rainbow trout; KOK – kokanee salmon; YEP – yellow perch; SMB – smallmouth bass; CRF - crayfish

1990s, we were stocking nearly 290,000 fingerling rainbow trout annually. We believe these fish were contributing to the higher catch of trout documented in the 1993 creel survey. This program was discontinued in 1995 after a research project indicated fingerling stockings yield limited benefits to anglers. Kokanee catch rates showed a notable increase over previous levels. This may be related to an increase in kokanee stocking beginning in 2002, when we increased the plant from 70,000 to 210,000 fish. These fish should have been about 175-250 mm, and were probably just beginning to contribute to the catch rates. Smallmouth bass also showed a marked increase in catch rates with a significant reduction in harvest. The increased catch of most species combined with the lower harvest rate suggest anglers may not be as harvest oriented as in past surveys.

RECOMMENDATIONS

1. Continue to stock Yellowstone cutthroat trout, and evaluate their contribution to the fishery over the next several years.

2. Continue stocking kokanee salmon at 210,000 fish and evaluate the effects of higher stocking on the size structure and catch rates in the coming years.

PALISADES RESERVOIR

METHODS

We set experimental gill nets throughout the reservoir on May 6, 7 and 8, and allowed them to fish overnight. The research nets measured 6 meters by 54.8 meters with 12 panels of mesh ranging in size from 20 to 152 mm (stretch mesh of 20, 25, 32, 38, 50, 64, 76, 89, 102, 127 and 152 mm). Total area of the nets was 334 m^2, which represents the equivalent area of four standard lowland lake nets. We standardized catch rate data from the 18 research nets by dividing the total catch by 72 to obtain equivalent estimates of fish per net night in standard lowland lakes nets. All fish encountered were identified to species and measured for total length (mm) before being released.

RESULTS

Results from the hydroacoustics survey are covered under a separate report (A. Butts, in press), and summarized in Table 12. We collected a total of 857 fish during the gill net survey. Nongame fish (Utah chubs and Utah suckers *Catostomus ardens*) accounted for 81% of the total catch, with sport fish making up the remaining 19%. Brown trout *Salmo trutta* were the dominant sport fish collected (16% of the catch), and ranged in size from 150-610 mm (Figure 12). Yellowstone cutthroat trout made up 3% of the catch, and ranged in size from 160-410 mm (Figure 13). Lake trout *S. namaycush* and kokanee ranged in size from 450-640 mm and 280-330 mm respectively, and constituted less than 1% of the catch (Figure 14). Length frequency distributions for Utah chubs and Utah suckers showed a modal size of 310 mm for Utah chubs and 380 mm for Utah suckers (Figure 15). We found catch rates for all species during 2000-2003 were lower than any previous samples (Figure 16).

DISCUSSION

Our results show Palisades Reservoir supports a low-density trout fishery. Brown trout were the most frequently encountered trout, and are self-sustained with natural reproduction and immigration from upstream river reaches. Yellowstone cutthroat trout are stocked annually, and appear to have limited natural recruitment. Kokanee salmon have also been impacted by the drought conditions experienced over the past several years, and suffer from poor recruitment as tributary access is limited. Palisades Lake has been drawn down to the conservation pool (200,000 acre-feet) for the past three years because of drought and irrigation demands. These drawdowns impair migrations of adfluvial stocks into tributary streams where natural reproduction occurs. Jeppson (1969 unpublished data) also theorized that large drawdowns prohibit production of invertebrate bottom fauna and force trout onto a plankton-forage fish diet. We believe the combination of these factors is limiting trout abundance at this time. Given the water management limitations within Palisades Reservoir, it is unlikely that a quality trout fishery can maintain itself under current drought conditions.

Table 12. Estimates of fish abundance from hydroacoustics surveys conducted on Palisades Reservoir, Idaho during May 2003.

Net Location	Species	Proportion (+/- 90 Percent Confidence Interval)	Abundance	90 Percent Confidence Interval
Pelagic	Brown trout	0.10 +/- 0.04	16,561	6,092
	Lake trout	0.01 +/- 0.01	1,774	704
	Utah chub	0.74 +/- 0.15	118,293	41,797
	Utah sucker	0.13 +/- 0.10	21,293	8,883
	Yellowstone cutthroat trout	0.01 +/- 0.02	1,774	1,235
Nearshore	Brown trout	0.15 +/- 0.13	19,240	12,552
	Kokanee salmon	0.01 +/- 0.01	837	729
	Utah chub	0.47 +/- 0.40	59,394	38,694
	Utah sucker	0.36 +/- 0.28	45,173	28,994
	Yellowstone cutthroat trout	0.02 +/- 0.02	2,091	1,453
Total	Brown trout	--	35,801	13,952
	Kokanee salmon	--	837	729
	Lake trout	--	1,774	704
	Utah chub	--	177,687	56,958
	Utah sucker	--	66,466	30,324
	Yellowstone cutthroat trout	--	3,866	1,907

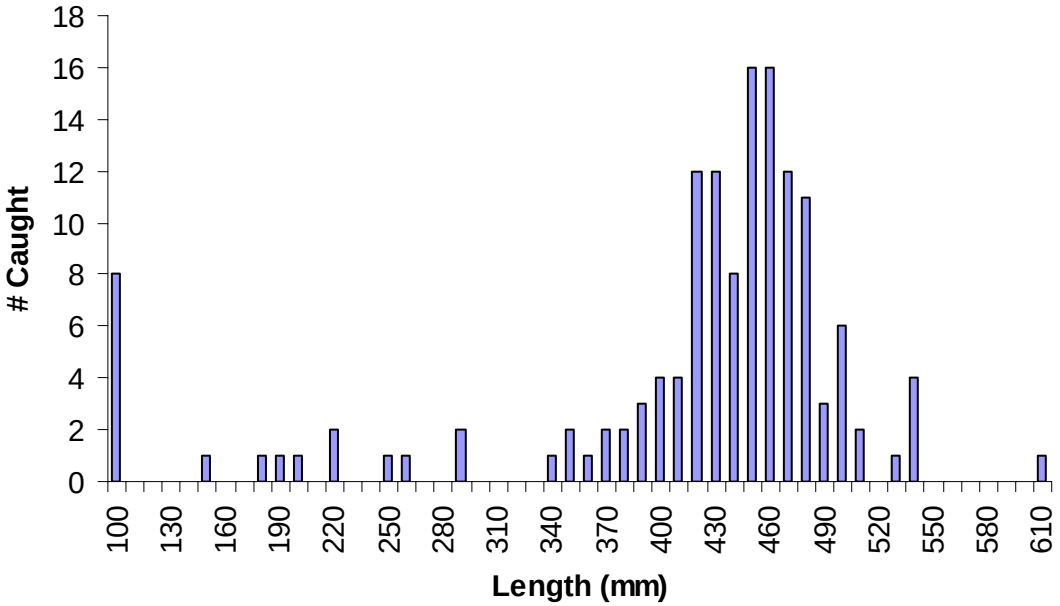

Figure 12. Length frequency of brown trout collected with gill nets in Palisades Reservoir, Idaho during 2003.

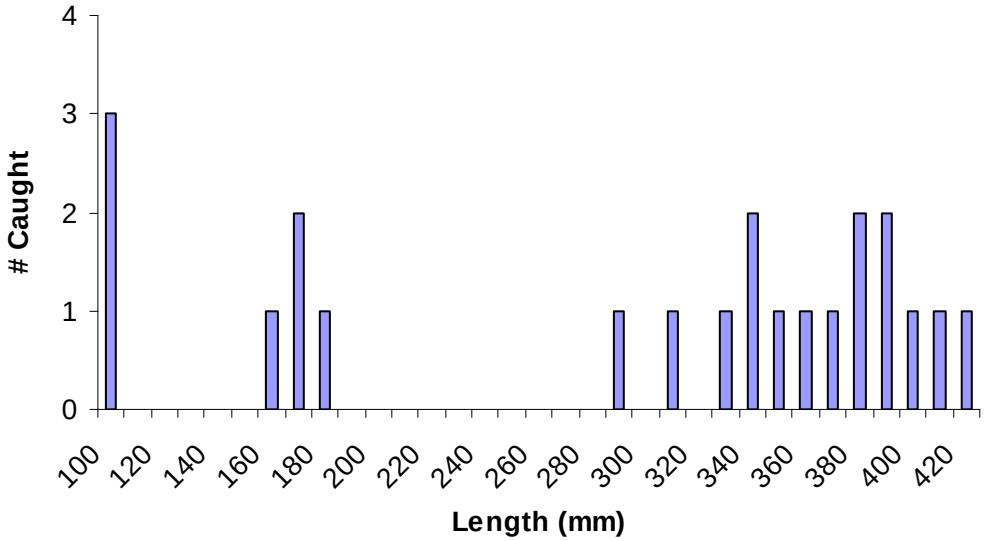

Figure 13. Length frequency of Yellowstone cutthroat trout collected with gill nets in Palisades Reservoir, Idaho during 2003.

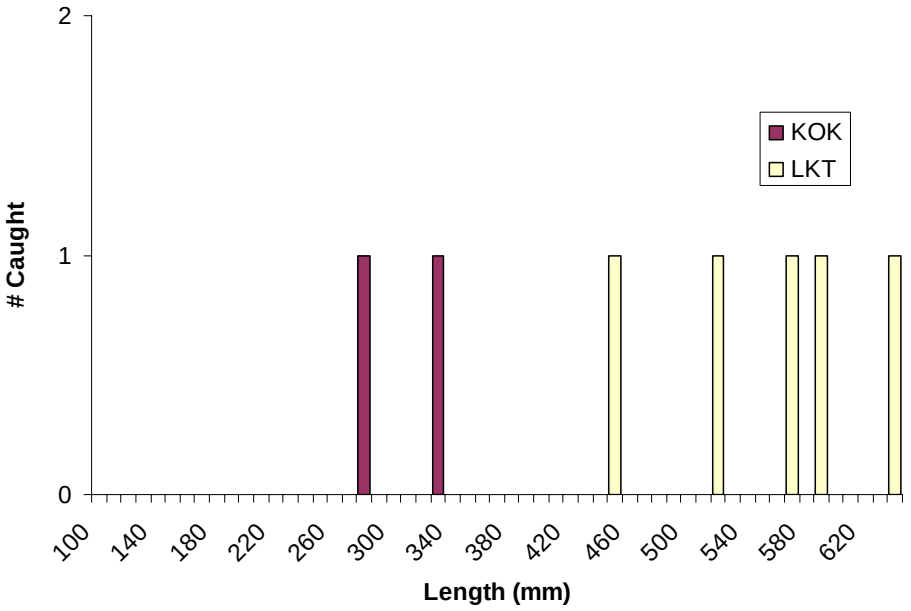

Figure 14. Length frequency of kokanee salmon (KOK) and lake trout (LKT) collected with gill nets in Palisades Reservoir, Idaho during 2003.

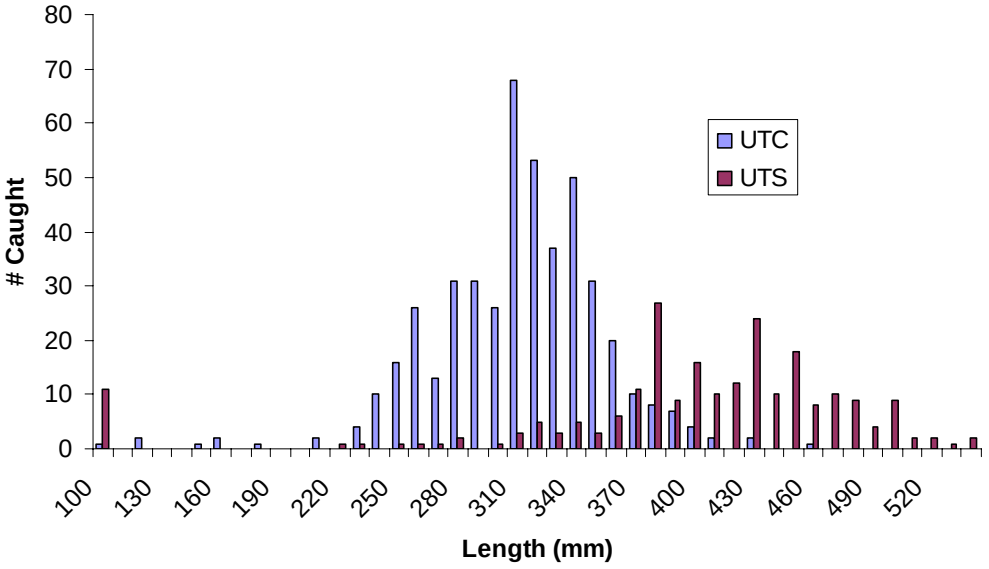

Figure 15. Length frequency of Utah chubs (UTC) and Utah suckers (UTS) collected with gill nets in Palisades Reservoir, Idaho during 2003.

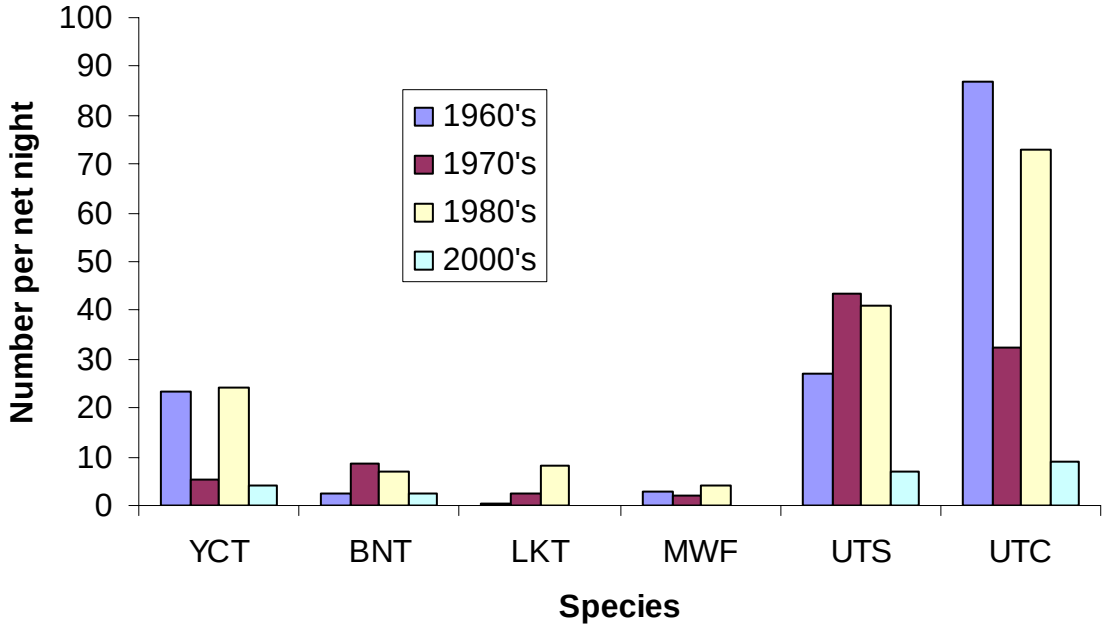

Figure 16. Gill net catch rates (fish per net night) caught in Palisades Reservoir, Idaho. Data was averaged for each decade and is presented as mean catch over that time period.

GEM LAKE

METHODS

On July 8, 2003 we used a Smith-Root electrofishing boat with pulsed DC current and bow-mounted headlights to assess fish populations in Gem Lake. The survey started at dusk, and proceeded for one hour. We drove the boat along the shoreline, and sampled representative habitat throughout the reservoir. All fish collected were identified and measured for total length (mm) before being released back into the reservoir.

RESULTS

We collected 17 fish during the one-hour electrofishing survey. Catch rates (fish per hour) ranged from one to seven fish per hour for the various species collected (Table 13). Suckers *Catostomus spp.* comprised the majority of the catch (41%), followed by smallmouth bass (12%), carp *Cyprinus carpio* (12%), rainbow trout (12%), brown trout *Salmo trutta (12%)* and yellow perch (6%, Table 13).

DISCUSSION

We have monitored angler use of Gem Lake through anecdotal observations throughout the year, and have noted only moderate use. Catchable trout stocking provides the major component of the fishery. An ice-fishery targeting yellow perch has developed in recent years. Our population survey found low densities of sport fish, but show the existing habitat is adequate to support warmwater fish. Our observations of shoreline habitat suggest spawning substrate for smallmouth bass may be in short supply, and may be one factor limiting this population. Additionally, young-of-the-year (YOY) smallmouth bass may incur poor overwinter survival if growth is slow.

RECOMMENDATIONS

1. Conduct spring electrofishing survey to assess smallmouth bass abundance and forage fish availability.

2. Work with local B.A.S.S. clubs and other interested citizens to assess abundance and quality of spawning habitat.

3. Collect young-of-the-year smallmouth bass during the fall to assess size prior to first winter.

Table 13. Catch per unit effort (fish per hour) for fish collected in Gem Lake, Idaho during 2003 electrofishing surveys.

Species	No. Caught	CPUE	Relative abundance (percent)
Rainbow trout	2	2	12
Sucker	7	7	40
Carp	2	2	12
Smallmouth bass	3	3	18
Brown trout	2	2	12
Yellow perch	1	1	6

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Jeppson, Paul. 1972. Henrys Lake Fishery Investigation. Job Completion Report. Idaho Department of Fish and Game, Boise.

McArthur, T.J. 1993. Creel Census System. Job Completion Report, Project F-73-R-15. Idaho Department of Fish and Game, Boise.

Spateholts, Robert L. 1984. Ecology of Naturalized and Introduced Stocks of Brook Trout in Henry's Lake, Idaho. Masters Thesis, Idaho State University.

APPENDIX

Appendix A. Locations used in standard Henrys Lake gill net sets and standard dissolved oxygen monitoring stations. Coordinates are given as UTMs.

Gill Net Sites

Gill Net 1.	12T 04 67 252 E	49 44 882 N
Gill Net 2.	12T 04 69 510 E	49 43 608 N
Gill Net 3.	12T 04 67 217 E	49 40 776 N
Gill Net 4.	12T 04 67 320 E	49 43 171 N
Gill Net 5.	12T 04 67 962 E	49 42 292 N
Gill Net 6.	12T 04 68 203 E	49 40 874 N

Dissolved Oxygen Sites

County boat dock:	12 T 04 65 725 E	49 44 234 N
Wild Rose:	12 T 04 67 751 E	49 45 816 N
Outlet:	12 T 04 71 374 E	49 38 741 N
Pittsburg Creek:	12 T 04 69 446 E	49 43 838 N
Hatchery Ladder:	12 T 04 69 290 E	49 45 489 N
Cliffs:	12 T 04 67 072 E	49 40 951 N

2003 ANNUAL PERFORMANCE REPORT

State of:	Idaho	Program:	Fisheries Management F-71-R-28
Project:	I-Surveys and Inventories	Subproject:	I-G Upper Snake Region
Job No.:	c	Title:	Rivers and Streams Investigations

ABSTRACT

We conducted mark-recapture population estimates during May, 2003 on three sections of the Henrys Fork to obtain fish population parameters and density estimates. Estimates were completed on the Box Canyon, Stone Bridge and Chester reaches. We compared estimates to previous year's samples where appropriate, and found overall abundance of rainbow trout *Oncorhynchus mykiss* to be lower than past year's samples in two of three reaches sampled (Box Canyon, Stone Bridge). Rainbow trout densities in the Chester reach were higher than 2002 estimates. Quality stock density (QSD) was similar to or higher than previous surveys for all reaches sampled. We used otoliths to determine age and growth of rainbow trout in the Stone Bridge reach, and found mean length at age three was 270 mm. We were able to locate 74 rainbow trout redds on a survey of redd abundance from Chester Dam downstream to the Fun Farm boat ramp, which suggests a substantial amount of reproduction occurs within this reach. We used population estimates of age-two rainbow trout to correlate flow regimes to year class strength, and showed that flows below 14 m^3/s during a trout's first winter produced below-average year classes, while those above that level produced stronger year classes. Constant spring flows also produced stronger year classes than when flows declined in the spring. An angler survey was conducted on the Mack's Inn reach of the Henrys Fork from the Big Springs Water Trail downstream to the Coffeepot Rapids reach. Interns with the Henry's Fork Foundation interviewed 252 anglers during July and August. We estimated the overall catch rate was 2.4 fish per hour, with anglers harvesting 11% of all fish caught. The majority of anglers (80%) were from out of state, while the remaining 20% were Idaho residents. Yellowstone cutthroat trout *O. clarkii bouvieri* were stocked in this section as fingerlings in 2002, and constituted 26% of captured fish. During October and November 2003, repairs to the Island Park Dam required the shutdown of flows resulting in dewatering of the Henrys Fork down to the Buffalo River (approximately 400m). We conducted a fish salvage manned by volunteers and Department staff in this reach over three days in October. Approximately 3,000 rainbow trout were physically moved, and an additional 1,000 fish herded out from this area at a total estimated cost of $22,000.

We conducted electrofishing surveys on three sections of the Big Lost River below Mackay Dam and on nineteen sites above the reservoir. Lower river assessments were used to collect age and growth information on trout and density information on mountain whitefish *Prosopium williamsoni*. Upper river surveys were to estimate densities and relative abundance. Rainbow trout were found throughout the drainage, with the highest densities in the East Fork.

Densities of fish > 150 mm ranged from 0 to 4.4 fish / 100m^2, with the lowest densities found in the West Fork drainage. Estimates of rainbow trout abundance above Mackay Dam have improved in 50% of areas compared to 1980s estimates, and in 60% of areas compared to 1990s estimates. Brook trout *Salvelinus fontinalis* are found throughout the Big Lost River, but appear to be thriving in the uppermost reaches of the drainage. Densities of fish > 150 mm ranged from 0 fish / 100m^2 to 22.9 fish / 100m^2, and were highest in the West Fork (Starhope) drainage. The mainstem and the North Fork had the lowest densities. Brook trout densities have increased in 60% of areas sampled compared to 1980s estimates, and in 57% of areas compared to 1990s estimates. Yellowstone cutthroat trout were first introduced into the West Fork in 2000. Densities ranged from 0 to 2.4 fish / 100m^2, and were most abundant in the West Fork drainage. No cutthroat trout were captured in the North Fork drainage, but a small number were recovered in all other areas of the Big Lost River, showing distribution throughout the drainage. We documented natural reproduction in the West Fork and several tributaries. We only found mountain whitefish in the East Fork and Mainstem Big Lost River. Densities of fish >200 mm were extremely low, and ranged from 0 to 0.2 fish / 100m^2. Current densities of whitefish are only three to ten percent of what was estimated in 1986 surveys. Whitefish are present in about 27% of the range historically occupied. Contrary to samples collected in 2002, we collected no age-0 whitefish below Mackay Dam, indicating a possible weak year-class. Recent work has identified the Big Lost River population as being genetically distinct from other whitefish populations. Additional information on whitefish is necessary to fully evaluate the status of the population.

We electrofished two sections of the upper Teton River, Idaho in August and September 2003. A total of 382 trout were captured during two days of sampling at Breckenridge. Species composition and relative abundance were cutthroat trout (3%), rainbow trout and hybrid rainbow x cutthroat trout (90%), and brook trout (7%). Estimated densities were 3 cutthroat trout, 287 rainbow trout, 7 brook trout, and 278 fish/km for all species combined. A total of 545 trout were captured during two days of sampling at Nickerson. Species composition and relative abundance were cutthroat trout (6%), rainbow trout (34%), and brook trout (60%). Estimated densities were 9 cutthroat trout, 87 rainbow trout, 165 brook trout, and 271 fish/km for all species combined. At Breckenridge, mean total length was 400 mm for cutthroat trout, 265 mm for rainbow trout, 247 mm for brook trout, and 269 mm for all species combined. Quality stock density (QSD) was 66.7% for cutthroat trout, 9.8% for rainbow trout, 0.0% for brook trout, and 11.6% for all species combined. At Nickerson, mean total length was 339 mm for cutthroat trout, 305 mm for rainbow trout, 240 mm for brook trout, and 268 mm for all species combined. QSD was 32.3% for cutthroat trout, 21.0% for rainbow trout, 0.0% for brook trout, and 9.1% for all species combined. Since 1987, cutthroat trout ranged from 3 to 78% of the electrofishing catch, with densities ranging from 3 to 379 fish/km, over the five upper Teton River sections that have been sampled – including Breckenridge and Nickerson. Cutthroat trout increased following special harvest regulations implemented in 1990 but then decreased to record low numbers for unknown reasons. Rainbow trout ranged from 5 to 90% of the catch, with densities ranging from 14 to 433 fish/km. They declined in the mid-1990s but have since increased. Brook trout ranged from 5 to 60% of the catch, with densities ranging from 7 to 279 fish/km. They have remained relatively stable. Only two brown trout have been caught, and they may have been introduced illegally from the lower Henrys Fork Snake River or South Fork Snake River. Cutthroat and brook trout were generally more common and had higher densities –

whereas rainbow trout were generally less common and had lower densities – as one moved upstream. Cutthroat and rainbow trout average lengths and QSDs increased dramatically in all sections. This reflects increased numbers of larger and older fish from reduced harvest as well as reduced numbers of juvenile fish. Brook trout size has also increased but to a lesser degree.

Authors:

Dan Garren
Regional Fishery Biologist

Bill Schrader
Senior Fishery Research Biologist

Jim Fredericks
Regional Fishery Manager

OBJECTIVE

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

HENRYS FORK

METHODS

Population Monitoring

We used two drift boat electrofishers to assess fish populations in three sections of the Henrys Fork (Box Canyon, Stone Bridge and Chester Dam). All samples employed two marking runs, followed by a seven-day rest, and a single-pass recapture event. Rainbow trout *Oncorhynchus mykiss*, brown trout *Salmo trutta* and mountain whitefish *Prosopium williamsoni* collected during initial runs were marked with a caudal fin hole punch, measured for total length (mm) and released to the area of capture. We made population estimates for rainbow trout, brown trout and mountain whitefish > 150 mm using Peterson's mark-recapture with Chapman's modification and Montana's MR5 data analysis program (MR5; Montana Department of Fish, Wildlife, and Parks 1994), which allowed comparisons to previous years to be made. We collected otoliths from a random sub-sample of rainbow trout and mountain whitefish in the Stone Bridge reach for age and growth analysis. Length at age, mortality, and survival were all calculated based on catch-curve analysis.

We decreased the sample reach in the Stone Bridge section from the 10.3 km sampled during 2002 to a 4.6 km stretch for the sake of efficiency and to minimize interference with anglers fishing the more easily accessed upper and lower portions of the reach.

We used results from the current survey combined with past estimates to correlate year-class strength to discharge in the Box Canyon reach of the Henrys Fork. We used a linear regression comparing age-two rainbow trout population estimates and flow characteristics to identify factors contributing to variation in year classes. We considered a relationship significant if it yielded a high r^2 value and made biological sense.

We surveyed rainbow trout redd abundance in the Chester Dam reach of the river by using a canoe with two observers. We floated the area between the dam and the Fun Farm Bridge, and noted disturbed areas of gravel with a depression and pillow complex characteristic of a trout redd. We entered locations into a global positioning unit, and downloaded onto a mapping program (Maptech's Terrain Navigator program, Maptech 2001) to assess the spatial distributions within the reach.

Creel Survey

A creel survey was conducted in conjunction with the Henrys Fork Foundation on the Upper Henrys Fork above Island Park Reservoir during July and August to document catch rates, angler success and the contribution of newly planted Yellowstone cutthroat trout *O. clarkii* to the fishery. A student volunteer floated in a canoe from the Big Springs Water Trail downstream to the Mack's Inn Bridge, then would drive around to the Coffeepot Trail trailhead and hike a circuit downstream below the rapids. All anglers encountered were interviewed and asked how long they had been fishing, gear type used, their residency, how many and what species of fish they had caught, and if they had released them. We also obtained information on fishing method (boat vs. wade), and if the trip was completed or not. Interview data was summed for each month to represent days used in interviews, but not expanded to the total month as the survey only encompassed two months and would provide little comparative information to previous years effort. As a result, only catch rate information, species composition and angler demographics are presented.

Fish Salvage

Repairs to the Island Park Dam during October and November required the shutdown of flows through the dam, resulting in dewatering of the Henrys Fork between the dam and the Buffalo River (approximately 400 m). We conducted a fish salvage manned by volunteers and Department staff in this reach over three days. Methods used to salvage fish from the river reach between Island Park Dam and the confluence with the Buffalo River included using human "drive lines" to herd fish downstream as flows receded, and extensive electrofishing. A full summary including cost estimates is presented in Appendix A.

RESULTS

Population Monitoring

Box Canyon

We collected 1,050 fish during the three days of electrofishing in Box Canyon. Species composition of fish handled was dominated by rainbow trout (59%), followed by mountain whitefish *Prosopium williamsoni* (41%), brook trout *Salvelinus fontinalis* (<1%), and splake *S. fontinalis x S. namaycush* (<1%). Size distribution of rainbow trout was skewed towards larger fish (RSD-Q = 45, Figure 1), with mean size of 365 mm, median size of 385 mm, and 1% of the captured fish greater than 500 mm (Table 1). We estimated 2,973 rainbow trout > 150 mm (95% CI = 1,935 - 3,977, cv = 0.18) in the reach, which equates to 804 fish per km (Table 2). This estimate falls below the 15-year average for this reach, and is substantially lower than the 2002 estimate (Figure 2). We estimated mountain whitefish at 2,121 whitefish > 200 mm (95% CI = 1,151 - 2,582, cv = 0.20), which equates to 573 fish per km.

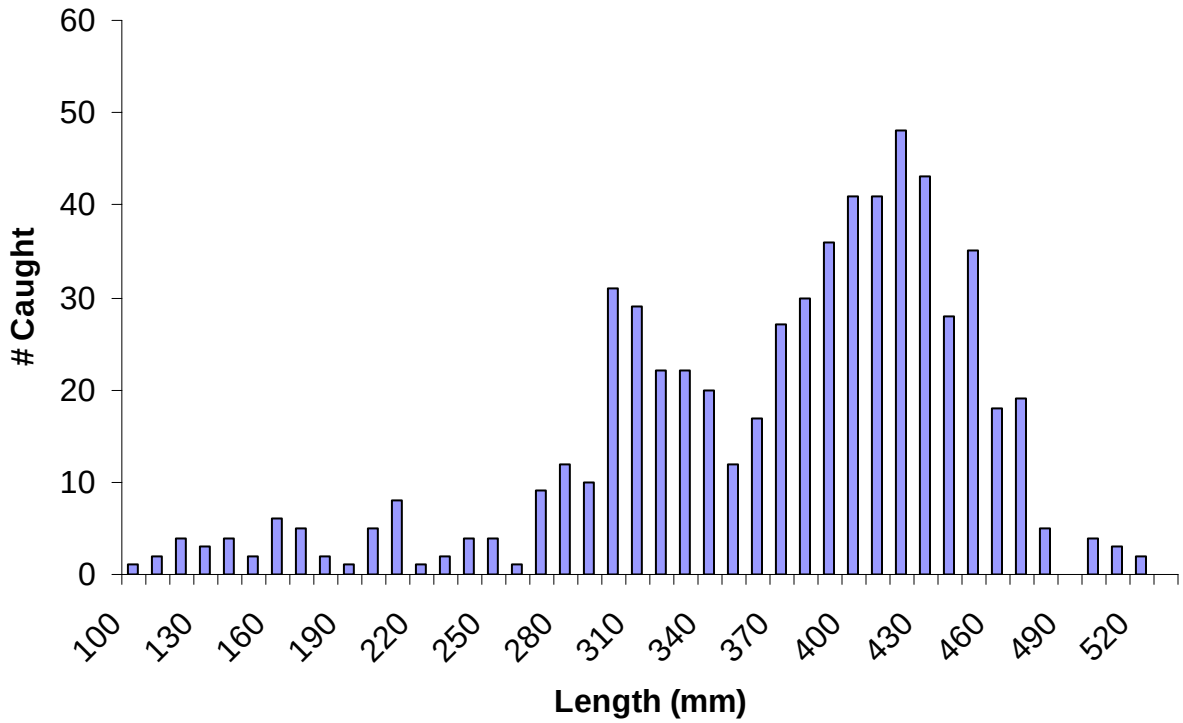


Figure 1. Length frequency distribution for rainbow trout collected electrofishing in the Box Canyon reach of the Henrys Fork, Idaho, 2003.

Table 1. Rainbow trout population index summaries for the Henrys Fork, Idaho in 2003.

Reach	Mean length at age three	Median length	QSD	Fish per km	Species composition		
					RBT	MWF	BRN
Box Canyon		385	45	804	59	41	0
Stone Bridge	270	310	21	1,412	38	59	1
Chester		410	63	361	31	64	4

Table 2. Data used in population estimates from the Henrys Fork, Idaho during 2002 and flow levels during sampling.

River reach	Number Marked	Number Captured	Number Recaptured	Population Estimate	Confidence Interval	Density (No./ km)	Discharge (Q)
Box Canyon							9.9 m^3/s[a]
Rainbow trout	419	185	24	2,973	1,935-3,977	804	
Mountain whitefish	210	176	19	2,121	1,151-2,582	573	
Stone Bridge							47.0 m^3/s[b]
Rainbow trout	225	114	3	6,496	951-12,042	1,412	
Mountain whitefish	213	294	0	--	--	--	
Brown trout	19	12	1	129	1-257	28	
Chester Dam							78.4 m^3/s[c]
Rainbow trout	80	218	7	2,056	866-3,566	361	
Mountain whitefish	239	361	15	4,919	2,991-7,867	863	
Brown trout	12	16	3	54	37-138	10	

[a]Data obtained from USGS gauge just downstream from Island Park Dam (13042500)
[b]Data obtained from USGS gauge near Ashton Reservoir (13046000)
[c]Data obtained from USGS gauge near St Anthony (13050500)

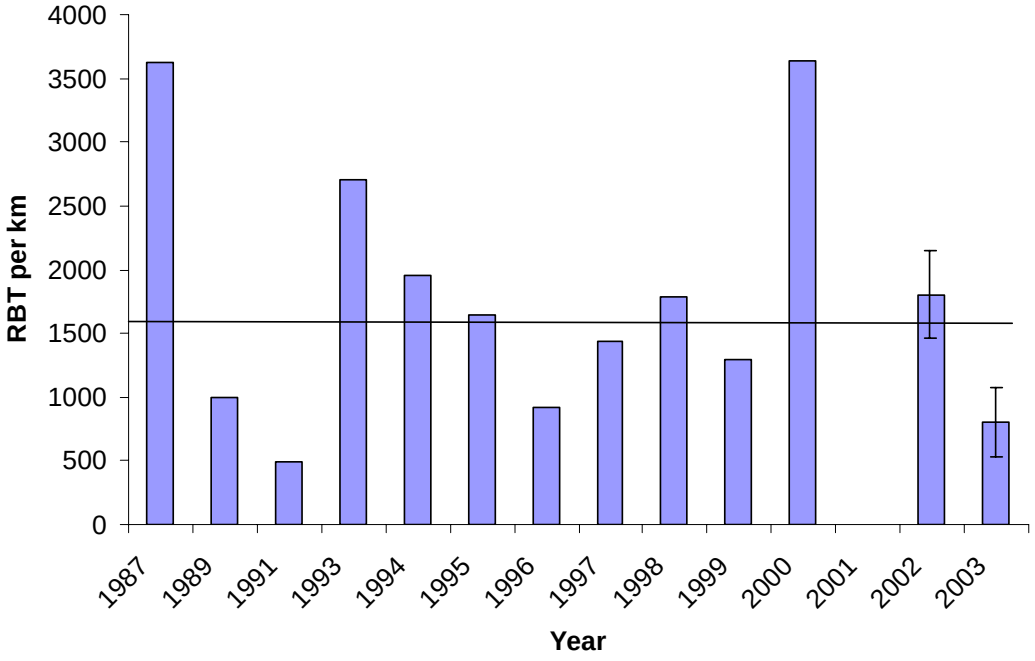


Figure 2. Annual population estimates (fish per km) for Box Canyon rainbow trout in the Henrys Fork, Idaho. Solid line indicates mean rainbow trout per km since 1987. 95% confidence intervals are in brackets.

We used population estimates from the past ten years to correlate year-class strengths to flow characteristics to address flow management from Island Park Dam. We used age-two fish in the analysis because they represent the first fully recruited cohort in our electrofishing samples.

We developed a database of flow characteristics from Island Park Dam. We segregated the water year into critical periods of winter, spring and summer flows (Figure 3). Flow characteristics used in regression analysis included minimum and maximum flows by month, fluctuations in flows on a daily, three-day, five-day, and ten-day average, and were stratified throughout seasons (Table 3). Regressions plotting estimates of age-two fish were run against all these flow variables. We used the resulting r^2 value to determine functionality of the regression, and found the most significant single variable affecting population estimates was flows during the first winter of a fish's life (Figure 4). Flows above 14.2 m^3/s produced stronger year classes than those below this level. We then used this regression to predict the population of age-2 fish in 2004 and 2005 samples based on winter flows of 2002 and 2003, and predicted below-average year classes were produced during both years (Figure 5). Another significant variable was spring flow, with years with declining spring flows producing weak year classes, while years with steady or increasing flows producing stronger year classes.

Stone Bridge

We collected 946 fish in the Stone Bridge reach of the Henrys Fork during the two-day population estimate. Species composition of the raw catch was 38% rainbow trout, 59% mountain whitefish and 3% brown trout *Salmo trutta*, although these are likely biased to some degree by an increased emphasis on collecting trout over whitefish. Rainbow trout and whitefish stock density indices were not as high as those found in the upper reaches of the river, with RSD-Q of 23 for rainbow trout. Mean and median size of rainbow trout was 310 and 308 mm, respectively, and no fish captured were greater than 500 mm (Figure 6). We estimated 6,496 rainbow trout > 150 mm in this reach (95% CI = 951 - 12,042; cv = 0.44), which equates to 1,412 fish per km, and is higher than all previous estimates (Figure 7). We could not estimate mountain whitefish abundance due to an absence of recaptured fish. However, length frequencies are presented in Figure 8. Brown trout relative stock indices were substantially larger for this reach of river, with a RSD-Q of 84. Length frequencies for brown trout are presented in Figure 9. We estimated 129 brown trout > 150 mm (95% CI = 1 – 257 fish; cv = 0.51), which equates to 28 fish per km.

Growth calculations show rainbow trout reach 270 mm by age three (Table 4). We developed mortality/survival estimates for rainbow trout in the Stone Bridge reach based on catch curve analysis (Figure 10). Trout survival between ages three and six was estimated at 70% annually (Table 5).

Chester Dam

We collected 1,094 fish during the two-day mark-recapture event in the Chester Dam reach of the Henrys Fork. Species composition was dominated by mountain whitefish (64% of total catch) followed by rainbow trout (31%), brown trout (4%), and Yellowstone cutthroat trout

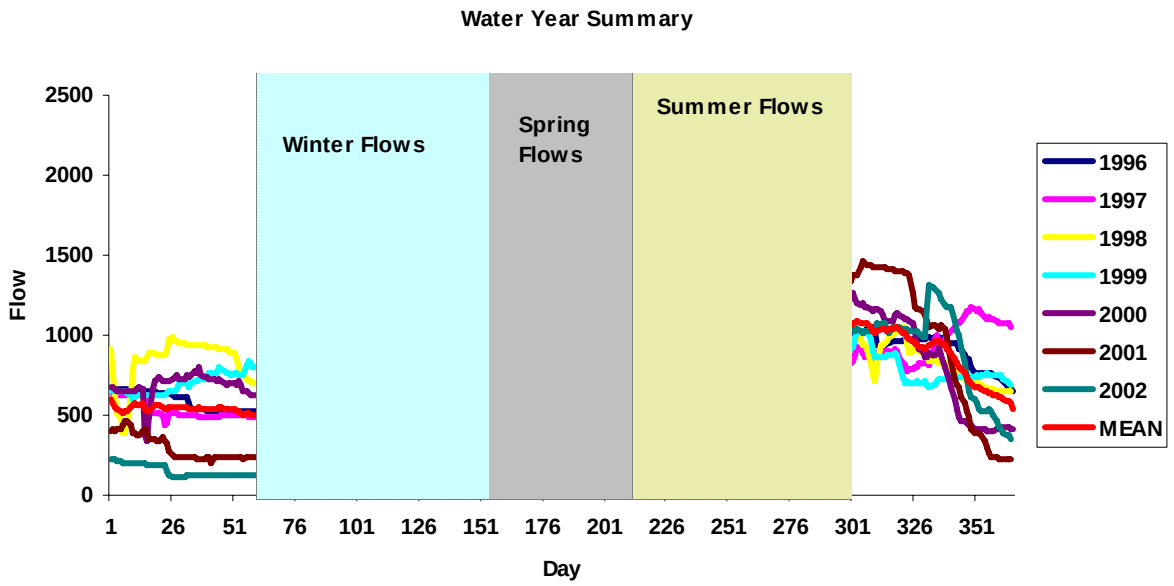


Figure 3. Flow data for the Box Canyon section of the Henrys Fork, Idaho. Data were obtained from the USGS gauge 13042500 near Island Park, Idaho.

Table 3. Flow characteristics used in regression analysis of year class strength in the Box Canyon reach of the Henrys Fork, Idaho. Strong relationships are noted in **bold type**.

Flow Characteristic	Relationship (+/-)	Trend line type	r^2 value
Max Winter Flow	**+**	**exp**	**0.59**
Max Spring Flow	+	exp	0.36
Max Summer Flow	+	exp	0.17
Min Winter Flow	**+**	**exp**	**0.62**
Min Spring Flow	+	exp	0.31
Min Summer Flow	-	exp	0.02
Mean winter flow	+	exp	0.17
Mean spring flow	+	exp	0.36
Mean summer flow	-	exp	0.09
Winter flow variation (max-min)	+	exp	0.09
Spring flow variation (max-min)	+	exp	0.15
Summer flow variation (max-min)	+	exp	0.24
Max daily change winter	+	exp	0.04
Max daily increase winter	+	exp	0.07
Max daily decrease winter	+	exp	0.17
Greatest 3-day change winter	+	exp	0.04
Greatest 3-day increase winter	+	exp	0.05
Greatest 3-day decrease winter	+	exp	0.16
Greatest 5-day change winter	+	exp	0.1
Greatest 5-day increase winter	+	exp	0.12
Greatest 5-day decrease winter	+	exp	0.18
Greatest 10-day change winter	+	exp	0.11
Greatest 10-day increase winter	+	exp	0.13
Greatest 10-day decrease winter	+	exp	0.14
Max daily change spring	-	exp	0.15
Max daily increase spring	-	exp	0.15
Max daily decrease spring	**-**	**exp**	**0.53**
Greatest 3-day change spring	-	exp	0.09
Greatest 3-day increase spring	-	exp	0.1
Greatest 3-day decrease spring	**-**	**exp**	**0.56**
Greatest 5-day change spring	-	exp	0.05
Greatest 5-day increase spring	-	exp	0.05
Greatest 5-day decrease spring	**-**	**exp**	**0.53**
Greatest 10-day change spring	-	exp	0.1
Greatest 10-day increase spring	-	exp	0.1
Greatest 10-day decrease spring	**-**	**exp**	**0.55**
Max daily change summer	-	lin	0.01
Max daily increase summer	-	lin	0.1
Max daily decrease summer	+	lin	0.04
Greatest 3-day change summer	-	lin	0.02
Greatest 3-day increase summer	+	lin	0.12
Greatest 3-day decrease summer	+	exp	0.13
Greatest 5-day change summer	+	exp	0.05
Greatest 5-day increase summer	-	lin	0.14
Greatest 5-day decrease summer	+	exp	0.23
Greatest 10-day change summer	+	exp	0.45
Greatest 10-day increase summer	-	lin	0.14
Greatest 10-day decrease summer	**+**	**exp**	**0.53**

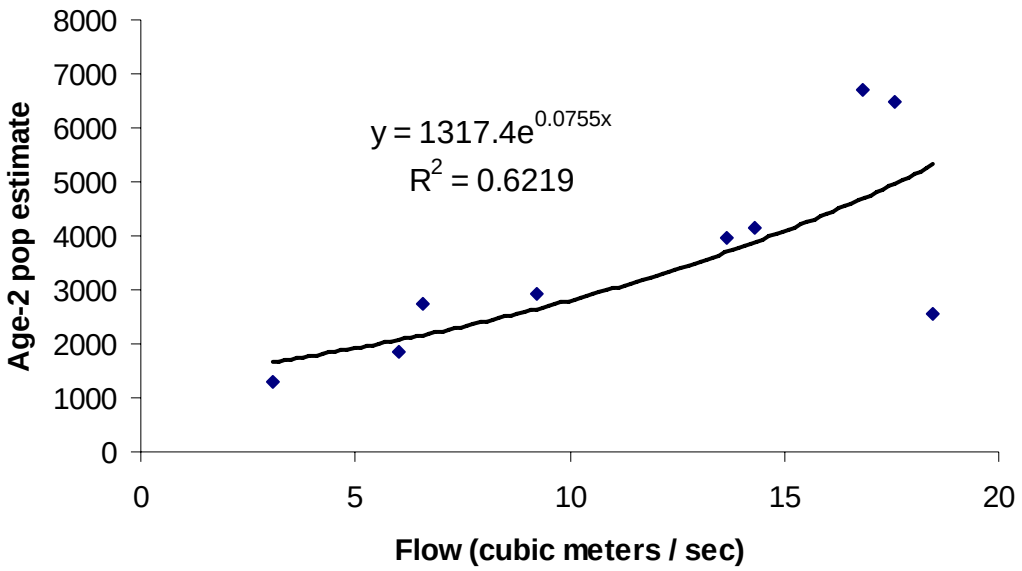


Figure 4. Regression depicting population estimates of minimum winter flows vs. estimated abundance of age-2 fish in the Box Canyon reach of the Henrys Fork, Idaho.

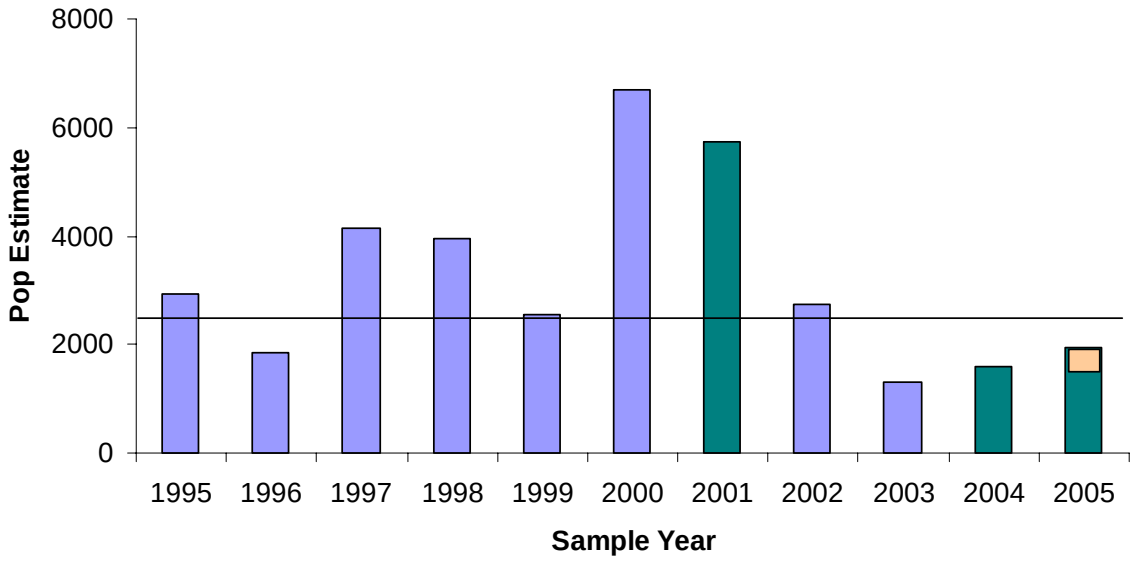


Figure 5. Age–2 rainbow trout abundance in the Box Canyon reach of the Henrys Fork, Idaho. Figures shown for 2001, 2004 and 2005 are estimated abundances based on a winter flow regression. The top portion of the 2005 estimate is the calculated (estimated) additional benefit to that year class based on negotiated flows from Island Park Dam releases during 2003.

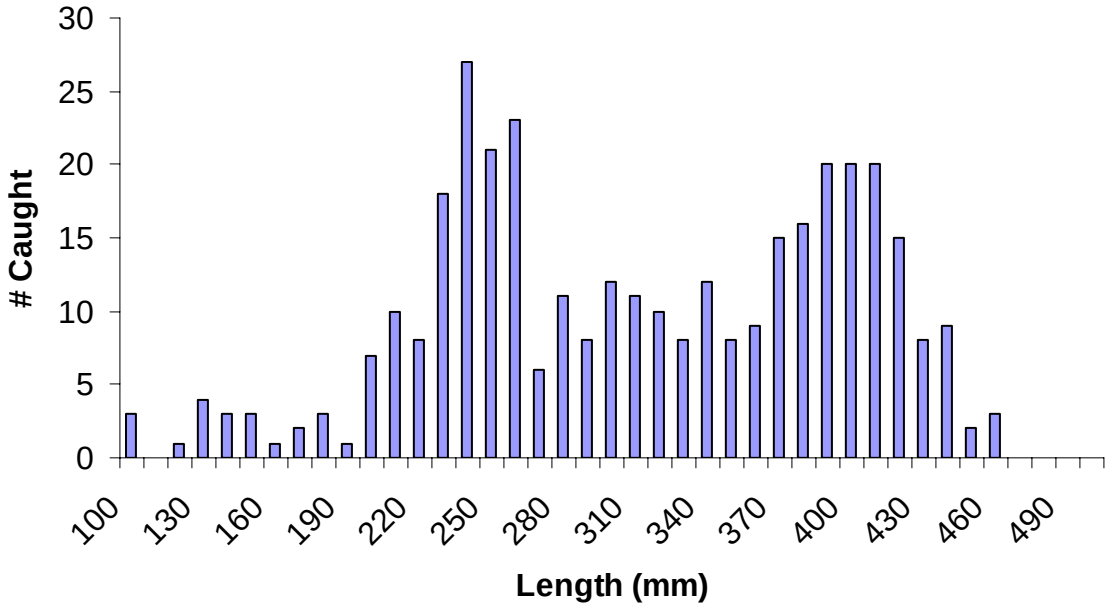


Figure 6. Length frequency distribution for rainbow trout collected electrofishing in the Stone Bridge reach of the Henrys Fork, Idaho 2003.

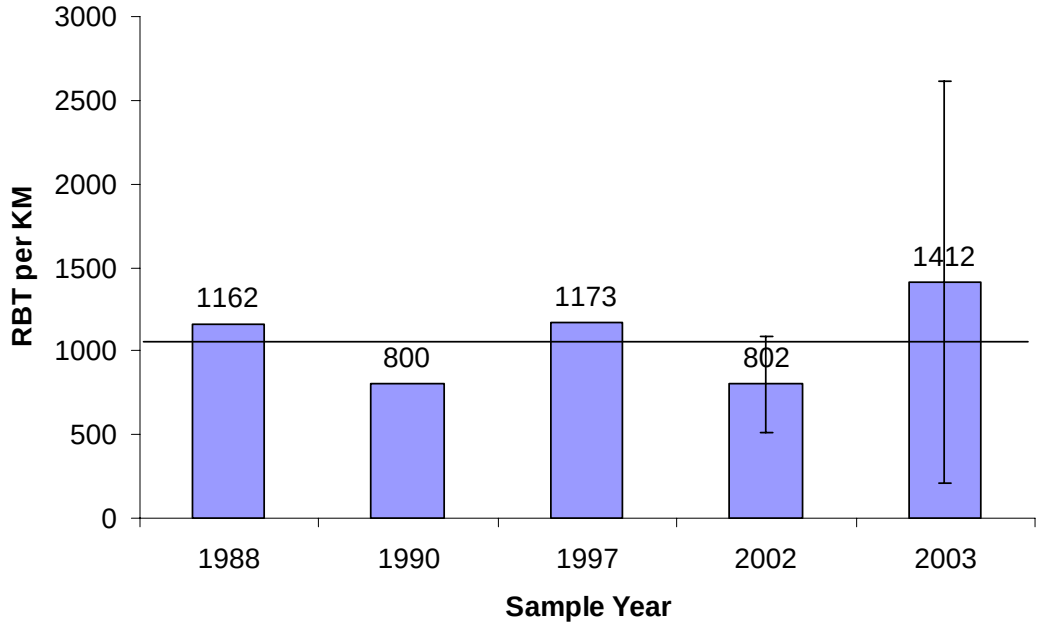


Figure 7. Rainbow trout density estimates for the Stone Bridge reach of the Henrys Fork, Idaho.

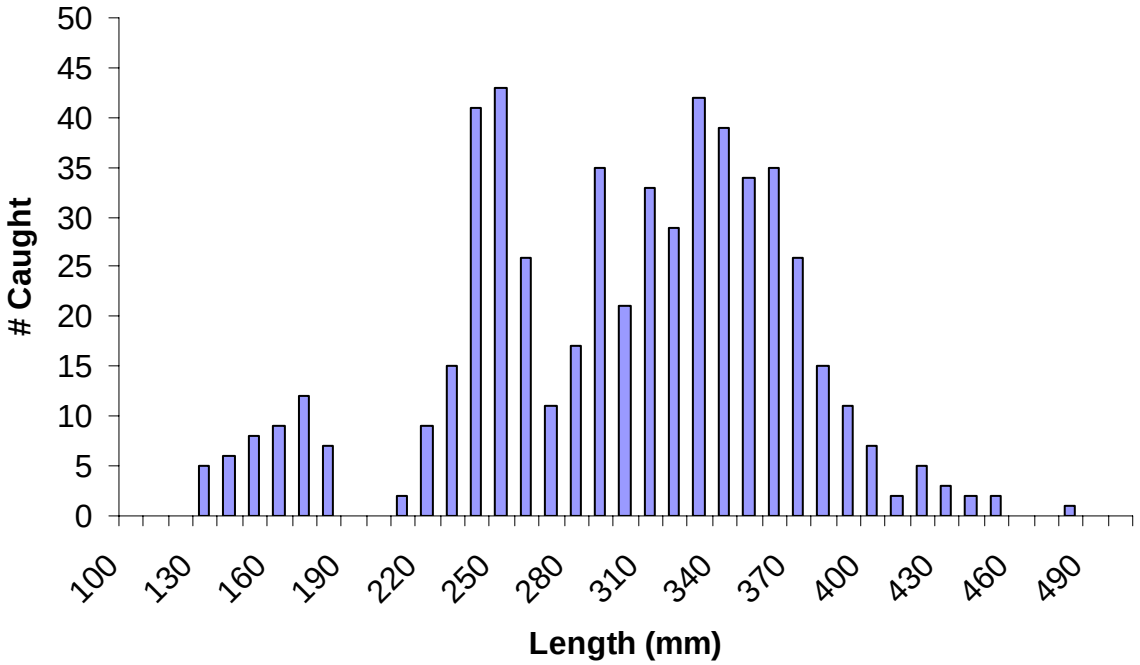


Figure 8. Length frequency distribution for mountain whitefish collected electrofishing in the Stone Bridge reach of the Henrys Fork, Idaho 2003.

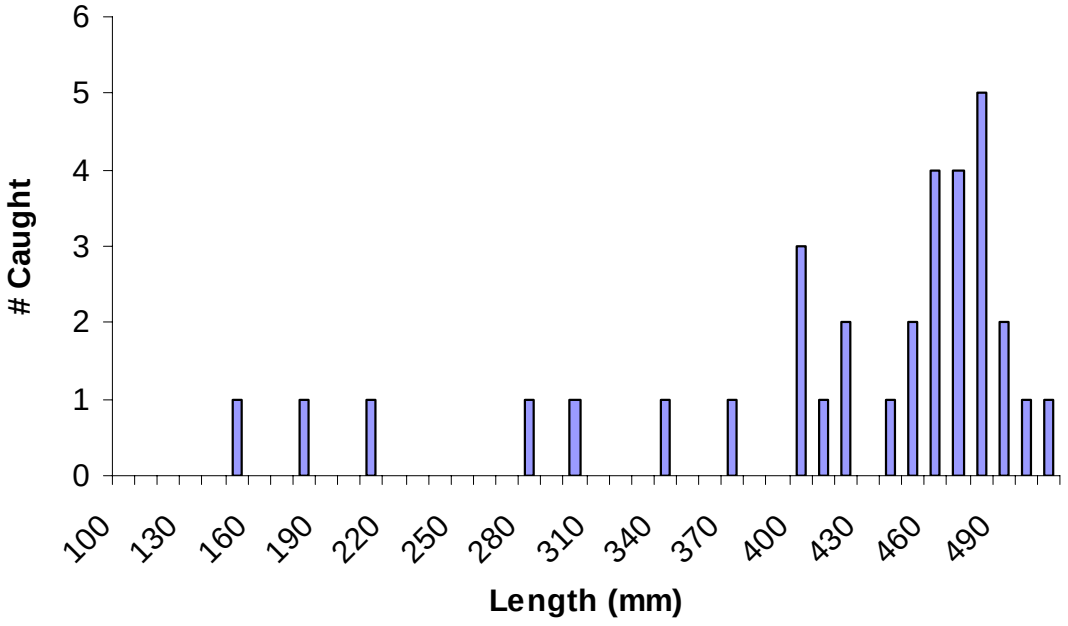


Figure 9. Length frequency distribution for brown trout collected electrofishing in the Stone Bridge reach of the Henrys Fork, Idaho 2003.

Table 4. Mean length at age of rainbow trout and mountain whitefish collected electrofishing in the Henrys Fork, Idaho 2003 based on otoliths.

Species	Mean Length at Age									
	1	2	3	4	5	6	7	8	9	10
Rainbow trout	142	230	270	352	390	383	--	--	--	--
Mountain whitefish	229	263	294	313	331	352	353	--	--	--

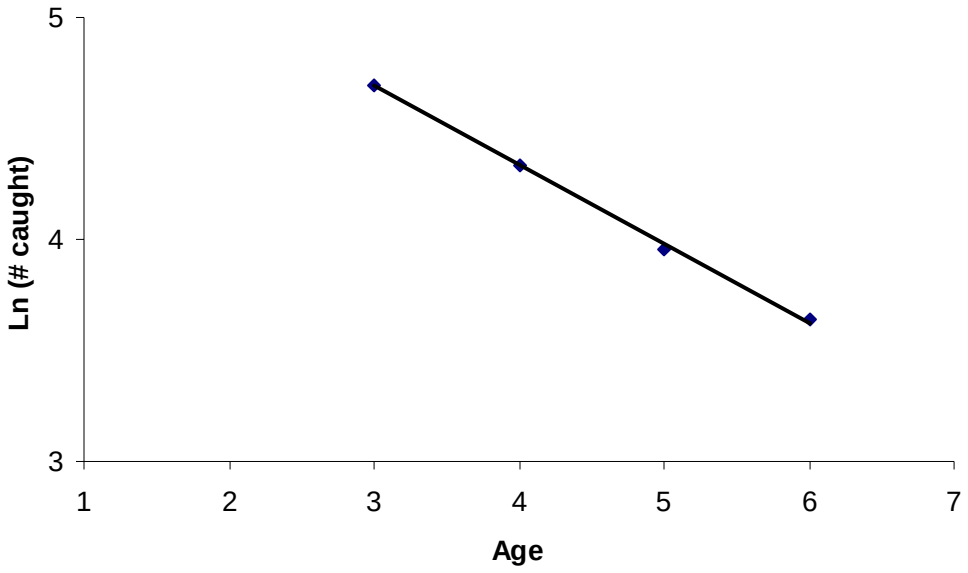


Figure 10. Catch curve for rainbow trout captured in the Stone Bridge reach of the Henrys Fork, Idaho 2003.

Table 5. Mortality and survival estimates for rainbow trout captured electrofishing in the Henrys Fork, Idaho 2003. Estimates are based on catch-curve analysis.

			Estimate	
Location	Age Class	Z	Survival	Mortality
Stone Bridge (2003)	3 to 6	-0.359	70%	30%
Stone Bridge (2002)	3 to 6	-0.656	52%	48%
Box Canyon (2002)	3 to 6	-0.510	60%	40%

(<1%). Rainbow trout size structure was skewed towards larger fish (QSD of 65), with a mean size of 366 mm, median size of 410 mm, and one rainbow trout greater than 500 mm (Figure 11). We estimated a total reach population of 2,056 rainbow trout > 150 mm (95% CI 866 - 3,566, cv = 0.31), which equates to 361 rainbow trout per km. This estimate is 28% lower than that found in 2002 by Ecosystems Research Institute consulting (ERI, Keith Lawrence, personal communication). We also estimated a mountain whitefish population > 200 mm at 4,919 fish, which equates to 863 fish per km. This is 37% lower than ERI's 2002 estimate. Size ranged from 125 mm to 465 mm (Figure 12).

Our 2003 redd survey documented redd locations throughout the reach from Chester Dam to the Fun Farm backwaters (Figure 13). We counted a total of 74 redds, which suggests significant rainbow trout spawning occurs within this section.

Creel Survey

Creel clerks interviewed a total of 252 anglers representing 139 angling parties in the Mack's Inn reach. Species caught by anglers included rainbow trout (67% of the catch), cutthroat trout (30% of the catch), brook trout (2% of the catch) and mountain whitefish (< 1% of the catch). The overall catch rate was 2.4 fish per hour, of which 11% were harvested. Twenty percent of interviewed anglers were residents, while the remaining anglers were nonresidents. Thirty-five percent of anglers were using bait, and 65% used lures or flies.

Fish Salvage

Salvage efforts below Island Park Dam resulted in the relocation of approximately 4,000 rainbow trout ranging in size from 100 mm to 500 mm. Approximately 3,000 rainbow trout were physically moved, and an estimated additional 1,000 fish herded out of this area at a total estimated cost of $22,000.

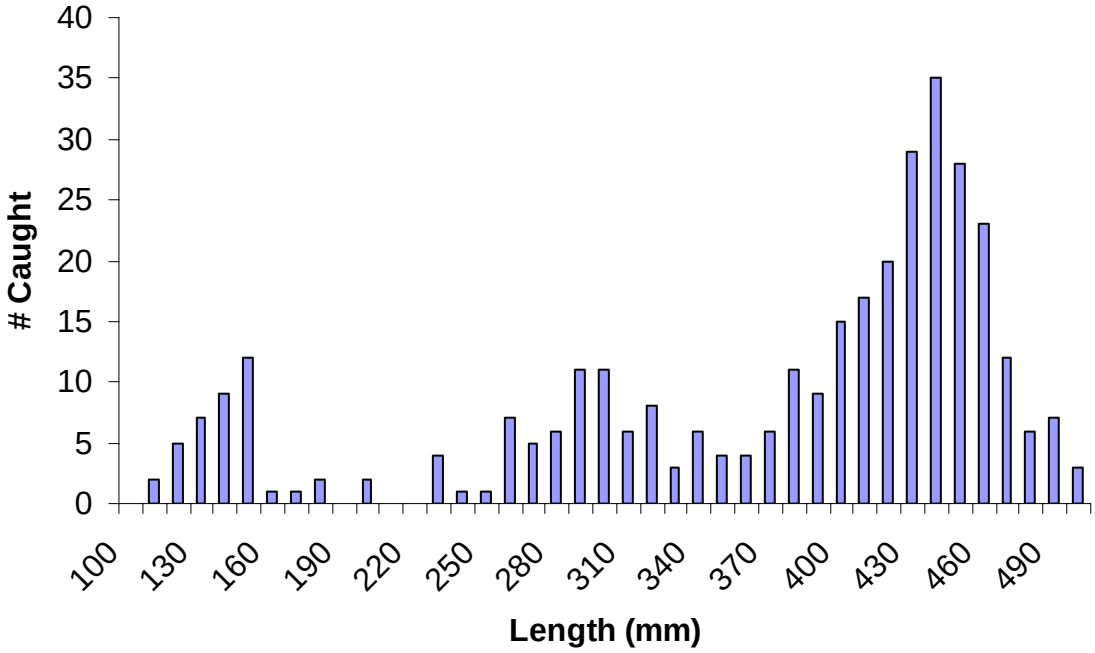


Figure 11. Length frequency distribution for rainbow trout collected electrofishing in the Chester Dam reach of the Henrys Fork, Idaho 2003.

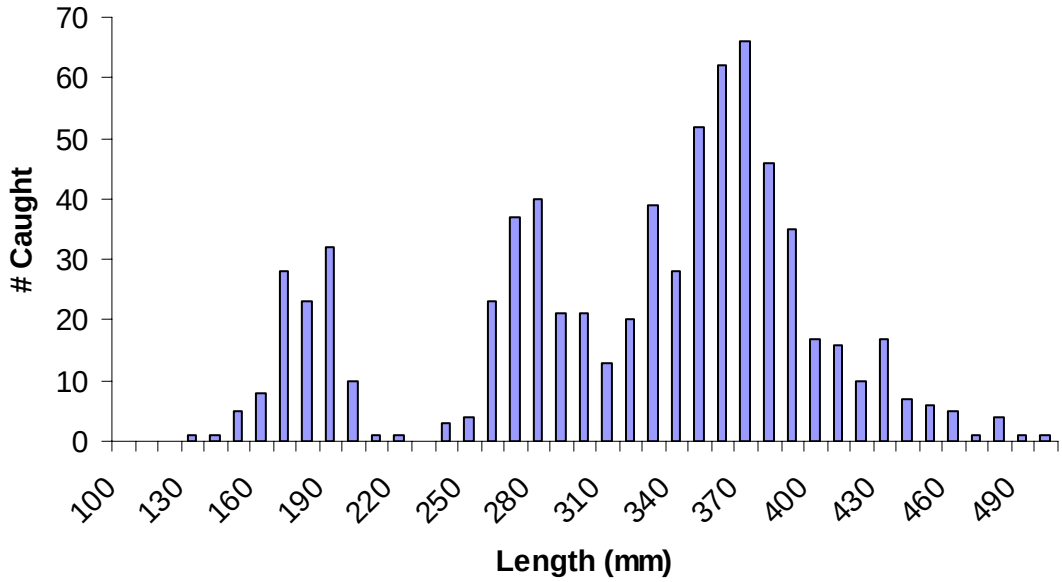


Figure 12. Length frequency distribution for mountain whitefish collected electrofishing in the Chester Dam reach of the Henrys Fork, Idaho 2003.

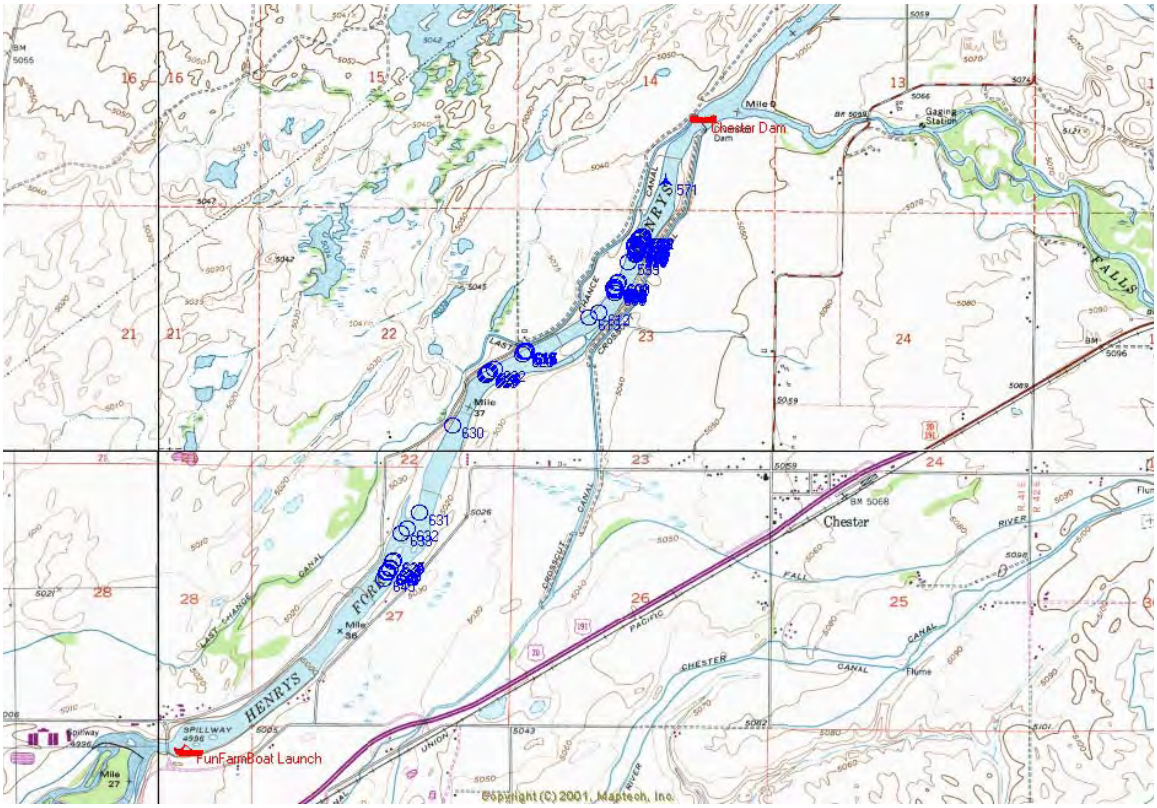


Figure 13. Rainbow trout redd abundance between Chester Dam and the Fun Farm Bridge on the Henrys Fork, Idaho 2003. Redds are noted as circles on the map.

DISCUSSION

Our Box Canyon population estimate indicates a lower density of rainbow trout than in recent years. However, flows during the sampling period were extremely low, and made navigation and maintaining continuity through the sample extremely difficult. Electrofishing crews had to repeatedly stop sampling to pull the boats through shallow areas, which gave fish a chance to avoid capture. Additionally, an unquantified portion of the Box Canyon could not be surveyed due to these low flows. Despite these difficulties, the low coefficients of variation from our study support the validity of our 2003 estimates; as do our confidence intervals of plus or minus 34%. Our estimates put densities well below the 15-year average. Length-frequency information shows several weak year classes of younger fish (up to age-three); indicating recruitment has not been consistent over the past several years. This is further substantiated by high RSD-Q values. Typically this value is around 25 for Box Canyon, and is reflective of a balanced population with both small and large fish present. The current estimate of 45 is indicative of an older population dominated by large fish. The long-term implications of such an unbalanced size structure will likely result in lower densities as these fish reach senescence and there are low numbers of fish recruiting to the fishery.

Analysis of our regressions of age-two rainbow trout abundance and abiotic factors indicated minimum winter flows have the most potential to influence population abundance. In years where winter flows are below 14 m^3/s, below-average year classes of age-two rainbow trout are produced. A second factor with substantial impacts to year-class strengths is spring flow. Population estimates of age-two rainbow trout are higher during years when spring flows are constant as opposed to years when flows are reduced over a period of one to ten days. This makes sense, as dewatering of juvenile habitat and/or redds may occur when flows are reduced. The management implications from a rough model like winter flows may be useful in explaining year class strengths and predicting population densities in coming years. The Henrys Fork at Box Canyon will likely incur several consecutive weak year classes, including the 2004 and 2005 offspring, which may result in lower densities of catchable fish.

Population estimates in the Stone Bridge reach show a rebound in rainbow trout abundance compared to upstream reaches. However, for rainbow trout and brown trout, our coefficient of variation and confidence intervals of plus or minus 87-100% indicate our estimates are of limited value, and should be considered as first-order estimates. Unlike upstream reaches, recruitment in the Stone Bridge section seems to be more consistent. Although the catch of age-1 trout was rare, there appear to be strong year classes of age-2 and age-3 rainbow trout.

Age and growth analysis for rainbow trout and whitefish indicated growth is slower in the Stone Bridge area than in the upstream reaches. Mortality and survival were similar between years, suggesting estimates are reliable.

Fish densities in the Chester Dam reach were similar to densities found in the Mack's Inn reach during 2002, and lower than those estimates found last year by the consultant work done by Ecosystems Research Institute. Length frequency analysis shows several weak year classes, primarily in younger (age two and three) fish. The resulting RSD-Q estimate was indicative of a population characterized by larger, older fish. Brown trout size distribution as reflected in RSD-Q was high, but this was heavily influenced by the absence of smaller fish. We expect year class strength would not be as variable as we found upstream in areas such as the Box Canyon because of more consistent flows from tributaries such as Warm River and Falls River.

However, year class structure was more similar to that found in Box Canyon than in Stone Bridge, and tend to vary from year to year.

We located several significant spawning areas below Chester Dam, which indicate this reach is contributing to recruitment in the lower river. Based on this information and other informal surveys done by biologists and others familiar with the river fishery, it is unlikely that the fishery below the dam is supported solely by recruitment from upstream river reaches. We believe significant reproduction and recruitment occurs within the reach itself under current conditions.

RECOMMENDATIONS

1. Continue population assessment in representative reaches of the Henrys Fork.

2. Continue collecting otolith samples for use in age, growth and cohort analysis from multiple reaches of the Henrys Fork.

3. Pursue opportunities to obtain increased winter flows to benefit trout recruitment.

4. Avoid sampling Box Canyon when flows are below 14.5 m^3/s as drift boat electrofishing becomes too difficult to effectively sample.

BIG LOST RIVER

METHODS

We used a canoe electrofishing rig with pulsed DC current to sample the fishery below Mackay Reservoir during 2002. Sampling proceeded upstream to increase our effectiveness. We experienced equipment malfunctions with the canoe electrofisher during our April 2003 sample, and had to use two backpack electrofishers in tandem to repeat sampling efforts conducted in 2002. Captured fish were measured for total length (mm) and released to the area of capture. We could not use the data for cohort analysis due to the differences in efficiency between the two collection methods. Instead, the one-day sample was useful for noting presence/absence of whitefish in the lower river reach.

We used a canoe electrofishing rig to sample the larger sections of the upper Big Lost River during August 2003 (four sites), and backpack electrofishers to sample the remaining 15 sites. We repeated sample reaches from past years where possible. Where this was not possible, we selected sites to capture spatial and/or major landscape impacts such as major tributaries, etc. Reach lengths were between 100 and 300 m, and incorporated a riffle or other barrier at the beginning and end of each section. Two to three passes were made with the electrofishers, with density estimates obtained from depletions. Density estimates (fish per 100 m^2) were calculated and compared to past years data.

RESULTS

Leslie Reach

We collected 60 fish in the Leslie reach of the Big Lost River. Species composition was 92% rainbow trout *Oncorhynchus mykiss*, 4% brook trout *Salvelinus fontinalis* and 4% mountain whitefish *Prosopium williamsoni*. Species composition differed from 2002 surveys, primarily as a result of low catch rates on brook trout. Rainbow trout ranged in size from 94 to 445 mm while brook trout ranged from 310 to 315 mm. Although significant numbers of juvenile whitefish were encountered during 2002 surveys, none were collected in 2003 efforts.

Houston Bridge

We collected 40 fish in the Upper Houston Bridge reach of the Big Lost River. Species composition was 63% rainbow trout and 37% brook trout. No mountain whitefish were collected, although in 2002 they comprised 15% of the total catch. Size range for rainbow trout was 84 to 455 mm, while brook trout ranged from 105 to 150 mm. No whitefish fry were observed in this reach.

Campground Reach

We collected 121 fish in the Campground reach of the Big Lost River. Species composition was 95% rainbow trout, 1% brook trout, and 4% mountain whitefish, which is similar to species composition found in 2002. Rainbow trout ranged from 80 to 495 mm, while whitefish ranged from 395 to 450. As in the other reaches sampled, we found no juvenile whitefish.

Big Lost River at Bartlett Point

We captured 42 salmonids in three 180-meter depletion runs at Bartlett Point. We estimated the population of rainbow trout at 33 fish for the reach, brook trout at 5 fish, Yellowstone cutthroat trout *O. clarkii bouvieri* at 4 fish, and mountain whitefish at 9 fish. Total trout numbers were similar to estimates conducted in 1988 and 1990, but densities of rainbow trout > 150 mm were lower than previously documented (Table 6). Mountain whitefish densities through this section have also declined compared to previous estimates (Table 7). Past estimates of 0.6 to 2.2 fish / 100 m^2 are substantially greater than the current estimates of 0.2 fish / 100 m^2. We only caught one juvenile whitefish, again indicating a weak year class. Rainbow trout ranged in size from 95 mm to 275 mm, with the majority (67%) being juvenile fish. Brook trout ranged from 75 mm to 230 mm, and were mainly juveniles (60%). Although cutthroat trout are not stocked here, we captured four, which shows significant movements throughout the drainage. These fish were all approximately 300 mm, and are likely fish planted in upstream locations. Sculpin were also noted in this reach.

Lower North Fork (Mouth to Summit Creek Section)

We estimated trout densities in the Lower North Fork at 1.5 fish / 100 m^2, significantly less than both the 6.4 fish / 100 m^2 estimate derived in 1986 for the same reach, and the1996 estimate of 14.7 fish / 100 m^2. Rainbow trout densities of fish > 150 mm are low at 0.69 fish / 100 m^2 (Table 8), but not unlike previous estimates of 1.0 fish / 100 m^2 (1986 and 1996). Rainbow trout ranged in size from 55 mm to 285 mm, with 54% being juvenile fish. Brook trout were as abundant as what was found in 1986 (0.2 fish / 100 m^2), but lower than the 1996 estimate of 10.8 fish / 100 m^2. Brook trout ranged from 75 mm to 175 mm, of which 55% were juvenile fish. Estimates of mountain whitefish were 3.0 fish / 100 m^2 in 1986, but were not captured in the current survey. No cutthroat trout were captured, but sculpin were noted.

Middle North Fork (Bartlett Creek to Grasshopper Creek)

The middle reach of the North Fork has not been sampled previously, but lies midway between two sampled areas. Trout density estimates were high, at 3.1 fish / 100 m^2, of which 2.6 fish / 100 m^2 were greater than 150 mm. The reach is dominated by hatchery and wild rainbow trout, with wild rainbow trout ranging in length from 120 to 240 mm, while the hatchery

Table 6. Density estimates (fish per 100 m^2) for historic sample reaches of the Big Lost River, Idaho. Density estimates presented are means for a given stream when more than one station was sampled in a given year.

			Density (fish / 100 m^2)			
Location	Drainage	Sample Year	All trout	Trout > 150 mm	RBT > 150 mm	BKT > 150 mm
Upper Big Lost River Mainstem	Main	1988	1.41	1.29	1.18	0.11
		1990	1.23	1.10	1.08	0.02
		2003	1.15	0.43	0.37	0.06
North Fork Big Lost River	North Fork	1986	13.23	1.76	0.33	1.43
		1996	14.70	8.35	0.50	7.85
		2003	2.07	1.33	0.94	0.39
Summit Creek	North Fork	1986	27.15	5.75	0.25	5.45
		1996	11.75	10.45	0	10.45
		2003	14.40	4.73	0.68	4.05
Wildhorse Creek	East Fork	1986	4.35	0.55	0.15	0.40
		2003	3.12	0.95	0.12	0.83
Lower East Fork	East Fork	1986	1.85	0.35	0.26	0.09
		1990	1.46	1.46	0.73	0.73
		2003	3.01	1.92	1.28	0.64
Upper East Fork	East Fork	1986	33.85	23.91	9.58	14.33
		1996	9.05	9.05	3.35	5.70
		2003	24.5	12.70	2.10	10.60
West Fork (Starhope Creek)	West Fork	1986	4.94	1.06	0.05	1.01
		2003	10.07	4.35	0.18	4.17
Muldoon Canyon Creek	West Fork	1986	9.70	2.90	0.10	2.80
		1996	4.25	3.62	0	3.62
		2003	19.4	4.05	0	4.05
Lake Creek	West Fork	1986	19.80	8.20	0.60	7.60
		1996	10.30	8.90	0	8.90
		2003	56.6	22.9	0	22.9

Table 7. Mountain whitefish abundance in the Big Lost River Drainage, Idaho as determined from electrofishing surveys.

Location	Year Sampled	Source	Length Sampled (meters)	Mean Width (meters)	Population estimate (fish > 200 mm)	Fish / 100 m^2	Fish per km
Desert	1970's	Overton					
	2003	USFS	0[a]	0[a]	0[a]	0[a]	0[a]
Big Lost @ Arco	1987	IDFG	490	9.1	262 (198-365)	5.2	473
	2002	USFS	0[a]	0[a]	0[a]	0[a]	0[a]
Big Lost @ Leslie	1991	IDFG	4,000	15	48 (35-57)	0.1	12
	2002	IDFG	1,000	18	1[b]	<0.01[b]	1[b]
Big Lost @ Mackay	1987	IDFG	1,238	24.2	NE[c]	NE[c]	NE[c]
	1991	IDFG	800	37.4	280 (176-507)	0.9	350
	2002	IDFG	1,000	20.6	45 (27-64)	0.2	45
Big Lost @ Harry Canyon	1986	IDFG	1,500	13.4	285[d]	1.42[d]	190[d]
	1988	IDFG	2,239	17.0	423 (336-550)	1.1	189
	1990	IDFG	2,240	17.0	219	0.6	98
	1996	IDFG	3,001	19.9	1,322	2.21	441
	2003	IDFG+USFS	180	19.5	9 (8-15)	2.6	50
East Fork - Whitworth	1986	IDFG	1,243	13.8	825 (617-1,162)	4.8	664
	1990	IDFG	1,375	12.4	65	0.4	47.3
	1996	IDFG	924	12.4	84	0.7	91
	2003	IDFG+USFS	115	11.2	1	0.1	8.7

Table 7, continued

Location	Year Sampled	Source	Length Sampled (meters)	Mean Width (meters)	Population estimate (fish > 200 mm)	Fish / 100 m^2	Fish per km
East Fork – Fox Creek	1986	IDFG	1,162	11.8	717 (549-977)	5.2	617
	1990	IDFG	1,209	11.3	51	0.4	43
	1996	IDFG	1,273	11.6	17[e]	0.1	14.2
	2003	IDFG+USFS	100	10.6	0	0	0
West Fork - Bridge	1986	IDFG	1,364	16.1	1,480 (758-4,191)	6.7	1,085
	2003	IDFG+USFS	100	14.7	0	0	0
West Fork – Cow Camp	1986	IDFG	1,440	10.5	344 (250-504)	2.2	239
	2003	IDFG+USFS	130	8.5	0	0	0
North Fork – Forest Boundary	1986	IDFG	1,140	10.5	362 (281-485)	3.0	318
	2003	IDFG+USFS	300	8	0	0	0
Wildhorse Cr (Lower section)	1986	IDFG	55	6	0	0	0
	2003	IDFG+USFS	200	10	0	0	0
Wildhorse Cr (Upper Sect)	1986	IDFG	213	7	0	0	0
	2003	IDFG+USFS	200	7	0	0	0
Antelope Cr – Wood Canyon	1987	IDFG	64	5.1	0	0	0
	1991	IDFG	569	6.7	0	0	0
	2003	USFS	200	5.9	0	0	0

[a] – Sampled, but no water present.
[b] – Numerous fry present, but not collected.
[c] – Whitefish present, but not estimated.
[d]- Only completed marking run. Figures presented are actual fish present, not a population estimate (would likely be higher).
[e] – No population estimate made – figures presented are actual fish present.

Table 8. Trout densities found in the Big Lost River, Idaho during 2003 electrofishing samples.

			Density (# per 100 m^2)					
Location	Drainage	Length (m)	All Trout	Trout > 150 mm	RBT* > 150 mm	BKT > 150 mm	MWF > 150 mm	YCT* > 150 mm
Mainstem (Bartlett Point)	Main	180	1.2	0.6	0.4	0.1	0.2	0.1
Lower North Fork	North	170	1.5	0.7	0.7	0.2	0	0
Mid North Fork	North	300	3.1	2.6	2.0	0.5	0	0
Upper North Fork	North	300	1.6	0.6	0.1	0.5	0	0
Summit Creek	North	300	14.4	4.7	0.7	4.0	0	0
Kane Creek	North	300	5.1	2.3	0.2	2.1	0	0
Lower Wildhorse Creek	East	200	0.4	0.3	0.2	0.2	0	0
Upper Wildhorse Creek	East	200	5.8	1.6	0.1	1.5	0	0
Fall Creek	East	200	2.3	1.7	0.7	0.9	0	0
Lower East Fork (Whitworth)	East	115	3.4	2.3	1.8	0.5	0.1	0.1
Middle East Fork (Fox Creek)	East	100	2.6	1.8	0.8	0.8	0	0.3
East Fork @ Burma	East	193	26.2	13.0	4.3	8.1	0	0
East Fork @ Swamps	East	178	22.8	14.8	0	14.8	0	0
Lower Starhope Creek	West	100	0.4	0.4	0.3	0	0	0.1
Mid Starhope Creek (Cow Camp)	West	130	17.1	10.1	0.1	8.9	0	1.2
Upper Starhope Creek	West	224	12.7	4.8	0.1	3.7	0	1.0
Broad Canyon Creek	West	164	24.2	7.0	0	7.0	0	0
Muldoon Creek	West	160	19.4	5.2	0	4.1	0	1.1
Lake Creek	West	148	56.6	25.4	0	22.9	0	2.4

* Includes hatchery trout

fish averaged 325 mm. We also found brook trout that ranged from 70 to 210 mm. No whitefish or cutthroat trout were captured, and sculpin were noted.

Upper North Fork

Similar to what was found in 1986, species composition shifted from rainbow trout to brook trout towards the headwaters of the North Fork. Densities of all trout were lower than those found in past studies, at 1.6 trout per 100 m^2 compared to 27.6 trout per 100 m^2 in 1986 and 5.9 per 100 m^2 in 1996. Although we only caught one rainbow trout, densities of fish > 150 mm have increased from 0 fish / 100m^2 in 1986 and 1996 to 0.1 fish / 100 m^2 in the current study. Brook trout made up 94% of the catch, with rainbow trout making up the remainder. Sixty-eight percent of all fish caught were juveniles. Length of brook trout ranged from 60 to 215 mm. No whitefish were captured, although they have been found here previously.

Summit Creek (Downstream of Phi Kappa Campground)

We estimated total trout densities in this reach at 14.4 fish per 100 m^2, which was higher than the 1996 estimate of 11.75 fish per 100 m^2, but lower than the 1986 estimate of 27.15 fish per 100 m^2. However, densities of trout >150 mm were similar to those found previously, with rainbow trout estimates increasing from 0.25 fish / 100 m^2 in 1986 to 0.68 fish / 100 m^2 in 2003, while brook trout decreased from 5.45 to 4.05 fish / 100 m^2 over the same time period. We collected a total of 116 trout on the two-pass depletion. Rainbow trout made up 7% of the catch, and ranged in size from 110 to 230 mm with 33% being juveniles. Brook trout made up the remainder of the catch, and ranged from 50 to 250 mm, with 66% juveniles. No sculpin were found, and whitefish were also absent despite being captured in previous samples.

Kane Creek

Prior to this year's sample, Kane Creek has no records of being surveyed despite being a moderately large component of the North Fork Drainage. We collected 44 fish in the 300 m reach, of which 96% were brook trout and 4% rainbow trout. We estimated a moderate trout population, with 5.1 trout / 100 m^2 of which 2.3 trout / 100 m^2 were greater than 150 mm. We estimated rainbow trout > 150 mm at 0.2 fish / 100 m^2, and brook trout at 2.1 fish / 100 m^2. Rainbow trout ranged from 170-210 mm, while brook trout ranged from 45-230 mm, and were 59% juveniles. Sculpin were noted on this survey, but whitefish were not.

Wildhorse Creek

We sampled two sections in Wildhorse Creek, and estimated overall trout abundance at 3.12 fish per 100 m^2. This represents a slight decline from the 4.35 fish / 100 m^2 estimated in 1986. Densities of rainbow trout > 150 mm were slightly lower than in 1986 at 0.12 fish / 100 m^2, which represent a 20% decline. Brook trout > 150 mm increased from 0.4 to 0.83 fish / 100m^2 from 1986 to 2003. Rainbow trout lengths ranged from 130 to 260 mm, while brook trout

ranged from 45 to 260 mm. Numerous sculpin were observed during the survey; however, no whitefish were found.

Fall Creek

Fall Creek has not been sampled prior to 2003. Like other streams in this drainage, a low-density population exists (2.3 fish / 100 m^2). Brook trout were more abundant than rainbow trout, constituting 70% of captured fish. Length of rainbow trout ranged from 130 to 260 mm with a density of 0.74 fish / 100 m^2 >150 mm, while brook trout ranged from 80 to 235 mm with a density of 0.96 fish / 100 m^2 > 150 mm. Sculpin were found on this survey, as were numerous brook trout fry.

Lower East Fork

We sampled two sections in the Lower East Fork (Whitworth and Fox Creek), and found relatively high densities of rainbow trout, at 1.3 fish /100 m^2 for trout >150 mm, which is an increase over 1986 estimates (0.26 fish / 100 m^2) and 1990s estimates (0.73 fish / 100 m^2). Rainbow trout ranged from 110 to 255 mm, with 35% juvenile fish. Brook trout were not as abundant, at 0.64 fish / 100 m^2 >150 mm, but still represented an increase over the 0.09 fish / 100 m^2 estimate from 1986. Brook trout lengths ranged from 140 to 215 mm, with 14% being juveniles. Sculpin were present, as were whitefish. This is one of two sites above Mackay Dam where mountain whitefish were found during 2003 surveys. However, densities have fallen significantly from previous levels. The current density of 0.04 fish / 100 m^2 is well below the 5.02 fish / 100 m^2 documented in the 1986 survey and the 0.4 fish / 100 m^2 estimates from the 1990s.

Upper East Fork

We also sampled two sections in the Upper East Fork (Burma and the Swamps), and found densities of all trout had improved markedly from the 1996 estimate of 3.4 fish / 100 m^2 to 24.5 fish / 100 m^2, but remained below the 1986 estimate of 33.9 fish / 100 m^2. Rainbow trout > 150 mm remain well below the 1986 estimate of 9.6 fish / 100 m^2, at 2.1 fish / 100 m^2. Brook trout > 150 mm were also found at lower densities (10.6 currently vs. 14.3 in 1986). No whitefish or sculpin were noted, although we believe sculpin were encountered and not recorded based on their presence above and below this sample. Whitefish have not been found in past surveys, either.

Lower West Fork (Starhope Creek)

We sampled two sections in the Lower West Fork (above the bridge on Forest Road 135 and at the Cow Camp). The bridge reach of the West Fork was broad and shallow with little diversity or cover. Consequently, trout densities were low. There was evidence of a recent beaver dam that had blown out at the Cow Camp section, which may have influenced density

estimates. Overall abundance estimates were 8.8 fish / 100 m^2, which is greater than the 2.4 fish / 100 m^2 estimated in1986. Rainbow trout estimates were 0.23 fish / 100 m^2 >150 mm, which is 64% higher than 1986 estimates. Brook trout densities have increased from 0.98 fish / 100 m^2 >150 mm estimated in 1986 to 4.41 fish / 100 m^2 >150 mm in the current survey.

Cutthroat trout were also found in low abundance in this reach (0.64 fish > 150 mm / 100 m^2). Mountain whitefish densities approached 9 fish / 100 m^2 in 1986, but were absent from the current study.

Upper West Fork (Loop Road)

Species composition of the uppermost section of the West Fork (just downstream of the loop road) was dominated by brook trout (145 fish), with one rainbow trout and 14 cutthroat trout captured. Densities of all trout combined have increased from 6.7 fish / 100 m^2 in 1986 to 12.7 in 2003. Rainbow trout have increased from 0 to 0.1 fish / 100 m^2 >150 mm over the same time. Brook trout have also increased, and were estimated at 3.7 fish / 100 m^2 >150 mm compared to 1.0 in 1986. We captured one young cutthroat trout that measured 95 mm, indicating natural reproduction. No sculpin or whitefish were caught, although whitefish have been found here in the past.

Broad Canyon Creek

The 2003 survey upstream of the loop road on Broad Canyon was the first population estimate completed on this tributary, and showed a high-density population of brook trout. We estimated 24.2 trout per 100 m^2 in this reach, of which 99% were brook trout. Juvenile fish including one cutthroat trout made up the majority of the catch (71%), but a healthy population of adult brook trout exists (7 fish / 100 m^2 > 150 mm). Brook trout lengths ranged from 40 to 245 mm. Shorthead sculpin were also found.

Muldoon Canyon Creek

We found a high-density brook trout population in Muldoon Canyon Creek upstream of the loop road, with a lower density of cutthroat trout. Overall trout abundance has increased over both the1996 estimates of 4.25 fish / 100 m^2 and the 1986 estimate of 9.7 fish / 100 m^2 to 19.4 in the current study. Rainbow trout have declined from 0.1 to 0 fish / 100 m^2 from 1986 to 2003, while estimates of brook trout >150 mm have increased from 2.8 to 4.1 fish / 100 m^2 over the same time. We estimated cutthroat trout at 1.1 fish / 100 m^2 in this reach. Seventy-five percent of the 184 fish collected were juveniles. Three of the 14 cutthroat trout sampled were less than 150 mm, and indicate natural reproduction. We captured one juvenile rainbow trout, but no sculpin or whitefish.

Lake Creek

As with the majority of the West Fork Drainages sampled, Lake Creek supports a thriving population of brook trout. Overall trout abundance has increased from the 1986 estimate of 15.8 fish / 100 m^2 and the 1996 estimate of 10.3 fish / 100 m^2 to 56.6 fish / 100 m^2. Rainbow trout have declined from 0.6 fish / 100 m^2 in 1986 to 0 in the current survey. Densities of brook trout > 150 mm were 22.9 fish / 100 m^2, compared to 7.6 fish / 100 m^2 found in 1986. We also found 11 cutthroat trout, including two fry, and estimated abundance at 2.4 fish / 100 m^2. Of the 252 fish we collected, 53% were fry. Lake Creek supports the highest density of brook trout found in the 2003 survey, as well as the highest density of cutthroat trout. We found sculpin as well as one grayling that probably washed downstream from one of the headwaters alpine lakes (Round Lake).

DISCUSSION

Overall abundance of trout in the Upper Big Lost River is similar to that documented in surveys in the 1980s (45% of 2003 samples had higher densities, 55% lower), and in all areas except the mainstem, have improved over densities found in the 1990s (71% of 2003 samples held higher densities). Estimates of both adult rainbow trout and adult brook trout have increased over 1986 estimates in 56% of the stations sampled. When compared to 1990s data, adult rainbow trout have increased in 60% of samples, while adult brook trout have increased in 57% of samples. Generally, it appears that estimates from the Mainstem and North Forks showed an overall declining trend, while those of the East and West Forks were improving. Fluctuations in trout densities throughout the drainage may be attributed to a combination of effects, including drought, improved range management, and resulting stream temperatures.

The stocking of cutthroat trout in addition to rainbow trout in the Upper Big Lost River appears to be providing a good fishery. It was previously suspected that whirling disease may be suppressing trout populations, and that cutthroat trout may be more resistant to infections. Although both juvenile and adult rainbow trout are persisting and in some instances doing well, cutthroat trout are now adding to the fishery. Stockings have only occurred in the West Fork, but cutthroat trout are now found throughout the entire Upper Big Lost River Drainage. Natural reproduction is also occurring, and may eventually aid cutthroat trout in becoming a significant component to the fishery. Of notable interest is the maximum size of trout encountered. The wild fish that were sampled rarely exceeded 300 mm, suggesting that growth is slow, or mortality is suppressing the maximum size of fish. Cutthroat trout, however, are attaining lengths commonly exceeding 300 mm, and in some instances, over 400 mm. These larger fish are certainly holdovers from previous stockings and not the result of better growth in the system. However, this very preliminary data suggests that cutthroat may have the potential to achieve larger sizes than rainbow trout.

Recent population assessments throughout the drainage show this species to be declining significantly from previous years. Of the nine sites sampled in 2003 where whitefish were previously found, only two still had whitefish present. Densities at both of these sites declined substantially from previous estimates. Whitefish are widely recognized as a larger river fish. Over the past several years, drought conditions have persisted throughout southeast Idaho. The effects of this have been felt in the Big Lost River Drainage. Decreased surface flows have resulted in a fragmented system that may be impacting whitefish year class success

and distribution. It is now common for the lower river to be dewatered below the Blaine Diversion. Whitefish are found from this point upstream to Mackay Dam, although the current years sample shows a possible year class failure. Upstream of the dam to Chilly Buttes is periodically dewatered, which creates a loss of connectivity between the reservoir and upriver fish populations. Stream reaches above Chilly Buttes are probably incurring lower flows as a result of poor snowpack and groundwater inflows. These conditions may be impacting habitat available to whitefish, and needed to sustain whitefish populations. Additional information is necessary to determine the habitat required by the various life stages of whitefish, and the availability of this habitat in the Big Lost River.

RECOMMENDATIONS

1. Monitor whitefish populations and collect basic life history information.

2. Periodically monitor cutthroat trout populations in the Upper Big Lost River above Mackay Dam to evaluate natural reproduction, distribution and contribution to the fishery.

TETON RIVER

INTRODUCTION

This report summarizes electrofishing data collected during 2003 in two sections of the upper Teton River (Teton Valley), Idaho. In addition, we summarize all main stem electrofishing data collected in the Teton Valley since 1987, except 1989, by Idaho Department of Fish and Game (Department) personnel. We exclude the 1989 data because few fish were captured, recapture runs were not made, and density estimates were not possible. Although some of our results will overlap those reported in Meyer et al. (2001, 2003) and Schrader and Brenden (in press), they will generally differ due to differences in analytical methods used. Statistics from other Teton River sections that have been electrofished since 1987, i.e., in the middle and lower parts of the drainage, will be reported in the future.

STUDY AREA AND METHODS

During 2003, we surveyed fish populations in the Breckenridge section on August 29 and September 4, and in the Nickerson section on September 3 and 9 (Table 9). Breckenridge and Nickerson have been the standard Department electrofishing sections in the Teton Valley since 1987 (Figure 14). They represent two different types of main stem habitat in the Teton Valley – each responding differently to drought conditions – and they have different levels of fishing pressure. Fish population information from these two sections represents the most comprehensive and longest-running data set for the entire Teton River. Although not sampled in 2003, we also report data from three other Teton Valley sections that have been surveyed sporadically in the past – Rainier, Buxton, and White Bridge. The primary objective of all surveys was to evaluate habitat improvement projects that began in 1988 (Gamblin and Brostrom 1988; Appendix B). All electrofishing was conducted between late August and late October (Table 9). Elapsed time from the first marking run to the last recapture run, inclusive, ranged from six to twenty-five days, excluding Breckenridge in 1991 when we did not make any recapture runs. In most cases, a single day was needed to make a single electrofishing run through a section, although two runs were occasionally made on a single day. The sections ranged from 2.0 to 7.1 km in length (Table 10).

During 2003, fish were captured using direct-current (DC) electrofishing gear (Coffelt VVP-15 powered by a Honda 5000 W generator) mounted in two drift boats. We used pulsed DC current through two boom-and-dangler anodes fixed to the bow while floating downstream. The boat hull was the cathode. Similar to previous years, the VVP settings were at 175-200 V, 5-6 A, 20% pulse width, and 60 Hz (pulses per second). Water conductivity ranged from 227 to 237 µmhos/cm. Various gear configurations have been used in the past – including throwing the anodes – but always out of one or two drift boats.

We attempted to capture all species and sizes of trout. Mountain whitefish and suckers were also captured in 1997 and 1999 as part of another research project (Schrader and Brenden, in press) but will not be reported here. Hereafter, “rainbow trout” will refer to wild rainbow and hybrid trout combined – but not hatchery rainbow trout. Hatchery rainbow trout were stocked as catchables through 1994. “Cutthroat trout” will include hatchery fingerlings from Henrys Lake stocked through 1991. After capture, fish were anesthetized, identified, and

Table 9. Teton Valley electrofishing survey dates and number of runs conducted in the Teton River, Idaho, 1987-2003. Sections are listed going upstream.

Section and year	First marking run date	Last recapture run date	Lapsed days	Total number of runs	Number of recapture runs
Breckenridge:					
1987	October 1	October 26	25	3	1
1991	October 3	---[a]	---	1	---
1994	August 30	September 14	15	3	1
1995	September 14	September 21	7	3	1
1997	September 23	October 1	8	3	1
1999	September 28	October 8	10	4	2
2003	August 29	September 4	6	4	2
Rainier:					
1987	September 30	October 23	23	4	3
1991	October 3	October 9	6	2	1
2000	October 2	October 11	9	3	1
Buxton:					
1987	September 29	October 13	14	2	1
1991	September 12	September 20	8	2	1
2000	September 27	October 4	7	3	1
Nickerson:					
1987	September 11	September 25	14	3	1
1991	September 12	September 20	8	2	1
1994	September 9	September 21	12	3	1
1995	September 27	October 3	6	3	1
1997	September 2	September 11	9	4	2
1999	August 31	September 9	9	3[b]	1
2003	September 3	September 9	6	4	2
White Bridge:					
1994	August 24	September 6	13	3[b]	1

[a] No recapture runs due to equipment failure.
[b] Took two days to complete one run due to equipment failure.

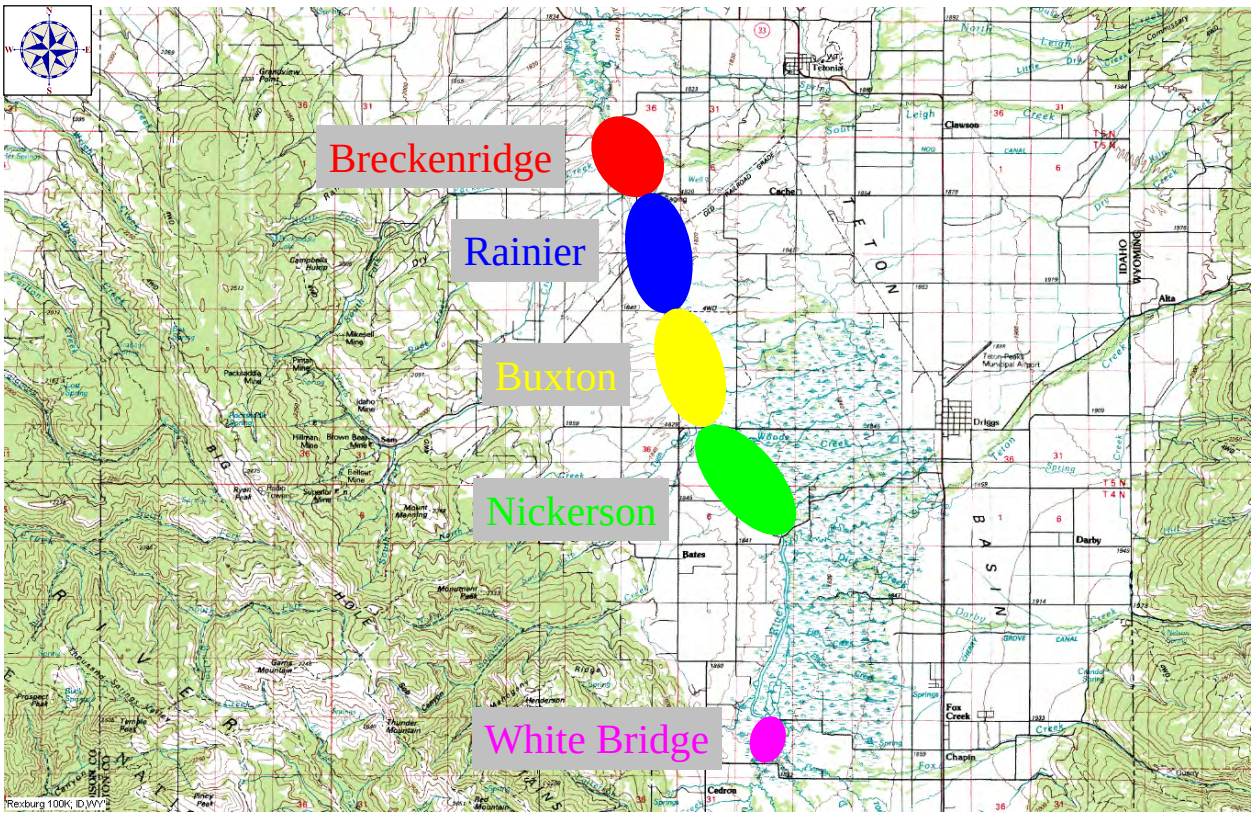


Figure 14. Map of Teton Valley showing Department electrofishing sections in the Teton River, Idaho.

Table 10. Physical characteristics of Teton Valley electrofishing sections in the Teton River, Idaho. Sections are listed going upstream.

Section	Mean wetted width (m)	Width source	Channel center length		Area[a]	
			mi	km	ha	100 m^2
Breckenridge	26	Field measure (1994), n=9	3.0	4.9	12.74	1,274
Rainier	37	IDFG files	3.4	5.5	20.35	2,035
Buxton	37	IDFG files	4.4	7.1	26.27	2,627
Nickerson	42	Field measure (1994), n=9	3.6	5.8	24.36	2,436
White Bridge	24	Field measure (1994), n=9	1.2	2.0	4.80	480

[a] Product of mean wetted width and channel center length.

measured to the nearest millimeter (TL). Brook trout less than 150 mm and all other species less than 100 mm (generally age-0) were not marked as they are not efficiently recruited to the gear. Age-1 and older fish were marked with a caudal fin punch and released.

Electrofishing data were entered and analyzed using the computer program Mark Recapture 5.0 (MR5; Montana Department of Fish, Wildlife, and Parks 1997). Additional analyses were made using Microsoft Excel. General statistical procedures were conducted according to Zar (1984).

We assumed capture probabilities did not vary with species, and relative abundance was estimated using proportions of all individual trout captured (excluding recaptures). Although capture probabilities vary with fish length (Schill 1992; Reynolds 1996), population size structures (length frequency distributions) and average fish lengths were estimated using all sizes of individual fish captured. Quality stock density (QSD) (Anderson 1980) was estimated using the number of individual fish captured greater than or equal to 400 mm divided by the number greater than or equal to 200 mm, times 100. Density was estimated using two methods in the MR5 computer program. The log-likelihood method was preferred over the modified Peterson method if modeled efficiency curves were acceptable (termcode=1 and at least one of two chi-square p-values>0.05).

RESULTS

Breckenridge

A total of 382 trout were captured during two days of electrofishing in August and September 2003. Species composition and relative abundance were cutthroat trout (3%), rainbow trout (90%), and brook trout (7%; Table 11, Figure 15). No rainbow trout were of hatchery origin.

Too few cutthroat trout (n=13) were sampled for a meaningful length frequency distribution (Appendix C). A relatively strong group of age-1 rainbow trout (about 100 to 250 mm) was observed, but there were few age-0 fish (<100 mm). Too few brook trout (n=25) were sampled for a meaningful length frequency distribution. Ages were approximated from these frequency distributions and were not validated.

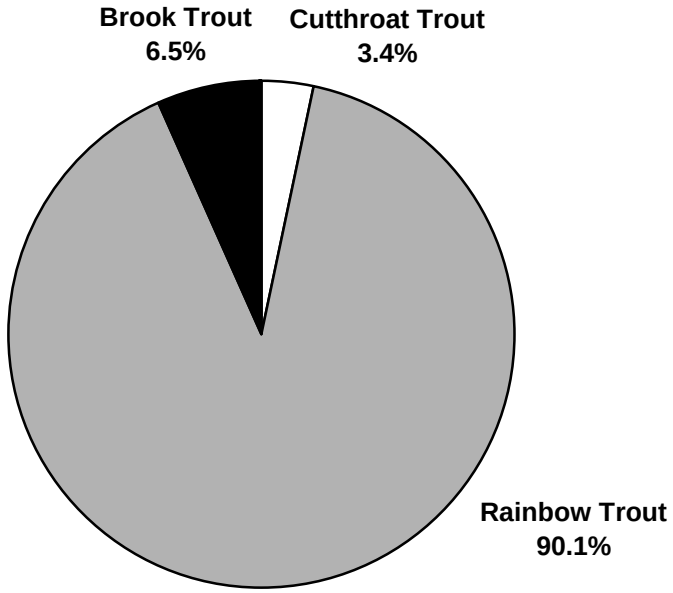
Mean total length (TL) was 400 mm for cutthroat trout, 265 mm for rainbow trout, 247 mm for brook trout, and 269 mm for all species combined (Table 12). Quality stock density was 66.7% for cutthroat trout, 9.8% for rainbow trout, 0.0% for brook trout, and 11.6% for all species combined. As mentioned, sample sizes were low for cutthroat and brook trout.

Electrofishing sampling efficiencies (R/C) ranged from 26% for rainbow trout to 71% for cutthroat trout (Table 13). Estimated densities were 3 cutthroat trout, 287 rainbow trout, 7 brook trout, and 278 fish/km for all species combined (Table 14).

Table 11. Trout species composition and relative abundance (%) at the five Teton Valley electrofishing sections (listed going upstream), Teton River, Idaho, 1987-2003. Total individual fish captured during mark and recapture runs equals n. Results are from MR5 database for all sizes of fish.

Year	Cutthroat trout[a]		Rainbow trout[b]		Brook trout		Brown trout		Total	
	%	n	%	n	%	n	%	n	%	n
Breckenridge										
1987	15.3	66	69.9	302	14.8	64	0.0	0	100.0	432
1991	27.8	5	66.7	12	5.6	1	0.0	0	100.0	18
1994	18.3	94	76.4	392	5.3	27	0.0	0	100.0	513
1995	39.9	103	43.0	111	17.1	44	0.0	0	100.0	258
1997	29.8	77	24.8	64	45.3	117	0.0	0	100.0	258
1999	44.4	107	37.3	90	18.3	44	0.0	0	100.0	241
2003	3.4	13	90.1	344	6.5	25	0.0	0	100.0	382
Rainier										
1987	26.0	153	51.6	304	22.2	131	0.2	1	100.0	589
1991	29.5	44	46.3	69	24.2	36	0.0	0	100.0	149
2000	55.8	139	30.9	77	13.3	33	0.0	0	100.0	249
Buxton										
1987	44.8	337	34.6	260	20.6	155	0.0	0	100.0	752
1991	37.6	99	38.8	102	23.6	62	0.0	0	100.0	263
2000	59.0	171	27.2	79	13.8	40	0.0	0	100.0	290
Nickerson										
1987	52.5	307	6.7	39	40.9	239	0.0	0	100.0	585
1991	46.6	178	20.9	80	32.5	124	0.0	0	100.0	382
1994	55.6	440	19.1	151	25.3	200	0.1	1	100.0	792
1995	78.2	352	5.8	26	16.0	72	0.0	0	100.0	450
1997	63.8	166	8.1	21	28.1	73	0.0	0	100.0	260
1999	55.8	188	11.3	38	32.9	111	0.0	0	100.0	337
2003	6.4	35	33.9	185	59.6	325	0.0	0	100.0	545
White Bridge										
1994	60.0	327	4.6	25	35.4	193	0.0	0	100.0	545

[a] Includes hatchery cutthroat trout planted as fingerlings through 1991.
[b] Includes hybrids, but does not include hatchery rainbow trout planted as catchables through 1994.



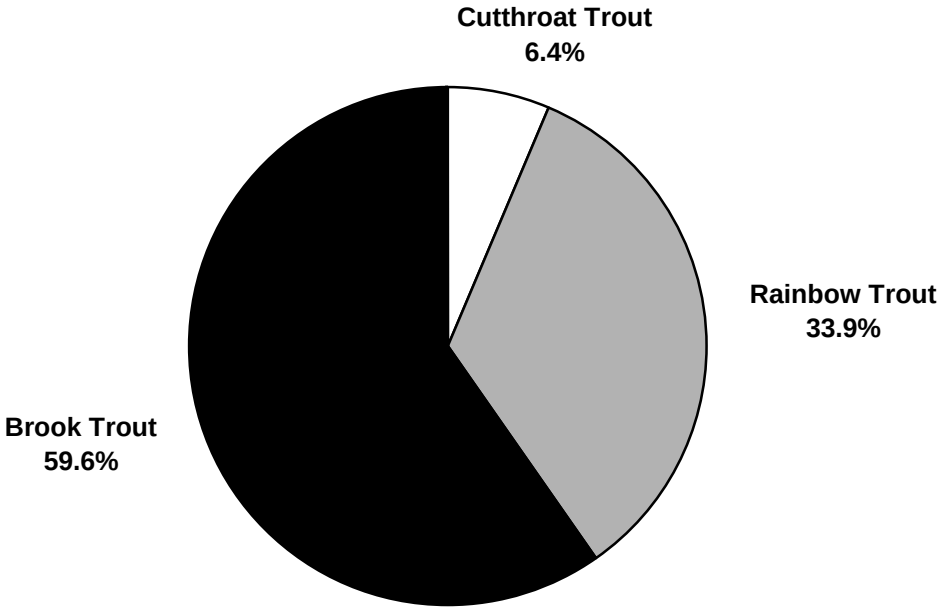


Figure 15. Trout species composition and relative abundance at the Breckenridge (top, n=382) and Nickerson (bottom, n=545) electrofishing sections, Teton River, Idaho, 2003. Results are from the MR5 database for all sizes of fish.

Table 12. Mean total length and quality stock density (QSD) of trout captured at the five Teton Valley electrofishing sections (listed going upstream), Teton River, Idaho, 1987-2003. Total individual fish captured during mark and recapture runs equals n. QSD=(number ≥400 mm/number ≥200 mm) x 100. Results are from MR5 database for all sizes of fish.

Year	Cutthroat trout[a]			Rainbow trout[b]			Brook trout			All trout[c]		
	Mean (mm)	QSD (%)	n	Mean (mm)	QSD (%)	n	Mean (mm)	QSD (%)	n	Mean (mm)	QSD (%)	n
Breckenridge												
1987	223	8.3	66	207	4.7	302	216	2.3	64	211	4.8	432
1991	134	0.0	5	297	9.1	12	220	0.0	1	247	8.3	18
1994	268	14.7	94	247	5.1	392	208	0.0	27	249	6.8	513
1995	296	17.2	103	286	14.7	111	227	0.0	44	280	13.5	258
1997	341	50.7	77	239	27.0	64	252	0.0	117	275	21.6	258
1999	325	19.0	107	291	11.6	90	270	0.0	44	302	12.8	241
2003	400	66.7	13	265	9.8	344	247	0.0	25	269	11.6	382
Rainier												
1987	219	3.4	153	210	2.0	304	203	0.0	131	211	1.9	589
1991	318	28.2	44	274	13.8	69	225	0.0	36	275	14.8	149
2000	342	27.0	139	303	35.6	77	243	0.0	33	317	25.7	249
Buxton												
1987	210	1.2	337	212	1.7	260	210	0.0	155	211	1.1	752
1991	255	10.9	99	230	1.5	102	208	0.0	62	234	4.8	263
2000	322	24.2	171	267	8.1	79	268	2.6	40	300	16.9	290
Nickerson												
1987	208	1.4	307	246	0.0	39	193	0.0	239	204	0.6	585
1991	233	3.0	178	282	11.1	80	213	0.0	124	236	4.1	382
1994	241	7.4	440	237	11.9	151	207	0.0	200	232	6.5	792
1995	277	14.1	352	316	43.5	26	230	0.0	72	271	13.6	450
1997	304	50.4	166	311	71.4	21	256	0.0	73	291	35.7	260
1999	284	13.4	188	361	34.2	38	248	0.0	111	281	11.4	337
2003	339	32.3	35	305	21.0	185	240	0.0	325	268	9.1	545
White Bridge												
1994	257	2.4	327	297	25.0	25	220	0.0	193	246	2.7	545

[a] Includes hatchery cutthroat trout planted as fingerlings through 1991.
[b] Includes hybrids, but does not include hatchery rainbow trout planted as catchables through 1994.
[c] Includes brown trout.

Table 13. Mark recapture electrofishing statistics for the five Teton Valley sections (listed going upstream), Teton River, Idaho, 1987-2003. Cases where R≤3 and unbiased density estimates are not possible (Ricker 1975) are highlighted.

Year	Cutthroat trout[a]				Rainbow trout[b]				Brook trout				All trout[c]			
	M[d]	C[d]	R[d]	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)
Breckenridge																
1987	41	29	4	14	214	94	6	6	51	13	0	0	306	136	10	7
1991	5	ND[e]	ND	ND	12	ND	ND	ND	1	ND	ND	ND	18	ND	ND	ND
1994	63	56	25	45	268	181	57	31	20	9	2	22	351	246	84	34
1995	78	37	12	32	77	41	7	17	32	15	3	20	187	93	22	24
1997	50	36	9	25	30	38	4	11	76	48	7	15	156	122	20	16
1999	66	58	17	29	55	41	6	15	29	17	2	12	150	116	25	22
2003	11	7	5	71	234	149	39	26	9	22	6	27	254	178	50	28
Rainier																
1987	58	108	13	12	131	188	15	8	65	68	2	3	255	364	30	8
1991	24	23	3	13	36	33	0	0	23	15	2	13	83	71	5	7
2000	96	59	16	27	59	25	7	28	25	8	0	0	180	92	23	25
Buxton																
1987	169	193	25	13	149	123	12	10	103	55	3	5	421	371	40	11
1991	64	41	6	15	56	49	3	6	33	37	8	22	153	127	17	13
2000	122	78	29	37	52	35	8	23	30	10	0	0	204	123	37	30
Nickerson																
1987	145	177	15	8	25	15	1	7	140	102	3	3	310	294	19	6
1991	90	96	8	8	47	39	6	15	63	65	4	6	200	200	18	9
1994	276	196	32	16	104	59	12	20	120	93	13	14	501	348	57	16
1995	241	165	54	33	23	4	1	25	58	15	1	7	322	184	56	30
1997	70	122	26	21	12	12	3	25	48	29	4	14	130	163	33	20
1999	121	98	31	32	24	19	5	26	75	43	7	16	220	160	43	27
2003	25	18	8	44	104	110	29	26	193	169	37	22	322	297	74	25
White Bridge																
1994	197	193	63	33	10	22	7	32	114	101	22	22	321	316	92	29

[a] Includes hatchery cutthroat trout planted as fingerlings through 1991.
[b] Includes hybrids, but does not include hatchery rainbow trout planted as catchables through 1994.
[c] Includes brown trout.
[d] M=number of fish marked on marking run; C=total number of fish captured on recapture run; R=number of recaptured fish on recapture run.
[e] ND = no data; no recapture runs due to equipment failure.

Table 14. Estimated abundance (N) of age-1 and older cutthroat trout (≥100 mm), rainbow trout (≥100 mm), brook trout (≥150 mm), and all trout (≥100 mm) at five Teton Valley electrofishing sections (listed going upstream), Teton River, Idaho, 1987-2003. Results are from MR5 database and analysis using the log-likelihood estimator unless otherwise noted. Ninety-five percent confidence intervals (1.96 x SD) are in parentheses.

First marking date	Cutthroat trout[a]		Rainbow trout[b]		Brook trout		All trout[c]	
	N/section	N/km	N/section	N/km	N/section	N/km	N/section	N/km
Breckenridge								
10/1/87	245[d] (168)	50 (34)	2,124[d] (1,382)	433 (282)	NUE[e]	NUE	3,520 (1,354)	718 (276)
10/3/91	NE[f]	NE	NE	NE	NE	NE	NE	NE
8/30/94	213 (66)	43 (14)	1,023 (126)	209 (26)	NUE	NUE	1,340 (135)	273 (28)
9/14/95	235 (84)	48 (17)	349 (180)	71 (37)	NUE	NUE	744 (169)	152 (34)
9/23/97	199 (72)	41 (15)	204[d] (138)	42 (28)	604 (299)	123 (61)	1,357 (266)	277 (54)
9/28/99	316 (84)	64 (17)	485 (245)	99 (50)	NUE	NUE	937 (187)	191 (38)
8/29/03	15[d] (4)	3 (1)	1,405 (266)	287 (54)	32[d] (10)	7 (2)	1,364 (213)	278 (43)
Rainier								
9/30/87	450 (125)	82 (23)	1,559 (459)	283 (83)	NUE	NUE	3,321 (541)	604 (98)
10/3/91	NUE	NUE	NUE	NUE	NUE	NUE	995[d] (681)	181 (124)
10/2/00	328 (74)	60 (14)	526 (444)	96 (81)	NUE	NUE	1,229 (271)	223 (49)
Buxton								
9/29/87	1,288 (234)	181 (33)	1,678 (628)	236 (88)	NUE	NUE	3,845 (523)	542 (74)
9/12/91	389[d] (233)	55 (33)	NUE	NUE	138[d] (64)	19 (9)	1,434 (383)	202 (54)
9/27/00	776 (342)	109 (48)	197[d] (96)	28 (14)	NUE	NUE	2,429 (838)	342 (118)
Nickerson								
9/11/87	1,851 (563)	319 (97)	NUE	NUE	NUE	NUE	4,985 (1,200)	859 (207)
9/12/91	1,628 (788)	281 (136)	317 (161)	55 (28)	695[d] (510)	120 (88)	2,879 (635)	496 (110)
9/9/94	2,200 (484)	379 (83)	533 (189)	92 (33)	849 (312)	146 (54)	3,647 (420)	629 (72)
9/27/95	814 (99)	140 (17)	NUE	NUE	NUE	NUE	1,217 (139)	210 (24)
9/2/97	479 (108)	83 (19)	NUE	NUE	253[d] (173)	44 (30)	996 (187)	172 (32)
8/31/99	645 (134)	111 (23)	82[d] (45)	14 (8)	499 (292)	86 (50)	1,133 (141)	195 (24)
9/3/03	52[d] (19)	9 (3)	504 (80)	87 (14)	956 (189)	165 (33)	1,569 (166)	271 (29)
White Bridge								
8/24/94	714 (83)	357 (41)	31[d] (9)	16 (4)	558 (149)	279 (74)	1,283 (102)	642 (51)

[a] Includes hatchery cutthroat trout planted as fingerlings through 1991.
[b] Includes hybrids, but does not include hatchery rainbow trout planted as catchables through 1994.
[c] Includes brown trout.
[d] Modified Peterson rather than log-likelihood estimate.
[e] NUE = no unbiased estimate possible as R≤3 (Ricker 1975).
[f] NE = no estimate; no recapture runs due to equipment failure.

Nickerson

A total of 545 trout were captured during two days of electrofishing in September 2003. Species composition and relative abundance were cutthroat trout (6%), rainbow trout (34%), and brook trout (60%; Table 12, Figure 15). No rainbow trout were of hatchery origin.

Like Breckenridge, too few cutthroat trout (n=35) were sampled for a meaningful length frequency distribution (Appendix D). Relatively strong groups of age-1 rainbow trout (about 100 to 250 mm) and brook trout (about 150 to 250 mm) were observed, but there were few age-0 fish. Ages were approximated from these frequency distributions and were not validated.

Mean total length (TL) was 339 mm for cutthroat trout, 305 mm for rainbow trout, 240 mm for brook trout, and 268 mm for all species combined (Table 12). Quality stock density was 32.3% for cutthroat trout, 21.0% for rainbow trout, 0.0% for brook trout, and 9.1% for all species combined. As mentioned previously, sample sizes were low for cutthroat trout.

Electrofishing sampling efficiencies (R/C) ranged from 22% for brook trout to 44% for cutthroat trout (Table 13). Estimated densities were 9 cutthroat trout, 87 rainbow trout, 165 brook trout, and 271 fish/km for all species combined (Table 14).

Cutthroat Trout

Since 1987, cutthroat trout ranged from 3 to 78% of the electrofishing catch over all sections (Table 11). They ranged from 3 to 44% at Breckenridge, from 26 to 56% at Rainier, from 38 to 59% at Buxton, and from 6 to 78% at Nickerson. They were 60% of the catch at White Bridge in 1994 – compared to 56% at Nickerson and 18% at Breckenridge for the same year. Age-1 and older ($\geq$100 mm) densities ranged from 3 to 379 fish/km – excluding several years when unbiased estimates were not possible (i.e. R$\leq$3; Table 14). They ranged from 3 to 64 fish/km at Breckenridge, from 60 to 82 fish/km at Rainier, from 55 to 181 fish/km at Buxton, and from 9 to 379 fish/km at Nickerson. There were 357 fish/km at White Bridge in 1994 – compared to 379 fish/km at Nickerson and 43 fish/km at Breckenridge for the same year. Until 2003, cutthroat trout were relatively more common and had higher densities as one moved upstream.

Cutthroat trout average lengths ranged from 134 to 400 mm overall (Table 12). They ranged from 134 to 400 mm at Breckenridge, from 219 to 342 mm at Rainier, from 210 to 322 mm at Buxton, and from 208 to 339 mm at Nickerson. They averaged 257 mm at White Bridge in 1994 – compared to 241 mm at Nickerson and 268 mm at Breckenridge for the same year. QSDs ranged from 0.0 to 66.7% overall. They ranged from 0.0 to 66.7% at Breckenridge, from 3.4 to 28.2% at Rainier, from 1.2 to 24.2% at Buxton, and from 1.4 to 50.4% at Nickerson. They were 2.4% at White Bridge in 1994 – compared to 7.4% at Nickerson and 14.7% at Breckenridge for the same year. Cutthroat trout were generally larger as one moved downstream.

Rainbow Trout

Since 1987, rainbow trout ranged from 5 to 90% of the electrofishing catch over all sections (Table 11). They ranged from 25 to 90% at Breckenridge, from 31 to 52% at Rainier, from 27 to 39% at Buxton, and from 6 to 34% at Nickerson. They were 5% of the catch at White Bridge in 1994 – compared to 19% at Nickerson and 76% at Breckenridge for the same year. Age-1 and older ($\geq$100 mm) densities ranged from 14 to 433 fish/km – excluding several years when unbiased estimates were not possible (i.e. R$\leq$3; Table 14). They ranged from 42 to 433 fish/km at Breckenridge, from 96 to 283 fish/km at Rainier, from 28 to 236 fish/km at Buxton, and from 14 to 92 fish/km at Nickerson. There were 16 fish/km at White Bridge in 1994 – compared to 92 fish/km at Nickerson and 209 fish/km at Breckenridge for the same year. Unlike cutthroat trout, rainbow trout were relatively more common and had higher densities as one moved downstream.

Rainbow trout average lengths ranged from 207 to 361 mm overall (Table 12). They ranged from 207 to 297 mm at Breckenridge, from 210 to 303 mm at Rainier, from 212 to 267 mm at Buxton, and from 237 to 361 mm at Nickerson. They averaged 297 mm at White Bridge in 1994 – compared to 237 mm at Nickerson and 247 mm at Breckenridge for the same year. QSDs ranged from 0.0 to 71.4% overall. They ranged from 4.7 to 27.0% at Breckenridge, from 2.0 to 35.6% at Rainier, from 1.5 to 8.1% at Buxton, and from 0.0 to 71.4% at Nickerson. They were 25.0% at White Bridge in 1994 – compared to 11.9% at Nickerson and 5.1% at Breckenridge for the same year. Unlike cutthroat trout, rainbow trout were generally larger as one moved upstream.

Brook Trout

Since 1987, brook trout ranged from 5 to 60% of the electrofishing catch over all sections (Table 11). They ranged from 5 to 45% at Breckenridge, from 13 to 24% at Rainier, from 14 to 24% at Buxton, and from 16 to 60% at Nickerson. They were 35% of the catch at White Bridge in 1994 – compared to 25% at Nickerson and 5% at Breckenridge for the same year. We have generally been unable to estimate densities due to low numbers of recaptures (i.e. R$\leq$3; Table 13). When we could make estimates, age-1 and older ($\geq$150 mm) densities ranged from 7 to 279 fish/km (Table 14). They ranged from 7 to 123 fish/km at Breckenridge, Rainier, and Buxton combined, and from 44 to 165 fish/km at Nickerson. There were 279 fish/km at White Bridge in 1994 – compared to 146 fish/km at Nickerson for the same year. Like cutthroat trout, brook trout were relatively more common and had higher densities as one moved upstream.

Brook trout average lengths ranged from 193 to 270 mm overall (Table 12). They ranged from 208 to 270 mm at Breckenridge, from 203 to 243 mm at Rainier, from 208 to 268 mm at Buxton, and from 193 to 256 mm at Nickerson. They averaged 220 mm at White Bridge in 1994 – compared to 207 mm at Nickerson and 208 mm at Breckenridge for the same year. QSDs rarely exceed zero because fish greater than 400 mm are rarely captured. Brook trout were about the same size throughout the Teton Valley and were smaller on average than either cutthroat or rainbow trout.

DISCUSSION

The 2003 relative abundance and density estimates for Teton Valley cutthroat trout were the lowest recorded since electrofishing began in 1987. Excluding White Bridge, average cutthroat trout density increased from about 40 to 55 fish/ha after special regulations were implemented in 1990, but then declined by half following 1994 (Figure 16). Densities were low (about 20 fish/ha) but stable from 1995 to 2000. By 2003, the population had collapsed to less than 2 fish/ha. In comparison, cutthroat trout densities in the South Fork Snake River during 2003 ranged from 42 to 118 fish/ha, which were also the lowest recorded since electrofishing began in 1986 (Schrader and Fredericks, in press). The Teton River from Highway 33 (Harrop's Bridge) upstream to the confluence with Trail Creek is roughly 40 km long, averages 33.3 m wide, for a total surface area of about 133 ha. This translates to about 250 cutthroat trout total in the Teton Valley during 2003. If half are adults, then the population was near the minimum equilibrium size (N_e=100) generally considered at risk of extinction.

Despite low but stable densities in the late 1990s, cutthroat trout were not considered in jeopardy prior to 2003 because biomass estimates were generally higher than those observed in the late 1980s and early 1990s – at least in the lower Teton Valley. Using standard weights and our density estimates from 1987 to 1999-2000, cutthroat trout biomass increased from 45 to 109 kg at Breckenridge, from 63 to 184 kg at Rainier, and from 142 to 162 kg at Buxton, but decreased from 183 to 128 kg at Nickerson. The increase in biomass can be directly attributed to fewer but larger fish from reduced harvest (Schrader, in press). However, the dramatic increase in average lengths and QSDs (Figure 17) reflects not only increased numbers of larger and older fish but also reduced numbers of juvenile fish for unknown reasons (Figure 18). This was particularly noticeable in 1997 when QSD was over 50%.

Special regulations may be warranted to protect cutthroat trout from any harvest in the Teton Valley – and perhaps throughout the Teton River drainage. Teton Valley cutthroat trout harvest declined from about 2,900 fish in 1975 (Irving et al. 1977) to 200 fish in 2000 (Schrader, in press). It is unlikely there were 200 legal-sized (i.e. greater than 406 mm) cutthroat trout in the Teton Valley during 2003. Supplementation may also be warranted to enhance recruitment and rebuild the population.

The 2003 density estimate for all trout combined was the third highest recorded – surpassed only by 1987 and 1994 (Figure 16). The increase since the late 1990s can be directly attributed to increasing numbers of rainbow trout but not brook trout. Excluding White Bridge, average rainbow trout density decreased from about 100 fish/ha in 1987 to 20 fish/ha in the late 1990s, but then rebounded to 65 fish/ha by 2003. In comparison, rainbow trout density in the upper South Fork Snake River during 2003 was 139 fish/ha, which is the highest on record (Schrader and Fredericks, in press). We estimate there were about 8,650 rainbow trout total in the Teton Valley during 2003.

Excluding White Bridge, average brook trout density increased slightly from about 20 fish/ha in 1991 to 35 fish/ha in 1994, but then declined to 20 fish/ha again by 2003 (Figure 16). We estimate there were about 2,650 brook trout total in the Teton Valley during 2003 – 6,000 less than rainbow trout but 2,400 more than cutthroat trout.

Since 1987, average lengths and QSDs for rainbow trout, and to a much lesser extent brook trout, have increased, but not as dramatically as for cutthroat trout (Figures 19 and 20). This is primarily because of more larger and older fish from reduced harvest (Schrader, in press). Juvenile rainbow and brook trout have not declined to the same extent as juvenile cutthroat trout.

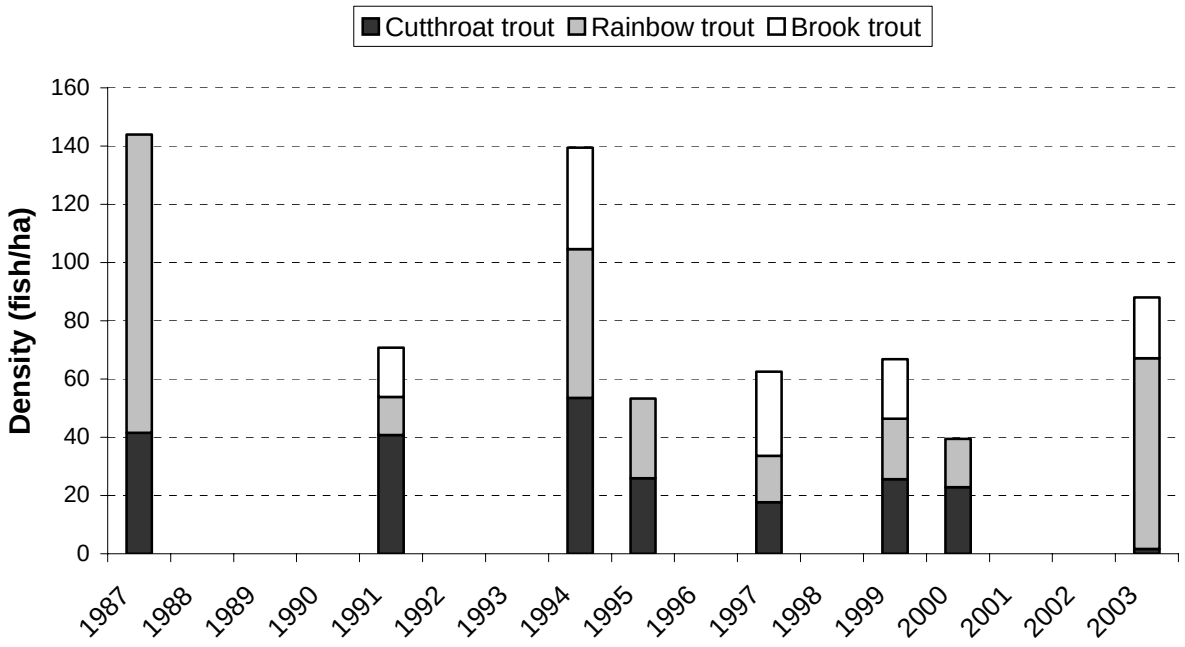


Figure 16. Age-1 and older cutthroat, rainbow, and brook trout density (fish/ha) averaged over all Teton Valley electrofishing sections except White Bridge, Teton River, Idaho, 1987-2003. Unbiased brook trout density estimates were not possible in 1987, 1995, and 2000.

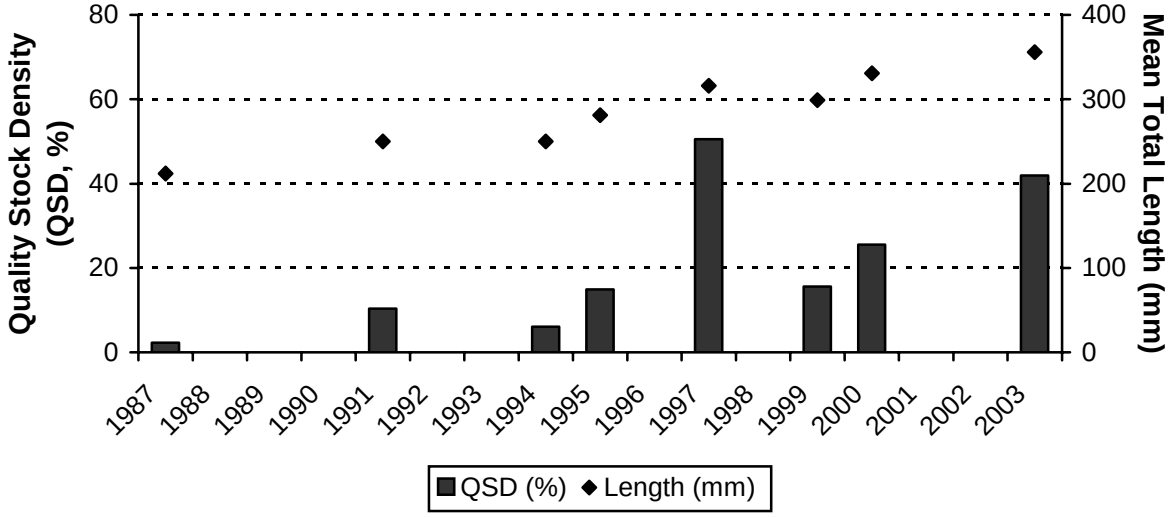


Figure 17. Cutthroat trout quality stock density (QSD) and mean total length over all Teton Valley electrofishing sections combined, Teton River, Idaho, 1987-2003.

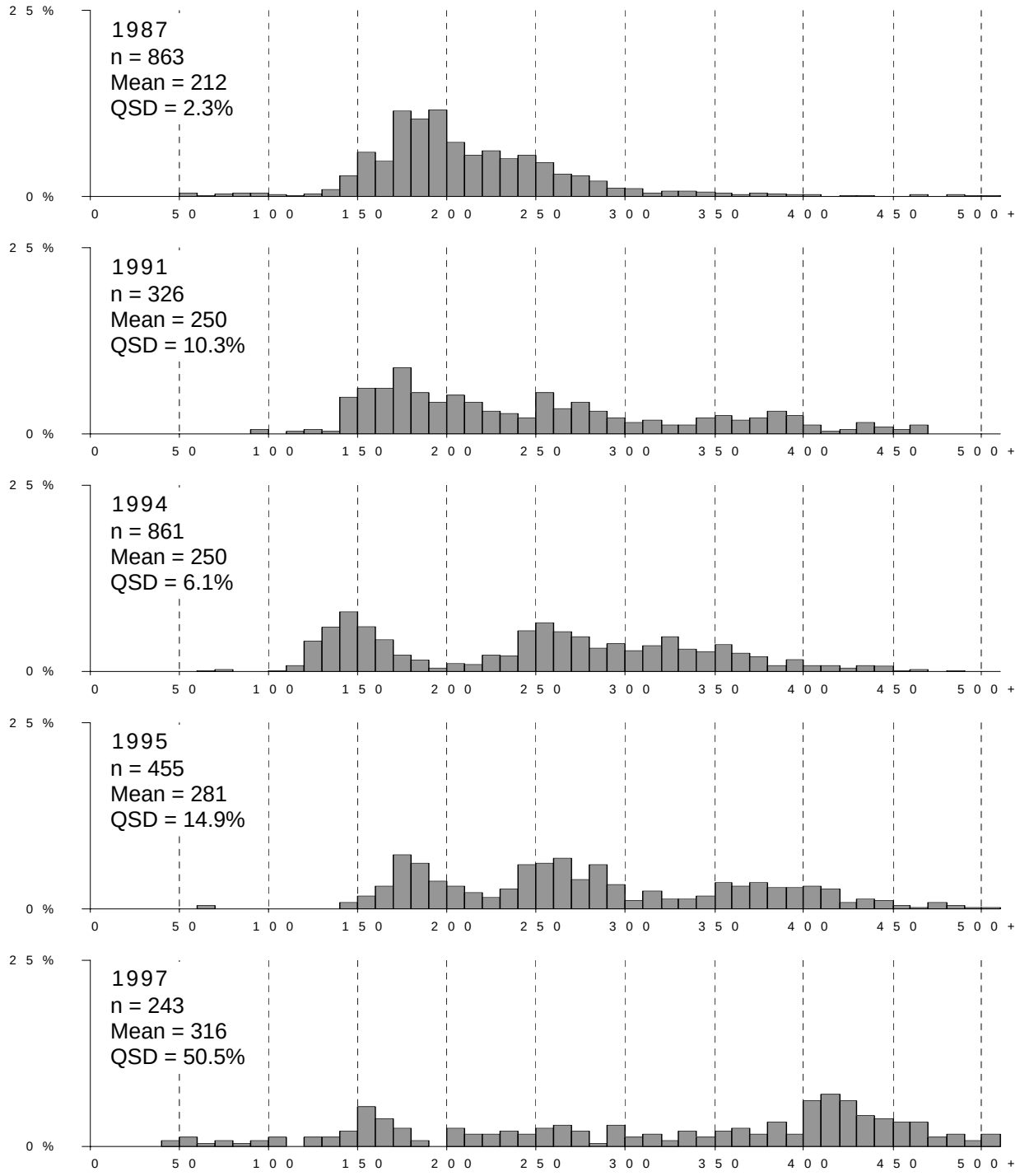


Figure 18. Length frequency distributions of cutthroat trout captured in the fall at all Teton Valley electrofishing sections combined, Teton River, Idaho, 1987-2003. Total individual fish captured during mark and recapture runs = n. Results are from MR5 database for all sizes (TL) of fish.

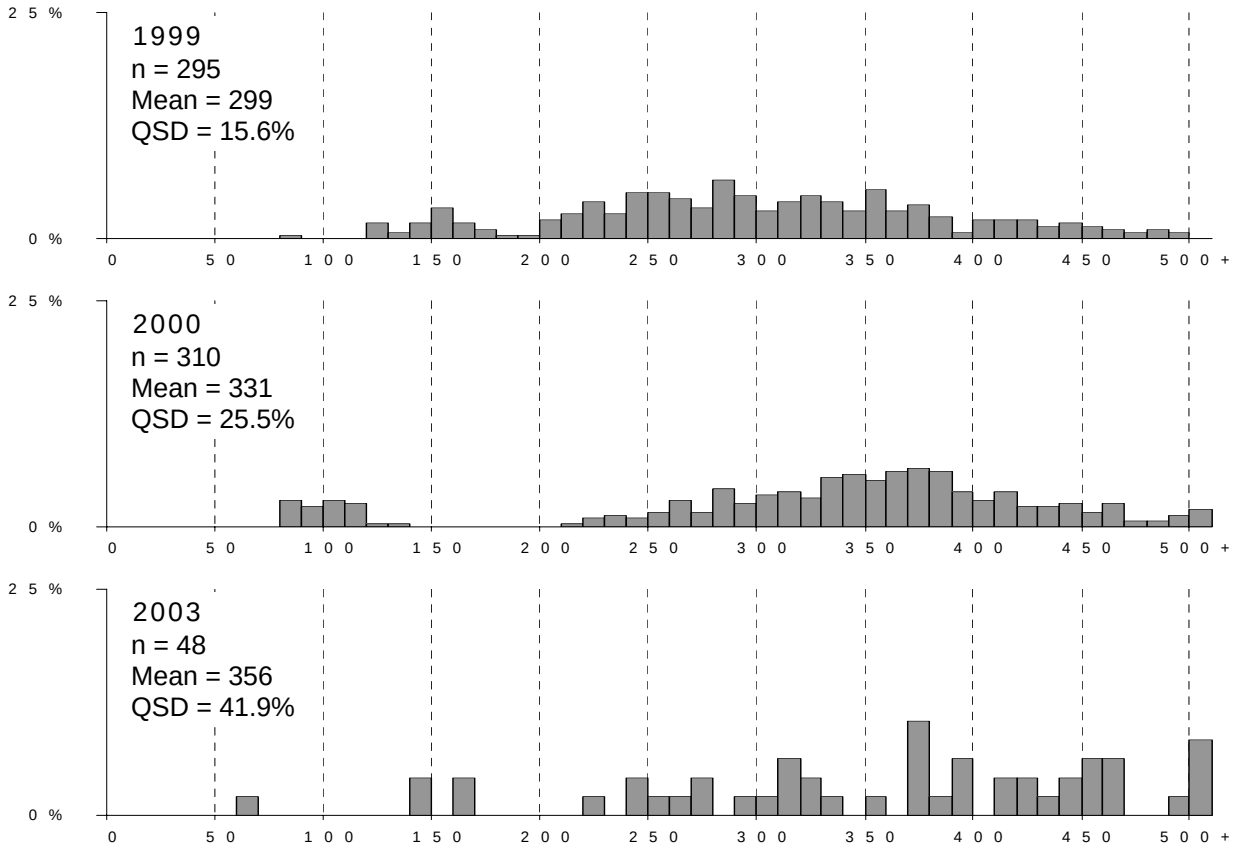


Figure 18. Continued.

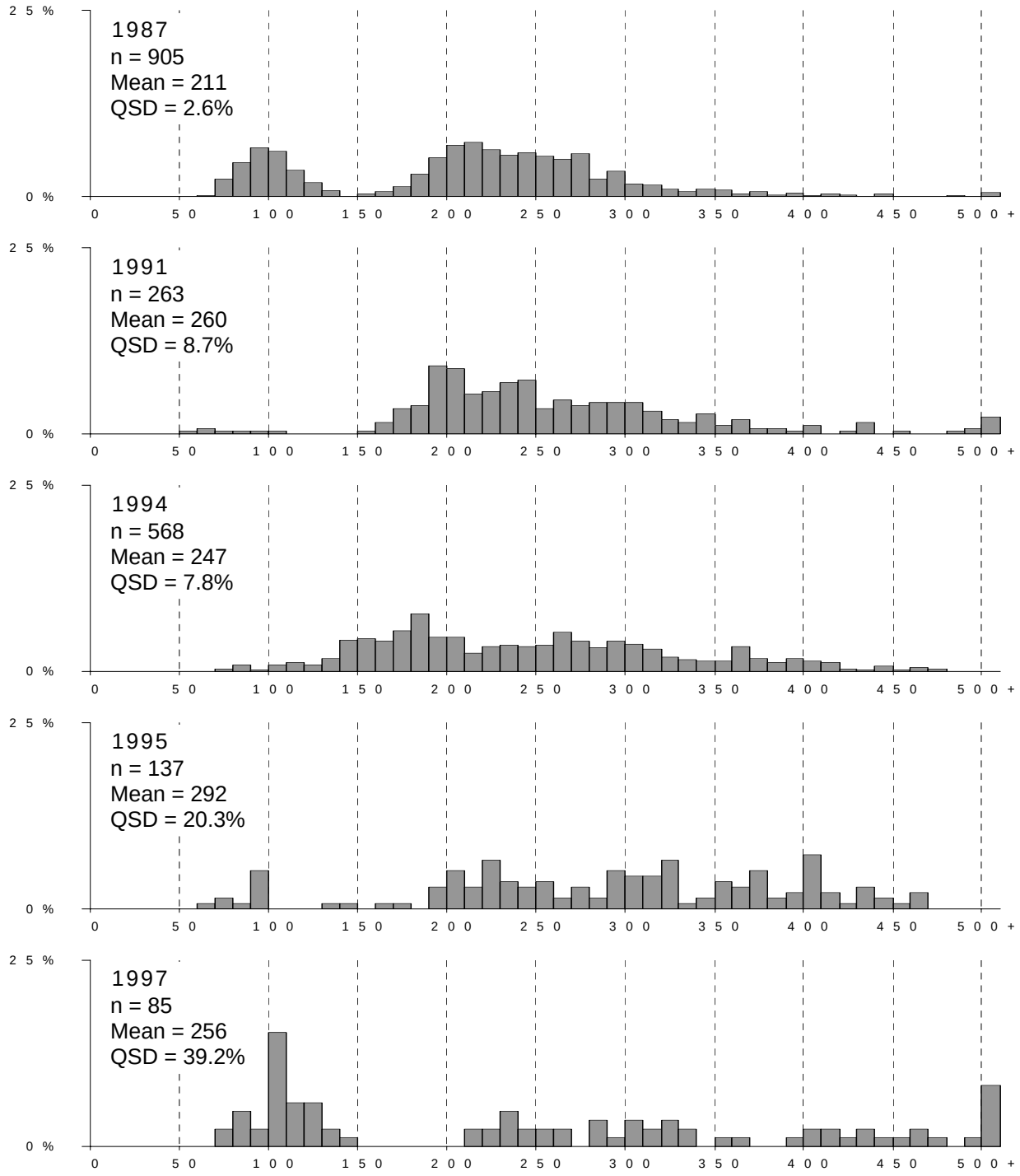


Figure 19. Length frequency distributions of rainbow trout captured in the fall at all Teton Valley electrofishing sections combined, Teton River, Idaho, 1987-2003. Total individual fish captured during mark and recapture runs = n. Results are from MR5 database for all sizes (TL) of fish.

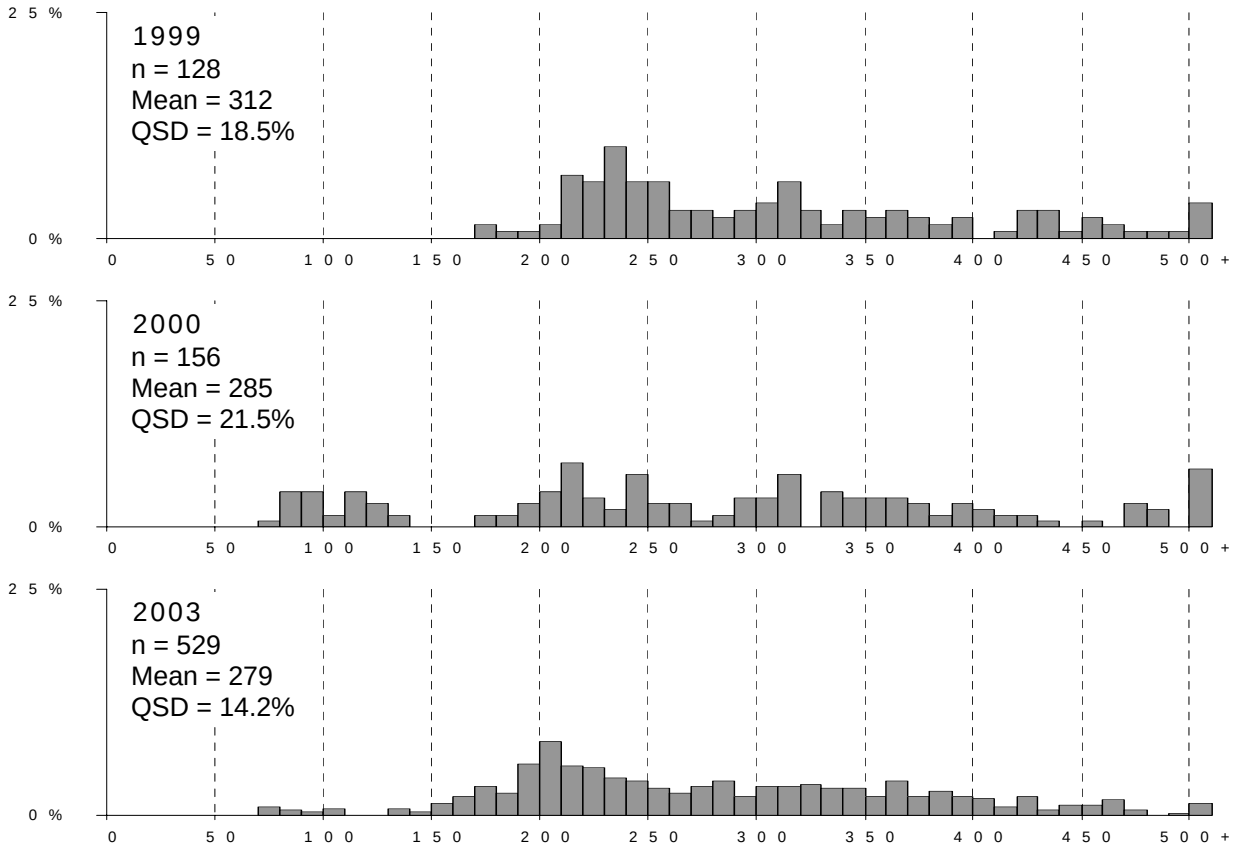


Figure 19. Continued.

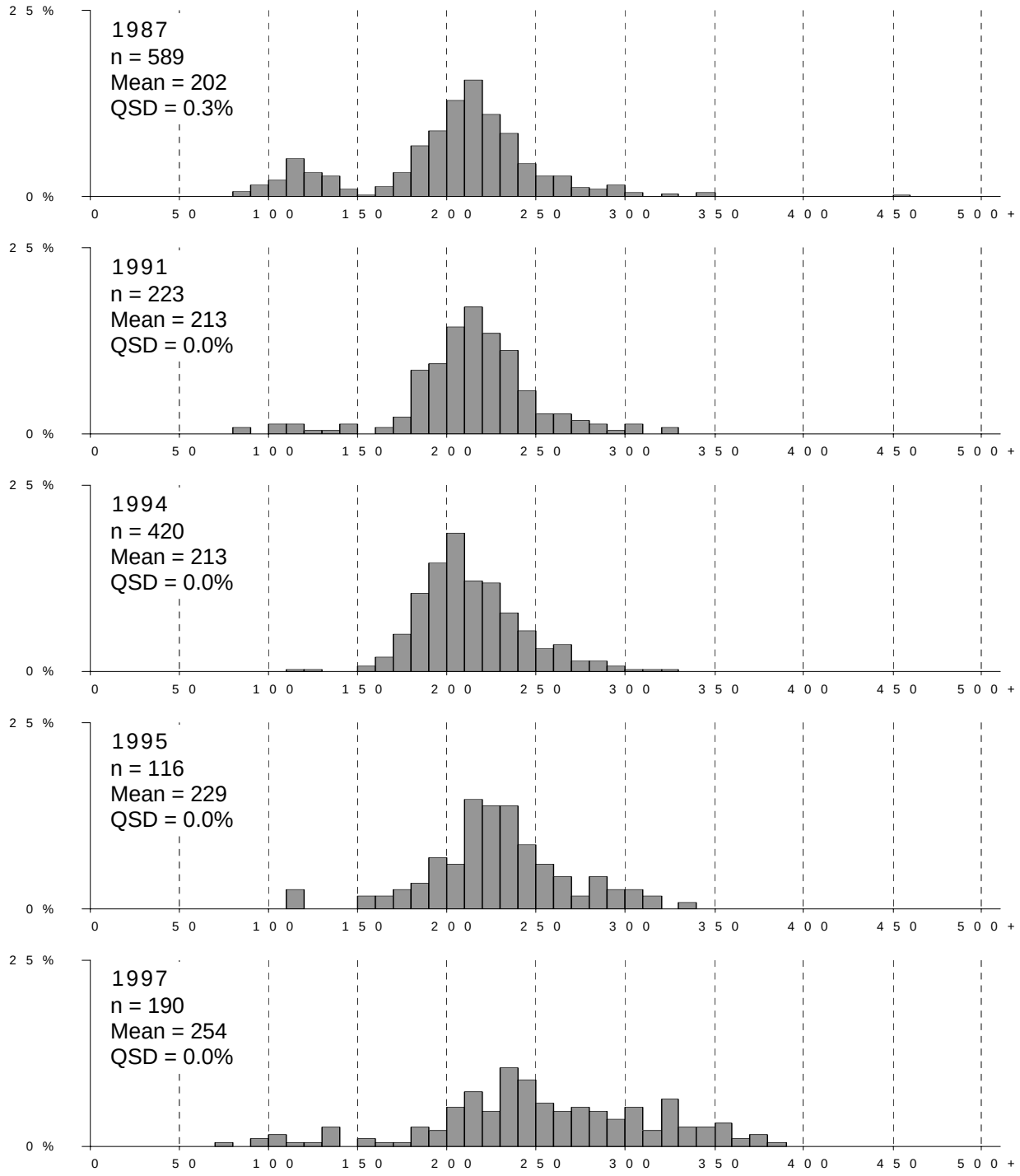


Figure 20. Length frequency distributions of brook trout captured in the fall at all Teton Valley electrofishing sections combined, Teton River, Idaho, 1987-2003. Total individual fish captured during mark and recapture runs = n. Results are from MR5 database for all sizes (TL) of fish.

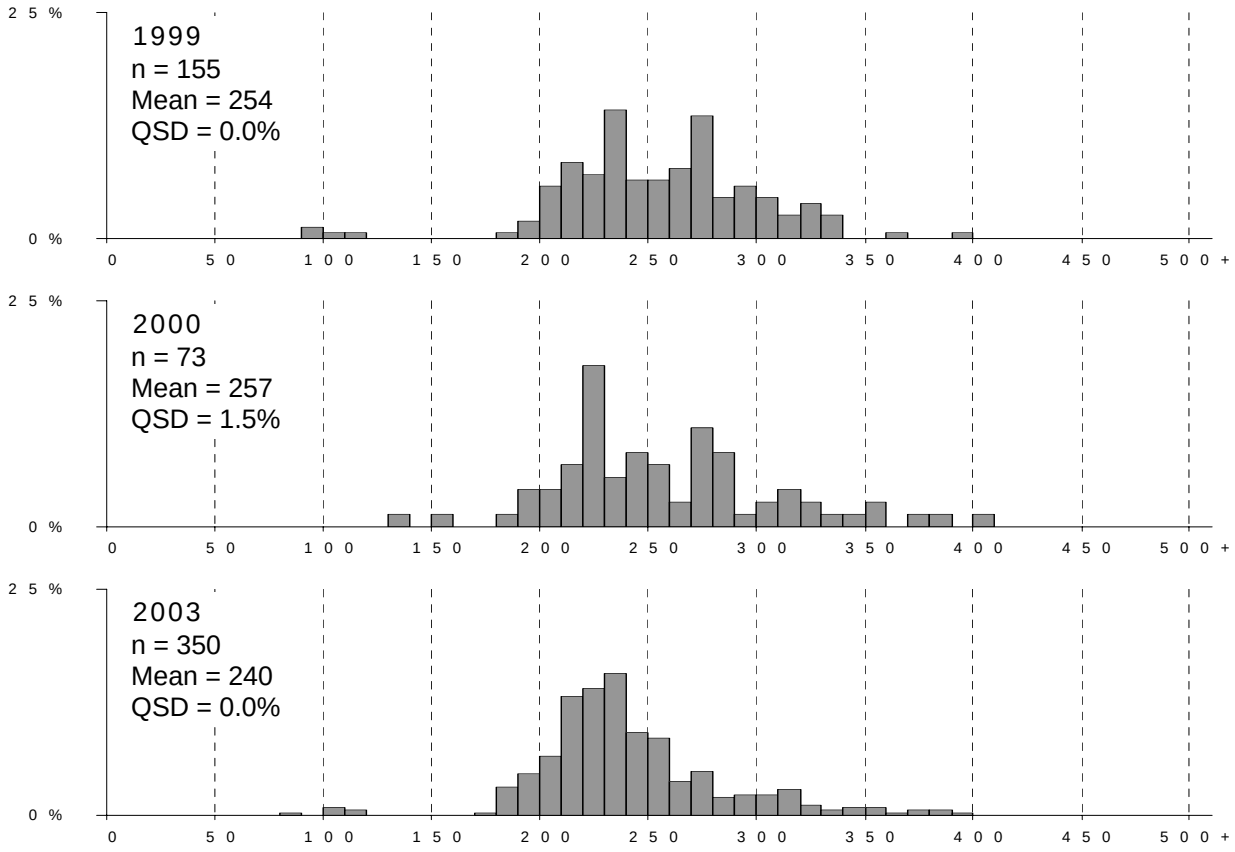


Figure 20. Continued.

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APPENDICES

Appendix A. Summary of the Island Park Dam fish salvage.

On September 30, 2003 a meeting was held between Freemont-Madison Irrigation District, Bureau of Reclamation, IDFG, Henrys Fork Foundation, Local guides and outfitters (Rene Harrop of Last Chance Anglers) and other interested publics. The purpose of the meeting was to inform local residents and concerned parties that the dam on Island Park Reservoir was in need of repairs that require the shutting down of flows into the Henrys Fork at Box Canyon. At the time the decision was made, there were no alternatives to dewatering the 400 m of river between the dam and the confluence with the Buffalo River.

The plans to dewater the dam necessitated the organization of an effort to salvage fish from this reach and move them to the watered section of river down by the Buffalo River confluence. Henrys Fork Foundation (HFF) president Steve Trafton organized the manpower required for this effort. IDFG coordinated the manpower on the ground, and conduct the salvage.

October 24:

Approximately 250 - 300 volunteers met at Island Park Dam at 08:00 after hearing about the salvage on the local news channels and papers. Most brought some form of nets, buckets, coolers and ATV's to assist with the operation. After a brief overview of the project, crews were organized into human "drive lines" as the flows were ramped down to zero at 0900 h. Initial efforts to remove fish from the receding water areas were conducted by these drive lines to herd fish downstream to the confluence. The initial effort was able to push fish all the way to the confluence, while subsequent efforts were hampered by lower water levels in the riffle areas between two major pools. Once lower water was encountered, crews began herding fish to the downstream ends of the pools and capturing fish with hand nets. Fish were then handed over to waiting ATV's with coolers attached, and ferried downstream to the release site. Drive lines conducted about eight to 10 runs before flows receded to the point alternative methods were warranted.

After the initial removals of fish were complete, we began electrofishing in the remaining pool that was accessible. We used two backpack electrofishers, with about 20 volunteers helping net. The tactics used in the drive line were used to aid in corralling fish during electrofishing. Again, numerous volunteers lined the banks, offloading captured fish to waiting ATV's for a shuttle to the release site. We conducted multiple passes using this method, and deemed them relatively effective.

We placed one IDFG personnel at the release site to document the size and number of fish moved with both of the above methods. Fish were grouped into adult size (> 250 mm) and sub-adult sizes (< 250 mm). Approximately 1,800 adult fish and 600 sub-adult fish were counted and released. We estimate 1,000 more fish were moved during the drive-line efforts, although this is a first-order estimate.

The pool directly below the dam remained too deep to effectively move fish after flows receded. Freemont Madison Irrigation District personnel added a pump to this pool to aid in drawing it down, and make fish removals possible. We assumed this pump would lower the pool to a workable level by the following morning. Therefore, we planned additional efforts for the 25th, although the volunteer level was kept to a minimum of Last Chance guides, IDFG, HFF and a few other volunteers.

Gear used: 300 volunteers, 5 Department personnel, 100 buckets, 50 dip nets, 2 backpack electrofishers, 10 ATV's.

Actual cost: 300 volunteers for 6 hours @ $7.00/hr = $12,600.00
3 professionals for 10 hours @ $30.00/hr = $900.00
2 technicians for 10 hours @ $15.00/hr = $300.00
2 backpack electrofishers (rental charge) = $600.00
10 ATV's @ $200/day = $2,000.00

Incurred cost: 100 buckets @ $6.00 ea = $600.00
50 dip nets @ $10.00 ea = $500.00

TOTAL = $16,400

October 25:

Crews assembled below the dam at 0800 h to assess the pool level, and the possibility of removing fish. Unfortunately the pump failed to remove enough water, and the pool remained unworkable. However, the second pool down (which was the target of most of the effort on the 24th) had receded, and we observed a large school of trout. Since we had manpower and equipment already on-site, we made a second effort in this area.

This effort used a 4-wheel drive truck with two 285-liter tanks in the back as our shuttle vehicle. We used a single backpack electrofishing unit and a dozen netters to remove fish. Netters surrounded the pool to reduce driving fish out, while the electrofisher was operated throughout the pool to stun fish. We made five passes before fish densities depleted. About 250 - 300 adult fish were moved from this effort.

The pump continued to run in the largest pool (directly below the dam) throughout the remainder of the October 25 and all through October 26. We scheduled one final attempt at salvaging this pool for October 27. Based on trout densities moved on the October 25 we expected high densities of trout remained in this pool.

Gear used: 30 volunteers, 3 professionals, 50 buckets, 30 dip nets, two 285-liter tanks, one 4WD pickup, one backpack electrofishing unit.

Total Cost: 30 volunteers for 6 hours @ $7.00/hr = $1,260
2 professionals for 10 hours @ $30.00/hr = $600.00
1 Technician for 10 hours @ $15.00/hr = $150.00
Two 285-liter tanks @ $50.00 ea = $100.00
4WD pickup rental @ $200.00/day = $200.00
1 Backpack electrofisher rental = $300.00
TOTAL = $2,610

October 27:

Once again, crews consisting of Department, HFF, and Last Chance guides assembled on the riverbanks below the dam at 11:00. The pool had receded to a mean depth of about four feet, and appeared workable. The shuttle vehicle on this day was a diesel truck with a 1,500-

liter stock tank in the back. The truck would move from the access road just below the dam to the confluence with the Buffalo River. However, a few obstacles were encountered. The first being that the substrate in the pool was extremely slick boulders that made effective wading a gamble at best. The second was that the pool itself was actually a hole approximately 4 meters deep, which made efficient transportation of fish to the truck difficult.

We overcame the first obstruction by using an aluminum johnboat to electrofish from. We placed a netter in either end of the boat, with the backpack electrofisher in the center. A rat-tail probe was placed over the edge of the boat, and the probe manipulated around the pool. The boat was maneuvered by means of ropes attached to either end of the boat and volunteers along the shoreline. These volunteers pulled the boat back and forth across the pool, and slowly worked it from one end to the other. We moved fish from the pool to the waiting truck by forming a human chain and passing nets of fish to the waiting truck. Approximately 30 volunteers were required to make this effective.

We conducted four passes through the pool over the course of the day. About 1,000 adult fish were removed before depleting the pool. Even though a large number of fish were removed from the pool, additional fish remained after the last pass was made. Time constraints limited us from making additional runs through the pool.

Gear used: 30 volunteers, 5 professionals, 30 landing nets, one aluminum johnboat, 1 submersible pump, one 1,500-liter stock tank, one diesel pickup truck

Total Cost: 30 volunteers for 6 hours @ $7.00/hr = $1,260.00
3 professionals for 10 hours @ $30.00/hr = $900.00
2 technicians for 10 hours @ $15.00/hr = $300.00
1 aluminum johnboat rental = $100.00
1 submersible pump = $50.00
1 1,500-liter stock tank rental = $150.00
Diesel pickup rental = $250.00
TOTAL = $3,010

Appendix B. Synopsis of historical IDFG fisheries surveys and projects conducted in the Teton River drainage, Idaho, 1987-2003.

The Teton River Enhancement Program (TREP) was initiated by the Department in 1987 (Gamblin and Brostrom 1988) and is ongoing, but it has been scaled back since 1994 when the Blackfoot Wildlife Management Area was purchased. The program focus is stream habitat restoration – primarily in the Teton Valley – and is operated using settlement funds from the U.S. Bureau of Reclamation (BOR) for the Teton Dam failure (Moore and Andrews 1983; Gamblin and Brostrom 1988). Funds were set aside and invested in a trust fund account with the goal of improving fish habitat in the Teton River drainage.

Fisheries management investigations began in 1987 to evaluate the program, but only some of the information for the Teton Valley has been formally reported. As part of a separate Teton Canyon research project, Schrader (in press) summarized creel surveys conducted throughout the drainage in 1988, 1994, and 2000 as well as water temperature data collected in 1996-2000. For the Teton Valley, Schrader and Brenden (in press) reported main stem electrofishing and black spot disease results from 1999. Meyer et al. (2001, 2003) also compared 1987 electrofishing results with those obtained in 1999-2000. Schrader and Jones (in press) reported fish movements throughout the drainage that were deduced using a variety of methods. These included jaw tagging (1987-1996), fin clipping (1997-1999), radiotelemetry (1998-1999), fish ladder trapping (1995, 1998-1999), and rotary screw trapping (1998-1999).

Numerous tributary surveys have been conducted throughout the drainage – including many tributaries in the Teton Valley. The US Forest Service (USFS) conducted fish and habitat surveys at 218 sites in upper portions (i.e., USFS public land) of 39 different streams (or forks of streams, i.e., anything named differently) in 1998 and in Moody Creek in 2000 (Ted Kellogg, USFS, personal communication). Copies of all their raw data are in Department Upper Snake Region files, but there is no final report.

As part of a Bonneville Power Administration (BPA) funded research project, Meyer and Lamansky (2002) conducted fish and habitat surveys at 107 sites on public and private land in 40 different streams (or forks of streams, i.e. anything named differently) in 2000. However, 42 sites in 20 streams were dry and not sampled, leaving 65 sites sampled. Meyer and Lamansky did not attempt to survey all Teton River tributaries and chose their sample locations randomly. This is the most current data for the random streams surveyed – although Kellogg's data is more comprehensive as they sampled every stream on USFS land. Copies of all of Meyer and Lamansky's raw data are in Department Upper Snake Region files, as is their annual report to BPA.

Idaho Department of Environmental Quality also surveyed tributaries in 1996-1999. Copies of all their raw data are in Department Upper Snake Region files, but there is no final report.

As part of ongoing whirling disease research, Elle and Schill (1999) electrofished lower Teton and Fox creeks in 1997, and then compared their results with TREP electrofishing that was conducted in 1987, 1991, and 1992. A Utah State University (USU) graduate student expanded sampling in these important spawning tributaries and others in 2003 and 2004 (Martin Koenig, USU, personal communication).

Irving et al. (1975, 1977) surveyed Bitch, Badger, and other unknown Teton Valley tributaries in 1974 and 1975 prior to Teton Dam. They used snorkeling, hook and line, and

electrofishing gear. Their raw data, specific locations of sampling sites, and maps and photographs no longer exist.

Finally, on the Wyoming side of the Teton Valley, Wyoming Game and Fish (WYGF) sampled 32 streams in 1998 and 1999 (Ralph Hudelson, WYGF, personal communication). Their raw data reside at the WYGF regional office in Jackson, Wyoming, with a copy of the final report in IDFG Upper Snake Region files.

Following is an abbreviated outline of all Department fisheries investigations and projects conducted or assisted by TREP from 1987 to 2003:

I. Population Surveys

A. Main Stem Electrofishing
   1. Lower Teton
      - South Fork (1993, 1999)
      - North Fork (1993, 1999)
      - Hog Hollow (1991)
   2. Teton Canyon
      - Parkinson (1992, 1998, 1999)
      - Upper and Lower Spring Hollow (1999)
   3. Teton Valley
      - Breckenridge (1987, 1989, 1991, 1994, 1995, 1997, 1999, 2003)
      - Rainier (1987, 1989, 1991, 2000)
      - Buxton (1987, 1989, 1991, 2000)
      - Nickerson (1987, 1989, 1991, 1994, 1995, 1997, 1999, 2003)
      - White Bridge (1994)

B. Tributary and Canal Electrofishing
   1. Lower Teton
      - Moody Creek (1985, 1988, 1990, 1993, 1994)
      - Wilford Canal (1987)
      - Other Canals (1995 [Der Hovanisian 1997])
   2. Teton Canyon
      - Badger Creek (1987, 1991 [Schill 1996])
      - Canyon Creek (2000)
   3. Teton Valley
      - Spring Creek (1992?)
      - Packsaddle Creek (1987)
      - Horseshoe Creek (1987)
      - Woods Creek (1987)
      - Bear Creek (1991)
      - Twin Forks creeks (1991, 1994)
      - Teton Creek (1987, 1992, 1997)
      - Fish Creek (1991, 1992?)
      - Dick Creek (1987)
      - Fox Creek (1991, 1992?, 1997)
      - Drake Creek (1988)
      - Little Pine Creek (1988)
      - Warm Creek (1989)

C. Gill Netting
   1. Teton Canyon
      - Barrow Ponds (1991, 1998)

D. Fyke Trap Netting
   1. Lower Teton
      - Hog Hollow (1993)
E. Seining
   1. Teton Canyon
      - Spring Hollow (1997)
   2. Teton Valley
      - Buxton (1988)
F. Hook and Line Sampling
   1. Lower Teton
      - Hog Hollow (1988)
   2. Teton Canyon
      - Parkinson (1988-1991, 1998)
      - Upper and Lower Spring Hollow (1988-1991, 1998)
      - Canyon Creek (1991)
      - Bitch Creek (1991)
      - Badger Creek (1988)
   3. Teton Valley
      - Breckenridge (1990)
      - Rainier (1988)
      - Buxton (1988)
G. Redd Surveys
   1. Teton Canyon
      - Canyon Creek (1999, 2000, 2001)
   2. Teton Valley
      - Most tributaries and main stem (1992)

II. Movement

A. Jaw Tagging (entire drainage 1987-1996; ERI at Felt Dam 1987-1988)
B. Fin Clipping (entire main stem 1997-1999)
C. Radiotelemetry (entire main stem 1998-99)
D. Fish Ladder Trapping
   1. Lower Teton
      - South Fork (1995, 1999)
   2. Teton Canyon
      - Felt Dam (1998, 1999; ERI 1987-1988)
E. Rotary Screw Trapping
   1. Lower Teton
      - Hog Hollow (1999)
   2. Teton Canyon
      - Narrows (1998)
      -

III. Age and Growth

A. Ages by Scales (1987, 1993, 1994, 1995)
B. Ages by Otoliths (1995)

IV. Age and Growth

A. Ages by Scales (1987, 1993, 1994, 1995)
B. Ages by Otoliths (1995)

V. Length/Weight Relationships

A. Measured Weights (1993-1995, 1998-1999)
B. Length/Weight Regressions
C. Standard and Relative Weights

VI. Whirling Disease

A. Lab Analysis
   1. Teton Valley
      - Breckenridge (1995)
      - Nickerson (1995)
B. Sentinel Tests (Elle and Schill 1999)
   1. Teton Valley
      - Rainier (1997)
      - Teton Creek (1997)
      - Fox Creek (1997)

VII. Black Spot Disease (1999)

VIII. Genetics (1998-2000)

IX. Creel Surveys

A. Fully Randomized Surveys (entire main stem 1988, 1994, 2000; Bitch Creek 1988)
B. Incidental Surveys (entire main stem 1989-1993, 1995)
C. Angler Opinions (entire main stem 1988)

X. Fish Stocking Evaluation

A. Evaluation of Cutthroat Trout Fingerlings (1988-1991)
B. Evaluation of Rainbow Trout Catchables (1988, 1994)

XI. Limnology

A. Thermographs
   1. Lower Teton
      - South Fork (1997, 1998, 1999)
      - North Fork (1997, 1998, 1999)
      - Hog Hollow (1997, 1998, 1999, 2000)
   2. Teton Canyon
      - Narrows (1998, 1999)
      - Bitch Creek (1996, 1997)
      - Badger Creek (1996)
   3. Teton Valley
      - Rainier (1996, 1997, 1998, 1999, 2000)
      - Teton Creek (1996, 1997)
      - Fox Creek (1996, 1997, 1998)
B. Borrow Ponds Limnology (1998)

XII. Habitat Surveys

A. Main Stem
   1. Teton Valley
      - Breckenridge (1988, 1991-Harrop; 1988-Breckenridge; 1988-Cook)
      - Rainier (1988-Cook; 1992-Dunn)

- Buxton (1988, 1991-Hill; 1991-Wilson)
- Nickerson (1988-Piquet/Murdock)
- White Bridge (1990-Drake)

B. Tributaries
   1. Lower Teton
      - Moody Creek (1993)
   2. Teton Canyon
      - Bitch Creek (1990)
   3. Teton Valley
      - Spring Creek (1992)
      - Packsaddle Creek (1987)
      - Horseshoe Creek (1987)
      - Bear Creek (1988, 1991, 1992)
      - Twin Forks creeks (1988, 1991, 1992)
      - Woods Creek (1988, 1992)
      - Teton Creek (1988, 1992)
      - Fish Creek (1992)
      - Patterson Creek (1987)
      - Fox Creek (1988, 1991, 1992)
      - Drake Creek (1987)
      - Little Pine Creek (1987)
      - Warm Creek (1987, 1988)

XIII. Habitat Projects

A. Riparian Fencing
   1. Harrop (1989)
   2. Hill (1989)
   3. Dunn (1989)
   4. Drake (1990)
   5. Zohner (1990)
   6. Horton/Kirk (1990, 1993, 1994)
   7. Wilson (1991, 1993, 1994)
   8. Woolstenhulme (1991)
   9. Gaudet (1992)
   10. Hokin (1993)
   11. Lerwill (1994)
   12. IDFG Fox Cr East (1994)
   13. Moulton (1994)
   14. Mithune/Kirk (1995)

B. Willow Planting (1990-1995)

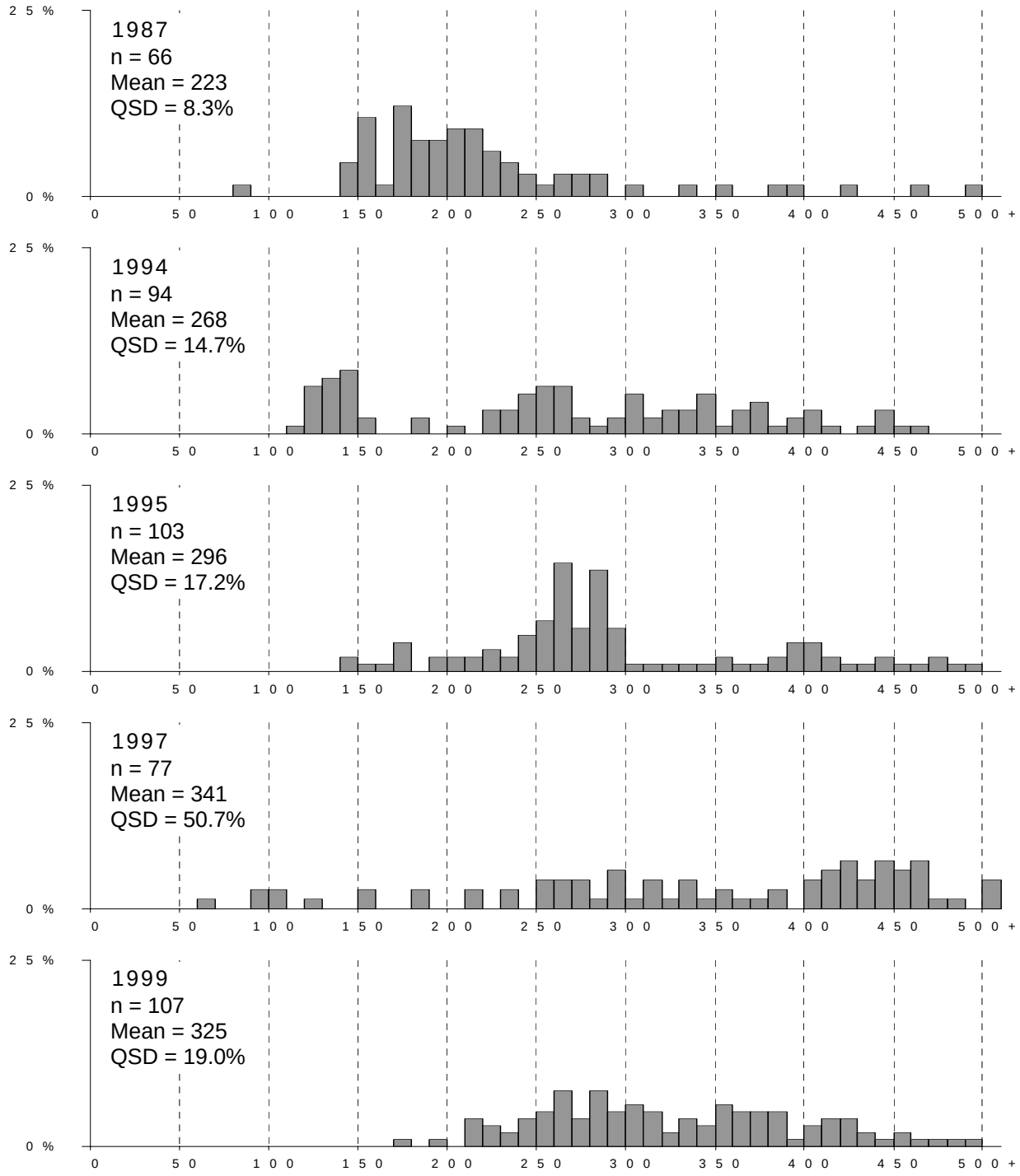
C. Tree Revetments (1991)

D. Instream Structures
   1. Wilson's Sills (1993)
   2. Lerwill's Barbs (1994)

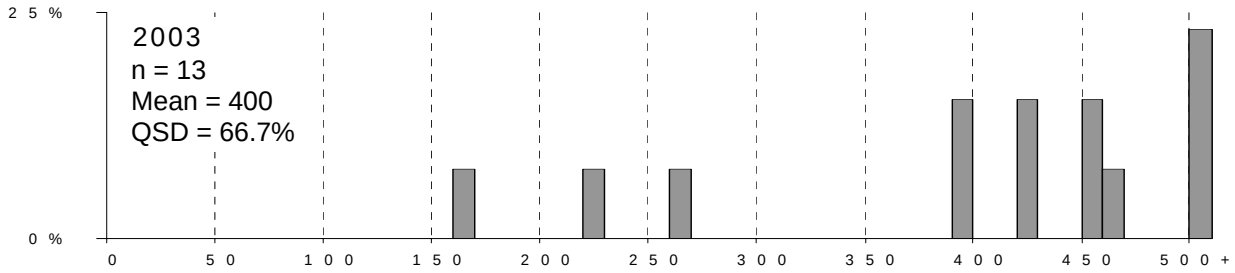
E. Fish Passage
   1. Trail Creek Ladder (1989)
   2. Moody Creek Railroad Culvert Ladder (1990)
   3. South Fork Teton Ladder (1994)

F. Property Purchase/Easements
   1. Trail Creek Pond (1994)

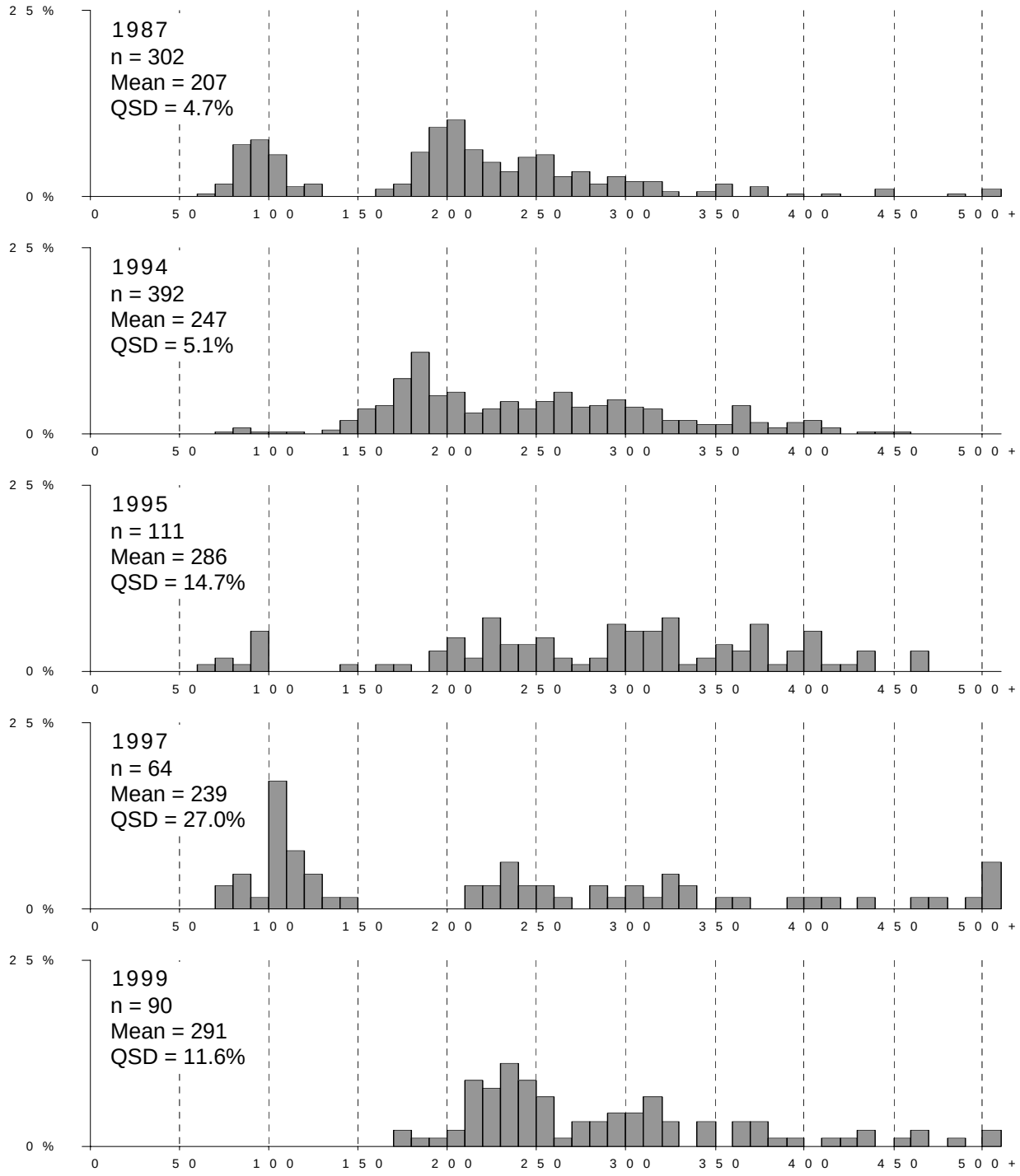
Appendix C. Length frequency distributions of cutthroat, rainbow and brook trout captured in the fall at the Breckenridge electrofishing section, Teton River, Idaho, 1987-2003. Total individual fish captured during mark and recapture runs = n. Results are from MR5 database for all sizes (TL) of fish.



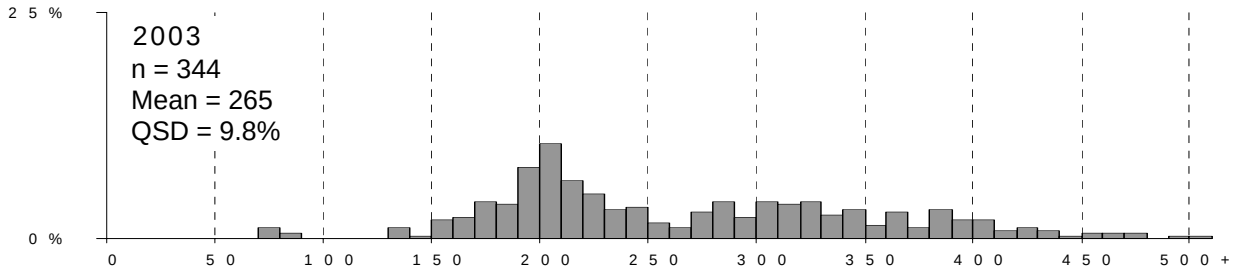
Appendix C-1. Length frequency distributions of cutthroat trout captured in the fall at the Breckenridge electrofishing section, Teton River, Idaho, 1987-2003. The 1991 distribution is excluded due to small sample size (n=5).



Appendix C-1. Continued.



Appendix C-2. Length frequency distributions of rainbow trout captured in the fall at the Breckenridge electrofishing section, Teton River, Idaho, 1987-2003. The 1991 distribution is excluded due to small sample size (n=12).



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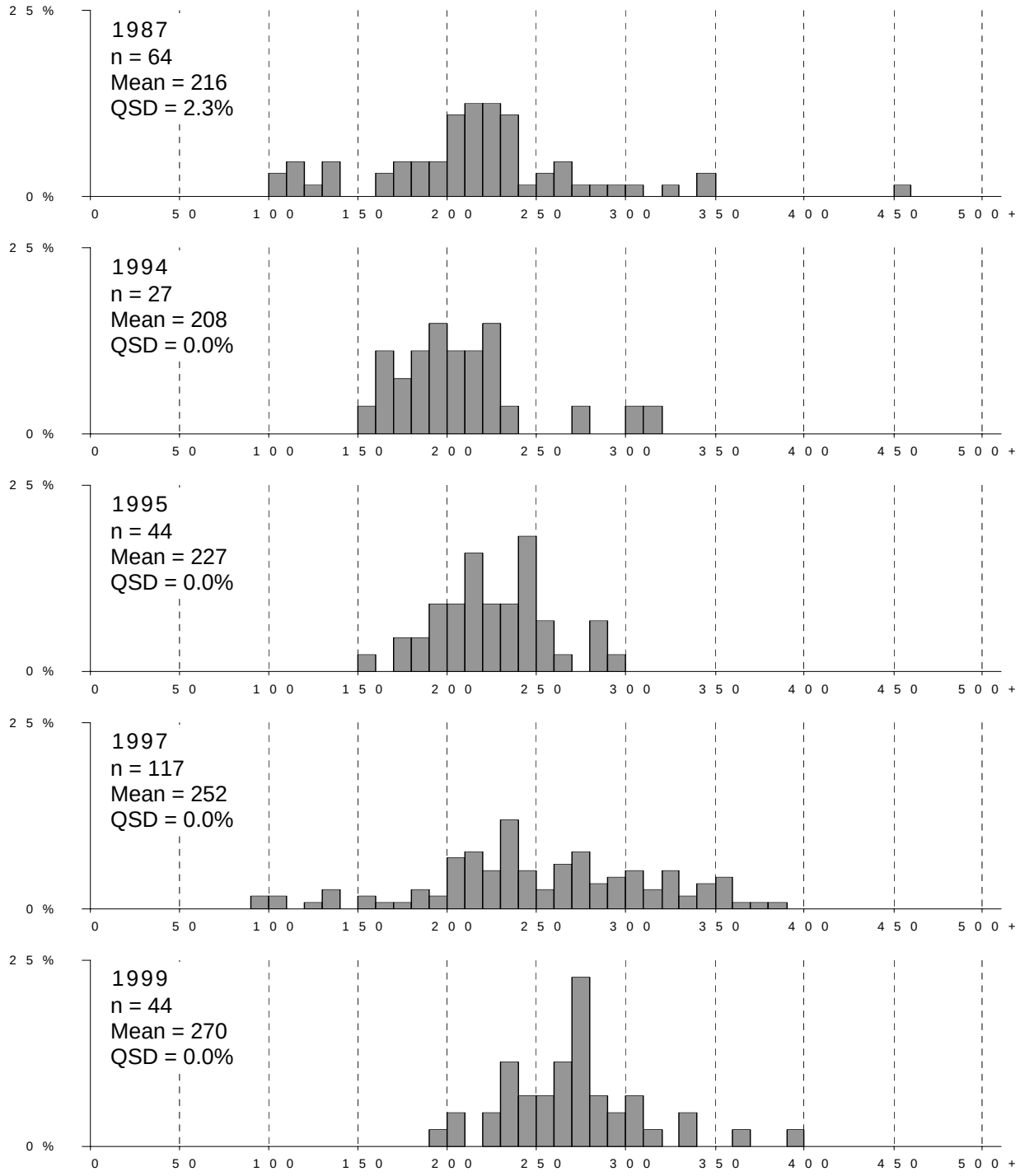
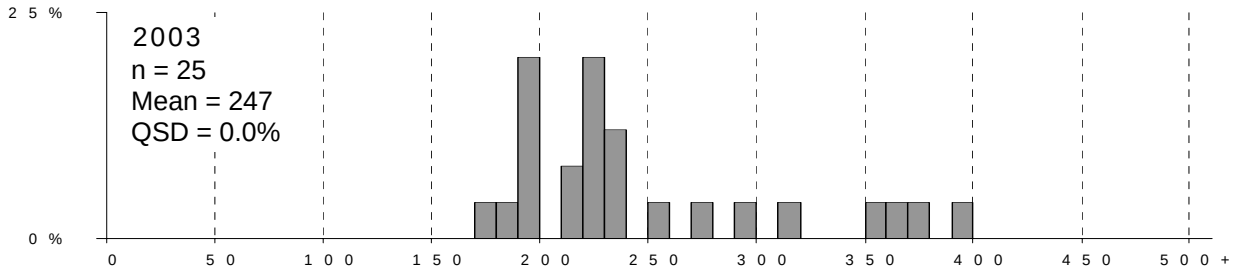
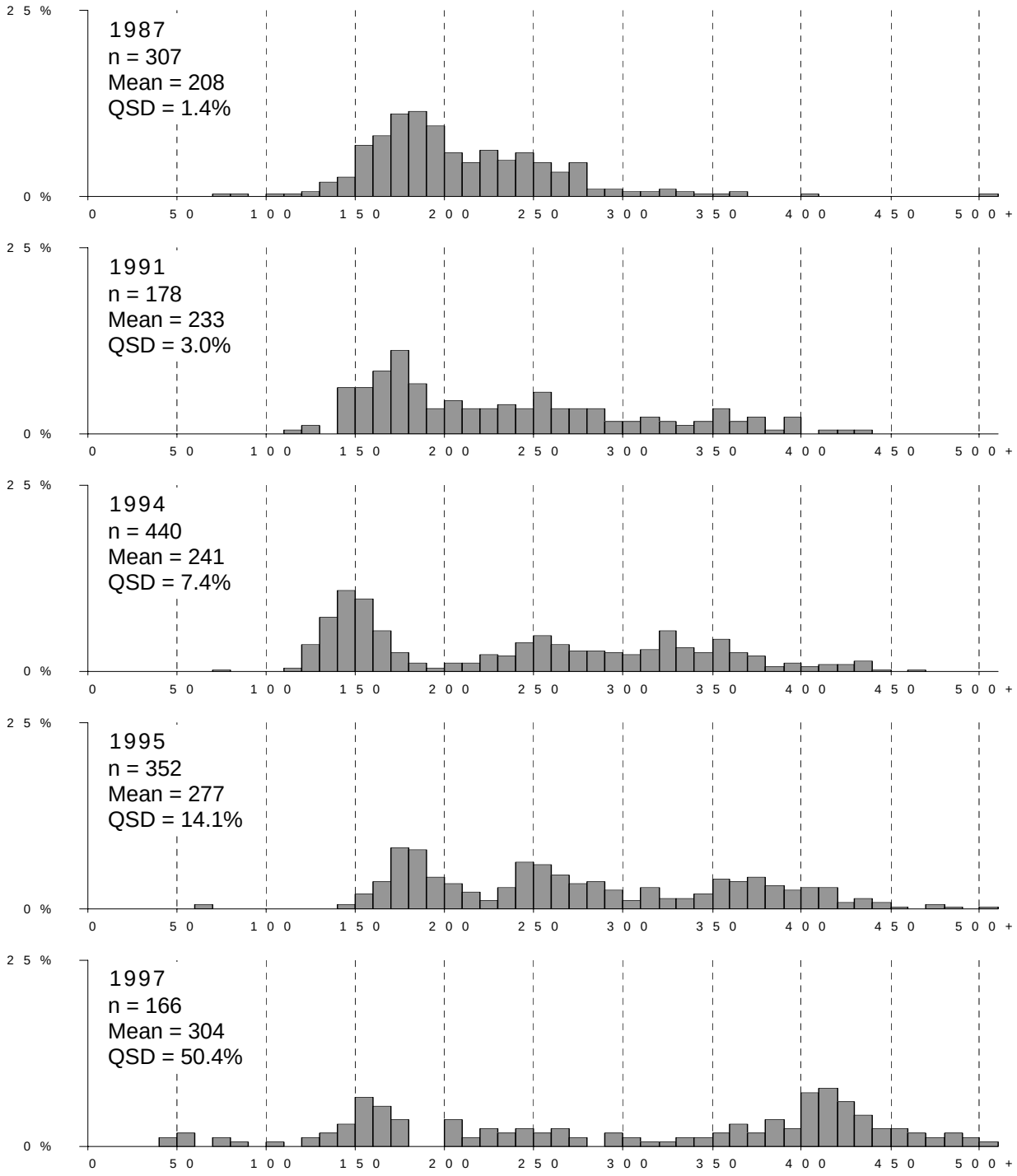


Appendix C-3. Length frequency distributions of brook trout captured in the fall at the Breckenridge electrofishing section, Teton River, Idaho, 1987-2003. The 1991 distribution is excluded due to small sample size (n=1).

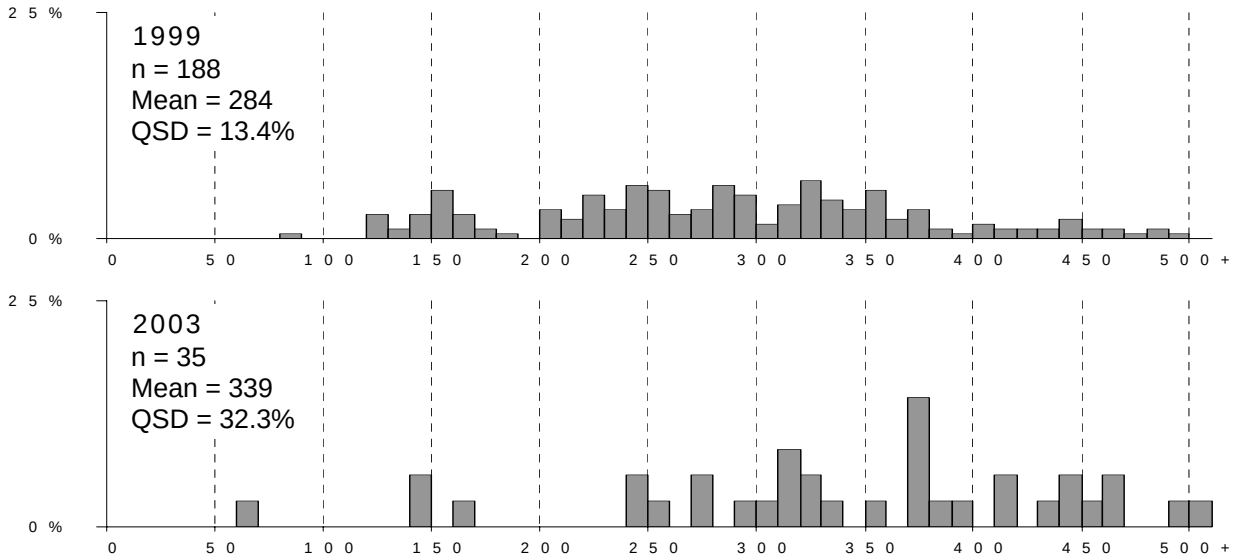


Appendix C-3. Continued.

Appendix D. Length frequency distributions of cutthroat, rainbow and brook trout captured in the fall at the Nickerson electrofishing section, Teton River, Idaho, 1987-2003. Total individual fish captured during mark and recapture runs = n. Results are from MR5 database for all sizes (TL) of fish.



Appendix D-1. Length frequency distributions of cutthroat trout captured in the fall at the Nickerson electrofishing section, Teton River, Idaho, 1987-2003.



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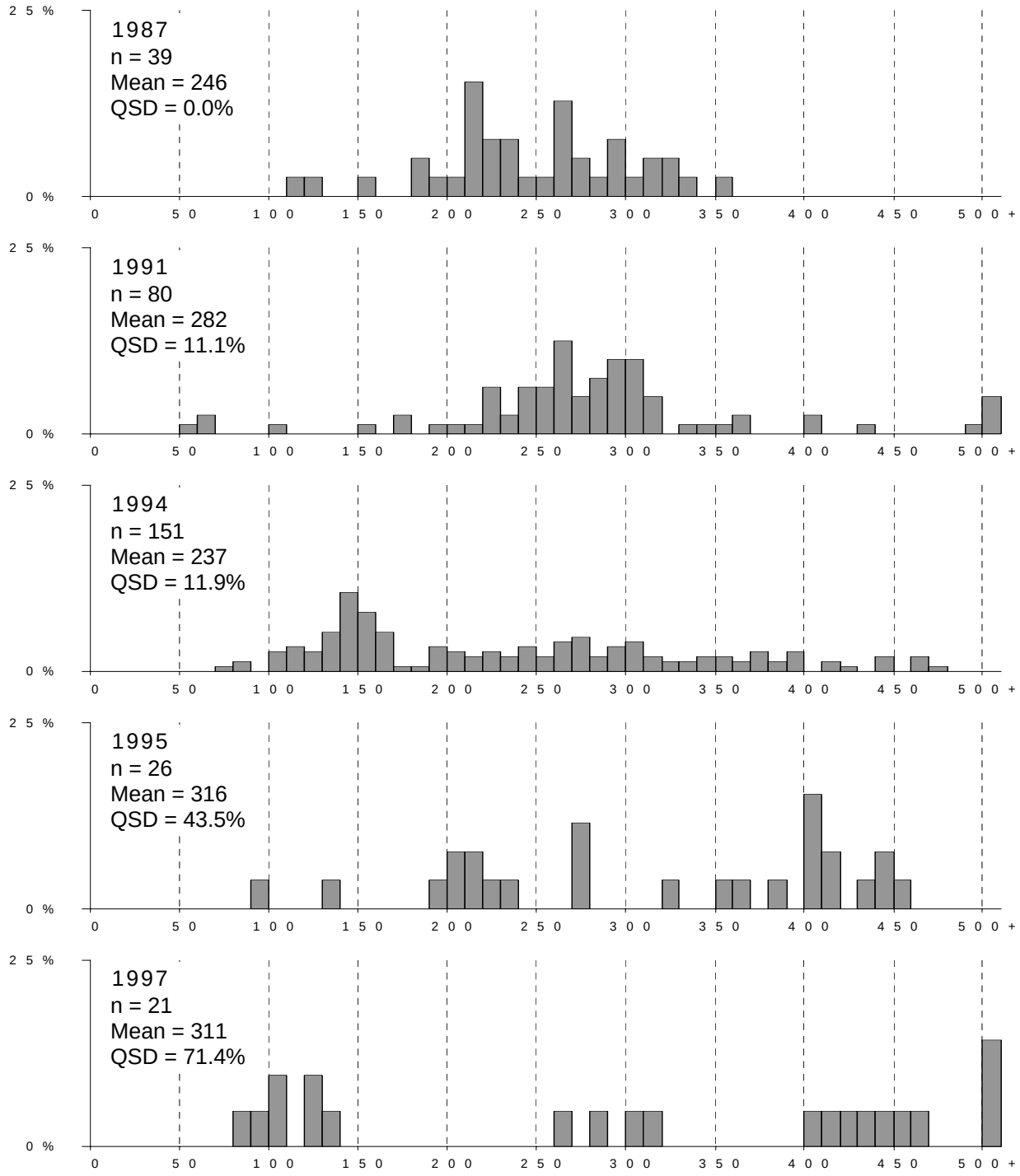
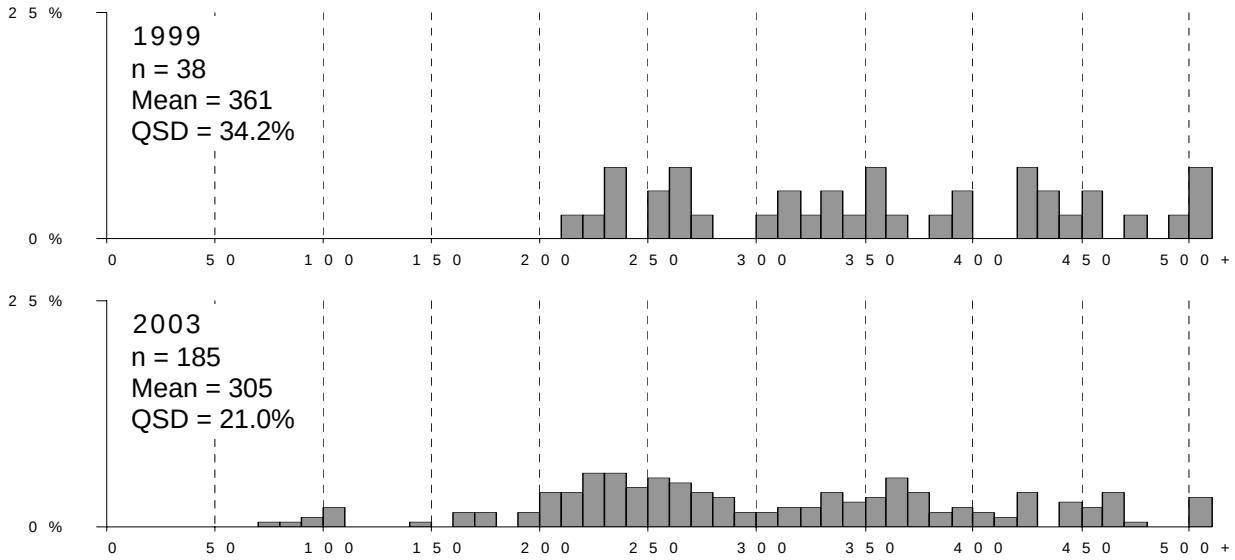


Appendix D-2. Length frequency distributions of rainbow trout captured in the fall at the Nickerson electrofishing section, Teton River, Idaho, 1987-2003.



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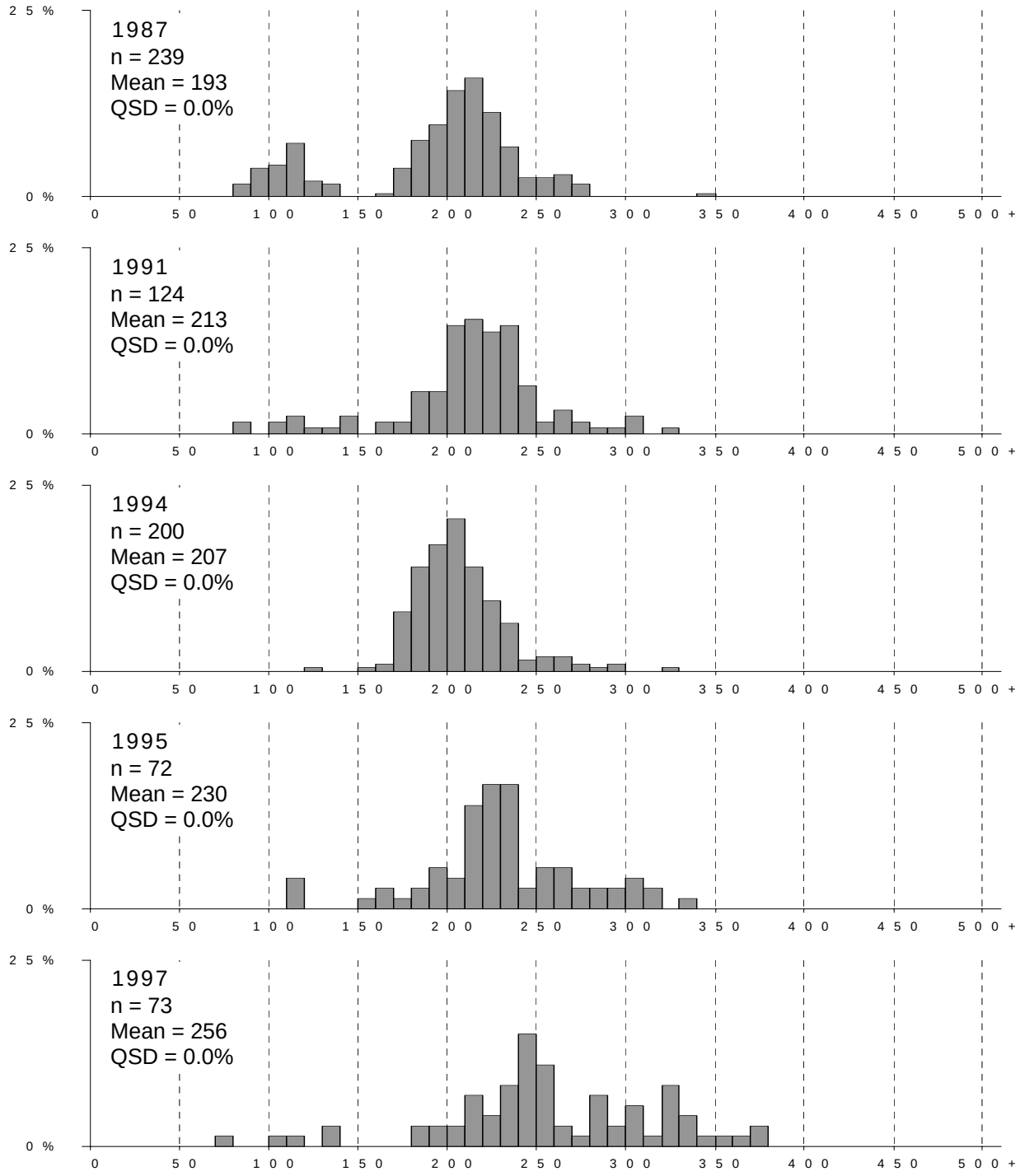
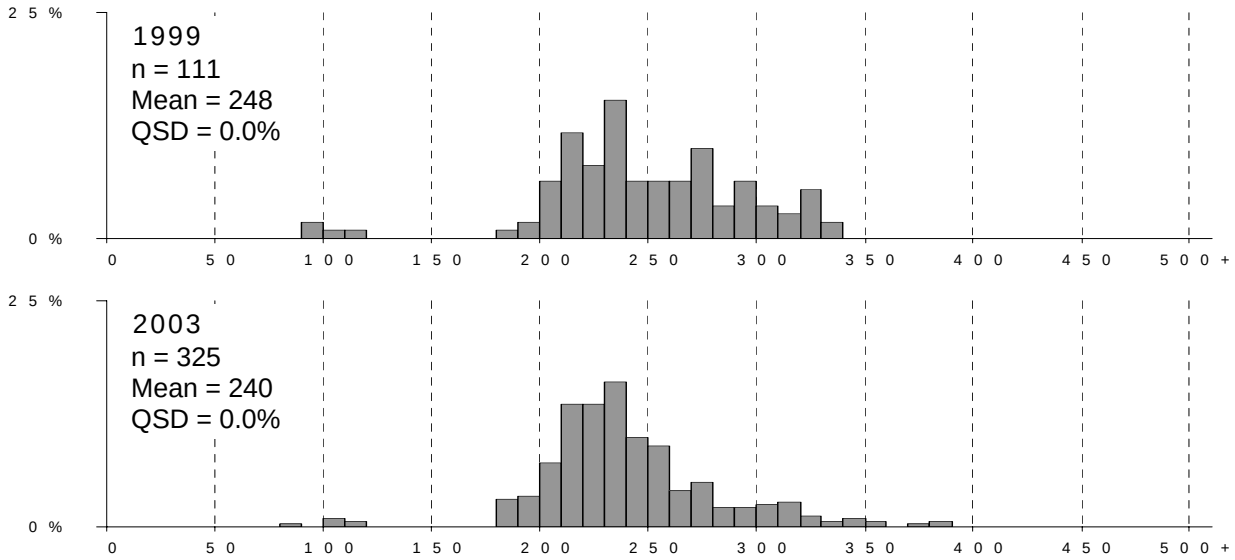
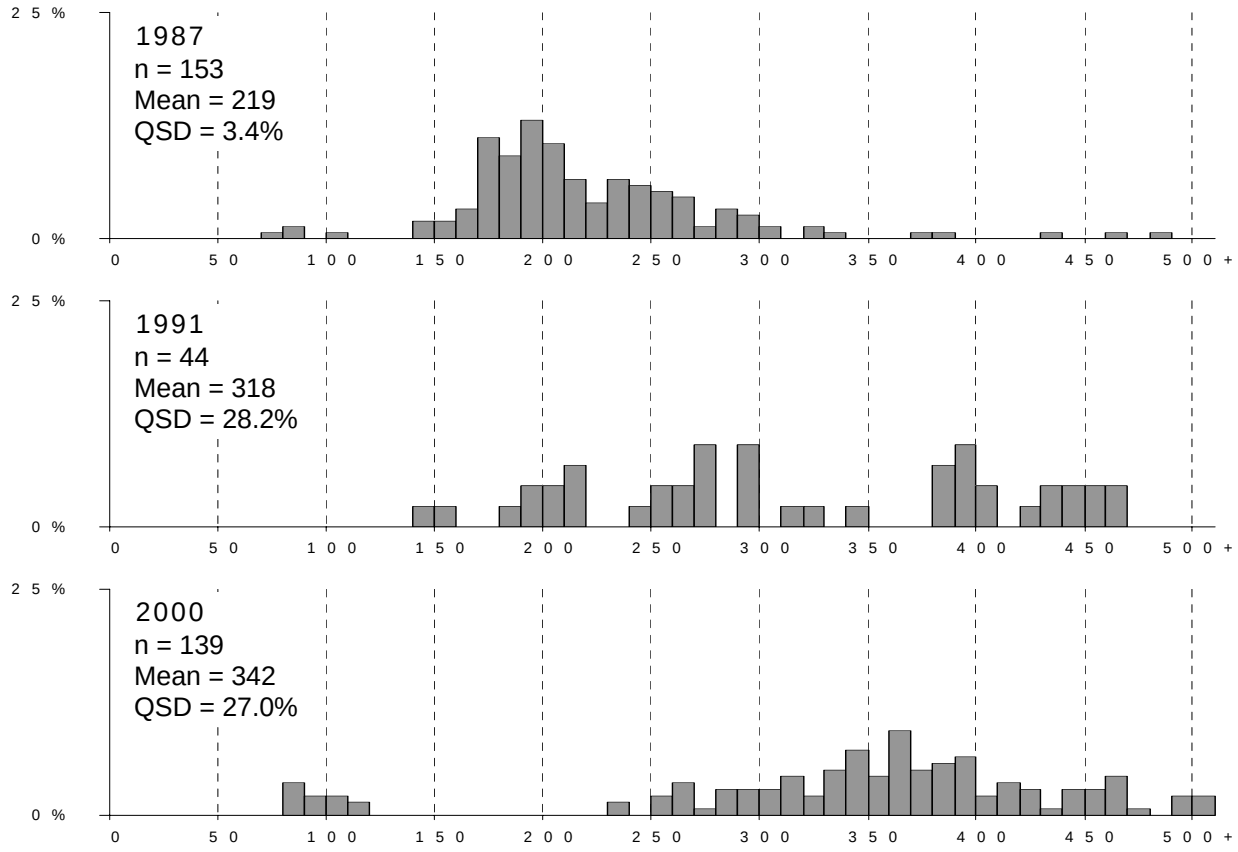


Appendix D-3. Length frequency distributions of brook trout captured in the fall at the Nickerson electrofishing section, Teton River, Idaho, 1987-2003.

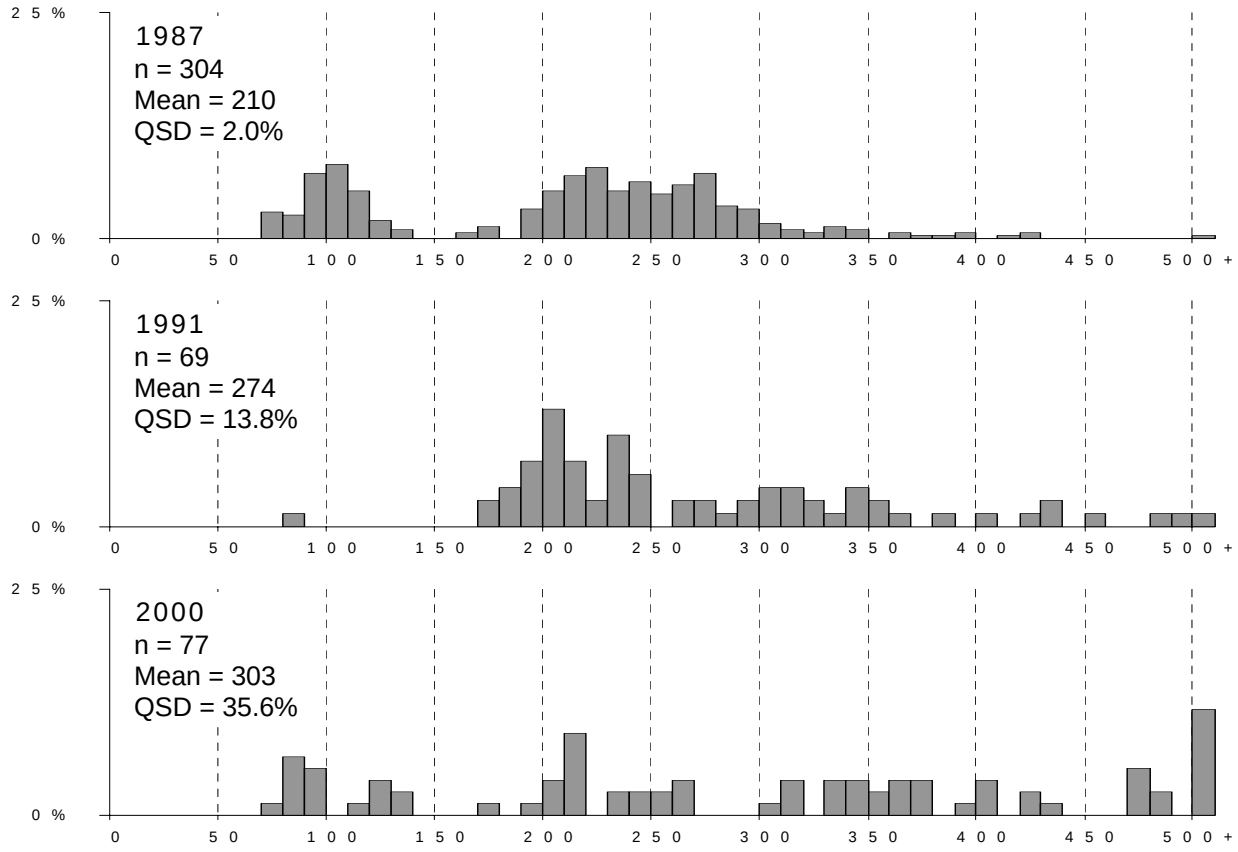


Appendix D-3. Continued.

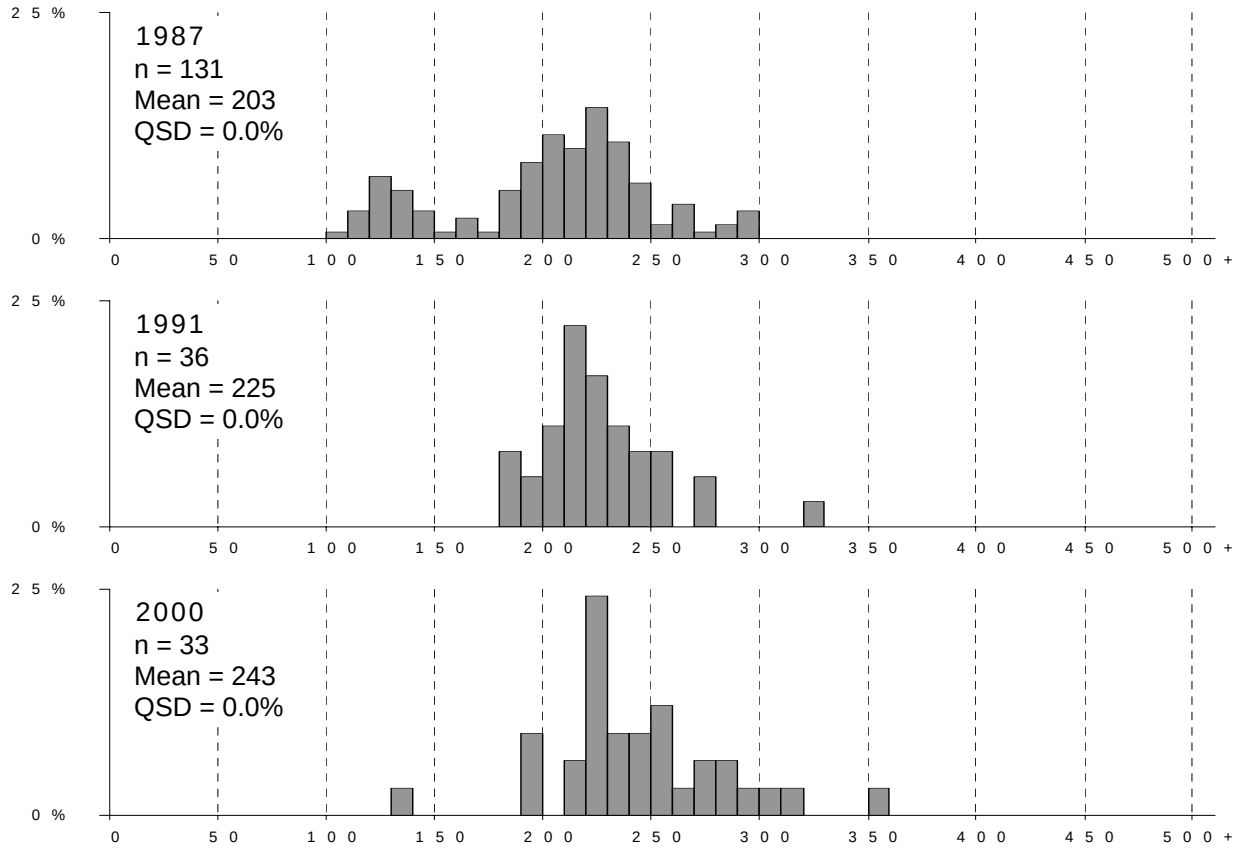
Appendix E. Length frequency distributions of cutthroat, rainbow and brook trout captured in the fall at the Rainier electrofishing section, Teton River, Idaho, 1987-2003. Total individual fish captured during mark and recapture runs = n. Results are from MR5 database for all sizes (TL) of fish.



Appendix E-1. Length frequency distributions of cutthroat trout captured in the fall at the Rainier electrofishing section, Teton River, Idaho, 1987-2003.

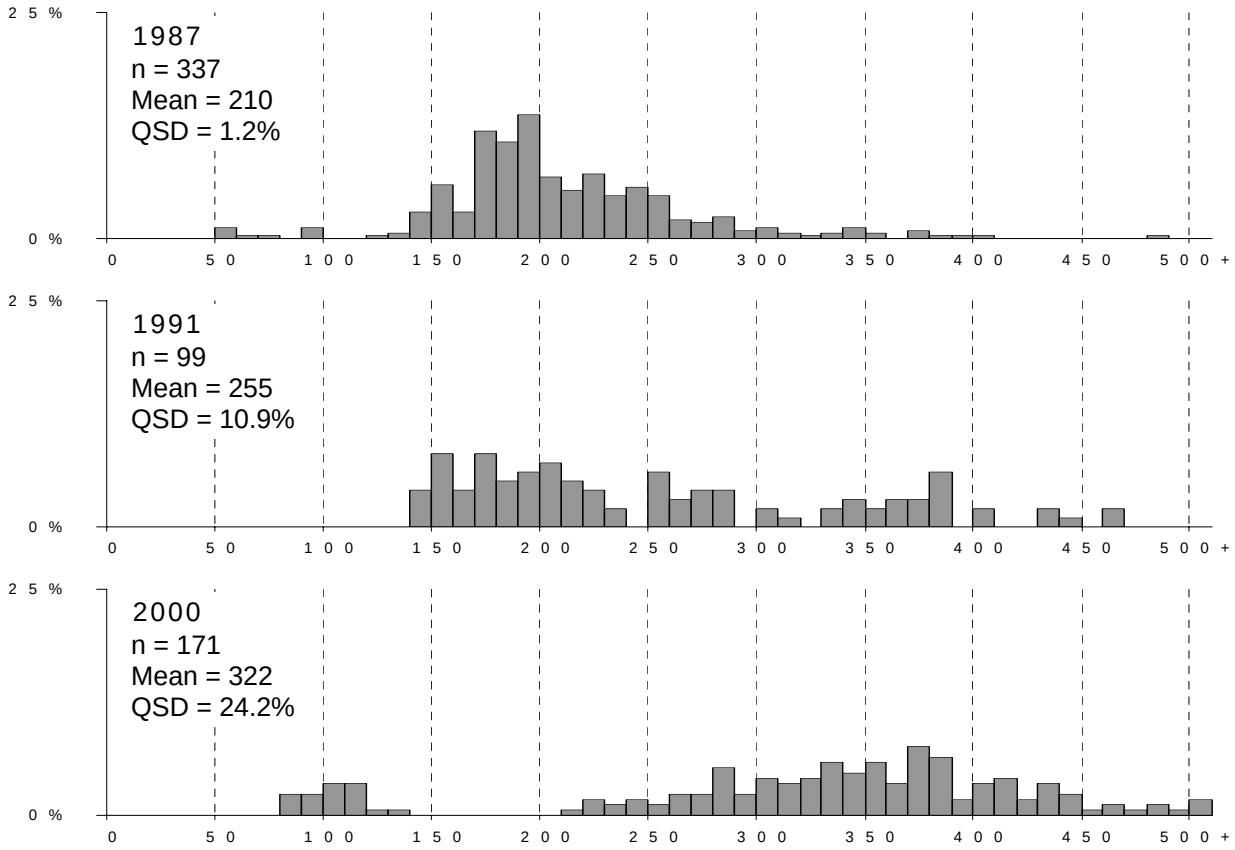


Appendix E-2. Length frequency distributions of rainbow trout captured in the fall at the Rainier electrofishing section, Teton River, Idaho, 1987-2003.

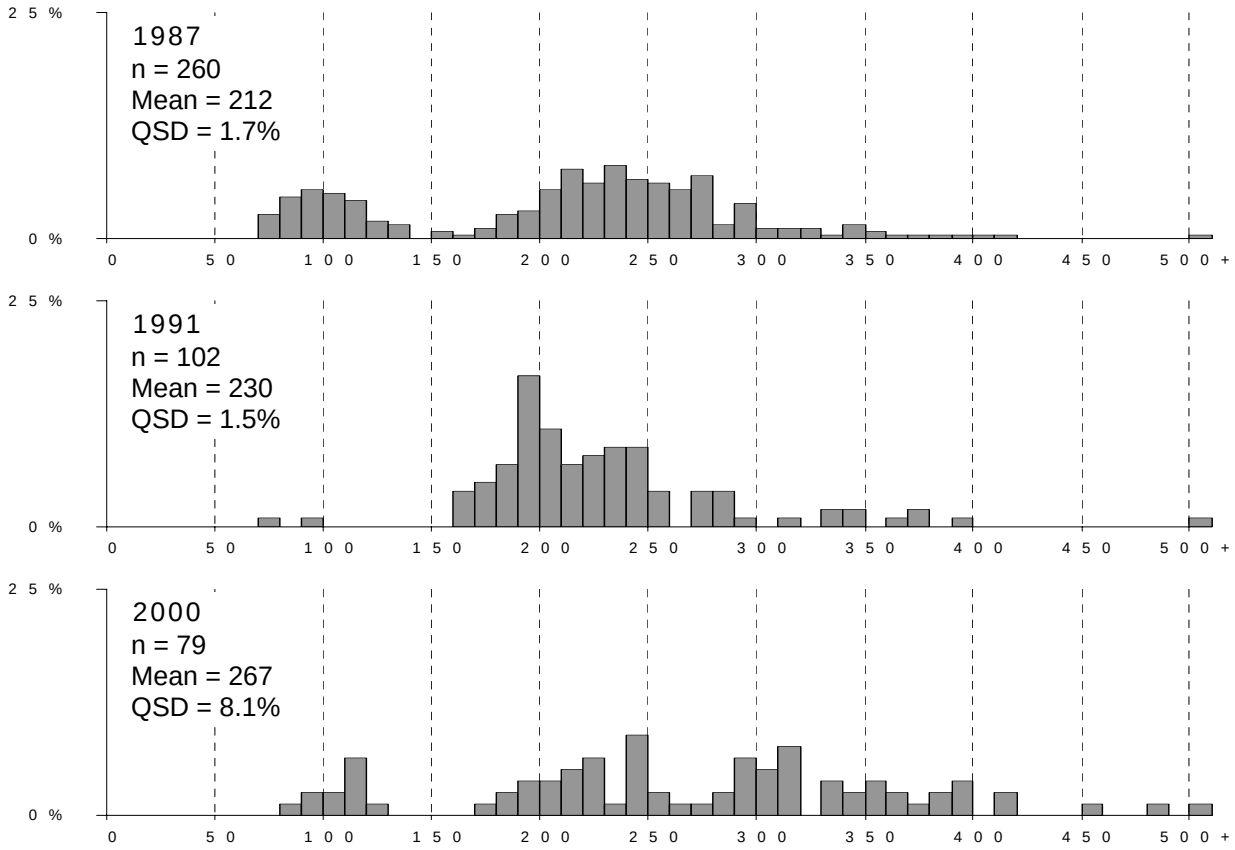


Appendix E-3. Length frequency distributions of brook trout captured in the fall at the Rainier electrofishing section, Teton River, Idaho, 1987-2003.

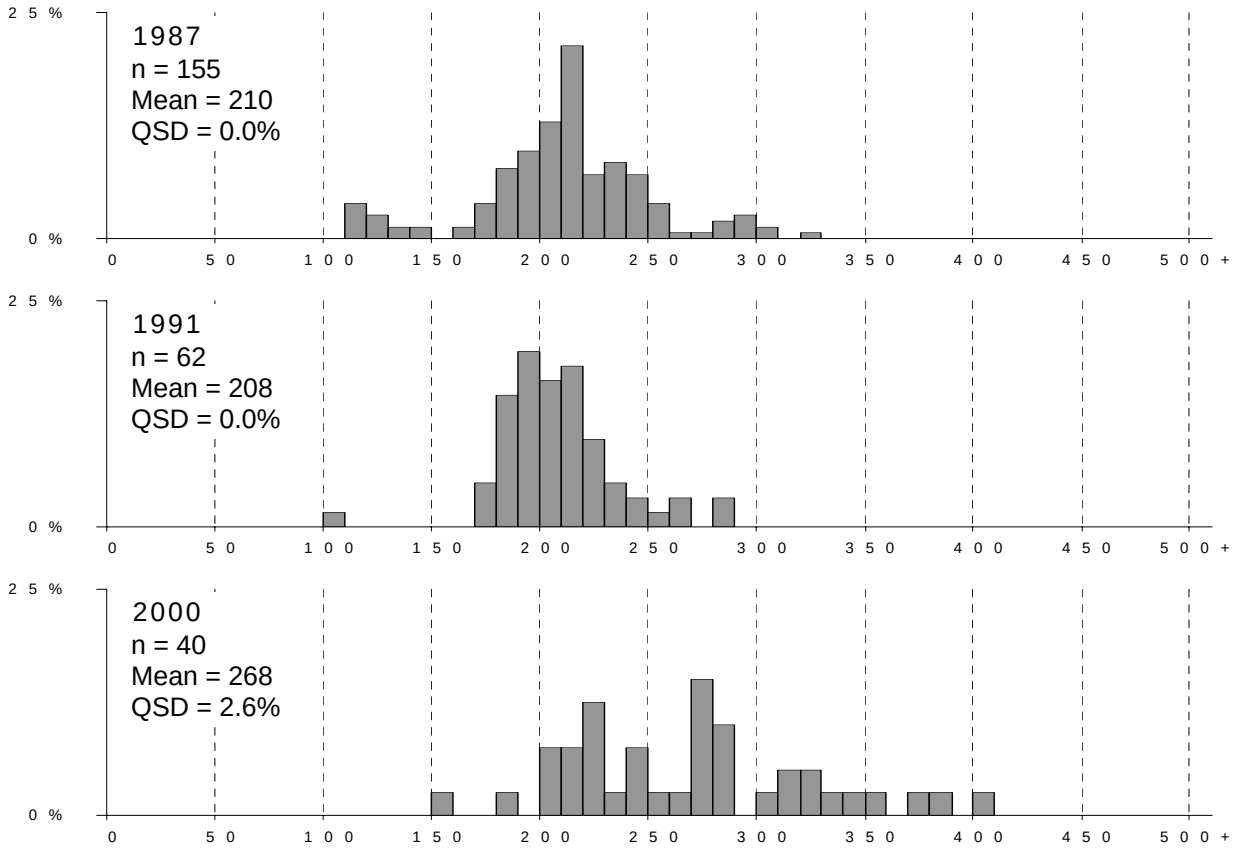
Appendix F. Length frequency distributions of cutthroat, rainbow and brook trout captured in the fall at the Buxton electrofishing section, Teton River, Idaho, 1987-2003. Total individual fish captured during mark and recapture runs = n. Results are from MR5 database for all sizes (TL) of fish.



Appendix F-1. Length frequency distributions of cutthroat trout captured in the fall at the Buxton electrofishing section, Teton River, Idaho, 1987-2003.

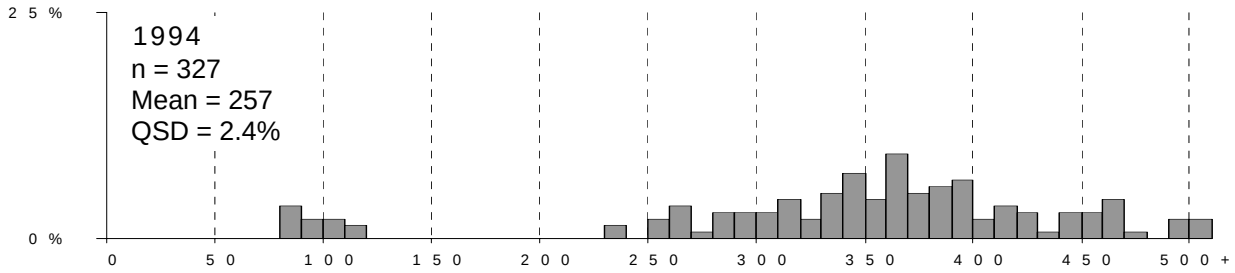


Appendix F-2. Length frequency distributions of rainbow trout captured in the fall at the Buxton electrofishing section, Teton River, Idaho, 1987-2003.

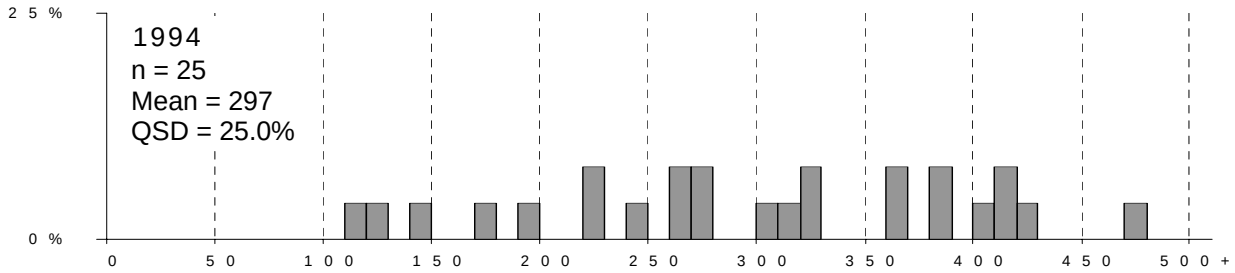


Appendix F-3. Length frequency distributions of brook trout captured in the fall at the Buxton electrofishing section, Teton River, Idaho, 1987-2003.

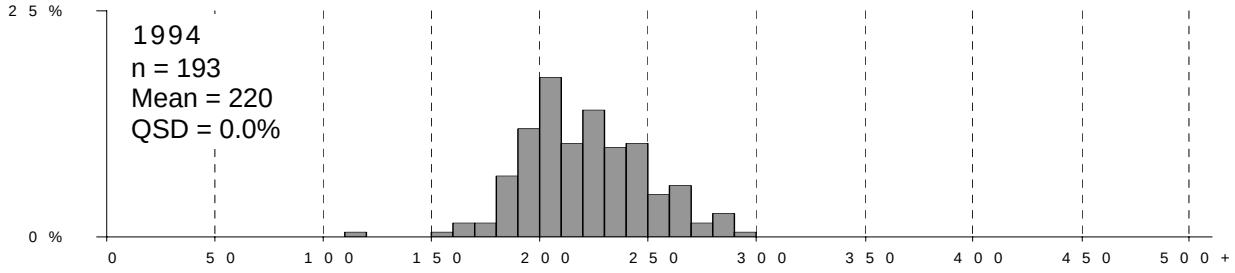
Appendix G. Length frequency distributions of cutthroat, rainbow and brook trout captured in the fall at the White Bridge electrofishing section, Teton River, Idaho, 1987-2003. Total individual fish captured during mark and recapture runs = n. Results are from MR5 database for all sizes (TL) of fish.



Appendix G-1. Length frequency distribution of cutthroat trout captured in the fall at the White Bridge electrofishing section, Teton River, Idaho, 1987-2003.



Appendix G-2. Length frequency distribution of rainbow trout captured in the fall at the White Bridge electrofishing section, Teton River, Idaho, 1987-2003.



Appendix G-3. Length frequency distribution of brook trout captured in the fall at the White Bridge electrofishing section, Teton River, Idaho, 1987-2003.

2003 ANNUAL PERFORMANCE REPORT

State of: Idaho Program: Fisheries Management F-71-R-28

Project: II - Technical Guidance Subproject: II-G Upper Snake Region

ABSTRACT

Upper Snake Region fisheries management personnel provided private individuals, organizations, public schools, and state and federal agencies with technical review and advice on various projects and activities that affect the fishery resources in the Upper Snake and sinks drainages of Idaho. Technical guidance also included numerous angler informational meetings, presentations, and letters, continuation of the Upper Snake Region portion of the 1-800 ASK-FISH program, and fishing clinics. Additionally, because of the low water conditions, Regional fisheries staff provided updates to local new media and the Idaho Fish and Game Department website on drought conditions and the effects on regional fisheries and boat access sites.

Author:

Jim Fredericks
Regional Fishery Manager

OBJECTIVES

1. To provide current fisheries and habitat information, concerns, and recommendations as needed to Department habitat specialists or directly to state, federal, and private parties contemplating projects with the potential to affect fish.

2. To provide technical fish and habitat management advice to public and private landowners and other agencies in order to sustain or enhance fish resources.

RESULTS

Technical guidance was provided to federal, state, county, municipal, and private agencies/entities upon request. Technical guidance was also provided to organized sportsmen's groups, conservation organizations, and private citizens in the form of fish pond development, stocking and management advice, funding requests and project feasibility opinions, and various conservation and educational programs.

Upper Snake Region fishery management staff provided technical assistance and guidance to the following government agencies and private groups:

Friends of the Teton River	Henry's Fork Foundation
Idaho Department of Parks and Recreation	Boy Scouts of America
Idaho Department of Water Resources	Sheridan Creek Restoration Committee
Henry's Fork Watershed Council	U.S. Bureau of Reclamation
Upper Snake River Fly Fishers	Snake River Cutthroats (TU chapter)
Teton Regional Land Trust	U.S. Fish and Wildlife Service
Jackson National Fish Hatchery	U.S. Forest Service
Bonneville County	U.S. Bureau of Land Management
Henry's Lake Foundation	North Fork Reservoir Company
Idaho Department of Environmental Quality	Palisades Creek Canal Company.
Natural Resources Conservation Service	Fall River Rural Electric Cooperative
PacifiCorp	The Nature Conservancy
Idaho Fish and Wildlife Foundation	HFWC Native Trout Subcommittee
Idaho Falls Rotary	Northwest Power Inc.
Flat Rock Club	Trout Unlimited Home Rivers Project

We responded to numerous requests for technical assistance and permit processing by private pond owners. We provided technical assistance to Trout Unlimited and the U.S. Forest Service in an effort to restore a natural stream channel in Garden Creek and increase stream flows by improving irrigation efficiency. We provided information to a group of citizens interested in improving fish passage and stream flows in Rainey Creek, a tributary to the South Fork of the Snake River.

We participated in a series of floats with the Friends of the Teton River and a committee of agency and private individuals to identify and prioritize candidate restoration sites in the Teton River Valley.

We participated in numerous discussions and decision making meetings regarding the timing and volume of flows from Island Park Dam and Palisades Dam in an effort to maximize the benefits of the available water to the fishery resources of the Henrys Fork and South Fork Snake River. Recommendations were to maximize winter flows in the Henrys Fork, but maximize the natural hydrograph shape in the South Fork.

We gave numerous informational presentations to sporting groups and responded to public concerns and questions about cutthroat trout conservation measures implemented in the region. We developed a brochure outlining status and management of the Yellowstone cutthroat trout population in the South Fork of the Snake River designed increase awareness of the threat posed by non-native rainbow trout and encourage anglers to harvest rainbow trout. We conducted kids fishing classes in conjunction with the Idaho Falls Parks and Recreation Department. We conducted Free Fishing Day clinics at 5 sites in the region. We provided information to the IDFG Ask-Fish program and news media regarding area fishing conditions. Additionally, because of the low water conditions, Regional fisheries staff provided updates to local new media and the Idaho Fish and Game Department website on drought conditions and the effects on regional fisheries and boat access sites.

2003 ANNUAL PERFORMANCE REPORT

State of: Idaho Program: Fisheries Management F-71-R-28

Project: III - Habitat Management Subproject: I-G Upper Snake Region

ABSTRACT

Regional personnel assisted with or conducted a range of habitat improvement activities in 2003. Routine maintenance and repair operations were conducted on Henrys Lake riparian fence and irrigation diversion fish screens, as well as riparian fences on Sellars Creek and Teton River tributaries. Irrigation diversion screens and fish ladders on Burns, Palisades, and Rainey creeks were operated and maintained. An inventory of fish migration barriers was conducted in the mainstem Little Lost River.

Author:

Jim Fredericks
Regional Fisheries Manager

OBJECTIVES

1. Work with landowners to improve/restore habitat on degraded streams on private property with good potential to enhance wild trout recruitment.

2. Provide up and downstream fish passage in key wild trout spawning and recruitment streams.

RESULTS

Henrys Lake

Since the early 1980s, the Upper Snake Region fisheries management program has worked with local ranchers and Henrys Lake Foundation to improve Henrys Lake tributary spawning and rearing habitat, provide fish passage around in-stream barriers, and reduce cutthroat trout fry losses to irrigation diversions. These projects include riparian fence to control livestock damage, re-establishment of riparian vegetation communities, and irrigation diversion fish screens. Each project is designed to maintain or increase the significant gains that have been achieved, in the last 17 years, towards restoring and enhancing cutthroat spawning and recruit production for the Henrys Lake fishery.

Electric fencing has been in place at Henrys Lake since the early 1990s. Fencing was stretched and solar panels, batteries, and connections were installed during May 2003 at ten sites on the tributaries of Henrys Lake as established in routine maintenance guidelines. Fencing was checked daily during the summer and fall months for proper voltage and function. Voltage was checked using a voltmeter at each of the ten sites.

Fish diversion screens are located at nine sites on the tributaries of Henrys Lake. Screens were maintained, cleaned and checked for proper operation on a daily basis during the summer and fall months of 2003.

We monitored fish passage through the Targhee Creek culvert under Highway 87. Because of poor passage through the culvert, upstream migrating spawners were seined and electrofished and moved upstream.

South Fork Snake River Tributaries

The Department cooperatively operated, and maintained three irrigation diversion screens on Burns, Rainey, and Palisades creeks, important South Fork Snake River cutthroat spawning tributaries. Fish ladders were also maintained in conjunction with fish weirs and trapping facilities at the diversions.

Willow Creek Tributaries

We conducted routine maintenance on riparian fences on Sellars Creek in 2003. No new fence was constructed.

Teton River

We conducted routine maintenance on riparian fences on several tributaries to the Teton River in the upper river valley. We maintained a fish ladder on a diversion on the lower Teton River.

Little Lost River Barrier Assessment

We conducted an assessment of fish passage barriers throughout the Little Lost River by walking the stream in late summer. Barriers were identified and efforts were initiated to construct fish passage facilities around two irrigation diversions that were functioning as barriers.

2003 ANNUAL PERFORMANCE REPORT

State of: Idaho Program: Fisheries Management F-71-R-28

Project: IV – Lake Restoration Subproject: I-G Upper Snake Region

ABSTRACT

No lakes were restored during the contract period; however we treated two small streams, South Sawtell and North Sawtell, near Henrys Lake with rotenone to remove brook trout *Salvelinus fontinalis* in preparation for reintroduction of native Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri*. Both streams are characterized by very simple channels with almost no tributary or spring flows. Both streams are completely diverted and have no surface flow that reaches the Henrys Lake Outlet. Therefore no detoxification was necessary. Rotenone was applied on August 20, 2003 at a rate of approximately 2 mg/L. In both streams treatment area was from above the uppermost distribution of brook trout, downstream to the end of surface flow. Approximately 2.4 km on South Sawtell and 5.6 km of North Sawtell was treated. Although no count was attempted, several hundred brook trout were killed in each stream, and fish retained in three different sentinel cages were all killed. We believe the treatment was effective, but will retreat in 2004 to ensure a complete removal of brook trout.
Author:

Dan Garren
Regional Fishery Biologist

Jim Fredericks
Regional Fishery Manager

METHODS

Two streams (South Sawtell Creek and North Sawtell Creek) were treated on August 20, 2003 with rotenone to remove brook trout *Salvelinus fontinalis* in preparation for reintroduction of native Yellowstone cutthroat trout *Oncorhynchus clarkii bouvieri*. Both streams are characterized by simple channels with almost no tributary or spring flows. Furthermore, both streams are completely diverted and have no surface flow that reaches the Henrys Lake Outlet. Therefore no detoxification was necessary.

Treatment stations were created using 5-gallon buckets with a 7/64" hole drilled in the bottom. . Liquid rotenone was used at a rate of 2 mg/L. Buckets were mixed with 14 oz liquid rotenone, and filled with water. Once placed on the edge of the creek and allowed to drain, the approximate application time was 45 to 60 minutes per bucket. Buckets were re-filled as the contents leaked out with a pre-measured concoction of diluted rotenone (same concentration as initially added). Flow was calculated in both systems to be approximately 2 cfs, and resulted in an application of 2 ppm rotenone. Drip stations were maintained for two hours at each station.

South Sawtell Creek (approximately 2.4 km) was treated from four drip stations, which started at the stream origin (12 04 68 661E, 49 33 323N). Other drip stations were at the forks approximately 1000 m downstream (12 04 68 968E, 49 33 187N), at the willow meadow approximately 2 km downstream (12 04 70 171E, 49 32 907N), and below the dam at the road crossing (12 04 70 805E, 49 32 651N). Two backpack sprayers were also incorporated in the operation – one working below the road crossing and covering seepage and weedy areas, and one operating upstream of the road crossing and covering the standing water and seepage areas upstream. Flows were approximately 40 liters per second (L/s) at the time of treatment.

North Sawtell Creek (approximately 5.6 km) was treated from five drip stations that started at an upstream fish barrier (12 04 67 001E, 49 34 039N). Other drip stations were located downstream at approximately 1 km intervals (12 04 67 416E, 49 34 025N; 12 04 68 161E, 49 33 765N; 12 04 70 261E, 49 33 977N; 12 04 70 261E, 49 33 437N). We used a backpack spraying operation at some standing water above a dam (approx 12 04 71 027E, 49 33 534N), and one final drip station below the dam (approx 12 04 71 130E, 49 33 571N). Flows were approximately 50 liters per second (L/s) at the time of treatment.

RESULTS AND DISCUSSION

South Sawtell Creek treatment began at approximately 1000 h, and lasted until 1200 h. Three live cages with brook trout were placed in the stream prior to and during the treatment. All cages contained dead trout when retrieved. It is likely that a thorough kill was achieved in this operation. Approximately four liters of liquid rotenone was used in the treatment of South Sawtell Creek.

The North Sawtell Creek treatment began at approximately 1500 h, and lasted until 1730 h. Three live cages with brook trout were placed in the stream prior to treatment. All cages contained dead trout when retrieved at the end of treatment. Approximately six liters of liquid rotenone was used in the treatment of North Sawtell Creek.

An additional treatment for both creeks is planned for August 2004. The intent is to ensure complete eradication brook trout prior to establishing a population of native Yellowstone cutthroat trout. Restocking efforts will incorporate collection of genetically pure trout from nearby drainages such as Rattlesnake Creek or Targhee Creek, and is planned for 2005.

Submitted by:

Dan Garren
Regional Fishery Biologist

William C. Schrader
Senior Fishery Research Biologist

Damon Keen
Assistant Fish Hatchery Manager

Jim Fredericks
Regional Fishery Manager

Approved by:

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Steve Yundt
State Fisheries Manager