Johnson + Haskins 2000

Nevada Division of Wildlife

SECTION 6 ANNUAL PROJECT REPORT
RECOVERY ACTION BULL TROUT
EASTERN REGION
1999

PREPARED BY

GARY JOHNSON
RICH HASKINS

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NEVADA DIVISION OF WILDLIFE, FISHERIES BUREAU
SECTION 6
ANNUAL PROJECT REPORT

PROJECT TITLE: Recovery Action For Bull Trout In Jarbidge River Drainage, Nevada , Eastern Region
SPECIES: Bull Trout, *Salvelinus confluentus*
PERIOD COVERED: January 1, 1999 to December 31, 1999

SUMMARY

An intensive fish population survey methodology was used in Jack Creek and Pine Creek in order to detect the presence, distribution, and relative abundance of bull trout. An estimated 174 redband trout, seven adult bull tout and 45 age 1+ bull trout were found inhabiting the upper 0.65 miles of Jack Creek below a natural barrier. Upstream access into lower Jack Creek was restored in November 1997, following the installation of a bridge where a culvert had previously created a presumed upstream fish migration barrier. Much less intensive fish population sampling conducted in Jack Creek in 1997 and 1998 may have failed to detect the low density population of bull trout. Intensive sampling in upper Pine Creek also resulted in the detection of a low density bull trout population. The upper 1.5 miles of Pine Creek was estimated to have contained a minimum of 40 bull trout and 266 redband trout. Ocular reconnaissance of the Right (headwater) Fork of the East Fork Jarbidge River revealed mostly a dry channel, with a minimal flow in some areas. Perennial flow in the headwater fork began from a spring source located about a 0.10 mile upstream of the confluence of the two headwater forks of the river. Electro-fishing in a 100 ft length of river located 0.5 mile downstream of the headwater forks (1999 thermograph location) resulted in the capture of two bull trout and five redband trout. An additional redband trout and bull trout were seen but missed within the sampled area. Fin-clips were taken from captured bull trout and preserved for future genetic analysis.

Thermographs were set in upper East Fork Jarbidge River, lower Cougar Creek, lower Fall Creek, upper Robinson Creek, upper Dave Creek, upper Jack Creek, and upper Pine Creek. The period of record for the thermographs was from early to mid-July to September 30 to November 16, 1999. The coldest and most constant temperatures were recorded in Dave Creek just downstream of the main spring source. The maximum daily temperature was only 44.16°F in Dave Creek. Only bull trout have been collected in the uppermost reach of Dave Creek during previous fish population surveys. The warmest thermograph site was in lower Cougar Creek where the 7-day mean maximum temperature was 61.27°F. Only redband trout were collected at the thermograph site in 1998. The warmest bull trout inhabited (low density) thermograph site was in upper Pine Creek wherein, the mean 7-day maximum temperature was 58.8°F. There were 50 days in July and August that the maximum temperature in upper Pine Creek was >53.6°F, which is

considered to be less than optimum juvenile bull trout habitat. Bull trout occupied upper Jack Creek had a 7-day mean maximum recorded temperature of 57.06°F and only 25 days had maximum temperatures >53.6°F. The 7-day mean maximum temperature in the low density bull trout occupied reach of lower Fall Creek was 55.84°F and there were 23 days that the temperature was >53.6°F. The bull trout occupied upper East Fork Jarbidge River had a 7-day mean maximum temperature of 53.69°F and there were six days that the temperature was> 53.6°F. While no bull trout are known to occupy Robinson Creek, the temperature metrics indicate suitability at least as good as in bull trout occupied upper Pine Creek. The 7-day mean maximum temperature in upper Robinson Creek was 58.36°F and there were 44 days that the temperature was> 53.6°F. Intensive fish population survey methodology could be used to detect the presence of bull trout in Robinson Creek.

OBJECTIVES

JACK **CREEK**

Objective

To conduct a population survey of Jack Creek to document the impact of removing the culvert barrier at the Jarbidge Road crossing.

Background

Federal agencies from Idaho conducted a snorkel survey in Idaho and in select Nevada sites in the Jarbidge River drainage during early to mid-July, 1994. The snorkel team reported seeing five or six adult bull trout in the pool formed below the outfall of the culvert beneath the Jarbidge Road crossing. These fish were thought to have been blocked from moving upstream in Jack Creek because of the velocity barrier in the culvert. The culvert had been replaced by Elko county in 1993 following a spring high flow event. An Idaho BIM stream survey form dated July 21, 1981, indicated that the old Jack Creek culvert was also a barrier to upstream movement of fish. A fish population survey of Jack Creek and Jenny Creek in early-September, 1992 found a dominant redband trout population and only one, five-inch bull trout.

The culvert fish barrier first came to the attention of NDOW during the first meeting of the Joint Idaho-Nevada Bull Trout Task Force on February 25, 1994. Through the efforts of Bull Trout Task Force members, money was raised to replace the culvert with a bridge. NDOW agreed to conduct fish population monitoring both before and after bridge installation. Surveys of five 100 foot sample sites located in the 2.7 miles of the fish occupied portion of Jack Creek and Jenny Creek found only redband trout in both August-September 1997 and August 1998. The bridge was completed in November 1997.

The fact that bull trout had not been detected in Jack Creek since 1992 made it clear that fish sampling should be intensified during 1999 in order to verify the presence of bull trout in Jack Creek.

procedures

A fish population survey design to detect bull trout was developed using recommendations in a Washington Department of Fish and Wildlife paper.[1] A sampling efficiency (capture) rate was determined from previous surveys of trout in Jack Creek using a single-pass electrofishing technique. The mean capture efficiency was 60%. The mean density of bull trout in Jack Creek in 1992 was 0.25 fish per 100 meters sampled stream. Using the aforementioned bull trout encounter density and capture efficiency, it was determined that eleven, 100 m sample stations needed to be electrofished in Jack Creek to confirm that no bull trout were present in the sample reach, at an 80% confidence interval. Each of the four original stations and an additional seven stations were sampled (Map 1). To confirm the upper limit of fish distribution, a 30 m section of stream was electrofished above what was noted as a natural fish barrier. The 30 m sample site on Jenny Creek up from its confluence with Jack Creek was electrofished to compare with earlier survey work.

Sample sites were pre-plotted on a USGS 7.5 minute topographic map. The period of survey was August 16, 17, and 29, 1999. Upon locating a sample site in the field, the start of electrofishing began at a natural pool/riffle break. A tape was run up the stream margin to mark each 30 m section. The capture data for the last 9.4 m of the 100 m sample site was also tallied separately on field forms. A Dirigo 750 backpack electroshocker unit utilizing a single pass electrofishing technique was used. Captured redband trout were recorded as catchables (>6 inches) or sub-catchables «6 inches) and immediately released below the capture area so as not to be recaptured. Bull trout captures were individually measured (total and fork lengths) and weighed. All measurements were in metric. Identified misses were recorded in each electrofished segment. A small, dorsal fin-clip was taken from each captured bull trout and preserved in order that they may be used in any future contracted bio-genetic contract.

Estimates of the number fish (spp.) per 100 m at each sample site were calculated by adding total fish (spp.) captured and fish (spp.) seen but missed at each station. The number of fish (spp.) per meter was converted to number of fish (spp.) per mile and all sample sites within the occupied range of the species were averaged. Minimum species

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IBonar S. A., M. Divens, and B. Bolding. 1997. Methods for sampling the distribution and abundance of bull trout and dolly varden. Washington Department ofFish and Game, Olympia, WA46 pp.

abundance estimates were derived from multiplying the mean number of fish (spp.) per mile x occupied length of each species.

8tream habitat measurements recorded at each sample station included both air and water temperatures and length of unstable streambanks. The following stream habitat variables were recorded at each sample site: relative turbidity; number of quality pools; bank cover type, relative density and vigor; relative riparian area density; relative amount of sedimentation, percent stream shading, percent livestock damage and vegetation utilization, beaver activity, upland vegetation types, and invertebrate types and relative abundance. 8tream flow was measured by the float method through a one meter length of relative uniform stream located in the bull trout occupied reach. Photos of two fish migration obstacles, the upstream fish barrier, and an adult bull trout were taken. Discharge was calculated using a roughness constant of 0.8 as indicated in the formula below:

$$\text{Discharge } \textit{(cms/cfs)} = \frac{\text{mean width} \times \text{mean depth} \times \text{length} \times 0.8}{\text{mean time (seconds)}}$$

Findings

Bull trout were found at the four uppermost sample sites below the upstream barrier. (Appendix I). Redband trout were present at all eleven sample sites located below the upstream barrier at an average density of 762.4 redband trout per mile. Examined redband trout were comprised of 23% catchables and 77% sub-catchables. Bull trout numbers dominated redband trout only at the highest elevation sample site (8-11) where a single redband trout was collected along with six bull trout. An additional five bull trout were seen but missed at 8-11. The two sample sites downstream of the bull trout dominated site had two bull trout within each of the sample sites. Redband trout comprised an average of 90.5% of the numbers of fish at the two aforementioned sample sites. A single bull trout that was captured at 8-8 was identified as a bull trout that had been collected and fin-clipped at 8-10, twelve days prior to its recapture at 8-8. The occupied range of the bull trout includes about 0.65 miles of stream below the fish barrier. Length frequency analysis of eight of the nine captured bull trout indicated a dominant Age I group that averaged 113 mm FL (95 - 121 mm). One larger bull trout was 173 mm FL and probably Age IV. One bull trout seen but missed at 8-10 was about nine inches long. Three adult-sized (approximately 9 inches) bull trout and a few juvenile bull trout were seen in the approximate 0.1 mile above 8-11, below a five foot high cascade migration barrier above whtch no fish were found (8-12). This barrier is probably why fish were never been found in upper Jack Creek during either the 1957 or 1992 fish population survey. There were an estimated 45 juvenile and seven adult bull trout in the upper 0.65 miles of Jack Creek. There were 1982 redband trout in about 2.6 miles of Jack Creek.

The bull trout, occupied reach of Jack Creek can be classified as an Rosgen A2 channel type with inclusions of an A1 type. Pool to riffle ratios were estimated to be about

40:60 at the upper two sample sites and 20:80 at the more bedrock S-9 sample site. Streambanks were mostly stable, despite channel modifications in some areas that were attributed to the 1995 spring time high water event. Streambank cover consisted of a light to moderate density of fir/cottonwood/aspen/juniper trees, alder; willow and an understory of forbs and bunch grasses. Riparian vegetation density was rated as "light" at S-9 and "moderate" at S-10 and S-11. Stream discharge was 2.2 cfs. On the morning of August 18th , stream temperatures ranged from 49.5°F to 51°F at sample sites having bull trout. On August 30th a temperature of 55°F was taken at 1719 hours at S-12 located above the fish barrier and at 1502 hours at S-8 the temperature was 57°F. The highest stream temperature was recorded in lower Jack Creek on August 16th and it was 58°F. The fact that bull trout were found at the upper limits of fish occupation in Jack Creek, is consistent with other Jarbidge streams having an adequate flow and favorable bull trout rearing temperatures.

The fact that the small bull trout sample population (n = 9) and other observed bull trout in Jack Creek were composed only of Age II and adult fish would lead one to believe that bull trout had spawned in Jack Creek in 1997, but not in 1998. According to bridge project personnel, it was unlikely that bull trout could have accessed Jack Creek after culvert removal on October 21, 1997 until after project completion on November 19, 1997.[2] It would seem unlikely that bull trout would have accessed Jack Creek to spawn later than November 19,1997.

A more plausible explanation for finding bull trout in upper Jack Creek is that they may have been in the stream all along but that previous sampling in 1997 and 1998 may have just missed sampling bull trout. Sampling in 1992, 1997, and 1998 was conducted at four sample sites and only the uppermost sample site (S-4) was within what was determined in 1999 to be the bull trout occupied reach. Sampled lengths of stream at each sample site prior to 1999 were only 30 m (100 ft) long. The 1999 survey data indicates that had sampled sites in 1999 been only 30 m long, bull trout would not have been sampled at either S-9, S-10 (same location as S-4), or at S-11. In other words, no bull trout would have been found in 1999 had we not sampled more than 30 m of stream at each sample site.

Recommendations:

(1) Any future survey work aiming to determine if bull trout reside in a particular stream should follow procedures used in Jack Creek in 1999. At a minimum, a mile of the upper fish inhabited reach of a stream should be intensively surveyed as was done in 1999.

(2) The question of whether or not fluvial bull trout are entering Jack Creek to spawn could be addressed by capturing and radio-tagging bull trout in the West Fork Jarbidge River in

2Craig Newman, USFS Project Engineer, personal communication, November 4, 1999.

summer prior to spawning migrations or by placing a weir and trap in lower Jack Creek to determine bull trout movements.

(3) The bull trout fin-clips taken from bull trout in Jack Creek should be analyzed and compared with samples taken elsewhere in the West Fork Jarbidge River drainage.

(4) The Jack Creek bull trout population should periodically (every three years) be sampled to determine population status.

(5) The bull trout occupied reach of Jack Creek could be walked periodically during the fall time in order to document time of spawning and spawning site characteristics.

Pine Creek

Objective

To delineate the upstream distribution and status of the bull trout in Pine Creek.

Background

Pine Creek was first surveyed to determine fish population status and stream habitat condition in mid-August 1992. This electroshocking survey of seven sample locations (100 feet each), found only redband trout. No fish were collected at the upper three sample sites in 1992, however, just below S-5 a 187 mm bull trout was seen and netted for identification. On September 29, 1997 a Conservation Aide was sent up Pine Creek to document bull trout presence in the vicinity of where the bull trout was captured in 1992. Within a quarter mile of the 1992 capture site, a garter snake with a juvenile bull trout hanging from it's mouth was captured and the fish was removed and released alive back into the stream. A resurvey of fish population sample sites established in 1992 was undertaken on August 5,1998. While only redband trout were captured at sample sites in Pine Creek, a juvenile bull trout was shocked and captured just up from Pine Creek in a small tributary located between S-5 and S-6. The fact that only a single bull trout had been collected in the Pine Creek drainage during each of three separate surveys, was good reason to conduct an intensive fish population survey of upper Pine Creek to document the distribution and relative abundance of bull trout.

Procedures

A fish population survey designed to detect bull trout was developed using

recommendations in a Washington Department of Fish and Wildlife paper.[3] A sampling efficiency (capture) rate was determined from previous surveys of trout in Jack Creek using single-pass electrofishing techniques. The mean capture efficiency was <50%. The mean density of bull trout in Pine Creek was unknown and hence, was assumed to be at least 0.5 fish per 100 meters of sampled stream. Using the aforementioned bull trout density and capture efficiency, it was determined that ten, 100 meter sample stations needed to be electrofished in Pine Creek in order that we could be confident (80% confidence level), that no bull trout were present in the sample reach. The sampled reach of Pine Creek chosen for intensive survey included the upper 1.5 miles of stream below the confluence of the West Fork of Pine Creek. This sample reach encompassed the locations of the 1992 surveyed sites of S-5 And S-6.

The survey period of survey was August 31, September 1 and 2, 1999. Sample sites were pre-plotted on a USGS 7.5 minute topographic map (Map2). One additional site was sampled located about a mile below the study reach. Upon locating a sample site in the field, the start of electrofishing began at a natural pool/riffle break. A tape was run up the stream margin to delineate each 30 m section. The capture data for the last 9.4 m of the 100 m sample site was also tallied separate on field forms. A Dirigo 750 backpack electroshocker using a single pass electrofishing procedure was used. Captured redband trout were counted as catchables (>6 inches), sub-catchables «6 inches),or young-of-year and immediately released below the capture area so as not to be recaptured. Bull trout captures were individually measured (total and fork lengths) and weighed. All measurements were in metric. Identified misses were recorded in each electrofished segment. A small, dorsal fin-clip was taken from each captured bull trout and preserved in order that they may be used in any future contracted bio-genetic contract.

Estimates of the number fish (spp.) per 100 m at each sample site were calculated by adding total fish (spp.) captured and fish (spp.) seen but missed at each station. The number of fish (spp.) per meter was converted to number of fish (spp.) per mile and all sample sites within the occupied range of the species were averaged. Minimum species abundance estimates were derived from multiplying the mean number of fish (spp.) per mile x occupied length of each species. Known missed trout that could not be identified were not included in individual species totals.

Stream habitat measurements recorded at each sample station included water temperature (OF) and length of unstable streambanks. The following stream habitat variables were recorded at each sample site: relative turbidity; number of quality pools by class; relative amount of stream cover, percent streambottom composition, and invertebrate types and relative abundance.

'Bonar S. A., M. Divens, and B. Bolding. 1997. Methods for sampling the distribution and abundance of bull trout and dolly varden. Washington Department ofFish and Game, Olympia,

Findings

Within the study reach bull trout were found at the highest elevation sites (S-9 and S-10), the two lowest elevation sites (S-1 and S-2), and at two (S-4 and S-6) of five sampled sites in between (Appendix II). Sample station (S-8) was not surveyed due to time constraints. At the add on sample site located about a mile below the study reach at the 1992 sample site S-3, there were only redband trout captured. Redband trout dominated the catch at all sample sites except, at S-2 where along with one unknown missed trout there were four bull trout catchables to three redband trout sub-catchabies. There were an average of 1.67 bull trout per 100 m of sampled stream within the 1.5 mile sample reach. There were an average of 11.00 redband trout per 100 m of sampled stream within the sample reach. There were 0.67 unknown missed trout per 100 m of sampled stream within the sample reach. Of the 122 captured and known missed trout within the study reach, 82.9% were redband trout, 12.3% were bull trout, and 4.9 % were unidentified missed trout. Redband trout were comprised of 47.5% catchables and 52.5% sub-catchables. Length frequency analysis of 12 captured bull trout indicates that two fish were Age I (mean TL = 106 mm), six fish were Age 11+ (mean TL = 174 mm), and two fish were Age 111+ (mean TL = 216 mm). Two older aged bull trout captures were 271 mm and 296 mm TL, The 296 mm bull trout was the largest bull trout ever recorded as captured by electrofishing in the Jarbidge River drainage. The largest of the bull trout captured in Pine Creek may have been fluvial migrants from the West Fork Jarbidge River. There were minimum estimates of 40 bull trout and 266 redband trout that inhabited the upper 1.5 mile reach of stream.

Streambanks were variously covered with alder, willow, grass, and forbs. Tree types that were often present included fir, aspen, and or cottonwood. Stream cover as created by streambank overhang, boulders, instream debris, and or deep water was deemed mostly "light to moderate." Quality pool habitat (Class 1,2 and 3) comprised an average of 12% of the stream within the upper surveyed reach and class 3 pools comprised 70% of the quality pool habitat. Rubble was judged to be the dominant substrate material (42 %) at all except, S-3 where bedrock was dominant. Boulders were present at all sites and comprised an average of 24% of the streambottom. While gravel comprised an average of 19% of the bottom, much of the gravel was one-quarter inch and less in diameter. Fines comprised an average of 10% of the streambottom. Bedrock was noted at two sites for an average surveyed area coverage of 5%. Commonly seen invertebrate types found in Pine Creek included several species mayflies and caddisflies, planaria, and the occasional stonefly. Recorded afternoon water temperatures during the survey ranged from 47°F to 53°F,

Recommendations:

(1) The fin-clips taken from bull trout in Pine Creek should be analyzed by Montana State University, to determine if the presence of a fluvial population of bull trout in Pine Creek can be made.

(2) Radio tagging adult bull trout in lower West Fork Jarbidge River could also provide insight into the possibility of a fluvial population segment using Pine Creek.

East Fork Jarbidge River

Objective

To delineate the upstream distribution and status of the bull trout in the East Fork Jarbidge River.

Background

During the August 1998 fish population survey of the U.S. Forest Service portion of the East Fork Jarbidge River, a couple bull trout were spot-shocked up from the confluence of the headwater forks of the East Fork Jarbidge River in the unnamed Right Fork (looking upstream). There was no time to examine the entire Right Fork to determine the upstream fish distribution. Given the possibility that bull trout could be inhabiting about a mile of stream and knowledge that bull trout have an affinity for occupying cold headwater reaches of streams, it was decided to intensively examine the Right Fork in 1999.

Procedures

On September 28-29, we backpacked into the East Fork Jarbidge River drainage via the Jarbidge River Trail from Pine Creek Campground located along the West Fork Jarbidge River. There was no suitable stream flow (mostly dry) in the portion of the Right Fork that was planned for survey. The upper limit of fish occupation in the Right Fork was determined by determining where stream flow commenced. A 100 ft long fish population sampling site located above the first trail crossing the upper East Fork Jarbidge River was electrofished using a single pass with a Dirigo® 750 backpack electroshocker (Map 3). This sample site was situated where a thermograph had been placed to record daily stream temperatures since July 15, 1999. Fish collected within the sampled area were measured (mm) and weighed (gm). Fin-elips were taken of a bull trout collected within the sample area and from an additional four bull trout collected upstream of the sample area. The fin-clips were preserved in alcohol. The thermograph was pulled and both air and water temperatures were recorded with a hand-held thermometer. Stream habitat characteristics that were recorded at the sample site included the following: relative turbidity; flow stage; stream type; relative amount of stream cover; number of pools by class; percent pool:riffle ratio; and streambottom percent composition. The relative abundance of stream invertebrates was assessed by random substrate inspection. Mean stream width was measured at 0, 50, and 100 feet. Stream gradient was measured with a hand-held clinometer.

Findings

Permanent streamflow in the Right Fork emanated from a spring located approximately an eighth of a mile upstream of the confluence of the two forks forming the East fork Jarbidge River. The Right Fork upstream of the confluence of the spring was mostly dry with only intermittent surface water. Downstream 0.75 miles of the confluence of the two forks at the river trail crossing the water temperature was 43°F at 1555 hours. The air temperature was 62°F in the shade. Above the trail crossing the river was fir tree lined with a few scattered cottonwood and alder trees. Stream gradient was 3.5%. Stream width averaged 11.374 fl (7.55 - 16.40 fl). Stream cover was judged "moderate" and most of the woody debris was situated above low water level that was evident at the time of survey. The 100 fl of electrofished river contained two quality Class 2 pools, two quality Class 3 pools, two Class 4 pools, and at least seven Class 5 pools for an overall pool to riffle ratio of 55:45. The streambottom was composed of boulder (35%), rubble (45%), gravel (20%), and a trace of sand/silt. Mayflies were common and Brachycendrid larvae were occasionally seen.

A total of five redband trout and two bull trout were collected within the 100 fl sample section of stream. Identified but missed fish included one sub-catchable redband trout and one sub-catchable bull trout. Redband trout averaged 199 mm **TL** (142 - 252 mm). The captured bull trout included a 55 mm young-of-year specimen and a 195 mm **TL** specimen. Including the number of missed trout, there were a minimum of 158.4 bull trout per mile and 316.8 redband trout per mile. The bull trout density in 1993 and 1998 at a location (R3S2) about 0.2 mile downstream of the trail crossing was 52.8 bull trout per mile and 0.0 bull trout per mile, respectively. In 1993 and 1998 no bull trout where collected at ten sample sites below R3S2. Only bull trout trout were collected in 1993 and 1998 at R3S3 located just below the headwater forks.

The five bull trout that were collected upstream of the sample section of stream averaged 139 mm **TL** (98 - 160 mm). Of the sample of seven bull trout, there were at least four year classes represented. Fin-clips were taken from six bull trout and preserved for later analysis.

Recommendations

The fin-clips collected during this survey should be included in any future genetic study of the bull trout population.

Thermographs

Objective

To develop temperature profiles of selected stream reaches in the East Fork and

West Fork of the Jarbidge River, to determine their suitability as bull trout habitats.

Background

Bull trout have been referred to as a glacial relict species due to it's preference for the coldest reaches of streams within its native range in the Pacific Northwest. The species proclivity for inhabiting cold headwater habitat has been well documented in the Jarbidge River Basin. The ease of gathering constant temperature data with today's thermographs has allowed for an ever growing collection of water temperature records for the summer-fall period. The combination of thermograph records and fish distribution data, best characterizes temperature suitability for various bull trout life stages. Agencies collected thermograph data in the Jarbidge River basin include NDOW, IDFG, BLM, USFS, and the USFWS.

Procedures

Optic StowAway ®Temp Loggers were set by NDOW in 1999 during the period July 7 through July 15. The thermographs were pulled from the various streams during the period September 29 through October 16,1999 (Table 1). Air and water temperatures were taken with a hand-held thermometer when both the thermographs were set and pulled.

Table 1. Jarbidge River drainage temperature monitoring sites, NDOW, 1999.

STREAM LOCATION	ELEVATION (FT)	PERIOD OF RECORD
Pine Creek	7280	07/07 - 10/15
Robinson Creek	7030	07/12-10/16
Fall Creek	6560	07/13 - 09/30
Dave Creek	7600	07/13 - 10/01
Jack Creek	6720	07114 - 10/01
Cougar Creek	6800	07115 - 09/30
East Fork Jarbidge River	7360	07115 - 09/29

The thermographs were set to record the maximum temperature in each one hour period throughout a *day.* Upon data recovery it was discovered that the computer time was off at the time the thermographs were launched, hence the computer data time readout was inaccurate. The correct *day* and time could be inferred by examining the time and temperature data recorded at each location when thermographs were first set and then pulled. Hence, there was no loss of data. The minimum and maximum recorded temperature were pulled from each of the days data set. From the mentioned data set, the single maximum temperature, the *3-day* maximum mean, 7-*day* maximum mean, and the

mean daily maximum temperature in August were all calculated. The entire temperature data set was examined to calculate the mean daily maximum temperature and the 3-day mean daily temperature maximum.

Findings

Dave Creek: The coldest maximum temperatures were recorded below the spring source in Dave Creek where maximum temperatures were recorded in late-July into August. The maximum temperature never went over 44.16°F. The mean maximum August temperature was only 43.00°F. The 3-day and 7-day mean maximum temperatures where 43.97°F and 43.40°F, respectively. The maximum daily mean temperature was 41.68°F. Where the spring enters Dave Creek is considered the upper distribution limit of bull trout. The creek channel above the spring source is ephemeral. There have been two fish population surveys on the Forest portion of stream and only bull trout have been found at the uppermost sample site below the spring. Bull trout and redband trout are sympatric downstream until about the Forest Boundary where redband trout are dominant.

Cougar Creek: The warmest maximum temperatures that were recorded in 1999 were registered in Cougar Creek where the daily maximum, 3-day mean maximum, and 7-day mean maximum temperatures were 61.94°F, 61.27°F, and 61.27°F, respectively. The mean daily maximum and mean daily 3-day maximum temperature were 57.3°F and 56.6°F, respectively. The Cougar Creek thermograph had 47 days during the recording period that were above 53.6°F (12°C). Only redband trout and sculpin were found inhabiting the location of the thermograph during the August 25, 1998 electrofishing survey of the site. However, less than one-half mile upstream (6960 ft elevation) there were two young-of-year bull trout and three redband trout sampled in 100 ft of stream on August 26, 1998. An additional 180 mm TL bull trout was spot-shocked just above the 100 ft sample site in 1998. Hand-held thermometer readings at the site with bull trout were 50°F at 1700 hours on August 25, 1998. Lower Cougar Creek could probably only be considered nodal bull trout habitat.

Fall Creek: The mean maximum temperature in August was 53.99°F. Recorded during the last full week in August, the 3-day and 7-day mean maximum temperatures were 56.50°F and 55.84°F, respectively. There were 23 days during the recording period that the temperature exceeded 53.6°F. The maximum daily mean and 3-day daily mean maximum temperatures were 53.12°F and 51.5°F, respectively. Bull trout inhabit both Fall Creek to just 'above the confluence of the upper tributary (Trib. B) and both lower reaches of unnamed tributaries (Trib. A and Trib. B). Observations taken during fish population sampling in 1993 confirmed adult bull trout within a 100 ft long, sample site located in lower Fall Creek. While only redband trout were collected in the lower reaches of both unnamed tributaries during 1993, both redband trout and bull trout uuveniles) were collected during sampling on August 5, 1998.

Upper East Fork Jarbidge River: The thermograph was placed in the river above the first trail crossing located about 0.7 mile downstream of the confluence of the *two* unnamed headwater forks. The mean maximum August temperature was 51.72°F. The warmest temperatures came during the later *two* weeks of July wherein, the maximum recorded temperature was 54.41 of. The 3-day and 7-day mean maximum temperatures were 54.04°F and 53.69°F, respectively. There were only six days during the recording period that the temperature was >53.6°F. The mean daily maximum (August 23) and mean daily 3-day maximum temperatures were only 49.8°F and 48.9°F, respectively. The location of this thermograph is in what has been identified as a probable bull trout spawning and rearing area.

Robinson Creek: The thermograph was located just downstream of the confluence of Jim Bob Creek. The warmest period in Robinson Creek was during in the last full weeks of August. The mean maximum August temperature was 56.06° F. The maximum temperature recorded was 59.38°F. The 3-day and 7-day mean maximum temperature was 58.71 OF and 58.36°F. The mean daily maximum and mean daily 3-day maximum temperatures were only 53.8°F and 53.8°F, respectively. There were 44 days that the temperature exceeded 53.6°F. Robinson Creek drainage has only been surveyed for fish throughout its length once (1993) and only redband trout were collected. Redband trout were found to occupy Robinson Creek to just upstream of the confluence of Jim Bob Creek. Possible natural barriers to upstream fish migration during low water periods were identified in lower Robinson Creek during the 1993 survey.

Jack Creek: The thermograph was located 25 fl upstream of a small, unnamed tributary stream drainage. The warmest recorded period was during the last two full weeks in August. The maximum recorded temperature was 57.54°F. The mean maximum August temperature was 54.54°F. The 3-day and 7-day mean maximum temperature was 57.20°F and 57.06°F, respectively. There were 25 days that the temperature exceeded 53.6°F. The mean daily maximum and mean daily 3-day maximum temperatures were 54.65°F and 54.3°F, respectively. An intensive fish population survey of Jack Creek was completed in August 1999. Redband trout and both juvenile (Age 1+) and adult bull trout were found residing in the 0.65 miles of stream from just below the tributary upstream to a natural rock fish barrier. A culvert in lower Jack Creek posed as an upstream fish barrier until November 1997 when fish passage was restored due to the culverts removal and its replacement with a bridge. Fluvial bull trout would have had access into Jack Creek in 1998. The adult bull trout found in Jack Creek may have migrated up Jack Creek from the West Fork Jarbidge River in preparation for spawning in 1999.

Pine Creek: The thermograph was located just over half way up Pine Creek and upstream of a small fish bearing (lower reach) unnamed tributary. The warmest period of record occurred during the last full weeks of August. The maximum recorded temperature was 60.33°F. The maximum - minimum temperature was 49.97°F. The mean maximum August temperature was 56.38°F. The 3-day and 7-day mean maximum temperatures were 59.2°F

and 58.8°F, respectively. There were 50 days in July and August that the temperature exceeded 53.6°F. The maximum mean daily and maximum 3-day mean daily temperature was 53.4°F and 52.9°F, respectively. An intensive fish population survey of upper Pine Creek was completed on August 31 and September 1 and 2, 1999. A low density bull trout population was found residing along with a more dominant redband trout population. Two of the largest bull trout captured may have been fluvial migrants from the West Fork Jarbidge River. The thermograph data was recorded from the lower end of the 1.5 mile bull trout occupied reach of upper Pine Creek.

Discussion

Temperature is one of the most important factors affecting the distribution of bull trout. Temperature records from the three local bull trout areas (upper West Fork Jarbidge River, upper East Fork Jarbidge River, and upper Dave Creek) are the coldest fish bearing stream reaches in the Jarbidge River drainage. These same three stream reaches contain the highest densities of bull trout and are most likely areas for spawning and rearing. Maximum water temperature never rose above 54.41 0F at either of the three monitoring sites. All three of these sites have a north-facing drainage basin. In the Flathead River drainage of Montana, the highest densities of juvenile bull trout were found in reaches where maximum temperatures were 53.6°F or less and juveniles were rarely found in streams with summer water temperatures exceeding 59.0° (Fraley et al., 1989). In British Columbia bull trout streams, within the temperature range of 53.6°F - 55.4°F, rainbow trout densities dominated bull trout densities (Haas, 0000). On September 29, 1999, at the upper East Fork Jarbidge River thermograph location where the maximum temperature rose to 54.41 of, there were three redband trout for every bull trout through the 100 ft sample area. The vast majority of the Jarbidge River system will likely always have a summer water temperature regime more suitable for redband trout occupancy than for bull trout occupancy. Laboratory studies have shown that bull trout optimal growth and upper lethal temperatures are lower than co-occurring brook trout, rainbow trout, and brown trout, suggesting a possible mechanism for replacement of bull trout by these nonnative salmonids, and for a high degree of isolation of remaining populations (Selong J., et al. 0000).

It is not clear, what particular temperature metric may be the most important in determining bull trout occupancy. When either daily maximum, 3-day mean maximum, 7-day mean maximum, or mean August maximum water temperature are used to rank the 1998 and 1999 monitored stream reaches, the ranking is the same (Appendix III). When the daily mean maximum temperature is examined across the same temperature data set, both upper Pine Creek and upper Robinson Creek have a lower daily mean maximum temperature than either of the Jack Creek monitoring sites. In upper Pine Creek, despite a daily maximum that reached 60.33°F and a 7-day maximum mean of 58.8°F, there is a low density bull trout population that persists. Perhaps bull trout in upper Pine Creek can withstand the daily maximums only because the stream cools down enough at night so that

the daily mean temperature is below any temperature threshold the species may have. In 1998, only redband trout and sculpin were found inhabiting a 100 ft sample site from which the 1999 Cougar Creek thermograph record came from. All the temperature metrics calculated for the Cougar Creek site point to the site being to warm for juvenile bull trout residency. Upper Robinson Creek temperature metrics indicate that this site may be suitable for low density bull trout occupation. The only fish population sampling in upper Robinson Creek occurred during the 1993 survey of the East Fork Jarbidge River drainage. Only redband trout were collected from a 100 ft sample site located above the confluence of Jim Bob Creek, just upstream of the thermograph site. In 1993, four sampled sites along Robinson Creek located downstream of the thermograph location had only redband trout. The lowest 100 ft sample site in Jim Bob Creek also had only redband trout in 1993. A more intensive fish population sampling of Robinson Creek should conducted to detect if a low density bull trout population exists (Bonar et al., 1997).

Recommendations

(1) Intensive fish population sampling of Robinson Creek and Jim Bob Creek should be conducted to determine bull trout presence.

(2) Additional water temperature data from both Pine Creek and Cougar Creek is warranted.

(3) Water temperature and intensive fish population data from Fox Creek should be collected.

Planning

Objective

To participate in the development of a Conservation Agreement and Conservation Strategies for bull trout in the Jarbidge River drainage.

Progress

This activity has not yet been initiated.

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Appendix I

Comparison offish captures and misses at each 100 m sample site in Jack Creek (WFJRD), August 16, 17, and 29, 1999.

Sample Site	Elevation Feet	**Bull** Captures	**Trout** Misses	Redband Trout Count	Unknown Misses
I	5960	0	0	37	0
2	6040	0	0	48	0
3	6090	0	0	84	0
4	6200	0	0	72	0
5	6320	0	0	79	0
6	6400	0	0	48	0
7	6480	0	0	51	0
8	6600	**1***	0	52	0
9	6680	2	0	IS	0
10	6760	1	1	26	0
11	6840	6	4	I	I

* This juvenile bull trout had a caudal fin-clip and was determined to have moved downstream following its original capture at SS-IO, twelve days previous.

Appendix II

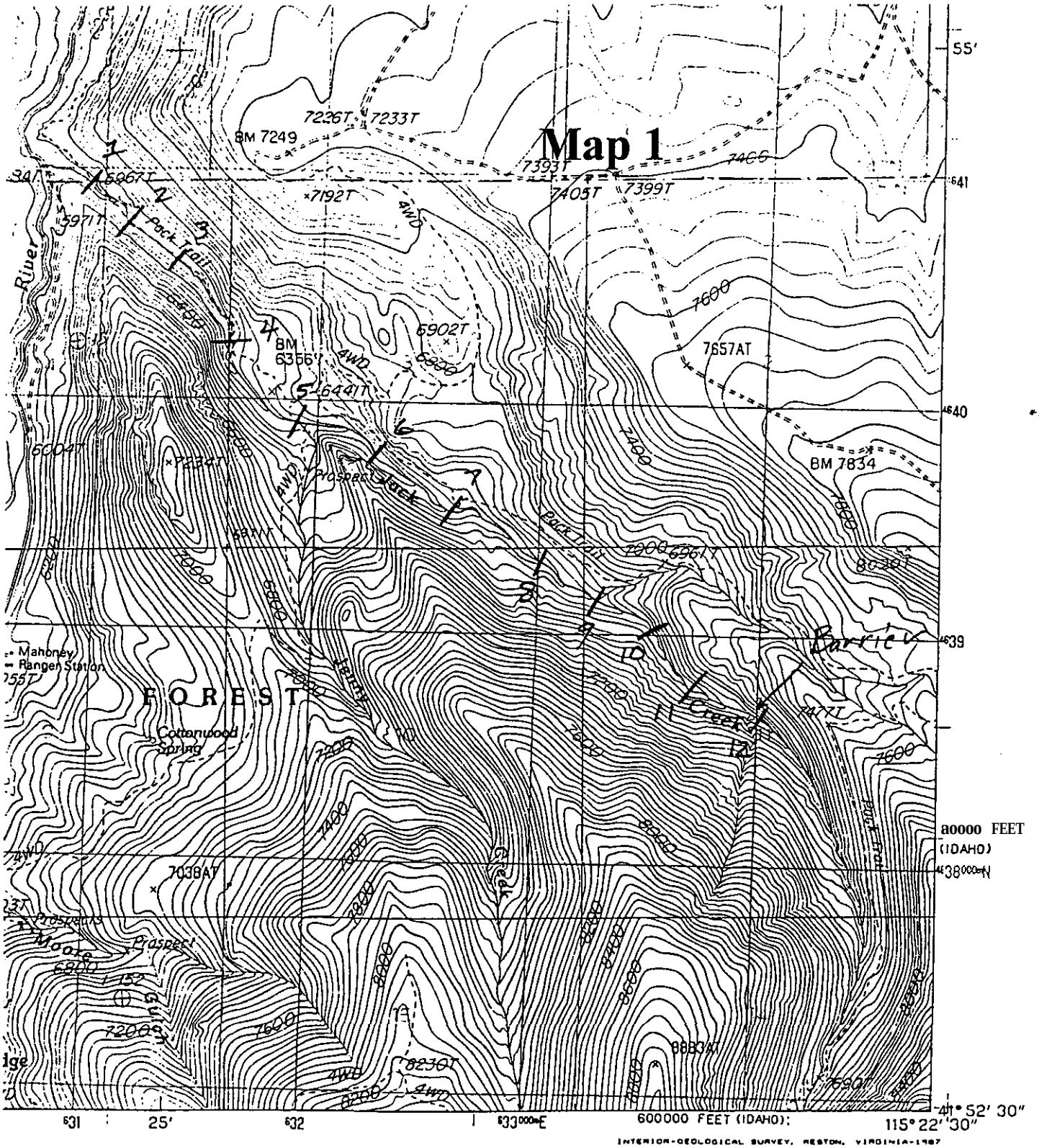
Comparison offish captures and misses at each 100 m sample site in Pine Creek, August 31, September I and 2, 1999.

Sample Site	Elevation Feet	**Bull** Captures	**Trout** Misses	Redband Trout Count	Unknown Misses
A	7018	0	0	7	0
1	7280	I	I	15	0
2	7348	3	1	3	I
3	7400	0	0	8	3
4	7430	3	0	10	I
5	7480	0	0	7	0
6	7510	2	0	15	I
7	7560	0	0	10	0
9	7625	2	0	12	0
10	7675	I	0	12	3

Appendix III

Jarbidge River thermograph sites and temperature (OF) metrics, NDOW 1998 and 1999.

Location	**Elevation** (Feet)	Mean August **Maximwn** Temp.	**Maximum** Temp.	3-Day **Maximum** Mean Temp.	7-Day Maximum Mean Temp.	**Maximum** Mean Daily Temp.
Upper Dave Cr.	7600	43.00	44.16	43.97	43.40	41.68
UpperWFJR	7400	51.10	52.98	52.70	52.26	50.69
UpperEFJR	7360	51.72	54.41	54.04	53.69	49.80
Trib. B - Slide Cr.	7400	52.70	55.87	54.85	54.64	50.59
Slide Cr.	7160	53.80	56.66	55.92	55.39	51.72
FalICr.	6560	53.99	57.15	56.50	55.84	53.12
Upper Jack Cr.	6720	54.54	57.54	57.20	57.06	54.65
Lower Jack Cr.	6320	55.70	58.67	58.10	57.46	56.11
Upper Robinson Cr.	7030	56.06	59.38	58.71	58.36	53.80
Upper Pine Cr.	7280	56.38	60.33	59.20	58.80	53.40
Lower Cougar Cr.	6800	58.80	61.94	61.27	60.80	57.30



INTERIOR-GEOLOGICAL SURVEY, RESTON, VIRGINIA-1987

9000 10 000

2000

NEVADA

QUADRANGLE LOCATION

1	2	)	1 Carson Reservoir 2 Dickshot 3 Murphy Hot Springs 4 Bearpaw Mountain 5 Robinson Creek 6 Coon Creek 7 Jarbidge South 8 Cook Pinnacle Peak
4		S	
6	7	8	

ROAD LEGEND

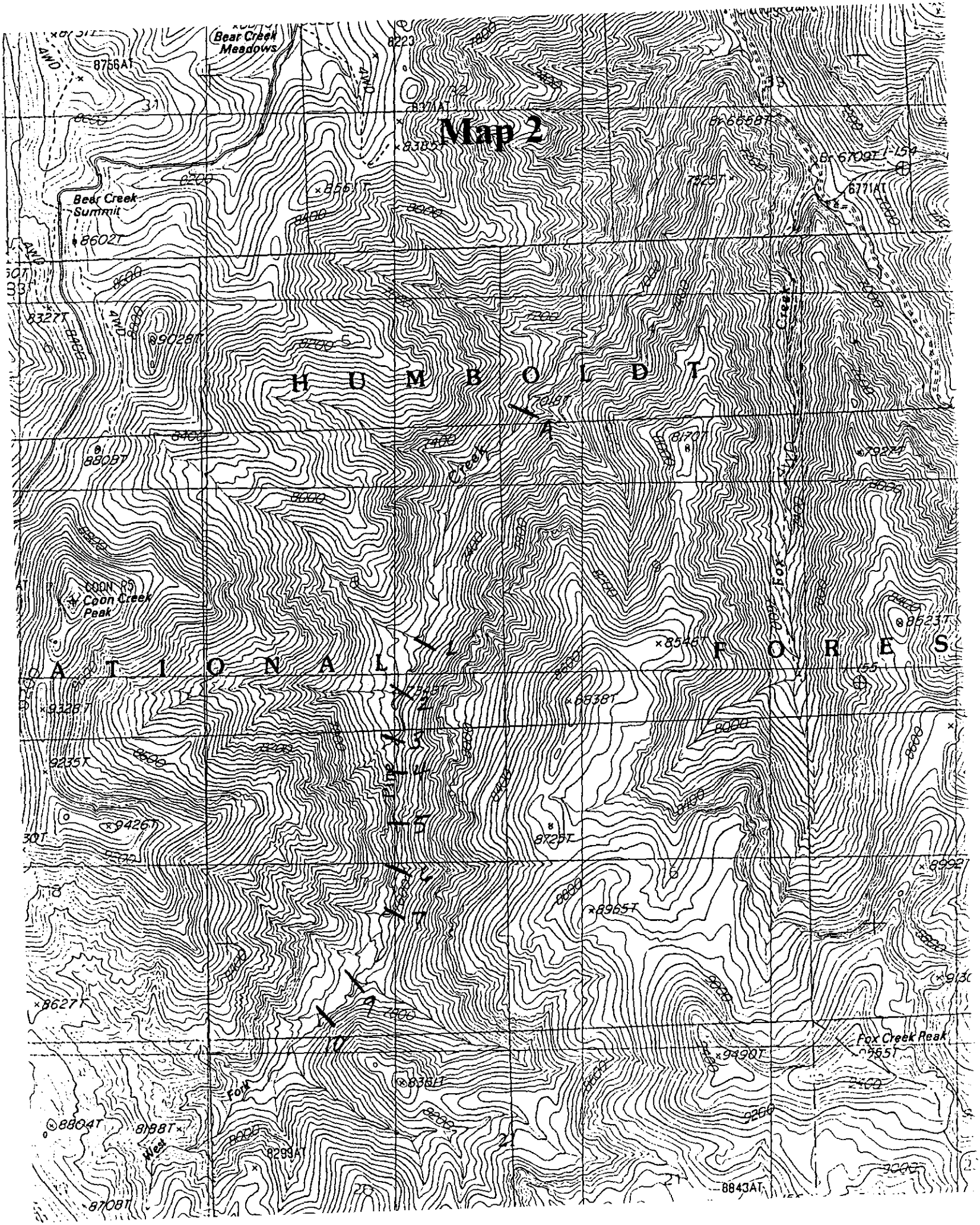
Improved Road
Unimproved Road
Trail

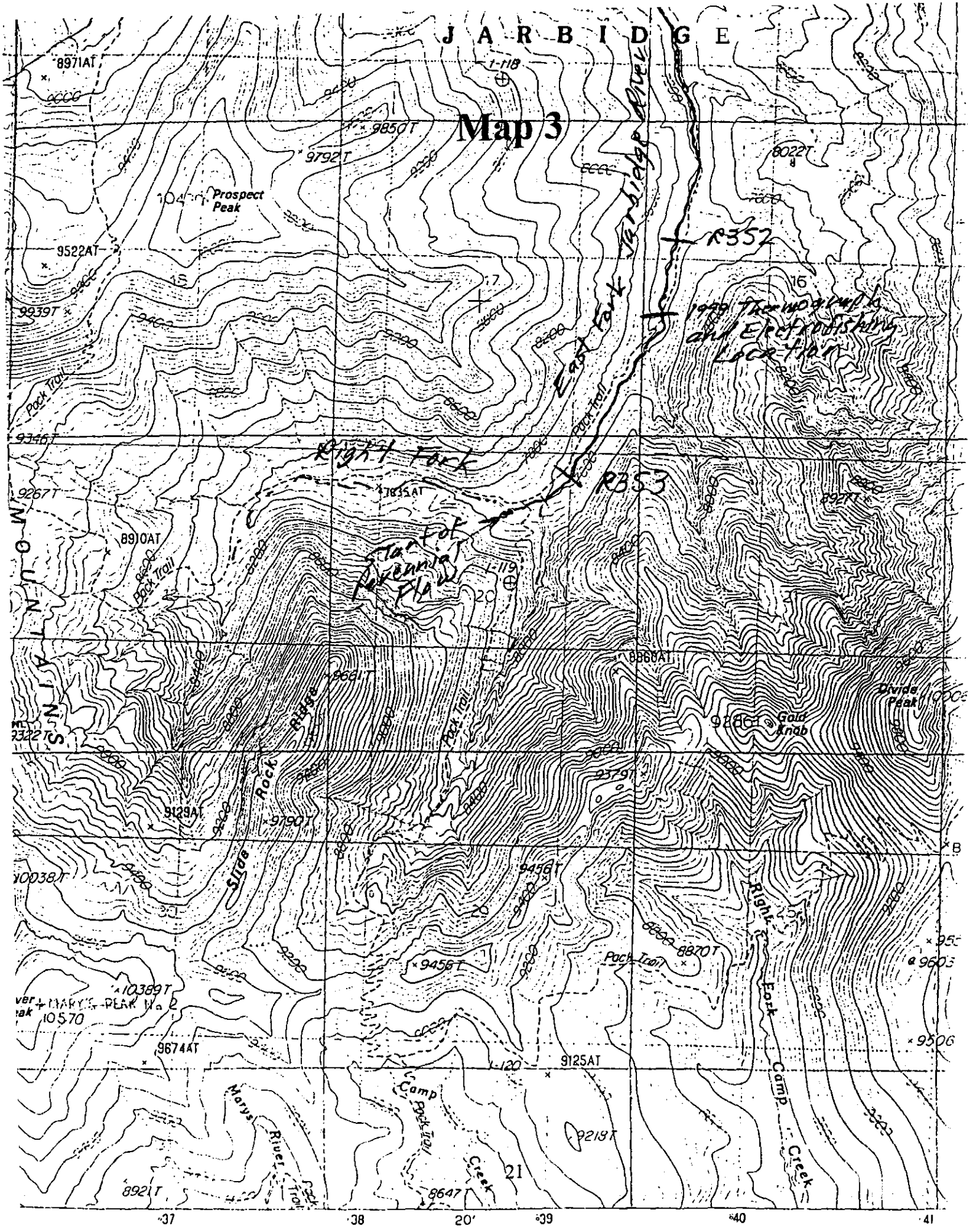
O Interstate Route 0 U.S. Route 0 State Route

21

JARBIDGE NORTH, NEVADA· IDAHO

PROVISIONAL EDITION 1986


Map 2
Bear Creek Meadows
Bear Creek Summit
Coon Creek Peak
Fox Creek Peak
HUMBOLDT
NATIONAL
FORES
4WD
8756AT
8602T
8880T
8327T
9028T
8223
8371AT
8381T
6658T
6709T
6771AT
7525T
8170T
7922T
8623T
8546T
8838T
9328T
9235T
9426T
8725T
8965T
8627T
8804T
8198T
8299AT
8381T
9490T
8843AT
8708T


JARBIDGE
Map 3
Prospect Peak
East Fork Jarbidge River
Right Fork
Start of Perennial Flow
Pack Trail
Rock Slide Ridge
Gold Knob
Divide Peak
Right Fork Camp Creek
Camp Creek Trail
Marys River Trail
MARYS PEAK No 2
10570
10389T
9971T
9456T
9125AT
9674AT
8870T
8910AT
8971AT
9850T
9792T
9522AT
9939T
9346T
9267T
9322T
9129AT
10038T
8892T
8647
9219T
8860AT
8661T
8815AT
8022T
R352
R353
1939 Thermopolis and Electrodishing Location
37
38
20'
39
40
41