FISHERY MANAGEMENT INVESTIGATIONS

FEDERAL AID IN FISH RESTORATION

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Steven M. Huffaker, Director

REGIONAL FISHERIES MANAGEMENT INVESTIGATIONS
UPPER SNAKE REGION (Subproject I-G, II-G, III-G, IV-G)

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 RENOVATION

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2002 ANNUAL PERFORMANCE REPORT

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Job: a Title: Mountain Lakes Investigations

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ABSTRACT

Fourteen mountain lakes were sampled throughout the Upper Snake River region during 2002. Samples were conducted to assess the existing fisheries and evaluate current stocking rates to ensure management goals were being met. Ten of the fourteen lakes sampled meet management objectives of providing catch rates of one fish per hour or better, while the remaining four lakes fall below this objective. Two of the lakes that are meeting objectives do so with no supplemental stockings, while eight require stocking on a three-year rotation. Increases in stockings would likely improve the fisheries in two lakes, while decreases in stockings may be warranted in an additional two lakes.

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INTRODUCTION

Fishing is a popular attraction at many of the mountain lakes in the Upper Snake River Region of Idaho. However, data pertinent to gauging the success and management of these fisheries is extremely limited. Prior to the 2002 sampling season, we met with the Salmon/Challis US Forest Service fisheries biologist and added to the standard methodology used by Idaho Department of Fish and Game (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. Fully collaborate management activities with appropriate state and federal agencies.

OBJECTIVES

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.

METHODS

Sampling methodology incorporates information found in the standard Department mountain lakes data sheets. In addition to this, the timing of surveys was scheduled to correspond to the third year following stocking, and prior to the current years stocking. This should allow the best opportunity to determine if natural reproduction is occurring in these lakes by analyzing length frequencies. If recruitment were strictly dependent on stocking, only one size class of fish would be present. Additionally, visual observations of fish were incorporated due to low catch of gill nets. In some instances, visual observation of fish may yield information that other methods may not be effective at collecting. Catch rate information was also obtained by angling in the given lakes. The Department's five-year management plan states a catch rate goal of one fish per hour for mountain lakes. Currently, there is no reliable way to evaluate this goal with standard mountain lakes surveys. Therefore, the current study utilized biologists, technicians and volunteers to fish the lakes and determine catch rates to assess if goals were being met. Gill nets, where appropriate, were incorporated as well to obtain size classes and fish species that may not have been picked up with other methods. All gill nets were set the first evening of sampling, and pulled the following morning – data is presented as fish per net night. Information on amphibian presence/absence was collected by surveying shoreline areas of the lake and recording all species encountered. During these surveys, aquatic and terrestrial insects encountered were also recorded.

RESULTS

Our samples collected rainbow trout *Oncorhynchus mykiss*, brook trout *Salvelinus fontinalis*, Yellowstone cutthroat trout *O. clarki bouvieri* and Arctic grayling *Thymallus arcticus*. Survey results indicate that management objectives of catching one fish per hour are being met on Grant Creek Lake, Moose Lakes 1 and 2, Round Lake, Long Lake, Divide Creek Lake, Pass Creek Lake, Upper Swauger Lake, Green and Corral Creek Lakes. Catch rate objectives are not being met on Rough Lake, Lake Creek 11 and 13 and the Right Fork of Fall Creek Lake. Natural reproduction was found in Moose Creek Lakes 1 and 2, and to a lesser extent in Long Lake. Amphibian populations were found in Round Lake, Long Lake, Lake Creek 11 and 13 and Pass Creek Lake. Data on specific lakes is presented in Appendix A.

DISCUSSION

Current management goals are being met on the majority of lakes actively managed by the Department. In addition to catch rate goals, the mountain lakes management plan calls for some lakes to remain fishless to provide areas of refuge for amphibians. Three of the 14 lakes sampled are filling this role and have amphibians present. Lakes not actively managed with fish stocking provide additional opportunities for amphibian habitat. These lakes are not currently monitored by the Department, but may be incorporated in future surveys where feasible.

RECOMMENDATIONS

1. Maintain current stocking rates in Long Lake, Divide Creek Lake, Pass Creek Lake, Upper Swauger Lake and Corral Creek Lake.

2. Stop stocking fish in Round Lake and assess the contributions of natural reproduction here. If catch rates decrease significantly, reinstate the stocking program in 2005.

3. Stop stocking Arctic grayling in Green Lake. Several attempts have been made to establish an Arctic grayling fishery here, with very little success. These fish may be more valuable in other areas.

4. Establish supplemental stocking of 500 Arctic grayling in Divide Creek Lake to provide a diverse fishing experience.

5. Increase stocking rates in Rough Lake from 2,500 cutthroat trout to 3,500 cutthroat trout. The easy access and desirable location could provide a quality fishery if catch rates improve.

6. Continue managing Moose Lake 1 and 2 as wild trout fisheries. Current levels of natural reproduction appear to be supporting these fisheries.

7. Maintain Lake Creek Lake 11 and 13 and the Right Fork of Fall Creek Lake as fishless to provide opportunities for amphibians.

APPENDIX A:

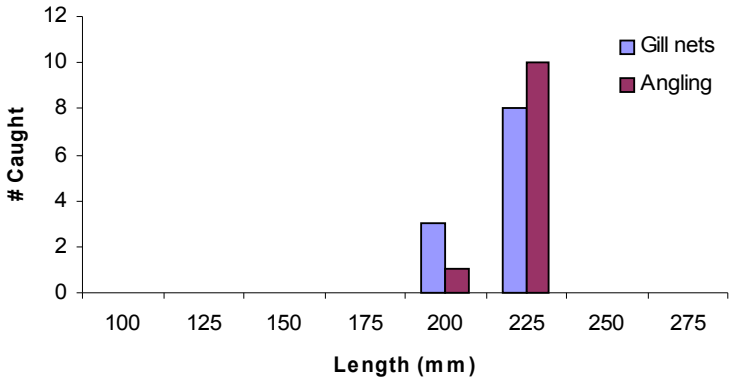
Summaries of mountain lakes surveyed in the Upper Snake Region, Idaho, 2002

Grant Creek Lake
261,436 E 4,871,766 N Z 12

Grant Creek Lake is a perennial lake located in the Big Lost River drainage, near Mackay, Idaho. The lake is small, measuring approximately 250 m in circumference (0.25 ha), with an average depth of one to two meters. Habitat surrounding the lake is mainly open meadow and brush, with approximately 25 m of open area between the lake and coniferous forest. A shoreline trail and one fire ring is evident, suggesting some angling pressure. There were no inlets or outlets at the time of sampling. The presence of cattle has caused significant impact to the lake and surrounding area, primarily by the addition of nutrients and siltation. Access is rough and consists of several miles of two-track four-wheel drive trails, followed by a two km hike to reach the lake.

On August 8, 2002, a survey was conducted to assess the fishery and physical characteristics of the lake. The fishery survey consisted of an overnight gill net set using experimental nets set perpendicular to the shore in combination with angling. Gill nets captured primarily rainbow trout and cutthroat trout. We spent 2.25 hours fishing and caught 11 fish. Visual assessment revealed numerous trout in the 200 mm range but no other size classes. We conducted amphibian surveys along the shoreline, but documented no amphibians.

The results of the work done on Grant Creek Lake indicate that this water body is meeting the fishery objectives of catching one fish per hour (actual catch rate 5 f/h). Although access is very rough, evidence of human use suggests that some anglers use the existing fishery. The relative size of fish encountered in the survey in combination with the existing habitat indicates that natural reproduction is not occurring. Therefore, we recommend stocking continue on a three-year rotation. Department records show this lake to have been stocked with as many as 1,000 fingerling cutthroat trout, although recent stockings have been 500 cutthroat trout. It is possible that this rate may be further reduced to 250 trout without compromising the fishery. It is also likely that some error in the Department stocking record exists, as rainbow trout are not listed as having been stocked in Grant Creek Lake even though they were encountered in the current survey.



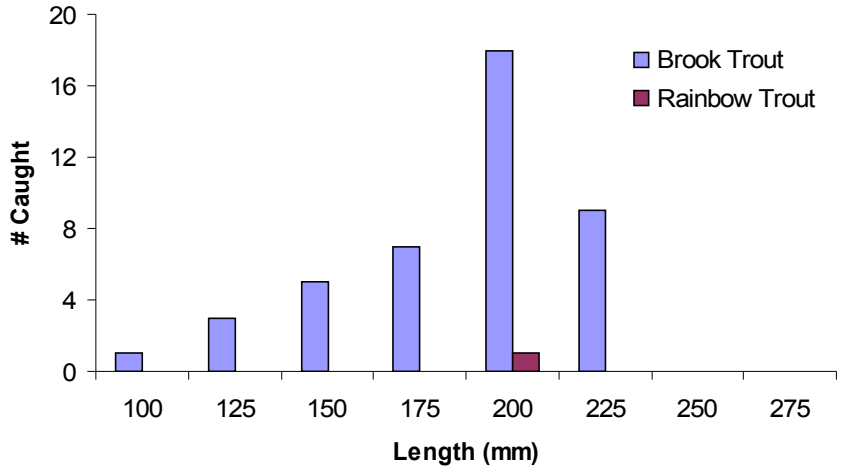
Length frequency for trout captured in Grant Creek Lake, Idaho, during 2002 fisheries surveys.

Moose Lake #2
736, 474 E 4,855, 039 N Z 11

Moose Lake #2 is a perennial lake located in the Big Lost River drainage, near Mackay, Idaho. The lake measures approximately 550 m in circumference (1.5 ha), with an average depth of one to two meters. Shoreline habitat is mainly open meadow and brush. There is no shoreline trail, or evidence of angler use. There are two inlets and one outlet to the lake, which provide approximately 87 m^2 of potential spawning area. Driving up Wildhorse Creek Road to the spur road at Fall Creek accesses the trailhead. A hike of four kilometers is needed to get to Moose Lake # 1, with Moose Lake # 2 a half-kilometer cross-country hike past this.

On August 7, 2002, we conducted a fisheries survey to assess the fishery and physical characteristics of the lake. The fishery survey consisted of visual assessment of fish presence in combination with angling. Gill nets were not set due to the shallow water. We encountered brook trout and rainbow trout (one fish) during the survey. We fished for 2.6 hours and caught 45 fish. Visual assessment of the fishery revealed numerous trout in the 200 mm range. We did shoreline amphibian surveys, but found no amphibians.

The results of the work done on Moose Lake # 2 indicate that this water body is meeting the fishery objectives of catching one fish per hour (actual catch rate 17 f/h). Access is rough and it is likely that few anglers utilize this fishery. The range in size of fish encountered in the survey in combination with the existing habitat indicates that natural reproduction is supporting the fishery. There are no records of fish stocking for this lake. Given the lake's high altitude (2,758 m), limited use and existing fishery, supplemental stockings are unwarranted.



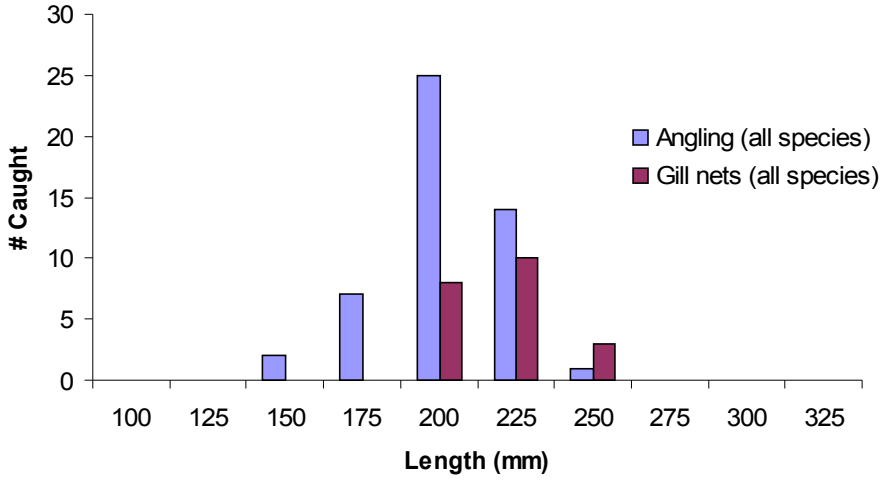
Length Frequency of trout captured angling in Moose Creek #2, Big Lost River Drainage, Idaho.

Moose Creek Lake # 1
736, 365 E 4,855, 451 N Z 11

Moose Lake #1 is a perennial lake located in the Big Lost River drainage, near Mackay, Idaho. The lake measures approximately 725 m in circumference (3 ha), with an average depth greater than two meters. Surrounding habitat consists of coniferous forest, with an access trail around the lake with evidence of use. Presence of litter was nonexistent despite numerous (three or four) camping spots with fire rings. There is one inlet and one outlet, which provide approximately 175 m^2 of potential spawning area. Driving up Wildhorse Creek Road to the spur road at Fall Creek accesses the trailhead. A hike of four kilometers is needed to get to Moose Lake # 1on a well-developed horse trail.

On August 7, 2002, a fisheries survey was conducted to assess the fishery and physical characteristics of the lake. The fishery survey consisted of visual assessment of fish presence in combination with angling and gill nets. Fish species encountered during the survey consisted of brook trout (62 fish) and rainbow trout (ten fish). A total of 3.75 hours were spent fishing resulted in 47 fish being captured. Visual assessment revealed numerous trout ranging in size from 150 mm to 250 mm. Shoreline amphibian surveys were conducted (60 min survey), but documented no amphibians.

The results of the work done on Moose Lake # 1 indicate that this water body is meeting the fishery objectives of catching one fish per hour (actual catch rate of 11 f/h). Access is good and it is likely that anglers utilize the fishery. The size range of fish encountered in the survey in combination with the existing habitat indicates that natural reproduction supports the fishery. The only existing fish stocking records date back to 1968, when 1,200 rainbow trout fry were stocked. Given the productive nature of the fishery, additional supplemental stockings of trout are unwarranted.



Length frequency distribution for trout captured in Moose Lake #1, Big Lost River Drainage, Idaho 2002.

Right Fork Fall Creek Lake
736, 672 E 4, 855, 945 N Z 11

Fall Creek Lake is a perennial lake located in the Big Lost River drainage near Mackay, Idaho. The lake measures approximately 400 m in circumference (1 ha), with an average depth less than one meter. Surrounding habitat consists of sub-alpine fir and conifer forest. There is no shoreline trail, and no evidence of human use of the area. There is no inlet and one outlet , which provide extremely limited spawning area for trout. Lake substrate was primarily silt and mud. Driving up Wildhorse Creek Road to the spur road at Fall Creek accesses the trailhead. A hike of three kilometers is needed to get to the outlet downstream of Fall Creek Lake where you depart from the main trail. A cross-country hike of less than a half-kilometer brings you to the lake.

On August 7, 2002, a survey was conducted to assess the fishery and physical characteristics of the lake. The fishery survey consisted of visual observations for fish presence. The shallow nature of the lake and clear water allowed visual assessment of all areas and revealed no fish. Gill nets were not set due to the shallow water. We conducted shoreline amphibian surveys (18 min survey), but documented no amphibians.

The results of the work done on the Right Fork Fall Creek Lake indicate that this water body does not meet objectives for providing a fishery. Access is rough and it is likely that people rarely fish here. No stocking records exist. Current management plans require that some lakes within each drainage remain fishless and receive no supplemental stockings of trout. Fall Creek Lake should be maintained to provide a fishless area within the upper Wildhorse Drainage.

Rough Lake
270, 972 E 4, 844, 622 N Z 12

Rough Lake is a perennial lake located in the Big Lost River drainage near Mackay, Idaho. The lake measures approximately 1 km in circumference (3.6 ha), with an average depth greater than two meters. Surrounding habitat is mainly coniferous forest. A partial trail around the shoreline exists and a couple of fire rings are evident, suggesting some angling pressure. There is one inlet and one outlet that provide minimal spawning habitat. Access is moderate and consists of almost 11 km of trail, which can accommodate hiking, horseback riding, four-wheeler or motorcycle traffic. The trailhead is accessed off of the Copper Basin Loop road, at the intersection of Lake Creek and the road.

On July 18, 2002, a fisheries survey was conducted to assess the fishery and physical characteristics of the lake. The fishery survey consisted of five anglers fishing for a total of 6.25 hours and resulted in three cutthroat trout being captured. We conducted shoreline amphibian surveys, but documented no amphibians.

The results of the work done on Rough Lake indicate that this water body is not meeting the fishery objectives of catching one fish per hour (actual catch rate 0.5 f/h). Access is relatively easy via motored vehicle or horseback. Evidence of human use suggests that anglers use the lake and existing fishery extensively. The relative size of fish encountered in the survey (200 – 225 mm) indicates that natural reproduction may not be occurring. Given the easy access and evidence of human use, it is recommended that stocking continue on a three-year rotation. Department records show this lake to have been stocked with an average of about 2,500 fingerling cutthroat trout (695/ha). The potential for heavy exploitation in this easily accessed lake requires a heavy load of stocked fish to provide a desirable fishery. It is recommended that current levels of stocking continue and an increase in the stocking rate be considered if future surveys show continued low catch of fish.

Round Lake
272, 279 E 4, 845, 138 N Z 12

Round Lake is located in the Big Lost River drainage, in the Copper Basin of Idaho. The lake measures approximately 625 m in circumference (2.4 ha), with an average depth of about two meters. There is a shoreline trail, and evidence of human use. Presence of litter was low despite a well-used camping area nearby. There is one inlet and one outlet, which provide approximately 20 m^2 of potential spawning area. Access consists of almost 9 km of trail that can accommodate hiking, horseback riding, four-wheeler or motorcycle traffic. The trailhead is accessed off of the Copper Basin Loop road, at the intersection of Lake Creek and the road.

On July 18, 2002, we conducted a survey to assess the fishery and physical characteristics of the lake. The fishery survey consisted of visual assessment of fish presence in combination with angling and gill nets. Arctic grayling (13 fish) were the only fish species encountered. We spent two hours fishing and caught five fish. Visual assessment of the fishery revealed numerous small Arctic grayling feeding along the lake surface and in the outlet. Stocking has not occurred here since 2001. The presence of these small fish indicates natural reproduction. We conducted Amphibian surveys along the shoreline of the lake (60 min survey) and documented the presence of Columbia spotted frogs.

The results of the work done on Round Lake indicate that this water body is meeting the fishery objectives of catching one fish per hour (actual catch rate of 3 f/h). Access is good and it is likely that anglers use this fishery heavily. The range in size of fish encountered in the survey in combination with the existing habitat found here indicates that natural reproduction is occurring and may be supporting the fishery. Fish stocking records for the lake date back to 1968, when rainbow trout fry were stocked. Cutthroat trout were stocked until the early 1990s, when Arctic grayling were planted. Currently, 625 f/ha are stocked in the lake. However, significant natural reproduction is occurring in the lake. It is possible that stocking could be stopped and this natural reproduction assessed in another three years. If the fishery declines significantly during this time, stocking should be reinstated.

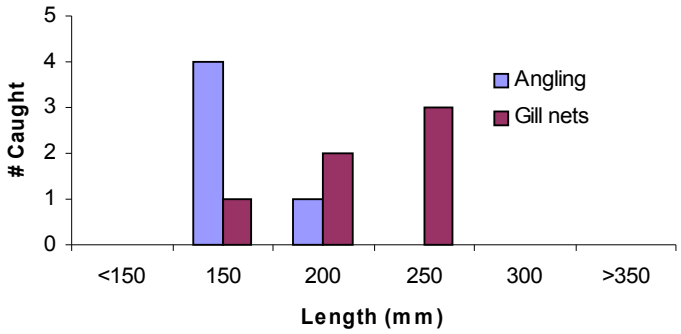


Figure 1. Length frequency for Arctic grayling captured in Round Lake, Idaho, during 2002 sampling.

Long Lake
271, 664 E 4, 844, 684 N Z 12

Long Lake is a perennial lake located in the Big Lost River drainage of Idaho. The lake is one of the largest lakes surveyed during 2002 and measures approximately 1.9 km in circumference (5.2 ha), with an average depth greater than two meters. Surrounding habitat consists of mixed coniferous forest. There is a shoreline trail, with evidence of human use. Presence of litter was low despite several well-used camping areas nearby. There are two inlets and one outlet, which provide approximately 50 m^2 of potential spawning area. Access is moderate and consists of almost 10 km of trail that can accommodate hiking, horseback riding, four-wheeler or motorcycle traffic. The trailhead is accessed off of the Copper Basin Loop road, at the intersection of Lake Creek and the road.

On July 17, 2002, we conducted a survey to assess the fishery and physical characteristics of the lake. The fishery survey consisted of visual assessment of fish presence in combination with gill nets. We did not fish this lake due to time constraints. The only fish species encountered during the survey were rainbow trout. Gill nets captured nine fish. Visual assessment of the fishery found few fish, although some trout were seen rising in the evening. Stocking has not occurred since 2001, when approximately 3,000 rainbow trout were planted. Of these fish, 300 were triploid rainbow trout. The presence of one small trout captured in the survey indicates natural reproduction is occurring to a limited extent. We conducted shoreline amphibian surveys along the shoreline of the lake and documented the presence of several adult Columbia spotted frogs.

The results of the work done on Long Lake indicate that this water body is likely meeting the fishery objectives of catching one fish per hour. Access to the lake is good and anglers are probably using this fishery extensively. Fish size ranges combined with the existing habitat indicates that natural reproduction occurs, but not at levels sufficient to support this popular fishery. Fish stocking records date back to 1968, when rainbow trout fry were stocked. Cutthroat trout were stocked until the early 1990s, when rainbow trout were reinstated. Currently, 575 f/ha are stocked. The large size of trout encountered in Long Lake, combined with the easy access and evidence of heavy use, likely draw significant numbers of anglers to the area. It is highly recommended to continue the stocking program here and evaluate this lake periodically.

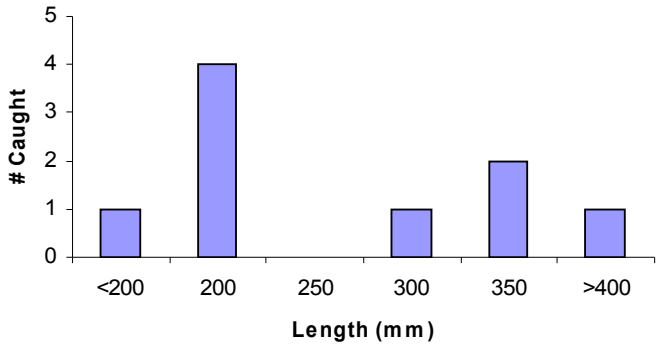


Figure 1. Length frequency distribution of cutthroat trout captured in gill nets in Long Lake, Idaho, 2002.

Lake Creek Lake # 11
271, 559 E 4, 842, 716 N Z 12

Lake Creek Lake #11 is a perennial lake located in the Big Lost River drainage, near Mackay, Idaho. The lake measures approximately 480 m in circumference (1.6 ha), with an average depth of one to two meters. Surrounding habitat is open rocky moraine. There is no access trail and no evidence of human use here. There is no inlet and one outlet, which provide extremely limited spawning area for trout (approximately 20 m^2). Access is moderate and consists of almost 11 km of trail that can accommodate hiking, horseback riding, and four-wheeler or motorcycle traffic and ends at Rough Lake. From Rough Lake, begin cross-country travel up the drainage for just over 1 km to a fork in the creek. Follow the left (eastern) fork for an additional 0.75 km to a narrow lake. Lake Creek Lake #11 is 0.25 km past here and is the uppermost water body in the drainage. The trailhead is accessed off of the Copper Basin Loop road, at the intersection of Lake Creek and the road.

On July 17, 2002, a survey was conducted to assess the fishery and physical characteristics of Lake Creek Lake #11. The fishery survey consisted of visual observations for fish presence as well as the use of angling and a short (two hour) gill net set. All methods used showed the same results as found in a 2001 survey – no fish were observed or captured. Amphibian surveys conducted in 2001 along the shoreline of the lake documented abundant frog populations. During the 2002 survey, we also found adult frogs. Although these frogs were not identified, it is assumed they are Columbia spotted frogs. In addition to frogs, freshwater shrimp, water boatmen and caddis fly larvae were observed, along with terrestrial insects like ants.

The results of the work done on Lake Creek Lake #11 indicate that this water body does not meet objective of providing a fishery. Access is difficult and it is likely that people rarely visit this lake. Stocking records show that rainbow trout were stocked in 1995 and 1998. It appears that abiotic factors such as over-winter habitat may be limiting populations here, since no fish were captured in either 2001 or 2002 surveys. Current management plans require that some lakes within each drainage remain fishless and receive no supplemental stockings of trout. Lake Creek Lake #11 provides a forage base that should support amphibians and should be maintained to provide a fishless area within the upper Lake Creek Drainage.

Divide Creek Lake
355, 162 E 4, 918, 014 N Z 12

Divide Creek Lake is located in the Medicine Lodge drainage of Idaho. The lake measures approximately 475 m in circumference (1.5 ha), with an average depth greater than two meters. Surrounding habitat consists of mixed coniferous forest. There is an access trail around the lake, with evidence of human use. Presence of litter was low despite several well-used camping areas nearby. There is no inlet and one outlet, but no spawning habitat is associated with this outlet. Access is moderate and consists of almost 8 km of trail that can accommodate hiking, horseback riding or motorcycle traffic. The trailhead is accessed off of the Bannock Pass road, at the northwestern end of the Medicine Lodge drainage.

On July 9, 2002, we conducted a survey to assess the fishery and physical characteristics of Divide Creek Lake. The fishery survey consisted of visual assessment of fish presence in combination with angling and gill nets. The only fish species encountered were cutthroat trout. We spent 1.5 hours fishing, and caught two fish. Gill nets were also used and captured an additional four fish. Visual assessment showed a few large trout cruising the shoreline. Stocking has not occurred here since 1999, when approximately 1,000 cutthroat trout fingerling were stocked. The absence of small trout captured in the survey indicates no natural reproduction. No amphibians were found. Abundant scuds were encountered, as were terrestrial insects such as horseflies, moths and bees.

Our results indicate that Divide Creek Lake is meeting the fishery objectives of one fish per hour (actual catch rate of 1.3 f/h). The range in size of fish encountered in the survey in combination with the existing habitat indicates that natural reproduction does not occur. Fish stocking records for the lake date back to 1970, when cutthroat trout fry were stocked. One experimental stocking of Arctic grayling was conducted in 1970. Currently, 650 cutthroat trout per ha are stocked in the lake. The large size of trout encountered in Divide Creek Lake, combined with the moderate access and stunning scenery likely draw numerous anglers to the area annually. It is highly recommended to continue the stocking program here, and evaluate this lake periodically.

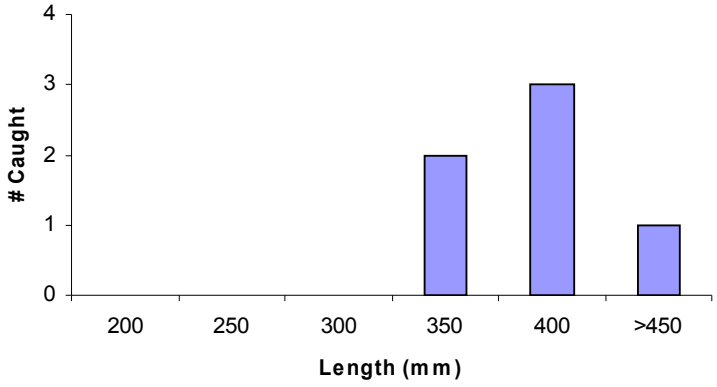


Figure 1. Length frequency distribution of cutthroat trout captured in gill nets in Divide Creek Lake, Idaho, 2002.

Pass Creek Lake
338, 482 E 4, 882, 135 N Z 12

Pass Creek Lake is a perennial lake located in the Birch Creek drainage of Idaho. The lake measures approximately 565 m in circumference (1.8 ha), with an average depth between one and two meters. Surrounding habitat consists of open sagebrush hillsides interspersed occasionally by coniferous forest. There is a partial access trail around the shoreline, with evidence of human use concentrated to a couple of areas near the access trail. Presence of litter was low despite heavily used trails into the area. There are two inlets and one outlet; however, no spawning habitat is associated with these areas. Access is easy and consists of almost 8 km of trail that can accommodate hiking, horseback riding or motorized off road vehicle traffic. The trailhead is accessed off of the Eight-mile Canyon road, at the southeastern end of the Birch Creek drainage.

On July 30, 2002, we conducted a survey to assess the fishery and physical characteristics of the lake. The fishery survey consisted of visual assessment of fish presence in combination with angling and gill nets. The only fish species encountered during the survey were cutthroat trout. We spent 7 hours fishing the lake and caught 17 fish. Gill nets were also used and captured an additional two fish. Two anglers were interviewed at the completion of their six-hour trip and had captured 24 trout. Visual assessment of the fishery showed many fish rising on insects. Stocking has not occurred here since 1999, when approximately 1,000 cutthroat trout fry were planted. The absence of small trout captured in the survey indicates natural reproduction does not occur. The substrate is mainly composed of silt, with abundant submerged vegetation and emergent vegetation dominating the shoreline. Amphibian surveys were conducted along the shoreline of the lake and yielded one sighting of an unidentified frog. Aquatic insects observed included dragonfly nymphs, while terrestrial insects such as grasshoppers, flies and dragonflies were all observed.

Pass Creek Lake is exceeding the fishery objectives of one fish per hour (actual catch rate of 2.5 f/h). The range in size of fish encountered in combination with habitat indicates that natural reproduction does not occur. Fish stocking records date back to 1972, when cutthroat trout fry were stocked. Currently, 555 cutthroat trout per ha are stocked. The relatively good fishing combined with the scenery and easy access likely draw numerous anglers. It is highly recommended to continue the stocking program and evaluate this lake periodically.

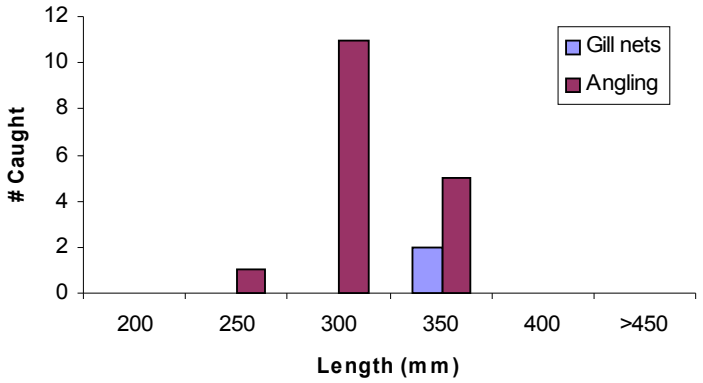


Figure 1. Length frequency distribution for trout captured in Pass Creek Lake, Idaho, 2002.

Upper Swauger Lake
293, 297 E 4, 883, 976 N Z 12

Upper Swauger Lake is a perennial lake located in the Little Lost River drainage, near Hawley Mountain, Idaho. The lake is fairly small, measuring approximately 400 m in circumference (0.8 ha), with an average depth of greater than two meters. Surrounding habitat is mainly open meadow and brush interspersed with small patches of sub-alpine fir forest and scree fields. A partial shoreline trail and one fire ring are present, suggesting this lake does sustain some angling pressure. There was one inlet and one outlet at the time of sampling, although spawning habitat was nonexistent due to heavy siltation. Sheep grazing is seasonally prolific in the immediate vicinity of the lake and has the potential to cause impacts through the addition of excess nutrients and riparian damage from grazing. Access is off of Pass Creek Road from the Little Lost Valley. Turn onto the Dry Creek Road, to the fork of Dry Creek and Long Lost Creek. Follow the Long Lost Creek road for approximately 7 km to the trailhead. A moderate hike of 2.5 km brings you to the lake.

On August 12, 2002, a survey was conducted to assess the fishery and physical characteristics of the 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. Only cutthroat trout were encountered in the survey. We fished for 11 hours and caught 29 fish. Visual assessment of the fishery revealed numerous trout in the 300 to 350 mm range but no other size classes. Shoreline amphibian surveys documented no amphibians.

Upper Swauger Lake is exceeding the fishery objectives of catching one fish per hour (actual catch rate 2.6 f/h). Although road access to the lake is very rough, the hike into the lake is moderate. Evidence of human use suggests some anglers use the existing fishery. The relative size of fish encountered in the survey in combination with the habitat found here indicates that natural reproduction does not occur. Therefore, we recommend that stocking continue on a three-year rotation. Department records show this lake to have been stocked with as many as 5,000 fingerling cutthroat trout (1982), although recent stockings have been a more modest 3,000 cutthroat trout. Creel surveys conducted in 1994 show catch rates by anglers to be 0.6 fish per hour at stocking rates of approximately 1,500 fish per year. This falls below management objectives of catch rates of one fish per hour and precipitated an increase in stocking to the current 3,000 fish. It is recommended that this rate be continued to maintain high catch rates in Upper Swauger Lake.

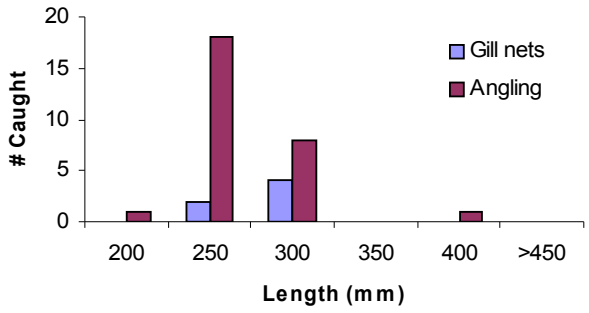


Figure 1. Length frequency distribution for fish captured in Upper Swauger Lake, Idaho, 2002.

Green Lake
269, 579 E 4, 842, 973 E Z 12

Green Lake is a perennial lake located in the Big Lost River drainage, east of Darlington, Idaho. The lake is fairly small, measuring approximately 550 m in circumference (1.8 ha), with an average depth of greater than two meters. Surrounding habitat is mainly open scree fields interspersed with small patches of coniferous forest and sagebrush. A partial shoreline trail exists, suggesting this lake does sustain some angling pressure. There were no inlets at the time of sampling but one outlet exists. Spawning is limited to approximately 30 m^2 of marginal habitat. Access is off the Copper Basin Loop road. Turn onto the Muldoon Canyon Road and follow this for five km. Take the rough 4-wheel drive trail on the left for 3.6 km to an old mine. A moderate uphill hike of less than one km brings you to the lake.

On July 18, 2002, a survey was conducted to assess the fishery and physical characteristics of the 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 only captured one fish, an Arctic grayling. A total of 16 hours were spent fishing, and resulted in 20 fish being caught. Visual assessment of the fishery revealed numerous trout in the 100 to 200 mm range, with a few fish >300 mm observed. Our shoreline amphibian surveys documented no amphibians.

The results of the work done on Green Lake indicate that this water body is meeting the fishery objectives of catching one fish per hour (actual catch rate 1.3 f/h). Although road access to the lake is very rough, the hike into the lake is moderate. Evidence of human use in the area suggests that some anglers use the existing fishery. The relative size of fish encountered in combination with the existing habitat indicates that cutthroat trout are reproducing. A creel census conducted in 1994 showed this lake to be rated by anglers as less than satisfactory in regards to the fishing experience. Given these facts, we recommend stocking continue at present levels for one more cycle. If catch rates drop below management goals, stocking rates should be increased from the current 1,000 cutthroat trout and 1,000 Arctic grayling to 2,000 cutthroat trout. One additional stocking of Arctic grayling should be conducted and evaluated. If these fish do not turn up in future samples, they should be discontinued.

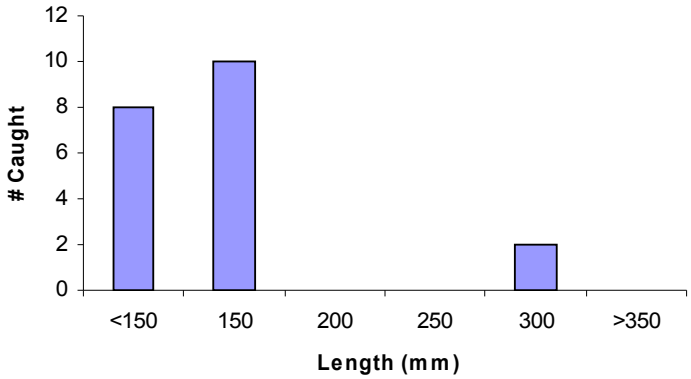


Figure 1. Cutthroat trout captured by angling in Green Lake, Idaho, 2002.

Corral Creek Lake
278, 065 E 4, 859, 023 N Z 12

Corral Creek Lake is a perennial lake located in the Big Lost River drainage, southeast of Mackay Reservoir, Idaho. The lake measures approximately 650 m in circumference (1.8 ha), with an average depth of greater than two meters at normal pool. However, during the 2002 survey, lake levels had receded, leaving 400 m of shoreline and approximately one ha surface area. Surrounding habitat is mainly rock scree fields with small amounts of brush and small patches of conifer forest. A partial shoreline trail exists and one fire ring is evident, suggesting this lake sustains some angling pressure. There were no inlets or outlets at the time of sampling. Access is off of Alder Creek Road (FR 144) in the Stewart Canyon/Shelly Mountain area. An off-road vehicle trail leads over the divide into the Corral Creek Drainage, where a moderate hike of 1.5 km brings you to the lake.

On August 22, 2002, we conducted a survey to assess the fishery and physical characteristics of the 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. We only encountered cutthroat trout in the survey. We spent nine hours fishing, and caught 26 fish. Visual assessment of the fishery revealed numerous trout in the 300 to 350 mm range but no other size classes. Our shoreline amphibian surveys documented no amphibians.

The results of the work done on Corral Creek Lake indicate that this water body is exceeding the fishery objectives of catching one fish per hour (actual catch rate 2.9 f/h). Good access to the lake is provided via horse or off-road vehicle trails. Evidence of human use in the area suggests anglers use the lake and existing fishery. The relative size of fish encountered in the survey combined with the existing habitat indicates that natural reproduction does not occur. Therefore, we recommend stocking continue on a three-year rotation. Department records show this lake to have been stocked with as many as 2,000 fingerling cutthroat trout (1990), although recent stockings have been a more modest 500 cutthroat trout. We recommend this stocking rate continue for the next several years or until water levels within the lake increase to full pool. This should be an adequate level of stocking to provide a quality experience for anglers willing to travel to the area to fish.

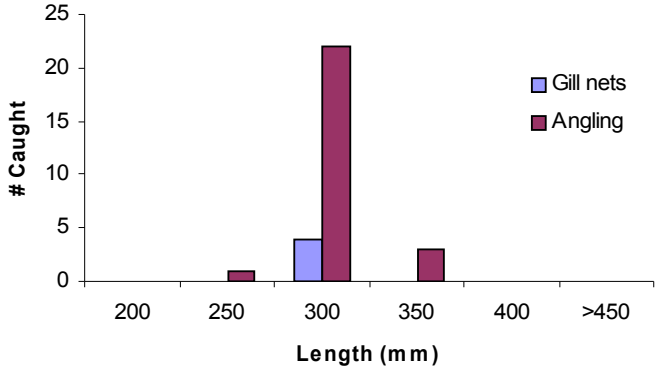


Figure 1. Length frequency for cutthroat trout captured in Corral Creek Lake, Idaho, 2002.

Lake Creek Lake # 13
271, 468 E 4, 842, 964 N Z 12

Lake Creek Lake #13 is a perennial lake located in the Big Lost River drainage, near Mackay, Idaho. The lake measures approximately 450 m in circumference (0.8 ha), with an average depth of one to two meters. Surrounding habitat consists of open rocky moraine. There is no access trail, and no evidence of human use here. There is one inlet and one outlet, which provide limited spawning area for trout (approximately 35 m^2). Access is moderate and consists of almost 11 km of trail that can accommodate hiking, horseback riding, and four-wheeler or motorcycle traffic and ends up at Rough Lake. From Rough Lake, begin cross-country travel up the drainage for just over 1 km to a fork in the creek. Follow the left (eastern) fork for an additional 0.75 km to the narrow lake. The trailhead is accessed off of the Copper Basin Loop road, at the intersection of Lake Creek and the road.

On July 17, 2002, we conducted a survey to assess the fishery and physical characteristics of Lake Creek Lake #13. The fishery survey consisted of visual observations for fish presence as well as the use of a short (two-hour) gill net set. No fish were captured in the gill net, although a school of small fish was observed near the outlet. Amphibian surveys found one frog. Although this frog was not identified, it is assumed to be a Columbia spotted frog. Freshwater shrimp, water boatmen and caddis fly larvae were observed, along with terrestrial insects (ants).

The results of the work done on Lake Creek Lake #13 indicate that this water body does not meet objectives for providing a fishery. Access is difficult and it is likely that people rarely visit this lake. Stocking records show that Arctic grayling were stocked in 1995 and 1998. It appears that abiotic factors such as limited over-winter habitat may hold fish populations to extremely low levels since no adult fish were encountered in this survey. Current management plans require that some lakes within each drainage remain fishless and receive no supplemental stockings of trout. Lake Creek Lake #13 provides a forage base that should support amphibians. We recommend no stocking here to allow amphibians the opportunity for refuge in a lake of low-density fish populations.

2002 ANNUAL PERFORMANCE REPORT

State of: Idaho Program: Fisheries Management F-71-R-27

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

Job No: b Title: Lowland Lake Investigations

Contract Period: July 1, 2002 to June 30, 2003

ABSTRACT

Eighteen experimental gill nets (nine sinking, nine floating) were used to assess fish populations and relative abundance in Henrys Lake during May 2002. We captured brook trout *Salvelinus fontinalis*, Yellowstone cutthroat trout *Oncorhynchus clarkii*, hybrid rainbow trout *O. mykiss* x Yellowstone cutthroat trout and Utah chub *Gila atraria*. Catch rates for all fish combined were not statistically different from previous years. Catch rates were separated by species but showed no statistical differences among previous years for all species except brook trout. Catch rates of brook trout, which have not been stocked since 1998, were below the long-term average and showed a significant decline from a high in 2000. Although catch rates of Utah chub are below the peak of abundance documented in 1993, this difference was not significant, due primarily to high variance in catch rates within sample years. Age and growth information collected during 2002 show trout grow very fast and have a relatively high mortality rate. An informal creel survey conducted during 2002 indicated catch rates were well below management goals. Prior to reinstatement of the brook trout stocking program, an opinion survey assessing angler preferences for fish species in Henrys Lake was conducted. Results show that anglers place a high value on having the opportunity to pursue multiple species, including brook trout. Based on this survey, the brook trout stocking program is scheduled to resume in 2003. Additionally, dissolved oxygen levels were monitored to assess the possibility of a winterkill event. Dissolved oxygen concentrations remained above levels considered necessary for trout survival and no winterkill was observed during 2001-2002. The 2002 spawning operations at Henrys Lake produced 1,707,869 eyed cutthroat trout eggs, 363,746 eyed hybrid trout eggs and 105,804 brook trout eggs. Cutthroat trout in the Hatchery Creek run averaged 435 mm and hybrid trout averaged 546 mm, while mean brook trout length was 438 mm. Pathology reports detected the presence of *Myxobolus cerebralis*, *Flavobacter indologenes* and *Aeromonas salmonicida* in adult fish from the 2002 spawning runs. 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 non-structured creel survey on Henrys Lake throughout the fishing season, interviewed 238 anglers, and estimated catch rates to be 0.41 fish per hour. Harvest composition was 42% cutthroat trout, 49% hybrid trout, and 9% brook trout.

We set seven experimental gill nets to assess population parameters and relative abundance of the fishery in Island Park Reservoir. Nets were set in standard locations used each May. Catch rates are similar to samples conducted in 2001 and demonstrate an overall

declining trend in abundance of all fish which began in 1998. Catch rates on salmonids with the exception of kokanee *O. nerka kennerlyi* and all non-game fish with the exception of Utah sucker *Catostomus ardens* follow this trend.

A lowland lakes survey was implemented in Mud Lake to determine the extent of a winterkill event that occurred during 2001-2002. We utilized gill nets and electrofishing in the 2002 survey and documented the presence of non-game fish (Utah chub and Utah sucker) and game fish (yellow perch *Perca flavescens*, bluegill *Lepomis macrochirus*, Lahontan cutthroat trout, brown bullhead *Ameiurus nebulosus* and largemouth bass *Micropterus salmoides*). Catch rates for sport fish were low and are similar to past surveys. The quality of this fishery appears to be limited by the high densities of undesirable fish species and winter environmental conditions.

We set three experimental gill nets in Golden Lake to assess the three-year effort to eradicate nonnative salmonids and establish native Yellowstone cutthroat trout. Nets were set overnight and captured adult cutthroat and rainbow trout, as well as juveniles from both species. Both adult and juvenile cutthroat trout were stocked in Golden Lake as part of the renovation project and were expected to be present. However, rainbow trout were unexpected and likely evaded the exclusion devices installed to prevent immigration. Efforts are now in place to "swamp" the Golden Lake system with both adult and juvenile Yellowstone cutthroat trout, effectively reducing the contributions of rainbow trout genetics.

Two experimental gill nets were used to collect kokanee during their shoreline spawning activities in Ririe Reservoir during September. We removed otoliths from a sample of the population to age kokanee. Mean length at age for kokanee was 347 mm, 385 mm and 388 mm, respectively for ages three, four and five. The spawning population consisted of approximately 19% age three fish, 71% age four fish and 10% age five fish. We also collected smallmouth bass *Micropterus dolomieu* to estimate population characteristics and assess growth parameters. Although this sample was too small for any conclusive results (n = 17), preliminary results indicate very slow growth. Bass are not reaching 300 mm even at six years of age although forage within the reservoir (primarily crayfish) appears to be abundant.

In an effort to improve ice fishing on Roberts Gravel Pond, a supplemental stocking of marked rainbow trout was planted on January 25, 2002. Efforts to estimate exploitation and the impacts of a winter stocking were compromised by a partial winterkill event in February. Dead yellow perch were observed along the shoreline of the lake. No tagged fish were reported caught during the ice fishing season.

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HENRYS LAKE

Methods

Population Monitoring

As part of routine population monitoring, gill net samples were collected from six standardized locations (total eighteen net nights) in Henrys Lake on June 10, 19 and 20, 2002 (Locations given in Appendix A). 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). Three of the nets set on June 10 were set improperly and were discounted from further analysis. Data analysis consisted of calculating catch rates as fish per net night. Data was assumed to be non-normal; therefore, a Kruskal-Wallis one-way analysis of variance was used to detect differences in population trends among data collected from 1999 to present. In addition to standard gill net samples, we used shoreline electrofishing to collect fish for exploitation estimates. Pulsed DC current from a boat electrofisher was used to obtain fish for tagging during May 2002. Length frequencies were compared to length frequencies obtained from gill nets to ensure the different methods were obtaining representative samples of the population and could be pooled for analysis.

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 age two to four.

Creel Survey

Henrys Lake Hatchery personnel conducted an informal creel survey throughout the fishing season to collect catch rate information. Interviews were conducted at random times throughout the day. 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. Data was analyzed using the Department's creel census program.

In addition to the creel survey, a public opinion survey was initiated to gauge public support for reinitiating the brook trout *Salvelinus fontinalis* stocking program as well as angler preferences for stocking actions on the lake. Survey procedure involved reading a brief statement about brook trout in Henrys Lake to the interviewee, followed by ten questions gauged to assess a respondent's views on brook trout management. Public sentiment was also obtained by phone interviews with respondents who called the Department after several news releases were aired to the public.

Spawning Operation

The Hatchery Creek fish ladder was opened for the spring run on February 27 and remained in operation until April 30. Fish ascending the ladder were identified as cutthroat trout *Oncorhynchus clarki* or hybrid trout *O. clarki* X *O. mykiss* and enumerated. A sub-sample of 10% of each group was measured (total length - mm). 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 cutthroat trout eggs and Kamloops rainbow trout milt obtained from Hayspur Hatchery. The hybrid contribution was sterilized by inducing a triploid condition by thermal shocking the eggs post fertilization. Hybrid eggs were placed in 28°C water and held in this condition for 20 minutes. All of the hybrid eggs were shipped to Mackay Hatchery for hatching, rearing, and subsequent release back into Henrys Lake. Cutthroat trout eggs were shipped to Grace, Ashton, and American Falls hatcheries for the catchable cutthroat trout program. The remaining cutthroat trout eggs were shipped to Mackay Hatchery for rearing and release back into Henrys Lake.

The fish ladder was opened for brook trout on October 14. Low water condition prevented the brook trout from successfully ascending the ladder, so trap nets were used at the mouth of Hatchery Creek. Part of the brook trout contribution was sterilized by inducing triploidy by thermal shocking eggs post fertilization. Brook trout eggs were placed in 28°C water and held in this condition for ten minutes. The remaining eggs were left in a diploid condition to provide future brood replacement for the hatchery operation.

Disease samples were taken from the spring and fall spawning runs. Ovarian fluids were collected from cutthroat trout and brook trout during spawning at Henrys Lake Hatchery. Ovarian samples were taken from egg pools of seven females. All seven-female egg pools were tested. Viral samples were taken randomly from 28 seven-female egg pools in the spring run and 6 seven-fish egg pools in the fall run. A mixed-sex group of 60 adult cutthroat trout during the spring run and 60 adult brook trout during the fall run were sacrificed for disease testing. All samples were sent to the Eagle Laboratory.

Dissolved Oxygen Monitoring

Winter dissolved oxygen concentrations; snow depth, ice thickness and water temperatures were taken at established sampling sites on Henrys Lake. Holes in the ice were drilled prior to sampling using a gas-powered ice auger. Dissolved oxygen samples were taken using an YSI model 95 oxygen probe and by sampling at each site at ice bottom and subsequent one-meter intervals until the bottom of the lake was incurred. Total mg/l of oxygen were calculated for each site.

Results

Population Monitoring

We collected a total of 166 fish in the 15 net nights with standard Henrys Lake experimental gill nets (Figure 1). Catch composition was 33% cutthroat trout, 45% hybrid trout, 10% brook trout, and 12% Utah chub *Gila atraria*. Cutthroat trout ranged from 150 to 465 mm total length, hybrid trout 180 to 585 mm, and brook trout 270 to 470 mm. Brook trout catch rates in gill nets has declined significantly from 2000 levels ($p = 0.0007$, Kruskal-Wallis Nonparametric AOV, Figure 2). Catch rates for both hybrid trout and cutthroat trout were similar to previous years and did not differ statistically from previous years catch rates. Utah chub catch rates are slightly higher than previous years samples (Figure 3). However, the difference in these catch rates are not significant ($p = 0.7$, K-W test). Mean length at age information for each trout species is presented in Table 1, and Figures 4, 5 and 6. Mortality estimates derived from catch curve analysis indicate mortality from age-two to age-four for Yellowstone cutthroat trout is 71%. Hybrid trout mortality was estimated at 43% for the same age group. However, mortality estimates from age-three to age-four for cutthroat and hybrid trout was 90% and 78%, respectively. Mortality estimates for brook trout were not possible due to highly variable recruitment.

Attempts to estimate exploitation based on tagging adult fish in Henrys Lake proved unsuccessful. Both day and nighttime electrofishing during May was used in an attempt to collect a representative sample of trout. We established a goal of collecting and tagging 1,000 fish prior to the season opener. After several attempts were made, it became apparent that processing time was underestimated and reaching the targeted 1,000 fish was unlikely. Additionally, comparisons between fish collected with electrofishing to those obtained from gill nets showed these two gears selected different segments of the overall population ($p < 0.001$, Kolmogorov-Smirnov Test, Figures 7 and 8). Therefore, estimates derived from this sample would not be representative of exploitation within the lake. Exploitation estimates were consequently eliminated from 2002 work.

Creel Survey

From May 26 through October 31, creel clerks conducted 238 interviews. Using the creel program, estimates were extrapolated and summarized. We estimated catch rates at 0.41 fish per hour for the season. Separate intervals ranged from a low of 0.16 fish per hour during the 4th interval to a high of 0.65 fish per hour in the 2nd interval. Creel information collected in Henrys Lake is summarized in Table 2. Additional information obtained from the creel survey included the ratio of fin clips from fish marked prior to stocking and is presented in Table 3.

Clerks interviewed 208 people in 150 interviews on the brook trout public opinion survey. Information gathered included reasons for fishing, importance of brook trout to the fishing experience, values of brook trout compared to native species, species preferences, and time spent fishing Henrys Lake including days per year and total years as well as participation if brook trout catch declines. Results show strong support for reinstatement of the brook trout stocking program. Specific results from the survey are presented in Appendix B.

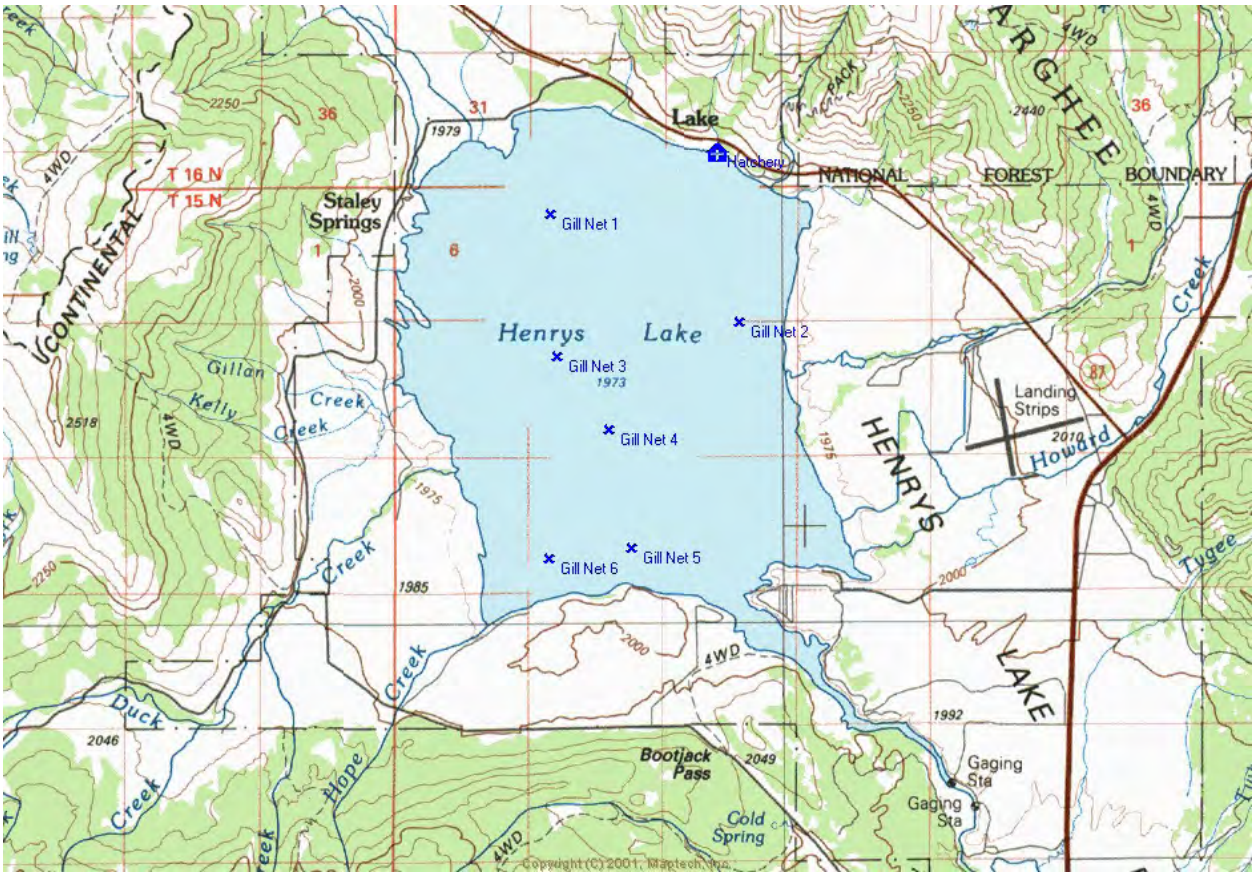

Figure 1. Spatial distribution of gill net locations used in population monitoring in Henrys Lake, Idaho.

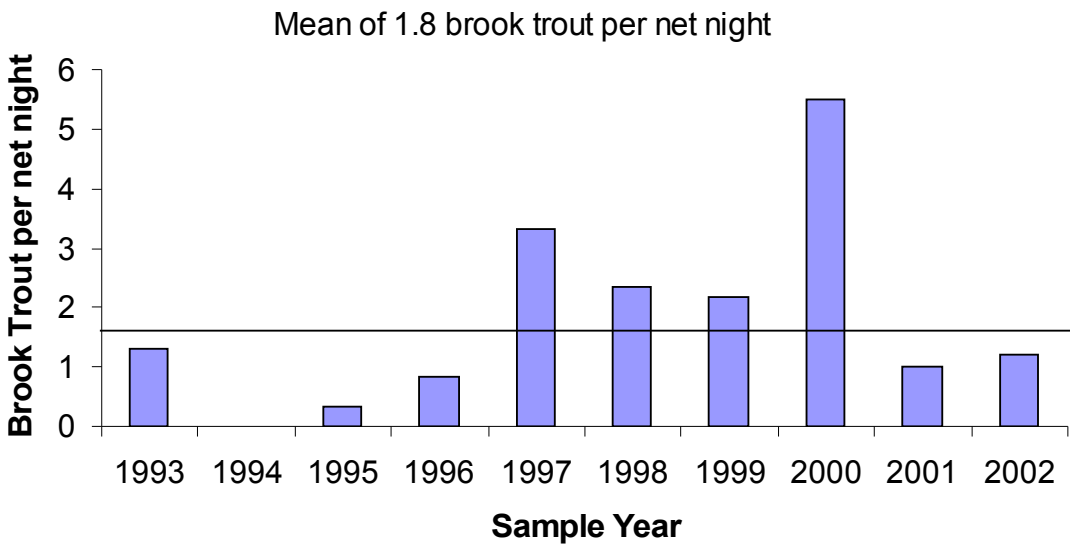

Figure 2. Brook trout catch rates in gill nets set in Henrys Lake, Idaho, 1993 to present.

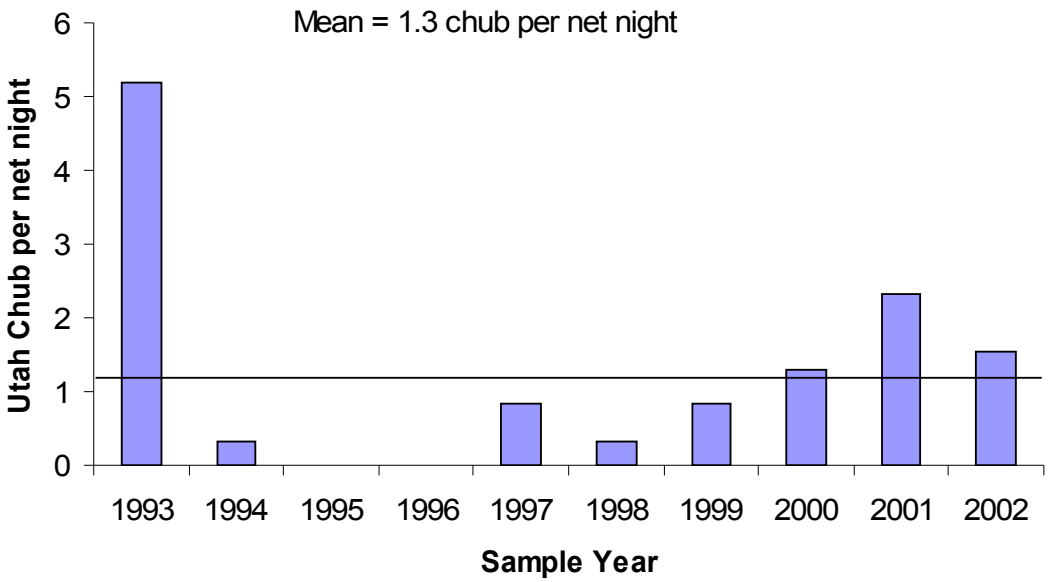

Figure 3. Utah chub catch rates in gill nets set in Henrys Lake, Idaho, 1993 to present.

Table 1. Mean total length (mm) at age for trout collected in Henrys Lake, Idaho, 2002 gill net surveys. Ages were obtained by analyzing otoliths.

	Age 1	Age 2	Age 3	Age 4	Age 5
Species:					
Cutthroat trout	182	336	409	433	--
(N)	(8)	(24)	(21)	(2)	
Hybrid trout	200	345	434	526	--
(N)	(5)	(28)	(41)	(9)	
Brook trout	--	319	388	448	470
(N)		(4)	(6)	(7)	(1)

Table 2. Annual estimates of angler data collected from Henrys Lake, Idaho, creel surveys.

					Catch composition		
Year	**Effort (1,000 h)**	**Catch (1,000)**	**Harvest (1,000)**	**Catch rate (fish/h)**	**YCT**	**HYB**	**BKT**
1979	94	30	18	0.32	35	42	23
1992	115	51	12	0.45	38	52	10
1993	114	73	26	0.64	76	21	3
1994	177	116	21	0.66	52	43	5
1995	172	99	20	0.58	37	60	3
1997	228	123	32	0.54	51	46	3
1999	228	148	27	0.65	22	65	13
2001	165	92	17	0.56	35	58	7
2002	--	--	--	0.41	42	49	9
Mean	**162**	**91.5**	**22**	**0.53**			

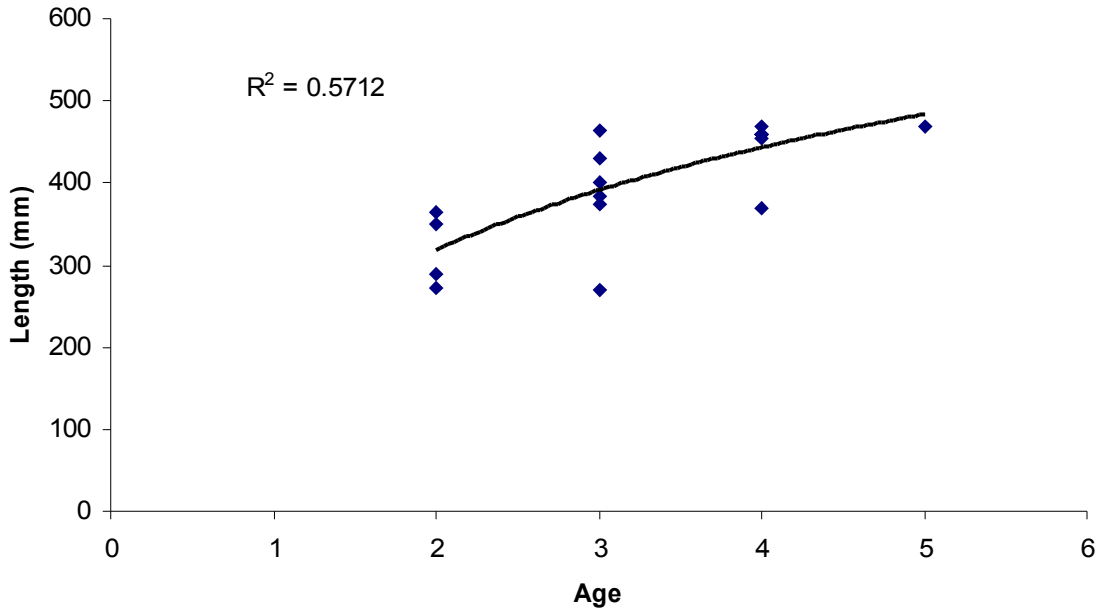

Figure 4. Brook trout length by age for trout captured with gill nets set in Henrys Lake, Idaho, June 2002.

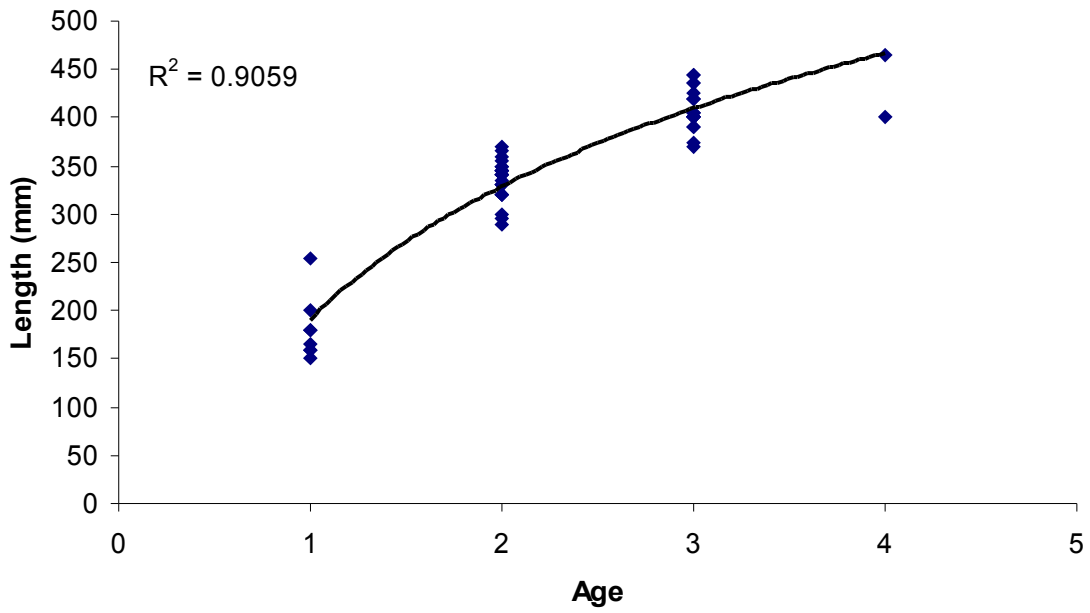

Figure 5. Yellowstone cutthroat trout length by age for trout captured with gill nets set in Henrys Lake, Idaho, June 2002.

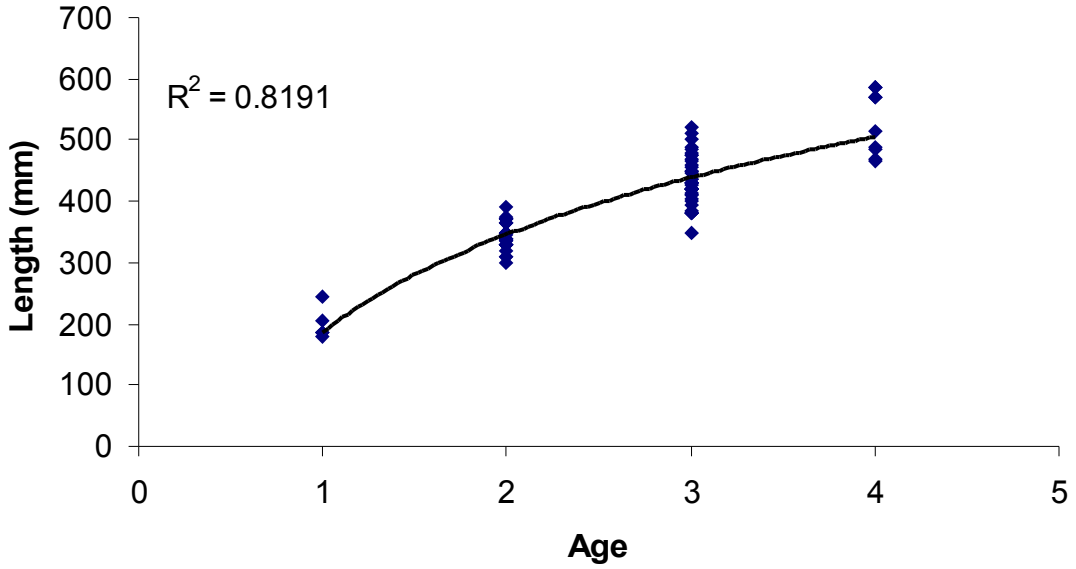

Figure 6. Hybrid trout length by age for trout captured with gill nets set in Henrys Lake, Idaho, June 2002.

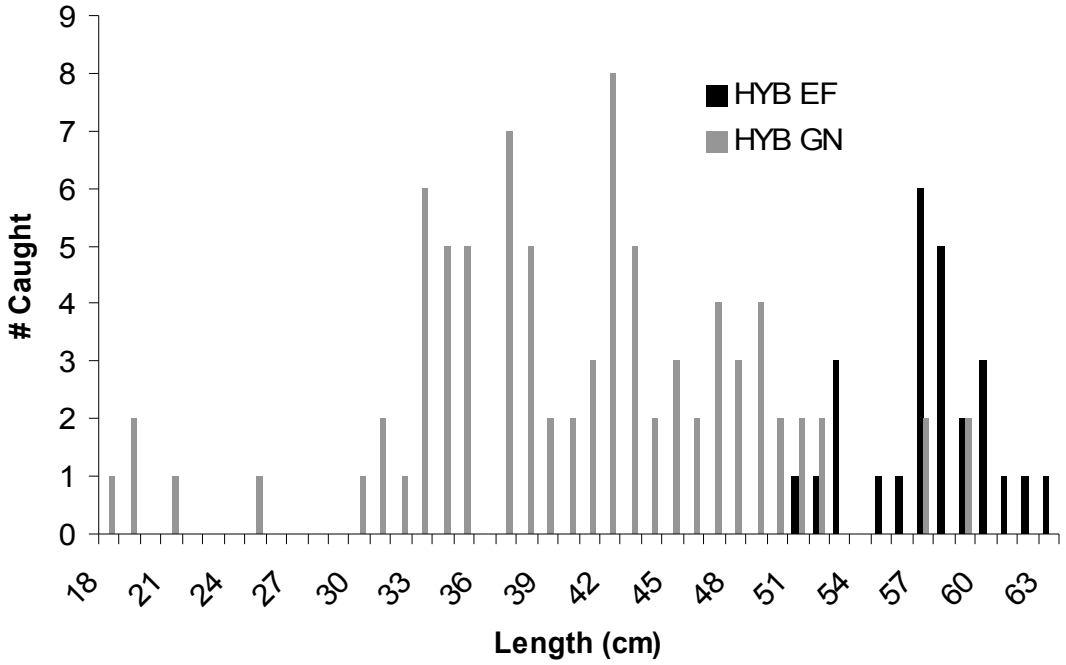

Figure 7. Length frequency distribution of hybrid trout captured with gill nets compared to hybrid trout captured with electrofishing in Henrys Lake, Idaho, 2002.

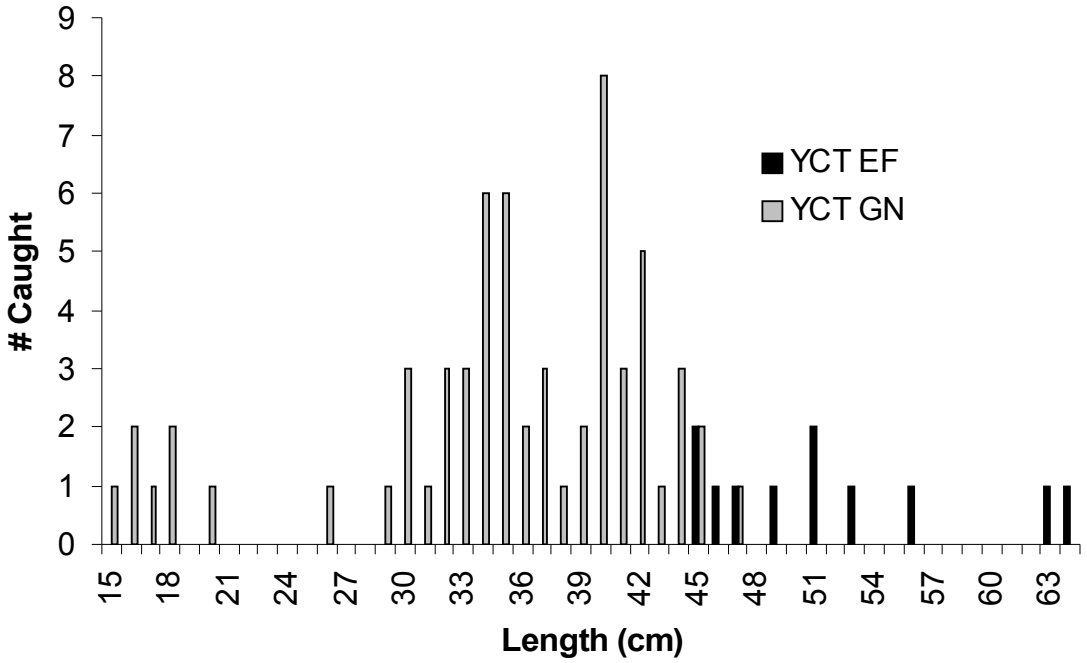

Figure 8. Length frequency distribution of Yellowstone cutthroat trout captured with gill nets compared to Yellowstone cutthroat trout captured with electrofishing in Henrys Lake, Idaho, 2002.

Table 3. Fin clipping data from trout stocked in Henrys Lake, Idaho. Data obtained from fish observed in annual creel surveys.

	Yellowstone cutthroat trout				Brook trout			
Year	# clipped	# of fish	# clipped fish	% clipped	# clipped	# of fish observed in creel	# clipped fish observed	% clipped
2002	11,074	38	7	18%	--	5	1	20%
2001	9,911	116	22	19%	--	30	6	20%
2000	10,000	14	1	7%	--	3	0	0%
1999	12,492	160	20	13%	--	48	5	10%
1998	10,474	--	--	--	2,067	--	--	--
1997	12,369	178	5	3%	2,044	11	1	9%
1996	10,029	--	--	--	1,961	1	0	0%

Spawning Operation

A total of 3,763 cutthroat trout ascended the spawning ladder between February 27 and April 30, with 2,033 males and 1,730 females enumerated. Hybrid trout totaled 1,090 fish, of which 655 were males and 435 were females. Mean length for male and female cutthroat was 463 and 447 mm, respectively. Combined mean cutthroat trout length was 455 mm. Hybrid trout males and females averaged 543 mm and 549 mm, respectively. Combined mean hybrid trout length was 546 mm.

Cutthroat trout green eggs totaled 2,648,450 from 1,081 females for a mean fecundity of 2,450 eggs per female (Table 4). Eyed cutthroat trout eggs totaled 1,707,869 for an overall eye-up rate of 65%. A total of eleven spawn days during this year's spring run were devoted to cutthroat spawning.

Hybrid trout green eggs totaled 766,850 from 313 females for a mean fecundity of 2,450 eggs per female (Table 5). Eyed hybrid trout eggs totaled 363,746 for an overall eye-up rate of 47%. Three spawn days were devoted to production of hybrid trout eggs during this years spawn.

Brook trout green eggs totaled 469,200 from 204 females for a mean fecundity of 2,300 eggs per female (Table 6). Eyed brook trout eggs totaled 240,482 for an overall eye-up of 51%. Of this total, 134,678 were diploid and had a mean eye-up of 73% eye-up and 105,804 were induced to triploid condition and had a mean eye-up of 37%. Two spawn days were devoted to diploid production and two spawn days were devoted to triploid production.

Disease sampling completed on adult spawning fish during the spring run detected *Myxobolus cerebralis* in nine of twelve pooled samples. Five of ten samples of brood detected *Flavobacter indologenes*. Disease sampling completed on adult spawning fish during the fall run detected *Aeromonas salmonicida*. Bacterial disease sampling taken during spawning from ovarian fluid was negative for all samples in both the spring and fall runs. Likewise, viral sampling was also negative for all samples collected during spring and fall spawn sampling.

Dissolved Oxygen Monitoring

Oxygen profiles for 2002 were recorded for the four sites (Pittsburgh Creek, County boat dock, Wild Rose, and the Outlet). Adequate dissolved oxygen was present throughout the reservoir during all periods sampled. The level of concern of 5 mg/l was reached only briefly at the Wild Rose site and throughout the sampling period at the outlet site. However, the outlet site often shows diminished oxygen supplies when water is not running through the dam, as was the case throughout the 2002 sampling period. Complete results are included in Table 7.

Table 4. Henrys Lake, Idaho, Yellowstone cutthroat trout spawning summary, 2002.

Spawn date	Lot #	Females spawned	# of green eggs	Mean fecundity	# Eyed eggs	Disease status	% Eye-up
3-7-2002	1	105	257,250	2,450	167,192	Neg.	65
3-11-2002	2	105	257,250	2,450	183,602	Neg.	71
3-14-2002	3	100	245,000	2,450	154,711	Neg.	63
3-18-2002	4	105	257,250	2,450	168,343	Neg.	65
3-21-2002	5	105	257,250	2,450	178,925	Neg.	70
3-25-2002	6	77	188,650	2,450	162,105	Neg.	86
3-30-2002	8	70	171,500	2,450	126,569	Neg.	74
4-8-2002	11	105	257,250	2,450	191,403	Neg.	74
4-11-2002	12	105	257,250	2,450	173,801	Neg.	68
4-18-2002	13	120	294,000	2,450	160,892	Neg.	55
4-25-2002	14	84	205,800	2,450	40,326	Neg.	20
TOTAL		**1,081**	**2,648,450**	**2,450**	**1,707,869**		**65**

Table 5. Henrys Lake, Idaho, hybrid trout spawning summary, 2002.

Spawn date	Lot #	Females spawned	# of green eggs	Mean fecundity	# Eyed eggs	Disease status	% Eye-up
3-28-2002	7	89	218,050	2,450	104,146	Neg.	48
4-1-2002	9	105	257,250	2,450	143,773	Neg.	56
4-4-2002	10	119	291,550	2,450	115,827	Neg.	40
TOTAL		**313**	**766,850**	**2,450**	**363,746**		**47**

Table 6. Henrys Lake, Idaho, brook trout spawning summary, 2002.

Spawn date	Lot #	Females spawned	# of green eggs	Mean fecundity	# Eyed eggs	Disease status	% Eye-up	Diploid/ triploid
10-22-2002	1	35	80,500	2,300	57,258	Neg.	71	Diploid
10-24-2002	2	45	103,500	2,300	77,420	Neg.	75	Diploid
Subtotal 2N		**80**	**184,000**	**2,300**	**134,678**		**73**	**Diploid**
10-31-2002	3	75	172,500	2,300	65,625	Neg.	38	Triploid
11-4-2002	4	49	112,700	2,300	40,179	Neg.	36	Triploid
Subtotal 3N		**124**	**285,200**	**2,300**	**105,804**		**37**	**Triploid**
TOTAL		**204**	**469,200**	**2,300**	**240,482**		**51**	

Table 7. Dissolved oxygen readings (mg/l) recorded in Henrys Lake, Idaho, wintertime monitoring.

Location	Date	Snow depth (mm)	Ice depth (mm)	Dissolved Oxygen			
				Ice bottom	One meter[a]	Two meters[a]	Three meters[a]
Pittsburg Cr	Jan 7	100	275	10.6	10.3	8.3	6.6
	Jan 16	150	375	10.4	10.1	7.8	6.5
	Jan 31	275	400	8.2	7.9	6.6	4.9
County Boat Dock	Jan 7	100	275	10.0	9.5	6.3	--
	Jan 16	150	300	10.5	9.7	5.4	--
	Jan 31	375	325	8.1	7.4	5.0	--
Wild Rose	Jan 7	100	275	10.2	9.4	8.1	4.8
	Jan 16	150	300	11.1	10.1	7.8	5.3
	Jan 31	325	300	7.3	7.1	5.7	3.7
Outlet	Jan 7	100	200	3.0	2.4	--	--
	Jan 16	150	275	2.4	1.9	--	--
	Jan 31	250	400	1.0	0.8	0.8	--
Hatchery	Jan 31	0	400	5.8	5.7	5.3	--

[a] – Depth measured from ice bottom

Discussion

Creel survey information collected in Henrys Lake during 2002 showed catch rates for much of the year to be well below what is typically encountered. This prompted speculation of a winterkill or other large-scale fish kill. 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 fish kill.

Dissolved oxygen data collected during the winter of 2001-2002 indicated preferred levels of oxygen (>5.0 mg/l) were present during all times data was collected. The only sampling location lacking desirable oxygen was at the Outlet. As a preventative method, the aeration station located on Hatchery Creek was activated in January 2002. Monitoring around this area indicated the pumps adequately mix and aerate water and provide ice-free areas for additional water/air interface. During the winterkill event of 1992, numerous trout were observed crowding the tributaries as oxygen declined. These streams provide a refuge during periods of low dissolved oxygen. Fish were not observed crowding tributaries during 2002, indicating that adequate levels of oxygen were present. Further, no dead fish were observed, which would be expected if a significant winterkill event occurred.

Other possible impacts to the trout population include summer kill as a result of poor oxygen levels. This also was discounted; as monitoring during August of 2002 showed sufficient levels present lake-wide, and we observed no dead or dying fish.

We do not believe the poor catch rates documented by the creel survey and described by anglers during the 2002 fishing season were the result of population-level impacts to the fishery. More likely, the multi-year drought cycle, combined with decreased lake levels, produced conditions not often encountered in Henrys Lake. We believe the combination of these factors is probably the cause of the poor catch rates observed during the 2002 fishing season.

We monitor annual population trends with gill nets set in standard locations. These nets are set at roughly the same time each year and are an indicator of population trends. Overall, there was little change in the catch rates during 2002 sampling when compared to previous years. Total catch rates for all fish, catch rates of trout, and individual catch rates on Yellowstone cutthroat trout and hybrid trout were all similar to catch rates in previous years. Fish densities have not changed significantly from last year or the long-term (10-year) average. One exception to this trend is brook trout, which have declined significantly from 2000 levels. This is expected, as supplemental stockings have not occurred since 1998, and natural reproduction has been shown to be minimal.

Utah chub catch rates remain similar to levels found in 2001 and show no indications of increased population growth. Gill net catch rates were highest in 1993 (>5 fish per net night) and have since declined to a relatively constant one to two fish per net night from 1997 to present. Compared to other water bodies with high chub abundance (Mud Lake 47 fish/night; Island Park Reservoir 48 fish/night), densities in Henrys Lake appear to be low. It does not appear that chub abundance as determined by our gill nets is increasing significantly. However, the threat of an increase in Utah chub abundance is present. Additional work to determine factors suppressing the population in Henrys Lake is warranted.

Estimates derived from catch-curve analysis show a relatively high mortality rate for Yellowstone cutthroat trout and to a lesser extent hybrid trout. Mortality is much greater for fish between age-three and age-four, and is probably tied to the stresses associated with spawning. Although the estimates derived from catch-curve analysis have value as a first-order estimate, additional precision will be obtained by continued assessment of cohorts over time. Cohort analysis will account for variation associated with strong and weak year-classes and yield more reliable mortality estimates. Additionally, the sterile hybrid-stocking program is likely to reduce spawning-related mortality and increase abundance of larger, trophy fish. Female hybrid trout should not produce eggs, thus reducing the amount of mortality associated with spawning activities. This, in turn, should give hybrids a chance at obtaining another year or two of growth and result in increased abundance of large, trophy fish.

The angler opinion/brook trout survey indicated anglers value diversity in their catch and want the opportunity to catch large brook trout. Although supplemental stocking ended in 1998, brook trout have persisted up to the current years' sample. A low level of natural reproduction occurs, but it is expected that densities will decline significantly below levels recorded over the previous two years without supplemental stocking. Given the public support for providing brook trout in the catch and the limited impacts to native fish, the decision was made to reinstate the brook trout stocking program.

RECOMMENDATIONS

1. Increase annual gill net sampling to a minimum of 18 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. Obtain population estimate using hydroacoustics to include abundance of nongame species as well as sportfish in combination with a standard creel survey.

4. Estimate exploitation based on population estimate and harvest estimate from creel survey.

5. Utilize multi-year data collection in population modeling program to ascertain any possible changes to management on the lake.

6. Continue winter-dissolved oxygen monitoring to document possible factors limiting trout production.

7. Explore possible factors contributing to suppression of Utah chub.

ISLAND PARK RESERVOIR

Methods

Since the 1992 drawdown and renovation of Island Park Reservoir, annual standardized gillnetting has been used to monitor species composition, relative abundance, and size structure of the fishery. On June 13, 2002, we set four sinking and three floating experimental gill nets overnight at standardized locations (seven net nights). All captured fish were identified, counted, and measured. Catch rate data and relative abundance information were compiled and compared to data from 1993 to present.

Results

We captured a total of 635 fish with a combined gillnetting effort of seven net-nights in standard locations (Figure 9). Catch composition included six species. Gamefish (rainbow trout and kokanee *O. nerka kennerlyi*) comprised 10% of the total catch, compared to 11% in 2001, and 26% in May 2000 samples. Utah chub and Utah sucker *Catostomus ardens* comprised 90% of the catch, compared to 89% and 74% in 2001 and 2000, respectively. Other species sampled were mountain whitefish *Propsopium williamsoni* (four fish) and largescale sucker *C. macrocheilus* (12 fish). Catch rates (number of fish per net night) on all species showed a continued decline that began in 1998 (Figure 10). Gamefish catch rates and non-gamefish catch rates are shown in Figures 11 and 12, respectively. Standard gill net locations are presented in Appendix A.

DISCUSSION

Catch per net night in Island Park Reservoir is similar to catch rates from 2001, and reflects a continued downward trend in abundance of all species except kokanee. After the community renovation that occurred in 1992, catch rates for all species was low. As fish populations rebuilt, catch rates increased, reaching a peak in abundance in 1998-1999. Catch rates began a steady decline since that time. The fishery in Island Park Reservoir appears to be following a pattern typical of a new reservoir or one newly renovated, where fish species rapidly expand and fill unexploited niches (trophic upsurge). This expansion reaches a peak of abundance, followed by a decline (trophic depression) to a more balanced ratio of habitat to abundance.

The only species that showed a marked increase from 2001 catch rates were kokanee. However, the increase in abundance found in 2002 samples is more likely the result of variation within the gill net sample than an actual biological change in the kokanee population. A large number of young (<200 mm) kokanee were captured in the 2002 survey. The schooling behavior of these fish would cause wide fluctuations in catch rates depending on whether a school was encountered with a net. No adult fish were collected during 2002 samples.

Attempts were made to correlate stocking rates of rainbow trout and catch rates in the

gill nets to assess the most effective rate for stocking Island Park. Stocked fish were broken out into catchable size (>150 mm), and fingerling/fry size. Preliminary analysis included looking at catchable fish contribution to gill net catch in both the year of planting and one year after, while fingerling/fry contributions were analyzed at one, two and three years post-stocking. Secondary analysis included all combinations of fingerling/fry and catchable stocking rates. Unfortunately, no analysis provided a strong relationship between stocking rates and catch rates in gill nets (r^2 <0.20, or a negative relationship between stocking rates and gill net catch rates). It is probable that other factors such as reservoir fluctuation may drive rainbow trout densities. Additional work should focus on the factors governing trout abundance in Island Park Reservoir.

RECOMMENDATIONS

1. Reduce annual gill net samples to every other year

2. Analyze potential factors related to the decline in gill net catch rates of rainbow trout.

3. Implement creel survey to estimate angler use, catch and harvest in 2003 or 2004.

4. Develop kokanee spawning fish surveys for long-term trend/abundance monitoring.

5. Use reward tags to estimate return to creel of catchable rainbow trout.

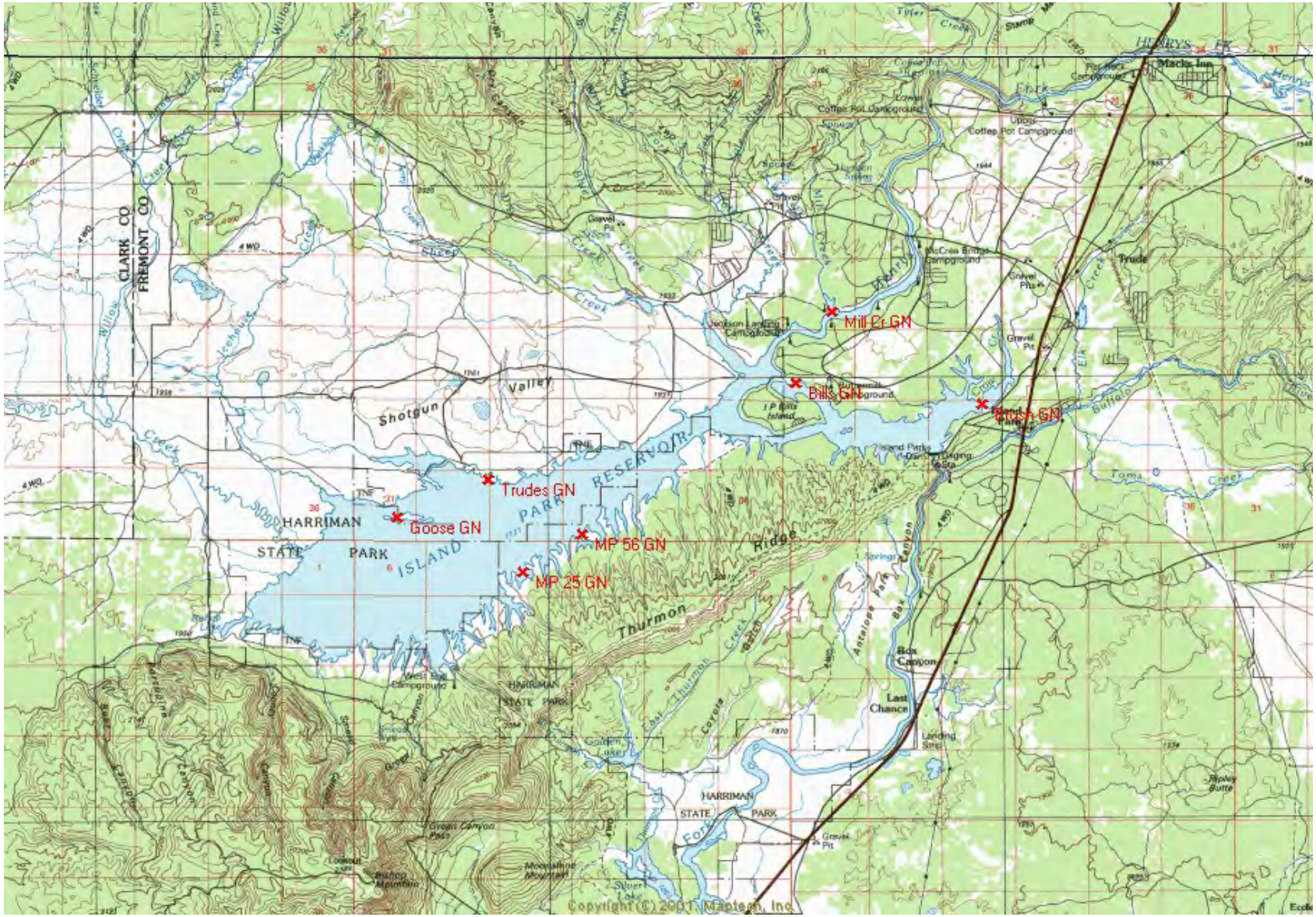

Figure 9. Gill net locations used for population assessments in Island Park Reservoir, Idaho.

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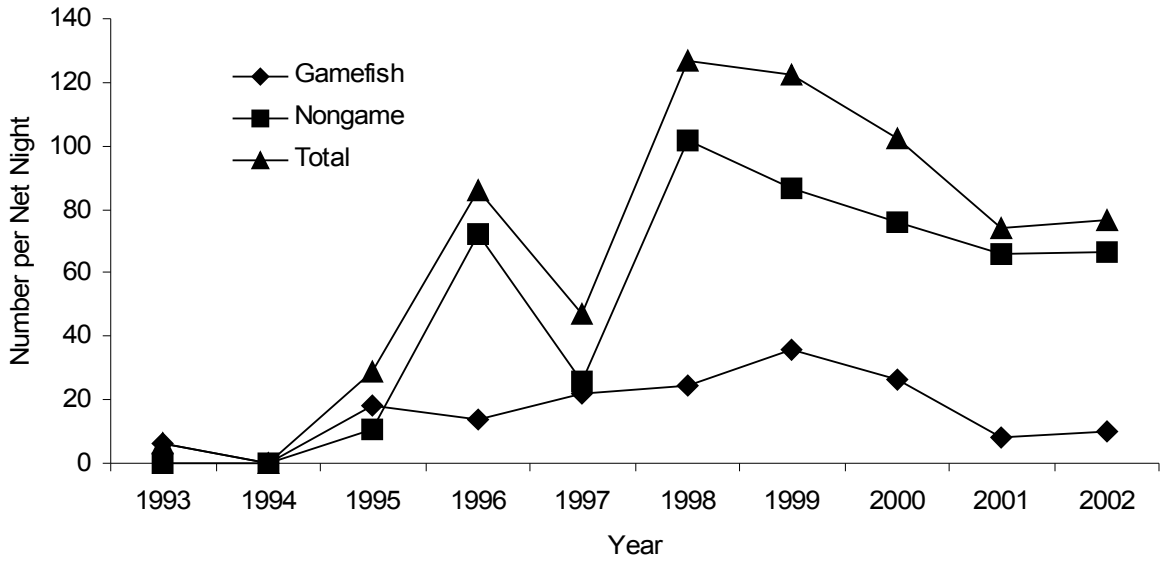


Figure 10. Gill net catch rates (fish/net night) for nets set in Island Park Reservoir, Idaho, June 2002.

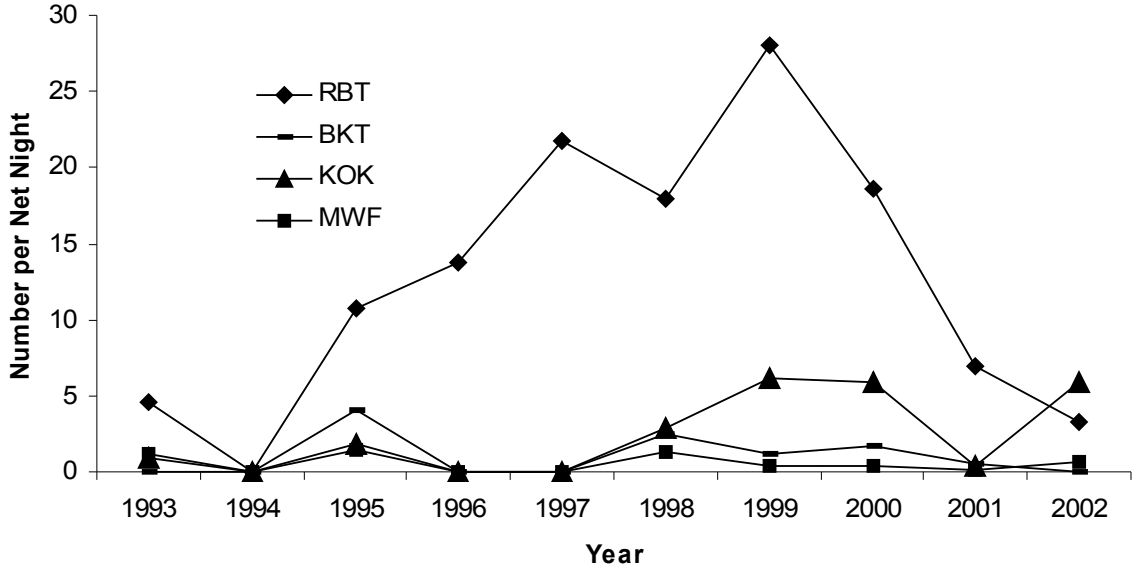


Figure 11. Gill net catch rates (fish/net night) for sport fish (rainbow trout, brook trout, kokanee and mountain whitefish) captured in Island Park Reservoir, Idaho, June 2002.

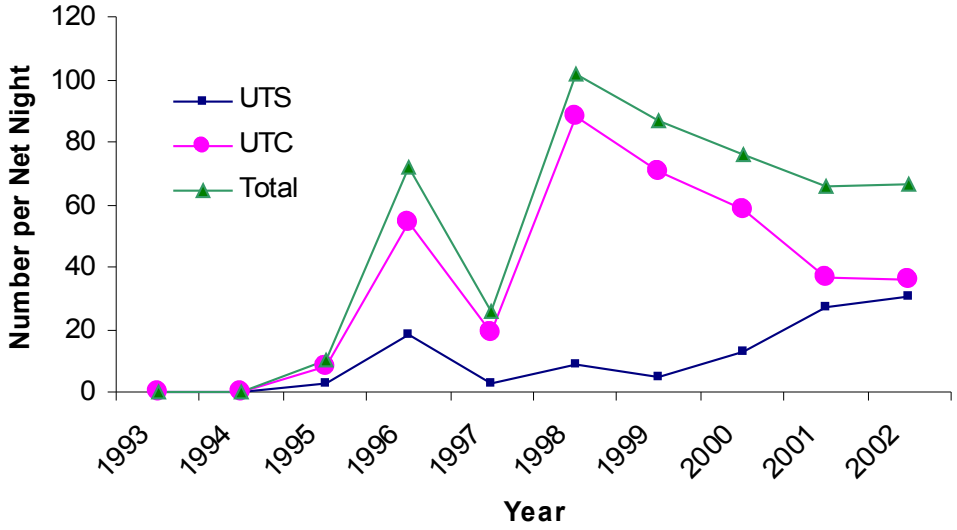


Figure 12. Gill net catch rates (fish/net night) for non-game fish (Utah sucker and Utah chub) captured in Island Park Reservoir, Idaho, June 2002.

MUD LAKE

Methods

We set four experimental gill nets in Mud Lake on June 28 to evaluate the effects of a winterkill that occurred during 2001-2002. Nets were set in four different areas and soaked overnight. Species encountered were identified, measured for total length (mm) and released. Nighttime boat electrofishing was used to capture additional fish. We conducted seven electrofishing runs totaling two hours sampling time on June 28. All fish captured were identified to species, measured for total length (mm) and released.

Results

Catch rates from electrofishing surveys indicate the 2001-2002 winterkill may have affected the fishery in Mud Lake. Catch per unit effort (CPUE), measured in fish per hour, for all species was low. Sportfish captured included bluegill *Lepomis macrochirus* and largemouth bass *Micropterus salmoides*, both of which were caught at the rate of 0.5 f/h, while brown bullhead *Ameiurus nebulous* were caught at one f/h. Non-game fish were captured at a higher rate (Utah chub 23 f/h). Gill net surveys corroborate what electrofishing demonstrated – low catch of sport fish but significant rough fish present. Results from both surveys are presented in Table 8, while gill net locations are provided in Figure 13 and Appendix A.

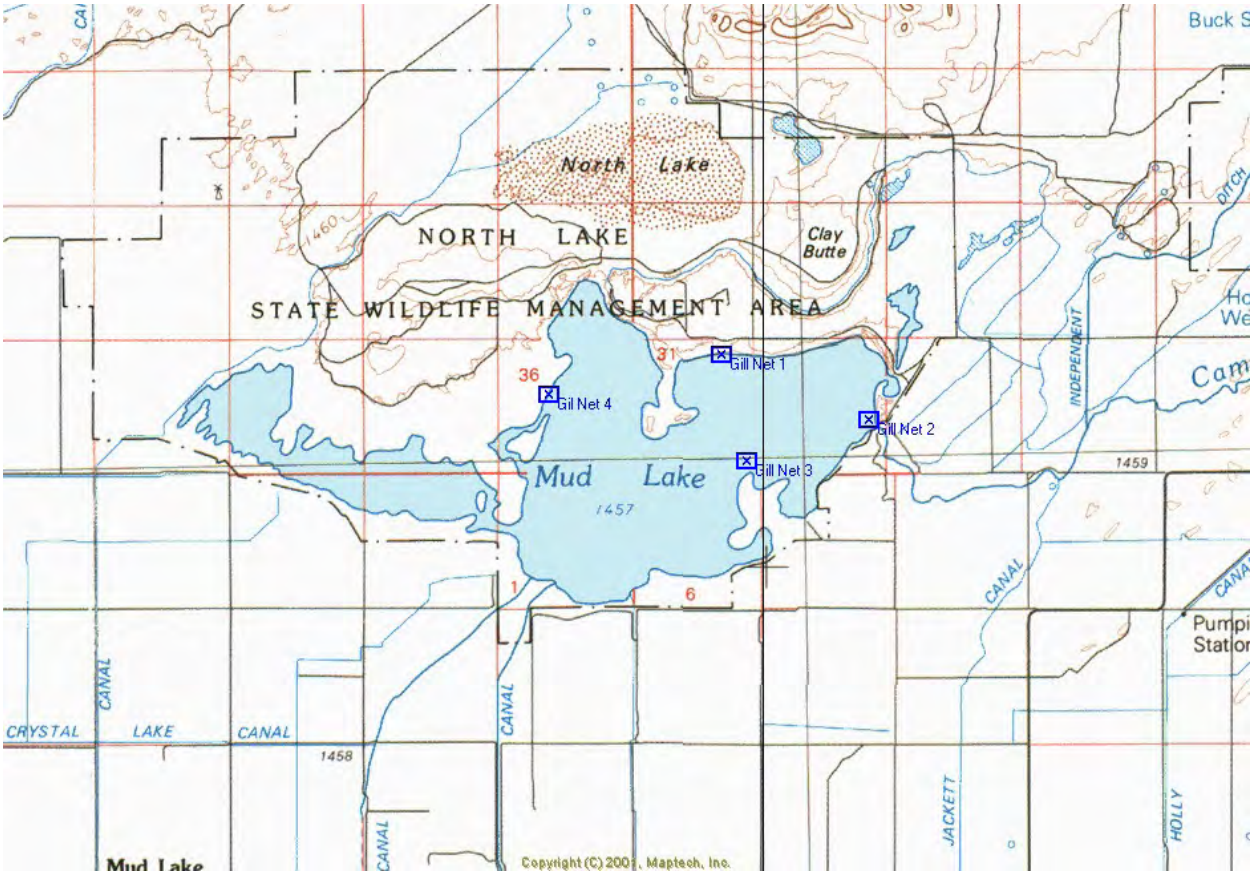


Figure 13. Gill net locations used in population monitoring in Mud Lake, Idaho, during 2002 sampling.

Table 8. Catch rates for fish species captured in Mud Lake, Idaho, 1992 and 2002.

Survey Year	Catch per Unit Effort	Largemouth bass	Bluegill	Yellow perch	Utah chub	Utah sucker	Brown bullhead
2002	Electrofishing	0.5	0.5	0.5	23.3	0	1.0
	Gill netting	0	0	3.1	47.3	10.1	0.6
1992	Electrofishing	0	0	60	NC	NC	NC
	Gill netting	0.5	0	8.5	83	51	8

Discussion

The lowland lakes survey implemented on Mud Lake suggests a limited winterkill event occurred during 2001-2002, and had an impact of the fishery. The low catch rates of sport fish suggest these occasional winter events may be limiting the potential to develop a sustainable fishery here. We contacted the Mud Lake Canal Company to discuss winter pumping of water to provide an area of higher oxygen concentrations. However, because of concerns regarding flood control management and the loss of control over irrigation manipulations by the company, we were told winter pumping was not an alternative. Constraints on water management limit the consistency and quality of the fishery. Additional attempts at working with the irrigation companies may result in a collaborative solution to the constraints limiting production and should be pursued as opportunity allows.

Recommendations

1. Continue efforts to work with irrigation district and the canal company to improve winter conditions of the lake.

2. Implement winter dissolved oxygen monitoring to record winterkill events.

3. Periodically monitor the fishery to assess population recovery from environmental impacts.

GOLDEN LAKE

Methods

Three experimental gill nets were set in Golden Lake to assess the effectiveness of nonnative fish species removals and to monitor the reintroduction of Yellowstone cutthroat trout. We used sinking experimental gill nets placed in areas where the absence of dense mats of vegetation allowed adequate deployment. Nets were set on the afternoon of July 26, 2002 and retrieved the following morning. All fish captured were identified and measured for total length (mm). All nonnative fish encountered were removed from the system.

Results

One overnight gill net sample was conducted on July 25-26, 2002 to assess the efficacy of the prior two years fish removal efforts, and the subsequent attempts at reestablishing Yellowstone cutthroat trout in Golden Lake. Our netting efforts were hampered by dense mats of aquatic vegetation but were considered successful overall. Three standard nets with a range of mesh size were set and documented the presence of adult Yellowstone cutthroat trout, adult rainbow trout, and juvenile fish from both of these species (Figure 14).

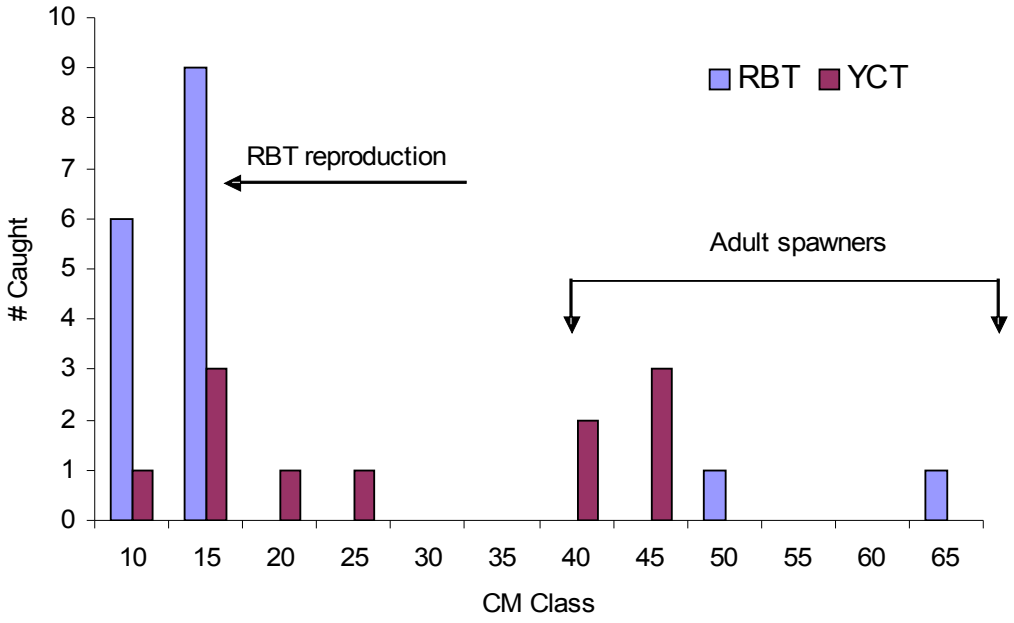


Figure 14. Gill net catch from samples conducted in Golden Lake, Idaho, July 25-26, 2002.

Discussion

As expected, both juvenile and adult Yellowstone cutthroat trout were encountered in 2002 samples. Adult Yellowstone cutthroat trout had been stocked in March and were likely to be encountered during these samples. Young of the year (YOY) Yellowstone cutthroat trout had also been stocked over the past year, with possible additions from natural reproduction by the adult fish stocked earlier in the year. Adult rainbow trout were also collected. The large size of the rainbow trout was somewhat surprising and suggests that the fish exclusion devices present at the outflow of the lake may not be 100% effective in barring entry by migrating trout. It is unlikely that large trout would have been able to avoid the toxicant applications from previous years. Further, these fish managed to successfully spawn. Numerous YOY rainbow trout were captured and show that a population is now established. Given the constraints surrounding chemical treatments of Golden Lake (time of entry restrictions due to swan nesting, unsuccessful immigration barriers, etc.) the most practical use of available resources is to attempt to swamp the genetics of the lake by adding additional adult and juvenile Yellowstone cutthroat trout. Monitoring should occur annually to document the relative success of the project and to assess the contribution of rainbow trout to the system.

Recommendations

1. Continue to monitor the establishment of trout with gill nets.

2. Continue stocking both adult and juvenile cutthroat trout in an attempt to flood the fishery with native fish and out-compete nonnative fish.

RIRIE RESERVOIR

Methods

We set standard experimental gill nets for a period of three hours on September 6, 2002 to obtain a sample of spawning kokanee for age and growth analysis. Nets were checked hourly and all captured fish removed. Fish were measured for total length (mm), otoliths were removed and stored in an envelope and sex of fish was noted. Mean length at age was determined by analyzing collected otoliths.

We also collected smallmouth bass *Micropterus dolomieu* using hook and line gear. Fish were measured for total length (mm) and otoliths were removed and stored in an envelope for later analysis. Age and growth information was obtained by analyzing collected otoliths. Attempts to estimate mortality utilizing catch curve analysis were undertaken but a small sample size precluded reliable results.

Results

We captured a targeted 100 kokanee with gill nets, which were aged by otolith analysis. Results indicate that most (71%) kokanee captured were age-four. Nineteen percent spawned at age-three, while the remaining 10% spawned as age-five fish. Mean length at age for age-three, age-four and age-five fish was 347 mm, 385 mm and 388 mm, respectively (Figure 15).

Our sampling with angling gear yielded 16 smallmouth bass, which were aged using otoliths. Sample sizes were inadequate to estimate mortality based on a catch curve. However, mean length at age for given year classes was estimated and is presented in Table 9.

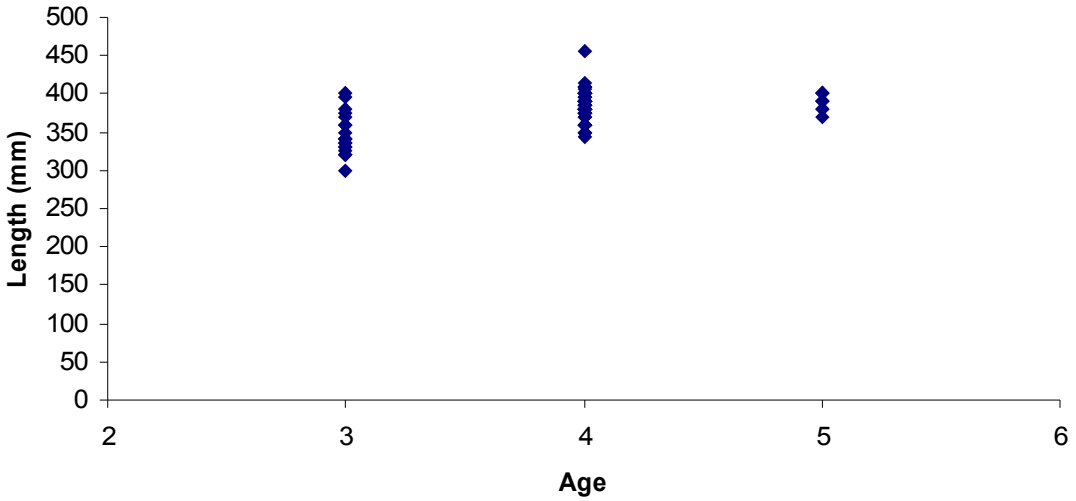


Figure 15. Length at age information for kokanee captured in gill nets set in Ririe Reservoir, Idaho, September 2002.

Table 9. Mean total length (mm) at age for smallmouth bass captured in Ririe Reservoir, Idaho, September 2002, compared with the statewide average.

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
Otoliths	--	188	--	222	229	275	--
Scales (1992)	83	137	201	254	323	357	392
Statewide average	85	157	222	277	326	372	415

Discussion

Information obtained from length at age of kokanee in Ririe Reservoir indicate good growth to age-five. Stocking rates through 2001 were fairly low, resulting in fast growth rates. Given the proximity of this resource to a major population center (Idaho Falls), we believe increased kokanee stocking can provide additional angling opportunity. Stocking rates were increased in 2002 from 70,000 fish to approximately 200,000 fish. Information obtained from the 2002 survey will be used as baseline information on growth to compare to stockings of higher density.

Age and growth information obtained from smallmouth bass collected during the current survey is of limited value for estimating population parameters and limiting factors within the lake. A low sample size coupled with missing year-classes precluded mortality estimates and analysis of year-class strength. However, age and growth information indicated growth of bass is below the statewide average. Age and growth work based on otolith analysis shows growth to be slower than that found in past research that utilized scales for ageing. Forage for bass appears to be abundant, as dense concentrations of crayfish were noted along the face of the dam. The slow growth of bass is somewhat surprising, given this forage. Several heavy infestations of intestinal parasites (tapeworms) were also noted during fish processing and may be contributing to slower growth. The thermal regime of the lake has been noted as the controlling factor for bass growth. However, given the abundance of preferred food, additional work may be warranted. Future sampling should include methods of obtaining larger samples of bass, and may include nighttime shoreline electrofishing.

Recommendations

1. Monitor kokanee populations with shoreline gill net samples.

2. Obtain age and growth information from kokanee and monitor length at age data to ascertain impacts from stocking fish at higher densities.

3. Attempt to collect adequate sample of smallmouth bass utilizing nighttime electrofishing. Analyze otoliths, and identify factors contributing to year-class variation.

ROBERTS GRAVEL POND

Methods

On January 25, 2002 approximately 100 catchable rainbow trout were marked with a Floy T-bar tag and stocked through the ice in Roberts Gravel Pond. The intent of the winter stocking was to enhance the popular ice fishery and estimate exploitation on trout as well as evaluate the merits of winter stocking. We posted signs along the shoreline offering a reward for anyone who turned in a tagged fish.

Results

Our exploitation/fishery enhancement stocking was impacted by a winterkill event that occurred at the beginning of February. Upon investigation, numerous dead and dying yellow perch *Perca flavescens* were found along the shoreline around the aeration system. We observed no dead trout; however, it is probable that these fish died prior to the perch dying off. No tagged fish were recovered throughout the fishing season.

Discussion

Although the winterkill event impacted the efforts to estimate exploitation on Roberts, the fish population was not completely eradicated. Reports of yellow perch being captured during the spring show some survival. These fish should replenish the fishery within a year or two.

Continued stocking of catchable trout will provide opportunities for anglers until the perch have a chance to rebound. The additional stockings of rainbow trout during the winter did not provide additional opportunities for anglers and may not be warranted in the future.

Recommendations

1. Continue stocking catchable rainbow trout.

2. Improve capabilities of aeration system on the pond as time and budgets allow.

APPENDICES

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

Gill Net Sites

Gill Net 1	467, 252 E	4, 944, 882 N	Z 12
Gill Net 2	469, 510 E	4, 943, 608 N	Z 12
Gill Net 3	467, 217 E	4, 940, 776 N	Z 12
Gill Net 4	467, 320 E	4, 943, 171 N	Z 12
Gill Net 5	467, 962 E	4, 942, 292 N	Z 12
Gill Net 6	468, 203 E	4, 940, 874 N	Z 12

Dissolved Oxygen Sites

County boat dock	465, 725 E	4, 944, 234 N	Z 12
Wild Rose	467, 751 E	4, 945, 816 N	Z 12
Outlet	471, 374 E	4, 938, 741 N	Z 12
Pittsburg Creek	469, 446 E	4, 943, 838 N	Z 12
Hatchery Ladder	469, 290 E	4, 945, 489 N	Z 12
Cliffs	467, 072 E	4, 940, 951 N	Z 12

Locations used in standard gill net sets in Island Park Reservoir, Idaho. Coordinates are given as UTMs.

Gill Net Sites

Bills	465, 499 E	4, 919, 897 N	Z 12
Brush	469, 648 E	4, 919, 391 N	Z 12
Mill Cr	466, 325 E	4, 921, 491 N	Z 12
Trude's	458, 721 E	4, 917, 667 N	Z 12
Goose	457, 126 E	4, 916, 809 N	Z 12
MP 25	459, 548 E	4, 915, 592 N	Z 12
MP 56	460, 759 E	4, 916, 403 N	Z 12

Locations used in gill net sets in Mud Lake, Idaho. Coordinates are given as UTMs.

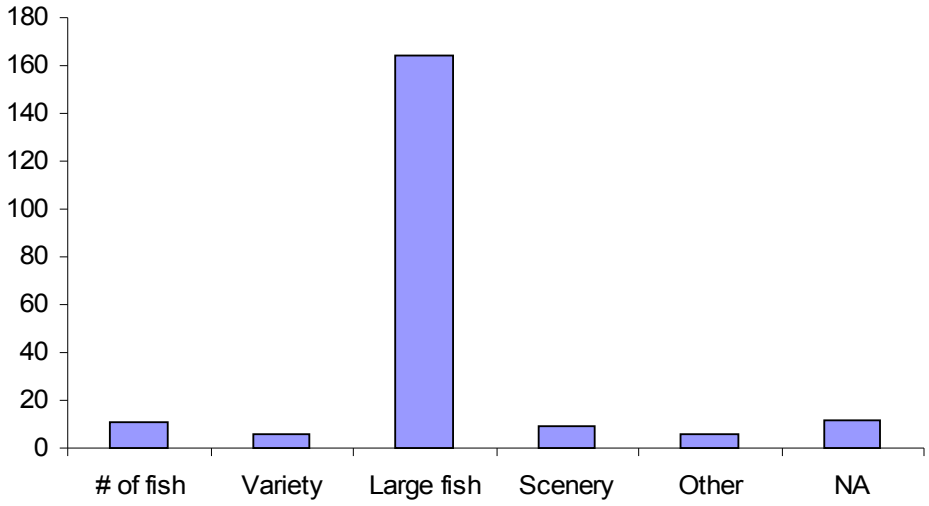
Gill Net Sites

Gill Net 1	389, 383 E	4, 859, 855 N	Z 12
Gill Net 2	390, 844 E	4,860, 403 N	Z 12
Gill Net 3	388, 911 E	4, 861, 168 N	Z 12
Gill Net 4	386, 975 E	4, 860, 755 N	Z 12

Appendix B. Summary of angler opinions on brook trout in Henrys Lake, Idaho, 2002.

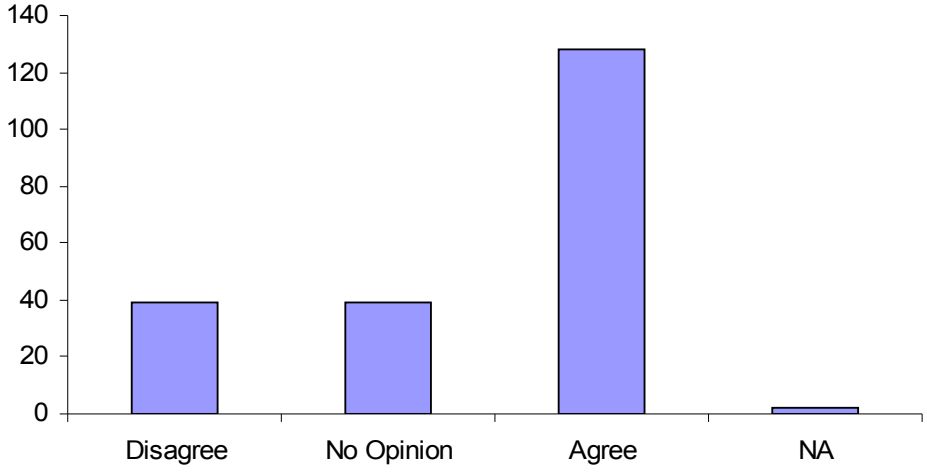
Total number of surveys = 150, representing 208 anglers

Mean number of years spent fishing Henrys Lake = 16

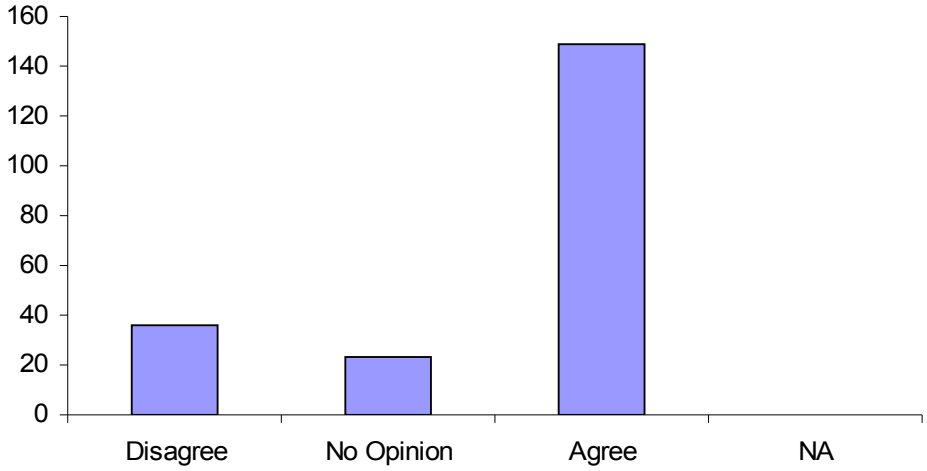


Responses to the question "The main reason I fish Henrys Lake is to: Catch lots of fish, Catch a variety of fish, Catch large fish, for the scenery, or other reasons."

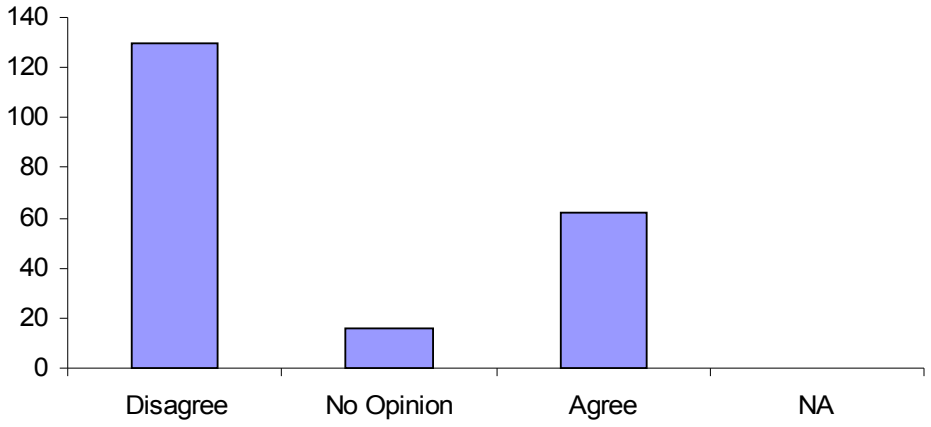
*Responses to the next four questions (agree/disagree) were based on a scale of 1-5, with 1 being strongly disagree, 2 disagree, 3 no opinion, 4 agree and 5 strongly agree. Results for strongly agree and agree were combined, as were the disagree votes.



Responses to the question "Brook trout are an important part of my Henrys Lake fishing experience".

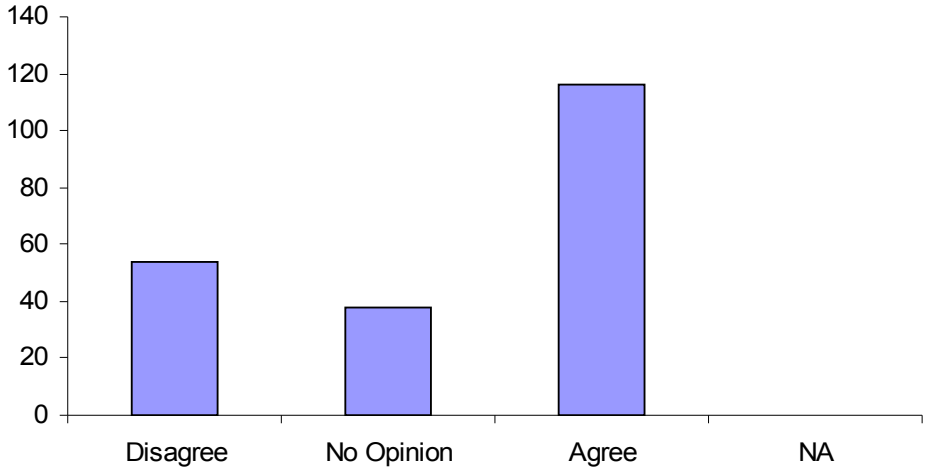


Responses to the question "I would like to see more brook trout in Henrys Lake only if there are no impacts to native cutthroat trout (1-5 scale)".

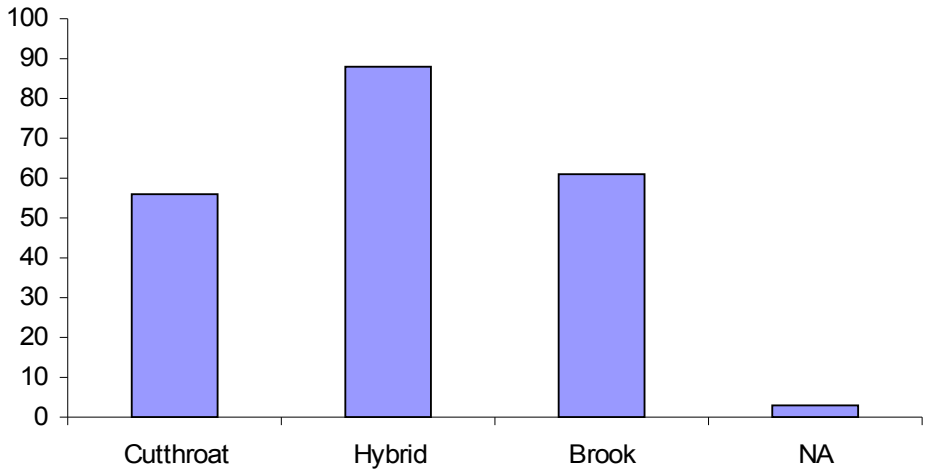


Responses to the question “I would like to see more brook trout in Henrys Lake even if they pose a risk to native cutthroat trout (1-5 scale)”.

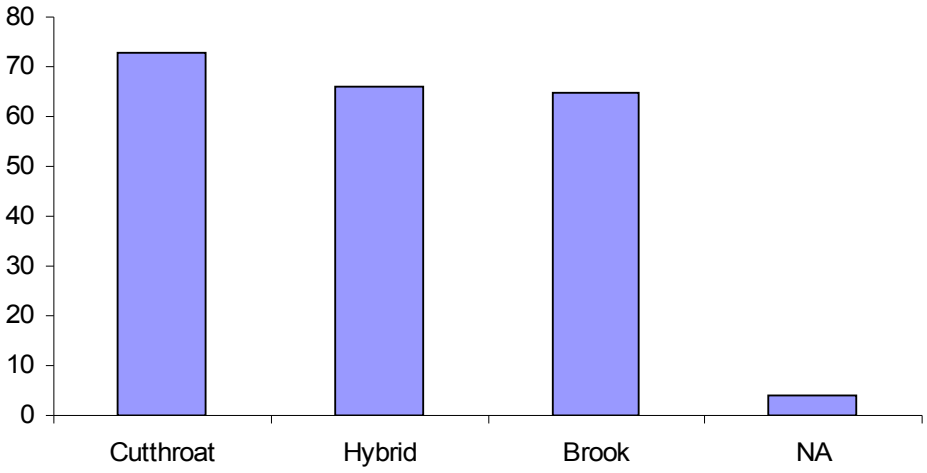
The previous two questions demonstrate that anglers would prefer to see brook trout stocked in Henrys Lake. However, the majority of anglers are somewhat concerned for impacts resulting from the stocking on native species.



Responses to the question “I come to Henrys Lake to catch native cutthroat trout (1-5 scale)”.

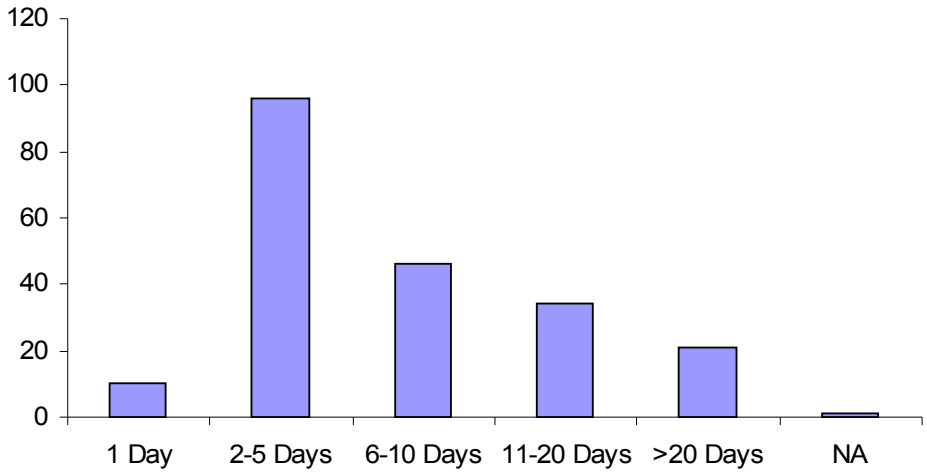


Response to the question "If I only caught one fish today, I would prefer it to be ____".

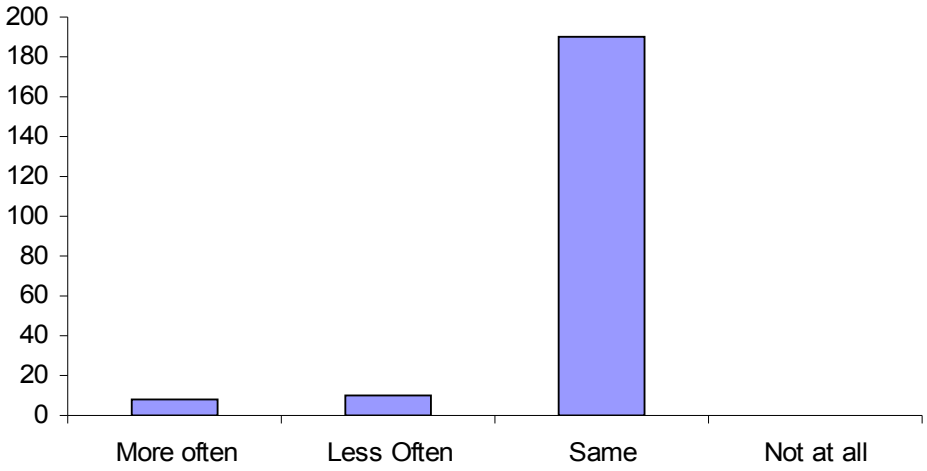


Response to the follow-up question "My second choice would be ____".

Of all anglers surveyed with these two questions, only 82 of 208 anglers (39%) did not have brook trout listed as their species of first or second choice. 42% of anglers chose hybrid trout as their first choice fish, while 29% of anglers had brook trout as their first choice. It is likely that the angling clientele that fishes Henrys Lake during the fall would be more inclined to rank brook trout as their species of choice.



Average number of days spent by anglers fishing Henrys Lake annually.



Response to the question “If the brook trout catch in Henrys Lake declines but overall catch remains the same, would you fish Henrys Lake _____”.

Of the anglers listed as saying they would fish Henrys Lake less often if brook trout were not stocked, several mentioned that they would still fish in the spring but would not fish in the fall when brook trout are a more dominant component in the catch.

2002 ANNUAL PERFORMANCE REPORT

State of:	Idaho	Program:	Fisheries Management F-71-R-27
Project:	I-Surveys and Inventories	Subproject:	I-G Upper Snake Region
Job No.:	c	Title:	Rivers and Streams Investigations

Contract Period: July 1 2002 to June 30 2003

ABSTRACT

We conducted mark-recapture population estimates on four sections of the Henrys Fork Snake River to obtain fish population parameters and density estimates. Estimates were conducted on the Mack's Inn reach, Box Canyon, Stone Bridge reach and the confluence with the South Fork Snake River. We compared estimates to previous years samples, and found overall abundance of rainbow trout *Oncorhynchus mykiss* to be similar to past years' samples in two of four reaches sampled (Box Canyon, Stone Bridge). Densities in the Mack's Inn and confluence reaches were substantially lower than in previous samples. Quality stock density (QSD) was higher than previous surveys for all reaches sampled. Age and growth of trout was assessed with otolith analysis. Mean size of rainbow trout at age-three was 364 mm and 311 mm in the Box Canyon and Stone Bridge reaches, respectively. A catch curve was developed and used to estimate mortality and survival. Estimates for mortality were 40% and 38% annually for the two reaches, respectively. Catch curve information was also used to correlate year-class variation with flow. However, low variation in flow levels over the past several years clouded predictions on environmental effects on year-class variability.

We compared data collected during the Box Canyon survey to evaluate the violation of assumptions associated with population estimates including waiting one week (immigration/emigration) and sampling within a shorter time period (unequal vulnerability to sampling gear). Data collected on both marking days was analyzed as a separate mark-recapture estimate and compared to the same data incorporated in the typical one-week assessment. Population estimates for rainbow trout were similar between methods, with acceptable coefficient of variation (CVs). Analysis was also conducted on mountain whitefish *Prosopium williamsoni* in the same manner and showed significant differences between samples, although CVs were higher for both methods than that considered acceptable.

We conducted electrofishing surveys on three sections of the Big Lost River below Mackay Dam to estimate population densities and gather fishery population parameters. Densities of trout in the Leslie section were 342 fish per ha and were higher than previous surveys conducted in 1991. Densities of rainbow trout in the Houston Bridge area were 153 fish per ha and 961 fish per ha in the Campground section. Population estimates on mountain whitefish were also conducted and averaged 21 fish per ha in the upper two reaches sampled, while the lower section had less than one fish per ha. Age and growth information of trout in the Big Lost River was also collected during the 2002 surveys. Mean size of rainbow trout at age three was 338 mm. A catch curve indicated rainbow trout mortality was 45% annually. The catch curve was also used to correlate year-class variation with environmental factors, and showed that flow levels greater than 5 m^3/s in April had a significant effect on shaping year-

class strength. High flows were strongly correlated with weak year-classes, while low flows were related to strong year-classes.

In the South Fork Snake River, a total of 1,608 trout were captured during four days of electrofishing at the Conant section in October 2002. Trout species composition and relative abundance were Yellowstone cutthroat trout *O. clarki* (53%), rainbow trout and hybrid rainbow trout x cutthroat trout (34%), brown trout *Salmo trutta* (14%), and lake trout *Salvelinus namaycush* (<1%). No kokanee *O. nerka kennerlyi* were caught. Estimated densities were 841 fish/km for cutthroat trout, 809 fish/km for rainbow and hybrid trout, 288 fish/km for brown trout and 1,805 fish/km for all species combined.

A total of 1,264 trout were captured during four days of electrofishing at the Lorenzo section in September 2002. Trout species composition and relative abundance were cutthroat trout (18%), rainbow trout and hybrid trout (<1%), and brown trout (81%). No lake trout or kokanee were caught. Estimated densities were 246 fish/km for cutthroat trout, 1,036 fish/km for brown trout and 1,385 fish/km for all species combined. Rainbow and hybrid trout density estimates were not possible due to the small sample size.

At Conant, mean total length was 338 mm for cutthroat trout, 326 mm for rainbow and hybrid trout, 339 mm for brown trout, and 334 mm for all species combined. Quality stock density (QSD) was 4.0% for cutthroat trout, 23.6% for rainbow and hybrid trout, 34.0% for brown trout, and 14.4% for all species combined. At Lorenzo, mean total length was 316 mm for cutthroat trout, 340 mm for rainbow and hybrid trout, 321 mm for brown trout, and 321 mm for all species combined. Quality stock density (QSD) was 2.3% for cutthroat trout, 16.7% for rainbow and hybrid trout, 14.4% for brown trout, and 12.1% for all species combined.

Trout Unlimited volunteers helped salvage approximately 702 fish in the dewatered south channel at Twin Bridges on November 2, 2002. Most fish were brown trout (690), followed by cutthroat trout (11), and numerous mountain whitefish. One additional hybrid trout was removed.

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HENRYS FORK SNAKE RIVER

Methods

Population Monitoring

We used two drift boat electrofishers to collect fish samples in three of four sections of the Henrys Fork Snake River (Mack's Inn, Box Canyon and Stone Bridge), (Appendix A), while a standard motorized electrofishing boat was used in the confluence section. All methods employed a marking run (one day in all sections except Box Canyon, which was two days marking), followed by a five to seven day rest and a single-day recapture event. All fish collected during marking runs were marked with a caudal fin hole punch, measured for total length (mm) and released to the area of capture. Population estimates were made using Peterson's mark-recapture with Chapman's modification, which allowed comparisons to previous years to be made. We collected otoliths from a random sub-sample of fish throughout the Box Canyon and Stone Bridge reaches for age and growth analysis. Length at age, mortality and survival were all calculated based on catch-curve and otolith analysis. We attempted to correlate year-class strength to monthly flows by plotting catch curve residuals against mean monthly flows. Relationships were considered significant when a high r^2 value fitted the plot and the results were biologically valid.

Evaluation of Mark Recapture Methods

We analyzed data collected during normal population estimates on the Box Canyon with two different methods. The first method treated the two-day marking event as a separate marking day and recapture day immediately following the marking period. The second method incorporated the first two collection days as marking events and the collection event a week later as the recapture day. Data from both methods was analyzed with Peterson's mark-recapture method with Chapman's modification for consistency among years. Results were compared (population estimate, 95% confidence intervals and coefficient of variation for both rainbow trout *Oncorhynchus mykiss* and mountain whitefish *Prosopium williamsoni*) to assess the efficacy of waiting a week between marking periods compared to sampling on concurrent dates.

RESULTS

Population Monitoring

Mack's Inn Reach

We collected a total of 1,004 fish during the two-day mark-recapture event in Mack's Inn reach of the Henrys Fork Snake River. Species composition was dominated by mountain

whitefish (83% of total catch) followed by rainbow trout (17%) and Yellowstone cutthroat trout *O. clarki bouvieri* (<1%). Rainbow trout size structure was skewed significantly towards larger, trophy fish (QSD of 95, Figure 1), with a mean size of 445 mm, median size of 480 mm, and 41% of all captured rainbow trout greater than 500 mm. We estimated a total reach population of 1,593 rainbow trout (95% CI 273-2,912, CV = 0.42) which equates to 332 rainbow trout per kilometer. This estimate is well below the 1994 estimate of 722 rainbow trout per km (Gamblin et al. 2002). We also estimated a mountain whitefish population of 3,300 fish (95% CI 2,374-4,228, CV = 0.14), which equates to 688 fish per km. This is the first year population estimates on mountain whitefish were conducted on this reach.

Box Canyon

We collected 1,991 fish during the three days of electrofishing in Box Canyon. Species composition of fish handled was dominated by rainbow trout (83%) followed by mountain whitefish (17%) and splake *Salvelinus fontinalis x S. namaycush*, brown trout *Salmo trutta* and brook trout *Salvelinus fontinalis* (<1%). Size distribution of rainbow trout was skewed towards larger fish (QSD-400 = 40, Figure 2), with mean size of 351 mm, median size of 370 mm, and less than 1% of the captured fish being greater than 500 mm. We estimated 6,668 rainbow trout (95% CI = 5,404-7,932, CV = 0.10) in the reach, which equates to 1,802 fish per km. This density estimate is at the 15-year average for this reach of river (Figure 3). Mountain whitefish estimates were conducted this year for the first time. We estimated 2,607 whitefish in this reach (95% CI = 895-4,319, CV = 0.34), which equates to 705 fish per km.

We also collected mean length at age information by analyzing otoliths from a random sample of fish collected during electrofishing efforts (Table 1). Results show growth to be faster than other water bodies in Idaho, with rainbow trout reaching 401 mm by age-four (Table 2). We developed mortality/survival estimates for rainbow trout in Box Canyon based on catch curve analysis (Figure 4). Estimated annual survival between age-three and age-six was 60% (Table 3), which is slightly higher than in 1987, when Corsi estimated annual survival of rainbow trout to be 47% over an unspecified age range (Corsi and Elle 1989).

Stone Bridge

We collected 1,440 fish in the Stone Bridge reach of the Henrys Fork Snake River during the two-day population estimate. Species composition was 64% rainbow trout, 30% mountain whitefish and 6% brown trout, although these are likely biased to some degree by an increased emphasis on collecting trout over mountain whitefish. Rainbow trout and mountain whitefish were not as large as those found in the upper reaches of the river (Figures 5 and 6), with QSD of 22 and 2 for rainbow trout and mountain whitefish, respectively. Mean size of rainbow trout was 327 mm, with a median of 333 mm, and two fish captured greater than 500 mm. We estimated 8,263 rainbow trout in this reach (95% CI = 5,321-11,204; CV = 0.18), which equates to 802 fish per km. The mountain whitefish estimate was 22,355 fish (95% CI = 0-47412 fish; CV = 0.57), which equates to 2,170 fish per km. Brown trout were substantially larger for this reach of the river, with a QSD of 75 (Figure 7). We estimated 869 brown trout (95% CI = 0-1,803 fish; CV = 0.55) which equates to 84 fish per km. The estimated population of rainbow trout was less than in 1997 and 1988 but nearly identical to 1990 estimates (Figure 8).

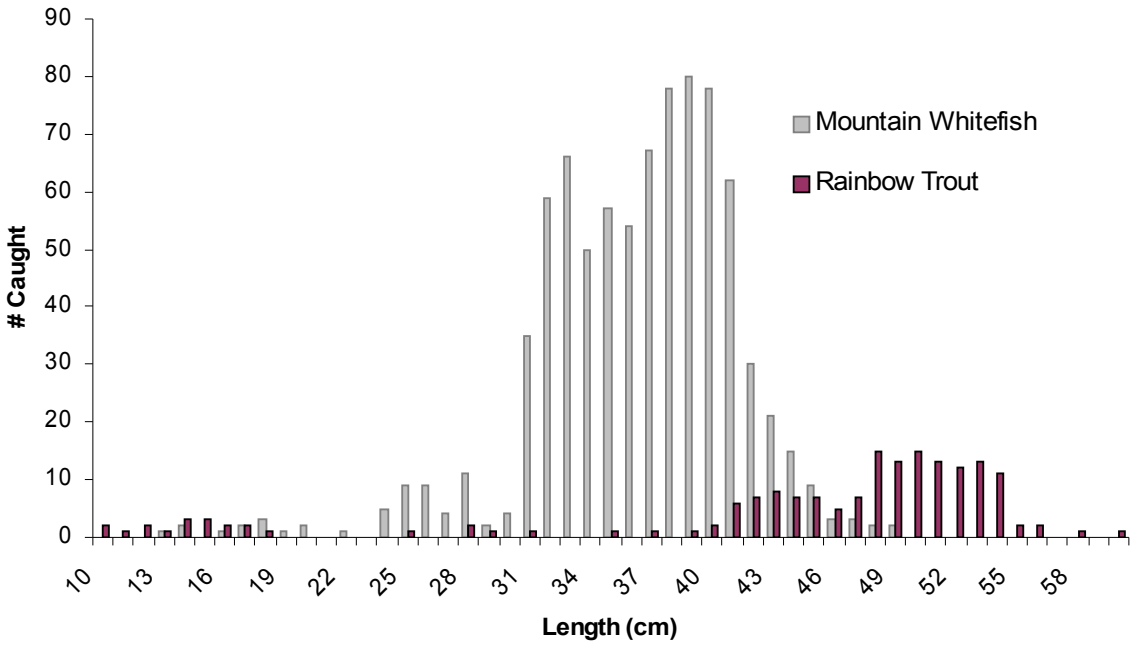

Figure 1. Length frequency distribution for fish collected electrofishing in the Mack's Inn reach of the Henrys Fork Snake River, Idaho, 2002.

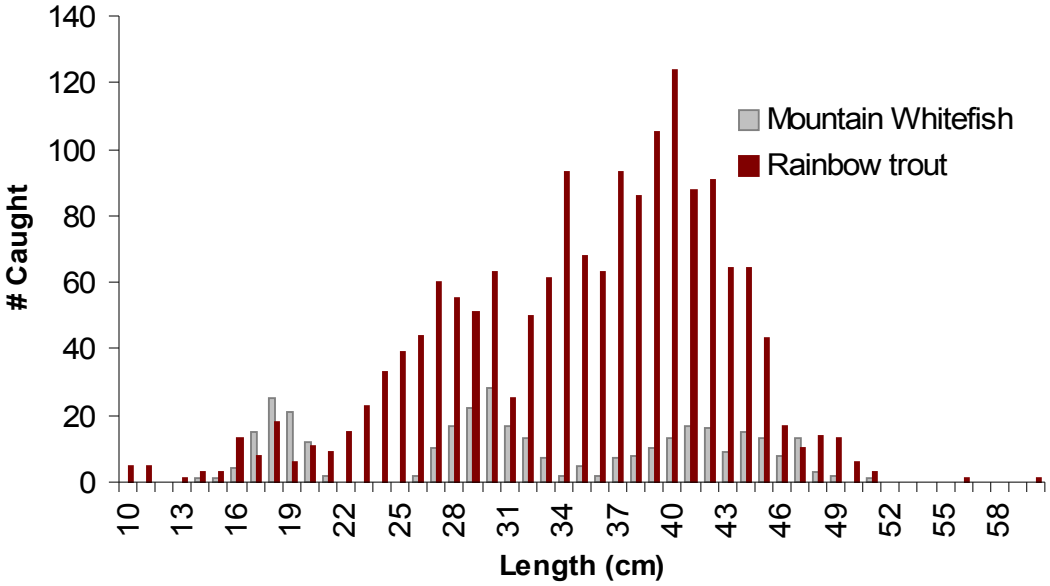

Figure 2. Length frequency distribution for fish collected electrofishing in the Box Canyon reach of the Henrys Fork Snake River, Idaho, 2002.

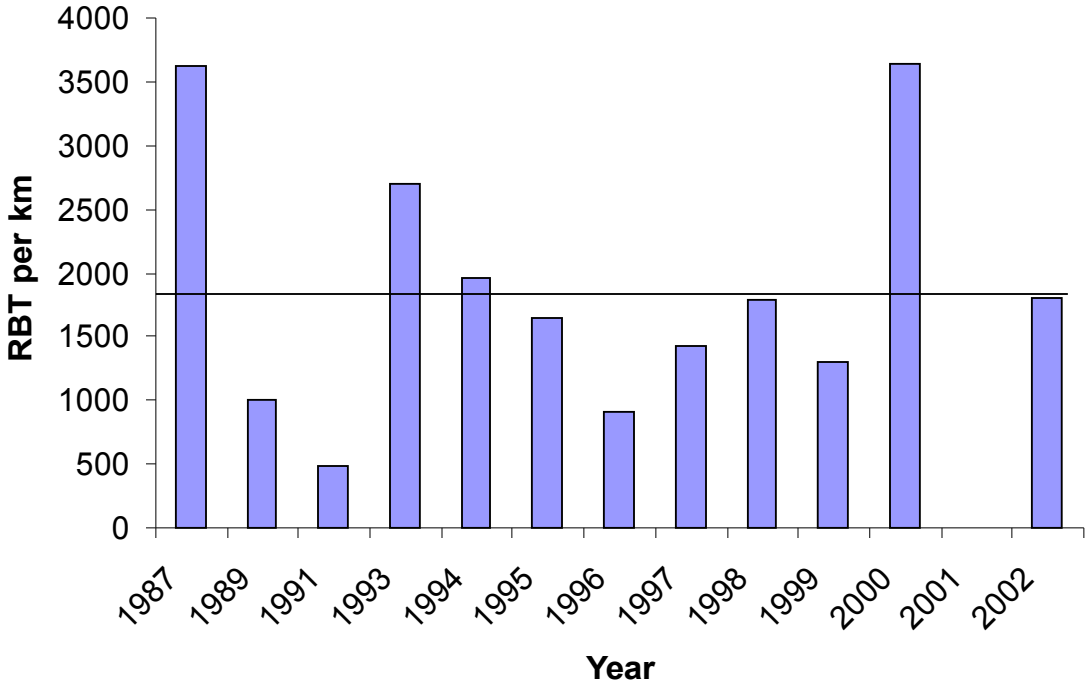

Figure 3. Annual population estimates (rainbow trout per km) for Box Canyon rainbow trout in the Henrys Fork Snake River, Idaho. Solid line indicates mean rainbow trout per km since 1993.

Table 1. Mean length at age based on otolith analysis of rainbow trout (RBT) and mountain whitefish (MWF) collected electrofishing in the Henrys Fork Snake River, Idaho, 2002.

	Mean length at age									
Species and location	1	2	3	4	5	6	7	8	9	10
RBT (Box Canyon)	150	295	364	401	416	425	--	--	--	--
RBT (Stone Bridge)	222	257	311	370	391	381	430	280	540	--
MWF (Box Canyon)	234	310	--	380	405	--	432	440	440	455

Table 2. Mean length at age four for rainbow trout collected in the Henrys Fork Snake River, Idaho, drainage compared to trout collected throughout Idaho.

Water Body	Mean length at age four
Henrys Fork (Box Canyon)	401 mm
Henrys Fork (Stone Bridge)	370 mm
Portneuf River[a]	360 mm
Big Wood River[a]	360 mm
Kootenai River at Hemlock Bar (1998)[a]	360 mm
Fall River[a]	320 mm
Medicine Lodge River[a]	280 mm
Little Lost River[a]	275 mm
Upper Warm River[a]	220 mm

[a] Adapted from Schill, 1992

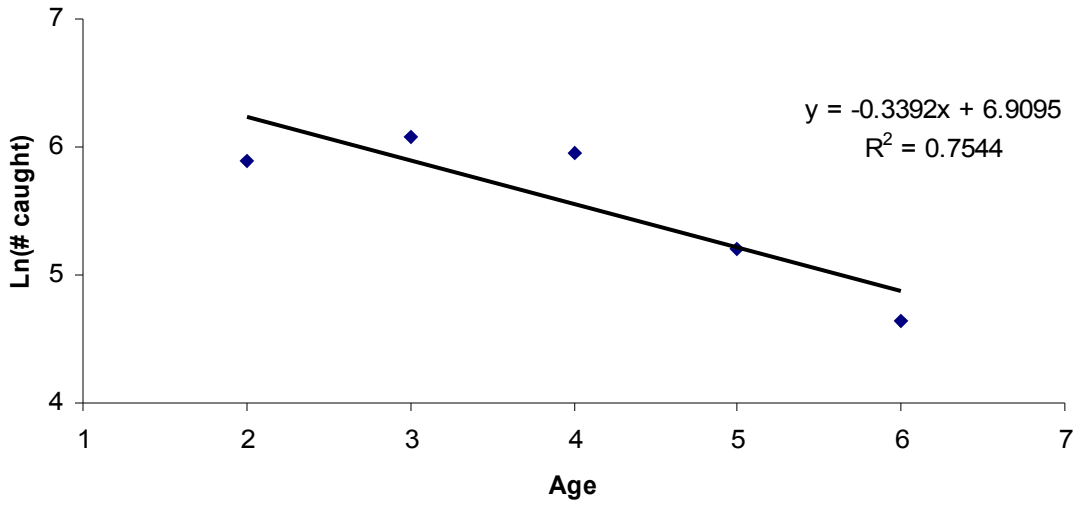

Figure 4. Catch curve for rainbow trout captured in the Box Canyon reach of the Henrys Fork Snake River, Idaho, 2002.

Table 3. Mortality and survival estimates for rainbow trout captured electrofishing in the Box Canyon reach of the Henrys Fork Snake River, Idaho, 2002. Estimates from age three to six are likely the most accurate estimates for Box Canyon, while ages two to six are likely the most accurate for the Stone Bridge reach.

		Estimate		
Location	Age class	Z	Survival (%)	Mortality (%)
Box Canyon	2 to 5	-0.220	80	20
	2 to 6	-0.339	71	29
	3 to 5	-0.444	64	36
	3 to 6	-0.510	60	40
Stone Bridge	2 to 6	-0.471	62	38
	3 to 6	-0.657	52	48
	3 to 9	-0.535	59	41

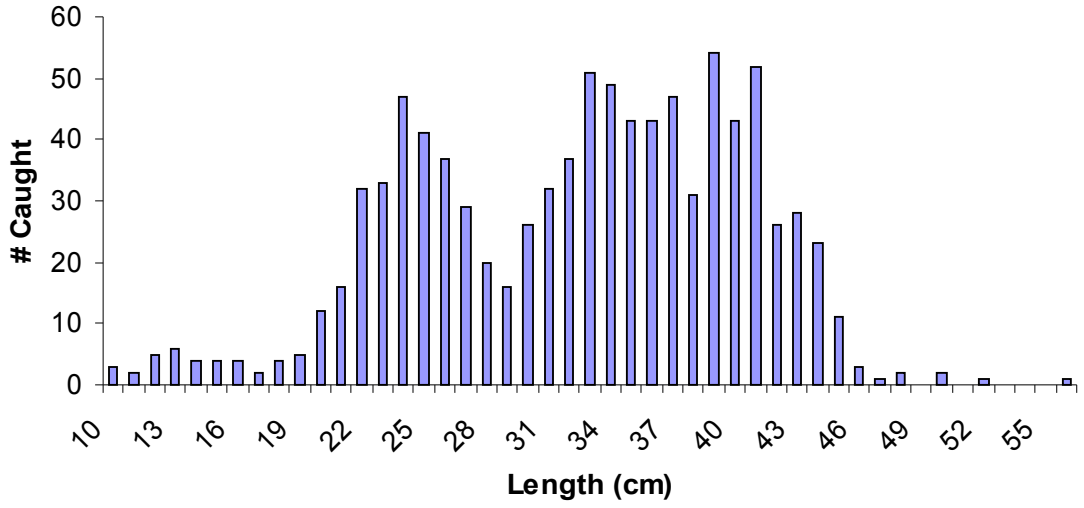

Figure 5. Length frequency distribution for rainbow trout collected electrofishing in the Stone Bridge reach of the Henrys Fork Snake River, Idaho, 2002.

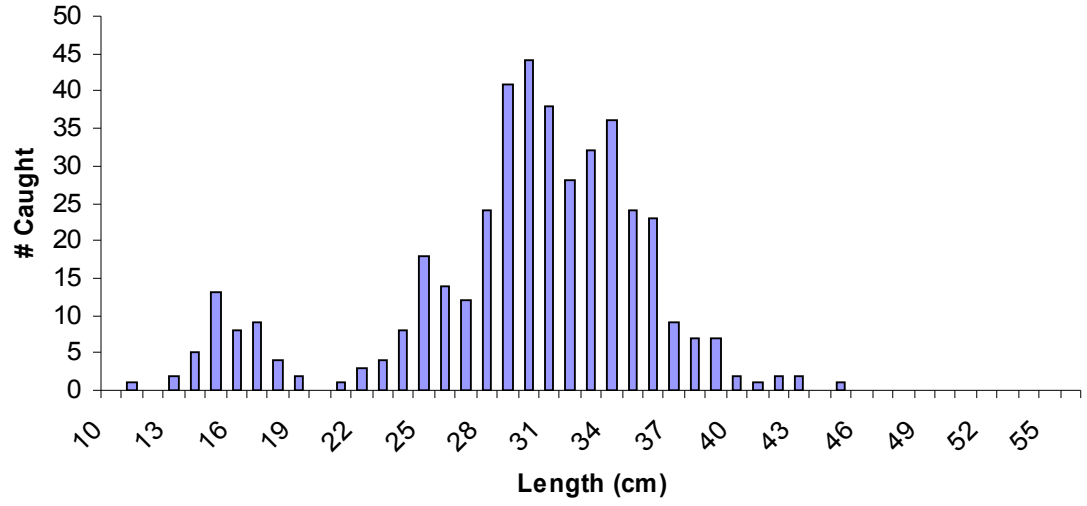

Figure 6. Length frequency distribution for mountain whitefish collected electrofishing in the Stone Bridge reach of the Henrys Fork Snake River, Idaho, 2002.

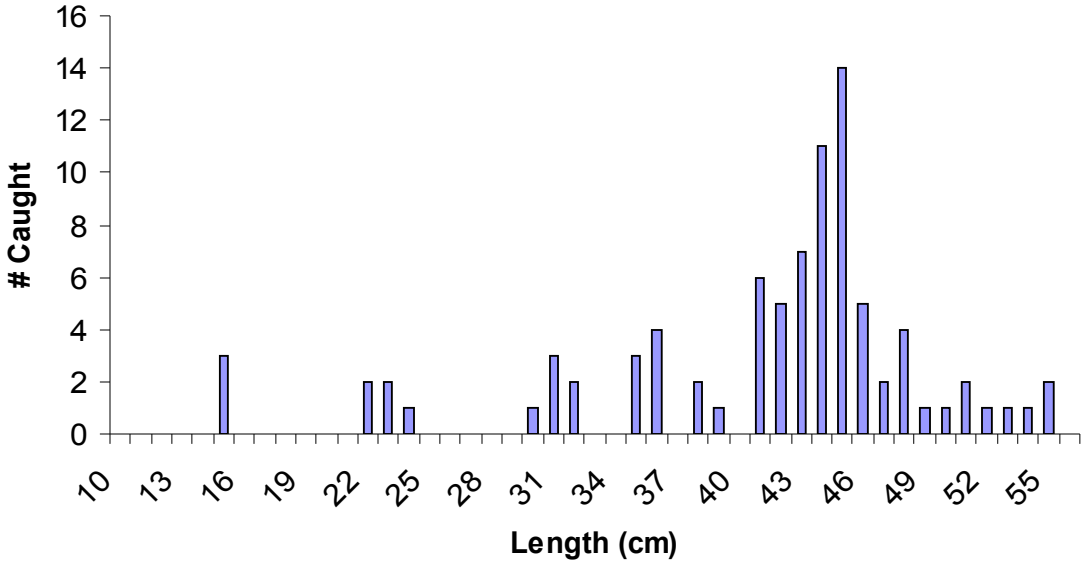

Figure 7. Length frequency distribution for brown trout collected electrofishing in the Stone Bridge reach of the Henrys Fork Snake River, Idaho, 2002.

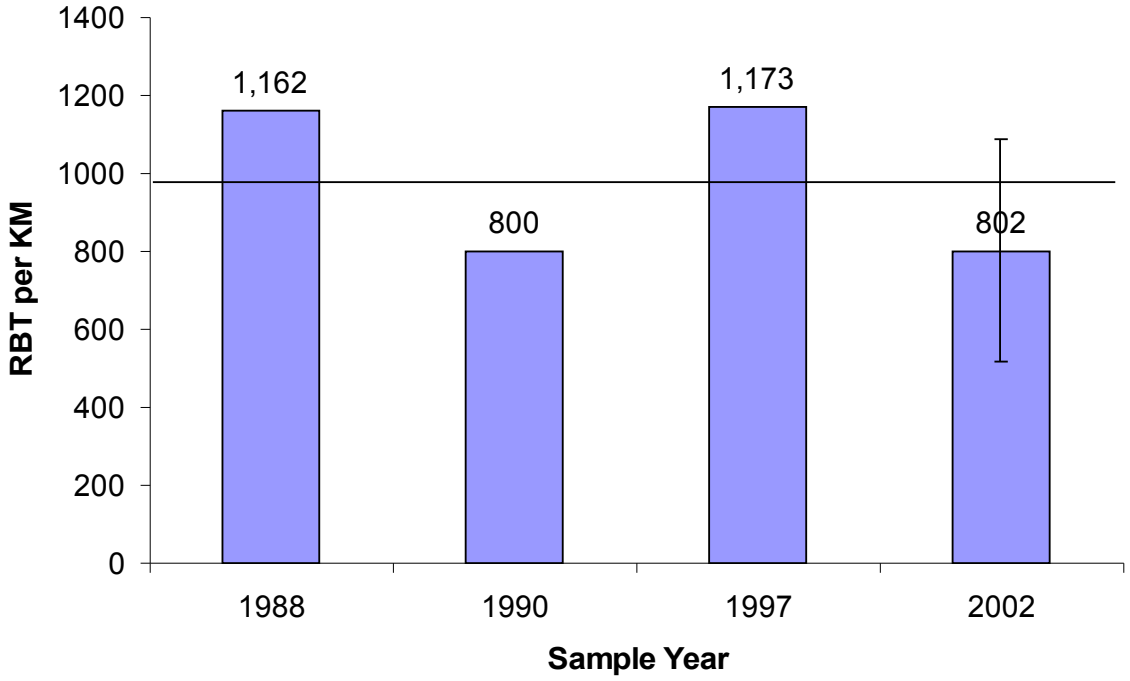

Figure 8. Rainbow trout density estimates for the Stone Bridge reach of the Henrys Fork Snake River, Idaho.

Growth was slower than in the upstream reaches, with rainbow trout reaching 311 mm by age-three (Table 4). Mortality/survival estimates for rainbow trout in Stone Bridge were developed based on catch-curve analysis (Figure 9). Trout survival between age-two and age-six was estimated to be 62% annually (Table 3).

Confluence Reach

We collected 124 fish in the Confluence section of the Henrys Fork Snake River. Species composition consisted of 56% mountain whitefish, 32% brown trout, 9% Yellowstone cutthroat trout and 2% rainbow trout. Size distributions were good, with QSD at 87, 45 and 25 for brown trout, Yellowstone cutthroat trout and rainbow trout, respectively. However, these figures may be influenced by the lack of smaller fish captured in these electrofishing samples (Figure 10). We were unable to collect enough fish of any species to develop population estimates, reliable age and growth information or mortality and survival estimates. A summary of population parameters for all sections sampled is presented in Table 4, while mark recapture information, estimates and flow data is presented in Table 5.

Evaluation of Mark Recapture Methods

The two methods used for estimating populations of fish in the Box Canyon reach of the Henrys Fork Snake River yielded similar estimates for rainbow trout (Figure 11) but significantly different results for mountain whitefish. Coefficients of variation, which are largely viewed as a measure of reliability for estimates like this (Van Den Avyle 1993), were at acceptable levels (<0.20) for rainbow trout but were slightly higher than that considered acceptable for mountain whitefish (Table 6).

Year-class Variability

Mean annual flows were strongly correlated to year-class strength, with higher mean annual flows resulting in stronger year-classes. Although overall flow variation was limited in Box Canyon during the winter, trend analysis of flow vs. recruitment for the winter months (January, February and March) all show that increased flows result in stronger year-classes. In Box Canyon, the strongest correlation was for mean June flows (Figure 12), again showing that higher flows produce stronger year-classes. We found similar results for the Stone Bridge reach of the river with higher mean flows in all months correlated to stronger year-classes. The strongest relationships were observed in winter and early spring flows and again in fall flows (Table 7).

Table 4. Population index summaries for the Henrys Fork Snake River, Idaho, 2002.

Reach	Mean length at age three	Median length	QSD	Fish per km	Species [a] composition (%) RBT	MWF	BRN	Annual mortality (%)	Percent > 500 mm
Mack's Inn	--	480	95	332	17	83	--	--	41 (RBT)
Box Canyon	364	370	40	1,802	83	17	--	40	< 1% (RBT)
Stone Bridge	311	333	22	802	64	30	6	38	< 1% (RBT)
Chester	--	--	48	501	--	--	--	--	--
Confluence	--	330	25	16 (BRN)	2	56	32	--	0 (BRN)

[a] RBT = rainbow trout, MWF = mountain whitefish, BRN = brown trout

Table 5. Data used in population estimates from the Henrys Fork Snake River, Idaho, during 2002 and flow levels during sampling.

River reach, species[a]	Number marked	Number captured	Number recaptured	Population estimate (N)	Confidence interval	Density (N per km)	Discharge (Q, m^3/s)
Macks Inn							<1
RBT	124	50	3	1,593	273 - 2,912	332	
MWF	183	645	35	3,301	2,374 - 4,228	668	
Box Canyon							24
RBT	1,065	512	81	6,668	2,374 - 4,228	1,802	
MWF	111	162	6	2,607	895 - 4,319	705	
Stone Bridge							64
RBT	501	427	25	8,263	5,324 - 11,204	802	
MWF	183	242	1	22,355	0 - 47,412	2,170	
BRN	59	28	1	869	0 - 1,803	84	
Confluence							90
RBT	4	0	0	--	--	--	
MWF	51	18	0	--	--	--	
BRN	21	18	2	138	22 - 255	16	

[a] RBT = rainbow trout, MWF = mountain whitefish, BRN = brown trout

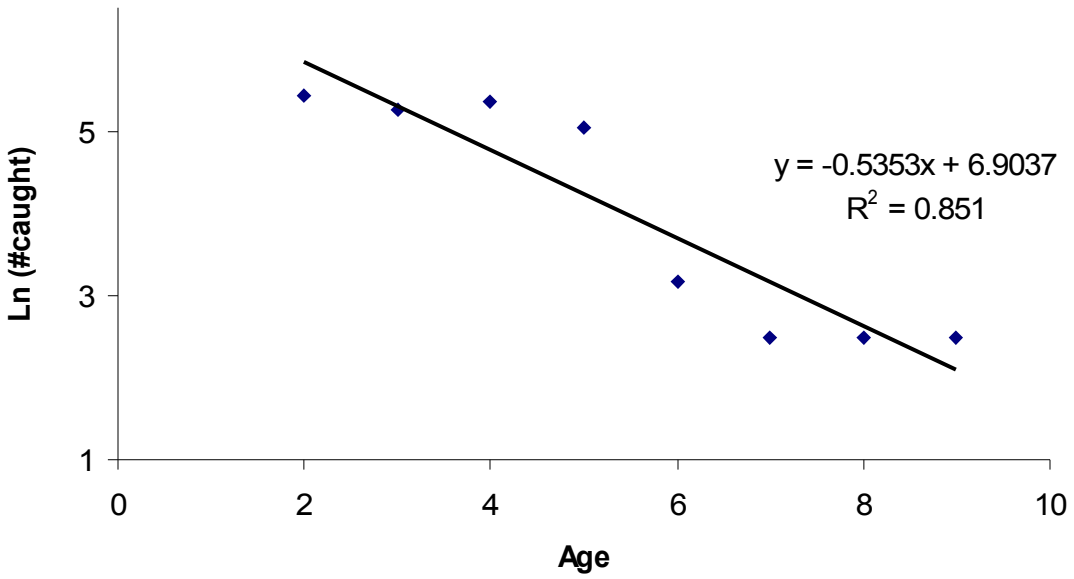

Figure 9. Catch curve for rainbow trout captured in the Stone Bridge reach of the Henrys Fork Snake River, Idaho, 2002.

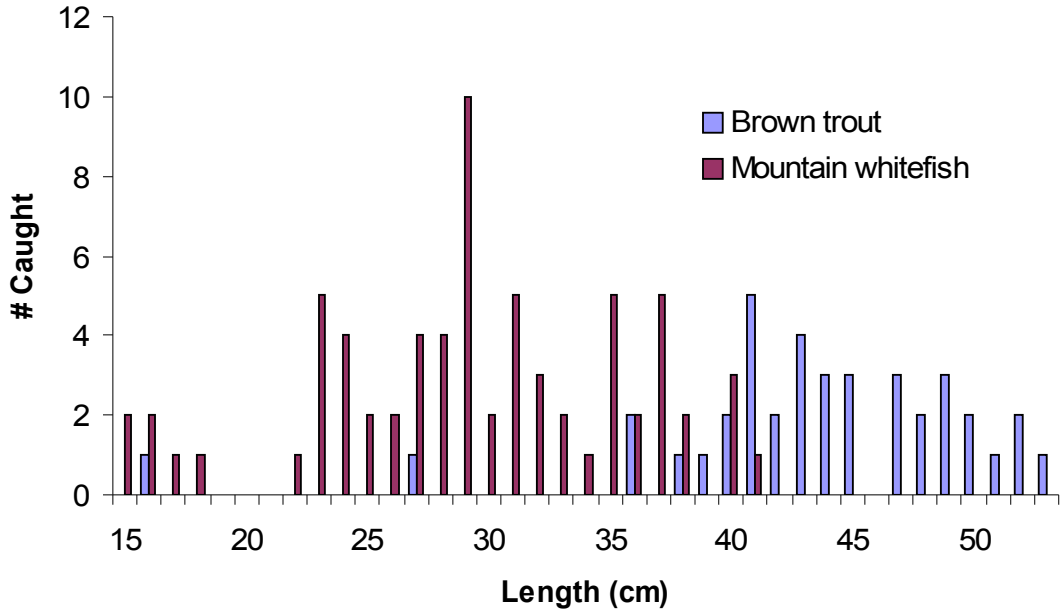

Figure 10. Length frequency distribution for fish captured electrofishing in the Confluence section of the Henrys Fork Snake River, Idaho, 2002.

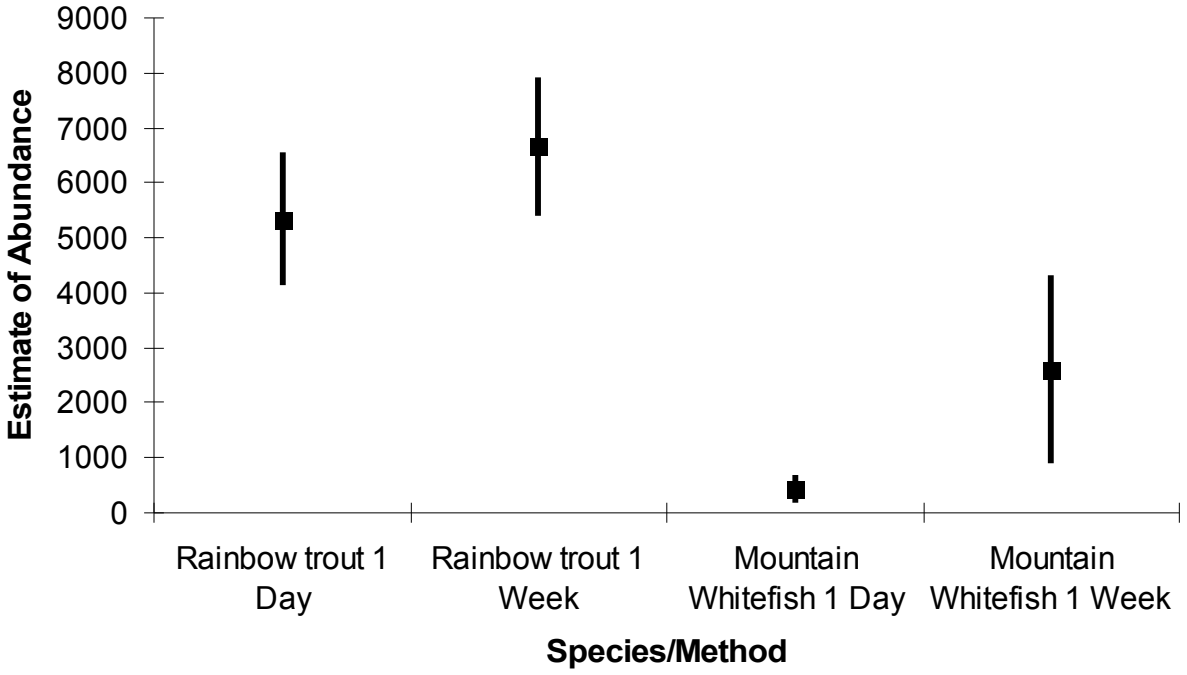

Figure 11. Comparisons of population estimates for rainbow trout (RBT) and mountain whitefish (MWF) using data collected in concurrent days (one-day event) and data collected with a week separating marking and recapture (one-week event).

Table 6. Comparisons of population estimate statistics for rainbow trout (RBT) and mountain whitefish (MWF) using data collected in concurrent days (one-day event) and data collected with a week separating marking and recapture (one-week event).

Metric	One day RBT	One week RBT	One day MWF	One week MWF
Estimate (N)	5,339	6,668	441	2,607
Variance V(N)	380,424	415,567	16,206	762,840
Coefficient of Variation (cv)	0.12	0.10	0.29	0.34
Standard Deviation (SD)	617	645	127	873
95% CI upper	6,548	7,932	691	4,319
95% CI lower	4,130	5,404	191	895
Range	2,418	2,527	499	3,424
% Change	23	19	57	66

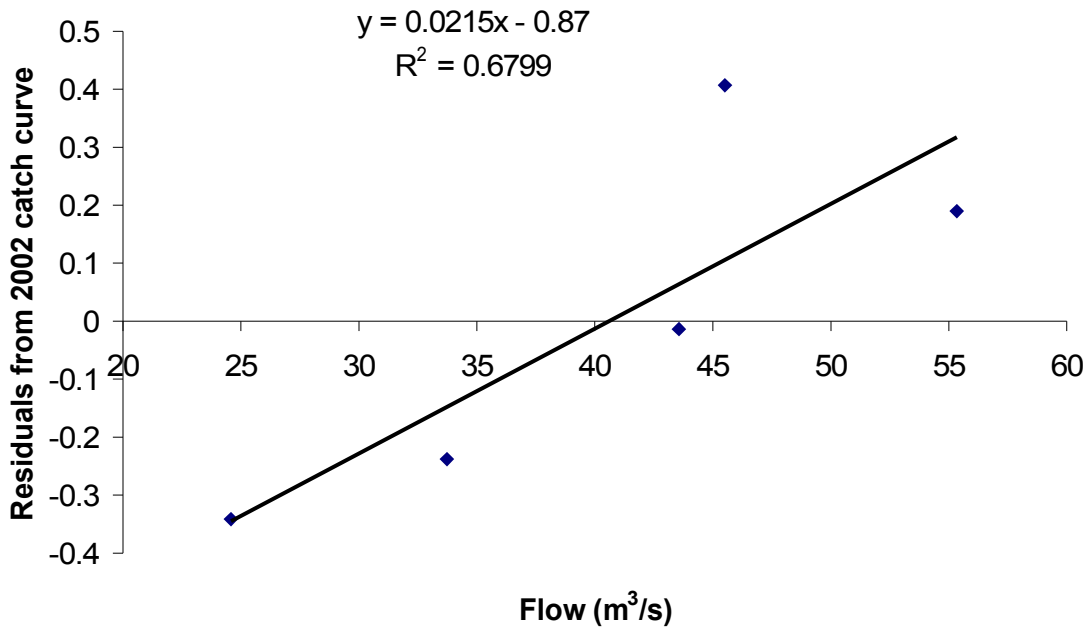

Figure 12. Mean June flows (1996-2000) versus catch curve residuals obtained from rainbow trout captured in the Box Canyon reach of the Henrys Fork Snake River, Idaho, 2002.

Table 7. R^2 values for regressions between mean monthly flows and catch curve residuals from the Box Canyon and Stone Bridge reaches of Henrys Fork Snake River, Idaho, 2002.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Box	0.35	0.07	0.10	0.13	0.29	0.68	0.10	0.48	0.04	0.34	0.57	0.63
St Br	0.69	0.80	0.79	0.37	0.60	0.46	0.42	0.49	0.68	0.82	0.67	0.29

Discussion

Population Monitoring

Mack's Inn Reach - Population estimates for rainbow trout on the Mack's Inn reach of the Henrys Fork Snake River in 2002 were significantly lower than in 1994 (Gamblin et al. 2002). Coefficients of variation, a measure used to determine the suitability of the population estimate used in this reach, indicate the estimates are not reliable and suggest that significant immigration and emigration occurred during the week between marking and recapture. Furthermore, the size structure of fish shows the fishery to be dominated by larger, adult fish. Given this combination of factors, it is very likely that the fishery sampled in May is composed of migrating, spawning fish from Island Park Reservoir. This migration may have been waning as the survey took place, with fish moving back to the reservoir. If such a migration were occurring, it would severely limit the potential for a recreational fishery in this reach, as the fishing season does not open until the majority of trout have moved back to the reservoir. Improvements to the fishery may be realized if a migration of late-running fish could be established.

Box Canyon - Box Canyon population estimates show the fishery to be healthy. Estimates were considered reliable, based on the low coefficients of variation. Density estimates are at the mean 15-year average, while size structure is the highest on record to date. Age and growth information show fast rainbow trout growth. Catch-curve analysis indicates year-class strength over the past five years is relatively constant, although stronger and weaker year-classes are apparent. Estimates of annual mortality are consistent with fast growing, minimally exploited populations and are comparable to estimates derived for the Big Lost River using identical methods. However, catch of older (> six years old) trout was nonexistent. When compared to other reaches of the river, it becomes apparent that this may be an aberration in sampling, as opposed to indications of higher mortality on older, larger fish. Differences derived between mortality estimates from 1987 and 2002 may be a factor of unreliability in ageing structures used. The 1987 sample utilized scales to determine ages, while the 2002 sample used otoliths. It is also possible that mortality/survival has changed over the 15 years between these surveys. Caution should be used when reviewing these mortality estimates, as they were developed based on catch-curve analysis and are not as accurate as cohort analysis. Additional years of data will be collected and used in cohort analysis methods for mortality estimation.

Length frequency analysis shows a disparity of catch on the smaller size classes of trout in Box Canyon. The fast flows and boulder habitat found in the canyon reach is more desirable to adult trout as opposed to juveniles. Although parts of Box Canyon are widely regarded as key spawning areas for this river reach, it may not offer as much juvenile rearing area as other reaches. Given the timing of this sample, it is possible this survey is influenced by migrating fish as opposed to the actual resident population. Future efforts should focus on determining if this sample is an accurate measure of the true resident population found in this river reach.

Stone Bridge - Population estimates in the Stone Bridge reach show a decline in rainbow trout abundance compared to upstream reaches. Estimates for rainbow trout densities are considered reliable (low CV), although mountain whitefish estimates are not. Species composition in this reach begins a trend away from dominance by rainbow trout, while brown

trout start to increase in abundance. Like mountain whitefish, brown trout abundance estimates are marred by a high coefficient of variation and are considered a preliminary estimate.

Age and growth analysis for rainbow trout and mountain whitefish indicated growth was slower in the Stone Bridge area than in the upstream reaches. Mortality and survival were remarkably similar between Box Canyon and Stone Bridge, and suggest some degree in reliability with these estimates. We expect to improve the accuracy of these measures in coming years with the implementation of cohort analysis.

Confluence Reach - Overall fish densities in the Confluence reach were well below any other reach. Size distribution as reflected in QSD was good for brown trout, but this was heavily influenced by the absence of smaller fish. The low gradient of the riverbed combined with heavy silt deposits from the collapse of the Teton Dam have significantly degraded the available habitat in this area. Heavy siltation has reduced primary production as well as spawning areas throughout this reach. Without significant improvements to the habitat, high densities of trout as found in other areas of the Henrys Fork Snake River will not be possible. As the hydrograph of the river is controlled to a large extent by dams and canals, broad-scale alterations to the habitat via flushing flows is unlikely. The fishery found here would be dependent from migrations of trout from nearby areas such as the Teton River, South Fork Snake River or upstream reaches of the Henrys Fork Snake River.

Evaluation of Mark Recapture Methods

Comparisons between trout population estimates derived from a one-day waiting period between marking and recapture and a one-week wait both resulted in statistically valid estimates for rainbow trout in Box Canyon. This suggests that violations to the assumptions of mark recapture models associated with immigration/emigration have a similar effect to violations associated with unequal vulnerability. In essence, for trout in this river reach, vulnerability to capture with a limited (one-night) rest between recapture and marking does not appear to be a significant factor in obtaining statistically valid population estimates. However, similar comparisons on mountain whitefish yielded statistical differences in population estimates. Given the relative time to recovery for whitefish after sampling with electrofishing, it is much more likely that estimates are heavily influenced by unequal vulnerability to electrofishing. Mountain whitefish estimates were not considered valid, primarily due to high coefficients of variation. Analysis of both species showed larger estimates after waiting a full week between mark and recapture and suggest there is bias associated with one or both methods. Although these conclusions are based on one year's worth of sampling, there is evidence that back-to-back sampling may be a viable alternative for rainbow trout if sampling with a week rest is not an option. Additional testing of this hypothesis is warranted and will be continued in future surveys.

Year-Class Variability

Attempts to measure year-class variability in the Henrys Fork Snake River were hampered by low variation in flows during the winter, which has been attributed to the primary controlling factor on year-class strength in the past (Mitro 1999). The low variation in flow

promotes scatter among data points and results in a fairly low r^2 value. Variation in year class strength was weakly correlated with mean monthly flows in the Box Canyon, while a stronger relationship exists in the Stone Bridge reach of the river. Flows in the Box Canyon are controlled by releases from Island Park Reservoir. During the years where analysis was conducted in this reach (year-classes from 1996-2000), flows did not vary to the extent they have in past years. This made it difficult to see relationships between flow and year-class variability. Despite the weak correlations to flow, the overriding trend of higher flows producing stronger year-classes was present, and corroborates Mitro's results. Winter flows during 2001 and 2002 have been extremely low. As these fish recruit to our sampling gear (as two-year-old fish), catch curve analysis is likely to show weaker year-classes of these fish and create stronger relationships between flow and year-class strength.

Year-class variability in the Stone Bridge reach of the Henrys Fork Snake River was similar to that in Box Canyon. Low variation in flow resulted in strong correlations among residuals but gave little useful information from a biological sense other than higher flows produce stronger year-classes. The low flows observed in 2001-2002 will likely help identify the relationship between monthly flows and year-class strength.

Recommendations

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

2. Continue collecting otolith samples for use in age, growth and cohort analysis from multiple reaches of the Henrys Fork Snake River to correlate environmental factors with year-class strengths.

3. Evaluate potential for establishing late-migrating run of trout out of Island Park Reservoir.

4. Continue efforts to assess the effectiveness of one-day vs. one-week waits between marking and recapture.

5. Use telemetry in Box Canyon to assess distribution of trout sampled in May to post-spawn locations, and assess whether these samples are representative of the fishery in this reach.

BIG LOST RIVER

Methods

We used a canoe electrofishing rig utilizing pulsed DC current to sample the fishery below Mackay Reservoir. Using two anodes and a crew of nine people, the boat was slowly pulled upstream while the sampling crews manipulated probes into all areas of the riverbed. Captured fish were measured for total length (mm), marked and released to the area of capture. The single-pass marking run was followed by a one-week rest period and a single pass recapture event. We sampled three reaches to represent the fishery in the area from Mackay Dam downstream to the Leslie Diversion. They were 1) Campground reach, 2) Upper Houston Bridge and 3) the Leslie Diversion (Figure 13). Locations of sample stations (UTMs) are given in Appendix B. Population estimates were made using Peterson's mark-recapture with Chapman's modification, which allowed comparisons to previous years to be made. Past estimates reported results in number of fish per hectare; the current report lists per ha estimates for comparisons as well as per kilometer estimates for region-wide comparisons. A random sub-sample of fish collected in all areas was used in age and growth analysis. Length at age, mortality and survival were all calculated based on catch-curve and otolith analysis.

We attempted to correlate year-class strength to monthly flows to evaluate the effects of abiotic factors on shaping year-class strengths. Residuals from the catch curve were plotted against a variety of mean monthly flows obtained from the USGS flow database. A relationship was considered valid if a strong trend were observed (high r^2 value) that could be attributed to biological realities associated with fish population dynamics.

Results

Leslie Reach

We collected a total of 708 fish during the two-day mark-recapture event in the Leslie reach of the Big Lost River. Species composition of captured fish was 55% rainbow trout, 45% brook trout and less than 1% mountain whitefish. Trout size structure was skewed significantly towards juvenile fish (Figure 14). Quality stock density (QSD) was low (2%). Population estimates for rainbow trout ≥ 200 mm derived for this reach were 244 fish (95% CI 188-300, CV = 0.12) or 136 rainbow trout per ha (244 per km). This estimate is significantly greater than the 57 rainbow trout per ha estimated in 1991 (Figure 15; Gamblin et al. 1993). Brook trout (≥ 150 mm) densities for this reach were estimated at 438 fish (95% CI 251-623, CV = 0.22) or 243 fish per ha (438 per km). Although significant numbers of juvenile mountain whitefish were encountered, capture of adult fish large enough to mark was limited and did not allow for estimates of abundance.

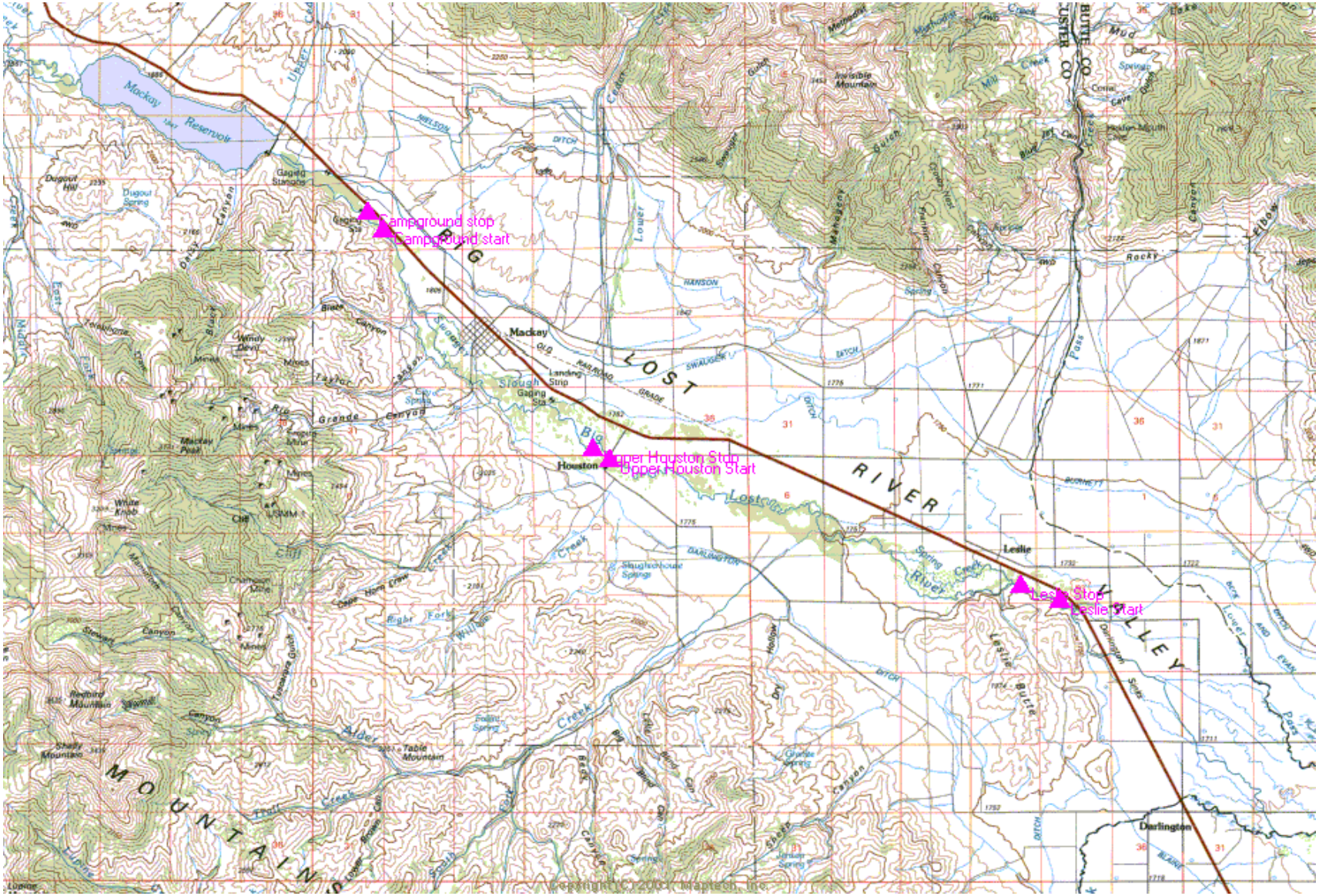

Figure 13. Map of the Lower Big Lost River, Idaho, showing the three areas sampled during 2002.

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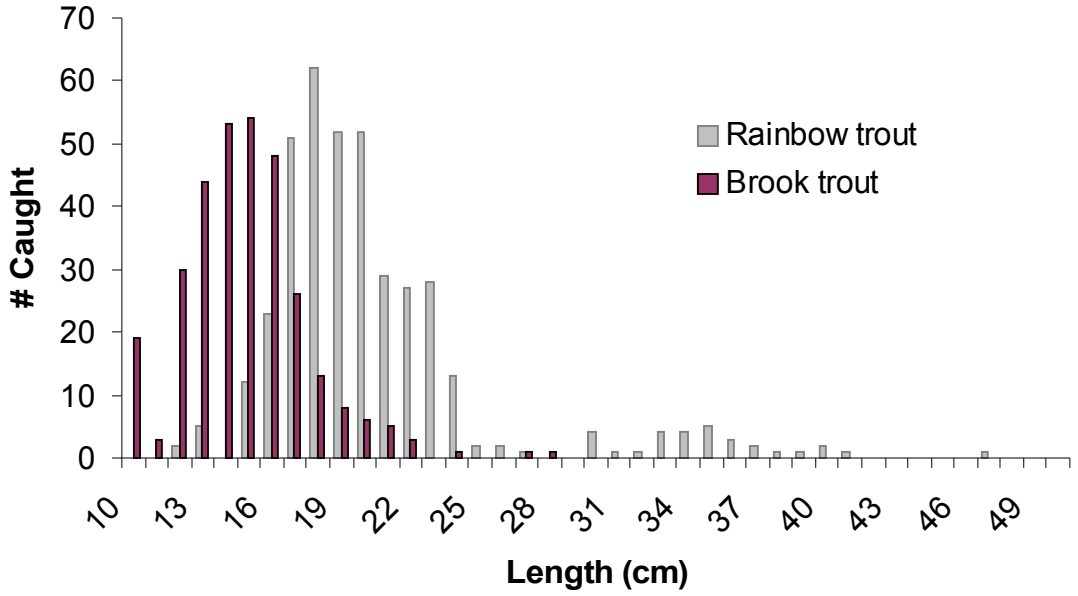


Figure 14. Length frequency distribution for trout captured in the Leslie reach of the Big Lost River, Idaho, 2002.

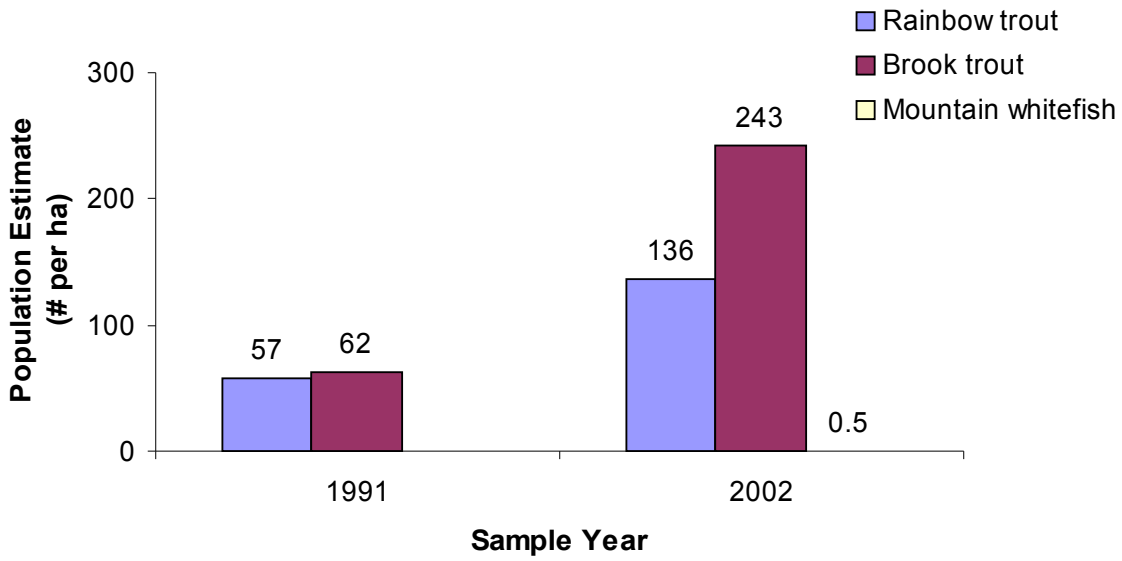


Figure 15. Population estimates for the Leslie reach of the Big Lost River, Idaho. Mountain whitefish densities were not estimated in 1991.

Houston Bridge

We collected 371 fish during the two-day mark-recapture event in the Upper Houston Bridge reach of the Big Lost River. Species composition of captured fish was 75% rainbow trout, 9% brook trout and 15% mountain whitefish. Population indices show a balanced trout size structure, with both juvenile and adult fish represented (Figure 16). Quality stock density for rainbow trout was 46%. Population estimates derived for rainbow trout ≥ 200 mm in this reach were 211 fish (95% CI 184-238, CV = 0.07) or 103 rainbow trout per ha (234 fish per km). We estimated brook trout densities (fish ≥150 mm) at 118 fish (95% CI 1-235, CV = 0.51) or 58 fish per ha (131 fish per km). Mountain whitefish abundance was estimated at 41 fish ≥ 200 mm (95% CI = 35-47, CV = 0.07) and equates to 20 fish per ha (46 fish per km).

Campground Reach

We collected 1,438 fish during the two-day mark-recapture event in the Campground reach of the Big Lost River. Species composition was 97% rainbow trout, 1% brook trout and 2% mountain whitefish. Population indices show trout size structure to be skewed towards adult fish with few juveniles captured (Figure 17). Quality stock density (400 mm) reflects a healthy fishery at 44%. We estimated a population of 1,874 rainbow trout ≥200 mm (95% CI 1,721-2,026, CV = 0.04) or 910 rainbow trout per ha (1,874 RBT/km, Figure 18). Brook trout densities for this reach were estimated at 17 fish ≥150 mm (95% CI 4-29, CV = 0.40) or 8 fish per ha (17 fish per km). Mountain whitefish abundance was estimated at 46 fish ≥ 200 mm (95% CI = 27-64, CV = 0.21) and equates to 22 fish per ha (45 fish per km). Densities of fish per section are displayed in Figure 19. Population parameters for all sections are displayed in Table 8.

Population Parameters

Seventy-four rainbow trout were aged, and mean length at age was determined from otolith analysis. Mean length at age-three was 338 mm, and was comparable to growth in the Henrys Fork Snake River and slightly greater than that found in the Big Lost River in 1987 (Table 9; Corsi and Elle 1989). Numbers of aged fish captured were expanded to the total number of fish caught. Results were used to build a catch-curve and estimate mortality (Figure 20). Mortality ranged from 41 to 45% depending on age classes used with the most reliable estimate at 45% from age-two to age-six (Table 10). Age and growth information was also collected on mountain whitefish and showed growth of these fish to be similar to rainbow trout in the Big Lost River. Sample sizes on these fish were too small to estimate mortality. Based on the catch-curve, year-class strength is variable, with strong year-classes being produced in 1997 and 1998, while weaker year-classes were produced in 1999 and 1996. Analysis of data collected in the Henrys Fork Snake River also show similar year-class strength patterns observed in the Big Lost, with strong year-classes produced in 1998 in all areas sampled and weak year-classes produced in 1996 in all areas. Similar yet weaker relationships were noted in 1997 (slightly strong year-classes) and 2000 (slightly weak year-classes).

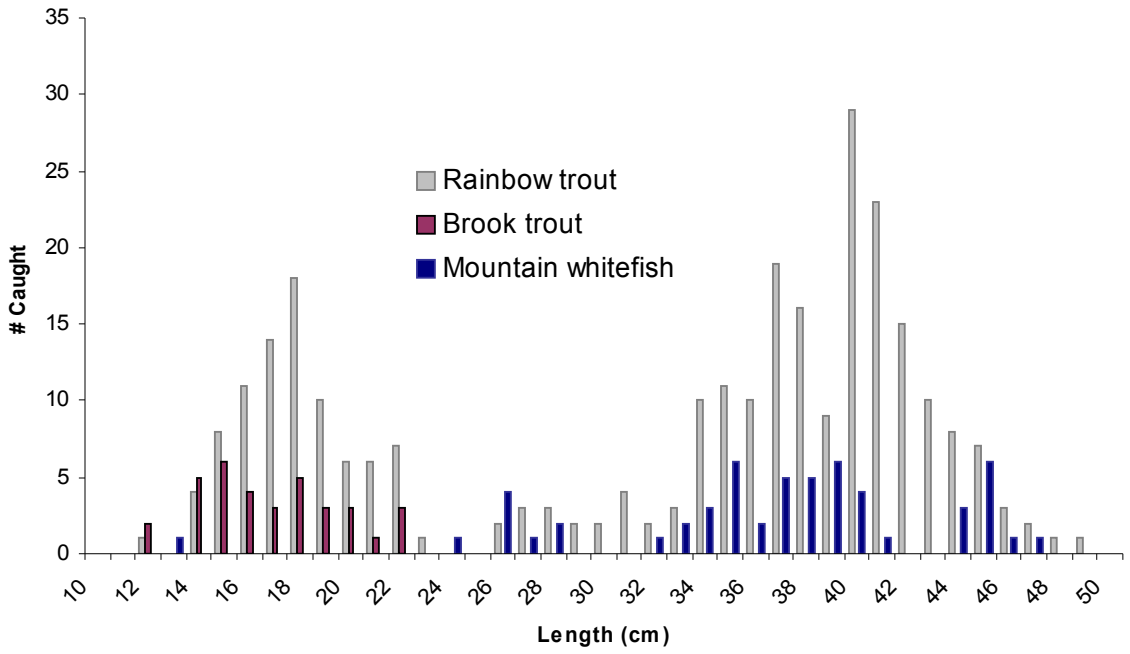


Figure 16. Length frequency distribution for fish captured electrofishing in the Upper Houston Bridge reach of the Big Lost River, Idaho, 2002.

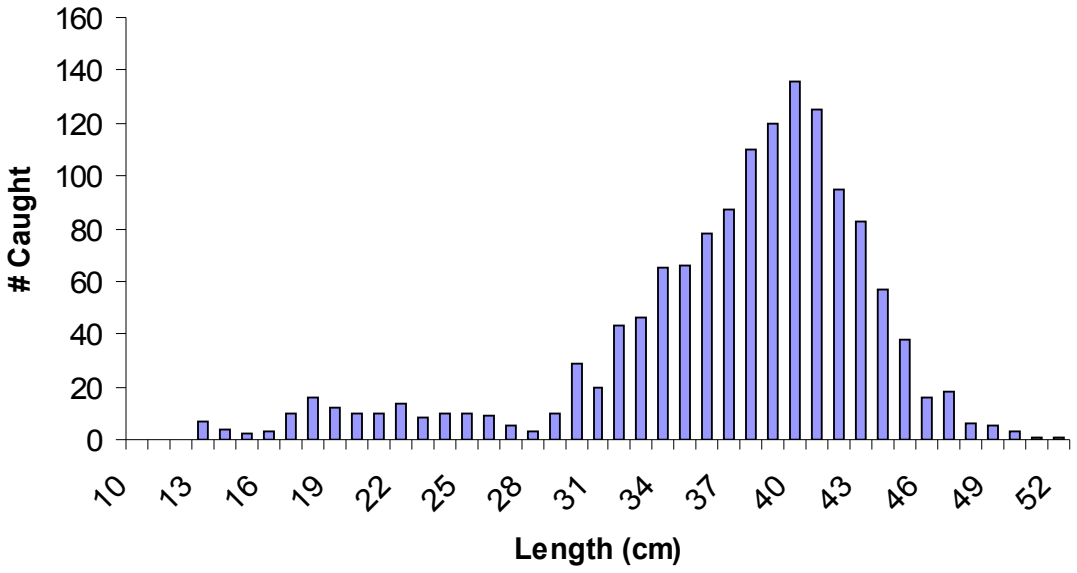


Figure 17. Length frequency distribution for rainbow trout captured electrofishing in the Campground reach of the Big Lost River, Idaho, 2002.

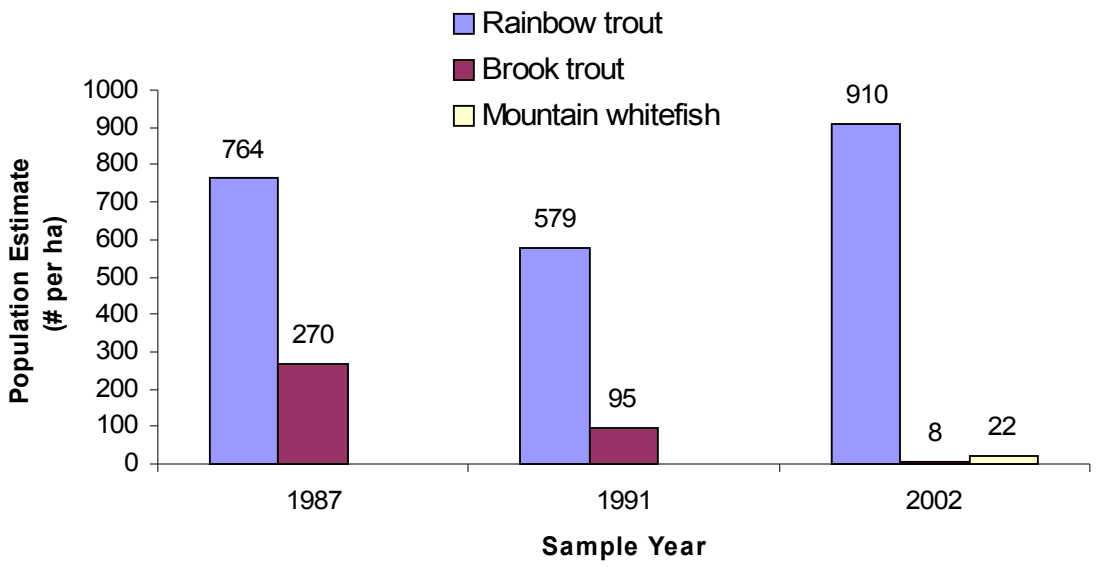


Figure 18. Population estimates for the Campground reach of the Big Lost River, Idaho.

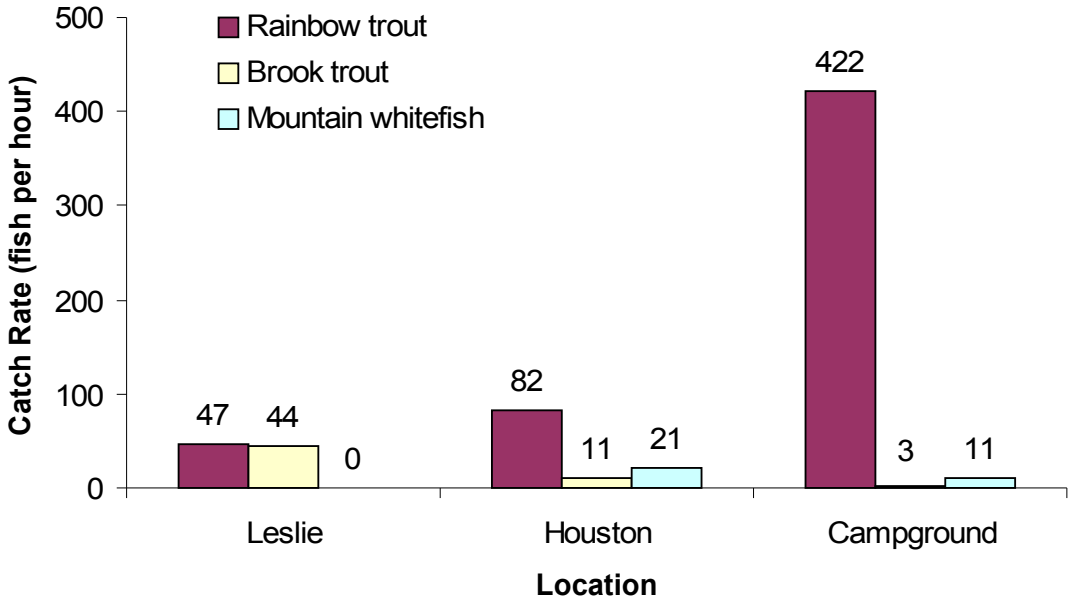


Figure 19. Catch rates (fish per hour electrofishing) for fish captured in the Big Lost River, Idaho, 2002.

Table 8. Population parameters for rainbow trout collected electrofishing in the Big Lost River, Idaho, 2002. Ages of fish were obtained by otolith analysis. Age and growth and mortality estimates were calculated on the entire fishery as opposed to reach-specific segments.

Reach	Length at age three (mm)	Median length (mm)	QSD (%)	RBT/km	Species composition (%)			Annual mortality (%)
					RBT	MWF	BKT	
Leslie		190	2	244	55	45	<1	
Campground	338	380	44	1,874	97	2	1	
Houston Bridge		365	46	234	75	15	9	45

Table 9. Mean length at age for fish collected electrofishing in the Big Lost River (BLR) and Henrys Fork Snake River (HFSR), Idaho, 2002.

Species	Mean length at age						
	1	2	3	4	5	6	7
BLR Rainbow Trout (2002)	110	186	338	402	409	475	428
BLR Mountain Whitefish (2002)	--	265	369	397	450	--	440
HFSR Stone Bridge RBT (2002)	222	257	311	370	391	381	430
HFSR Box Canyon RBT (2002)	150	295	364	401	416	425	--
BLR Rainbow Trout (1987) [a]	104	185	277	351	424	467	534

[a]1987 estimates were derived with scale analysis by Corsi and Elle (1989).

Table 10. Catch curve analysis for rainbow trout captured in the Big Lost River, Idaho, 2002. Estimate from ages two to six is likely most representative of actual mortality.

Age class	Estimate		
	Z	Survival (%)	Mortality (%)
2 to 6	-0.60	55	45
2 to 7	-0.57	57	43
3 to 6	-0.55	58	42
3 to 7	-0.52	59	41

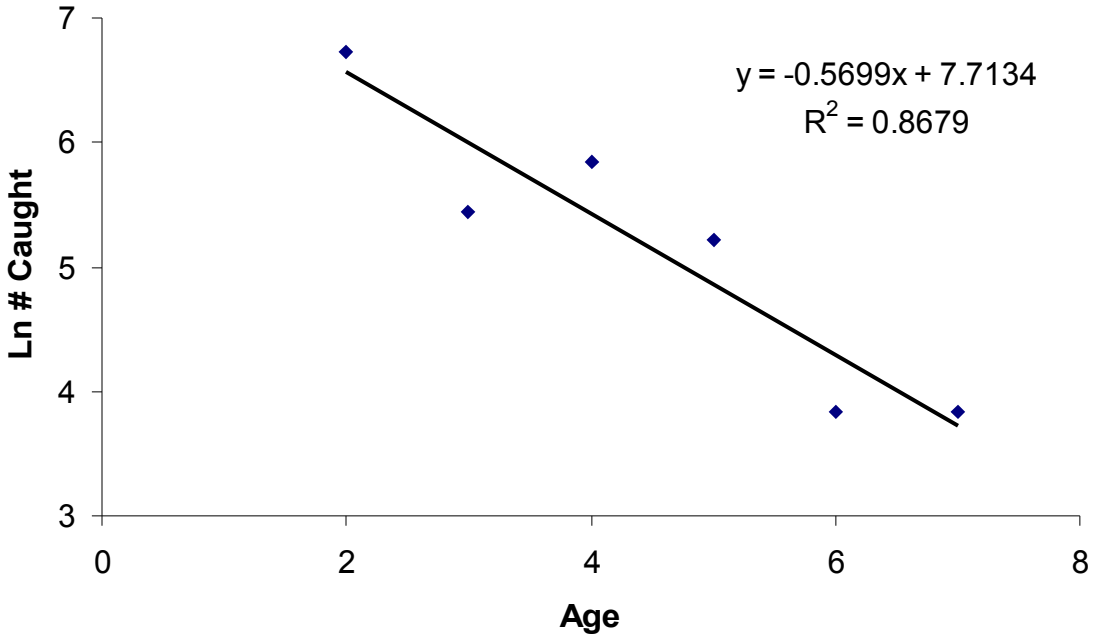


Figure 20. Catch curve for rainbow trout captured in the Big Lost River, Idaho, 2002. Fish were aged using otoliths.

Attempts to associate year class variation with environmental factors by plotting catch-curve residuals to mean monthly flow indicated a strong relationship in year-class strength and flows during the spring (Figure 21). The strongest fit to the data occurred when mean April flows were plotted (r^2 = 0.86). All other months were also tested, with a slightly significant relationship in March flows (r^2 = 0.71, Table 11). Mean monthly flows from other months were not considered significant.

DISCUSSION

Overall, the rainbow trout population in the Big Lost River appears to be healthy. However, distributions of adult trout appear to be concentrated towards the upper portion (closer to the dam) of the river than downstream areas. Juvenile fish follow the opposite trend, with highest densities in the lower reaches and very few in upstream areas. These downstream areas are heavily impacted by canal diversions, which have the potential to affect recruitment of juvenile fish either by entrainment into canals or dewatering of the river channel. Juvenile fish of all species utilize this downstream area heavily. Analysis of otoliths from whitefish collected in 2002 showed several missing year-classes. However, low sample sizes of fish were collected during 2002 and precluded adequate assessment of year-class strengths and correlations to flow issues. Future work should investigate the relative entrainment of both mountain whitefish and trout in the lower sections of the river.

Population parameters of trout collected in the 2002 sample show brook trout populations in the upper river to be declining from levels documented in earlier samples. This may be a factor of displacement by a more abundant rainbow trout population, or an element of sampling variability or other abiotic factors. Brook trout densities in the lower river are substantially greater than previous samples and may reflect selectivity for the habitat.

Rainbow trout populations in the Big Lost River are comparable to world-famous waters such as the Henrys Fork Snake River. Densities of trout found in the upstream areas of the river are estimated to be greater than those in the Box Canyon reach of the Henrys Fork Snake River, with better population structure metrics such as QSD. Even river-wide density estimate averages surpass the famed Henrys Fork Snake River, and depict a high-quality fishery.

At least part of the success of the fishery in the lower Big Lost River can be attributed to flows out of the reservoir. We found a strong relationship between flows below 5 m^3/s in spring (April) and strong year-classes for rainbow trout. This makes biological sense, as rainbow trout are spawning in March and April. If high flows impacted redd success or fry survival, poor year-classes will result. Therefore, lower flows (below 5 m^3/s) appear to be beneficial to rainbow trout reproduction. This prediction is supported to a large extent by the similar relationship between March flow and year-class strength. Additional sampling is warranted to confirm this relationship, as cohort variability relations to flow may be influenced by additional data.

Although comparable to similar fisheries found in the Upper Snake River region, caution should be used when viewing the mortality/survival estimates obtained from the current report. Mortality estimates derived from catch-curve analysis are influenced by year-class variability, and may not truly represent actual mortality. Additional work should be conducted to assess these vital parameters utilizing cohort analysis. Likewise, comparisons of year-class variability among water bodies are vulnerable to the same assumptions. Multiple years of data will likely strengthen relationships found among year-class trends noted in this study.

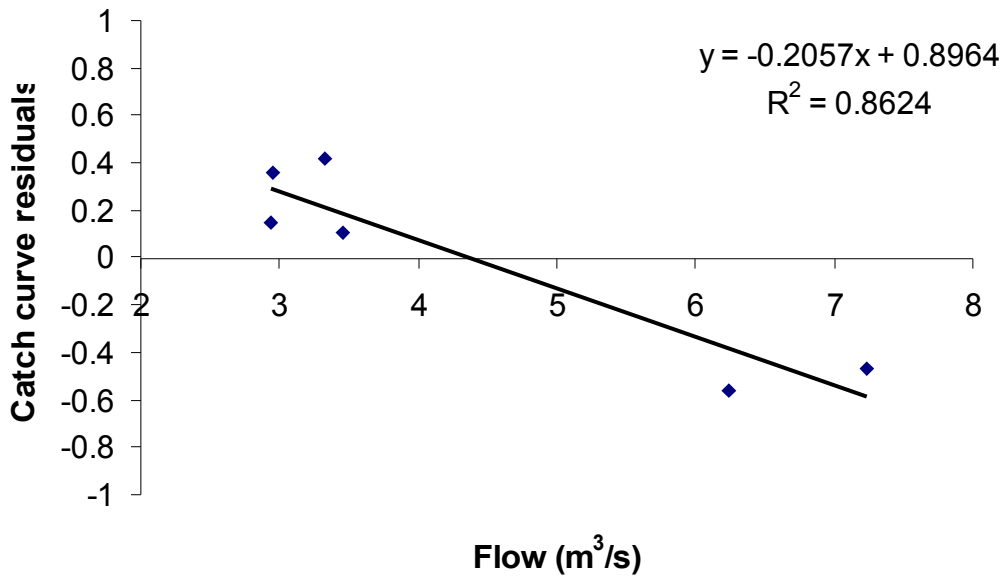


Figure 21. Catch curve residuals plotted against mean monthly flows for April from the Big Lost River, Idaho.

Table 11. r^2 values for residuals plotted against mean monthly flows from catch curve analysis of the Big Lost River, Idaho.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
r^2	0.02	0.03	0.71	0.86	0.17	0.01	0.04	0.03	0.08	0.08	0.43	0.13

RECOMMENDATIONS

1. Continue monitoring efforts of the lower Big Lost River for a minimum of two more consecutive years to obtain age and growth information for mortality assessments and cohort analysis.

2. Monitor and evaluate mountain whitefish populations; specifically develop method of assessing year-class strength based on catch of young-of-the-year whitefish and develop catch-curves for whitefish populations.

3. Continue efforts to correlate year-class variability to environmental factors such as instream flows.

SOUTH FORK SNAKE RIVER

INTRODUCTION

Trout populations in the South Fork Snake River have been monitored annually using electrofishing since 1986. Four river sections have been electrofished (Figure 22): Palisades (5.0 km), Conant (4.9 km), Twin Bridges (2.9 km), and Lorenzo (4.8 km). However, only the Conant section has been sampled every year, a portion of which was sampled in 1982 as well (Moore and Schill 1984). The last creel census was conducted in 1996 (Schrader et al. 2003).

Special regulations restricting harvest of Yellowstone cutthroat trout were enacted upstream of the Heise measuring cable to Irwin in 1984 and extended to Palisades Dam in 1988 (Appendix C). Based on this success, the restricted cutthroat trout harvest regulation was implemented throughout eastern Idaho in 1990 and included the lower South Fork Snake River (below Heise) and all its tributaries. The two fish, none between 8-16 inches, regulation was extended to all trout species (including brown trout) in the mainstem (but not tributaries) in 1992. Emergency changes in 1999 removed rainbow trout (and later hybrid rainbow trout x cutthroat trout, hereafter “rainbow trout”) from special regulations, returning them to the general six fish bag limit with no size restrictions. The minimum size restriction (8 inches) for cutthroat and brown trout was eliminated in 2000. The lower river (below the Heise cable) is open year-round to fishing, whereas the upper river is closed December 1 to Memorial Day weekend.

METHODS

Mainstem Electrofishing

During 2002, the Conant section was electrofished on October 3, 4, 10, and 11, and the Lorenzo section was electrofished on September 17, 18, 24, and 26. The upper or lower half of a section was sampled each day. A new side channel created in the lower half of Lorenzo was

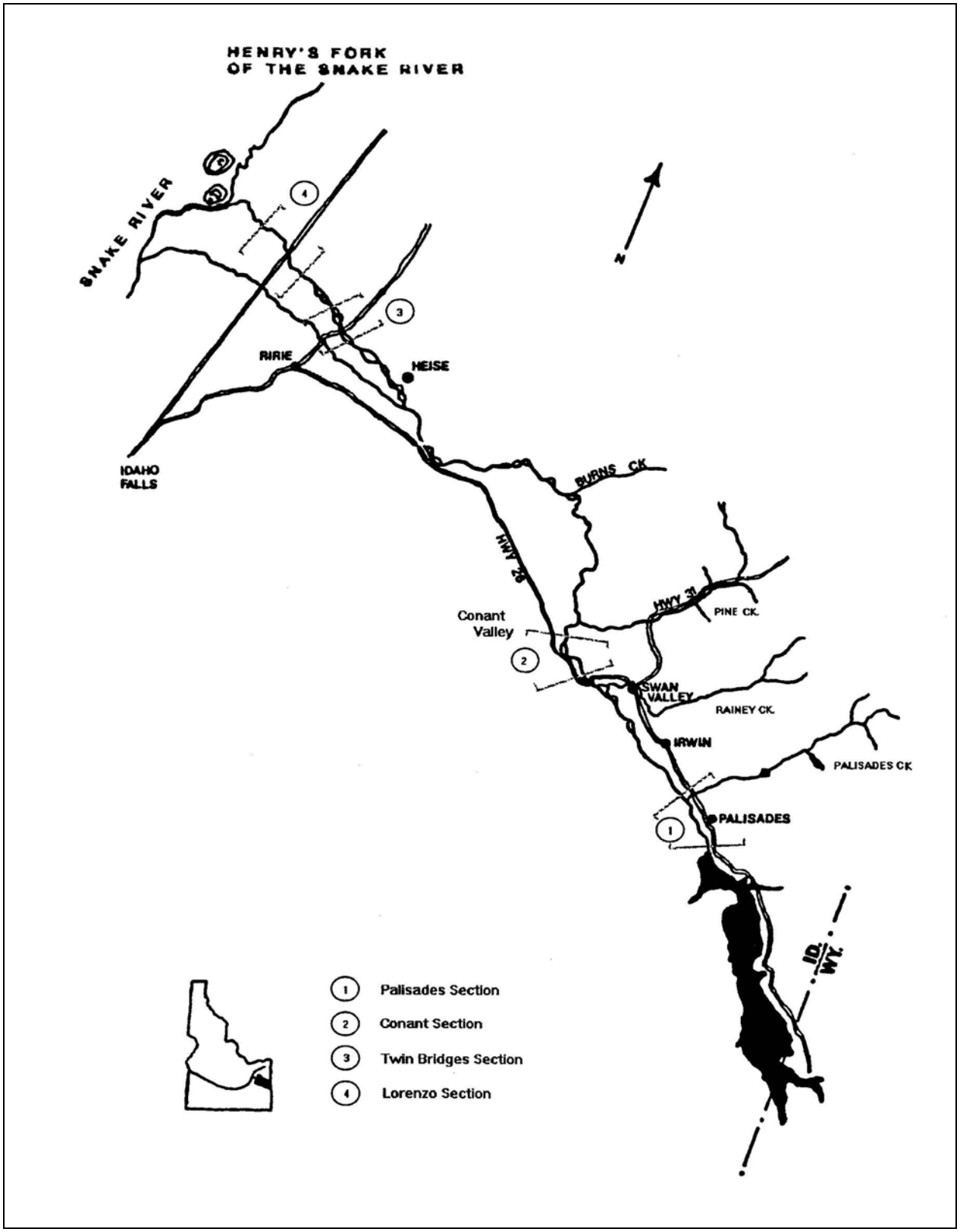


Figure 22. Map of South Fork Snake River, Idaho, showing electrofishing sections.

electrofished for the first time in 2002. At Conant, flows varied from 68.0 to 72.8 m^3/s (2,400 to 2,570 ft^3/s) at the Irwin gage (USGS, provisional data; Appendix D). At Lorenzo, flows varied from 73.9 to 122.4 m^3/s (2,610 to 4,320 ft^3/s) at the Lorenzo gage (USGS, provisional data; Appendix E). A minimum of 70.8 m3/s (2,500 ft^3/s) is needed at either section for safe boat operation and efficient sampling.

Fish were captured using direct-current (DC) electrofishing gear (Coffelt VVP-15 powered by a Honda 5000 W generator) mounted in an 18-foot Alumaweld sled with a 150 hp outboard jet. We used pulsed DC current through two boom-and-dangler anodes fixed to the bow while driving downstream. The boat hull was the cathode. Similar to previous years, the VVP settings were at 200-225 V, 5-6 A, 20% pulse width, and 60 Hz (pulses per second).

We attempted to capture all species and sizes of trout. Fish were anesthetized, identified, and measured to the nearest millimeter for total length (TL). Brown trout less than 150 mm and all other species less than 100 mm that are approximately age-0 were not marked as they are not effectively recruited to the gear. Age-1 and older fish were marked with a caudal fin punch and released. On the recapture runs at both sections, we collected fixed stratified subsamples of 10 fish per 25 mm length group for each species. A total of 309 fish were collected at Conant (95 cutthroat, 124 rainbow, and 90 brown trout), and 208 fish were collected at Lorenzo (72 cutthroat, 3 rainbow, and 133 brown trout). Individual fish were placed in labeled Zip-lock bags, put on ice, and frozen at the end of the day. They were later weighed to the nearest gram to develop length-weight relationships. They were also re-measured (to the nearest mm, TL) to estimate freezer shrinkage. Gonads were examined to determine sex and maturity for all species, and mature brown trout female gonads were extracted to estimate fecundity. Otoliths and dorsal fin rays, but not scales, were extracted to develop an age-length key (Devries and Frie 1996).

Electrofishing data were entered and analyzed using the computer program Mark Recapture 5.0 (MR5; Montana Department of Fish, Wildlife, and Parks 1994). Other data were entered and analyzed using Microsoft Excel. General statistical analysis was 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), population size structures (length frequency distributions) and average fish lengths were estimated using all sizes of individual fish captured. Quality stock density was estimated using the number of individual fish captured >406 mm divided by the number >203 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).

Fish Salvage

Low flows in the lower river (below Heise) during late fall typically strand fish in dewatered side channels. Trout Unlimited volunteers and regional fisheries staff salvaged the Twin Bridges south channel on November 2, 2002. Work crews used backpack electrofishing gear to capture most stranded game fish. Fish were identified, counted, and hauled to and released in the mainstem. No other data were recorded.

RESULTS

Mainstem Electrofishing

Conant

A total of 1,608 trout were captured during four days of electrofishing in October 2002. Species composition and relative abundance were cutthroat trout (53%), rainbow trout (34%), brown trout (14%), and lake trout *Salvelinus namaycush* (<1%; Figure 23, Appendix F). No kokanee *O. nerka kennerlyi* were captured. Less than 1% of the cutthroat trout captured was of hatchery origin.

The cutthroat trout length frequency distribution shows a weak group of age-1 fish (~100 to 250 mm), although age-2 and older fish (>250 mm) are well represented (Figure 24). In contrast, fairly strong groups of age-1 rainbow trout (Figure 25) and brown trout (Figure 26) were observed, but not as strong as in the past. Ages were approximated from these frequency distributions and will be validated with otoliths in the future.

Mean total length (TL) was 338 mm for cutthroat trout, 326 mm for rainbow trout, 339 mm for brown trout, and 334 mm for all species combined (Appendix G). Quality stock density was 4.0% for cutthroat trout, 23.6% for rainbow trout, 34.0% for brown trout, and 14.4% for all species combined. Sample sizes were similar to previous years. The length-weight regression was y=0.00002 x 2.9126 for cutthroat, y=0.000007 x 3.079 for rainbow, and y=0.000009 x 3.013 for brown trout (Figure 27).

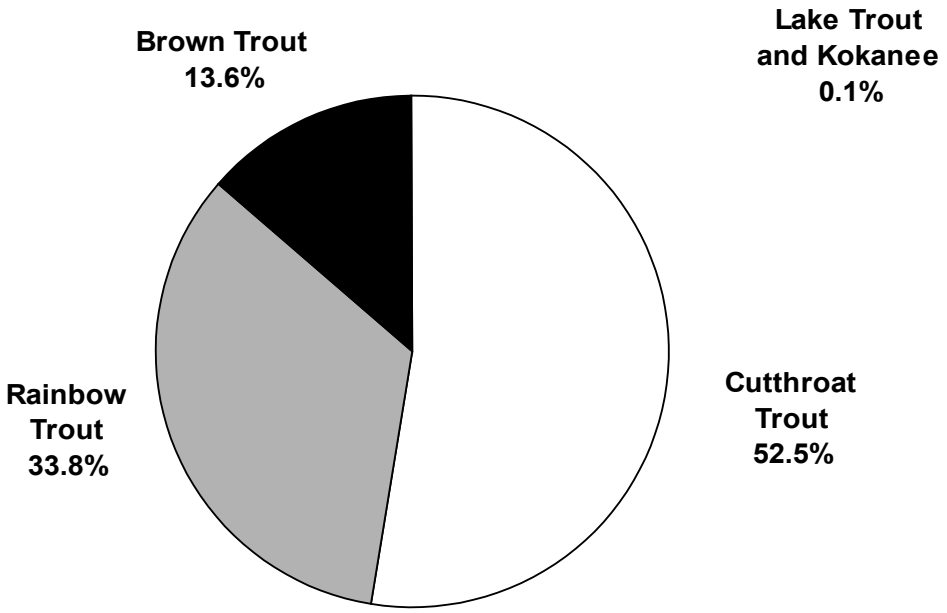
Electrofishing sampling efficiencies (R/C) were also similar to previous years and ranged from 8% for brown trout to 13% for cutthroat trout (Appendix H). Estimated densities were 841 fish/km for cutthroat trout, 809 fish/km for rainbow trout, 288 fish/km for brown trout, and 1,805 fish/km for all species combined (Figure 28, Appendix I).

Lorenzo

A total of 1,264 trout were captured during four days of electrofishing in September 2002. Species composition and relative abundance were cutthroat trout (18%), rainbow trout (<1%), and brown trout (81%; Figure 23, Appendix J). No lake trout or kokanee were captured. None of the cutthroat trout captured was of hatchery origin.

The cutthroat trout length frequency distribution shows a weak group of age-1 fish (~100 to 250 mm), although age-2 and older fish (>250 mm) are well represented (Figure 29). In contrast, a fairly strong group of age-1 brown trout (Figure 30) was observed, but not as strong as in the past. Ages were approximated from these frequency distributions and will be validated with otoliths in the future.

Mean total length (TL) was 316 mm for cutthroat trout, 340 mm for rainbow trout, 321 mm for brown trout, and 321 mm for all species combined (Appendix K). Quality stock density



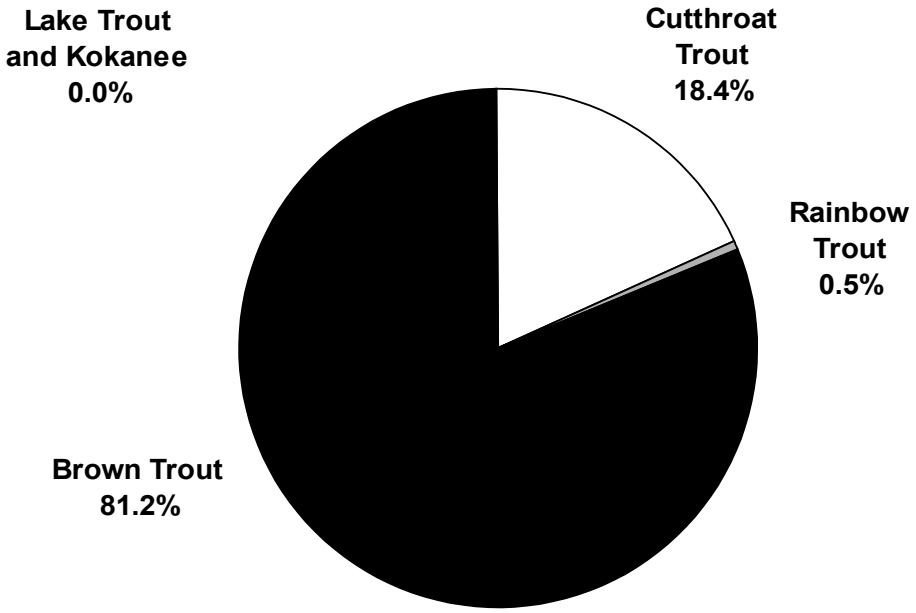


Figure 23. Trout species composition and relative abundance at the Conant (top, n=1,608) and Lorenzo (bottom, n=1,264) electrofishing sections, South Fork Snake River, Idaho, 2002.

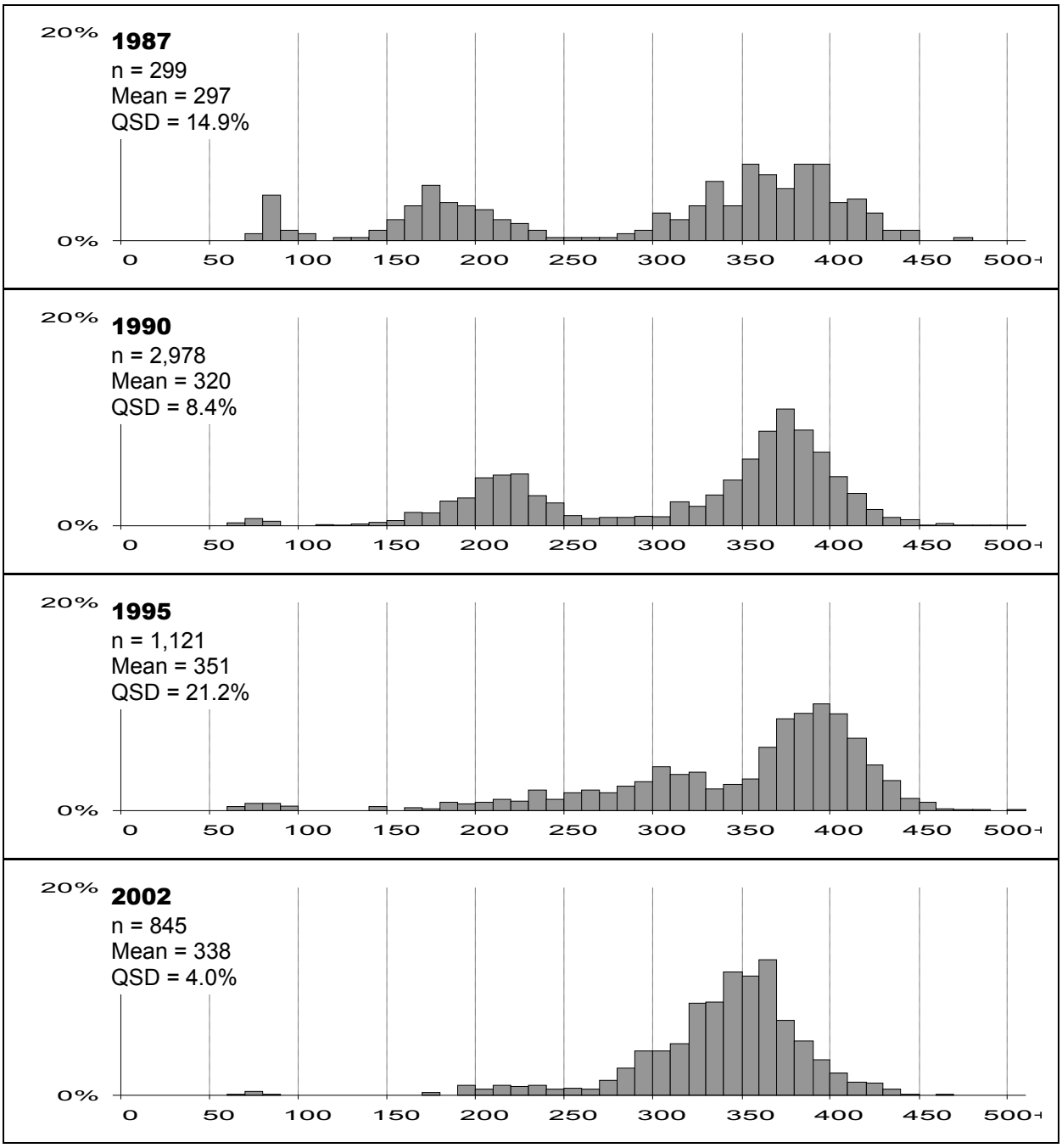


Figure 24. Length frequency distributions of cutthroat trout captured in the fall at the Conant electrofishing section, South Fork Snake River, 1987-2002. Abscissa is total length (mm). Total individual fish captured during mark and recapture runs = n. Note strong age-1 groups (~100 to 250 mm) in 1987 and 1990, but weak groups in 1995 and 2002.

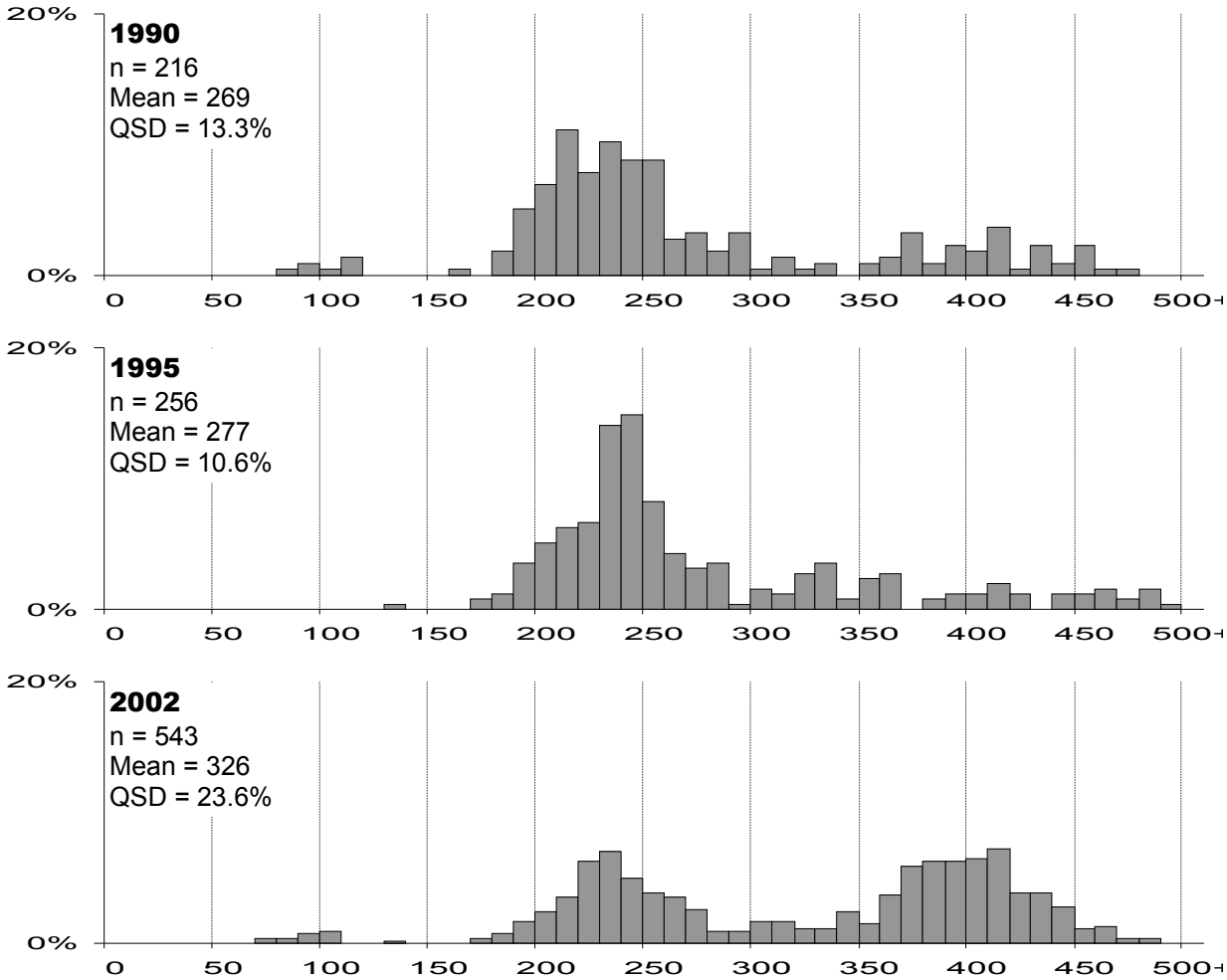


Figure 25. Length frequency distributions of rainbow trout captured in the fall at the Conant electrofishing section, South Fork Snake River, 1990-2002. Abscissa is total length (mm). Total individual fish captured during mark and recapture runs = n. Not shown is 1987 when only six fish were captured. Note strong age-1 groups (~150 to 300 mm) in 1990 and 1995, but less so in 2002.

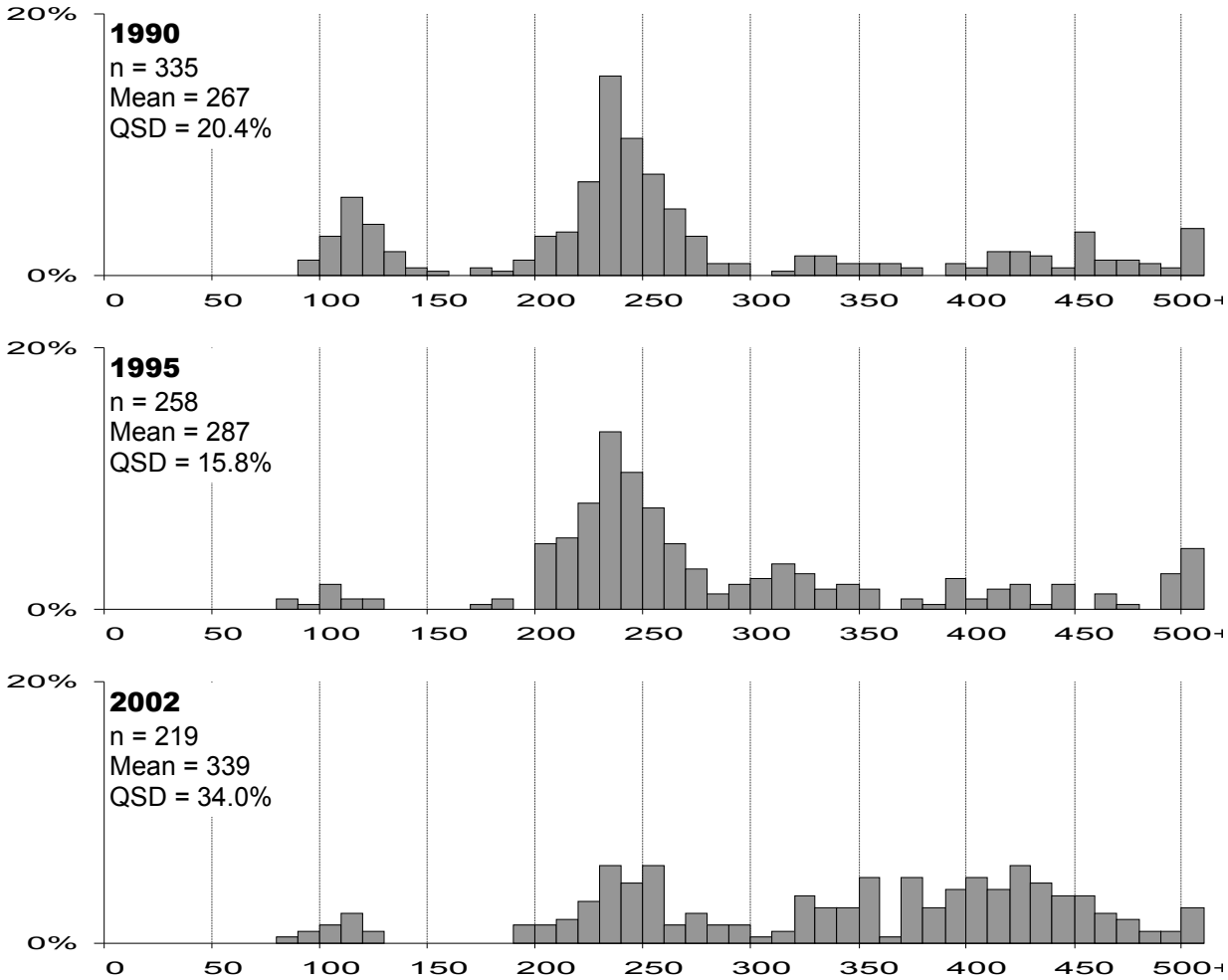


Figure 26. Length frequency distributions of brown trout captured in the fall at the Conant electrofishing section, South Fork Snake River, 1990-2002. Abscissa is total length (mm). Total individual fish captured during mark and recapture runs = n. Not shown is 1987 when only 43 fish were captured. Note strong age-1 groups (~150 to 300 mm) in 1990 and 1995, but less so in 2002.

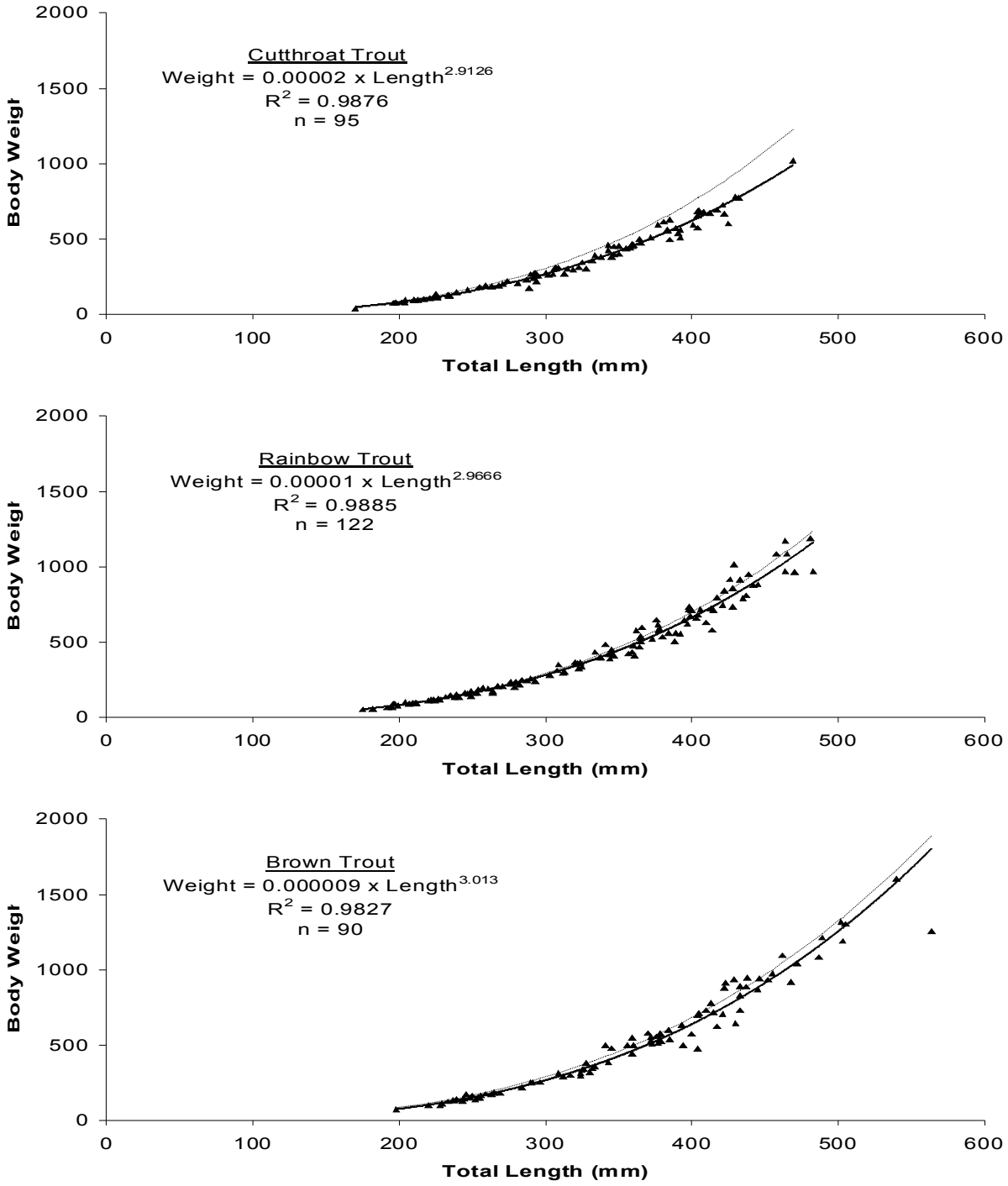


Figure 27. Regression of fish weight on total length (TL) for cutthroat (top), rainbow (middle), and brown trout (bottom) at the Conant electrofishing section, South Fork Snake River, Idaho, 2002. Dashed line is standard weight according to Anderson and Neumann (1996). Age-0 fish were not included.

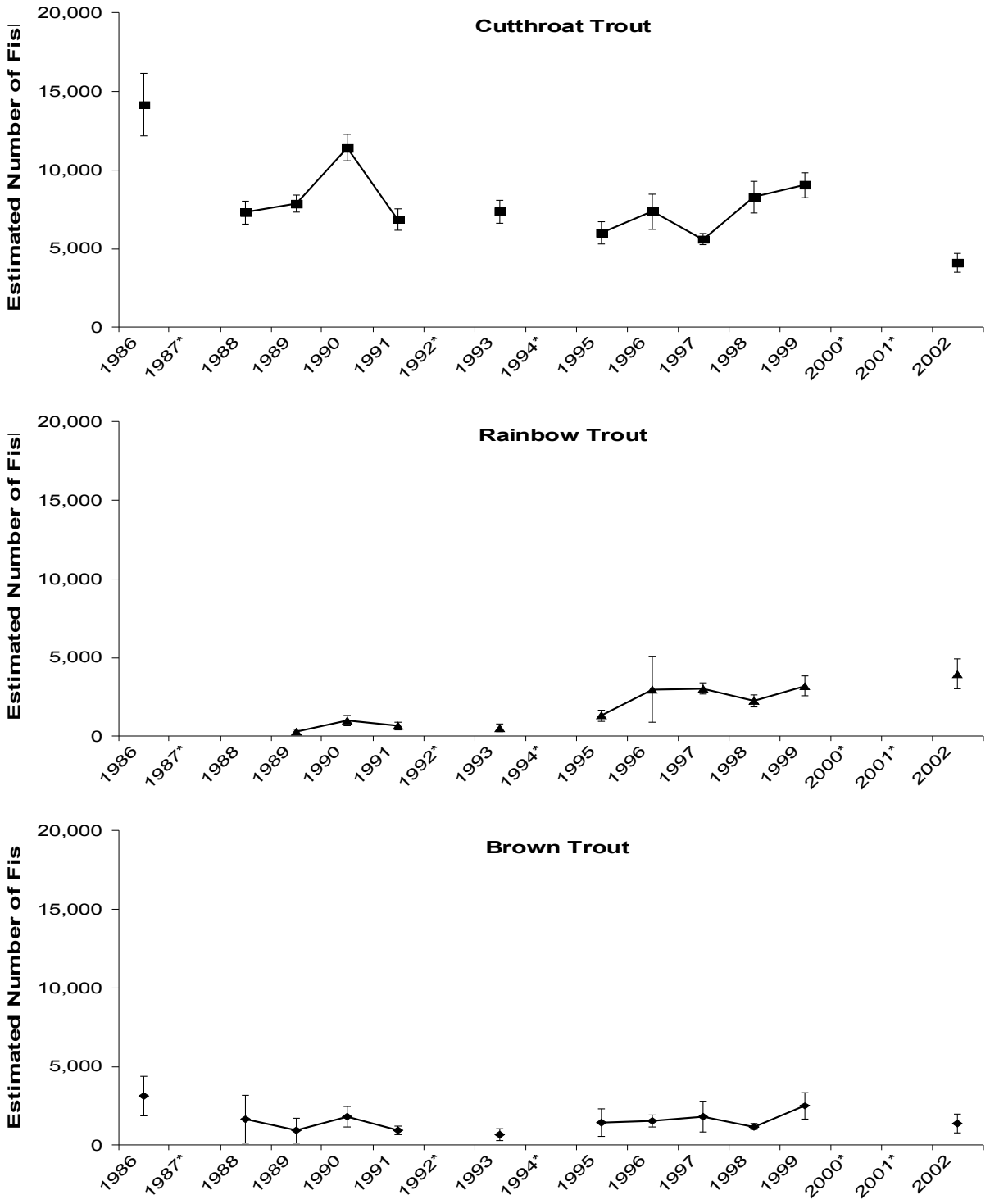


Figure 28. Abundance trends for age-1 and older cutthroat (top, ≥102 mm), rainbow (middle, ≥102 mm), and brown trout (bottom, ≥152 mm) at the Conant electrofishing section, South Fork Snake River, Idaho, 1986-2002. Confidence intervals are at 95%. Asterisks indicate years when no estimate was possible.

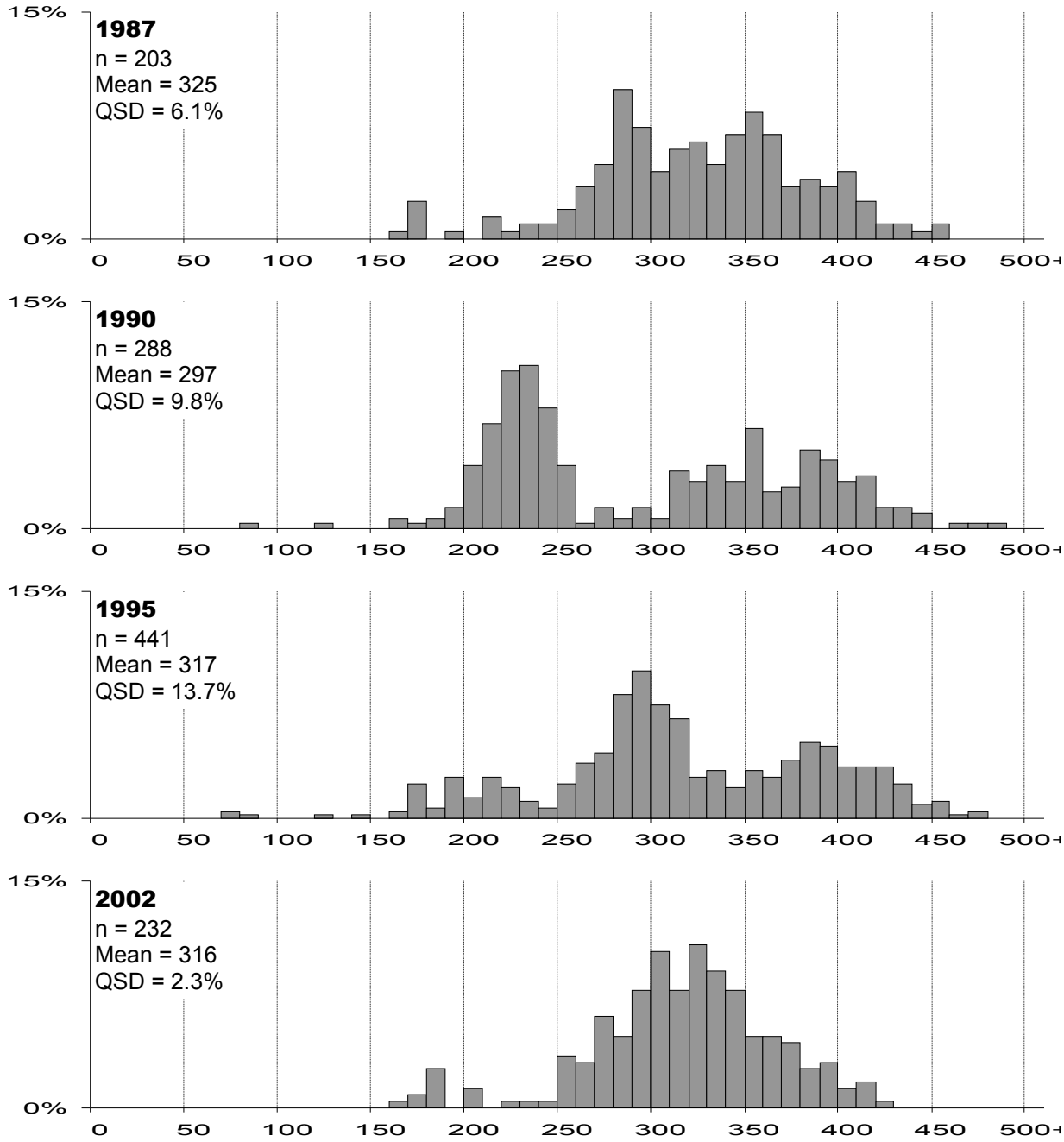


Figure 29. Length frequency distributions of cutthroat trout captured in the fall at the Lorenzo electrofishing section, South Fork Snake River, 1987-2002. Abscissa is total length (mm). Total individual fish captured during mark and recapture runs = n. Note a strong age-1 group (~100 to 250 mm) in 1990, but weak groups in 1987, 1995, and 2002.

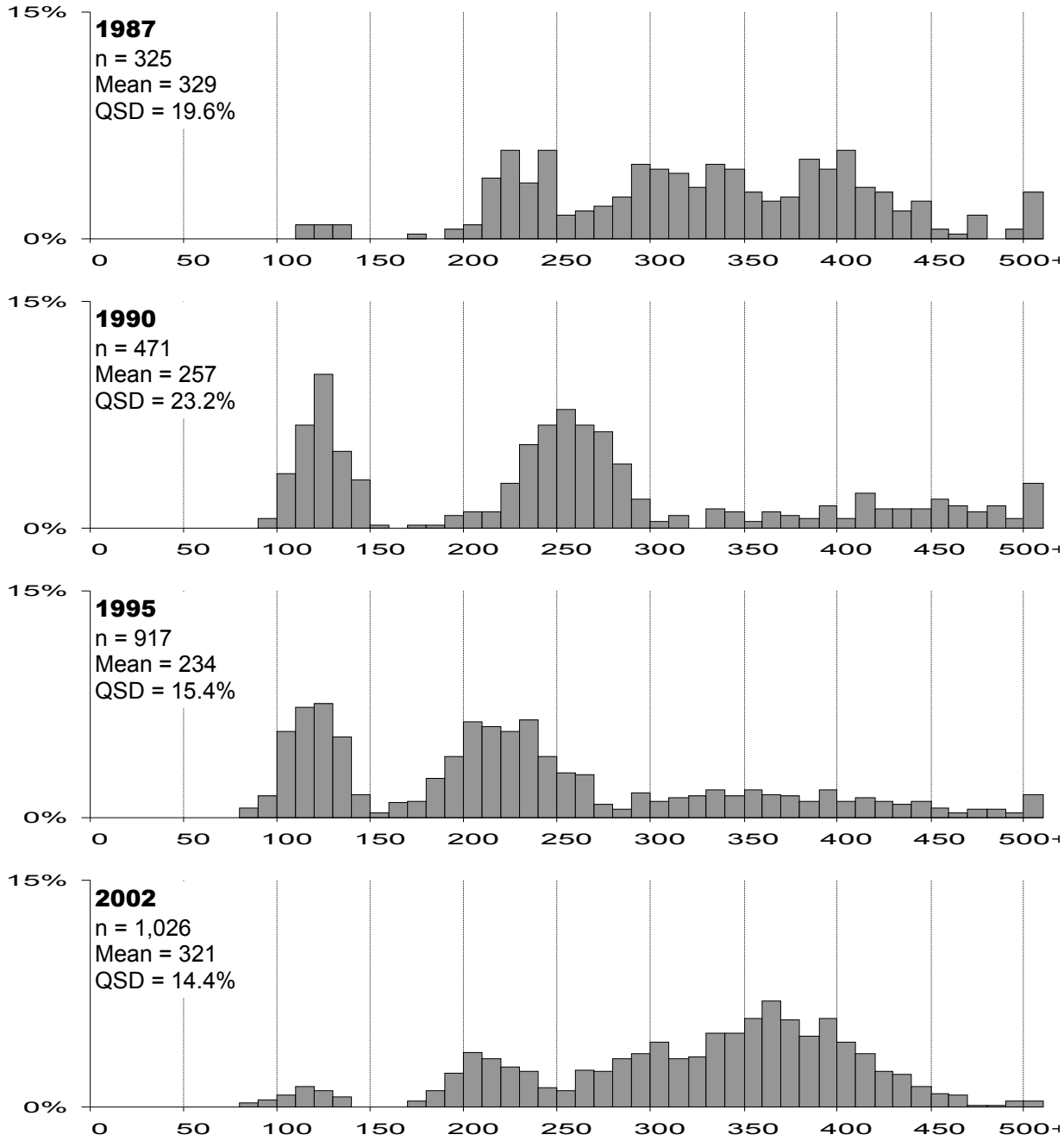


Figure 30. Length frequency distributions of brown trout captured in the fall at the Lorenzo electrofishing section, South Fork Snake River, 1987-2002. Abscissa is total length (mm). Total individual fish captured during mark and recapture runs = n. Note strong age-1 groups (~150 to 300 mm) in 1990 and 1995, but less so in 1987 and 2002.

was 2.3% for cutthroat trout, 16.7% for rainbow trout, 14.4% for brown trout, and 12.1% for all species combined. Sample sizes were similar to previous years. The length-weight regression was y=0.00002 x 2.8729 for cutthroat and y=0.00002 x 2.8943 for brown trout (Figure 31).

Electrofishing sampling efficiency (R/C) was 10% for both cutthroat and brown trout, which was similar to previous years (Appendix L). Estimated densities were 246 fish/km for cutthroat trout, 1,036 fish/km for brown trout, and 1,385 fish/km for all species combined (Figure 32; Appendix M). Similar to previous years, only seven rainbow trout were captured and a density estimate was not possible.

Fish Salvage

At the Twin Bridges south channel, work crews salvaged approximately 702 game fish. Most fish were brown trout (690), followed by cutthroat trout (11), and numerous mountain whitefish *Prosopium williamsoni*. One additional hybrid trout was removed.

DISCUSSION

At both sections in 2002, cutthroat trout relative and absolute abundance is lowest on record and continues the general downward trend observed since the early 1990s (Figures 28, 32, and 33). In contrast, rainbow trout estimates at Conant (but not Lorenzo) are highest on record - continuing an upward trend observed over the same time period. Rainbow and hybrid trout are now as abundant as cutthroat trout in the upper South Fork Snake River. It is likely these two trends are directly related – that increasing rainbow trout have caused cutthroat trout to decline. We conclude that the growing rainbow trout population in the upper river is the major threat to the genetic integrity and long-term viability of cutthroat trout in the South Fork Snake River. Further, liberalized rainbow trout harvest regulations implemented in 1999 have yet to reverse these trends. More effective education and outreach is necessary to encourage anglers to harvest rainbow trout, or more creative solutions are needed to reduce the growing rainbow trout population.

Brown trout estimates at Lorenzo (but not Conant) are highest on record - continuing an upward trend similar to rainbow trout at Conant (Figures 28, 32, and 33). In the lower South Fork Snake River, factors causing the recent decline in cutthroat trout have not had the same effect on brown trout.

Although relative abundance trends can be misleading, the same trends in absolute abundance (or density) are apparent. For the purposes of long-term trend analysis we use relative abundance, as several density estimates were not possible due to small sample size or no recapture runs.

Although cutthroat trout QSD at Conant is somewhat improved compared to recent years, it remains at the low end of that observed over the last 20 years (Figure 34). The slight improvement may be due to recent yearclass failures (i.e. relatively few juvenile fish) rather than relatively more large fish. Cutthroat trout QSD has declined to a record low at Lorenzo as well. Lack of recruitment from the recent drought combined with harvest of large fish likely explains the overall decline in cutthroat QSDs in the South Fork Snake River.

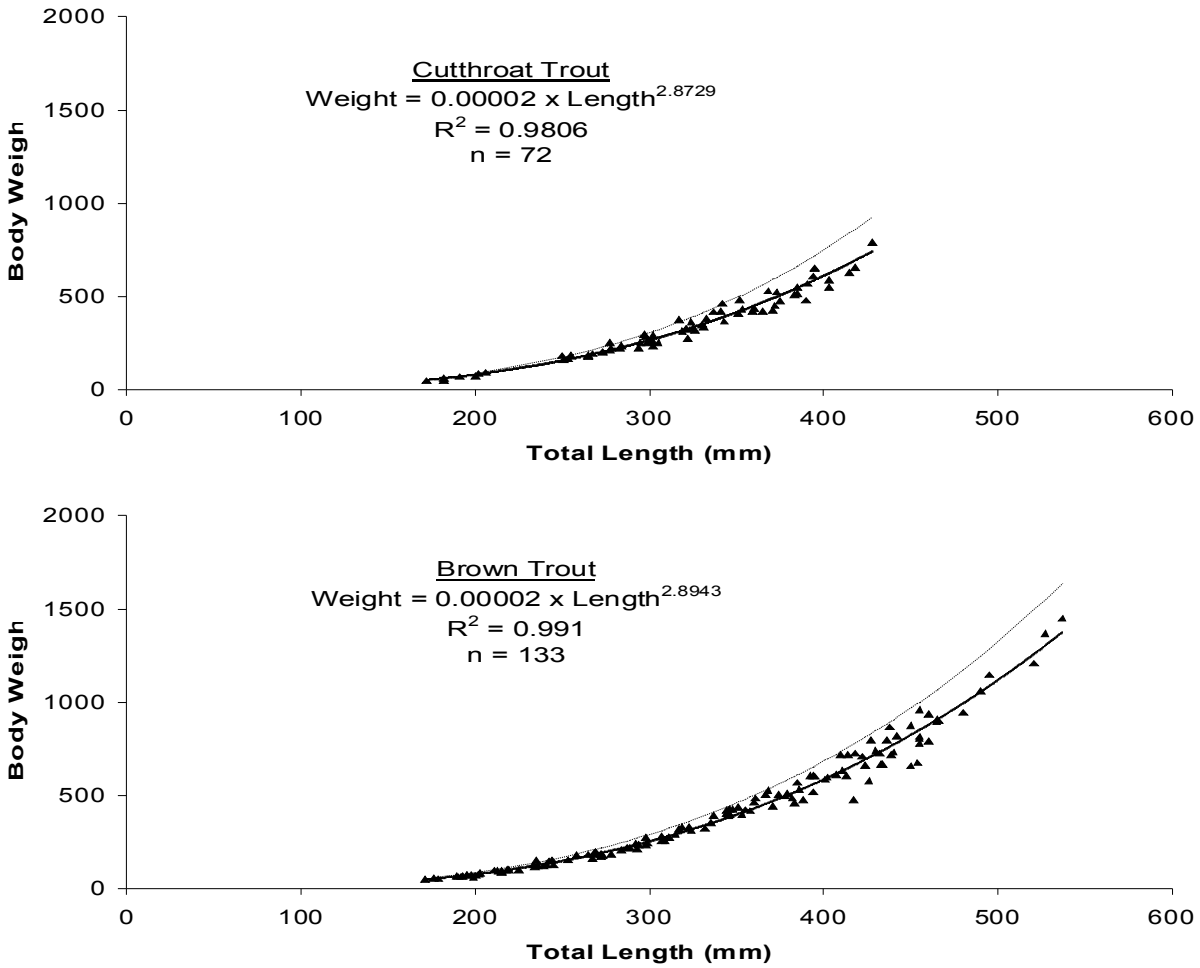


Figure 31. Regression of fish weight on total length (TL) for cutthroat (top) and brown trout (bottom) at the Lorenzo electrofishing section, South Fork Snake River, Idaho, 2002. Dashed line is standard weight according to Anderson and Neumann (1996). Age-0 fish were not included.

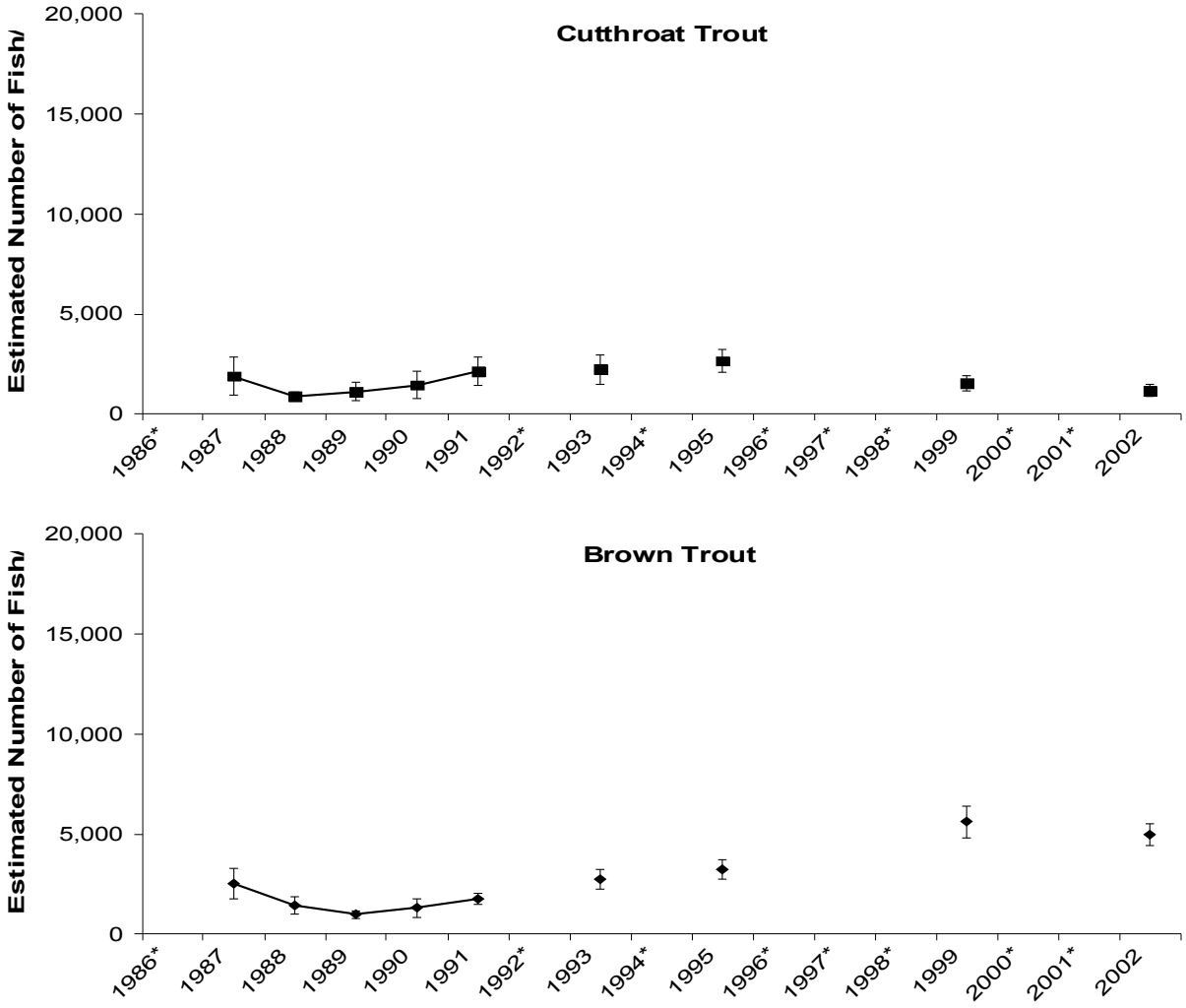


Figure 32. Abundance trends for age-1 and older cutthroat (top, ≥102 mm) and brown trout (bottom, ≥152 mm) at the Lorenzo electrofishing section, South Fork Snake River, Idaho, 1987-2002. Confidence intervals are at 95%. Asterisks indicate years when no estimate was possible.

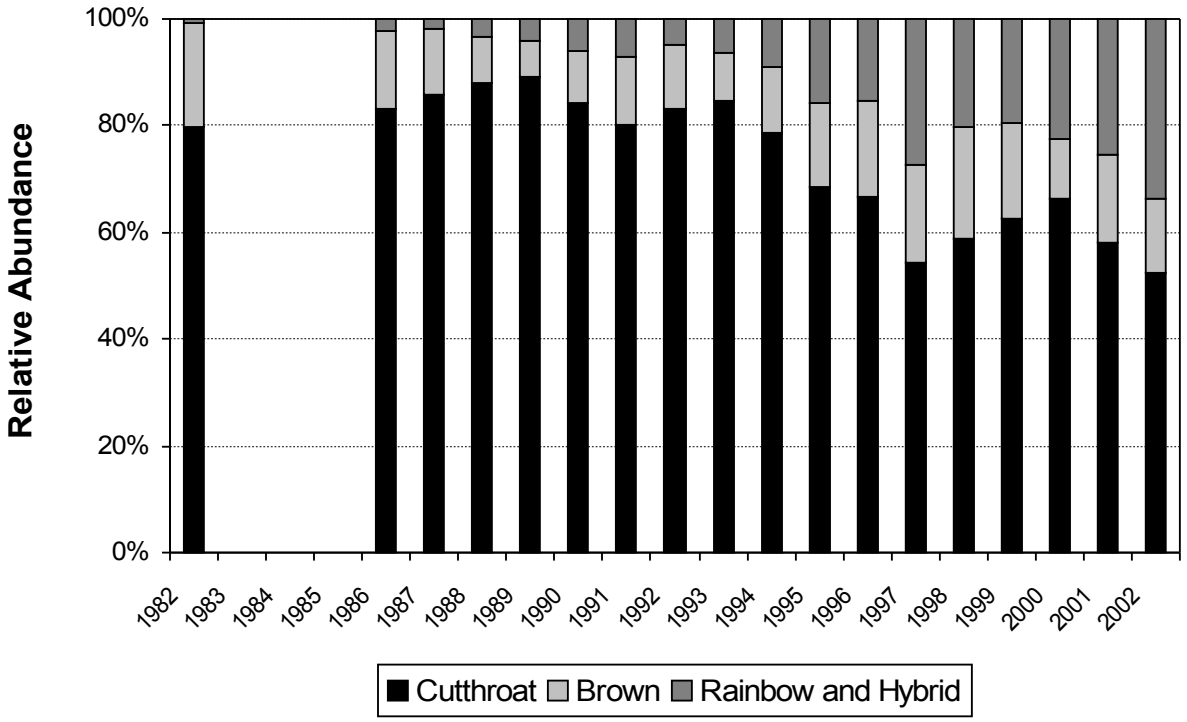


Figure 33. Trout relative abundance trends at the Conant electrofishing section, South Fork Snake River, Idaho, 1982 to 2002. Results for 1982 are from Moore and Schill (1984).

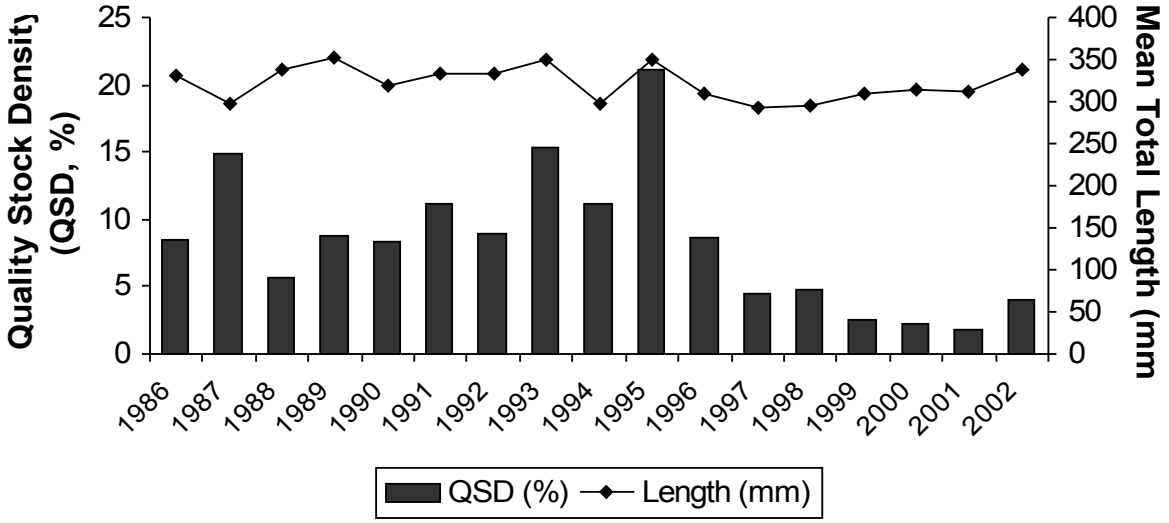


Figure 34. Cutthroat trout quality stock density (QSD) and mean total length trends at the Conant electrofishing section, South Fork Snake River, Idaho, 1986 to 2002.

Rainbow and brown trout QSDs have held steady or improved at both sections, reflecting more large fish as well as fewer juvenile fish relative to stock size. However, these taxa have consistently produced stronger year classes than cutthroat trout during the recent drought. Unlike cutthroat trout, these taxa are primarily mainstem spawners and may be less affected by low flows during spawning or over-wintering.

Because the 1982, 1986, and 1987 electrofishing efforts were conducted in November rather than in October, and the section was shortened in 1982 and 1987 resulting in smaller sample sizes, comparability of data from these years is somewhat limited. Similarly, the 1997 data may be confounded by significant habitat changes that occurred with near-record runoff of 1,190 m^3/s (42,000 ft^3/s) in June.

RECOMMENDATIONS

1. Continue monitoring South Fork Snake River trout populations by electrofishing.

2. Continue developing length-weight regressions for each trout species. Predict fish weights from measured lengths and estimate biomass and standing crops for all sections and years. Compare relative weights.

3. Continue to inform and educate anglers regarding the value of conserving cutthroat trout by harvesting rainbow trout. Develop informational brochure and fish identification card and distribute to anglers. Post informational signs on kiosks at boat ramps. Explore other creative solutions to reduce the growing rainbow trout population.

4. Conduct a fully randomized creel survey in 2003 to estimate angler effort, catch and harvest rates, and total catch and harvest throughout the entire South Fork Snake River.

5. Conduct a reward-tagging study in 2003 to estimate annual exploitation rates. Compare with independently derived rates using creel survey statistics and density estimates.

6. Coordinate with other research projects including flow-based cohort analysis, biologically based system modeling, and tributary weir evaluation.

7. Modify regulations to enhance cutthroat trout survival and reproduction while allowing for maximum harvest of rainbow and hybrid trout.

ACKNOWLEDGMENTS

IDFG employees Steve Yundt, Jason Jackson, Ethan Crawford, Terry Thomas, Trapper Bradshaw and Jerry Williams helped with electrofishing. L.D. "Buck" Goodrich (Trout Unlimited) organized and numerous volunteers helped with the side channel salvage. South Fork Snake River research funding was provided by U.S. Department of Interior, Bureau of Reclamation, under contract # 1425-00-FL-10-6460 (Biologically Based System Management).

LITERATURE CITED

Anderson, R.O., and R.M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B.R. Murphy and D.W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Corsi, C., and S. Elle. 1989. Regional fisheries management investigations. Idaho Department of Fish and Game, 1987 Job Performance Report, Project F-71-R-12, Boise.

DeVries, D.R., and R.V. Frie. 1996. Determination of age and growth. Pages 483-512 in B.R. Murphy and D.W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Gamblin, M., S. Elle, and J. Tharp. 1993. Regional fisheries management investigations. Idaho Department of Fish and Game, 1991 Job Performance Report, Project F-71-R-16, Boise.

Gamblin, M., T.J. Herron, B.A. Rich, and W.C. Schrader. 2002. Regional fisheries management investigations. Idaho Department of Fish and Game, 1994 Job Performance Report, Project F-71-R-19, Boise.

Mitro, M. G. 1999. Sampling and analysis techniques and their application for estimating recruitment of juvenile rainbow trout in the Henrys Fork of the Snake River, Idaho. Doctoral dissertation, Montana State University, Bozeman.

Montana Department of Fish, Wildlife, and Parks. 1994. MARKRECAPTURE Version 4.0: A software package for fishery population estimates. Montana Department of Fish, Wildlife, and Parks, Helena.

Moore, V., and D. Schill. 1984. South Fork Snake River fisheries investigations. Idaho Department of Fish and Game, Job Completion Report, Project F-73-R-5, Boise.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research Board of Canada, Bulletin 191, Ottawa.

Schill, D.J. 1992. Statewide data summary. Wild trout investigations. Idaho Department of Fish and Game, Job Performance Report, Project F-73-R-13, Boise.

Schrader, W.C., J. Dillon, and M. Gamblin. 2003. Regional fisheries management investigations. Idaho Department of Fish and Game, 1996 Job Performance Report, Project F-71-R-21, Boise.

Van Den Avyle 1993. Dynamics of exploited fish populations. Pages 105-134 in Inland Fisheries Management in North America. C. Kohler and W. Hubert, 1993. American Fisheries Society, Bethesda, Maryland.

Zar, J.H. 1984. Biostatistical analysis, 2nd edition. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

APPENDICES

Appendix A. Locations used for electrofishing stations on the Henrys Fork Snake River, Idaho. All locations are given in UTMs and include start and stop points. All sampling was conducted from a boat in a downstream direction.

Henrys Fork:

Mack's Inn reach	Start	477, 614 E	4, 926, 394 N	Z 12
	Stop	474, 131 E	4, 927, 290 N	Z 12
Box Canyon reach	Start	468, 677 E	4, 917, 703 N	Z 12
	Stop	467, 701 E	4, 914, 352 N	Z 12
Stone Bridge reach	Start	473, 052 E	4, 883, 863 N	Z 12
	Stop	464, 230 E	4, 884, 113 N	Z 12
Confluence reach	Start	425, 638 E	4, 849, 529 N	Z 12
	Stop	422, 857 E	4, 844, 618 N	Z 12

Locations used for electrofishing stations on the lower Big Lost River, Idaho. All locations are given in UTMs, and include start and stop points. All sampling was conducted in an upstream direction.

Big Lost River:

Lower Leslie site:	Start	303, 115 E	4, 858, 762 N	Z 12
Upper Leslie site:	Stop	302, 258 E	4, 859, 177 N	Z 12
Lower Houston site:	Start	292, 915 E	4, 862, 350 N	Z 12
Upper Houston site:	Stop	292, 561 E	4, 862, 666 N	Z 12
Lower Campground:	Start	288, 011 E	4, 867, 934 N	Z 12
Upper Campground:	Stop	287, 610 E	4, 868, 370 N	Z 12

Appendix C. South Fork Snake River, Idaho, fishing regulations 1970-2003.

Year	Season	Trout bag & size limit	Special
1970	May 30 - Nov 30	7 lb. + 1 fish, not to exceed 15 fish	Whitefish open 3/1 to 4/30 Irwin to Dam; Mouth to Heise cable open all year
1971	May 29 - Nov 30	Same	Same
1972	May 27 - Nov 30	7 lb. + 1 fish, not to exceed 10 fish	Same
1973	May 26 - Nov 30	Same	All species open 3/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year
1974	May 25 - Nov 30	10 fish, not more than 2 exceeding 14”	Same
1975	May 24 - Nov 30	Same	Same
1976	May 29 - Nov 30	10 fish, not more than 5 exceeding 12”, and not more than 2 exceeding 18”	Same
1977	May 28 - Nov 30	6 fish, only 2 over 16”	Same, except dam tailrace closed
1978	May 27 - Nov 30	Same	Dam tailrace closed; all species open 5/27 to 9/30 Irwin to Dam; Mouth to Heise cable open 5/27 to 12/31
1979	May 26 - Nov 30	Same	Dam tailrace closed; all species open 4/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year
1980	May 24 - Nov 30	Same	Same
1981	May 23 - Nov 30	Same	Same
1982	May 29 - Nov 30	Same	Same, except open 9/1 to 11/30 within 100 yards of Burns Creek
1983	May 28 - Nov 30	Same	Same
1984	May 26 - Nov 30	Same, except Heise cable to Irwin only 2 CT, none between 10-16”	Same
1985	May 25 - Nov 30	Same, except added hybrids	Same
1986-1987	May 24/23-Nov 30	Same	Same
1988-1989	May 28/27-Nov 30	6 fish, only 2 over 16”; except Heise cable to Dam only 2 CT or HYB, none between 10-16”	Mouth to Heise cable open all year; open 9/1 - 11/30 within 100 yards of Burns Creek
1990-1991	May 26/25-Nov 30	6 fish (except only 2 CT or HYB, none between 8-16”, on all rivers and streams)	Mouth to Heise cable open all year
1992-1993	May 23/29-Nov 30	2 fish, none between 8-16”	Same
1994-1995	May 28/27-Nov 30	Same	Same
1996-1997	May 25/24-Nov 30	Same	Same
1998	May 23 - Nov 30	Same	Same
1999	May 29 - Nov 30	6 fish (except only 2 CT, HYB, or BRN, none between 8-16”)	Same
2000-2001	May 27/26-Nov 30	6 fish (except only 2 CT or BRN, none under 16”)	Same
2002-2003	May 25/24-Nov 30	Same	Same

Appendix D. Sampling dates, flows, and catch rates at the Conant electrofishing section, South Fork Snake River, Idaho, 1986-2002. Flows were recorded at the USGS Irwin gage.

Sampling dates	Range of flows (m^3/s)	Range of flows (ft^3/s)	Mean flow (m^3/s)	Catch rate (fish/day)[a]
11/4,5, 6, 7,20 1986	100.2-107.0	3,540-3,780	101.7	413
11/5,6 1987[b,c]	24.6-26.6	869-941	25.6	174
10/3,4,11 1988	102.0-105.0	3,600-3,710	103.4	630
10/18,19,27 1989	84.7-86.7	2,990-3,060	86.1	930
10/11,12,18 1990	98.8-104.5	3,490-3,690	100.8	1,292
10/7,8,15 1991	127.2-135.7	4,490-4,790	131.7	741
10/14 1992[b]	60.3	2,130	60.3	719
10/13,14,21,22 1993	74.2-108.2	2,620-3,820	90.9	481
10/7,11,14 1994[b]	34.5-69.1	1,220-2,440	52.4	368
10/5,6,12,13 1995	72.8-115.8	2,570-4,090	93.2	436
10/3,4,10,11 1996	106.5-107.3	3,760-3,790	106.9	472
10/16,17,23,27 1997[d]	69.7-99.1	2,460-3,500	84.4	851
10/7,8,14,15 1998	91.5-126.6	3,230-4,470	109.6	593
10/13,14,20,21 1999	101.1-118.1	3,570-4,170	109.6	763
10/19,26 2000[b]	87.8-95.2	3,100-3,360	91.5	602
10/4,5 2001[b]	117.2-117.5	4,140-4,150	117.4	669
10/3,4,10,11 2002	68.0-72.8	2,400-2,570	71.6	423

[a] Includes recaptured fish; catch rate = (M+C)/number days sampled.
[b] No recapture runs due to low flows.
[c] Only 3.2 km of larger 4.9 km section was electrofished with drift boat.
[d] Major habitat changes with spring runoff.

Appendix E. Sampling dates, flows, and catch rates at the Lorenzo electrofishing section, South Fork Snake River, Idaho, 1987-2002. Flows were recorded at the USGS Lorenzo gage.

Sampling dates	Range of flows (m^3/s)	Range of flows (ft^3/s)	Mean flow (m^3/s)	Catch rate (fish/day)[a]
9/29,30; 10/7 1987	58.6-69.7	2,070-2,460	64.5	183
10/4,6,11 1988	30.9-34.3	1,090-1,210	33.1	205
10/13,16,23 1989	24.7-25.5	871-899	25.1	197
10/3,4,10 1990	49.9-79.0	1,760-2,790	67.7	265
9/18,19,30 1991	60.3-77.3	2,130-2,730	71.5	346
9/23,27; 10/4,7 1993	46.2-72.0	1,630-2,540	56.6	244
10/2,4,10,11 1995	27.4-45.0	967-1,590	36.1	358
9/28,29; 10/6,7 1999[b]	49.6-86.7	1,750-3,060	67.0	378
9/17,18,24,26 2002	73.9-122.4	2,610-4,320	97.8	335

[a] Includes recaptured fish; catch rate = (M+C)/number days sampled.
[b] Major habitat changes with spring, 1997, runoff.

Appendix F. Trout species composition and relative abundance (%) at the Conant electrofishing section, South Fork Snake River, Idaho, 1982-2002. Total individual fish captured during mark and recapture runs are in parentheses.

Year	Cutthroat trout[a]	Rainbow trout	Brown trout	Lake trout	Kokanee	Total
1982[b,c,d]	79 (181)	1 (2)	19 (44)	1 (2)	0 (0)	100 (229)
1986[c]	83 (1,647)	2 (47)	14 (285)	<1 (4)	0 (0)	99 (1,983)
1987[c,e,f]	86 (299)	2 (6)	12 (43)	0 (0)	0 (0)	100 (348)
1988	88 (1,570)	3 (58)	9 (159)	<1 (1)	0 (0)	100 (1,788)
1989	89 (2,291)	4 (103)	7 (175)	0 (0)	0 (0)	100 (2,569)
1990	84 (2,978)	6 (216)	9 (335)	<1 (4)	0 (0)	99 (3,533)
1991	80 (1,646)	7 (150)	13 (259)	0 (0)	0 (0)	100 (2,055)
1992[e]	83 (598)	5 (34)	12 (87)	0 (0)	0 (0)	100 (719)
1993	85 (1,528)	6 (113)	9 (166)	0 (0)	0 (0)	100 (1,807)
1994[e]	79 (867)	9 (100)	12 (136)	0 (0)	<1 (1)	100 (1,104)
1995	69 (1,121)	16 (256)	16 (258)	0 (0)	0 (0)	101 (1,635)
1996	66 (1,190)	15 (274)	18 (325)	<1 (1)	<1 (1)	99 (1,791)
1997[g]	54 (1,676)	27 (840)	18 (567)	<1 (1)	<1 (2)	99 (3,086)
1998	59 (1,312)	20 (454)	21 (469)	<1 (1)	0 (0)	100 (2,236)
1999	63 (1,803)	19 (560)	18 (513)	0 (0)	0 (0)	100 (2,876)
2000[e]	66 (800)	22 (271)	11 (134)	0 (0)	0 (0)	99 (1,205)
2001[e]	58 (778)	25 (341)	16 (219)	0 (0)	0 (0)	99 (1,338)
2002	53 (845)	34 (543)	14 (219)	<1 (1)	0 (0)	101 (1,608)

[a] Includes hatchery cutthroat trout.
[b] Only 1.9 km of larger 4.9 km section was electrofished.
[c] Electrofishing conducted in early November rather than October.
[d] From Moore and Schill (1984), not MR5 database.
[e] No recapture runs due to low flows.
[f] Only 3.2 km of larger 4.9 km section was electrofished with drift boat.
[g] Major habitat changes with spring runoff.

Appendix G. Mean total length and quality stock density (QSD) of trout captured at the Conant electrofishing section, South Fork Snake River, Idaho, 1986-2002. Total individual fish captured during mark and recapture runs equals n. QSD=(number >406 mm/number >203 mm) x 100.

	Cutthroat trout[a]			Rainbow trout			Brown trout			All trout[b]		
Year	n	Mean (mm)	QSD (%)	n	Mean (mm)	QSD (%)	n	Mean (mm)	QSD (%)	n	Mean (mm)	QSD (%)
1986[c]	1,647	330	8.5	47	307	11.4	285	338	29.0	1,983	330	11.5
1987[c,d,e]	299	297	14.9	6	262	0.0	43	249	11.5	348	292	14.3
1988	1,570	338	5.6	58	328	12.3	159	310	22.8	1,788	335	7.3
1989	2,291	353	8.8	103	323	19.6	175	343	38.5	2,569	351	11.2
1990	2,978	320	8.4	216	269	13.3	335	267	20.4	3,533	310	9.7
1991	1,646	333	11.2	150	251	6.6	259	274	14.1	2,055	320	11.3
1992[d]	598	333	9.0	34	282	2.9	87	264	6.6	719	323	8.4
1993	1,528	351	15.3	113	340	18.2	166	330	34.2	1,807	348	17.2
1994[d]	867	297	11.2	100	251	13.4	136	236	7.4	1,104	287	10.9
1995	1,121	351	21.2	256	277	10.6	258	287	15.8	1,635	328	18.7
1996	1,190	310	8.7	274	262	6.6	325	284	12.7	1,791	297	9.2
1997[f]	1,676	292	4.5	840	262	4.3	567	274	12.5	3,086	279	6.0
1998	1,312	295	4.8	454	318	13.3	469	279	8.4	2,236	297	7.4
1999	1,803	310	2.6	560	312	11.6	513	292	9.1	2,876	307	5.5
2000[d]	800	315	2.3	271	307	13.8	134	312	12.8	1,205	312	6.0
2001[d]	778	312	1.8	341	304	16.9	219	311	17.6	1,338	310	8.2
2002	845	338	4.0	543	326	23.6	219	339	34.0	1,608	334	14.4

[a] Includes hatchery cutthroat trout.
[b] Includes lake trout and kokanee.
[c] Electrofishing conducted in early November rather than October.
[d] No recapture runs due to low flows.
[e] Only 3.2 km of larger 4.9 km section was electrofished with drift boat.
[f] Major habitat changes with spring runoff.

Appendix H. Electrofishing statistics for the Conant section, South Fork Snake River, Idaho, 1986-2002.

	Cutthroat trout[a]				Rainbow trout				Brown trout				All trout[b]			
Year	M[c]	C[c]	R[c]	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)
1986[d]	1,171	546	70	13	32	17	2	12	186	107	8	7	1,393	670	80	12
1987[d,e,f]	299	ND[g]	ND	ND	6	ND	ND	ND	43	ND	ND	ND	348	ND	ND	ND
1988	1,101	567	98	17	41	18	1	6	115	48	4	8	1,257	634	103	16
1989	1,424	1,067	200	19	58	55	10	18	107	79	11	14	1,589	1,201	221	18
1990	1,768	1,527	317	21	118	112	14	12	213	134	12	9	2,102	1,774	343	19
1991	1,159	627	140	22	105	54	9	17	158	120	19	16	1,422	801	168	21
1992[e]	598	ND	ND	ND	34	ND	ND	ND	87	ND	ND	ND	719	ND	ND	ND
1993	998	630	100	16	78	41	6	15	110	66	10	15	1,186	737	116	16
1994[e]	867	ND	ND	ND	100	ND	ND	ND	136	ND	ND	ND	1,104	ND	ND	ND
1995	633	565	77	14	130	143	17	12	154	117	13	11	917	825	107	13
1996	714	548	72	13	165	114	5	4	216	127	18	18	1,097	789	95	12
1997[h]	914	926	164	18	436	476	72	15	352	298	83	28	1,703	1,702	319	19
1998	679	694	61	9	221	259	26	10	276	242	49	20	1,176	1,196	136	11
1999	1,021	899	117	13	347	242	29	12	297	247	31	13	1,665	1,388	177	13
2000[e]	800	ND	ND	ND	271	ND	ND	ND	134	ND	ND	ND	1,205	ND	ND	ND
2001[e]	778	ND	ND	ND	341	ND	ND	ND	219	ND	ND	ND	1,338	ND	ND	ND
2002	499	396	50	13	303	264	24	9	117	111	9	8	919	772	83	11

[a] Includes hatchery cutthroat trout.
[b] Includes lake trout and kokanee.
[c] 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.
[d] Electrofishing conducted in early November rather than October.
[e] No recapture runs due to low flows.
[f] Only 3.2 km of larger 4.9 km section was electrofished with drift boat.
[g] ND = no data; no recapture runs.
[h] Major habitat changes with spring runoff.

Appendix I. Estimated abundance (N) of age-1 and older cutthroat trout (>102 mm), rainbow trout (>102 mm), brown trout (>152 mm), and all trout (>102 mm) at the Conant electrofishing section, South Fork Snake River, Idaho, 1986-2002. Standard deviations for the log-likelihood estimates are in parentheses.

First marking date	Cutthroat trout[a]		Rainbow trout		Brown trout		All trout[b]	
	N/section	N/km	N/section	N/km	N/section	N/km	N/section	N/km
11/4/86	14,161 (1,005)	2,890	NUE[c]	NUE	3,142 (632)	641	13,935 (608)	2,844
11/5/87	NE[d]	NE	NE	NE	NE	NE	NE	NE
10/3/88	7,306 (370)	1,491	NUE	NUE	1,652 (776)	337	9,005 (434)	1,838
10/18/89	7,860 (269)	1,604	310 (65)	63	936 (405)	191	8,788 (262)	1,793
10/11/90	11,416 (432)	2,330	1,004 (161)	205	1,806 (331)	369	14,633 (435)	2,986
10/7/91	6,854 (340)	1,399	657 (135)	134	954 (129)	195	7,920 (287)	1,616
10/14/92	NE	NE	NE	NE	NE	NE	NE	NE
10/13/93	7,364 (374)	1,503	538 (127)	110	663 (194)	135	8,058 (324)	1,644
10/7/94	NE	NE	NE	NE	NE	NE	NE	NE
10/5/95	6,029 (367)	1,230	1,326 (181)	271	1,442 (440)	294	8,349 (391)	1,704
10/3/96	7,361 (562)	1,502	2,982[e] (1,076)	609[e]	1,538 (196)	314	11,233 (640)	2,292
10/16/97[f]	5,609 (190)	1,145	3,037 (183)	620	1,809 (507)	369	9,659 (234)	1,971
10/7/98	8,286 (510)	1,691	2,257 (196)	461	1,189 (90)	243	10,770 (389)	2,198
10/13/99	9,051 (407)	1,847	3,207 (317)	654	2,508 (423)	512	13,873 (443)	2,831
10/19/00	NE	NE	NE	NE	NE	NE	NE	NE
10/4/01	NE	NE	NE	NE	NE	NE	NE	NE
10/3/02	4,120 (297)	841	3,965 (489)	809	1,410 (306)	288	8,845 (399)	1,805

[a] Includes hatchery cutthroat trout.
[b] Includes lake trout and kokanee.
[c] NUE = no unbiased estimate possible as $R \leq 3$ (Ricker 1975).
[d] NE = no estimate; recapture runs not made.
[e] Modified Peterson rather than log-likelihood estimate.
[f] Major habitat changes with spring runoff.

Appendix J. Trout species composition and relative abundance (%) at the Lorenzo electrofishing section, South Fork Snake River, Idaho, 1987-2002. Total individual fish captured during mark and recapture runs are in parentheses.

Year	Cutthroat trout	Rainbow trout	Brown trout	Lake trout	Kokanee	Total
1987	38 (203)	<1 (2)	61 (325)	0 (0)	0 (0)	99 (530)
1988	36 (210)	1 (6)	63 (363)	0 (0)	0 (0)	100 (579)
1989	34 (191)	1 (3)	65 (362)	0 (0)	0 (0)	100 (556)
1990	38 (288)	<1 (2)	62 (471)	0 (0)	0 (0)	100 (761)
1991	37 (359)	1 (6)	63 (610)	0 (0)	0 (0)	101 (975)
1993	37 (342)	2 (15)	62 (572)	0 (0)	0 (0)	101 (929)
1995	32 (441)	1 (9)	67 (917)	0 (0)	0 (0)	100 (1,367)
1999[a]	23 (331)	<1 (7)	76 (1,093)	0 (0)	0 (0)	99 (1,431)
2002	18 (232)	<1 (6)	81 (1,026)	0 (0)	0 (0)	99 (1,264)

[a] Major habitat changes with spring, 1997, runoff.

Appendix K. Mean total length and quality stock density (QSD) of trout captured at the Lorenzo electrofishing section, South Fork Snake River, Idaho, 1987-2002. Total individual fish captured during mark and recapture runs equals n. QSD=(number >406 mm/number >203 mm) x 100.

	Cutthroat trout			Rainbow trout			Brown trout			All trout[a]		
Year	n	Mean (mm)	QSD (%)	n	Mean (mm)	QSD (%)	n	Mean (mm)	QSD (%)	n	Mean (mm)	QSD (%)
1987	203	325	6.1	2	290	0.0	325	329	19.6	530	327	14.3
1988	210	332	9.8	6	311	0.0	363	309	22.0	579	317	17.2
1989	191	331	19.2	3	341	0.0	362	301	35.2	556	311	28.7
1990	288	297	9.8	2	512	100.0	471	257	23.2	761	273	17.4
1991	359	301	12.9	6	303	0.0	610	232	10.1	975	258	11.2
1993	342	325	5.3	15	294	15.4	572	261	13.1	929	285	9.9
1995	441	317	13.7	9	325	11.1	917	234	15.4	1,367	261	14.6
1999[b]	331	334	8.0	7	350	0.0	1,093	272	7.8	1,431	287	7.8
2002	232	316	2.3	6	340	16.7	1,026	321	14.4	1,264	321	12.1

[a] Includes lake trout and kokanee.
[b] Major habitat changes with spring, 1997, runoff.

Appendix L. Electrofishing statistics for the Lorenzo section, South Fork Snake River, Idaho, 1987-2002.

	Cutthroat trout				Rainbow trout				Brown trout				All trout[a]			
Year	M[b]	C[b]	R[b]	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)
1987	146	63	6	10	2	0	0	0	232	105	12	11	380	168	18	11
1988	133	90	13	14	4	2	0	0	250	136	23	17	387	228	36	16
1989	127	77	13	17	1	2	0	0	257	127	22	17	385	206	35	17
1990	208	92	12	13	2	0	0	0	342	152	23	15	552	244	35	14
1991	199	177	17	10	0	6	0	0	363	294	47	16	562	477	64	13
1993	144	216	18	8	7	8	0	0	277	322	27	8	428	546	45	8
1995	265	198	22	11	4	5	0	0	420	541	44	8	689	744	66	9
1999[c]	194	163	26	16	3	4	0	0	515	634	56	9	712	801	82	10
2002	108	138	14	10	4	3	1	33	472	615	61	10	584	756	76	10

[a] Includes lake trout and kokanee.
[b] 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.
[c] Major habitat changes with spring, 1997, runoff.

Appendix M. Estimated abundance (N) of age 1 and older cutthroat trout (>102 mm), rainbow trout (>102 mm), brown trout (>152 mm), and all trout (>102 mm) at the Lorenzo electrofishing section, South Fork Snake River, Idaho, 1987-2002. Standard deviations for the log-likelihood estimates are in parentheses.

First marking date	Cutthroat trout		Rainbow trout		Brown trout		All trout[a]	
	N/section	N/km	N/section	N/km	N/section	N/km	N/section	N/km
9/29/87	1,897 (490)	395	NUE[b]	NUE	2,548 (392)	531	4,657 (476)	970
10/4/88	896 (116)	187	NUE	NUE	1,441 (215)	300	2,539 (239)	529
10/13/89	1,125 (236)	234	NUE	NUE	992 (98)	207	3,250 (288)	677
10/3/90	1,462[c] (351)	305[c]	NUE	NUE	1,309 (241)	273	4,554 (360)	949
9/18/91	2,136 (356)	445	NUE	NUE	1,752 (138)	365	4,575 (319)	953
9/23/93	2,254 (376)	470	NUE	NUE	2,740 (259)	571	5,822 (357)	1,213
10/2/95	2,657 (282)	554	NUE	NUE	3,254 (250)	678	7,617 (350)	1,587
9/28/99[d]	1,539 (195)	321	NUE	NUE	5,618 (396)	1,170	7,130 (357)	1,485
9/17/02	1,180 (158)	246	NUE	NUE	4,974 (287)	1,036	6,650 (319)	1,385

[a] Includes lake trout and kokanee.
[b] NUE = no unbiased estimate possible as R $\leq$ 3 (Ricker 1975).
[c] Modified Peterson rather than log-likelihood estimate.
[d] Major habitat changes with spring, 1997, runoff.

2002 ANNUAL PERFORMANCE REPORT

State of: Idaho Program: Fisheries Management F-71-R-27

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

Contract Period: July 1, 2002 to June 30, 2003

ABSTRACT

Upper Snake Region fisheries management personnel provided private individuals, organizations, public schools, 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 news 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	Henrys Fork Foundation
Idaho Department of Parks and Recreation	Boy Scouts of America
Idaho Department of Water Resources	Sheridan Creek Restoration Committee - Idaho
Henrys 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 developed a brochure outlining regulations and management of private fish ponds in Idaho designed to minimize illegal stocking of fish ponds and new introductions of non-native species. We responded to numerous requests for technical assistance and permit processing by private pond owners.

We met with volunteers from the Friends of the Teton River and the Teton Valley chapter of Trout Unlimited to provide training for redd surveys in Teton Valley tributaries. We provided instruction on how to identify redds through an understanding of construction and through some sample photos. We also participated in a series of Teton River floats to identify and prioritize candidate sites for stream restoration work.

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 provided information to the Department 1-800-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.

2002 ANNUAL PERFORMANCE REPORT

State of: Idaho Program: Fisheries Management F-71-R-27

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

Contract Period: July 1, 2002 to June 30, 2003

ABSTRACT

Regional personnel assisted with or conducted a range of habitat improvement activities in 2002. Rocks were placed in an angle-iron fish ladder in the Targhee Creek culvert to improve passage for spawning Yellowstone cutthroat trout migrating from Henrys Lake. 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 on Burns, Palisades, and Rainey creeks were operated and maintained. Regional personnel and volunteers planted riparian vegetation at the site of the Burns Creek weir to restore disturbances made during construction.

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 16 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 2002 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 2002. Additionally, the two ten-foot wire mesh screens on Howard Creek and the lower four-foot wire mesh screen on Targhee Creek were replaced with perforated plate screens fabricated in the Salmon Screen Shop. Funds for the screen replacements were procured from the Henrys Lake Foundation at a cost of $6,108.00. Installation costs were incurred and paid for by the Henrys Lake project funding of the Idaho Department of Fish and Game.

We improved fish passage through the Targhee Creek culvert under Highway 87 by using angular rocks to create baffles in the existing ladder. Although the ladder was replaced after being washed out during the high runoff in 1997, no rocks had been replaced to create the necessary baffles. In November rock, which was provided by the Idaho Department of Transportation, was placed in rungs of the angle-iron ladder located inside the culvert.

South Fork Snake River Tributaries

The Department cooperatively operated and maintained two irrigation diversion screens on Burns Creek and Palisades Creek, important South Fork Snake River cutthroat spawning tributaries. One of the four Palisades Canal screens was removed for replacement of bearings and seals. The other three screens will be refurbished over the next three years.

Regional personnel and about 12 volunteers from the local Trout Unlimited Chapter planted about 200 trees and shrubs at the site of the Burns Creek weir to restore land disturbed during weir construction. Plants consisted of woods rose, chokecherry, water birch, and dogwood.

Willow Creek Tributaries

We conducted routine maintenance on riparian fences on Sellars Creek in 2001. No new fence was constructed.

Teton River Tributaries

We conducted routine maintenance on riparian fences on several tributaries to the Teton River in the upper river valley.

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